SA1 Chij St Joseph's Convent 2
SA1 Henderson Secondary School 15
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Index Number	Class	Name

CHIJ ST JOSEPH'S CONVENT
SEMESTRAL ASSESSMENT 1

O **O**

SCIENCE (CHEMISTRY)

Secondary 2 Express

Friday, 6 May 2016
50 minutes

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your index number, class and name on all the work you hand in.
Write in dark blue or black pen.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
There are **ten** questions. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C**, and **D**.
Choose the **one** you consider correct and shade your choice in the Multiple Choice Answer Sheet with a 2B pencil.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Section B
Answer **all** questions in the spaces provided.

The number of marks is given in brackets [ ] at the end of each question or part question.
Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
Electronic calculator may be used in this paper.
The total of the marks for this paper is 40.

A copy of the Periodic Table is printed on page **11**.

FOR EXAMINER'S USE	
A	
B	
Total	40

This document consists of **11** printed pages.

Setter(s) : Mr Zulkiffli and Mrs Lee-Tan YJ

Section A (10 marks)

Answer **all** questions.

1 The table below shows the electronic structures of four elements.

element	electronic structure
W	2.6
X	2.8.7
Y	2.8.2
Z	2.8.6

Which of the following combination forms a covalent substance?

A an atom of **W** and an atom of **Y**
B two atoms of **X** and an atom of **Z**
C an atom of **Y** and two atom of **X**
D two atoms of **Y** and two atoms of **Z**

2 Which substance will only conduct electricity in the solid state?

A magnesium chloride
B magnesium oxide
C magnesium ribbon
D magnesium sulfate

3 Which of the following **cannot** be deduced from the number of valence electrons in an atom?

A the identity of the element of the atom
B the chemical reactivity of the atom
C the number and type of charges when the atom forms an ion
D the group number of the atom in the Periodic Table

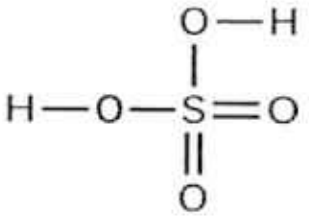
4 Three elements, **W**, **X** and **Y** are in the same period of the Periodic Table. They form ions with the following charge

element	charge on ion
W	-3
X	+2
Y	-1

What is the arrangement of these elements in the increasing order of atomic number?

A X, W, Y
B X, Y, W
C Y, X, W
D Y, W, X

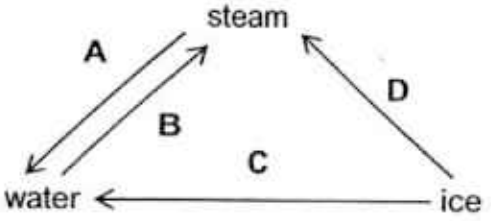
5 The diagram shows the bonding in sulfuric acid.



How many electrons are shared between sulfur and oxygen atoms?

A 6
B 8
C 12
D 16

6 Which of the following changes of state of water is exothermic?



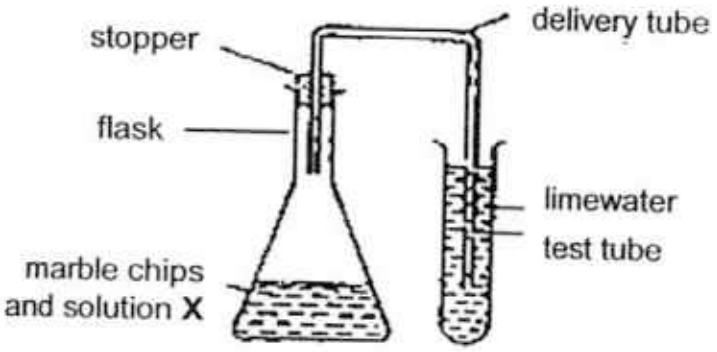
7 Photosynthesis can be represented by the following:

$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2 \qquad \Delta H = +2802\ kJ$$

Which of the following deduction is **correct**?

A Heat energy is released to the surrounding.
B The temperature of the surrounding will stay constant.
C The temperature of the surrounding will increase.
D Light energy is absorbed from the surrounding.

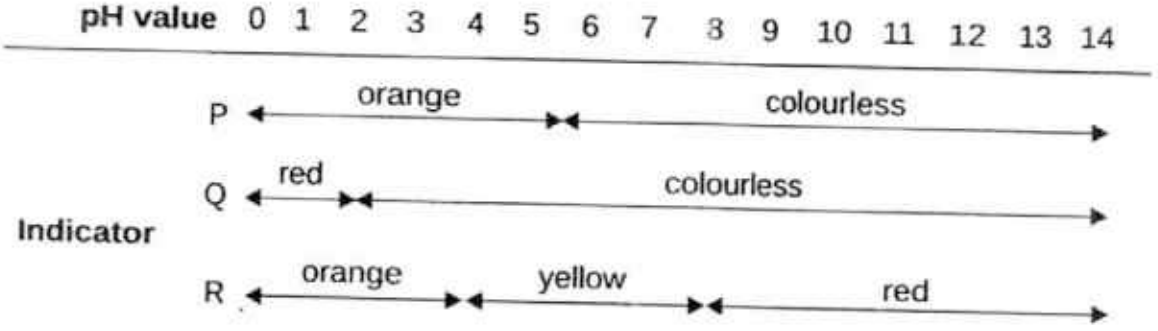
8 A gas which forms white precipitate with limewater is produced when marble chips (calcium carbonate) is reacted with solution **X**.



Which of the following is a possible identity of solution **X**?

A aqueous ammonia
B bleach
C table salt
D vinegar

9 The information below gives the colours of three different indicators, **P**, **Q** and **R**, at different pH values.



What colour will be observed if all three indicators were added to water?

A blue
B colourless
C red
D yellow

10 Which statement best explains why a shaken can of carbonated drink explode when opened?

A Pressure is released therefore gas particles in the drink expanded.
B Pressure is released therefore spacing between the gas particles increases.
C Pressure builds up as gas particles absorb heat and move further apart.
D Pressure builds up as covalent bonds within the gas particles are broken to form atoms.

Section B (30 marks)

Answer **all** questions in the spaces provided.

For Examiner's Use

1 Hydrogen can form ions with different charges, H^+ and H^-.

(a) Fill in the table below to show the number of sub-atomic particles in H atom and H^- ion.

	proton	neutron	electron
H atom	1		1
H^- ion		0	

[1]

(b) Describe the formation of H^- ion from hydrogen.

.....

.....

..... [1]

(c) In the space below, draw a diagram to show the 'dot and cross' diagram of sodium hydride, NaH. Only the valence electrons need to be shown.

[2]

For Examiner's Use

2 The table gives the composition of three particles.

particle	number of protons	number of electrons	number of neutrons
X	7	7	8
Y	7	7	7
Z	11	11	12

(a) With reference to the table above, explain why

(i) particles **X** and **Y** are isotopes of the same element,

.....

..... [1]

(ii) particle **Z** reacts readily.

.....

..... [1]

(b) (i) State the group number of particle **X** and **Z**.

X.....**Z**..... [1]

(ii) Particle **X** reacts with particle **Z** to form compound **1**.
Write the chemical formula of compound **1**.

..... [1]

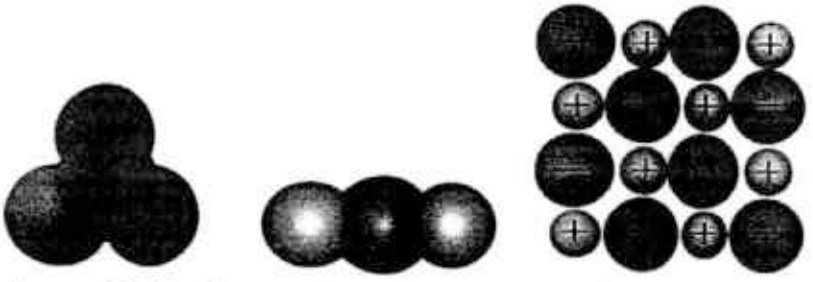
(iii) Can compound **1** conduct electricity? Explain your answer.

.....

..... [1]

For Examiner's Use

3 The diagrams show the names and models of three substances.



phosphorus trichloride carbon dioxide sodium chloride

(a) In the space below, draw a 'dot and cross' diagram to represent phosphorus trichloride.

[2]

(b) Explain why carbon dioxide exists as a gas but sodium chloride is a solid at room temperature and pressure.

.....

.....

.....

.....

..... [3]

For Examiner's Use

4 When zinc reacts with sulfuric acid, the temperature of the solution increases rapidly.

(a) **(i)** Write a word equation to represent the reaction.

..... [1]

(ii) State the chemical formula of all the products from the reaction.

..... [2]

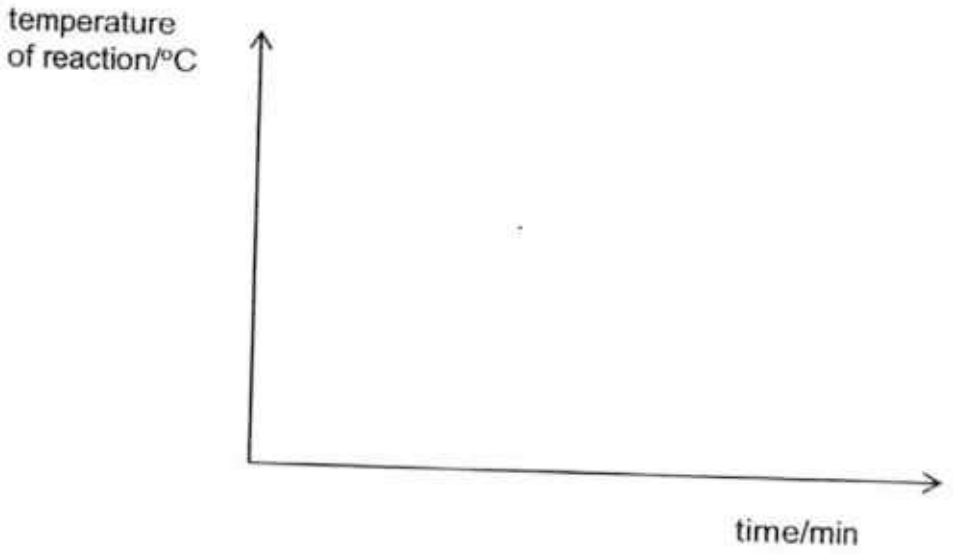
(b) What type of energy change can we classify the above reaction?

Explain your answer.

.....

..... [2]

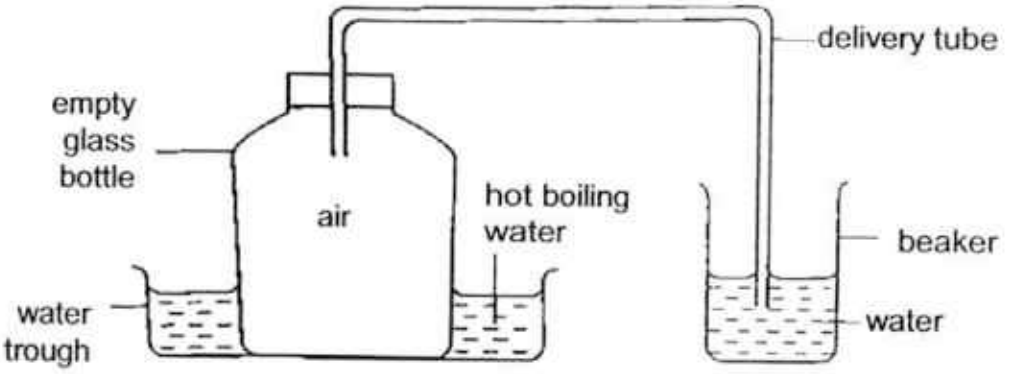
(c) Sketch a graph to represent how the temperature of the reaction will change against time.



[1]

5 Study the experimental set-up below.

For Examiner's Use



(a) Predict what is observed in the beaker of water.

.....

..... [1]

(b) Using ideas of kinetic particle theory, explain your answer in **(a)**.

.....

.....

.....

..... [3]

6 (a) An experiment was carried out to compare the acidity of some fruit juices. An alkali, sodium hydroxide solution was used to neutralise 25.0 cm^3 of each fruit juice.

For Examiner's Use

fruit juice	volume of sodium hydroxide solution needed for neutralisation /cm^3
apple	10
lemon	16
pineapple	6
grapefruit	14
lime	12

(i) Using the information from the table, identify which fruit juice has the lowest pH. Explain your answer.

.....

.....

..... [2]

(ii) Name the gas that will be produced when sodium carbonate is added to the fruit juices.

..... [1]

(iii) State the difference in observation when equal mass of sodium carbonate is added to lemon juice and pineapple juice separately.

.....

..... [1]

(b) Sodium hydroxide also reacts with ammonium nitrate to give out a pungent gas. Describe how the gas can be tested.

.....

.....

..... [2]

End of paper

The Periodic Table of the Elements

Key

relative atomic mass
atomic symbol
name
atomic number

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	64 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	– Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La lanthanum 57 *	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– Ac actinium 89 †															

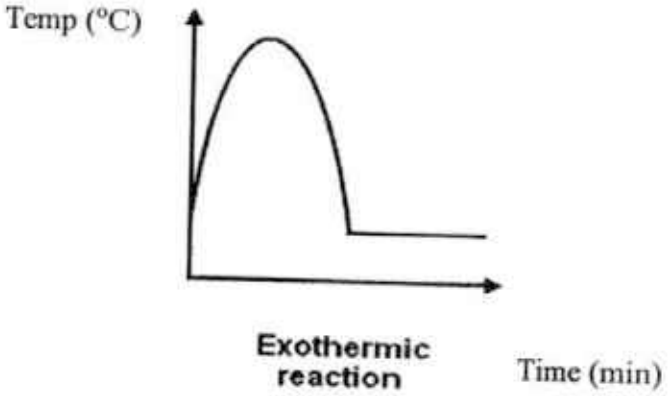
*58-71 Lanthanoid series	140 Ce cerium 58	141 Pr Praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
†90-103 Actinoid series	232 Th thorium 90	– Pa protactinium 91	238 U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lr lawrencium 103

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

Sec 2 Exp SA1 2016 Science Chemistry

Question	1	2	3	4	5
Answer	B	C	A	A	C
Question	6	7	8	9	10
Answer	A	D	D	D	B

1a	H atom: 0n H- ion: 1p, 2e	1
b	hydrogen atoms gain 1 electron	1
c	Na+ (8 e) 1m H- (2e; 1 dot, 1 cross) 1m	
2ai	They have 7/ same number protons hence they are of the same element but X has 1 less neutrons from Z (or quote the number: X has 8 neutrons but Y has 7 neutrons)/different number of neutrons	1
ii	They need to lose 1 e to obtain a fully filled valence shell/ stable noble gas configuration[this is with BOD]	1 1
b	X: V, Z: I Students who wrote both roman numerals and number form are not awarded the mark. They showed lack of precision in their answers. Z_3X	1 1 1
ii	Yes, There's free moving ions in aqueous and molten state	1
3a	PCl_3 one P and 3Cl with sharing of a pair of electron between each P and Cl → 1m correct number of valence e for Cl and P→ 1m	
b	Carbon dioxide has a low boiling point but sodium chloride has a high melting point. Carbon dioxide (occurs as simple molecular structure) is held by weak intermolecular forces of attraction, little energy is needed to overcome the attractive force. Sodium chloride (occurs as giant ionic lattice structure) is held by strong electrostatic forces of attraction between oppositely charged ions, large amount of energy is needed to overcome the attractive force	1 1 1

4	(a) zinc + sulfuric acid → zinc sulfate + hydrogen (ii) $ZnSO_4$ and H_2 (allow ECF from (i)) (b) Exothermic reaction . Heat energy Is given to the surroundings/ temperature has increased (c)  	1 2 1 1
5a	Bubbles will be seen Effervescence [marked with BOD]	1
b	Air particles in the glass bottle gain kinetic energy/energy/ heat energy Air particles will move faster "vibrate" is unacceptable Air particles will move further apart hence spacing between air particles will increase If students simply wrote spacing between air particles will increase, they are not awarded the mark as this is not account for. Volume of air will increase hence pushing gas out of the delivery tube	1 1 1 1 Max 3
6ai	lemon juice it needs the greatest volume of sodium hydroxide to remove the acidicity/ remove the excess Hydrogen ions	1 1
ii	carbon dioxide gas	1
iiii	more vigorous bubbling in lemon juice than pineapple juice	1
b	use a damp red litmus paper which will turn blue	1 1

Class	Index Number	Name

HENDERSON SECONDARY SCHOOL

MID-YEAR EXAMINATION 2016
SECONDARY 2 EXPRESS

LOWER SECONDARY SCIENCE

WEDNESDAY 18TH MAY

2 hours

Additional materials:
Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your Name, Index number and Class on all the work you hand in.
For Booklet A, write in soft pencil.
For Booklet B, write in dark blue or black pen. You may use a soft pencil for any diagrams or graphs.

Booklet A – Section A
There are **thirty** questions in Section A. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft 2B pencil** on the separate Multiple Choice Answer Sheet.

Read the instructions on the Answer Sheet very carefully.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

Hand in Booklet A, Booklet B, and MCAS separately.

Booklet A

This document consists of **10** printed pages.

Setter: Ms K Chandran

[Turn over

Section A (30 marks)

1 The chemical name for table salt is sodium chloride.

It is made up of elements sodium and chlorine.

Which of the following statements is **not** correct?

A Both elements are able to conduct electricity at room temperature.

B It cannot be separated into their elements by physical means.

C The elements are joined together in fixed proportions by mass.

D The properties of its components differ from that of sodium chloride.

2 Which of the following only contains compounds?

A bronze, gold, iron

B chlorine, carbon dioxide, lead

C salt, sugar, water

D silicon, sulfur, zinc

3 Which of the following is a molecule of an element?

A Co

B CO

C CO_2

D O_2

4 The table shows information related to three different substances, **P**, **Q** and **R**. Substances **Q** and **R** have more than two components.

substance	information
P	made up of one type of atoms
Q	components that make up the substance exist in a fixed ratio
R	components that make up the substance can still be seen

Based on the table, which of the following statements is true?

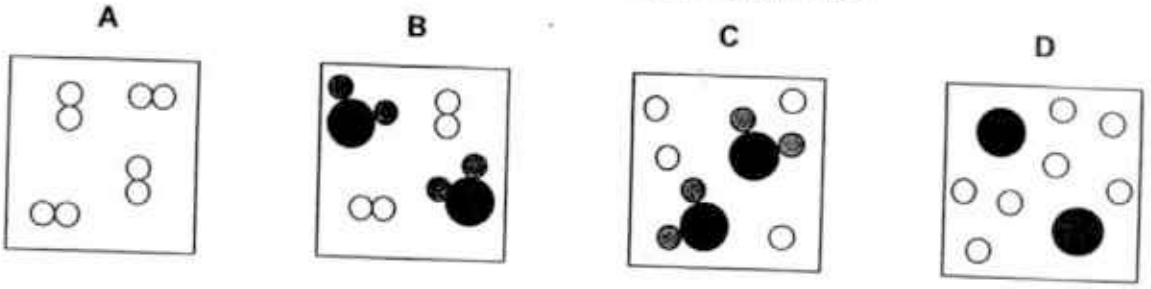
A A chemical reaction is involved to produce substance **Q** but not substance **R**.

B If substance **R** is mixed with substance **P** by physical means, the properties of the substances will change.

C Substance **P** and **Q** cannot be separated into simpler substances.

D Substance **P** must be a metal.

5 Which of the following diagrams represents a mixture of two elements?



6 You are given a mixture of ethanol and a dilute solution of sodium chloride in water. Ethanol boils at 78°C and sodium chloride dissolves in water.
To obtain ethanol and solid sodium chloride, what two techniques would you use?

	first technique	second technique
A	distillation	evaporation
B	evaporation	distillation
C	filtration	distillation
D	filtration	evaporation

7 A very old painting has been sprayed accidentally with new paint. The solubilities of the old paint and the new paint in different solvents are shown below.

Which solvent could be used to remove the new paint without damaging the original painting?

solvent	old paint	new paint
A	insoluble	insoluble
B	insoluble	soluble
C	soluble	insoluble
D	soluble	soluble

8 Some table salt has been mixed with sand. What is the correct order of techniques needed to obtain the pure salt from the mixture?

A dissolving → evaporating → filtering

B dissolving → filtering → evaporation

C evaporating → dissolving → filtration

D filtration → evaporating → dissolving

9 Which factor given below does **not** affect the solubility of a substance?

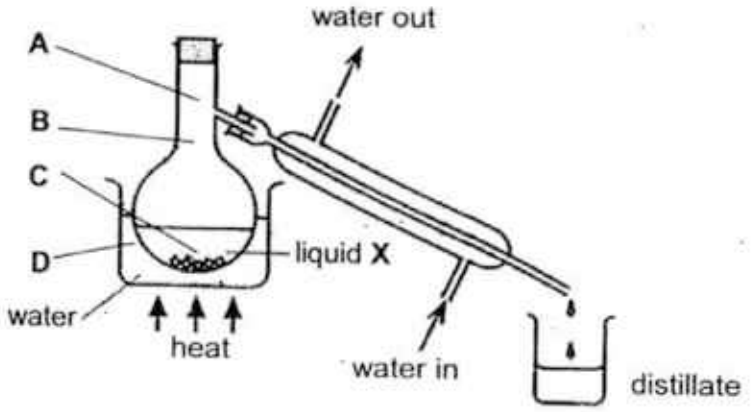
A rate of stirring

B temperature

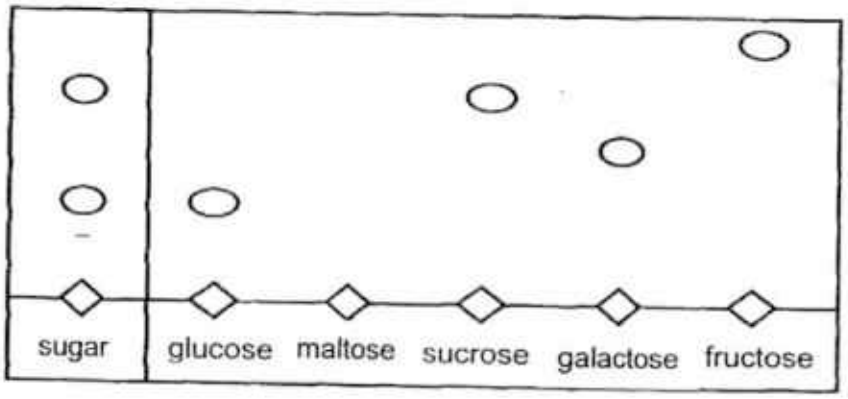
C type of solute

D type of solvent

10 The set-up shown below is used to measure the boiling point of a liquid **X**. Where should the bulb of the thermometer be placed?



11 Sugar was treated with dilute hydrochloric acid. The resulting solution was analysed by chromatography. The following chromatogram was obtained.



This chromatogram suggests that dilute hydrochloric acid breaks down the sugar into

A fructose, galactose and glucose.

B fructose, glucose, and sucrose.

C glucose, maltose and one sugar not among the reference sugars.

D glucose and sucrose.

12 What is used to decompose copper chloride solution into copper and chlorine gas ?

A electricity

B heat

C light

D oxygen

13 Which of the following is a physical change?

A baking cakes

B burning paper

C cooking food

D dissolving sugar in a cup of tea

14 Which separation technique is used to show that sea water contains dissolved substances?

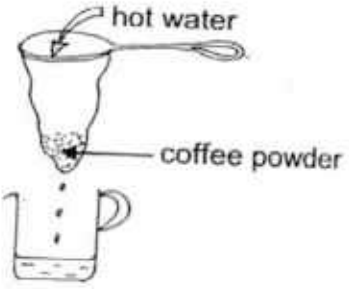
A condensation

B distillation

C evaporation

D filtration

15 The following diagram shows a coffee bag used in a coffee shop to separate the coffee powder from the black coffee after pouring hot water into the coffee bag.



The coffee powder that is left behind in the coffee bag is known as the .....(1)..... and the black coffee is the .....(2)..... .

	(1)	(2)
A	filtrate	residue
B	residue	filtrate
C	solute	solvent
D	solvent	solute

16 Timothy heated four different substances. Based on his observations, which one of them underwent a physical change upon heating?

	appearance at the start	observation made during heating	appearance after cooling
A	clear liquid	clear liquid	clear liquid
B	green powder	black solid	black solid
C	purple crystals	purple vapour	purple solid on sides of test tube
D	white solid	white solid	white solid

17 During respiration, glucose reacts with oxygen to form carbon dioxide and water.
Which of the following word equations correctly represents this change?

A carbon dioxide + glucose ⟶ oxygen + water

B carbon dioxide + water ⟶ glucose + oxygen

C glucose + oxygen ⟶ carbon dioxide + water

D glucose + water ⟶ carbon dioxide + oxygen

18 Jerry is stung by a bee. His mother rubs baking soda on his wound to relieve the pain.
What can you infer from this observation?

A The bee sting contains an element which reacts with the baking soda.

B The bee sting is acidic.

C The bee sting is alkaline.

D The bee sting is neutral.

19 Calcium hydroxide reacts with sulfuric acid to form a salt and water.
Which of the following is the **correct** name of the salt formed?

A calcium hydrate

B calcium oxide

C calcium sulfate

D calcium sulfuric

20 Which of the following solutions when mixed may form a solution of pH 7?

A ammonia solution and water

B hydrochloric acid and potassium hydroxide

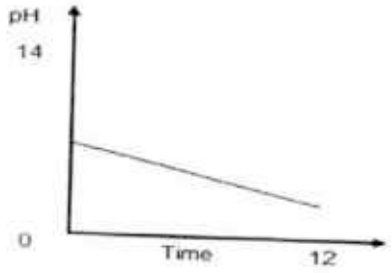
C sodium chloride solution and nitric acid

D sodium hydroxide and water

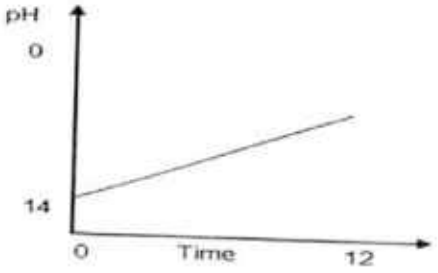
21 Jackson wanted to do a simple experiment. He bought a carton of orange juice and a carton of yoghurt from the supermarket. He mixed them together in equal proportions and tested the pH level of the mixture at 2-hour intervals. The table below shows the results obtained. Choose the correct graph that the student had plotted based on his experimental results.

time (hour)	0	2	4	6	8	10	12
pH	5	4.5	4	3.5	3	2.5	2

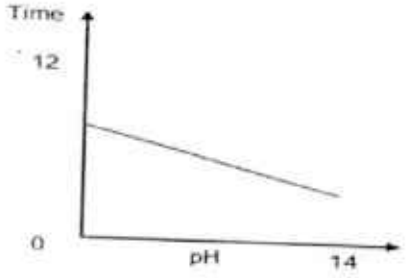
A



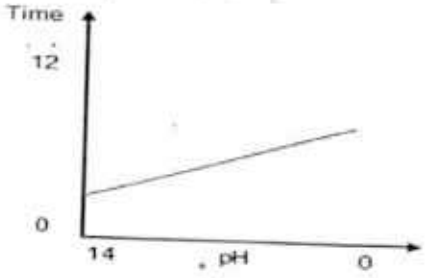
B



C



D



22 Jack was told to heat four substances. Which substance will undergo a chemical change upon heating?

A	iodine
B	salt
C	sugar
D	wax

23 Which of the following changes are caused by exposure to light?

I burning of charcoal
II decomposition of silver bromide on film
III manufacturing food by green plants
IV production of vitamin D in skin

A I, II B I, III C II, III D II, III, IV

The table gives information about three indicators.
Use the following table to answer questions 24 and 25

indicator	colour at pH 2	pH at which color changes	colour at pH 13
phenolphthalein	colourless	8	red
thymol blue	blue	4	pink
congo green	orange	12	green

24 Which colours would be obtained when each indicator is added to a neutral solution?

	phenolphthalein	thymol blue	congo green
A	colourless	blue	orange
B	colourless	pink	orange
C	red	blue	green
D	red	pink	green

25 When the three indicators are added to three test tubes of solution **Y**, the colours of the indicators are as shown in the table below.

phenolphthalein	thymol blue	congo green
red	pink	orange

Which of the following pH could be the pH of solution **Y**?

A pH 2

B pH 3

C pH 9

D pH 14

26 A fish in a pond appears to be 1.6 m from the surface of a pond. Given that the refractive index of water is 1.33, what is the real depth of the fish?

A 0.84 m **B** 1.20 m **C** 2.13 m **D** 2.93 m

27 A boy is having his eyesight tested by an optician. The chart is located 5 m behind him. There is a mirror 4 m in front of him. How far does this chart appear from him?

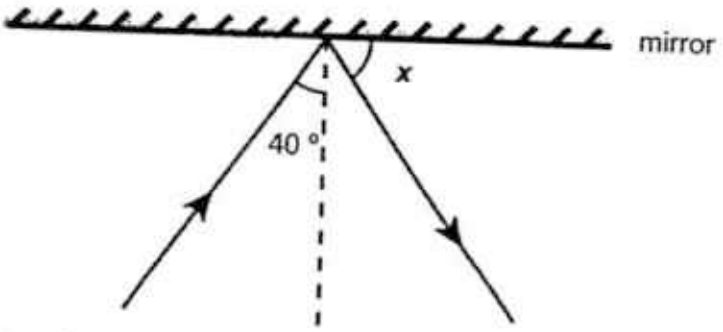
A 4m

B 9 m

C 10 m

D 13 m

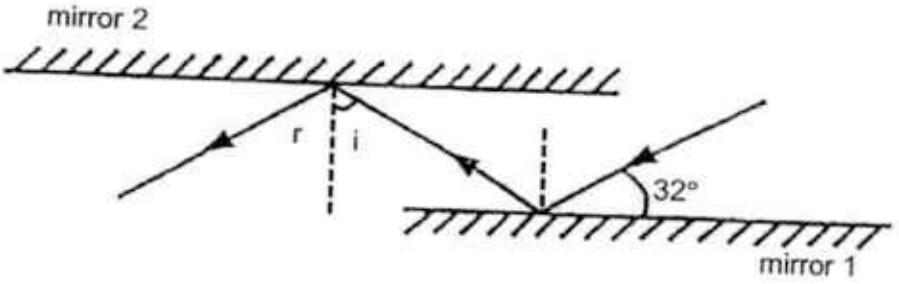
28 The diagram below shows a light ray which is incident on a plane mirror.



What is the value of *x*?

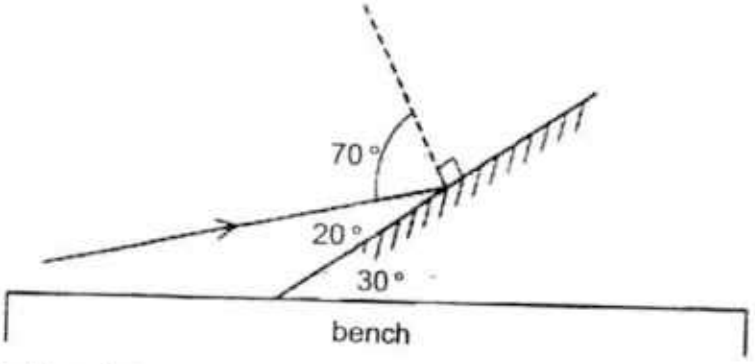
A 35 ° B 50 ° C 55 ° D 65 °

29 Given that mirror 1 and 2 are parallel to each other, what will be the **angle of reflection** of the the reflected ray at mirror 2, when a single ray of blue light hits the surface of plane mirror 1 at 32° ? (*Note: The diagram is **not** drawn to scale.*)



A 32 ° B 58 ° C 68 ° D 116 °

30 A mirror is placed tilted at an angle of 30 ° to the bench. A ray of light is directed so that it hits the mirror at an angle of 20 ° to the surface of the mirror.



What is the angle of reflection of the ray?

A 20 ° B 30 ° C 50 ° D 70 °

- End of Booklet A -

DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a = X b

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

5

Class	Index Number	Name

HENDERSON SECONDARY SCHOOL

MID-YEAR EXAMINATION 2016
SECONDARY 2 EXPRESS

LOWER SECONDARY SCIENCE

WEDNESDAY 18TH MAY

2 hours

Additional materials:
Writing paper (on request)

READ THESE INSTRUCTIONS FIRST

Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your Name, Index number and Class on all the work you hand in.
For Booklet A, write in soft pencil.
For Booklet B, write in dark blue or black pen. You may use a soft pencil for any diagrams or graphs.

Booklet B – Sections B and C
Answer **all** questions in Section B and Section C.
Write your answers in the spaces provided on the question paper.
In calculations, you should show all the steps in your working, giving your answer at each stage.

The number of marks is given in brackets [ ] at the end of each question or part question.

Section	Mark
A	/30
B	/40
C	/30
Total:	/100

Hand in Booklet A, Booklet B and MCAS separately.

Booklet B

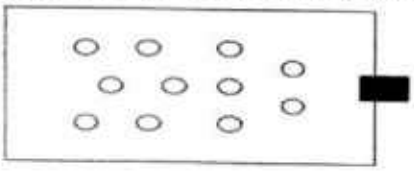
This document consists of **10** printed pages.

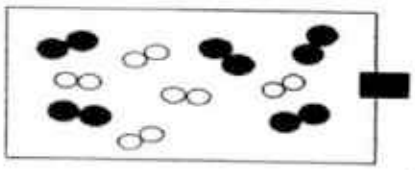
Setter: Ms K Chandran

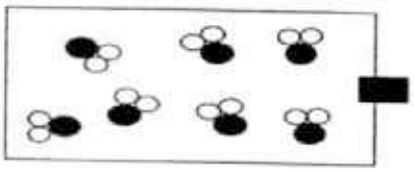
[Turn over

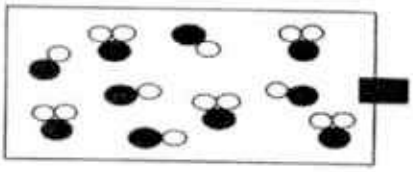
Section B (40 marks)

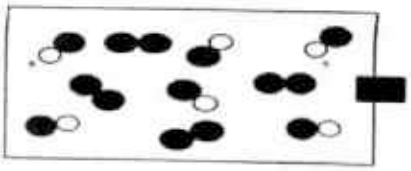
1 **(a)** The diagrams below show the arrangement of particles in some substances. Match each diagram to one of the descriptions on the right. [5]











mixture of 2 compounds

compound

mixture of molecules of an element and molecules of a compound

atoms of an element

mixture of 2 elements made up of diatomic molecules

(b) State one similarity and one difference between molecules of an element and molecules of a compound.

.....

.....

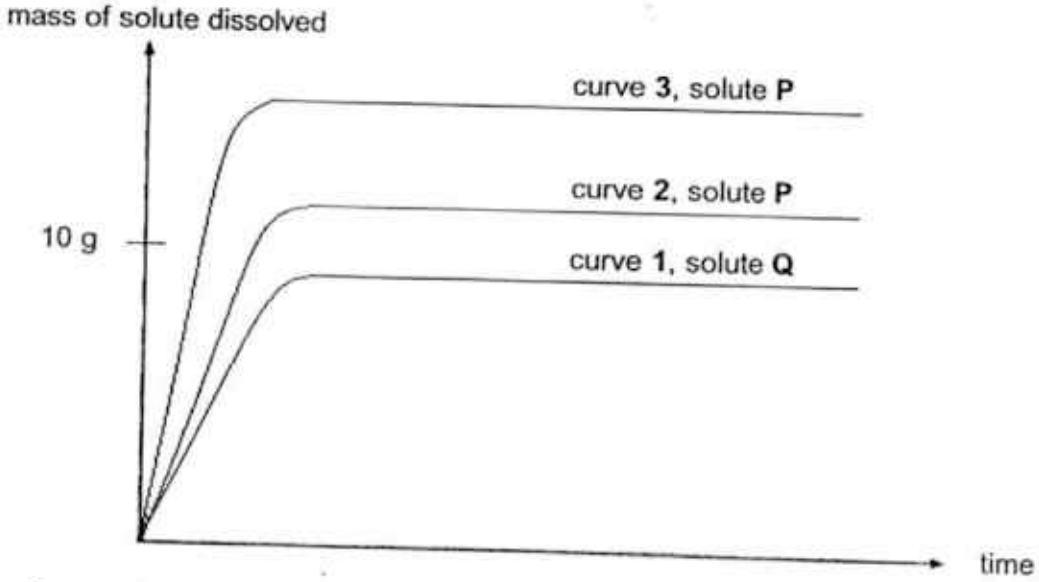
.....

.....[2]

(c) The table shows some information about atoms of elements W and X. (The letters do not represent the symbols of the elements.)
Complete the table by filling in information for these elements. [3]

element	mass number	atomic number	number of electrons	number of neutrons
W	27	13		
X	23		11	12

2 Tricia dissolved 18 g of two different solutes, **P** and **Q**, into two beakers each containing 50 cm^3 of water at room temperature. The mixture in each beaker was stirred until no more solutes could be dissolved.



(a) With reference to curves **1** and **2** in the graph above, compare the difference in solutes **P** and **Q** in terms of their solubility in water.

.....

.....[1]

(b) What does the horizontal line of each curve represent?

.....

.....[1]

(c) Tricia repeated the experiment with the same conditions as above, except using smaller particle size of solute **Q** only.
Draw, on the same axes, the curve that would result. [1]

(d) **(i)** Suggest how curve **3** for solute **P** can be obtained if 18 g of solute **P** is dissolved in 50 cm^3 of water.

.....

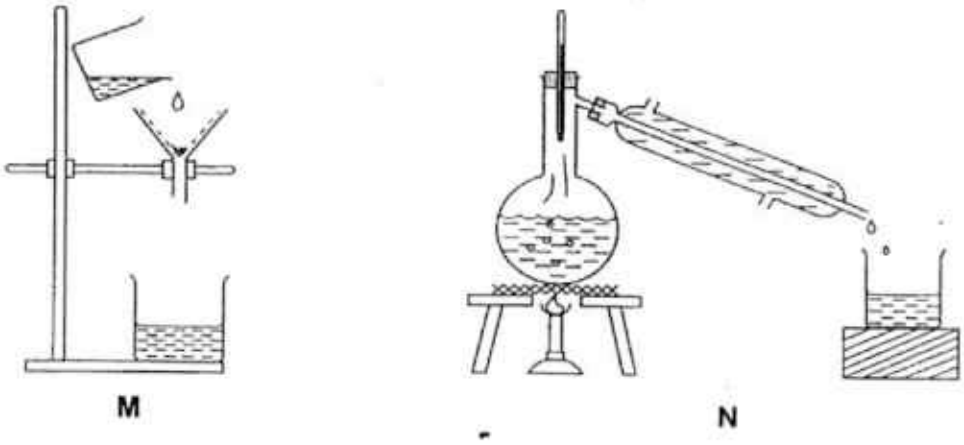
.....[1]

(ii) Explain your answer in (d)(i).

.....

.....[2]

3 The diagram shows two methods of separating water from the mixtures.



(a) Name the two methods, **M** and **N**.

.....

.....[2]

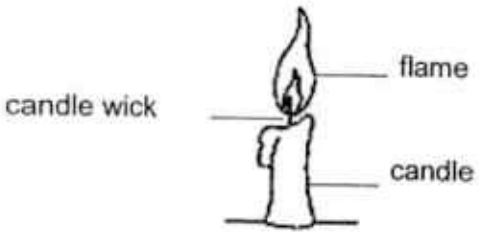
(b) Which of the two methods is a better way of purifying water? Why?

.....

.....

.....[2]

4 The diagram below shows a candle burning.



(a) Identify a physical change in the diagram and explain why it is considered a physical change.

.....

.....

.....[2]

(b) Identify a chemical change in the diagram and explain why it is considered a chemical change.

.....

.....[2]

(c) **(i)** State the other reactant that is needed for the reaction to take place.

.....[1]

(ii) The candle wick is a form of carbon.
Write down the word equation for the chemical change.

.....[2]

5 Study the following activities carefully. State the name of the process and whether it is a chemical change or physical change. [3]

(a) **(i)** Heat magnesium ribbon in a jar of oxygen gas.

(ii) Heat iron filings and sulfur powder in a test tube.

(iii) Heat a piece of candle wax in a test tube.

	name of the process	chemical change or physical change
(i)		
(ii)		
(iii)		

(b) A list of chemicals is given below:

- zinc
- calcium hydroxide
- nitric acid

Select chemicals from the list and write down a word equation that will give each of the following products. Each chemical may be used more than once or not at all.

(i) salt and water only

.....[2]

(ii) hydrogen gas

.....[2]

6 (a) State the laws of refraction.

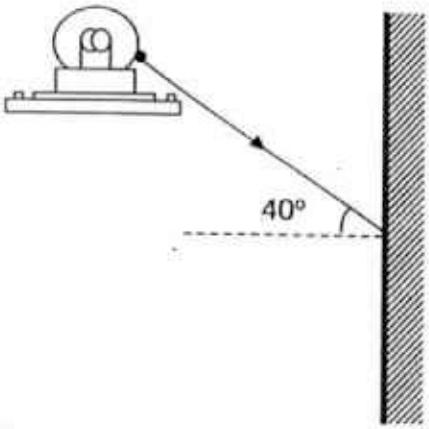
.....

.....

.....

.....[2]

The diagram shows a light ray from a light bulb hitting the surface of a plane mirror. Consider the light ray as coming from the point on the light bulb.



(b) The light ray bounces off the surface of the plane mirror.
What is the name for this change in direction of the light ray?

.....[1]

(c) On the diagram,

(i) mark accurately, with a dot and letter **B**, the position of the image of the bulb,

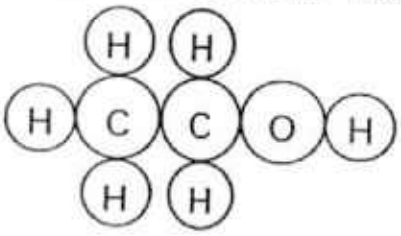
(ii) show the path of the light ray after it bounces off the surface of the plane mirror, and

(iii) mark and write the angle of reflection. [3]

- End of Section B -

Section C (30 marks)

7 (a) Ethanol (also commonly called alcohol) is a liquid at room temperature. It is found in many perfumes and deodorants. The diagram represents a molecule of ethanol.

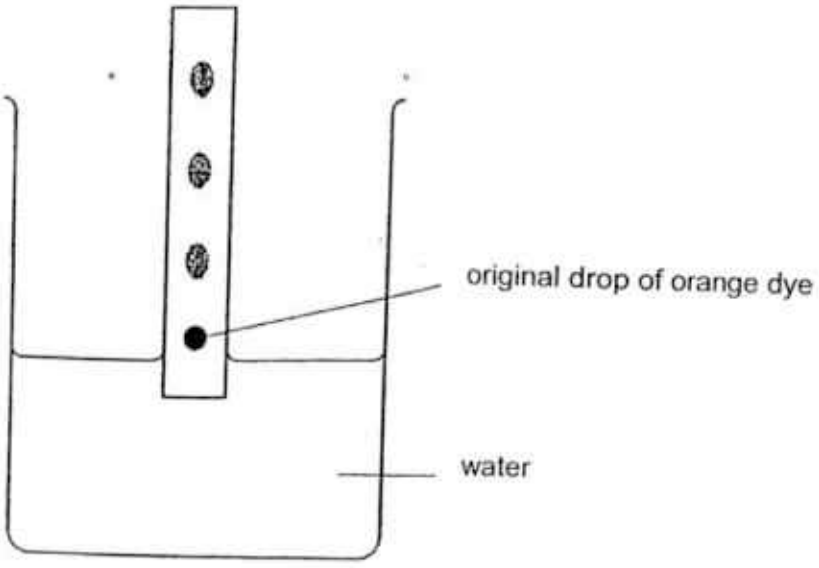


(i) State the number of each type of atom present in the molecule.

.....[2]

(ii) What is the formula of the molecule? .....[1]

(b) Dyes are used to colour some sweets. A student placed a drop of orange dye on a piece of filter paper. The end of the paper was then dipped into a beaker of water. The results are shown below.



(i) What is the name of the process shown in the diagram?

.....[1]

(ii) Is the orange dye a mixture or a compound? Give a reason for your answer.

.....

.....[2]

(iii) What would have happened if the original drop of dye had been placed below the water level?

.....

.....[1]

(c) Given a mixture of iron, sulfur and copper sulfate crystals, how would you obtain iron and sulfur from the mixture?

.....

.....

.....

.....[3]

8 'A carbonate is found in egg shells and sea shells.'

(a) (i) Using the properties of acid, describe how you would carry out a test to show that egg shells contain a carbonate. Draw a suitable labelled diagram to aid your explanation.

.....

.....

.....

.....

.....

.....[5]

(ii) Write a general equation for the reaction in your answer to **(a)(i)**.

.....[2]

(b) A laboratory technician forgets to label 3 bottles of colourless solution. He only knows that one solution has pH exactly 7, one has pH less than 7 and one has pH more than 7. He has one bottle of blue litmus paper and one bottle of red litmus paper available.

Describe what you would do to help the laboratory technician sort out the bottles and label the bottle as acid, alkali or neutral.

.....

.....

.....

.....

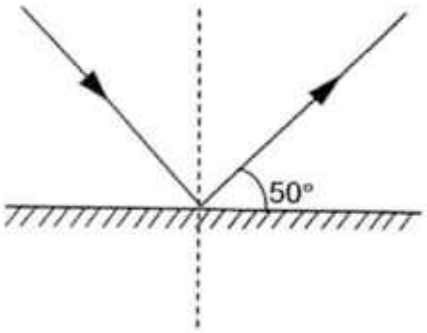
.....

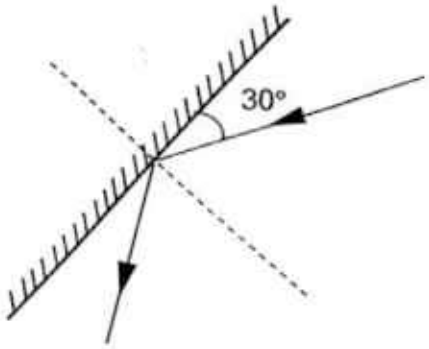
.....

.....

.....[3]

9 (a) For each of the following light rays reflected, state the angle of incidence. [2]





(i) Angle of incidence = _____

(ii) Angle of incidence = _____

(b) An object is placed 5 cm in front of a plane mirror. The mirror is then moved 2 cm towards the object. Calculate the distance between the initial and final position of the image that is seen in the mirror.

distance = ...cm [2]

(c) What is the relationship between the angle of incidence and the angle of reflection for a light ray undergoing reflection?

.....

.....[1]

(d) (i) State the two types of reflection.

.....[1]

(ii) State a difference between the two types of reflection.

.....

.....[2]

(iii) State 2 properties of images in a plane mirror.

.....

.....[2]

- End of Booklet B -

HENDERSON SECONDARY SCHOOL
MID-YEAR EXAMINATION 2016
SECONDARY TWO EXPRESS SCIENCE
Marking Scheme

Section A (30 marks)

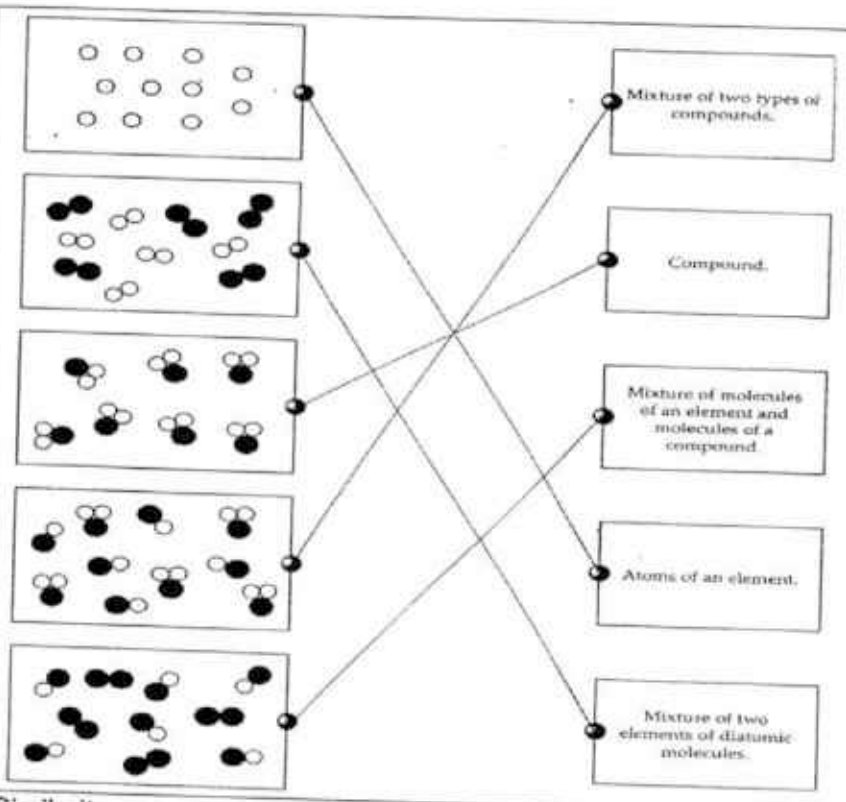
1	2	3	4	5	6	7	8	9	10
A	C	D	A	D	A	B	B	A	A

11	12	13	14	15	16	17	18	19	20
D	A	D	C	B	C	C	B	C	B

21	22	23	24	25	26	27	28	29	30
A	C	D	B	C	C	D	B	B	D

Section B (40 marks)

1 a (5)



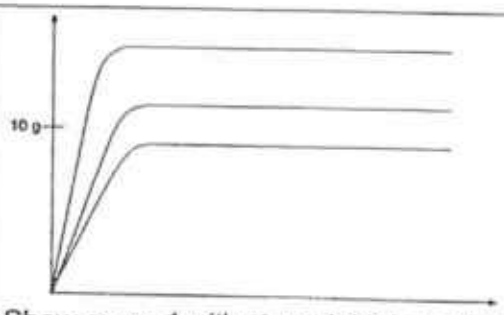
b (1, 1)

Similarity:
Both are made up of two or more atoms chemically combined together. (1)

Difference:
Molecules of a compound consist of different types of atoms chemically combined together while the molecules of an element consist of the same type of atoms chemically combined together. (1)

c (2, 1)

element	mass number	atomic number	number of electrons	number of neutrons
W	27	13	**13**	**14**
X	23	**11**	11	12

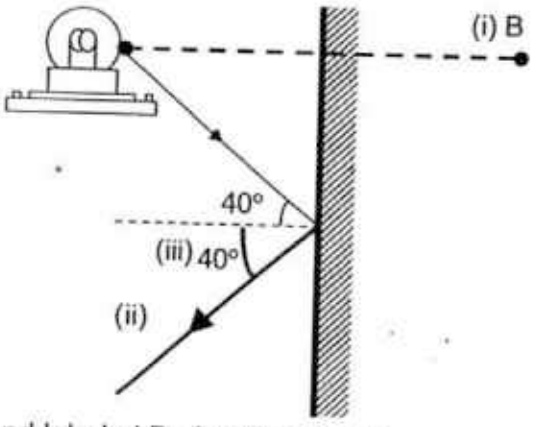
2	(a)		Solute P has **higher solubility** in water than solute Q. Remarks: Do not accept 'larger amount of solute P than Q can be dissolved in water'.	1
	(b)		It represents the **maximum mass of solute** that had **dissolved** in 50 cm^3 of water. Or It represents that the **solution is saturated** with the solute.	1
	(c)		 Show curve 1 with steep initial gradient but same saturation point.	1
	(d)	(i)	Increase temperature of solvent / use hot water / heat up the mixture	1
		(ii)	**More solute can dissolve** (OR it saturates **higher**) because higher temperature will **increase solubility**. It is dissolved in a **shorter time** (OR steeper and saturates faster) because higher temperature **increases the rate of dissolving.**	1 1

3	(a)	M : filtration, N : distillation	2
	(b)	N By boiling the mixture, water boils to become steam and condenses into water.	1 1

4	(a)		Identify: Solid candle wax **melting** to form liquid wax. Explain: Liquid wax can be cooled and solidified to form solid candle Or Melting is a **reversible** change. Remarks: Award mark as long as 'melting' is stated. Do not accept: 'No new substances formed'.	2
	(b)		Identify: **Burning** of the candle/wick. Explain: New product is formed / Carbon dioxide is produced Or Reaction is not reversible / irreversible. Remarks: Accept 'combustion'.	2
	(c)	(i)	Oxygen	1
		(ii)	carbon + oxygen $\xrightarrow{\text{heat}}$ carbon dioxide	2

			Deduct 1 mark if • 'heat' is not stated • reactants and/or products are written wrongly • no '+' sign in equation • no ⟶ used in equation / straight, forward arrow only Do not accept if answer is written in pencil.	

5	(a)	(i)	combustion, chemical change	1
		(ii)	combination, chemical change	1
		(iii)	melting, physical change	1
	(b)	(i)	calcium hydroxide + nitric acid → water + calcium nitrate	2
		(ii)	zinc + nitric acid → hydrogen + zinc nitrate	2

6	(a)		The incident ray, refracted ray and normal all lie on the same plane at the point of incidence. For any two given media, the ratio of sin i / sin r is a constant	1 1
	(b)		Reflection of light	1
	(c)	(i)		1
		(ii)		1
		(iii)		1
			1m only if dot and labeled B , 0 m if no arrow	

Section C (30 marks)

7a) i) 6 Hydrogen atoms, 1 oxygen atom and 2 carbon atoms. [Any 2=1,all 3 =2]

ii) C_2H_5OH/ C_2H_6O / CH_3 CH_2OH [1]

b) i) Chromatography [1]

ii) Mixture. [1]
As it can be separated into 3 components. [1]

iii) The drop of dye would have dissolved into the water.
OR The chromatogram would not have formed. [Any 1 = 1]

c) Using a magnet, separate out the iron. [1]
Add water to dissolve the copper sulfate as sulfur remains insoluble. [1]
Filter to obtain sulfur as residue. [1]

8ai) 1. Crush egg shells and place some in a test tube. [0]
2. Add some acid to the egg shells and pass the gas produced into limewater [2]
3. If white precipitate forms in the limewater, then the gas is carbon dioxide this shows that egg shells contains carbonate. [1]
Labelled diagram: teat pipette [1] Lime water [1]

(ii) Acid + Carbonate → Salt + water + carbon dioxide [Any 2/3/4=1,all 5 =2]

(b) Dip the blue litmus paper into a bottle of solution –turns red, then it is an acid. [1]
If not, dip the red litmus as well – if it remains red, then the solution is neutral. [1]
Use the red litmus on one of the two remaining solutions, the one that turns red litmus blue is an alkali [1]

9a i) 40° ii) 60° [Any 1 =1,max 2]

b) 5 + 2 – 3 [1]
=4cm [1]

c) The angle of incidence equals the angle of reflection for a light ray on a plane surface. [1]

di) Diffuse and smooth / Regular and irregular [1]

ii) The angle of incidence equals the angle of reflection for a light ray in regular reflection, does not equal in irregular reflection. [1]
Regular reflection occurs on a smooth surface but regular reflection occurs on a rough surface. [1]
Accept any other reasonable answer.

iii) The image is laterally inverted.
Image distance is equal to object distance.
The image is the same size as the object.
The image is virtual.
The image is upright. [Any 1 =1,max 2]

- End of Examination Marking Scheme -

8

Name	Index Number	Class

JURONG SECONDARY SCHOOL
2016 MID YEAR EXAMINATION
Secondary 2 Express

Science (Physics)

10 May 2016

Total Duration: 2 hours

READ THESE INSTRUCTIONS FIRST

Write neatly using a ballpoint pen either in dark blue or black. (Neither a pencil nor a highlighter is to be used.)

All diagrams or labelling must be drawn neatly and clearly with a pencil (except words must be written with a ball pen)

Each question in Section A has **4** possible answers. Select the most suitable answer and write **A**, **B**, **C** or **D** in the boxes provided on page 6.

For questions in Section B and C, answer **all** questions on the lines/spaces provided.

The number of marks in given in bracket [ ] at the end of each question or part question.

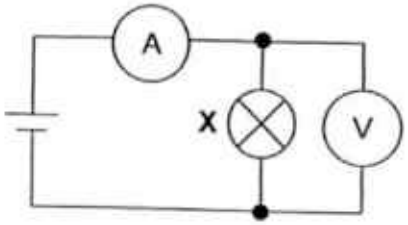
For Examiner's Use	
Section A	10
Section B	14
Section C	10
Sub-Total	34

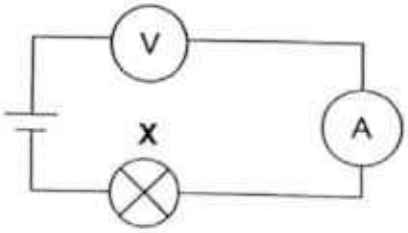
This paper consists of 12 printed pages including this cover page.

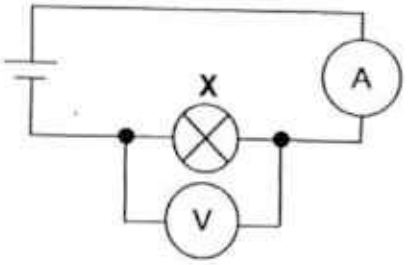
Section A: Multiple Choice Questions (10 marks)

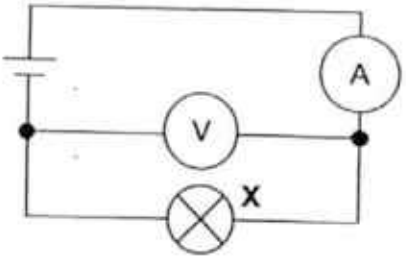
Each question in Section A has 4 possible answers. Select the most suitable answer and write A, B, C or D in the boxes provided on page 6.

1 Which of the following set-ups **cannot** be used to determine the resistance of bulb **X**?

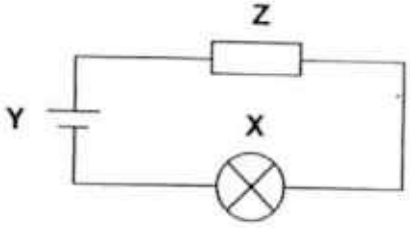
A


B


C


D


2 The figure below shows a circuit with three electrical components, **X**, **Y** and **Z**.



Which of the following statements is **correct**?

A **X** converts light energy into electrical energy.

B **Y** converts electrical energy into light energy.

C **X** and **Z** converts electrical energy into other forms of energy.

D **Y** and **Z** converts thermal energy into other forms of energy.

3 What would happen if a 3 A fuse in an appliance is replaced with a 5 A fuse?

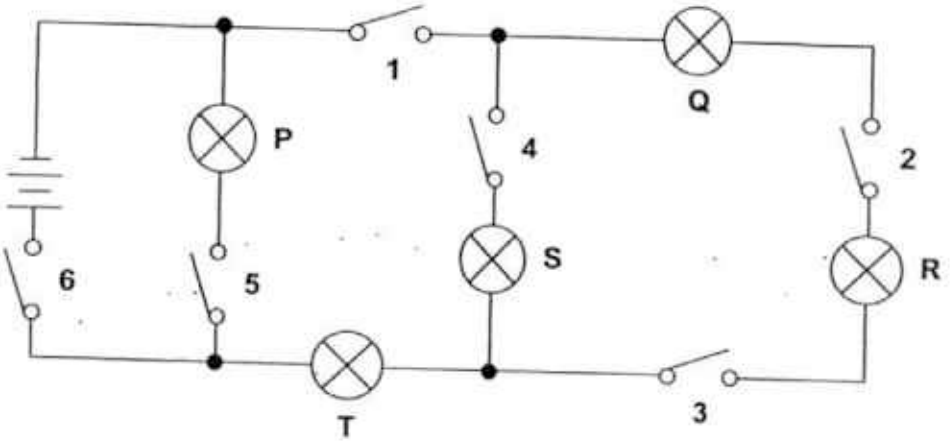
A The appliance would become more dangerous to use.

B The appliance would not work.

C More current would flow through the appliance.

D The user would be better protected against electric shock.

4 Which of the following switches should be closed for bulbs **P** and **R** to light up?



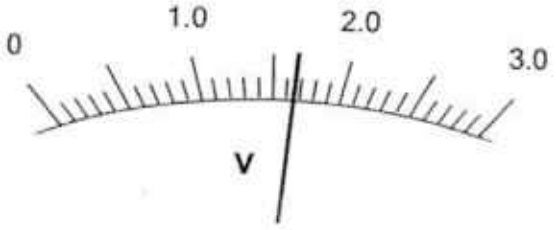
A 1, 4, 5 and 6

B 1, 2, 3, 4 and 6

C 1, 2, 3, 5 and 6

D 1, 2, 3, 4, 5 and 6

5 What is the reading of the meter in the figure below?



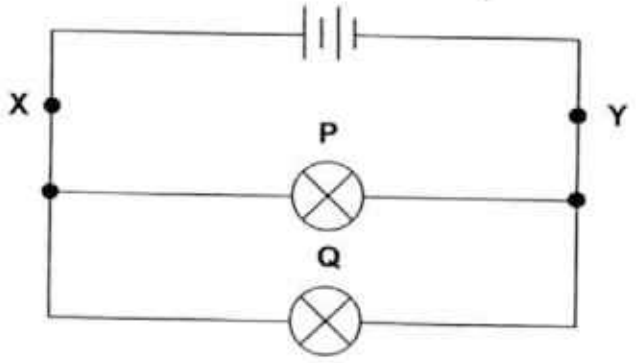
A 1.55 V

B 1.60 V

C 1.65 V

D 1.70 V

6 A student sets up a circuit as shown in the figure below. Both bulbs, **P** and **Q**, light up.



He then joins points **X** and **Y** with a wire.

What will he observe?

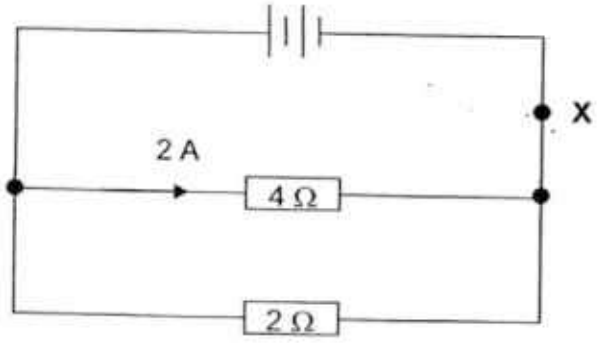
A Both bulbs continue to light up.

B Only bulb **P** lights up.

C Only bulb **Q** lights up.

D Both bulbs do not light up.

7 The figure below shows a circuit. The current flowing through the 4 Ω resistor is 2 A.



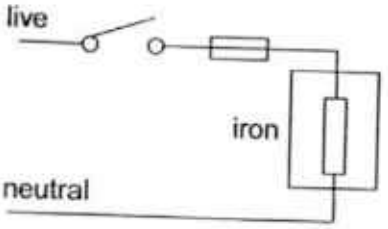
What are the possible values of current flowing through the 2 Ω resistor and point **X**?

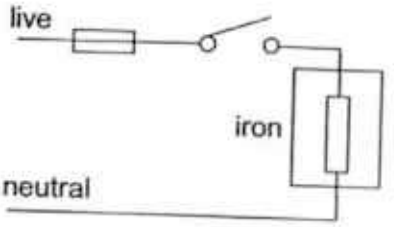
	current through 2 Ω resistor / A	current through X / A
A	1	4
B	1	6
C	4	4
D	4	6

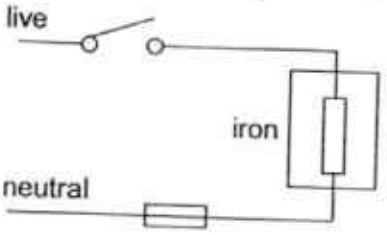
8 Which of the following protects users from electric shock when using an electrical appliance?

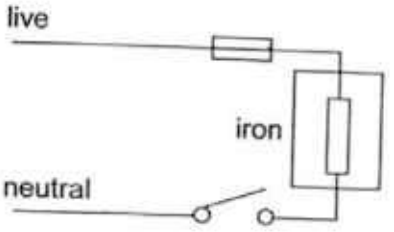
A switch
B earth wire
C neutral wire
D live wire

9 Which of the following set-ups shows the **correct** placement of the switch and the fuse connected to an electric iron?

A


B


C


D


10 Which of the following is **true** about electric current?

A An electric current consists of moving charges.
B An electric current consists of moving atoms.
C An electric current consists of moving electrons.
D An electric current consists of moving protons.

Question	1	2	3	4	5	6	7	8	9	10
Answer										

Section B – Structured Questions (14 marks)

Answer all questions and show all relevant workings on the spaces provided.

11 A student set up a circuit with two identical bulbs, **X** and **Y**, as shown in Fig. 11.1. The ammeter reading is 0.6 A.

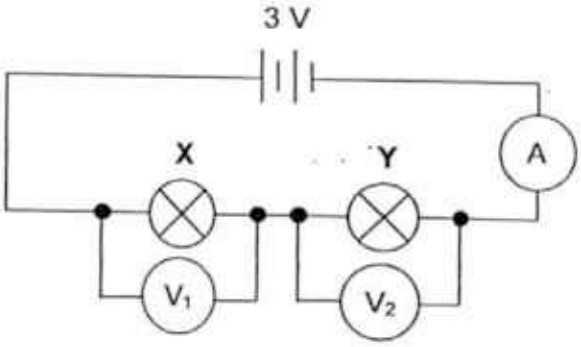


Fig. 11.1

(a) State what are the readings on the two voltmeters. Show your working clearly.

V_1 = _____

V_2 = _____ [1]

(b) State what is the current flowing through each bulb. Explain your answer.

_____

_____ [1]

(c) The student then removes bulb **Y** from the circuit as shown in Fig. 11.2.

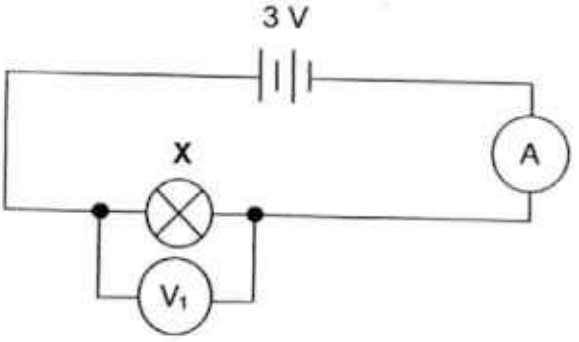


Fig. 11.2

State how the ammeter reading changes. Explain your answer.

_____

_____ [2]

12 Fig. 12.1 shows three identical light bulbs. You are given two dry cells and a switch.

Fig. 12.1

On Fig. 12.1 above, draw a closed circuit diagram such that

(a) when one of the bulbs fails, the other two will remain lighted; [2]

(b) by using an electrical component, the brightness of the bulbs can be varied, and [1]

(c) by using another electrical component, the total potential difference of the circuit can be measured. [1]

13 Fig. 13.1 shows several dangerous uses of electrical appliances in the kitchen.

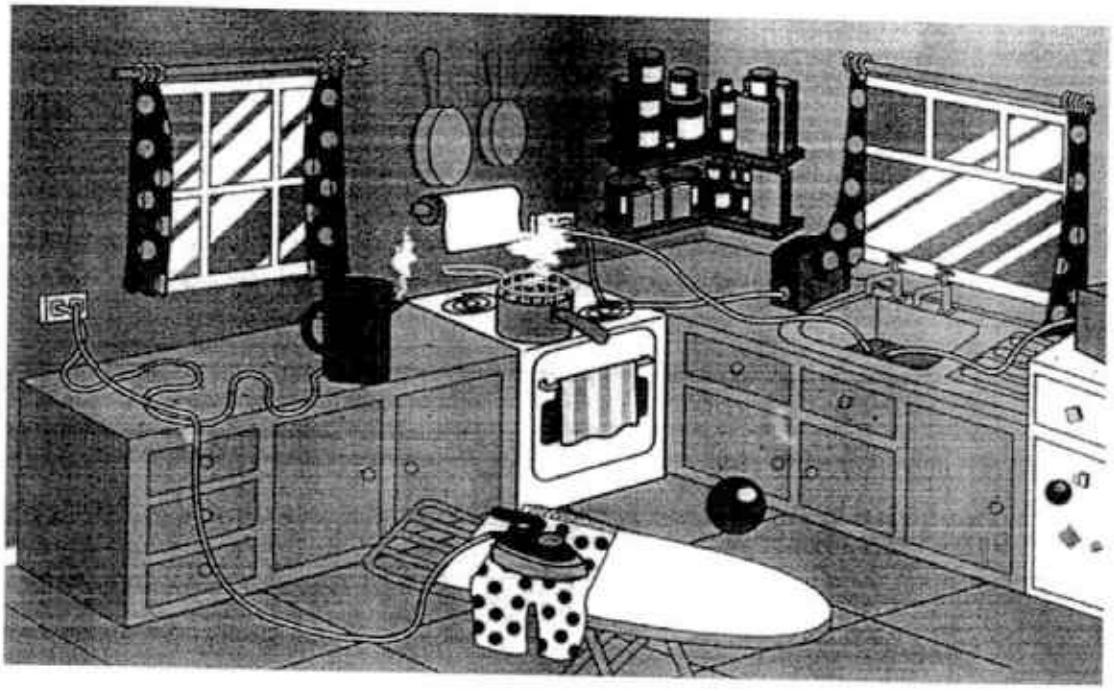


Fig. 13.1

On Fig. 13.1, circle **two** dangerous uses of electrical appliances and complete Table 13.2.

Table 13.2

	situation	electrical hazard	one safety precaution to take
(i)			
(ii)			

[3]

14 Fig. 14.1 shows the circuit diagram of an electric bell.

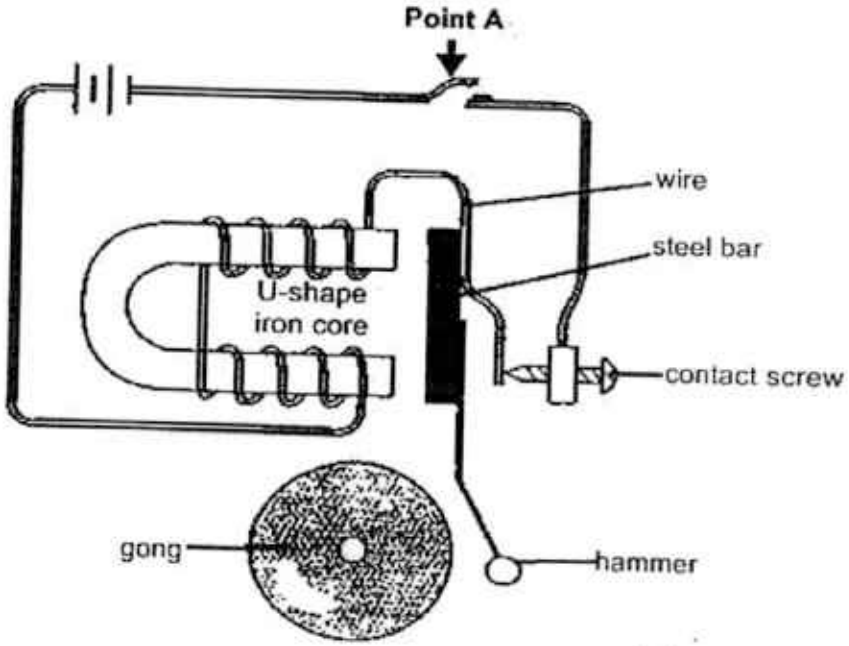


Fig. 14.1

When point **A** is pressed downward, current flows and the hammer will strike the gong.

(a) State the effect caused by the current which allows the hammer to strike the gong.

_____ [1]

(b) On Fig. 14.1, label the direction of the conventional current flow with an arrow. [1]

(c) State one method to increase the force in which the hammer strikes the gong.

_____ [1]

Section C: Free-Response Questions (10 marks)

Answer all questions on the spaces provided. Show all relevant workings.

15 Fig. 15.1 shows a bar chart of the electrical energy consumption for four families living in 4-room HDB flats for the month of April 2016.

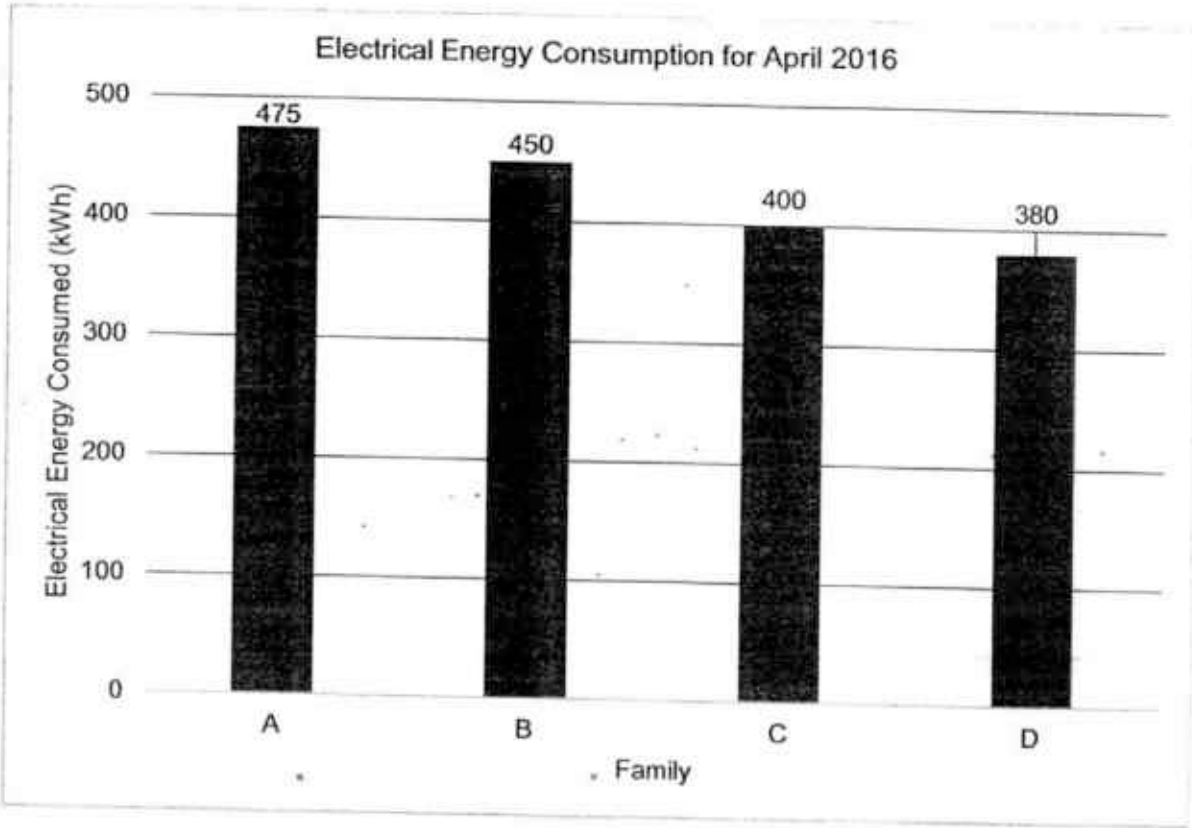


Fig 15.1

(a) The national average consumption for the 4-room HDB flat is 400 kWh.

(i) State which family or families have electrical energy consumption that fall below the national average.

_____ [1]

(ii) State which family or families have electrical energy consumption that are above the national average.

_____ [1]

(b) Table 15.2 shows the number of family members in each family.

Table 15.2

Family	A	B	C	D
No. of family members	6	4	5	3

"To check whether a family consumes more electrical energy than the other, we just need to compare their total electrical energy consumption for the month." Comment on the fairness of this statement by using the information in Fig. 15.1 and Table 15.2.

_____

_____

_____

_____

_____

_____ [2]

(c) Suggest **two** electrical energy saving tips for the families when they are using the refrigerator.

_____

_____ [2]

(d) Another family, **E**, uses the appliances as shown in Table 15.3 for a day.

Table 15.3

Appliance	Power rating	Time used
Refrigerator	0.3 kW	24 hours
Air-conditioner	1 kW	8 hours
4 lights	40 W each	4 hours 30 minutes
Computer	350 W	2 hours 30 minutes

(i) Define what is *power*.

_____

_____ [1]

(ii) Calculate the cost of electrical bill for the month of April (30 days). The unit cost of electrical energy is 25 cents per kilowatt-hour.

Cost = _____ [3]

- End of Paper -

Secondary 2 E 2016 MYE Physics

Question	1	2	3	4	5	6	7	8	9	10
Answer	B	C	A	C	C	D	D	B	B	A

Wrong unit, no unit, wrong capitalization of unit: [-1 mark] maximum

Section B – Structured Questions

11 (a) $V_1 = V_2 = 3/2$
$= 1.5$ V [1]

No working / incorrect working, no mark awarded.

(b) 0.6 A

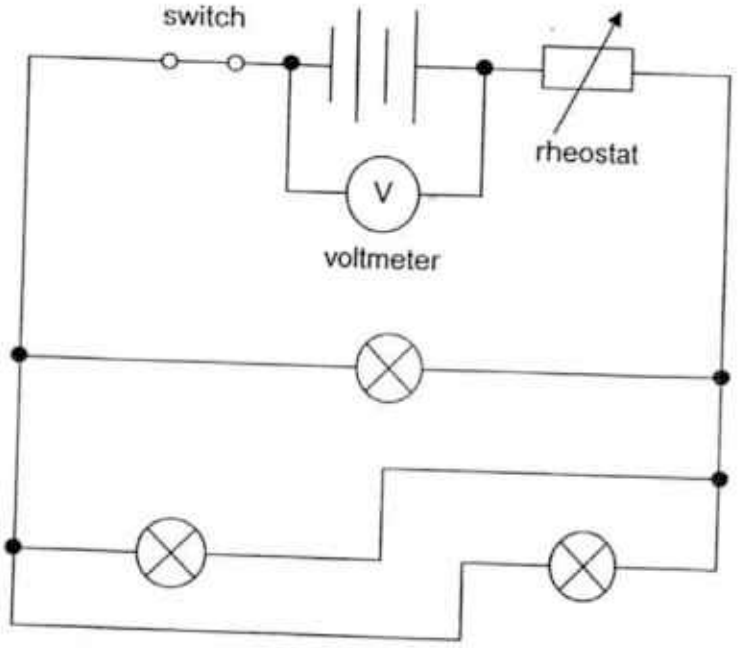
Current at every point in a series circuit is the same. [1]

(c) @ Ammeter reading increases/ ammeter reading is 1.2 A [1]
@ When one bulb is removed, total resistance/ effective resistance decreases in a series circuit. [1]

Do not accept: resistance decreases

Note: if the first point is wrong though the second point is correct, zero mark is awarded (wrong concept)

12



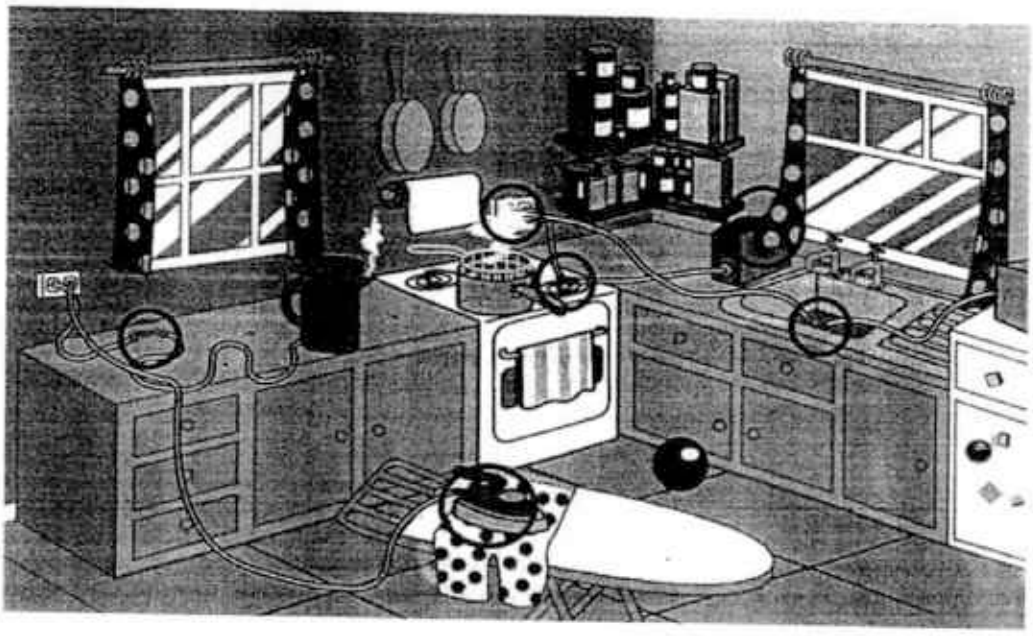
[4]

1 mark – bulbs in parallel arrangement (with nodes drawn)
1 mark – closed switch and two batteries connected correctly
1 mark – correct placement and correct circuit symbol of variable resistor/ rheostat

(accept other possible answers)

1 mark – correct placement and correct circuit symbol of voltmeter (with nodes drawn)

13



	situation	electrical hazard	one safety precaution to take
(i)	Kettle with frayed or damaged wire/ insulation of wire is worn out is still in use	electric shock	Do not use electrical appliances with old or frayed wires. Replace the frayed wires.
(ii)	Wire submerged in water	electric shock	Never use electrical appliances in wet places.
(iii)	Curtain on top / at the opening of toaster	electrical fire	Make sure no object obstructs the operation of electrical appliances.
(iv)	Wire near heat source (insulation of wire may melt and expose wires underneath)	electrical fire / electrical shock	Never place wire near heat source.
(v)	Iron is left turned on / iron on the pants	electrical fire	Do not leave electrical appliances turned on when not in use / left unattended.
(vi)	Water vapour from the pot condenses on the switch	electric shock	Do not operate electrical appliances/ do not use sockets which are near the cooking source when there is cooking. Do not accept: move the cooking away from the nearby sockets.

[3]

Any two of the situations listed above.

Every 2 correct answers – 1 mark

Note:

- The identification of the danger in the figure must match with the description and must be correct, otherwise no mark is awarded for all 3 columns.

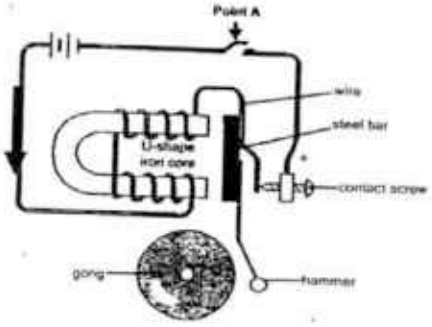
No circling of dangerous use – minus 1 mark

Do not accept:

- food is cooked but gas cooker is not turned off/ pot on the gas cooker left unattended
- kettle is boiling and is left unattended
- kettle is near the edge of the table (not an electrical hazard)
- kitchen paper towel near heat source
- loose wires on the floor may result in tripping over the wires (not an electrical hazard)

14 (a) magnetic [1]

(b)



[1]

(c)
- Increase the number of turns of wire around the U-shape iron core. [1]
- Increase the number of batteries used.
- Increase current.

Any one of the above.

Accept: stronger battery

Section C – Free-Response Questions

15 (a) (i) D [1]

* no mark awarded for excess

(ii) A and B [1]

* both answers to get 1 mark
* no mark awarded for excess

(b)

Family	A	B	C	D
Electrical energy consumed per person / kWh	475 / 6 = 79.2	450 / 4 = 112.5	400 / 5 = 80	380 / 3 = 126.7

- Family D consumed the least amount of electrical energy (380 kWh), per person consumption is the highest (126.7 kWh).
- Family A consumed the highest amount of electrical energy (475 kWh), per person consumption is the least (79.2 kWh). [1]

1st mark: comparison between electrical energy per household consumption versus electrical energy per person consumption; must give specific examples

Accept: comparison between
- Family B and Family D
- Family C and Family D
- Family A and Family B
- Family A and Family C

Therefore, statement is <u>not fair</u> as <u>number of family members</u> in the household also plays a part in the amount of electrical energy consumed as could be seen from Family A and Family D. Family A has the lowest electrical energy consumption per person though it has the most number of members compared to Family D which has the highest electrical energy consumption per person though it has the least number of members. [1]

2nd mark: quote specific examples stating that number of family members matter and it will affect the energy consumption per household

Accept:
- Fewer number of family members, yet consumes more electrical energy as a family (e.g. B versus C)
- more number of family members would mean more electrical energy consumed as a family (e.g. A versus B)

(c)
- Set the <u>thermostat</u> in the refrigerator/ temperature to the <u>recommended setting</u>. Overcooling the refrigerator requires more electrical energy.
- Allow hot food to cool before putting it in the refrigerator.
- Do not keep the fridge door open longer than necessary / close the door when not in use.
- Do not fill the refrigerator fully and leave some spaces. [2]
- Minimise the number of times of opening the refrigerator.

Any two of the above.

Do not accept:
- buy energy saving refrigerator
- increase temperature of the refrigerator
- switch off the refrigerator when going overseas

(d) (i) The amount of electrical energy converted to other forms of energy in one second. [1]

Accept: rate at which energy is used / amount of energy used per second

Do not accept: electricity

(ii) Using E = Pt

Appliance	Power rating	Time used	Electrical energy consumed per day
Refrigerator	0.3 kW	24 hours	7.2 kWh
Air-conditioner	1 kW	8 hours	8 kWh
4 lights	0.04 kW x 4	4.5 hours	0.72 kWh
Computer	0.35 kW	2.5 hours	0.875 kWh

Electrical energy consumed per day = 7.2 + 8 + 0.72 + 0.875
= 16.795 kWh [1]

Total electrical energy consumed for April = 16.795 x 30 (e.c.f)
= 503.85 kWh [1]

Electrical bill = 503.85 x 0.25 (e.c.f)
= $125.96 (to 2 d.p) [1]

Accept: $126

Name	Index Number	Class

JURONG SECONDARY SCHOOL
2016 Mid-Year Examination
Secondary 2 Express

Science (Chemistry)

10 May 2016

Additional materials: Nil

Total Duration : 2 hours

Read these instructions first

Write your name and index number on the cover page in the spaces provided.

You are only allowed to use a ball pen (either of dark blue or black ink) to write neatly. (Neither a pencil nor highlighter may be used).

All diagrams or labelling must be drawn neatly and clearly with a pencil (words must be written with a ball pen).

A calculator may be used if required.

Do not read the questions until told to do so.

Section A: Multiple-choice questions [10 marks]
Section B: Structured questions [13 marks]
Section C: Data-based Question [10 marks]
Answer **all** questions in the spaces provided in the question paper.

A copy of the Periodic Table is attached on page 10.

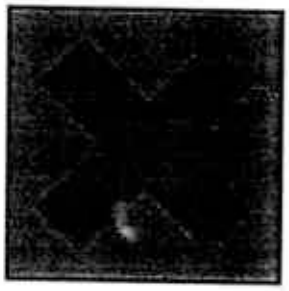
Section	Marks
A	
B	
Total	33

This document consists of **10** pages including this page.

Section A: Multiple Choice Questions (10 marks)
Write the correct options A, B, C or D in the spaces below.

Question	1	2	3	4	5	6	7	8	9	10
Answer										

A1 The diagram shows a hazard symbol on a chemical bottle.



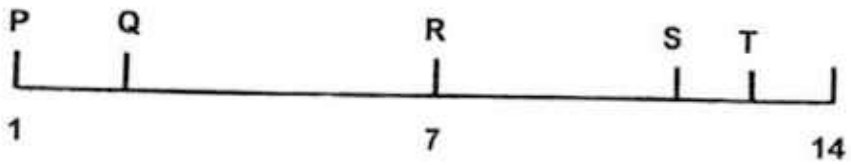
Which statement about the symbol is correct?

A The substance will not catch fire easily.
B The substance is non-corrosive.
C The substance is poisonous of a biological nature.
D The substance produces vapour that can irritate the eyes.

A2 Which statement about sulfuric, hydrochloric and nitric acids is correct?

A They react with calcium to produce carbon dioxide gas.
B They react with calcium carbonate to produce carbon dioxide.
C They react with calcium hydroxide to produce hydrogen gas.
D They react with calcium to produce water.

A3 The pH values of five aqueous solutions, **P**, **Q**, **R**, **S** and **T**, of equal concentrations, are shown.



pH scale

What could the solutions be?

	aqueous ammonia	ethanoic acid	hydrochloric acid	potassium chloride	potassium hydroxide
A	P	S	T	Q	R
B	S	Q	P	R	T
C	P	Q	R	S	T
D	Q	R	S	T	P

A4 **D**, **E** and **F** are three solutions with pH values of 2, 5 and 8 respectively. The three solutions are mixed together as shown.

I. solution **D** + solution **E**
II. solution **E** + solution **F**
III. solution **D** + solution **F**

Which solutions, when mixed together, could form a solution of pH 7?

A **II** and **III** only
B **I** and **II** only
C **I** and **III** only
D **II** only

A5 Which of the equations is **not** correct?

A copper(II) hydroxide + sulfuric acid → copper(II) sulfate + water
B iron + sulfuric acid → iron(II) sulfate + hydrogen gas
C sodium carbonate + hydrochloric acid → sodium chloride + carbon dioxide
D magnesium carbonate + nitric acid → magnesium nitrate + carbon dioxide + water

A6 An aqueous solution has a pH value of 2.

What information can be derived from this fact about the ions present in the solution?

	concentration of H^+ ions	concentration of OH^- ions
A	low	low
B	low	high
C	high	low
D	high	high

A7 Which gas changes damp blue litmus paper red and then bleaches?

A carbon dioxide gas

B oxygen gas

C hydrogen gas

D chlorine gas

A8 A solution containing a high concentration of hydrogen ions.

I. It has a pH of less than 7.
II. It liberates chlorine gas when added to a carbonate.
III. It conducts electricity.

Which statements best describes the solution?

A statements I, II and III

B statements I and II only

C statements I and III only

D statements II and III only

A9 Which pair of substances will react to produce water as one of their products?

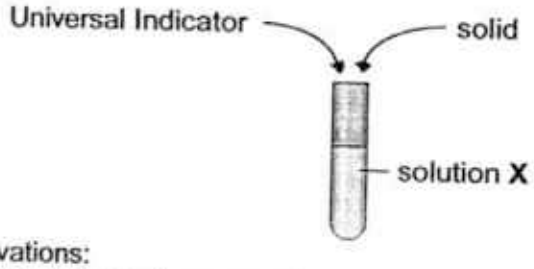
A calcium nitrate and zinc sulfate

B hydrochloric acid and sodium carbonate

C ethanoic acid and magnesium

D sulfuric acid and sodium chloride

A10 A solid is used to react with an unknown solution. Universal indicator is then added to the solution **X** that is formed. A lighted splint is used to test for the gas that is evolved.



Observations:
Universal indicator turns purple.
A colourless, odourless gas extinguishes a lighted splint with a pop sound.

Which correctly explains the observations?

I. Solution X is alkaline.
II. The evolved gas is hydrogen gas.
III. Solid is likely to be a carbonate.

A statements **I** and **II**

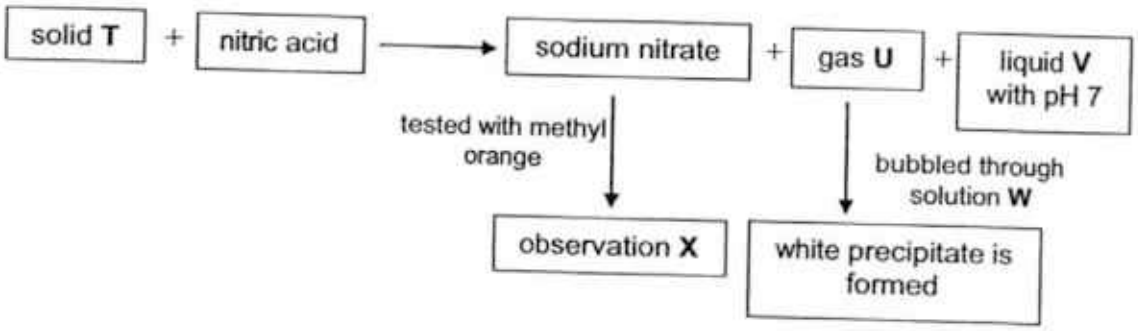
B statements **I** and **III**

C statements **II** and **III**

D statements **I**, **II** and **III**

Section B: Structured Questions [13 marks]
*Answer **all** questions in the spaces provided.*

B1 Study the flow diagram and answer the questions that follow.



(a) **Name** the unknown substances **T**, **U**, **V** and **W**.

solid **T**: .....

gas **U**: .....

liquid **V**: .....

solution **W**: ..... [4]

(b) Describe observation **X** when sodium nitrate is tested with methyl orange.

..... [1]

(c) Nitric acid can also react with an alkali to produce sodium nitrate.

(i) Name the alkali.

..... [1]

(ii) Write a word equation for the reaction between nitric acid and the alkali.

..... [1]

B2 Moist red litmus paper is commonly used to test for gases such as ammonia gas.

(a) State the observation to confirm the identity of ammonia gas.

..... [1]

(b) Explain why the litmus paper must be moistened when testing for ammonia gas.

.....

.....

..... [2]

B3 Citric acid is a weak acid and hydrochloric acid is a strong acid.

(a) Define '*acid*'.

.....

..... [1]

(b) Describe a test that can be carried out in the school laboratory to differentiate the strength between hydrochloric acid and citric acid.

.....

.....

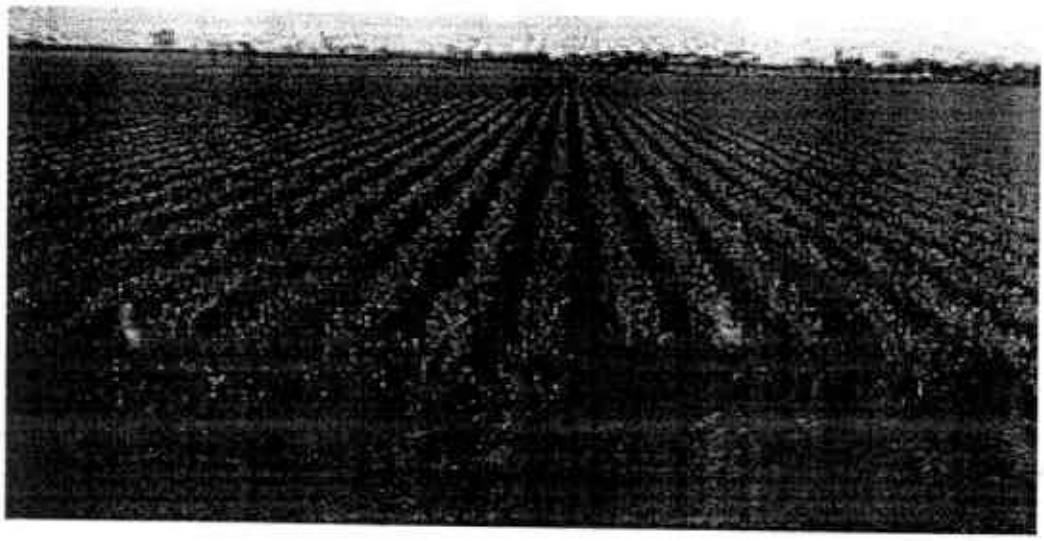
.....

.....

..... [2]

Section C: Data-based Question [10 marks]
*Answer **all** questions in the spaces provided.*

C1 Calcium hydroxide, traditionally know as slaked lime, is an inorganic compound which is alkaline. It is obtained when calcium oxide is mixed with water. Calcium hydroxide is relatively soluble in water and it is generally used in sewage treatment and fresh water treatment. It is also commonly used in food industry to manufacture food such as century eggs, corn tortillas and it can also be used as a substitute for baking soda. This is due to its low toxicity and *mildness* of its basic properties.



Farmers also commonly use calcium hydroxide in aiding the conditions of soil. However, it is advised by experts that calcium hydroxide should not be added to soil containing ammonium fertilisers as the reaction as shown will take place.

calcium hydroxide + ammonium nitrate → calcium nitrate + ammonia gas + water

(a) (i) **Name** the ion that is found in all alkalis.

..... [1]

(ii) State two properties of calcium hydroxide.

.....

..... [2]

(b) **(i)** State how calcium hydroxide can help in aiding the condition of soil.

..... [1]

(ii) Using the reaction stated, explain why calcium hydroxide should not be added to the soil containing ammonium salts.

.....

..... [1]

(iii) Name the salt that is formed when calcium hydroxide reacts with sulfuric acid.

..... [1]

(c) **(i)** State an example of alkali that is not advisable to be added to soil.

..... [1]

(ii) Briefly explain why the alkali should not be added.

.....

.....

..... [2]

(iii) State the colour change when phenolphthalein is added to the alkali named in **c(i)**.

..... [1]

End of Paper

DATA SHEET
The Periodic Table of the Elements

Group

I	II											III	IV	V	VI	VII	0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60
Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63
157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66
165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69
173 Yb Ytterbium 70	175 Lu Lutetium 71	
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92
Np Neptunium 93	Pu Plutonium 94	Am Americium 95
Cm Curium 96	Bk Berkelium 97	Cf Californium 98
Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101
No Nobelium 102	Lr Lawrencium 103	

Key

a / X / b	a = relative atomic mass X = atomic symbol b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.)

Jurong Secondary School
2E Science (Chemistry)
2016 Mid-Year Examination
Marking Scheme

Section A: Multiple-choice Questions [10 marks]

Question	1	2	3	4	5
Answer	D	B	B	A	C
Question	6	7	8	9	10
Answer	C	D	C	B	A

MCQs are generally well done.

Section B: Structured Questions [13 marks]

Qn	Answer	Remarks
B1a)	T: **sodium carbonate [1]** U: **carbon dioxide [1]** V: **water [1]** W: **calcium hydroxide [1]** OR **limewater [1]** Question is generally well done except some students write limewater as two words.	For T, U, V and W, spelling must be correct to be awarded [1]. Accept either or of W.
B1b)	Methyl orange turns from **orange to yellow [1]**. **Common error: Students cannot see that sodium nitrate is a neutral salt of pH 7. Most of the students took it as acid.**	Colour change must be stated to award [1].
B1ci)	**sodium hydroxide [1]**	spelling must be correct to be awarded [1].
B1cii)	**sodium hydroxide + nitric acid → sodium nitrate + water [1]**	Accept ecf from 1c(i)
B2a)	Moist red litmus paper **turns blue [1]**.	
B2b)	MP1: When the litmus paper is dry, **ammonia gas** is **not able** to **produce hydroxide ions [1]** that will react with the red litmus paper to turn blue. MP2: When the litmus paper is **moistened**, the ammonia gas can **dissolve and produce hydroxide ions** that will **display the property of alkali, enabling the colour change [1]** of litmus paper from red to blue. **Common error: Question badly attempted. Students cannot relate that ammonia gas is dry and cannot display alkali properties.**	MP1: mentioning that dry gas no hydroxide ions or ammonia can display its property in aqueous form MP2: dissolved ammonia produces hydroxide ions, display property of alkali, causing colour change
B3a)	A substance which **dissolves in water** to produce **hydrogen ions** as the **only positive ion [1]**	

B3b)	Method 1: Use of universal indicator Hydrochloric acid – U.I. changes from **green to red** [1] Ethanoic acid – U.I. changes from **green to orange / yellow** [1] Method 2: Reaction of acid with reactive metal / metal carbonate Hydrochloric acid – reaction produces a **large** amount of **effervescence** [1] Ethanoic acid – reaction produces a **small** amount of **effervescence** [1] **Common error: Some students did not mention the original colour of Universal Indicator.**	MP: If the initial colour of UI is not indicated but the final colour of the UI is correct after adding to both acids, award 1 mark.

Section C: Data-Based Question [10 marks]

Qn	Answer	Remarks
C1ai)	**hydroxide [1]**	spelling must be correct to be awarded [1].
C1aii)	**conducts electricity** **soluble in water** **pH>7** **bitter taste** **slippery/soapy** **caustic** **turns red litmus paper blue**	any 1 point award [1] award **maximum of 2 marks**
C1bi)	It can help to **reduce the acidity of the soil** [1] OR It helps to **neutralise the acidic soil [1]**.	
C1bii)	There will be a **loss of hydroxide ions** as calcium hydroxide **reacts with ammonium nitrate to produce calcium nitrate**, which is a **salt [1]**. **Common error: Students unable to relate the use of calcium hydroxide to the equation and see that the reaction cause the loss of hydroxide ions.**	MP: must mention that the hydroxide ions are lost as salt is produced.
C1biii)	**calcium sulfate [1]**	spelling must be correct to be awarded [1].
C1ci)	any **strong alkali [1]**, such as sodium hydroxide, potassium hydroxide, lithium hydroxide	spelling must be correct to be awarded [1].
C1cii)	The alkali is extremely **caustic [1]** and it can **destroy the cells** found in plants and the plants may **wither and die [1]**.	
C1ciii)	turns from **colourless to pink [1].**	

Name	Index Number	Class

JURONG SECONDARY SCHOOL
2016 MID-YEAR EXAMINATION
Secondary 2 Express

Science

10 May 2016

Biology Module

Total Duration for Science: 2 hours

Candidates answer on the question paper.
Additional materials: Nil

Read these instructions first

Write your name and index number on the cover page in the spaces provided.

Do not open the booklet until told to do so.

Section A: Multiple-choice questions [10 marks]
Answers to Section A **must** be written in the table provided on page 2.

Section B: Structure questions [13 marks]
Answer **all** questions in the spaces provided in the question paper.

Section C: Data-based question [10 marks]
Answer **all** parts in the spaces provided in the question paper.

Section	Marks
A	
B	
C	
Total	33

This document consists of **9** pages including this page.

Section A: Multiple-choice Questions [10 marks]

Choose the correct answer for each question and write its letter in the table below.

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10

A1 Which part of the alimentary canal is most acidic?

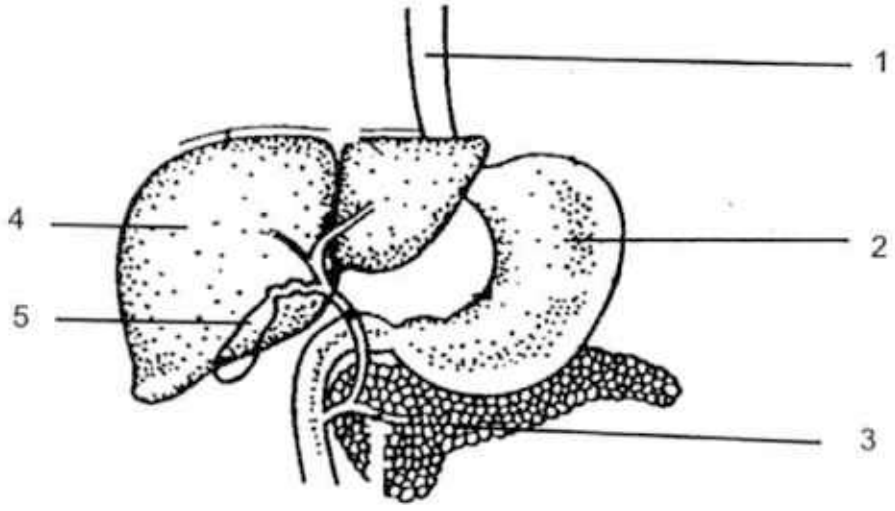
A oesophagus

B stomach

C small intestine

D large intestine

A2 Which two structures produce substances involved in the digestion of fats?



A 1 and 4

B 3 and 4

C 3 and 5

D 4 and 5

A3 What are the functions of the large intestine?

	absorption of water	production of enzymes
A	no	no
B	no	yes
C	yes	no
D	yes	yes

A4 Why does chewing food help digestion?

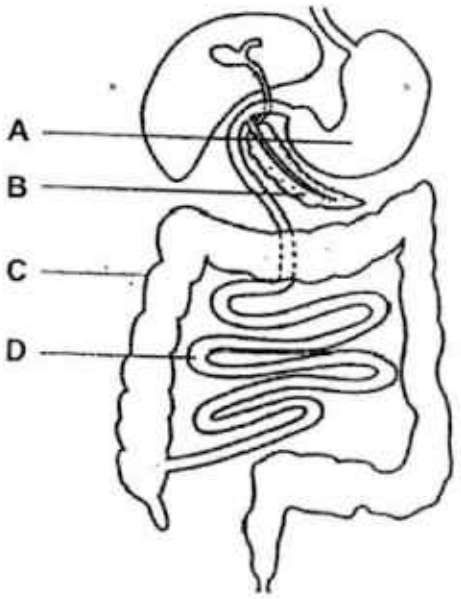
A the food becomes easier to swallow

B the food has a better taste

C the food has a greater surface area for enzymes to work on

D the food becomes softer

A5 Which structure is not part of the alimentary canal?



A6 Four different tests were carried out on some food and the results are recorded in the table below. Which food contained both starch and protein?

food	Benedict's test	biuret test	ethanol emulsion test	iodine test
A	+	+	-	-
B	+	-	+	-
C	-	-	+	+
D	-	+	-	+

A7 Runners often eat bananas during long races. Which nutrient in a banana is important during the race?

A carbohydrates

B fibre

C vitamins

D minerals

A8 Two tests were carried out on a food sample. The results of the tests are listed in the table below:

test	result of test on food sample
1	mixture turned violet
2	cloudy emulsion formed

What is the food sample most likely to be?

A pasta

B cucumber

C cheese

D pineapple

A9 Which of the following is not a function of the liver?

A produce lipase

B produce bile

C convert excess amino acids to urea

D convert excess glucose to glycogen

A10 The table shows the nutrient contents in a bowl of chicken rice.

food	protein / g	carbohydrate /g	fat /g
rice	0.2	8.9	0.0
chicken	2.1	0.0	0.5

What would be the main end-products of digestion of the above meal?

A simple sugars and glycerol

B fatty acids and glucose

C amino acids and simple sugars

D glycerol and amino acids

Section B: Structured Questions

[13 marks]

Answer **all** questions in this section in the spaces provided.

B1 **Fig. 1.1** below shows the human digestive system.

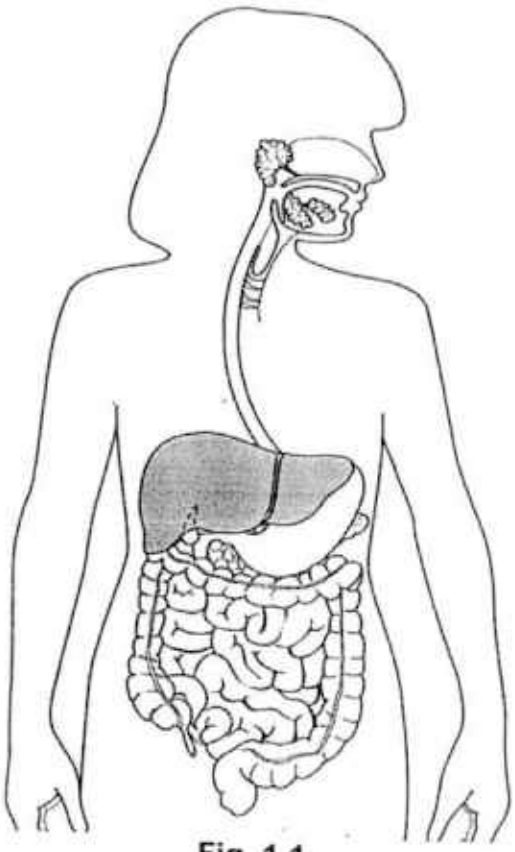


Fig. 1.1

(a) Label and name the part where

(i) digestion of protein begins;
(ii) digestion of food is completed. [2]

(b) Explain why protein needs to be digested. [3]

.....

.....

.....

.....

B2 **Fig. 2.1** shows a pill designed to cure an intestinal infection.

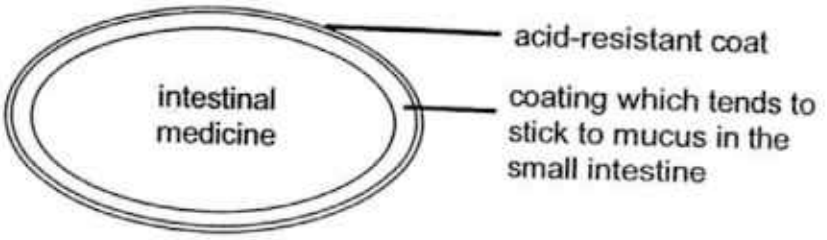


Fig. 2.1

(a) Explain the role of the "acid-resistant coat". [3]

.....

.....

.....

.....

(b) Explain the advantage of the "permeable coat that tends to stick to mucus in the small intestine". [3]

.....

.....

.....

.....

B3 Define malnutrition and give an example of malnutrition in the world today. [2]

.....

.....

.....

Section C: Data-based Questions [10 marks]

Answer **all** questions in this section in the spaces provided.

C1 **Table 1.1** shows the calories and food group requirements for 3 different groups of people.

Table 1.1

food group	older adults	pregnant women	active teen boys
daily calories	1600 calories	2200 calories	2800 calories
grains group	6	9	11
vegetable group	5	4	4
fruit group	3	3	3
milk group	4	5	4
meat and beans group	2	2	4

(a) Based on the data provided in Table 1, explain the following: [6]

(i) *older adults*

Calories requirement: .....

Why is the calories requirement for older adults the lowest among 3 groups?

.....

.....

.....

(ii) *pregnant women*

Explain why a pregnant women requires the high amount of milk group products in her diet.

.....

.....

.....

(ii) *active teen boys*

Explain the data for the requirement in grains group and meat/beans group.

.....

.....

.....

(b) Describe how you would test a sample of milk for presence of lipids. [4]

.....

.....

.....

.....

.....

.....

End of Biology Paper

JURONG SECONDARY SCHOOL
MID-YEAR EXAMINATION 2016
Secondary 2 (Express)

Science (Biology)

10 May 2016

Section A: Multiple-choice Questions

[10 marks]

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
B	B	C	C	B	D	A	C	A	C

Section B: Structured Questions

[13 marks]

Qn.	Answers	Mark allocation	Markers Annotations
B1i ii	label 'stomach' correctly; label 'small intestine(s)' correctly;	1 1	R: Mouth (in this context, we are only referring to chemical digestion)
b	MP1 idea that protein are large molecules and needs to be digested into smaller/simpler molecules; MP2 ref to protein digested to amino acids after digestion; MP3 idea that amino acids are small + thus able to be absorbed into bloodstream;	1 1 1	
B2a	MP1 ref to presence of acid in stomach; MP2 AW pill has to pass through stomach before reaching small intestines; MP3 acid resistant coat prevents the pill from being destroy/broken down/corroded by the acid in the stomach; AW: prevents medicine from bring released in stomach (thus not reaching small intestines)	3	the main idea of this answer is - there is HCl in the stomach - HCl will corrode the coating of the pill if it is not acid resistant - we need to ensure the medicine is able to reach the small intestines and be released there MP3 R:digested because HCl cannot "digest"
b	MP1 ref to small intestines has mucus; MP2 AW if pill stick to mucus in small intestines, it stays there longer; MP3 ref to the drug has more time to be released into the small intestines to cure the infection;	3	
B3	MP1 AW taking in excess + insufficient quality of a certain type of food/nutrients; MP2 obesity/starvation/alcoholism, or any other appropriate answer;	2	MP2: must name the condition R: spelling mistakes
Cai	1600 calories (no marks awarded) MP1 not so active/stopped growing; MP2 do not require too much energy;	1 1	R: they do not need so much "calories"

ii	MP1 ref milk high in calcium; MP2 ref growing foetus needs calcium;	1 1	R: protein Also, there is a common misconception that foetus "feed on the milk that the mother drinks"
iii	MP1 ref to grain is carbohydrates + provide most energy/calories; MP2 ref to meat/beans is protein + muscle growth and repair; accept other appropriate answers	1 1	must link the function to the food category
b	MP1: pour 1cm^3 milk sample into test tube + add 1cm^3/equal amount of ethanol into the test tube MP2: shake well; MP3: pour the mixture into 2cm^3 of distilled water + in another test tube; MP4: if a white/cloudy emulsion is formed, lipids is present + if it remains clear, lipids is absent	4	R: white precipitate R: colourless

9

KUO CHUAN PRESBYTERIAN SECONDARY SCHOOL

2016 MID YEAR EXAMINATION

Secondary 2 Express

NAME

CLASS

REG. NO

LOWER SECONDARY SCIENCE

5 May 2016

2 hour

Additional Materials: Multiple Choice Answer Sheet

Setter: Mr. Joseph Chung

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.

This paper consists of 3 sections.

Section A consists of 30 multiple-choice questions.
Answer **all** questions.
For each question, choose the most appropriate answer and shade the letter corresponding to the answer in soft 2B pencil on the separate Multiple Choice Answer Sheet.

Section B consists of 8 structured questions.
Answer **all** questions in dark blue or black pen in the space provided on the Question Paper.

Section C consists of 3 free response questions.
Answer **all** questions in dark blue or black pen in the space provided on the Question Paper.

The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
Section C	
Total	

.....
Parent's signature/ Date

This document consists of **31** printed pages, including the cover page.

[Turn over

Section A (30 marks)

*Answer **ALL** questions in this section.*

Shade the letter corresponding to the answer in soft 2B pencil on the separate Multiple Choice Answer Sheet.

1 Light travels at different speeds in different mediums. Which of the following represents the decreasing speed of light in the respective mediums?

A air, water, glass

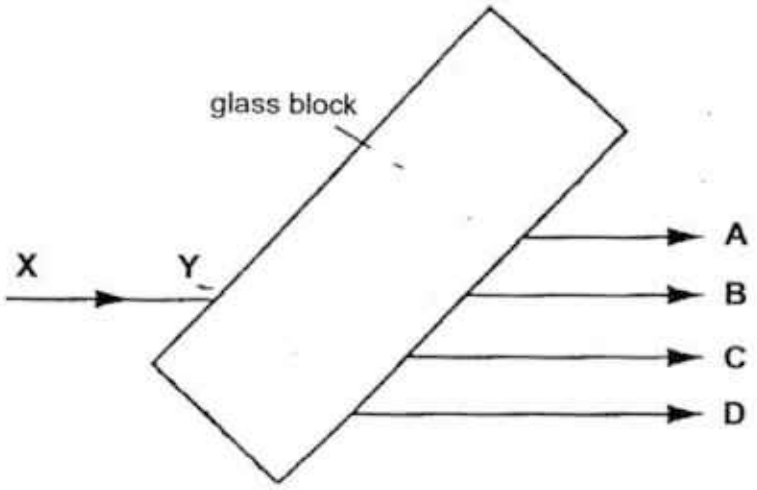
B air, glass, water

C glass, water, air

D water, air, glass

2 **XY** is a ray of light that passes through the rectangular glass block.

Which of the four rays, A, B, C, D shown is most likely to represent the path of the light ray emerging from the glass block after refraction?



3 The formation of a rainbow is the result of light undergoing

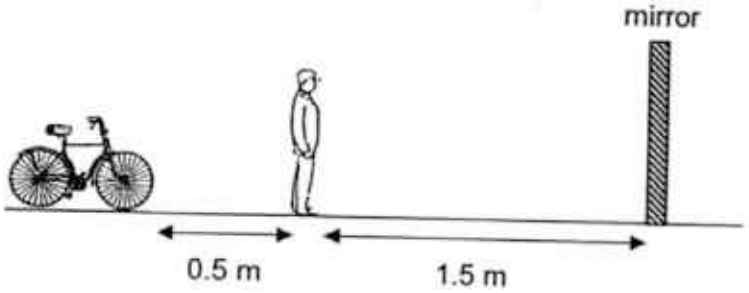
A deflection.

B dispersion.

C irregular reflection.

D regular reflection.

4 Anthony stands in front of a mirror that is placed 1.5 m away from him. He sees a bicycle that is 0.5 m behind him.



What is the distance from his eyes to the image of the bicycle?

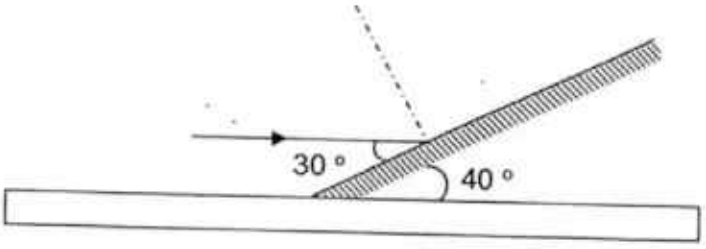
A 0.5 m

B 1.5 m

C 3.0 m

D 3.5 m

5 The diagram below (not drawn to scale) shows a mirror that is tilted at an angle of 40 ^{0} to the bench. A ray of light is shone at an angle of 30 ^{0} to the surface of the mirror.



What is the angle of reflection?

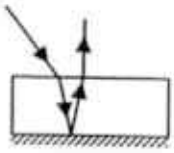
A 30 °

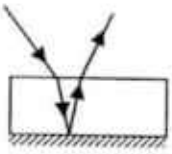
B 40 °

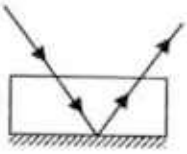
C 60 °

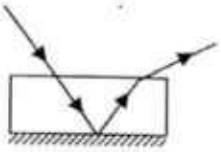
D 70 °

6 The bottom surface of a glass block is silvered to act as a mirror. Which diagram could represent the path of a light ray which enters this glass block through the top surface?

A 

B 

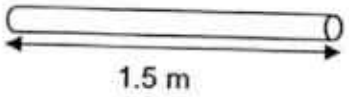
C 

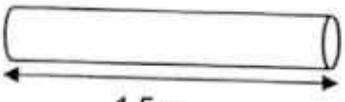
D 

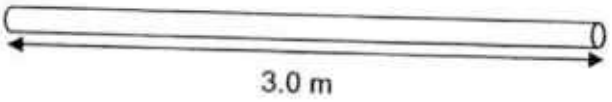
7 Which of the following is **not** the correct representation of the SI unit for the respective measurements?

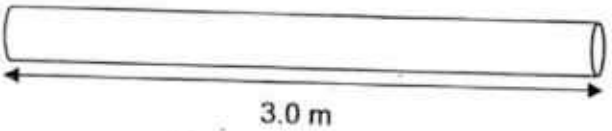
	measurement	SI unit
A	current	ampere
B	resistance	ohm
C	potential difference	volts
D	energy	kilowatt

8 The diagram below shows four wires of different dimensions made from the same metal. Which of the following has the **lowest** electrical resistance?

A 

B 

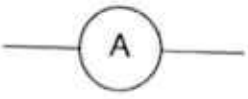
C 

D 

9 Which of the following electrical component can be used to vary the brightness of a light bulb in a circuit?

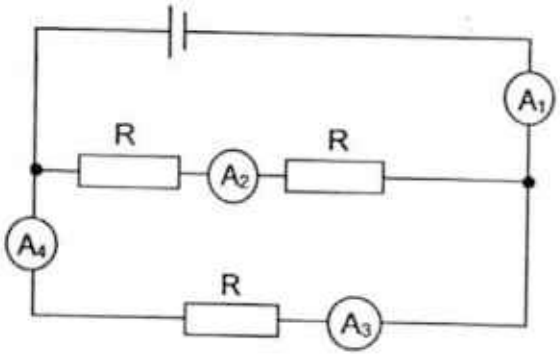
A

B

C 

D

10 The diagram shows an electric circuit with three identical fixed resistors R.



Which ammeter has the largest reading?

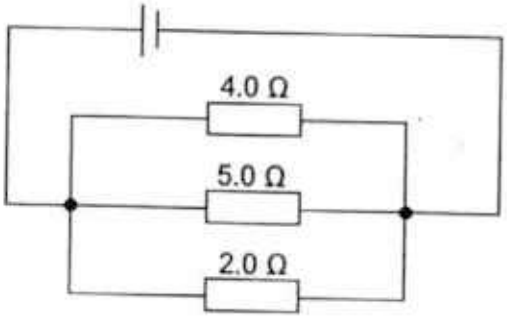
A A_1

B A_2

C A_3

D A_4

11 The diagram below shows three resistors that are connected in a parallel circuit.



What is the total resistance of the circuit?

A 0.09 Ω

B 0.95 Ω

C 1.05 Ω

D 11.0 Ω

12 Which of the following precautions should be taken to prevent electrocution?

i. never insert any item into the electrical socket

ii. never use electrical gadgets in wet places

iii. overload an electrical socket

iv. replace worn out insulation of electrical wiring

A i and ii only

B i, ii and iv only

C ii, iii and iv only

D all of the above

13 What is the purpose of boiling chips in the distillation process?

A to ensure smooth boiling of the solution

B to produce more distillate

C to slow down the boiling process of the solution

D to speed up the boiling process of the solution

14 Which of the following are advantages of paper chromatography?

i. only a small amount of sample is required

ii. fast and accurate analysis can be given

iii. able to separate complex mixtures into its various components

A i only

B i and ii only

C ii and iii only

D all of the above

15 Which method can be used to obtain iron filings from a mixture of iron and sulfur?

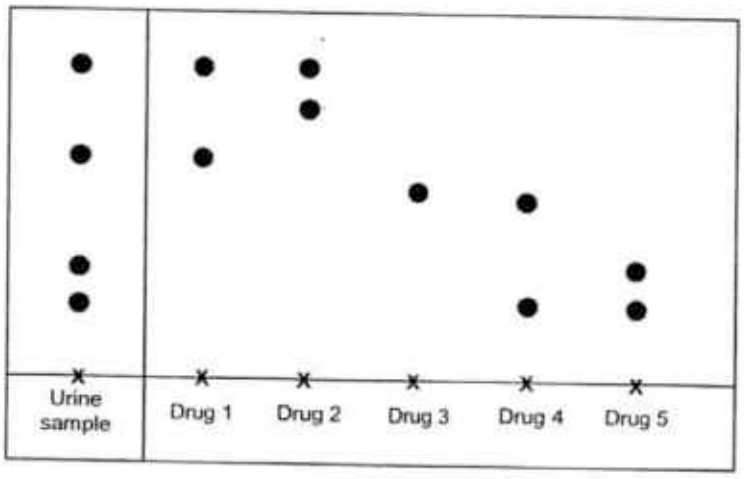
A add water to the mixture, stir and filter

B heat the mixture

C use electric current to pass through the mixture

D use magnetic attraction

16 Paper chromatography is often used to test for the presence of drugs in an athlete's urine sample. The diagram below shows the paper chromatogram of an athlete.



Which drugs are present in the urine sample of the athlete?

A Drug 1 and Drug 3

B Drug 1 and Drug 5

C Drug 1, Drug 3 and Drug 5

D Drug 1, Drug 4 and Drug 5

17 Pure water can be obtained from sandy sea water. Which process needs to be carried out to obtain pure water after the sea water is filtered?

A evaporation to dryness

B paper chromatography

C simple distillation

D sublimation

18 Overhead electricity cables are often hung loosely from pole to pole. Which of the following explains why they are installed this way?

A to allow more room for expansion of cables

B to decrease the electrical conductivity

C to increase the electrical conductivity

D to prevent the cables from snapping due to contraction in cold weather

19 In the process of conduction, energy is transferred

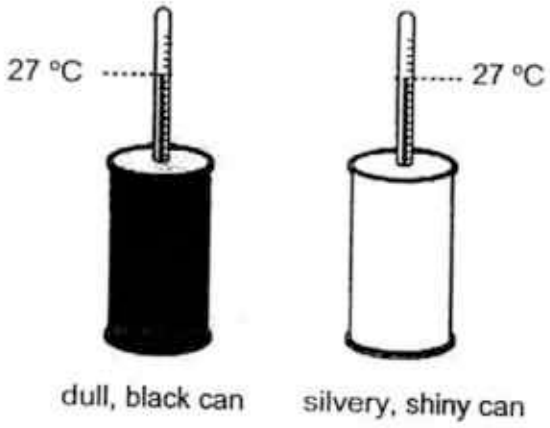
A because of density differences in a liquid.

B because of temperature differences in a solid.

C by the diffusion of particles through a liquid.

D by the vibration of particles in a solid.

20 Two cans of the same shape and material are filled up with equal volume of water at 27 °C. One can is a dull, black can while the other is a silvery, shiny can. The two cans are placed under the sun for 30 minutes.



Which of the following represents the correct observation after 30 minutes?

A The temperature rise in both cans will be the same.

B The temperature in both cans will remain the same at 27 °C.

C The temperature rise in the dull, black can will be more than that of the silvery, shiny can.

D The temperature rise in the dull, black can will be less than that of the silvery, shiny can.

21 A woolen jacket filled with wool helps to keep a person warm in cold climate. How does the wool keep the person warm?

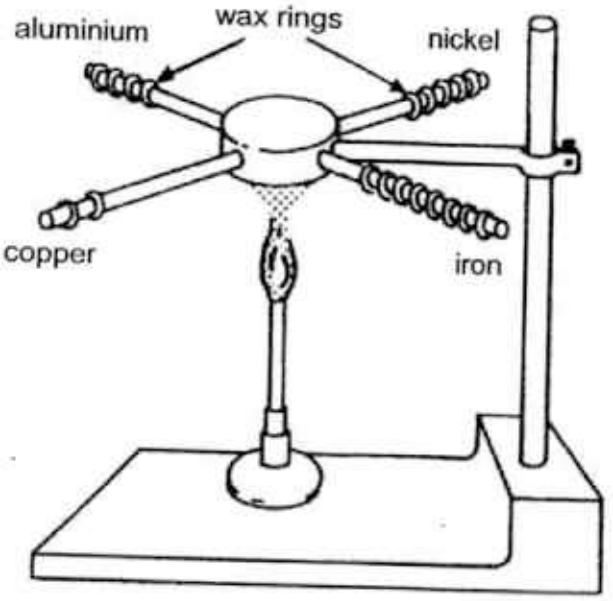
A The wool generates high temperature.

B The wool helps to prevent heat loss by convection.

C The wool is a good absorber of heat.

D The wool traps air, which is a good insulator of heat.

22 David sets up an experiment to investigate the heat conductivity of four different types of metals. All the metals started with the same number of wax rings at the start of the experiment. After 15 minutes, the diagram below shows the observation made by David.



Based on the information given above, arrange the metals in decreasing order of their heat conductivity.

A copper > aluminium > nickel > iron

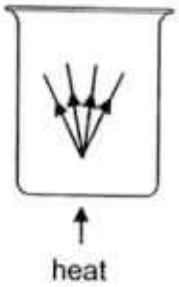
B copper > nickel > aluminium > iron

C iron > aluminium > nickel > copper

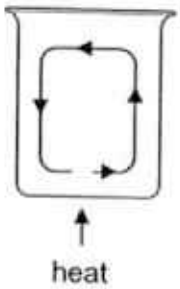
D iron > nickel > aluminium > copper

23 Which of the following diagrams show the correct representation of the convection current in a beaker of boiling liquid?

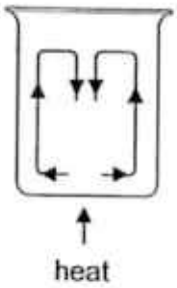
A



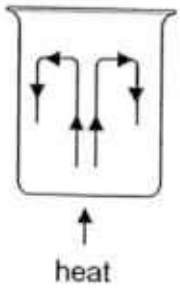
B



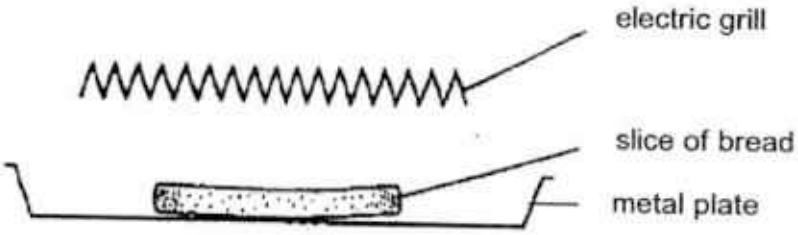
C



D



24 A slice of bread is placed on a metal plate under an electric grill to make a toast.



How does the heat reach the bread?

A by conduction only

B by radiation only

C by conduction and radiation only

D by conduction, convection and radiation

25 Which of the following statements about sound is **not** true?

A Sound travels in the form of wave.

B The average hearing range of an adult human is between 20 Hz to 20,000 Hz.

C The lower the frequency, the higher the pitch of sound produced.

D The speed of sound in air is 330 m/s.

26 A tuning fork has a frequency of 30 Hz. Which of the following statements about the tuning fork is **true**?

A The tuning fork takes 1 minute to produce 30 vibrations.

B The tuning fork takes 1 second to produce 30 vibrations.

C The tuning fork takes 30 minutes to produce 1 vibration.

D The tuning fork takes 30 seconds to produce 1 vibration.

27 The sound wave from the guitar has a lower frequency than the sound wave produced by a trumpet. However, the sound wave produced by the trumpet has a higher amplitude than the sound wave produced by the guitar.

Which of the following correctly represents the pitch and volume of the sound wave made by the guitar and the trumpet?

	lower pitch	lower volume
A	guitar	guitar
B	guitar	trumpet
C	trumpet	guitar
D	trumpet	trumpet

28 The time taken for sound to travel in a thin iron rod of length 320 m is 0.1 seconds. What is the speed of sound in iron metal?

A 0.0003125 m/s

B 32 m/s

C 320 m/s

D 3200 m/s

29 A ship sends sound wave vertically downwards to the sea bed. The time taken to detect the echo is 1.5 seconds. If the speed of sound in water is 1500 m/s, what is the depth of the sea?

A 1125 m

B 2250 m

C 4500 m

D 9000 m

30 In which of the following scenarios does sound travel the fastest?

A drilling through the wall

B explosion in space

C shouting across the hall

D sonar that measures the depth of the ocean

- End of Section A -

Name: _____ ( ) **Class:** _____

Section B (40 marks)

*Answer **ALL** questions in this section.*

Show your working and write your answers in the space provided.

1 Fig. 1.1 shows a triangle **ABC** placed in front of a plane mirror.

(a) Draw and label the image **A'B'C'** formed behind the mirror. [2]

(b) Show, by drawing **two** light rays from point **B** of the object, how the image is being formed. [2]

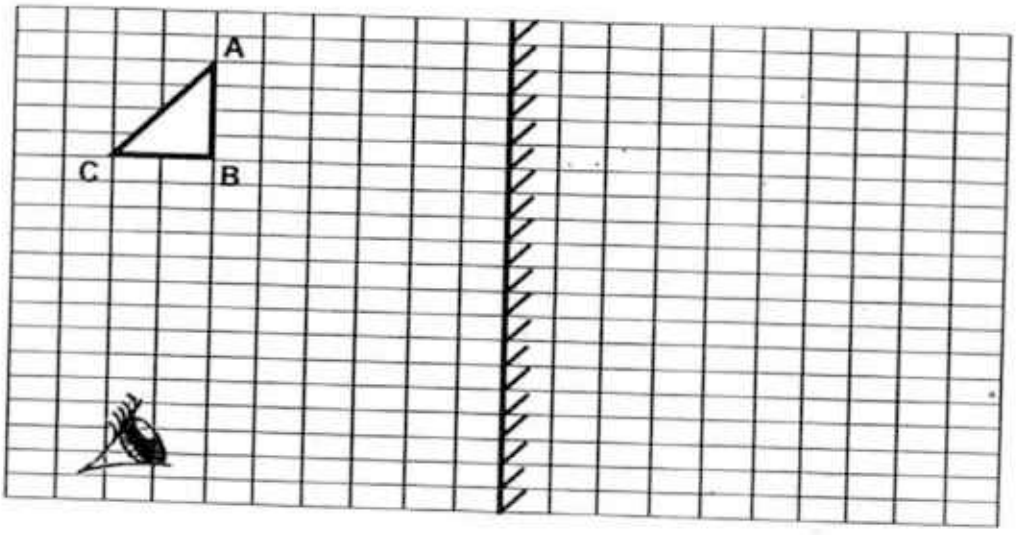


Fig. 1.1

2 Fig. 2.1 shows the electrical system of a hot water heater.

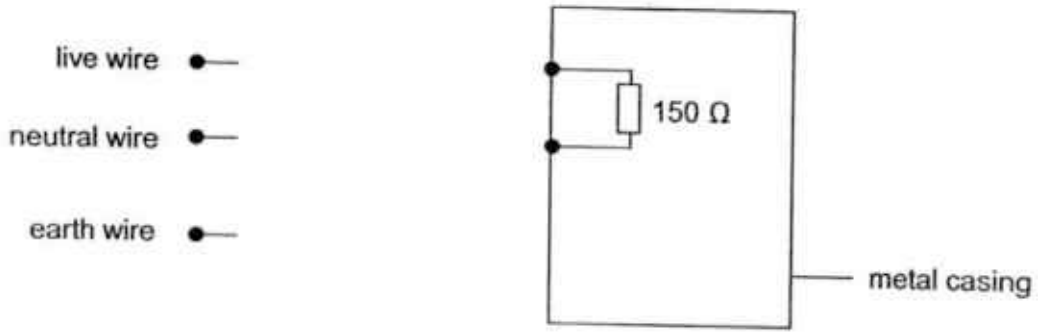


Fig. 2.1

(a) On Fig. 2.1, complete the electrical system by connecting the following:

(i) the live, neutral and earth wires to the hot water heater [2]

(ii) the fuse to the hot water heater. Label the fuse in your drawing. [1]

(b) A voltage of 240 V is applied across the hot water heater. The heating element has a resistance of 150 Ω. Calculate the amount of current passing through the heating element.

[2]

(c) Suggest a material that can be used as the heating element. Explain why.

.....

.....

..... [2]

3 Fig. 3.1 shows a circuit diagram.

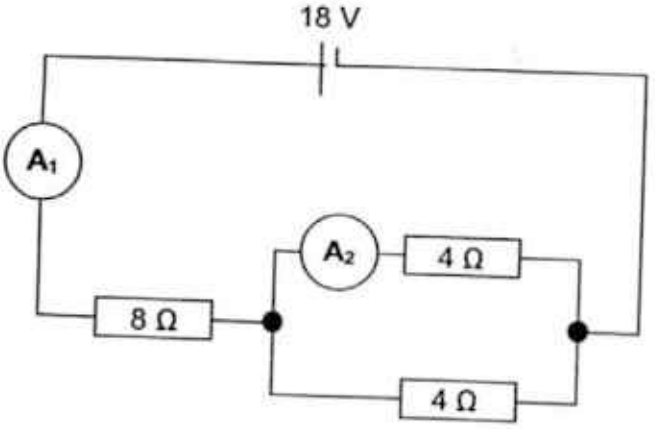


Fig. 3.1

(a) Calculate the total resistance of the circuit.

Total resistance = ... [2]

(b) Calculate the reading of the current that will be shown on ammeter A_1.

Reading on ammeter A_1 = ... [1]

(c) Calculate the reading of the current that will be shown on ammeter A_2.

Reading on ammeter A_2 = ... [1]

4 Table 4.1 shows the power ratings of each air-conditioner unit and each electric fan used in the household.

Table 4.1

appliance	power rating	number of hours used per day
air-conditioner	1600 W	7 hours
electric fan	125 W	10 hours

A family uses three air-conditioner units and three electric fans to keep their house cool.

(a) Calculate the total amount of electrical energy used in kWh in the household per day.

[3]

(b) The cost of using one unit of electrical energy is $0.20. Calculate the total cost of electricity used per day.

[1]

5 Aaron accidentally mixed two liquids, **X** and **Y** together. Liquid **X** has a boiling point of 50 °C, while liquid **Y** has a boiling point of 86 °C. To separate the two liquids, he set up the apparatus as shown in Fig. 5.1.

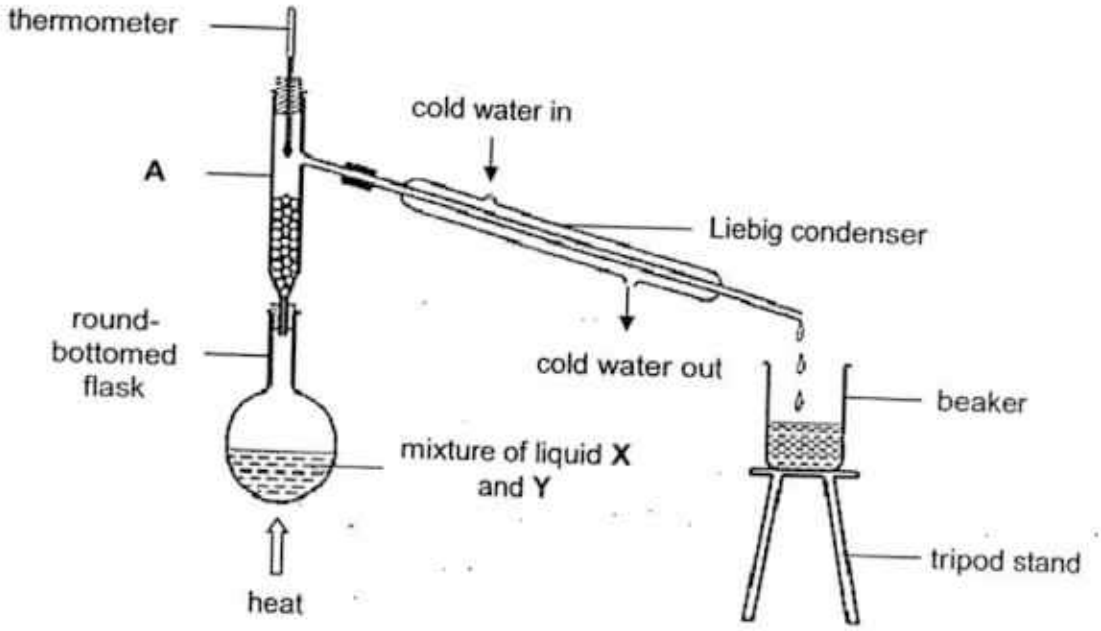


Fig. 5.1

(a) Name this separation technique.

..... [1]

(b) Identify apparatus **A** and state its function.

A: .....

Function of **A**: .....

.....

..... [2]

(c) State which liquid will be collected in the beaker first. Explain why.

.....

.....

..... [2]

(d) Aaron made a mistake when setting up the apparatus shown in Fig. 5.1. Identify the mistake made and explain how this will affect his separation.

.....

.....

.....

..... [2]

6 Fig. 6.1 shows a vacuum flask which keep water hot for a long period of time.

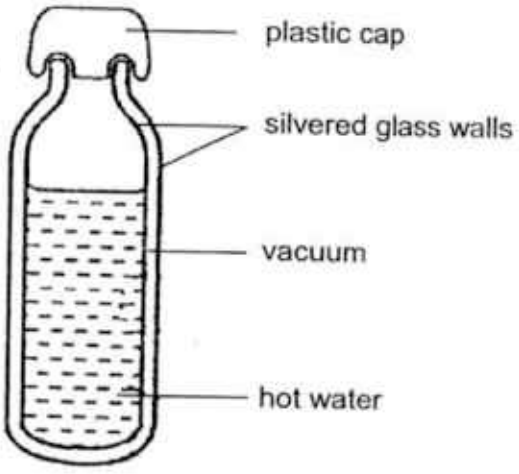


Fig. 6.1

Explain how the following features of the vacuum flask is able to help keep the water hot for a long period of time.

(a) plastic cap

.....

.....

.....

..... [2]

(b) silvered glass walls

.....

.....

.....

..... [2]

(c) vacuum

.....

.....

.....

..... [2]

7 Fig. 7.1 shows the cooling system of a refrigerator.

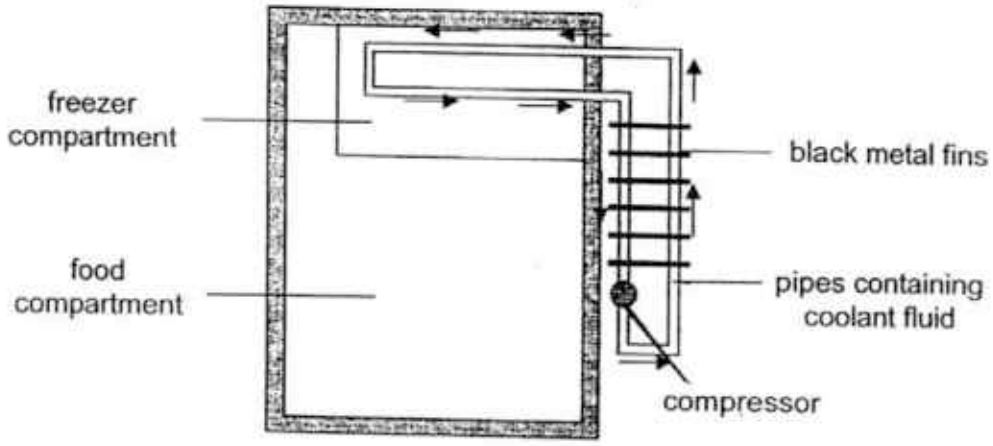


Fig. 7.1

To keep the items in the refrigerator cool, the compressor pumps a coolant fluid through the pipes. The coolant fluid goes to the top part of the refrigerator where it will take heat out of the freezer compartment. Once the coolant fluid exits the refrigerator, the heat is given off into the surroundings at the back of the refrigerator through the black metal fins.

(a) Explain how this process helps to keep the refrigerator cool.

.....

.....

.....

.....

..... [2]

(b) Explain why the metal fins are black.

.....

.....

..... [2]

8 Fig. 8.1 shows the displacement-time graph of a sound wave over time.

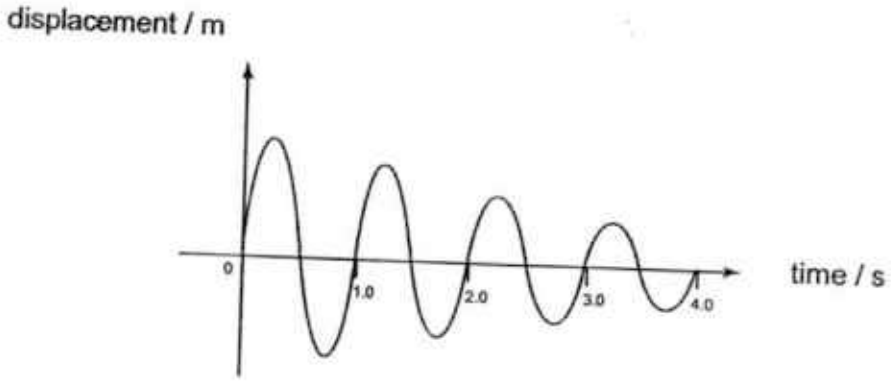


Fig. 8.1

(a) With reference to Fig. 8.1, what can you conclude about the pitch of the sound wave? Explain why.

.....

.....

..... [2]

(b) With reference to Fig. 8.1, what can you conclude about the volume of the sound wave? Explain why.

.....

.....

..... [2]

- End of Section B -

Name: _____ ( )

Class: _____

For Examiner's Use			
Q 9		Q 11	
Q 10		Total	

Section C (30 marks)

*Answer **ALL** questions in this section.*
*Each question carries **10 marks**.*
Show your working and write your answers in the space provided.

9 **(a)** Fig. 9.1 shows how purple food colouring solution is made from purple cabbage.

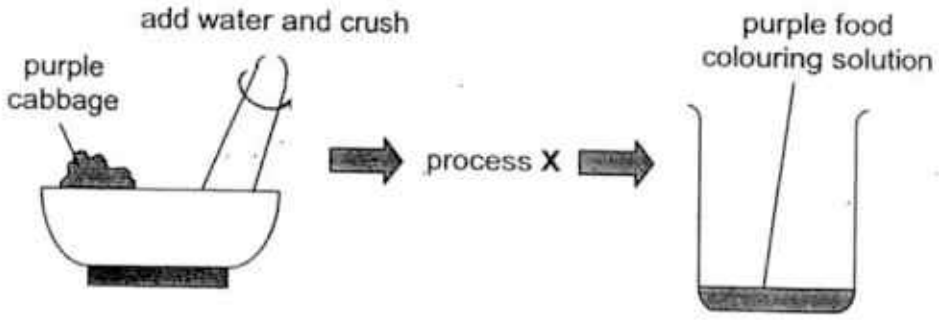


Fig. 9.1

After crushing the purple cabbage, process **X** was carried out to remove the unwanted solid cabbage parts from the purple food colouring solution.

(i) Name process **X**.

..... [1]

(ii) Describe how process **X** is able to separate the unwanted solid cabbage parts from the purple food colouring solution. Identify the residue and filtrate in your answer.

.....

.....

.....

..... [2]

(b) The purple food colouring solution was analyzed using paper chromatography. Fig. 9.2 and Fig. 9.3 shows two different paper chromatograms, with different solvents being used.

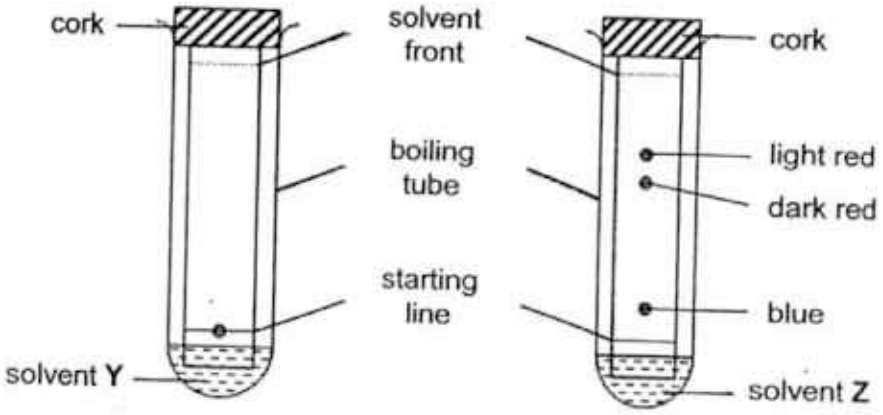


Fig. 9.2 **Fig. 9.3**

(i) Compare Fig. 9.2 and Fig. 9.3. State which of the following solvent (**Y** or **Z**) is the purple food colouring soluble in? Explain why.

.....

.....

..... [2]

(ii) Explain why ink should **not** be used to draw the starting line.

.....

..... [1]

(iii) State whether the purple food colouring is a pure substance or a mixture. Explain why.

.....

.....

..... [2]

(c) A few drops of the purple food colouring solution are placed in the centre of a filter paper as shown in Fig. 9.4. After the solution has dried, solvent **Z** is added to the centre of the paper.

On Fig. 9.4, draw and label the different coloured components present in the purple food colouring to show the paper chromatogram that will be obtained with this set-up. [2]

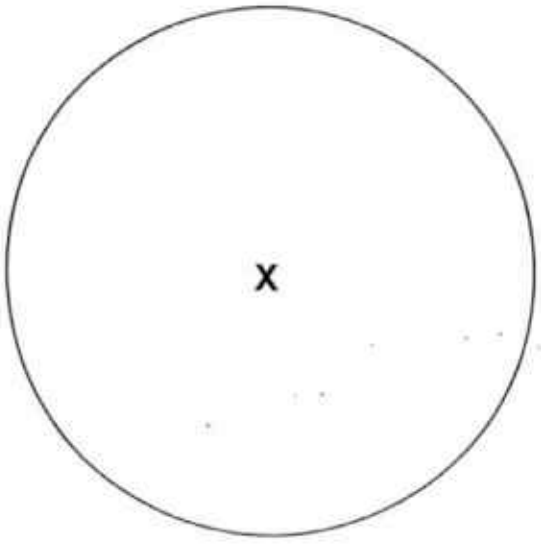


Fig. 9.4

10 **(a)** Fig. 10.1 shows a bimetallic strip which is made up of two metals attached firmly to each other. Metal **X** expands at a faster rate than metal **Y** when heated and contracts at a faster rate than metal **Y** when cooled.

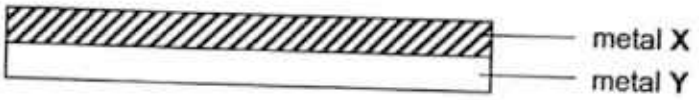


Fig. 10.1

In the space provided below, draw and label how the bimetallic strip will look like **(i)** when heated and **(ii)** when cooled.

(i) when heated	**(ii)** when cooled

[2]

(b) Brian wanted to use the same type of bimetallic strip to construct a fire alarm system for his science project. Fig. 10.2 shows an example of his fire alarm.

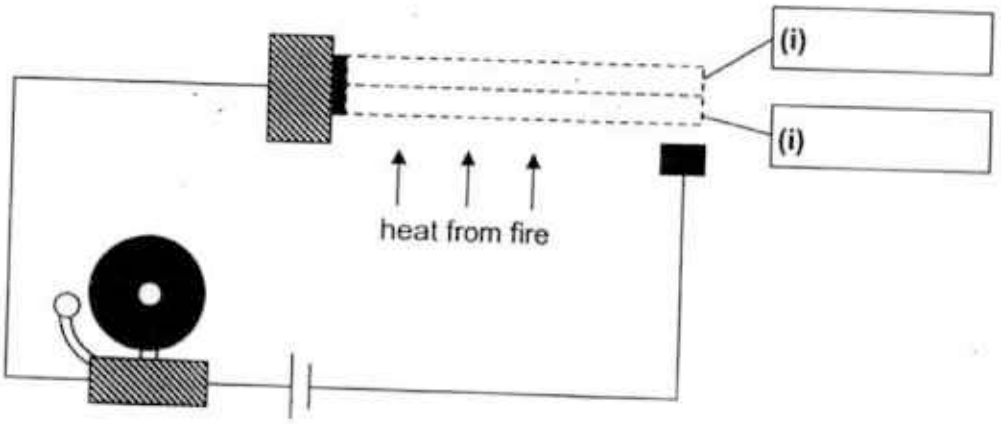


Fig. 10.2

(i) In the boxes in Fig. 10.2, label the correct positions of the metals (metal **X** and metal **Y**) on the bimetallic strip that will allow the fire alarm to function properly. [1]

(ii) With reference from Fig. 10.2, explain how the fire alarm works when a fire is detected.

.....

.....

.....

.....

.....

..... [3]

(iii) Suggest an identity for metal **X** and metal **Y**.

metal **X** .....

metal **Y** ..... [2]

(iv) State **one common** physical property of the two metals used in the bimetallic strip.

..... [1]

(v) State **one** other use of bimetallic strips.

..... [1]

11 (a) Fig. 11.1 shows a bell-jar experiment set up by Student **A** to investigate how sound travels through a medium. The vacuum pump gradually removes the air from the bell-jar when it is switched on.

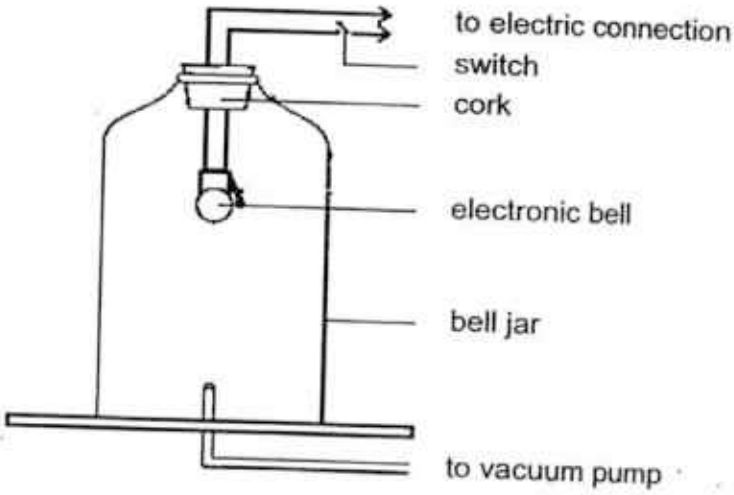


Fig. 11.1

(i) What will happen when Student **A** switched on the electronic bell, with the presence of air inside the bell jar?

.....

..... [1]

(ii) State what happens when Student **A** switched on the vacuum pump?

.....

..... [1]

(iii) What conclusion can you draw from this experiment?

.....

..... [1]

(b) Fig. 11.2 shows two students, **A** and **B**, standing in front of a wall. Student **A** claps his hands once. Student **B** hears two sounds – the clap followed by an echo.

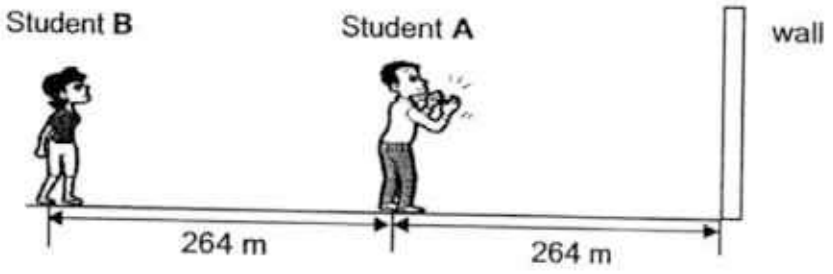


Fig. 11.2

Given that speed of sound in air is 330 m/s, calculate the time interval between the two sounds.

[3]

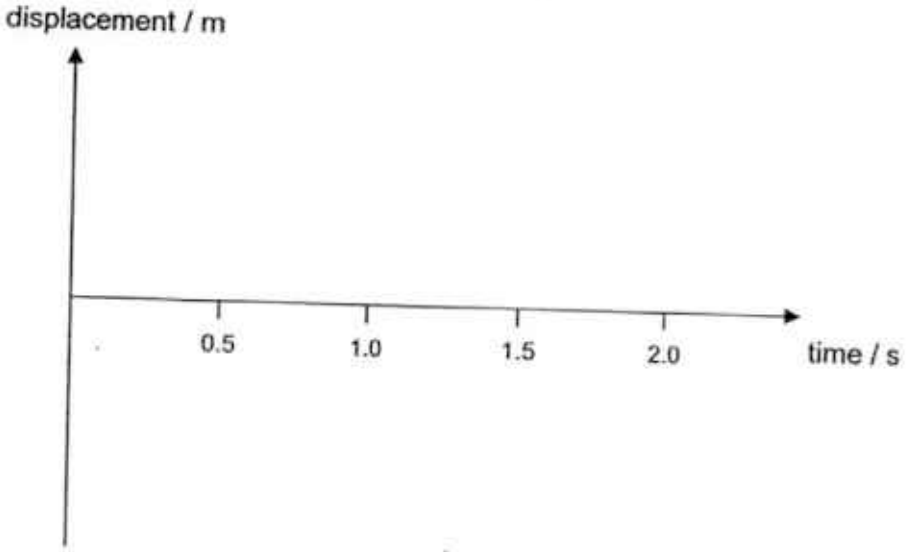
(c) **(i)** Define frequency and state its SI unit.

.....

.....

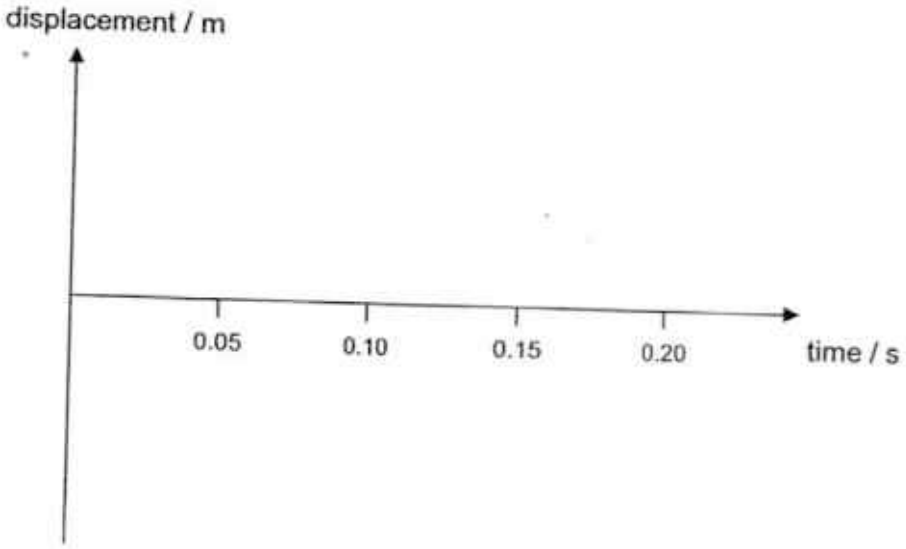
..... [2]

(ii) The frequency of a sound wave is 2 Hz. Sketch the displacement-time graph.



[1]

(iii) The frequency of a sound wave is increased to 10 Hz. Sketch the new displacement-time graph.



[1]

- End of Paper -

KUO CHUAN PRESBYTERIAN SECONDARY SCHOOL
SECONDARY TWO EXPRESS
GENERAL SCIENCE
MID-YEAR EXAMINATION 2016
Answer Scheme

Section A – Multiple Choice Questions (30 marks)

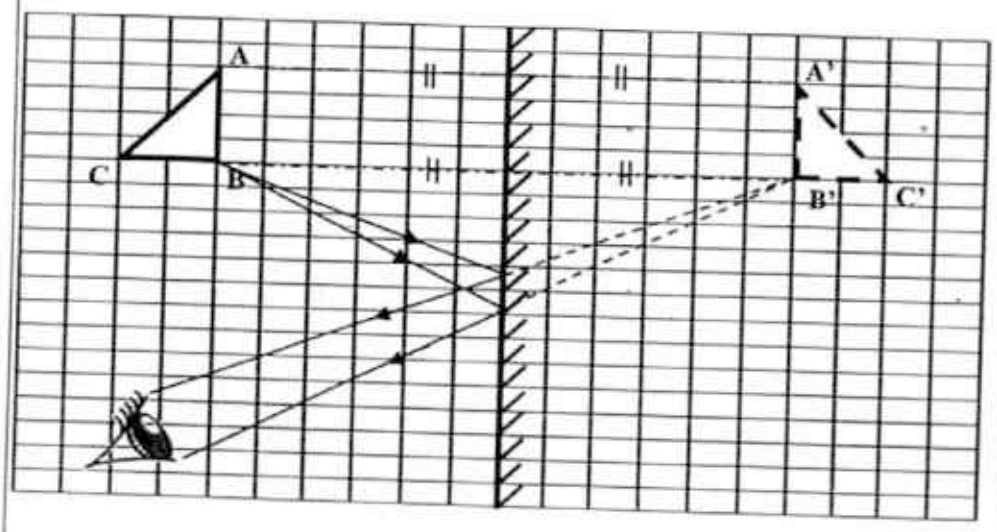
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
A	C	B	D	C	B	D	B	D	A

Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
C	B	A	D	D	B	C	D	D	C

Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
D	A	D	C	C	B	A	D	A	A

Section B Structured Questions (40 marks)

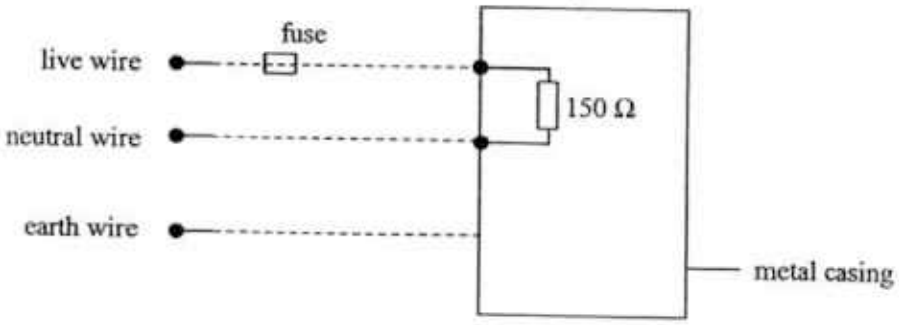
1



(a) 1m for correct labeling of image; 1m for same size and shape of image with correct distance

(b) 1m for two light rays from point B with correct arrows; 1m for dotted lines behind mirror (not from Point B – no marks awarded)

Total: 4m

2	ai / ii		(i) 1m for correct connection of live wire and neutral wire (i) 1m for correct connection of earth wire to metal casing * -1m from part (i) if any other additional connection were drawn (ii) 1m for correct positioning of fuse with label
	b	V = IR I = 240 V / 150 Ω I = **1.6 A**	1 1 (minus 1m if no/wrong units) * no marks if answer in fractions
	c	Nichrome Nichrome has a **high resistance**, therefore a **higher amount of heat** can be generated. *OR* Nichrome has a **high melting point** to **withstand the heat** generated by the hot water heater.	1 1
			Total: 7m
3	a	Effective resistance of parallel circuit: $1/R = 1/R_1 + 1/R_2$ $1/R = ¼ + ¼$ $1/R = ½$ R = **2 Ω**	1

2

		Total resistance of circuit = 8 Ω + 2 Ω = **10 Ω**	1 (minus 1m overall if no units) ECF – if correct calculation, maximum 1m overall
	b	V = IR I = 18 V / 10 Ω I = 1.8 A Therefore, ammeter reading on A_1 is **1.8 A**.	1 (no marks if no units) *allow for ecf from part a
	c	Ammeter reading on A2 = 1.8 A / 2 = **0.9 A**	1 (no marks if no units) *allow for ecf from part b
			Total: 4m
4	a	Total electrical used by the three air-conditioner units per day = 3 x (power x time) = 3 x (1600 W x 7 h) = 3 x (1.6 kW x 7h) = 3 x 11.2 kWh = **33.6 kWh** Total electrical energy used by the three fans per day = 3 x (power x time) = 3 x (125 W x 10 h) = 3 x (0.125 kW x 10h) = 3 x 1.25 kW = **3.75 kWh** Total electrical energy used in the household per day = 33.6 kWh + 3.75 kWh = **37.35 kWh**	1 1 1

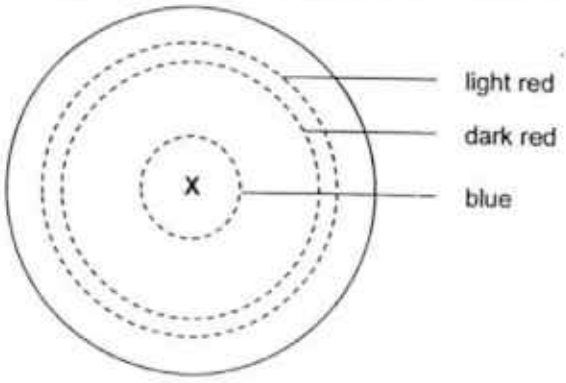
3

			(minus 1m overall if no/wrong units)
	b	Total cost of electricity used per day = 37.35 kWh x $0.20 = **$7.47**	1 (no marks if no units) ECF – if correct calculation, 1m
			Total: 4m
5	a	Fractional distillation	1 (no marks if wrong spelling)
	b	A: fractionating column Function of A: filled with glass beds to provide a larger surface area for the **condensation** of vapour that **does not have enough energy** OR To allow a **liquid of higher boiling point** to **condense** and fall back **during distillation of a liquid of lower boiling point** OR To allow a liquid of higher boiling point to **condense** and fall back if there is **not enough energy**	1 (no marks if wrong spelling) 1
	c	Liquid **X**. It has a **lower** boiling point.	1 1
	d	The cold water should go in from the bottom of the condenser instead of from the top of the condenser. There will **no be maximum condensation of the vapour**, resulting in the loss of some vapour. OR There will be **lesser amount of distillate collected**.	1 1

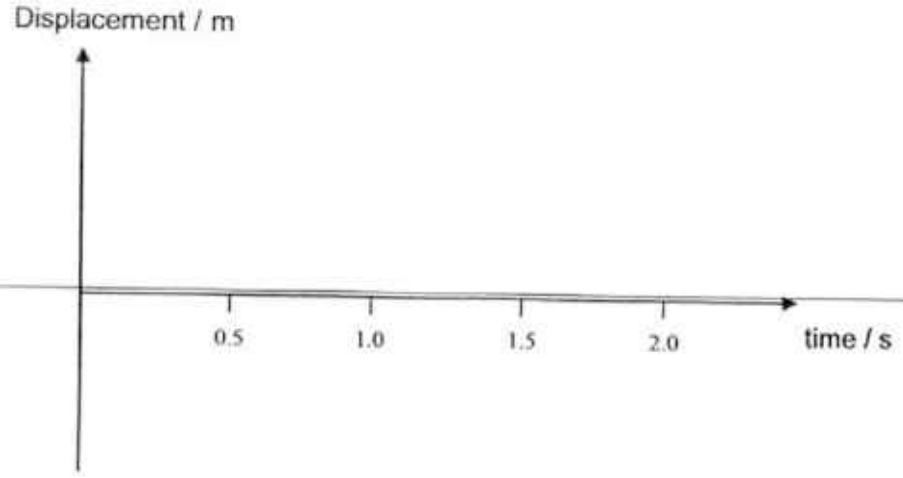
6	a	The cap is made up of plastic which is a **poor conductor of heat / insulator of heat**,	Total: 7m 1
		thereby **minimizing/reducing heat loss by conduction**.	1
		OR	
		The cap also helps to **prevent heat loss by convection** into the **surroundings**	1
		as **hot air cannot rise up to be replaced by cold air**.	1
	b	Silvered glass walls **minimize / reduce heat loss by radiation**	1
		as silvered surfaces are **poor radiators / able to reflect the radiated heat back / good reflectors of heat / poor absorbers.**	1
	c	Vaccum **prevents heat loss through convection and conduction**	1
		As air is removed and these two processes **require a medium / cannot take place in a vacuum.**	1
7	a	When the coolant fluid enters the freezer compartment, it takes heat away from the air.	Total: 6m
		The **cooler air** at the freezer compartment is **denser** and **sinks** to the bottom of the refrigerator (food compartment).	1
		The cooler air **displaces the warmer and less dense air** which then **rises** to the top of the refrigerator.	1
		This forms a convection current which keeps the refrigerator cool.	
	b	Black coloured objects are **good radiators of heat**.	1
		The black metal fins **emit / give out heat** away from the refrigerator **easily** into the surroundings and keeps the refrigerator cool.	1
		NOTE: if students say "good absorbers and good radiators", they must be able to explain both aspects, i.e. "can absorb heat quickly from the coolant" and "give out heat quickly to the surroundings".	
8	a	**No significant change in pitch** of the sound	Total: 4m 1
		as **frequency** remains the **same** throughout / frequency is at 1Hz / one cycle or vibration per second.	1
	b	Volume getting **softer**	1

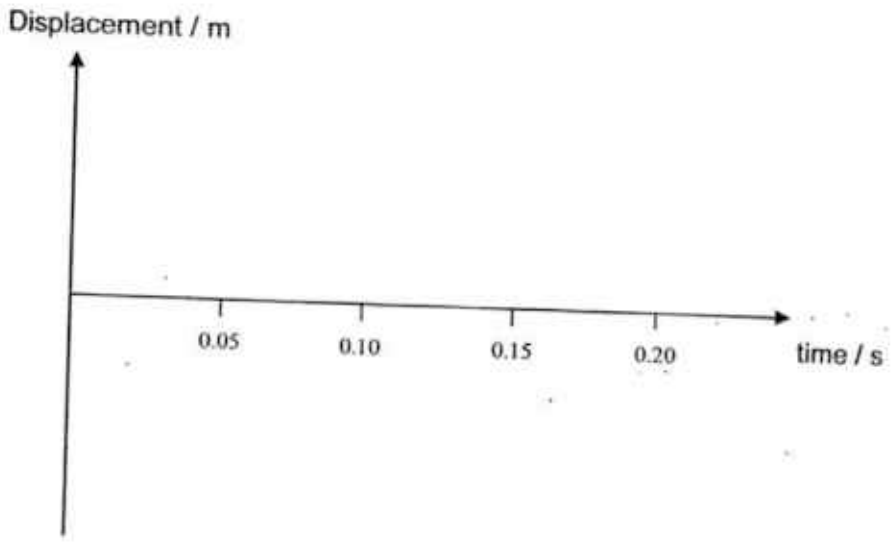
		as **amplitude** of sound wave is **decreasing**	1
			Total: 4m

Section C: Free Response Questions [30marks]

9	ai	filtration	1
	aii	The unwanted solid cabbage parts are too **big to pass through the small pore openings** of the filter paper. The unwanted solid cabbage parts will be collected at the filter paper as **residue**, wherease the purple food colouring solution will pass through the filter paper and be collected as **filtrate**.	1 1
	bi	Solvent **Z** When solvent Y is used, the purple food colouring **remains on the starting line** but when solvent Z is used, the purple food colouring **separates into three different coloured components.**	1 1
	bii	If ink is used, it may **dissolve** in the solvent and **affect the accuracy** of the results.	1
	biii	The purple food colouring is a **mixture**. It is **separated** into **three different** coloured components (light red, dark red and blue)	1 1
	c		Total 2m 1m for all three coloured components drawn in the correct order; with labels 1m for correct distance between components
			Total: 10marks
10	ai		1

			(no marks if no labels)
	aii		1 (no marks if no labels)
	bi	Top box – metal X Bottom box – metal Y	1
	bii	Metal X expands at a **faster rate / more** than Metal Y. During a fire, the heated strip **bends with metal X on the outside of the curve / bends downwards.** The bimetallic strip will touch the contact point and **close the cirucit**, allowing current to flow through and triggering the alarm.	1 1 1
	biii	X – brass Y – iron	1 1
	biv	High melting point	1
	bv	Thermostat / bimetallic thermometer *any other reasonable answer	1
			Total: 10marks
11	ai	A **ringing sound** can be **heard**.	1
	aii	As the vacuum pump is being switched on, the air will be sucked out of the bell jar. The **ringing sound** can **no longer be heard** when the air is **completely sucked out**. OR The **ringing sound** will become **softer** as air is **being sucked out**.	1
	aiii	Sound must travel through a medium / sound cannot travel through a vaccum.	1
	b	Time taken for clap to be heard = distance / speed = 264 m / 330 m/s	

		= **0.8 s** Time taken for echo to be heard = distance / speed = (264 m x 3) / 330 m/s = 792 m / 330 m/s = **2.4 s** Time interval between the two sounds = 2.4 s – 0.8 s = **1.6 s**	1 1 1 (minus 1m overall if no units for answers) ECF – if correct calculation using wrong answers from earlier parts, maximum 1m overall for final answer
	ci	Frequency of sound is the **number of cycles per second** made by the vibrating sound of sound. SI unit: **hertz (Hz)**	1 1 (accept either one; no marks awarded if wrong spelling)
	cii		1 (amplitude must be the same over time)
			8

	ciii		1 (amplitude must be the same over time)
			Total: 10marks

13

NAME:	CLASS:	INDEX NO:

QUEENSWAY SECONDARY SCHOOL

MID-YEAR EXAMINATION 2016

SECONDARY TWO EXPRESS

LOWER SECONDARY SCIENCE

11th May 2016
1 hour 30 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

Write your name, Class and Index No. above.

There are **TWO SECTIONS**. Answer **ALL** questions.

SECTION 1: PHYSICS [35 marks]
Answer **all** the questions in the spaces provided.

SECTION 2: CHEMISTRY [45 marks]
Answer **all** the questions in the spaces provided.

INFORMATION FOR CANDIDATES:
The intended number of marks for questions is given in [ ] at the end of each question or part question.

A copy of the Periodic Table is printed on page 24.

The use of an approved scientific calculator is expected, where appropriate.

Hand in **SECTIONS 1** and **2** separately.

This document consists of **24** printed pages.

Setter: Physics: Mr J Ong
Chemistry: Miss Lim MX & Miss S Teo

[Turn over

SECTION 1: PHYSICS SECTION

35

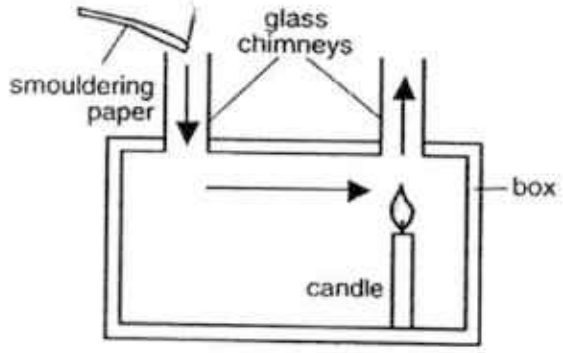
SECTION 1 (A) Multiple Choice Questions [10 marks]

Answer **all** the questions in this section in the table on **page 6**.

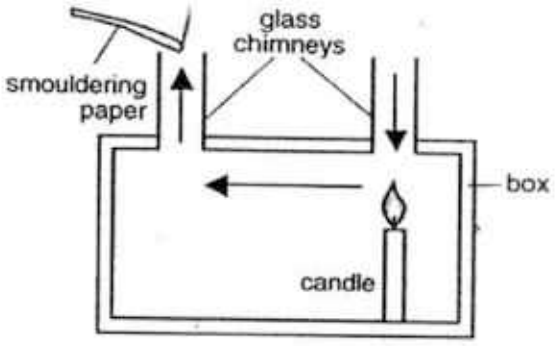
1 When hot water is poured in a thick glass, it cracks. This is due to

A the glass melting.
B the glass turning to gas.
C uneven contraction of the inner walls compared to the outer walls.
D uneven expansion of the inner walls compared to the outer walls.

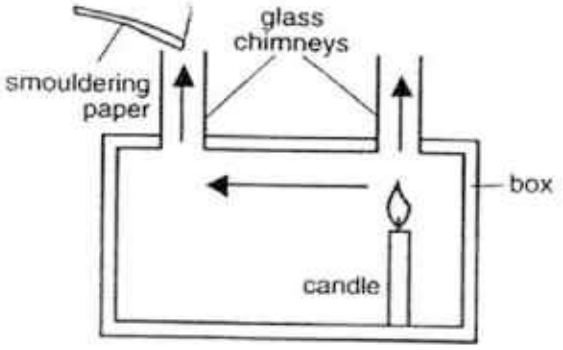
2 Which of the following diagrams shows the correct direction of the convection current set up in the box?



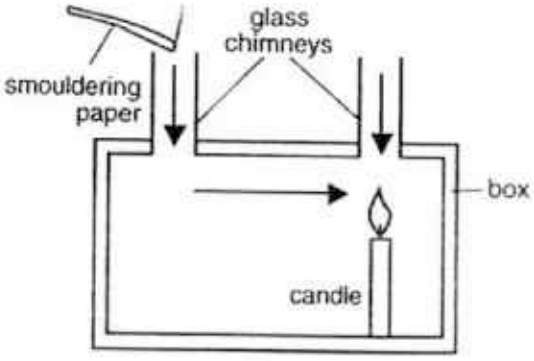
A



B

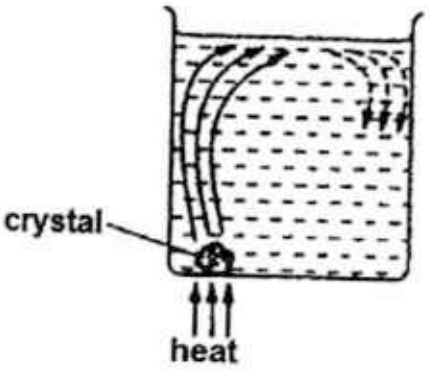


C



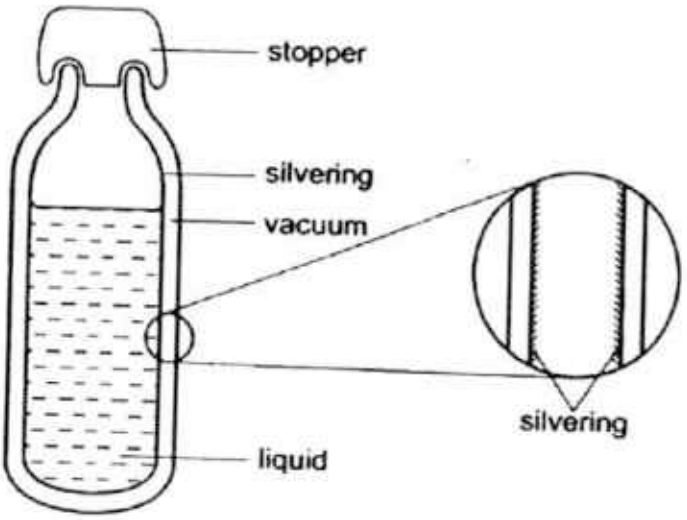
D

3 The diagram shows a crystal being heated in a beaker of water. The crystal releases a dye which shows how the water circulates around the beaker. Why does the water above the crystal rise?



A The water contracts and its density decreases.
B The water contracts and its density increases.
C The water expands and its density decreases.
D The water expands and its density increases.

4 The diagram shows a vacuum flask and an enlarged view of a section through the flask wall.



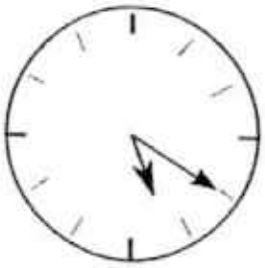
The main reason for the silvering is to reduce heat transfer by

A conduction only.
B conduction and convection.
C radiation only.
D radiation and convection.

5 Which of the following statements about the property of mirror image is **incorrect**?

A The image is laterally inverted.
B The image is twice the size of the object.
C The object is upright.
D The object is virtual.

6 A man looked into a plane mirror and saw the image of a clock as shown below.



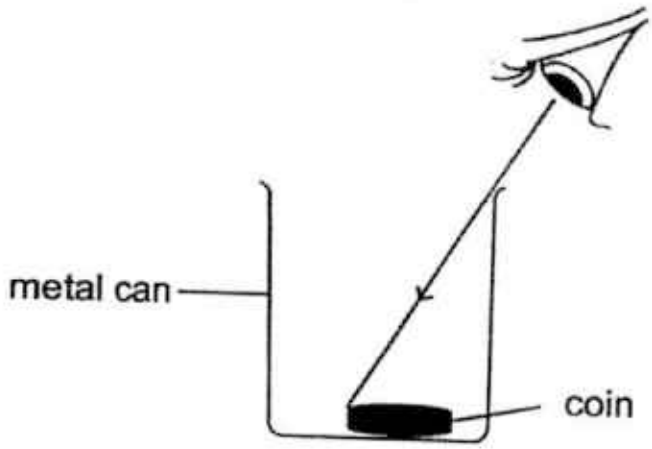
What was the actual time shown?

A 5 : 20
B 6 : 40
C 11 : 50
D 12 : 10

7 Which pair of mirrors shows their correct usages?

	concave mirror	convex mirror
A	dentist's mirror	security mirror
B	microscope	rear view mirror of a car
C	security mirror	microscope
D	security mirror	dentist's mirror

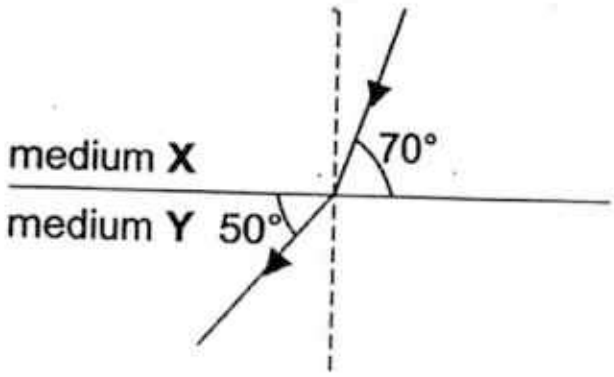
8 In the given diagram, the coin is just out of sight.



If water is poured into the metal can, the coin will

A appear larger.
B become further away.
C become visible.
D float to the surface.

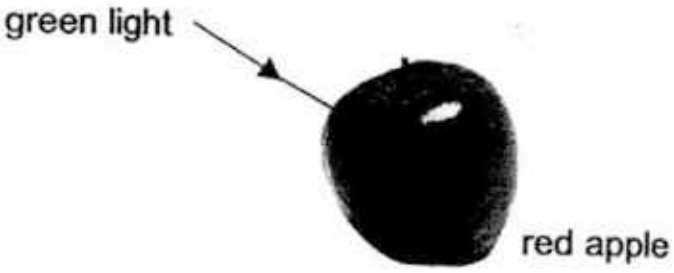
9 The diagram below shows how a ray of light travels from medium **X** to medium **Y**.



What are the values for the angle of incidence and the angle of refraction?

	Angle of Incidence	Angle of Refraction
A	20°	40°
B	20°	50°
C	70°	40°
D	70°	50°

10 The diagram below shows green light being shone on a red apple.



How will the apple appear to an observer?

A black
B green
C red
D white

Qns	1	2	3	4	5
Ans					
Qns	6	7	8	9	10
Ans					

[END OF SECTION 1(A)]

SECTION 1(B): Structured Questions [17 marks]

Answer **all** the questions in this section in the spaces provided.

11 **Fig. 11.1** below shows the results from an experiment.

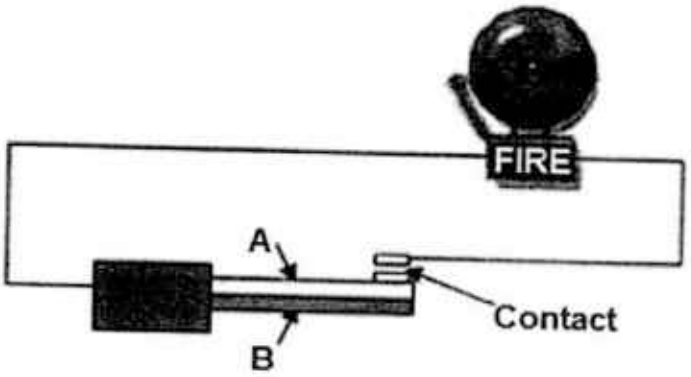


Fig. 11.1

(a) The bimetallic strips in the fire alarm is made up of brass and steel. Which metal is brass, **A** or **B**?

.....[1]

(b) Explain how the fire alarm works when there is a fire.

.....

.....

.....

.....[2]

(c) What would happen to the fire alarm after the fire has been put out?

.....

.....

.....

.....[2]

12 **Fig. 12.1** below shows a method of heating a room using solar energy instead of conventional sources of energy. A brick wall with a blackened surface is placed behind a double-glazed window facing the Sun. During the day, the wall stores energy received from the Sun as heat energy.

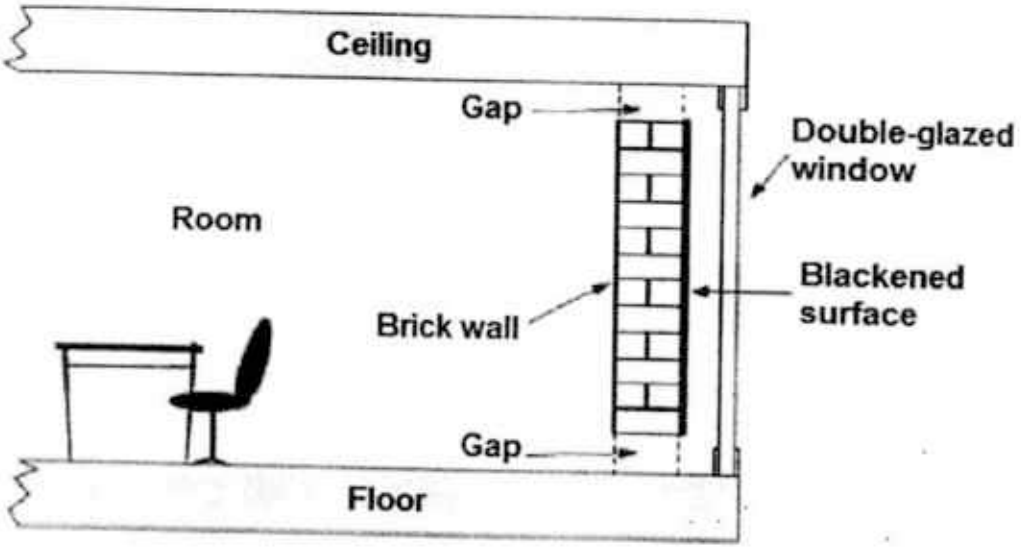


Fig. 12.1

(a) Name the process by which energy from the Sun is transferred to the Earth.

.....[1]

(b) Why is the surface of the wall painted black?

.....

.....[1]

(c) Name the process by which heat energy from the black surface wall is transferred to the air near to it.

.....[1]

(d) Describe how this heated air is uniformly distributed throughout the room.

.....

.....

.....[2]

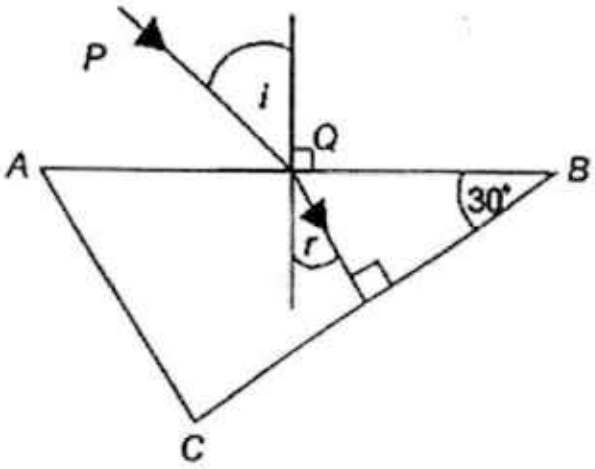
(e) The double-glazed window consists of two sheets of glass which trap a layer of air between them. Explain how using a double-glazed window affects the rate at which the temperature of the room changes.

.....

.....

.....[2]

13 **Fig. 13.1** represents a ray of **red** light passing from air to glass.



(Diagram not drawn to scale)

Fig. 13.1

(a) Explain why the light ray bends towards the normal when it passes through the glass at **AB**.

.....

.....[1]

(b) On **Fig. 13.1**, draw the path of the red light ray after it hits side **BC**. [1]

(c) A ray of **blue** light is also incident to the surface **AB** at the same angle of incidence. Determine whether will there be any difference in the paths travelled by red and blue light through the prism. Explain your answer.

.....

.....

.....[2]

(d) The colour black is actually not a colour. It is the absence of light. If so, how can black objects be seen, like the black alphabets and words of this question on the white paper?

.....

.....[1]

[END OF SECTION 1(B)]

SECTION 1(C): Structured Questions [8 marks]

Answer **all** the questions in this section in the spaces provided.

14 A pencil, covered with blue and yellow stripes, is placed in front of a mirror in an enclosed room. **Fig 14.1** below shows the location of the image of the pencil. X' marks the image of the pencil's tip.

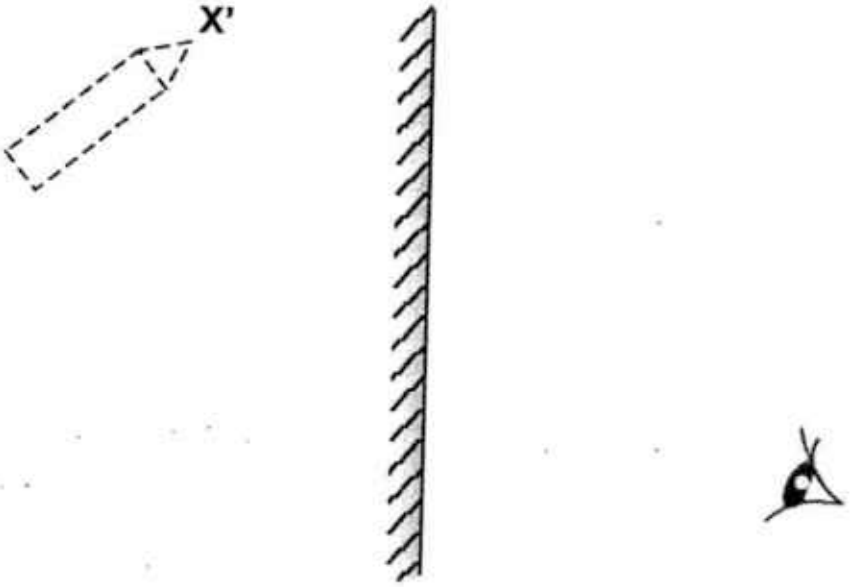


Fig. 14.1

(a) On **Fig. 14.1** above, draw

(i) the actual position of the pencil. [1]

(ii) two reflected rays reaching the observer's eye from the pencil's tip. [1]

(iii) draw the two corresponding incident rays coming from the pencil's tip. [1]

(b) Explain why the image of the pencil is drawn with a dotted line.

.....[1]

(c) Describe and explain how the distance between the pencil and its image change when the pencil is brought nearer to the mirror by 1 cm.

.....

.....

.....[2]

(d) If the light source in the room is changed to one that only gives out green light, what colour(s) would the pencil appear to the observer? Explain your answer.

.....

.....

.....[2]

[END OF SECTION 1]

Name : ..... ( ) Class : .....

ST JOSEPH'S INSTITUTION

END-OF-YEAR EXAMINATION
(SECONDARY 2)

LOWER SECONDARY SCIENCE

PAPER 1

5 OCTOBER 2016

45 minutes

1045 – 1130 hrs

Additional Materials: Optical Answer Sheet

READ THESE INSTRUCTIONS FIRST

1. Answer all questions by shading your answers in the appropriate spaces in the optical answer sheet.
2. Use a 2B pencil only. Make sure all amendments on the optical answer sheet are thoroughly erased using a soft eraser.
3. Use pi (π) value preprogrammed in calculator.
4. Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

This document consists of **14** printed pages.

[Turn over]

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

Section A (30 marks)

*There are thirty questions in this section. Answer **all** questions. For each question there are four possible answers, **A**, **B**, **C** and **D**. Choose the one you consider correct and shade your choice in the appropriate oval in the optical answer sheet provided.*

A1 Which of the following is measured in Newtons?

A Weight
B Mass
C Density
D Length

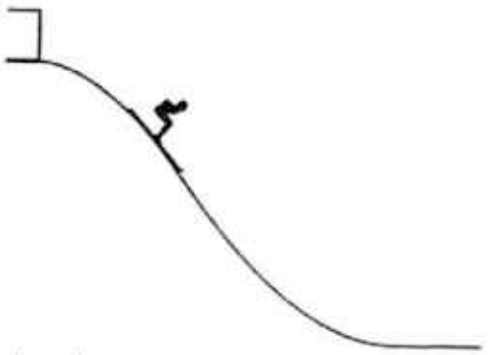
A2 Which of the following apparatus are needed to determine the density of an irregularly shaped rock?

A Vernier calipers, spring balance
B Metre ruler, electronic balance
C Measuring cylinder, electronic balance
D Measuring tape, spring balance

A3 What form of energy do we get directly from the Sun?

A Electrical
B Nuclear
C Chemical potential
D Light

A4 A skier walks to the top of a ski slope at a constant speed and gains 125 000 J of energy. She skis down the slope and when she reaches the bottom of the slope, she has 45 000 J of kinetic energy.

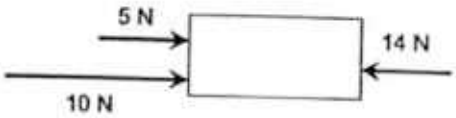


How much energy has been converted to heat and sound at the bottom of the slope?

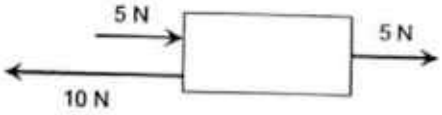
A 170 000 J
B 125 000 J
C 80 000 J
D 45 000 J

A5 Which of the following results in a net force to the left?

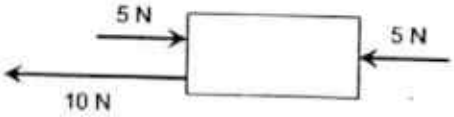
A



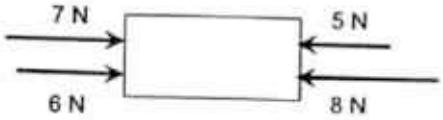
B



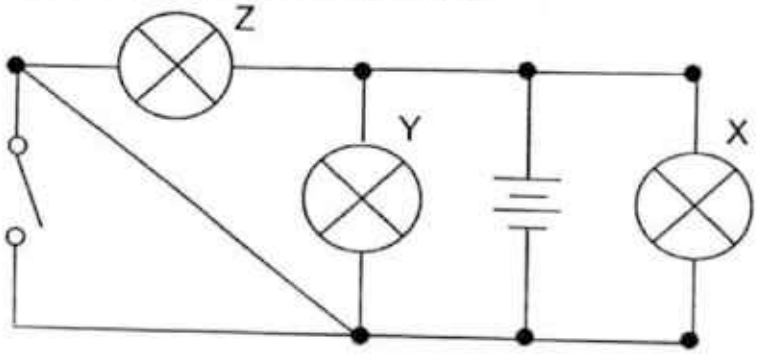
C



D



A6 A student sets up the circuit shown. The switch is open (off). Which lamps are on and which lamps are off?



	Lamp X	Lamp Y	Lamp Z
A	Off	Off	Off
B	On	Off	Off
C	Off	On	Off
D	On	On	On

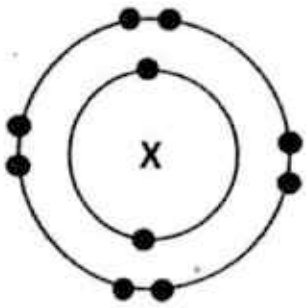
A7 Which of the following generates the **least** amount of energy if operated from the same voltage supply?

- **A** a 5000 W electric cooker used for 1 minute
- **B** a 1000 W electric motor used for 10 minutes
- **C** a 500 W electric iron used for 1 hour
- **D** a 100 W lamp used for 1 day

A8 Which part of an electrical appliance should the earth wire be connected to?

- **A** fuse
- **B** metal case
- **C** on/off switch
- **D** plastic handle

A9 Three elements **X**, **Y** and **Z** have consecutively increasing proton numbers. The atomic structure of element **X** is shown below.



What will be the symbol for the ion of element **Z** in its compounds?

- **A** Z^-
- **B** Z^{2-}
- **C** Z^+
- **D** Z^{2+}

A10 If a new element Ja is discovered with 6 valence electrons in its atom. Which of the following statements is true about element Ja?

- **A** It can conduct electricity.
- **B** It reacts vigorously with water.
- **C** It loses 2 electrons to form a positive ion of 2+ charge.
- **D** It readily reacts with oxygen to form a covalent compound

A11 The table below shows the atomic structures of six particles, represented by the letters **E** to **J**. The letters are not the symbols of the elements.

Particle	Number of		
	Protons	Neutrons	Electrons
E	16	8	8
F	18	10	8
G	16	8	10
H	12	12	10
I	11	12	10
J	12	12	12

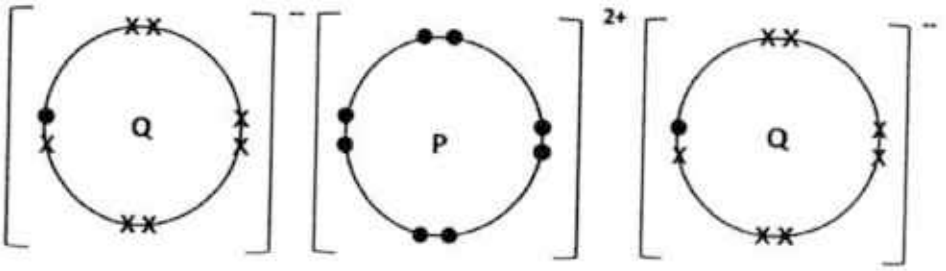
Which of the two particles from the table are an atom and a positive ion of the <u>same</u> element?

A **E** and **F**
B **F** and **G**
C **I** and **J**
D **H** and **J**

A12 Which of the following element compounds <u>does not</u> have any covalent bonds?

A Ammonium chloride
B Nitrogen dioxide
C Potassium hydroxide
D Sodium oxide

A13 Elements **P** and **Q** are from Period 3 of the Periodic Table. The diagram below shows the dot and cross diagram of a compound formed by **P** and **Q**.



Which of the following is the correct electronic structure of **P** and **Q** before bonding occurs?

	P	Q
A	2,8	2,7
B	2,8,2	2,8,6
C	2,8,2	2,8,7
D	2,8,8	2,8,8

A14 A solid **R** has the following properties:

1. It is green in colour.
2. It is insoluble in water.
3. It produces effervescence when added to dilute sulfuric acid

What is **R**?

A Calcium hydroxide
B Copper(II) carbonate
C Lithium oxide
D Zinc

A15 Which of the following acids of equal concentration will produce the highest amount of hydrogen (H^+) ions in water?

A Carbonic acid
B Hydrochloric acid
C Nitric acid
D Sulfuric acid

A16 The figure below shows four test tubes **A**, **B**, **C** and **D** containing a piece of metal in dilute acid.

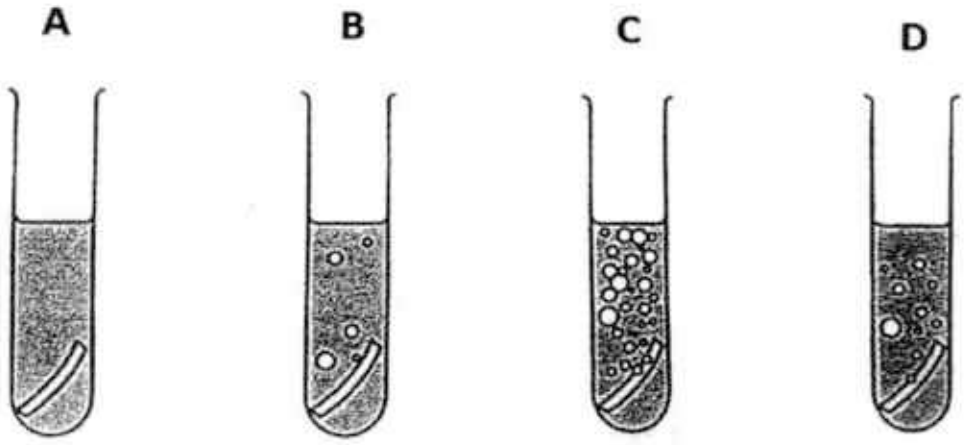


Figure A16

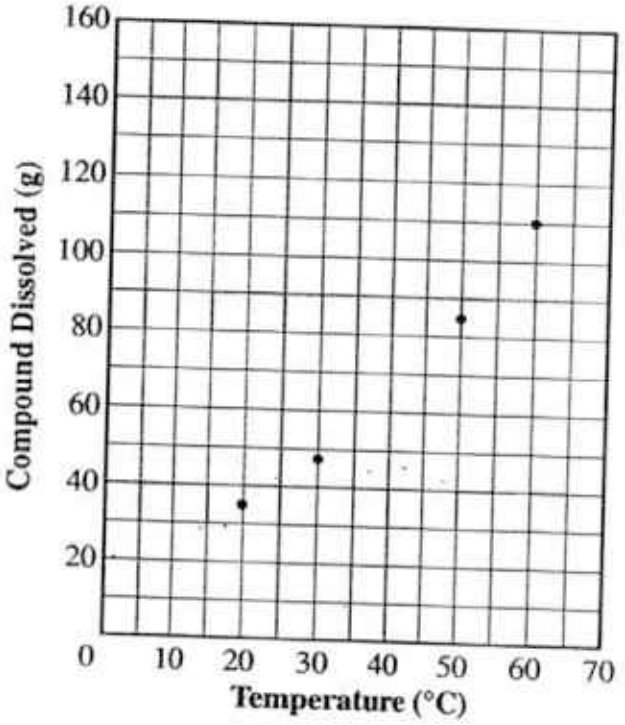
Which of the following shows the correct pair of metal and dilute acid in the test tube respectively?

A Calcium and dilute ethanoic acid
B Copper and dilute hydrochloric acid
C Magnesium and dilute sulfuric acid
D Sodium and dilute nitric acid

A17 The pH of aqueous sodium hydroxide is 14. A few drops of Universal indicator are added to a test tube of aqueous sodium hydroxide. What will be the final colour of the mixture when one spatula of sodium chloride is added to the test tube?

A Green
B Red
C Violet
D Yellow

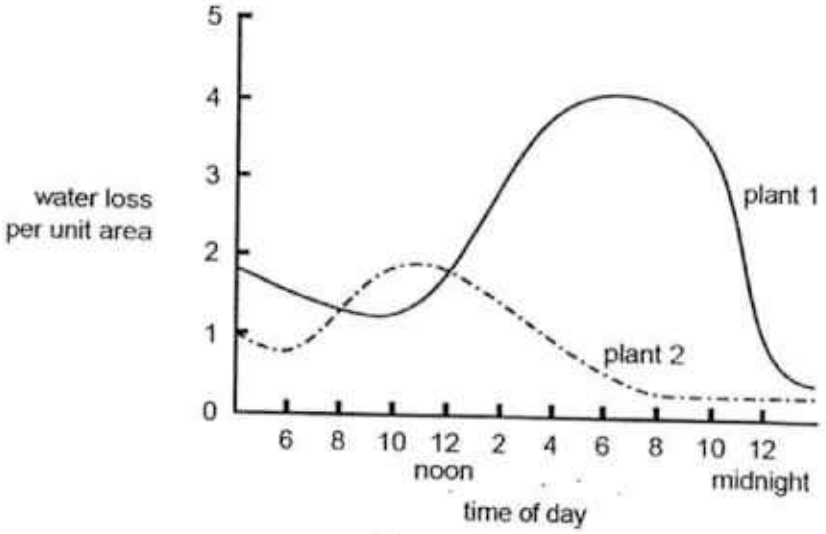
A18 Students in Joseph 101 are investigating how temperature, in degrees Celsius (°C), affects the solubility of a compound (X) in 100 millilitres (ml) of water. The students were given a graph that shows the solubility of a certain compound, as shown below.



The students had to predict how many grams (g) of X will dissolve in 100 ml of water at 40°C. Based on the information in the graph, which of the following is the best prediction of how many grams of X will dissolve at 40°C?

A 40g
B 65g
C 80g
D 100g

A19 The amount of water lost per unit area from the leaf surface of two different plants was measured. Both plants were grown in the same conditions. The results are shown in the graph.



Which of the following can you conclude from the information obtained?

- **A** Plant 2 will be more likely to survive in a dry environment than plant 1.
- **B** At 10.00 am the stomata opening will be greater in plant 1 than in plant 2.
- **C** At 12.00 noon, plant 1 has a greater water loss per unit area than plant 2.
- **D** At 5.00 pm the rate of photosynthesis will be greater in plant 2 than in plant 1.

A20 Under which of the following environmental conditions will transpiration in a well-watered potted plant be expected to be highest?

- **A** Still air and bright sunlight
- **B** Still air and shade
- **C** Moving air and bright sunlight
- **D** Moving air and shade

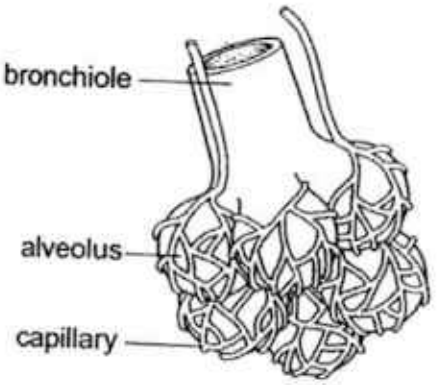
A21 Which of the following substance builds up in a muscle as a result of anaerobic respiration?

- **A** Ethanoic acid
- **B** Ethanol
- **C** Lactic acid
- **D** Carbon dioxide

A22 Which of the following is a harmful waste material that leaves the blood and travels through the lungs before leaving the body?

A Carbon dioxide
B Nitrogen
C Oxygen
D Water

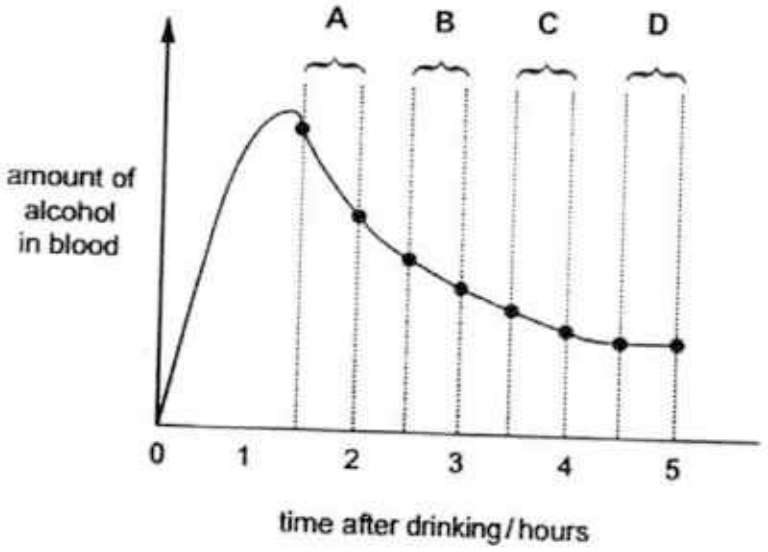
A23 The diagram below is a bunch of alveoli in the human lung.



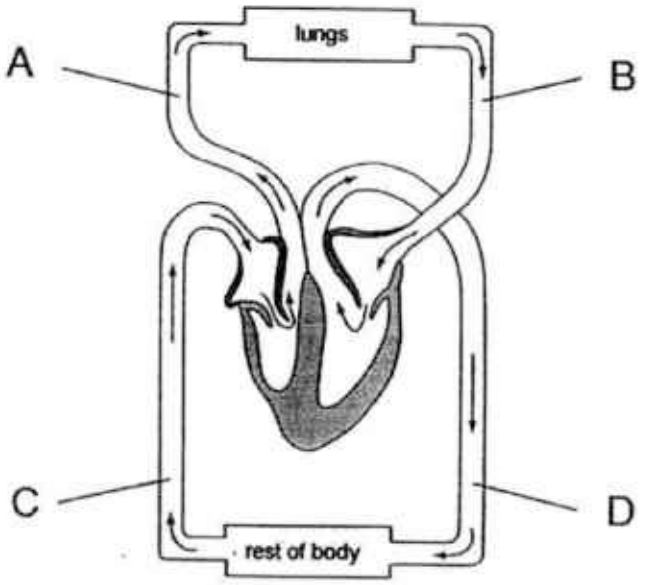
Which one of the following adaptations increases the total surface area of the alveoli?

A It exists in large numbers.
B It has a cell wall which is one-cell thick.
C It has a moist surface.
D It is surrounded by numerous blood capillaries.

A24 Samples of blood are taken every half hour from a person who has been drinking alcohol. The graph shows the amount of alcohol in this person's blood. During which period is alcohol removed fastest from the blood?



A25 The figure below shows the human circulatory system. In which vessel is the blood pressure highest?



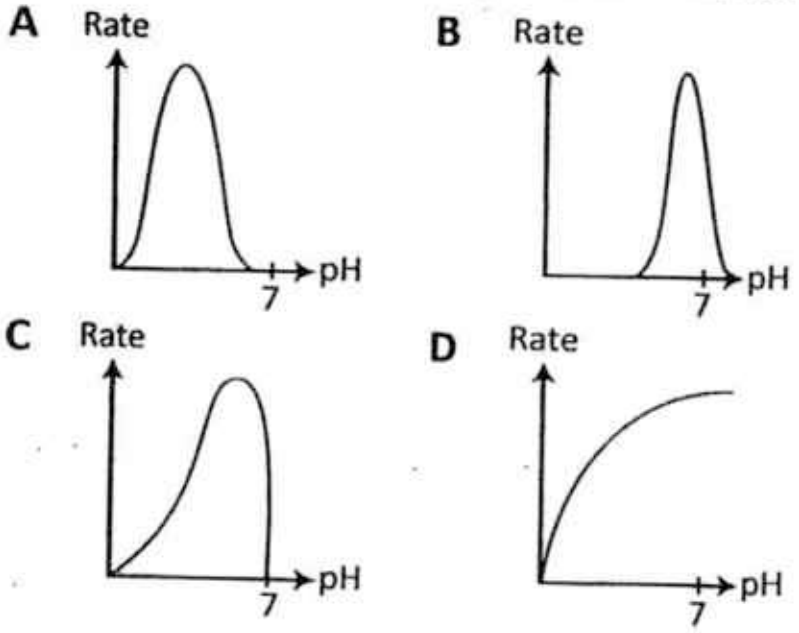
A26 Which of the following statement are correct?

I. Bile is acidic and is produced by the gall bladder.
II. Digestion begins in the mouth.
III. Peristalsis in the oesophagus pushed food down to the stomach.

A I and II
B I and III
C II and III
D I, II and III

A27 Enzymes are catalysts which are made of proteins that increased the rates of reactions without themselves being changed at the end of the reaction.

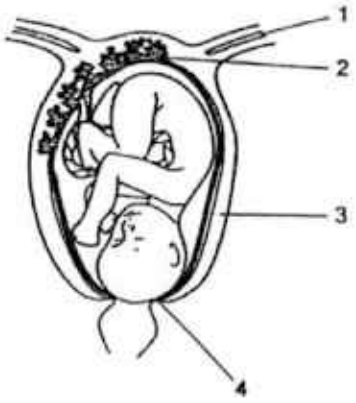
Enzymes are found in many different parts of the human body. Which of the following graph shows the effects of an enzyme which is found in the mouth?



A28 A male chimpanzee has 48 chromosomes in each of his regular body cells. How many chromosomes would be found in each of his sperm cells?

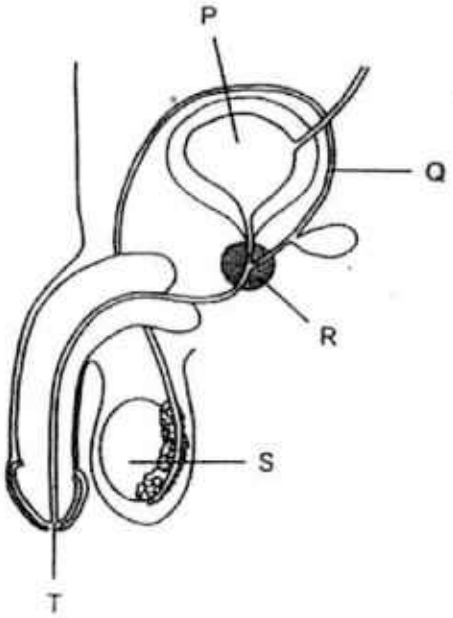
A 96
B 48
C 24
D 12

A29 Where are the uterus and the cervix?



	Uterus	Cervix
A	1	2
B	2	1
C	4	3
D	3	4

A30 The diagram shows part of the male reproductive system.



Which structures produce seminal fluid and sperm?

	Seminal fluid	Sperm
A	Q	R
B	P	Q
C	S	T
D	R	S

Answers to LSS Sec 2 – Paper 1

End-of-Year Examination 2016

Section A

1	A		11	D		21	C
2	C		12	D		22	A
3	D		13	C		23	A
4	C		14	B		24	A
5	C		15	D		25	D
6	D		16	C		26	C
7	A		17	C		27	B
8	B		18	B		28	C
9	D		19	A		29	D
10	D		20	C		30	D

QUEENSWAY SECONDARY SCHOOL
Science Department

MID-YEAR EXAMINATION 2016

MARK SCHEME

Level: 2 Express

Total Marks: 35

Subject: Lower Secondary Science (Physics)

Setter: Jimmy Ong

Section A [10 marks]

Qn	1	2	3	4	5	6	7	8	9	10
Ans	D	A	C	C	B	B	A	C	A	A

Section B [17 marks]

11 (a) B: Brass 1

(b) When there is a **fire outbreak**, the bimetallic strip will **bend upward**, 1
as metal B expands more than metal A, and **close the circuit**. The fire alarm is switched on subsequently. 1

(c) Once the **fire is put out**, the bimetallic strip will **return to its original position** due to contraction, 1
hence **opening the circuit** and switching off the fire alarm. 1

Total = 5

12 (a) Radiation. 1

(b) Black is a good/best absorber of heat/radiation/IR 1

(c) Conduction (only). 1

(d) Any 2 of the following points:

- By convection 1
- Warm/hot air (beside blackened surface) expands, becomes less dense and rise. 1
- Cooler, denser air inside sinks to replace the warm rising air. 1

max 2

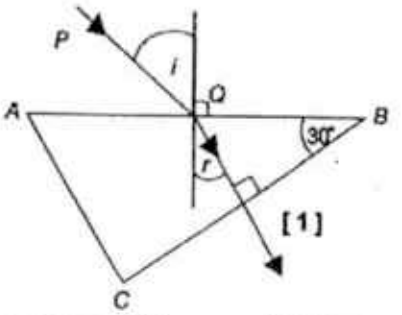
(e) Air is a good insulator/poor conductor of heat (or two sheets of glasses are both insulator of heat) 1

Heat lost to outside/surroundings is minimized (or more heat is retained in the room) + temperature rise faster. 1

Total = 7

13 (a) The glass is **denser** than air. / The speed **decreases** when light travels into the glass. 1

(b)



(c) **Blue light travels at a lower speed than red light in glass** 1

thus it will **refract at different angles/bend more than red light** 1

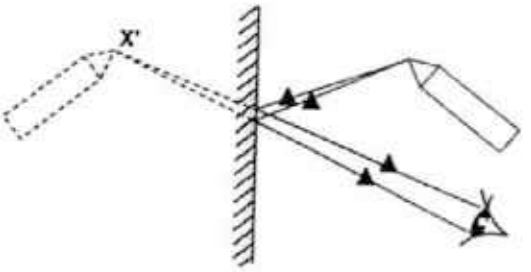
resulting in different paths of travel.

(d) Black objects cannot be seen by our eyes because there is no light reflected into our eyes from these objects. Rather, our eyes detect the colours framing these black objects, thus determining the outlines of the objects. Black objects absorb all colours. 1

Total = 2

Section C [8 marks]

14 (a) Solid line ½
Correct distance and orientation ½
Correct rays 2



(b) To illustrate that the image is virtual. 1

(c) The distance will be shorter ½
by 2 cm. ½
As distance between image and mirror is equal to distance between object and mirror.

(d) Black 1
and green stripes ½
The blue will absorb the green light and reflect none, ½
while the yellow will absorb none and reflect green light. ½

Total = 8

SECTION 2: CHEMISTRY SECTION

NAME:	CLASS: 20_	INDEX NO:	45

SECTION 2 (A) Multiple Choice Questions [15 marks]
Answer **all** the questions in this section in the table on **page 16**.

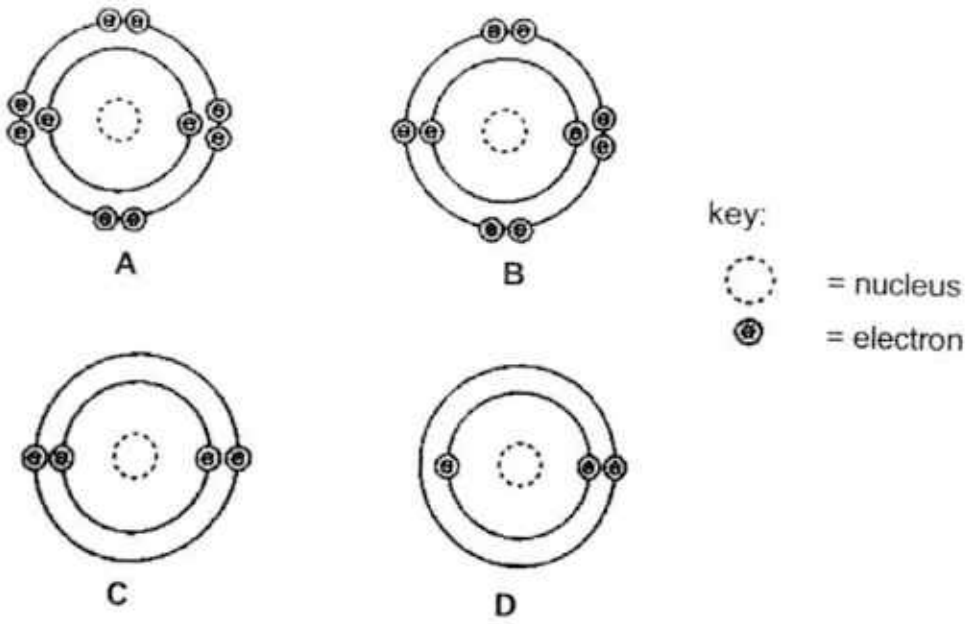
1 Element **X** is represented by the symbol $^{85}_{37}X$.
Which of the following statements is true about element **X**?

A It has 37 neutrons.
B It has 85 electrons.
C It has 48 protons.
D The total number of protons and electrons is 74.

2 An ion of element **Z** has 4 protons, 2 electrons and 5 neutrons.
What is the mass and charge of this ion?

	Mass	Charge
A	6	2+
B	6	2-
C	9	2+
D	9	2-

3 The electronic structures of four atoms are shown.
Which atom is chemically unreactive?



4 A compound has the chemical formula $Fe(NO_3)_3$.
How many elements and atoms are present in the compound?

	number of elements	number of atoms
A	3	11
B	3	13
C	4	11
D	4	13

5 Element **X** has the electronic configuration 2.8.3.
Element **Y** has the electronic configuration 2.8.6.

Which of the following shows the correct formula of the compound formed between element **X** and element **Y**?

A X_2Y_3 **B** X_3Y_2
C Y_2X_3 **D** Y_3X_2

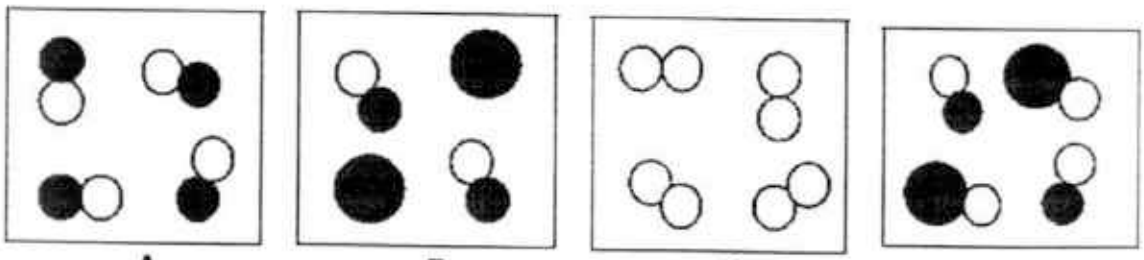
6 An element **Z** has two isotopes, ^{238}**Z** and ^{236}**Z**.

How does ^{238}**Z** differ from ^{236}**Z**?

A It has 2 more neutrons.
B It has 2 more protons.
C It has 2 more neutrons and 2 more electrons.
D It has 2 more protons and 2 more electrons.

7 In the diagram, each circle represents an atom.
Circles of different sizes represent different atoms.

Which diagram represents a mixture of compounds?



A B C D

8 Which of the following list contains an element, a compound and a mixture?

A air, steel, sugar
B carbon dioxide, oxygen, sodium chloride
C copper, seawater, sulfur
D crude oil, iron, water vapour

9 Element **X** has the following properties.

I good conductor of heat
II silver solid at room temperature
III malleable

Identify element **X**.

A argon
B calcium
C copper
D mercury

10 Which method can be used to separate steel powder from sulfur powder?

A Distillation
B Evaporation to dryness
C Filtration
D Magnetic attraction

11 A student makes some crystals.

What should the student check to test the purity of the crystals?

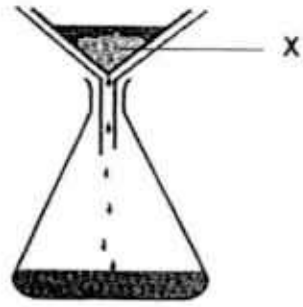
A colour of crystals
B melting point
C shape of crystals
D size of crystals

12 Which of the following factors will affect the solubility of a solute?

I rate of stirring
II temperature of solvent
III type of solvent

A I and II
B II and III
C I and III
D All of the above

13 A mixture of sodium chloride, potassium chloride and silver chloride is added to a beaker containing water. Only silver chloride cannot dissolve in water. The solution is filtered as shown below.



Which of the following is most likely to be **X**?

A A residue of silver chloride
B A distillate of silver chloride
C A residue of sodium chloride and potassium chloride
D A filtrate of silver chloride

14 Which of the following statements is **not** true of all solutions?

A No residue is collected after filtration.
B They are colourless.
C They are homogeneous.
D There is no separation of solute and solvent when left to stand.

15 Which of the following substance forms a suspension when mixed with water?

A chalk
B salt
C sugar
D vinegar

ANSWERS :

Qns	1	2	3	4	5
Ans					
Qns	6	7	8	9	10
Ans					
Qns	11	12	13	14	15
Ans					

[END OF SECTION 2 (A)]

SECTION 2 (B): Structured Questions [20 marks]

Answer **all** the questions in this section in the spaces provided.

16 The following elements are found in the same period of the Periodic Table and some of their electronic configurations are shown below.

Na	Mg	Al	Si	P	S	Cl	Ar
			2.8.4	2.8.5	2.8.6		2.8.8

(a) Write down the missing electronic configurations. [1]

(b) Explain, in terms of structure, why the elements above belong to Period **3**.

.....[1]

(c) **(i)** Name the element that will readily lose one electron to attain a noble gas configuration.

.....[1]

(ii) Write the chemical formula of the ion formed.

.....[1]

(d) An experiment was carried out by burning magnesium metal, which is a good conductor of electricity, in yellowish-green chlorine gas to produce white solid of magnesium chloride.

During the experiment, a bright light was given off. A test was conducted on the white solid and it was found that it is not a conductor of electricity.

(i) Write a word equation to represent the above reaction.

.....[1]

(ii) Draw '**dot and cross**' diagrams to show the electronic structure of magnesium chloride. [3]

(iii) State two characteristics of a compound, supported with evidence from the above description. [3]

Characteristic **1**:

.....

.....

Evidence **1**:

.....

.....

Characteristic **2**:

.....

.....

Evidence **2**:

.....

.....

17 The boxes in **Fig. 17.1** contain descriptions of four different substances, **P**, **Q**, **R** and **S**.

Solid **P** is a white solid that can be separated into two different substances by adding water and filtering.	Liquid **Q** is made up of a fixed ratio of carbon, hydrogen and oxygen that are chemically combined.
Solid **R**, when heated, melts to a yellow liquid that cannot be made into a simpler substance.	When electricity is passed through colorless liquid **S**, it breaks down to produce hydrogen and oxygen.

Fig. 17.1

(a) Decide whether each substance should be classified as an element, compound or mixture. Show your decision by ticking (✓) the correct box shown in **Table 17.1**.

Table 17.1

Substance	Element	Compound	Mixture
P			
Q			
R			
S			

[2]

(b) (i) Identify liquid **S**.

.....[1]

(ii) Using the answer from part **(i)**, write a **word** equation to represent the breakdown of liquid **S** to form hydrogen and oxygen.

.....[1]

(c) Complete **Table 17.2**.

	Name of compound	Positive ion	Negative ion	Chemical formula
(i)		Al^{3+}		$AlCl_3$
(ii)	Sodium carbonate	Na^+		
(iii)	Calcium hydroxide		OH^-	
(iv)	Copper (II) sulfate			$CuSO_4$

[4]

18 Jason wants to find out whether fine sugar or sugar cubes will dissolve faster in water. He placed 5.0 g of fine sugar in Beaker **A** and 5.0 g of sugar cubes in Beaker **B**, keeping all the other conditions to be the same.

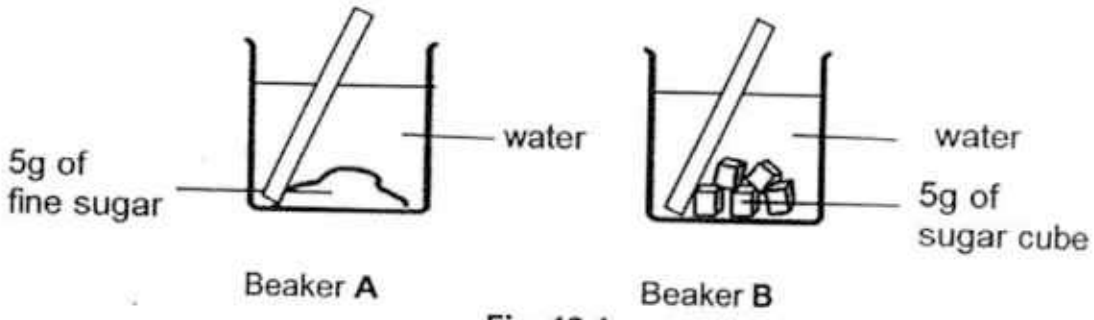


Fig. 18.1

(a) Identify the solute and solvent used in both beakers. [1]

Solute ..... Solvent .....

(b) Given that both beakers are stirred at the same rate, explain whether sugar in Beaker **A** or **B** will dissolve faster.

.....

.....

.....[1]

(c) State one other method that Jason can use to increase the rate of dissolving.

.....[1]

[END OF SECTION 2(B)]

SECTION 2 (C): Free-Response Question [8 marks]

Answer **all** the questions in this section in the spaces provided.

19 A mixture of liquids, listed in **Table 19.1**, is to be separated using the setup as shown in Fig. 19.2 below.

Table 19.1

Name of Liquid	Boiling point / °C	Volume / cm^3
Dichloromethane	41	20.0
Ethanol	78	20.0
Hexene	64	10.0

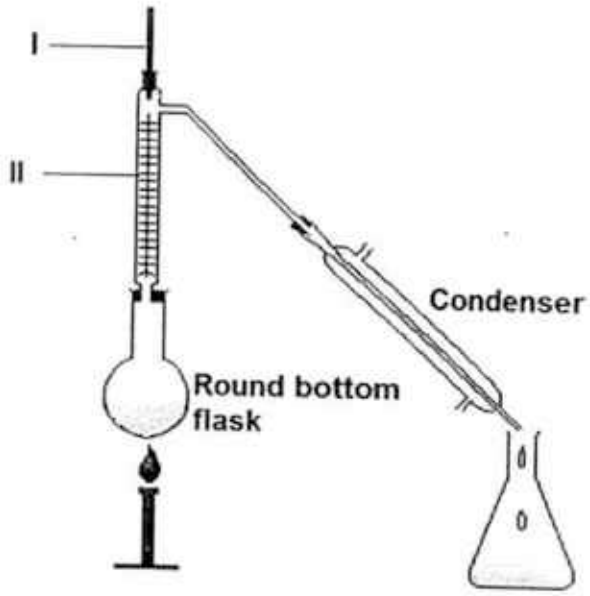


Fig. 19.2

(a) Name the method of separation shown above.

.....[1]

(b) Name apparatus **I** and **II** that are used in this set-up.

.....[2]

(c) Explain why it is necessary for the water flow at the condenser to be as indicated.

.....[1]

(d) State the order in which the distillates will be collected.

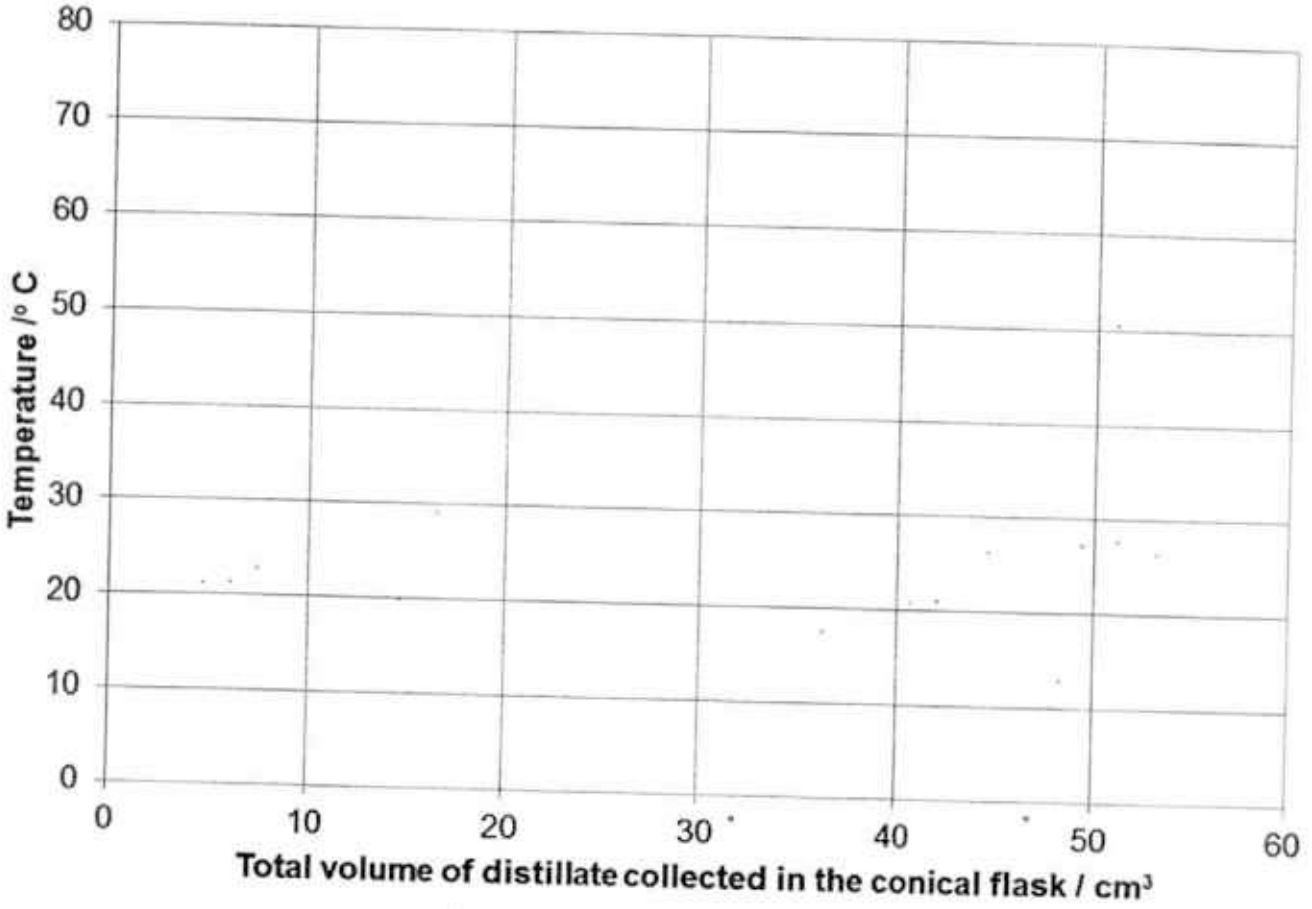
.....[1]

(e) A student carried out the above experiment and noticed that the setup was shaken vigorously during boiling. Describe a modification to the above setup which will lessen the shaking.

.....[1]

(f) Given that the same conical flask is used to collect all the distillates, sketch a line graph and label the total volume of distillate collected as temperature changes.

[2]



[END OF PAPER]

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

Key: a X b
a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

QUEENSWAY SECONDARY SCHOOL
Science Department

MID-YEAR EXAMINATION 2016

MARK SCHEME

Level: 2 Express

Total Marks: 45

Subject: Lower Secondary Science (Chemistry)
Setter: Lim Mei Xuan & Sharelyn Teo

Section A [15 marks]

Qn	1	2	3	4	5	6	7	8	9	10
Ans	D	C	A	B	A	A	D	D	B	D
Qn	11	12	13	14	15					
Ans	B	B	A	B	A					

Section B [22 marks]

16 (a)

Na	Mg	Al	Si	P	S	Cl	Ar
2.81	**2.82**	**2.83**	2.8.4	2.8.5	2.8.6	**2.87**	2.8.8

(All four electronic configurations must be correct. No ½ mark) 1

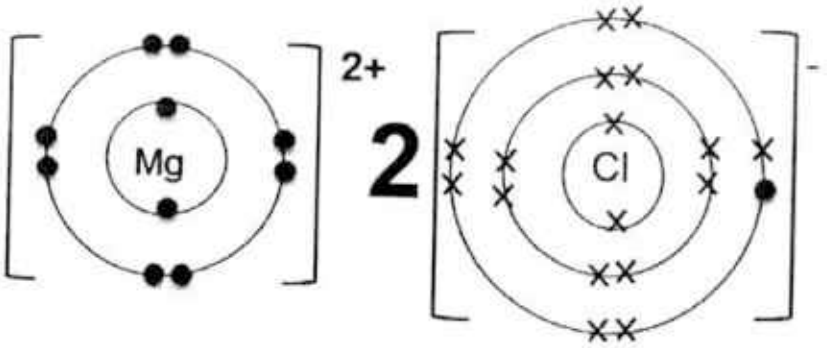
(b) All elements have **3 electron shells.** 1

(c) (i) Sodium 1

(ii) Na^+ 1

(d) (i) magnesium + chlorine → magnesium chloride 1

(ii) Each correct ion – 1m each 1
Correct ratio – 1m 3



(iii)	Characteristic:	A compound is formed by chemical reaction OR There is an energy change when a compound is formed.	1
	Evidence:	A bright light was given off during the reaction .	½
	Characteristic:	The properties of a compound is different from its constituent elements.	1
	Evidence:	The white solid formed could not conduct electricity/ A white solid is formed from a silvery solid and greenish-yellow gas (other charateristics of compound are not acceptable)	½

Total = 10

17 (a) Each tick ½ mark.

Substance	Element	Compound	Mixture
P			✓
Q		✓	
R	✓		
S		✓	

2

(b) (i) water 1

(ii) water → hydrogen + oxygen 1

(c) ½ mark each

	Name of compound	Positive ion	Negative ion	Chemical formula
(i)	**Aluminium Chloride**	Al^{3+}	**Cl^-**	$AlCl_3$
(ii)	Sodium carbonate	Na^+	**CO_3^{2-}**	**Na_2CO_3**
(iii)	Calcium hydroxide	**Ca^{2+}**	OH^-	**$Ca(OH)_2$**
(iv)	Copper (II) sulfate	**Cu^{2+}**	**SO_4^{2-}**	$CuSO_4$

4

Total = 8

18 (a) Solute: sugar
Solvent: water

1

No ½ mark, both answers must be correct.

(b) Sugar in Beaker A will dissolve faster.
Fine sugar has a larger surface area to come into contact with water. 1

(c) Increase temperature
Increase rate of stirring 1

Total = 3

Section C [8 marks]

19 (a) Fractional Distillation

1

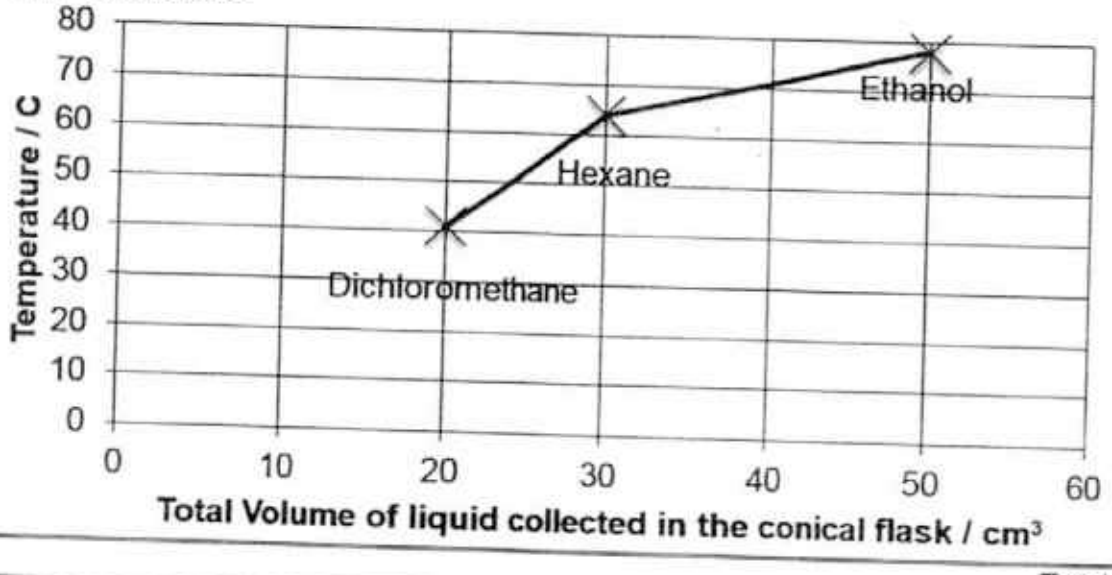
(b) I: Thermometer
II: fractionating column 1
1

(c) So that the **entire condenser can be filled with cold water**. 1

(d) Dichloromethane, Hexene, Ethanol 1

(e) The student can add boiling chip into the distillation flask. 1

(f) 1 m – correct point plotted
1 m – correct label



2

Total = 8

10

Name: _____( ) Class: Sec _____

St. Gabriel's Secondary School

2016 First Semestral Examination

Subject	:	**Lower Secondary Science**
Level/Stream	:	**Sec 2 Express**
Duration	:	**1 hour 45 minutes**
Date	:	**3 May 2016**
Setter	:	**Mr C J Tan**

Additional materials: *Multiple Choice Answer Sheet*

READ THESE INSTRUCTIONS FIRST

Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, register number and class in the spaces above.

Section A

Answer **all** the questions using the multiple choice answer sheet provided.
Four suggested answers are given for each question.
Choose the best answer and use a 2B pencil to shade each corresponding bubble clearly.
Each question carries one mark. The total marks for this section is 30 marks.

Section B

Answer **all** the questions in the spaces provided. The total marks for this section is 40 marks.

Section C

Answer **all three** questions in the spaces provided.
The total marks for this section is 30 marks.

For Examiner's Use	
Section A	
Section B	
Section C	
Total	100

This question booklet consists of **21** printed pages including this cover page.

SECTION A : MULTIPLE-CHOICE QUESTIONS [30 marks]

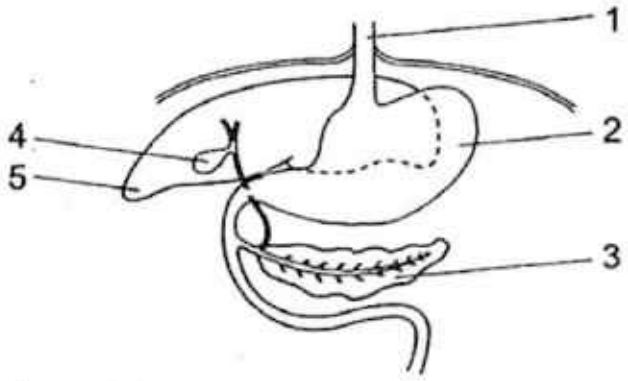
1 Three statements about water are listed below.

I Water is used as a solvent for many reactions.
II Water is involved in many metabolic reactions.
III Water cools down a surface area when it evaporates.

Which statement(s) make(s) water suitable for use in a blood transport system?

A I only
B II only
C I and III only
D II and III only

2 The diagram shows part of the human alimentary canal.



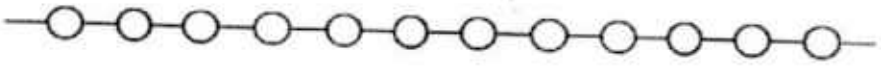
Which two structures produce substances involved in the digestion of fats?

A 1 and 4
B 2 and 3
C 3 and 5
D 4 and 5

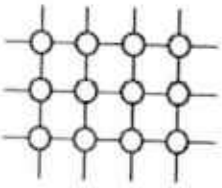
3 Lipase solution was added to milk. After 30 minutes, the milk had become more acidic. What were the reactant and product(s) in this reaction?

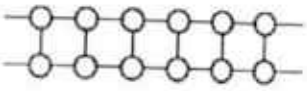
	Reactant	Product(s)
A	Fats	Amino acids
B	Fats	Fatty acids and glycerol
C	Proteins	Amino acids
D	Proteins	Fatty acids and glycerol

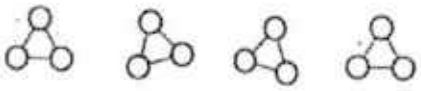
4 The diagram shows part of a starch molecule.

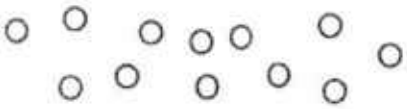


Which diagram shows this molecule after it has been completely digested?

A 

B 

C 

D 

5 What digestive enzyme works best in a very acidic environment?

A Amylase in the mouth
B Protease in the stomach
C Lipase in the small intestine
D Carbohydrase in the small intestine

6 Which structure has a large surface area for the absorption of digested food?

A liver
B stomach
C small intestine
D gall bladder

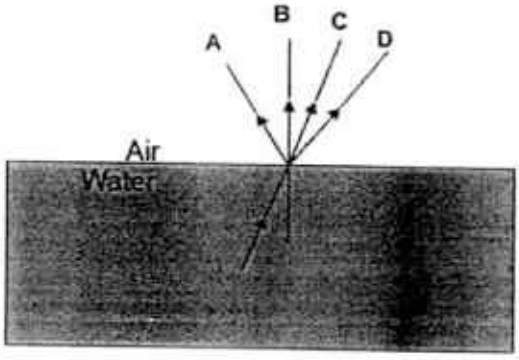
7 Which of the following is **not** one of the applications of plane mirrors?

A Cosmetics mirror
B Periscopes
C Blind corner mirror
D As decorative purpose to make a room appear bigger

8 An object is placed at a distance of 20 cm from a plane mirror initially. It is then moved away from the mirror by another 25 cm. What is the distance between the object and its image now?

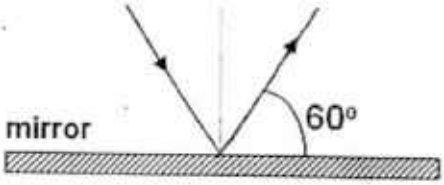
A 25 cm
B 45 cm
C 50 cm
D 90 cm

9 A light ray passes from water to air as shown in the diagram below



Which labelled arrow shows the correct direction of the ray of light in air?

10 The diagram below shows a ray of light reflected at the surface of a plane mirror. Which of the following angle of incidence and angle of reflection is correct?



	Angle of incidence/ °	Angle of reflection/ °
A	30	30
B	30	60
C	60	30
D	60	60

11 A student uses a length of wire as a resistor. He discovers that the resistance of the wire is too small. To make a resistor of higher value, he should use a piece of wire that is

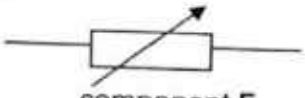
A shorter and thinner.
B shorter and thicker.
C longer and thinner.
D longer and thicker.

12 What is an electric current?

A Flow of molecules
B Rate of flow of charges
C Flow of energy
D Rate of change of potential difference

13 Consider the two electrical symbols shown below:

component E



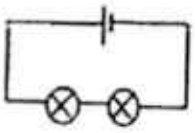
component F

What does each symbol represent?

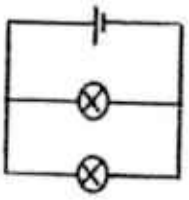
	component E	component F
A	fuse	rheostat
B	fuse	resistor
C	resistor	rheostat
D	resistor	fuse

14 Which circuit gives the brightest lamp(s)?

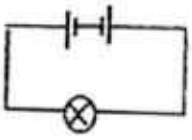
A



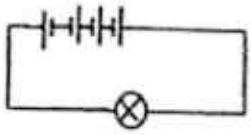
B



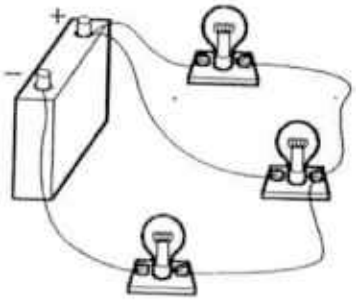
C



D

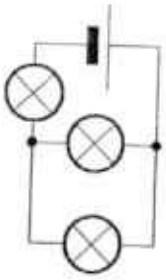


15 The diagram shows a circuit with three lamps and a cell.

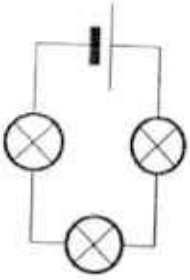


Which is the circuit diagram for the above arrangement?

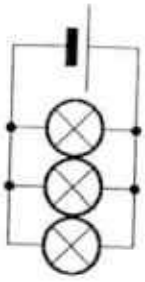
A



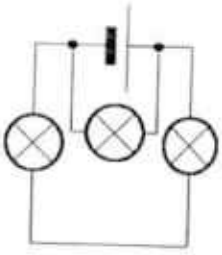
B



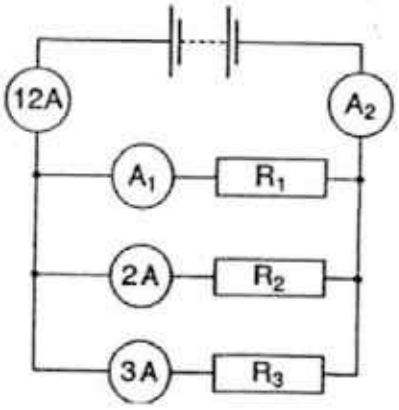
C



D

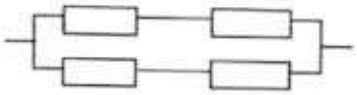


16 What is the reading on ammeter A_1 and A_2 respectively?

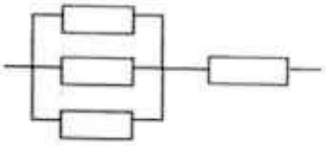


	A_1	A_2
A	2 A	12 A
B	7 A	12 A
C	7 A	9 A
D	12 A	12 A

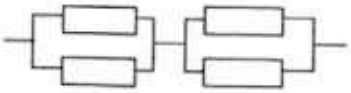
17 Four identical resistors with a resistance of 1 Ω each are arranged in the four ways shown in the diagrams below.



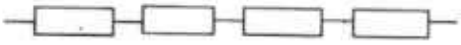
arrangement I



arrangement II



arrangement III

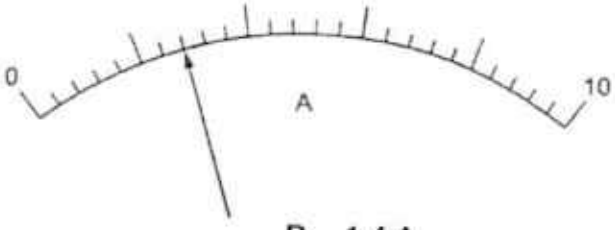


arrangement IV

How many of these arrangements will result in an effective resistance of more than 1 Ω?

A 1
B 2
C 3
D 4

18 The diagram shows a scale of an ammeter. What is the reading?



A 1.2 A
B 1.4 A
C 2.4 A
D 2.8 A

19 The heating effect of an electric current is used in some appliances. In which appliance is the heating effect a nuisance?

A Electric drill
B Electric iron
C Electric kettle
D Electric oven

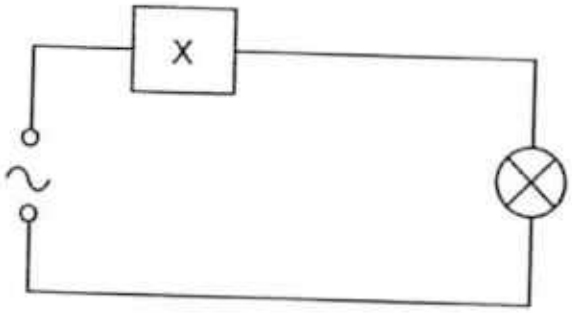
20 Which one of the following correctly matches the colours of the wires in a three-pin plug?

	Earth Wire	Live Wire	Neutral Wire
A	Blue	Brown	Green and Yellow
B	Brown	Green and Yellow	Blue
C	Green and Yellow	Brown	Blue
D	Green and Yellow	Blue	Brown

21 Singapore Power charges 10 cents for each kWh of electrical energy used.
What is the cost of using a 6000 W electric oven for 6 hours?

A $ 3.60
B $ 36
C $ 360
D $ 3 600

22 The device **X** in this circuit is designed to cut off the electricity supply automatically if too much current flows.



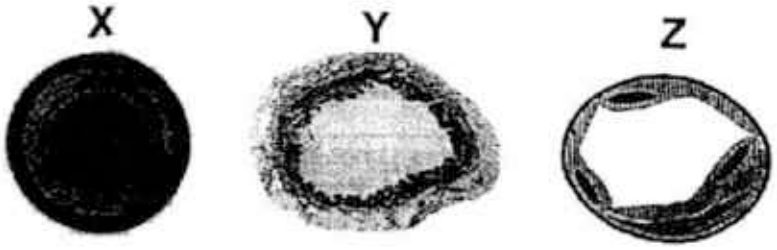
What is device **X**?

A A fuse
B A switch
C A variable resistor
D An ammeter

23 Which of the following does **not** describe the correct function for the given part of blood?

	Part of Blood	Function
A	Plasma	Transports carbon dioxide from all parts of the body to the lungs.
B	Platelets	Help blood to clot.
C	Red blood cells	Transport oxygen from all parts of the body to the lungs.
D	White blood cells	Fight infection and kill germs.

24 The cross section of three types of blood vessels are given below. Which of the following options indicates the correct type of blood vessel?



	X	Y	Z
A	Artery	Capillary	Vein
B	Vein	Artery	Capillary
C	Artery	Vein	Capillary
D	Capillary	Vein	Artery

25 The density of liquid oxygen is higher than oxygen gas because the particles in liquid oxygen _____.

A are closer together
B have a greater mass
C have a higher density
D have a smaller volume

26 Why does ice float on water?

A Ice has a smaller volume than water.
B Ice has a lower density than water.
C Ice is a solid but water is a liquid.
D Ice is converted from water when it is freezed.

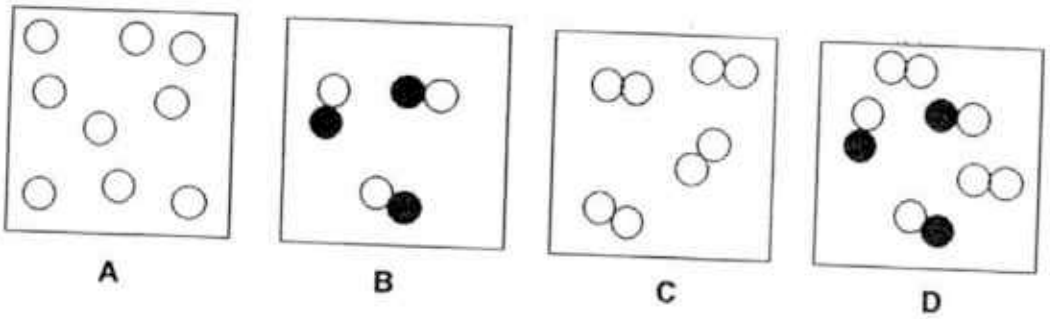
27 Which method could be used to obtain pure water from a sugar solution?

A Simple distillation
B Filtration
C Crystallisation
D Chromatography

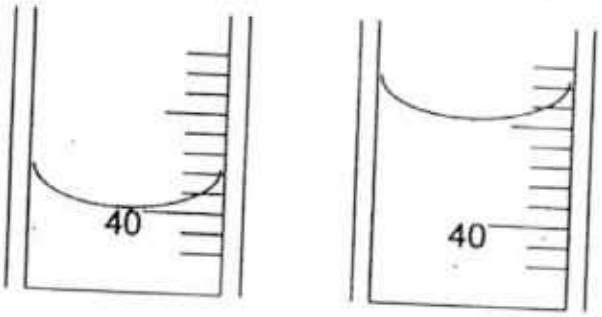
28 What is the physical property that allows substances to be separated by chromatography?

A They have different colours.
B They have different densities.
C They have different boiling points.
D They have different solubilities in the same solvent.

29 Which one of the following diagrams represents molecules of a compound?



30 The figures below show the difference in water level (in cm^3) before and after a solid **Q** was submerged in a measuring cylinder. Given that solid **Q** is 20 g, what is the density of solid **Q**?



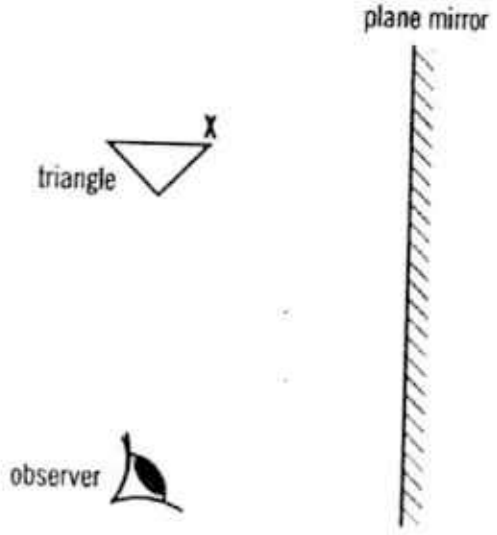
A 0.3 g/cm^3
B 0.5 g/cm^3
C 2.0 g/cm^3
D 4.0 g/cm^3

Name: _____ ( ) Class: Sec _____

SECTION B : STRUCTURED QUESTIONS [40 marks]

Answer all the questions in the spaces provided.

1 The diagram below shows a triangle placed in front of a plane mirror. One of the characteristics of the image formed is that it is virtual.



(a) What does a virtual image means? [1]

.....

.....

(b) Draw the image of the triangle in the mirror. [1]

(c) Hence, complete the ray diagram by drawing two rays of light to show how the observer sees the image of point **X** of the triangle in the mirror. [2]

(d) Other than the image being virtual, list two other characteristics of the image formed. [2]

.....

.....

(e) The following diagrams show two types of reflection of light rays.

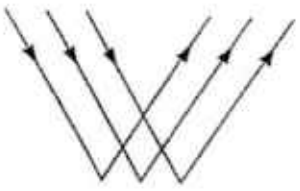


Diagram A

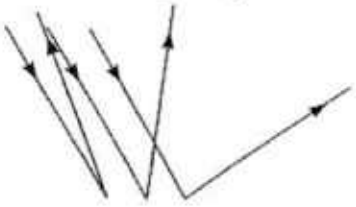


Diagram B

(i) Name the type of reflection as shown in diagram **B**. [1]

.....

(ii) What kind of surface, rough or smooth, will produce the reflection shown in diagram **B**? [1]

.....

2 (a) What is refraction of light? [1]

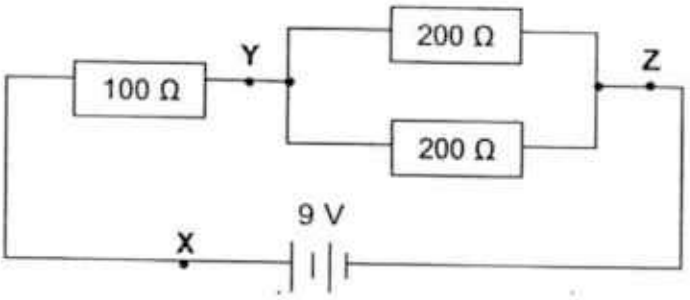
.....

.....

(b) How does the speed of light change as it moves from an optically less dense medium to an optically denser medium? [1]

.....

3 The diagram below shows an electric circuit.



(a) Calculate the total resistance across **Y** and **Z**. [2]

Total resistance = ...

(b) Calculate the total resistance of the whole circuit. [1]

Total resistance = ...

(c) Calculate the current flowing in point **X**. [1]

Current = ...

(d) Using the correct symbol, add an ammeter to the circuit diagram, to measure the current at point **X**. [1]

4 **Figure 4.1** below shows some food just before it enters the stomach and **Figure 4.2** shows the same food as it leaves the stomach four hours later.

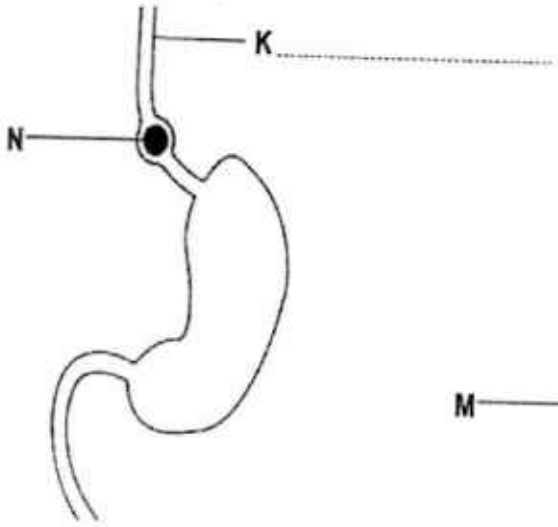


Figure 4.1

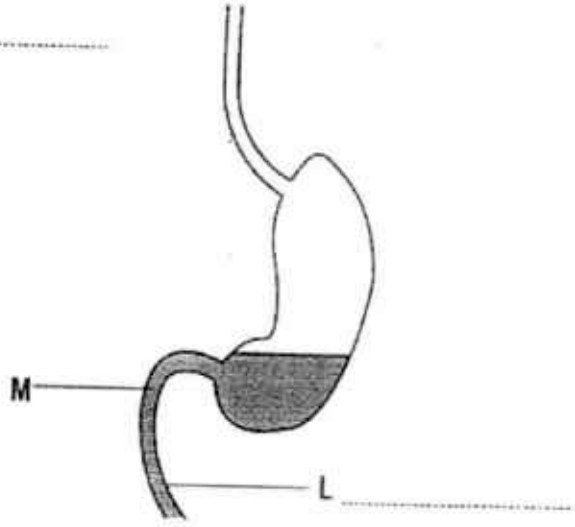


Figure 4.2

(a) On **Figure 4.1 and Figure 4.2**, label structures **K** and **L**. [2]

(b) Name the enzyme present in the ball of food at **N**. [1]

.....

(c) The food consisted of meat, potatoes and spinach. Tick the appropriate boxes in **Table 4.3** to show the comparison of food at positions **M** and **N**. [3]

	More at **M** than **N**	Less at **M** than **N**	Almost the same at **M** and **N**
Starch			
Protein			
Fibre			

Table 4.3

(d) Name the region of the alimentary canal which will contain fibre in the largest proportion and give a reason for your answer. [2]

.....

.....

.....

5 The table below shows the amounts of carbohydrate, fat and protein present in 100 g portions of 5 different foods.

food	mass in 100 g portion / g		
	carbohydrate	fat	protein
P	0	20	80
Q	5	95	0
R	97	3	0
S	60	10	30
T	25	25	50

Using the letters **P** to **T**, which food

(a) is likely to be a piece of beef? [1]

.....

(b) contains the greatest amount of a type of nutrient that is used for the growth and repair of body cells? [1]

.....

(c) contains the greatest amount of a type of nutrient that is needed for keeping an animal warm? [1]

.....

6 **Figure 6.1** shows an electric kettle. It has a metal casing and a fuse.

Figure 6.1

(a) State, with a reason, whether a 2-pin plug or 3-pin plug, has to be used for this electric kettle. [2]

.....

.....

(b) How should the fuse be connected to the wires? (Tick the correct box.) [1]

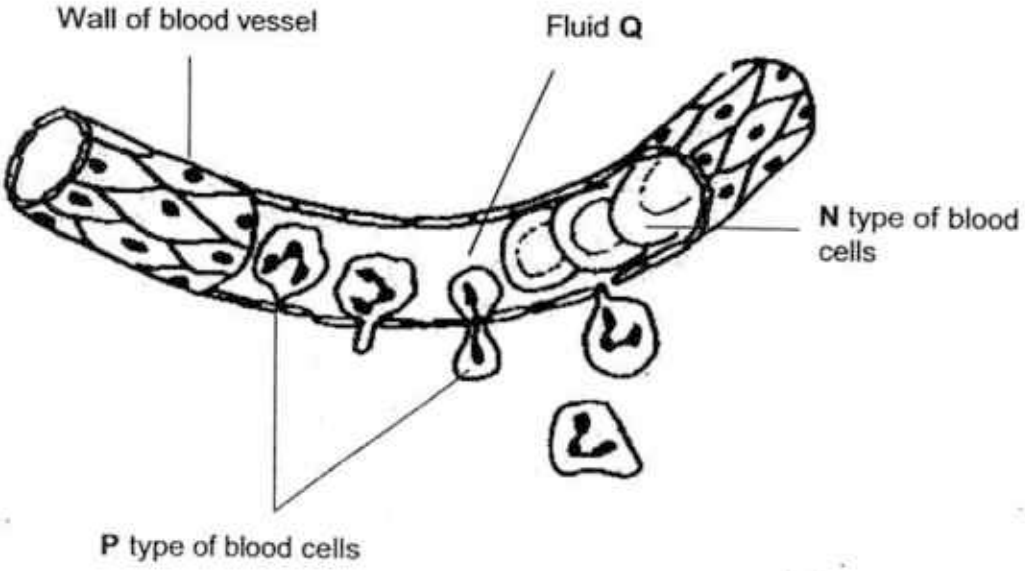
To Live Wire	To Neutral Wire	To Earth Wire

(c) The electrical power input to the kettle is 2000 W and the kettle is used for 400 s. Calculate the electrical energy, supplied to the kettle in **i)** SI unit and **ii)** kwh. [3]

i) Electrical energy supplied to the kettle (in SI unit) = ...

ii) Electrical energy supplied to the kettle (in kWh) = ...kWh

7 The content inside a blood capillary is shown in the diagram below.



(a) Identify **N** and **P** type of cells. [2]

N: .....

P: .....

(b) State two characteristics of **N** type of cells and explain how each of the characteristics support the function(s) of the cells. [4]

.....

.....

.....

.....

.....

.....

(c) What is fluid **Q**? Suggest a function of fluid **Q**. [2]

.....

.....

.....

Name: _____( ) Class: Sec _____

SECTION C : FREE RESPONSE QUESTIONS [30 marks]
Answer **all** questions in this section.

9 (a) **Figure 9.1** below shows an apparatus set up to investigate digestion.

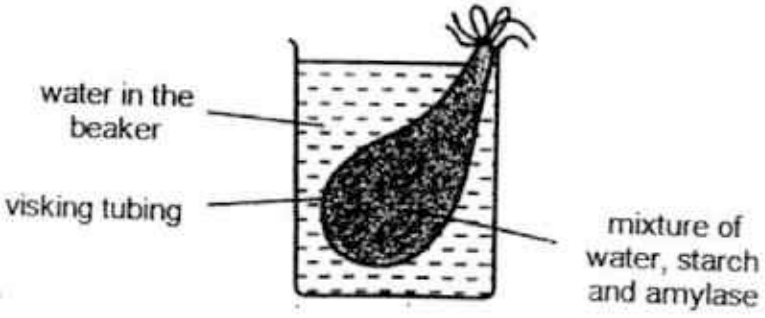


Figure 9.1

The apparatus was left at 30°C for one hour. The water in the beaker was then tested and was found to contain reducing sugars.

The digestion of starch present in the visking tubing is expected to complete in four hours.

(i) Explain why reducing sugars were found in the water in the beaker. [3]

.....

.....

.....

.....

(ii) The water in the beaker was also tested for starch after an hour since the start of the experiment. State if starch will be present or absent, in the water. Explain your answer. [2]

.....

.....

(b) Amylase is an enzyme commonly used in beer production. A study is carried out in a beer manufacturing company to find out the effect of temperature on amylase so as to obtain the best condition for beer production.
The result is shown in **Table 9.2** on page 17.

Temperature (°C)	Amylase activity (arbitrary unit)
0	0.0
10	0.2
20	0.5
30	1.0
40	2.2
50	4.5
60	8.2
70	9.0
80	1.0
90	0.0

Table 9.2

(i) Describe the trend in amylase activity as temperature increases from 0°C to 70°C. [1]

.....

(ii) Explain why the amylase activity decreases when the temperature increases above 70°C. [1]

.....

(iii) Explain why only a small amount of amylase is required in the experiment. [1]

.....

(iv) Another study is then carried out to find out the effect of pH on amylase activity. The result of the study is shown in **Table 9.3**.

pH	Amylase activity (arbitrary unit)
4	0.3
5	0.7
6	2.0
7	4.0
8	9.0
9	5.0
10	3.0

Table 9.3

Based on **Table 9.2** and **Table 9.3**, if you were the manager of the beer manufacturing company, what are the two conditions (temperature and pH) you would choose to otain the greatest yield of beer? [2]

.....

.....

.....

10 **(a)** The following experiment in **Figure 10** was set up to separate a mixture of ethanol and water. Ethanol has a boiling point of 78°C while water has a boiling point of 100°C.

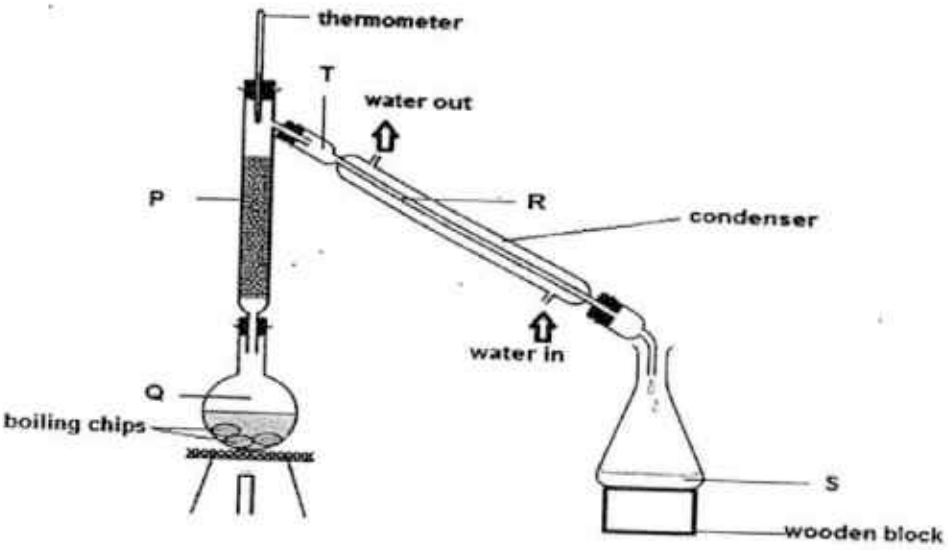


Figure 10

(i) State the method used in this experiment to separate the two liquids. [1]

.....

(ii) Identify the apparatus labeled **P**. [1]

.....

(iii) What process(es) take(s) place in **Q**? [1]

.....

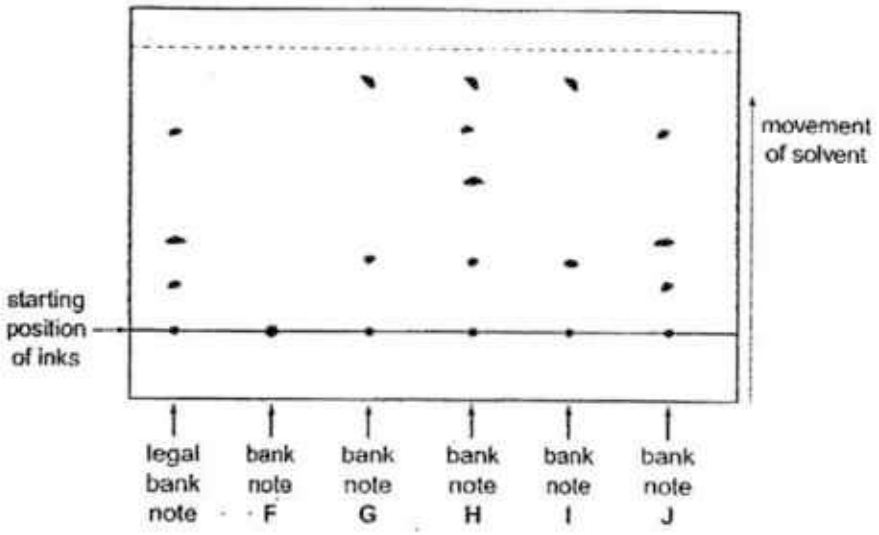
(iv) What process takes place in **R**? [1]

.....

(v) Which liquid will be collected as the distillate first? Explain your answer. [2]

.....

(b) Forensic scientists use paper chromatography to compare the inks from five different bank notes with the ink used to make legal bank notes. The results are shown below.



(i) Which of the bank notes is legal? [1]

.....

(ii) Which of the bank notes are printed with identical inks? [1]

.....

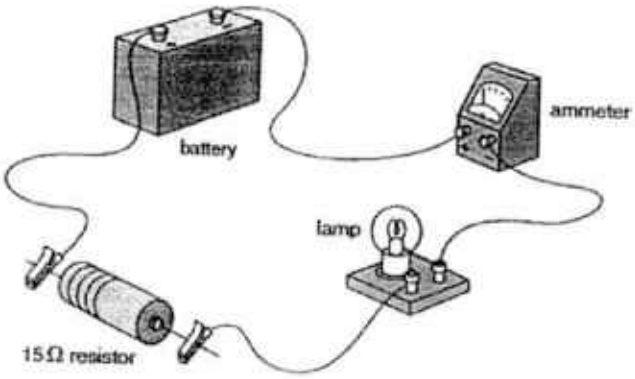
(iii) Which of the bank notes is printed with ink containing four different dyes? [1]

.....

(iv) Explain why the ink from bank note **F** remained at the starting position. [1]

.....

11 A student set up an electric circuit as shown.



(a) **(i)** The lamp lights up but the needle of the ammeter moves below the zero mark. What change should be made so that the ammeter works correctly? [1]

.....

(ii) In the space below, draw a circuit diagram, with the correct symbols to represent the above circuit. [2]

(b) **(i)** Name the instrument that would be needed to measure the potential difference (p.d.) across the 15 Ω resistor. [1]

.....

(ii) Using the correct symbol, add this instrument to your circuit diagram in **(a)(ii)**, in a position to measure the p.d. across the 15 Ω resistor. [1]

(c) **(i)** The potential difference across the 15 Ω resistor is 6 V.
Calculate the current in the resistor. [2]

.....

.....

.....

(ii) State the value of the current in the lamp. [1]

.....

.....

(d) Another 15 Ω resistor is connected in parallel with the 15 Ω resistor that is already in the circuit. State what effect, if any, adding this extra resistor has on the current in the lamp. Explain your answer. [2]

.....

.....

.....

[End of Paper]

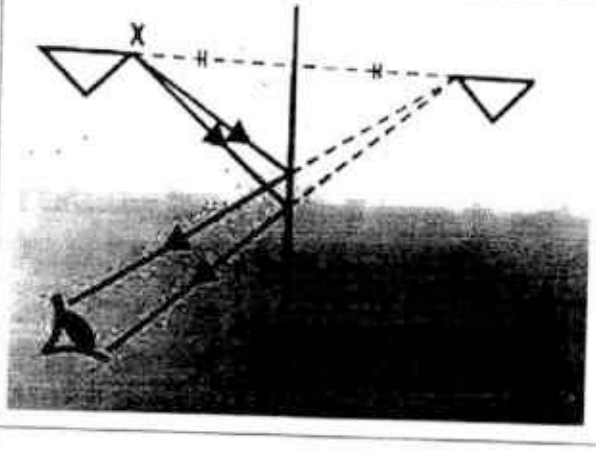
St. Gabriel's Secondary School
2016 Sec 2E SA1 Marking Scheme

Section A

1	2	3	4	5	6	7	8	9	10
A	C	B	D	B	C	C	D	D	A
11	12	13	14	15	16	17	18	19	20
C	B	C	B	A	B	B	D	A	C
21	22	23	24	25	26	27	28	29	30
A	A	C	C	A	B	A	D	B	D

8A, 7B, 7C, 9D

Section B

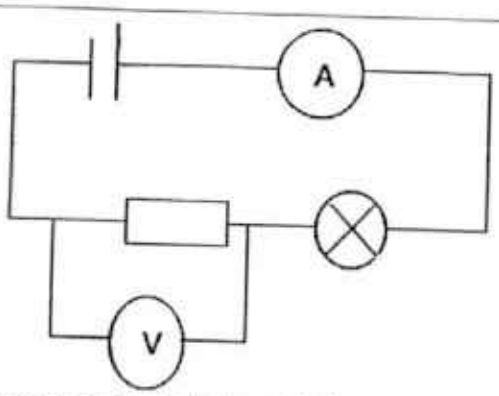
			Remarks
1	(a)	Image which cannot be captured on a screen.	[1]
	(b) (c)		[1] for correct shape of image and distance of image from mirror [1] for light rays from object to eye [1] for virtual rays behind mirror No arrow minus 1 mark
	(d)	• The distance of the image from the mirror is equal to the distance of the object from the mirror. • The image and the object are the same size. • The image is upright. • The image is laterally inverted. ***Unacceptable***: *Image is not magnified / diminished; Image is straight (?); Image must be positioned (?); Image is inverted; Image is inversely opposite (?);* *It will have the same distance; Distance between image in a plane mirror and the object is the same;* *Image is of the same plane (dimension, not size) as the object;* *Normal, reflection ray and incident ray lie on the same plane / Angle of incidence is equal to the angle of reflection (both are not characteristics of the **image** formed);* *Image looks the same as object. "Same" is not specific enough. Is it upright? Of the same size?*	[2 marks for any 2 characteristics]
	(a)	(i) Irregular reflection or diffused reflection	[1]

		(ii) Rough surface	[1]
2	(a)	It is the bending of light when light ray travels from one medium to another medium of different optical density.	[1]
	(b)	It decreases.	[1]
3	(a)	1/R = 1/100 + 1/100 = 2/100 R = 200/2 R = 100Ω	[1] [1]
	(b)	R = 100 + 100 = 200 **Ω**	[1]
	(c)	V = IR I = V / R = 9/ 200 = **0.045 A**	[1]
	(d)	Correct symbol of ammeter across the point X	[1]
4	(a)	**K**: Oesophagus **L**: Duodenum/ small intestine	[1] [1]
	(b)	amylase	[1]
	(c)		[1] each: total [3]
	(d)	Colon/ large intestine. The rest of the digested food products are absorbed in the small intestine.	[1] [1]

	More at **M** than **N**	Less at **M** than **N**	Almost the same at **M** and **N**
Starch			✓
Protein		✓	
Fibre			✓

5	(a)	Q	[1]
	(b)	P	[1]
	(c)	Q	[1]
6	(a)	3 – pin plug The metal casing has to be connected to the Earth wire to prevent electrical shock	[1] [1]
	(b)	The fuse should be connected to the Live wire.	[1]
	(c)	(i) Electrical energy (in SI unit) = 2000 x 400 = 800 000 J Electrical energy (in kWh) = 2 x (400 / 3600) = 0.222 kWh	[1] [1] [1]
	(d)	(ii) Cost = 0.222 x 8 = 1.78 cents	[1] [1]
7	(i)	N: red blood cells P: white blood cells	[1] [1]
	(ii)	Bi-concave in shape[1]: increases surface-area volume ratio so that more oxygen can be carried/increases rate of diffusion of oxygen[1] Contains haemoglobin[1]: red pigment that binds to oxygen [1] Lacks nucleus [1]: more space for haemoglobin [1] Flexible[1]: able to squeeze into the lumen of capillaries[1]	Any 2 correct answers to get 4 marks
	(iii)	Plasma ; Plasma carries dissolved food substances / antibodies / oxygen /hormones to cells OR waste products away from cells to be expelled from body	[1] Any one of the functions: [1]

				Remarks
			Section C	
9	(a)	(i)	Amylase digests starch into reducing sugars.	[1]
			Reducing sugars are small molecules and are able to diffuse through the partially permeable visking tubing,	[1]
			from a region of high concentration to a region of low concentration.	[1]
		(ii)	Starch is absent.	[1]
			Starch is a large molecule and cannot pass through the visking tubing.	[1]
	(b)	(i)	Amylase activity increases	[1]
		(ii)	The enzymes are denatured.	[1]
		(iii)	Enzymes do not get broken down or chemically changed at the end of reaction and can be re-used.	[1]
		(iv)	70°C pH 8	[1] [1]
10	(a)	(i)	Fractional distillation [Reject distillation]	[1]
		(ii)	Fractionating column	[1]
		(iii)	Boiling	[1]
		(iv)	Condensation	[1]
		(v)	Ethanol.	[1]
			It has a lower boiling point.	[1]
	(b)	(i)	J	[1]
		(ii)	G and I	[1]
		(iii)	H	[1]
		(iv)	F	[1]
11	(a)	(i)	Connect wire from positive terminal of battery to positive terminal of ammeter.	[1]

		(ii)	 2 correct symbols to get [1] [voltmeter drawing is for b(ii)]	[2]
	(b)	(i)	Voltmeter	[1]
		(ii)	Connect voltmeter in parallel to the 15Ω resistor with the correct symbol.	[1]
	(c)	(i)	Current = voltage/ resistance = 6/15 = 0.4A	[1] [1]
		(ii)	Lamp current = 0.4A	[1]
	(d)		When the two resistors are connected in parallel, the total resistance will be decreased. As such, the current in the lamp will be higher than 0.4 A.	[1] [1]

15

ZHONGHUA SECONDARY SCHOOL
Mid-Year Examination 2016

CANDIDATE NAME		( )
CLASS	2	E

LOWER SECONDARY SCIENCE — **11 May, 2016**

Secondary 2 Express — **2 hours**

Set by: **Ms Rozianna / Ms Lin Jiaxuan / Mr Ong Kai Kun**

Vetted by: **Mr Lawrence Tang/ Ms Ong Lay Hong/ Ms Rozianna**

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces at the top of this page and on all separate answer paper used.

Write in dark blue or black pen.

You may use a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

There are **thirty** questions on this paper. Answer all questions. For each question there are four possible answers **A**, **B**, **C** and **D**.

Choose the one you consider correct and record your choice in soft pencil on the separate OTAS Answer Sheet.

Section B

Answer **all** questions.

Write your answers in the spaces provided on the Question paper.

Section C

Answer **all** questions.

Write your answers in the spaces provided on the Question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.

All essential working must be shown clearly.

A copy of the Periodic Table is printed on page 24.

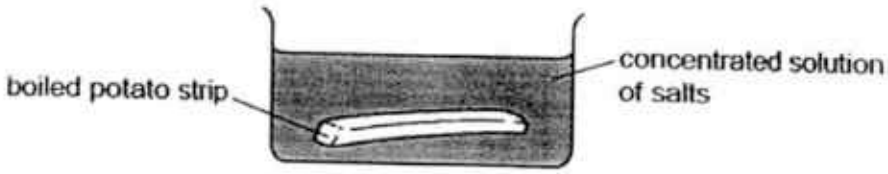
For Examiner's Use	
Section A	30
Section B	30
Section C	40
Total	

This document consists of **24** printed pages, including this cover page.

Section A

Answer **all** the questions.

1 Boiling potatoes destroys their cell membranes. A peeled, boiled potato strip is placed in a concentrated solution of salts.



What process took place in the above experiment?

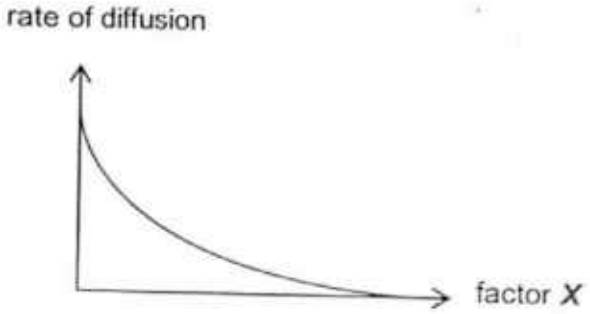
	osmosis	diffusion
A	✓	✓
B	✓	×
C	×	✓
D	×	×

key

✓ = takes place

× = does not take place

2 The graph below shows how the rate of diffusion changes with a factor ***X***.



The factor ***X*** could be _____ (P) or _____ (Q).

	P	Q
A	concentration gradient	size of diffusing molecule
B	concentration gradient	surface area over which diffusion occurs
C	diffusion distance	size of diffusing molecule
D	diffusion distance	surface area over which diffusion occurs

3 Which of the following best describes the difference between active transport and passive transport?

	active transport	passive transport
A	water molecules only	all types of particles
B	from higher to lower concentration	from lower to higher concentration
C	requires a selectively permeable membrane	does not require a selectively permeable membrane
D	requires respiration	does not require respiration

4 Some yellow fumes are released into the corner of an enclosed room. After some time, it can be observed that the fumes are uniformly dispersed in the room.

Which of the following statements best describe what happens to the fume particles in the room?

A They diffuse uniformly to the rest of the room.

B They diffuse by random movement to the rest of the room until they are uniformly distributed.

C They moved uniformly throughout the room by active transport.

D They moved uniformly throughout the room by osmosis.

5 A human red blood cell is placed in a concentrated glucose solution.

In which direction will the water molecules move and what is the effect on the cell?

	water molecules	effect on cell
A	move into the cell	cell increases slightly in size
B	move into the cell	cell undergo lysis
C	move out of the cell	cell decreases slightly in size
D	move out of the cell	no change in cell volume

6 The term, biomass, refers to

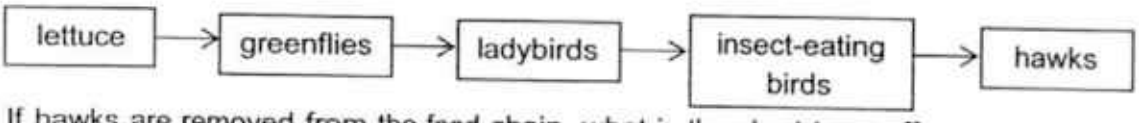
A the total weight of all organisms in a food chain.

B the total weight of all organisms in a trophic level.

C the total dry mass of all organisms in a food chain.

D the total dry mass of all organisms in a trophic level.

7 The diagram shows a food chain.

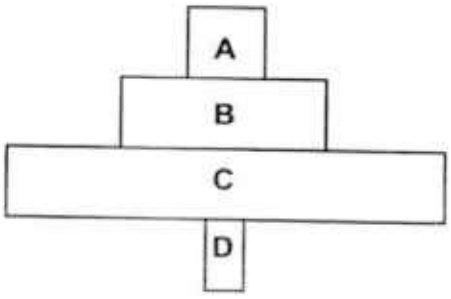


If hawks are removed from the food chain, what is the short term effect on the numbers of the other organisms?

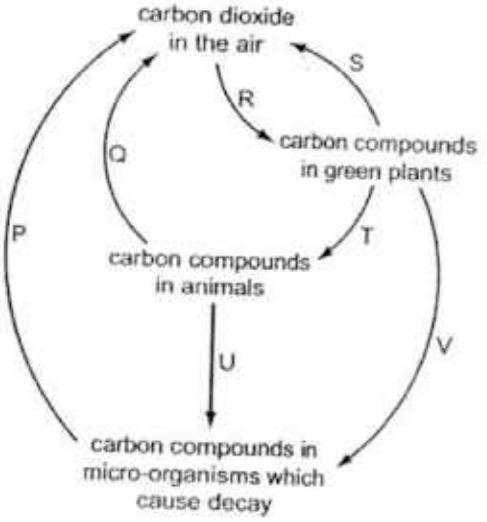
	greenflies	ladybirds	insect-eating birds
A	decrease	increase	decrease
B	decrease	increase	increase
C	Increase	decrease	decrease
D	increase	decrease	increase

8 The diagram shows a pyramid of numbers in a woodland ecosystem.

At which trophic level are the individual organisms largest in size?



9 The diagram shows a carbon cycle.



Which three letters represent the process of respiration?

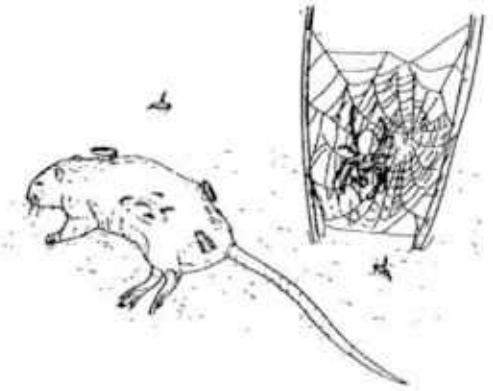
A P, Q and R

B P, Q and S

C S, T and V

D T, U and V

10 The diagram shows organisms feeding on a dead rat and one of the organisms which, in turn, feeds on them.



Which of the following is needed to complete the food chain?

A predator

B producer

C sunlight

D water

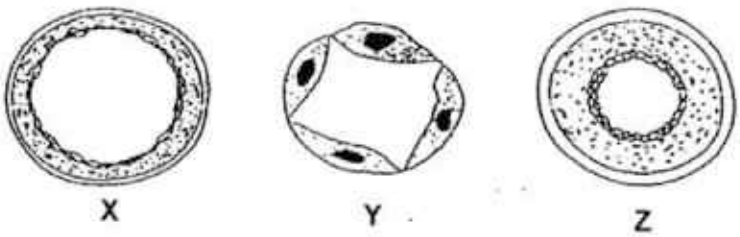
11 The characteristics of blood taken from a particular human blood vessel are listed below.

1 high oxygen concentration
2 high blood pressure
3 lower carbon dioxide concentration

Which blood vessel did the blood sample most likely come from?

A aorta
B pulmonary artery
C pulmonary vein
D vena cava

12 The diagram shows the cross sectional view of three types of blood vessels **X**, **Y** and **Z**.



	allows fluid to pass through wall	carries fluid high in pressure
A	X	Y
B	Y	X
C	Y	Z
D	Z	X

13 Which sequence shows the shortest route taken by blood travelling from a leg to an arm in the human body?

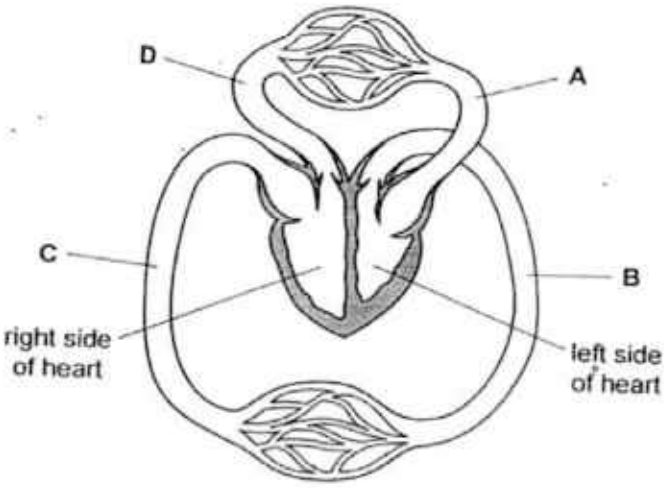
A leg → heart → lungs → kidney → arm
B leg → lungs → heart → stomach → arm
C leg → kidney → heart → lungs → arm
D leg → heart → lungs → heart → arm

14 How do veins differ from arteries?

	width of lumen	elastic fibres	muscles in wall
A	wider	more	more
B	wider	less	less
C	narrower	more	less
D	narrower	less	more

15 The diagram represents part of the circulatory system.

Where is the blood pressure lowest?



16 The testes are found within the scrotum outside the body because _____.

A it is easier to differentiate the male from the female

B the temperature in the body is too low for the sperms to survive

C the temperature outside the body is most suitable for the production and storage of sperms

D there is no space to keep inside the body

17 The fertilisation of the egg usually takes place in the _____.

A cervix
B ovary
C oviduct
D uterus

18 Which of the following shows the correct sequence of events?

A fertilisation → ovulation → menstruation → implantation
B implantation → fertilisation → ovulation → menstruation
C menstruation → ovulation → fertilisation → implantation
D ovulation → fertilisation → menstruation→ implantation

19 Which of the following chemical substances is responsible for changes in the lining of uterus in a woman's menstrual cycle?

1 oestrogen
2 progesterone
3 testosterone

A 1 only
B 1 and 2 only
C 2 and 3 only
D 1, 2 and 3

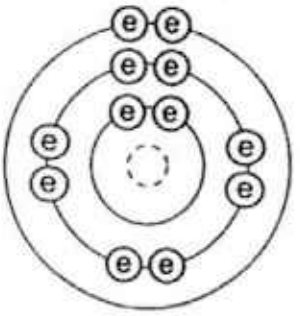
20 Which of the statements below about birth control methods is correct?

A Contraceptive pills are consumed to prevent ovulation.
B Ligation is an option for couples who are considering a temporary birth control method.
C The spermicide is usually used together with a diaphragm to kill sperms.
D The intra-uterine device (IUD) is inserted to prevent the implantation of eggs in the fallopian tube.

21 What is the electronic structure of an atom with a proton number 5 and a nucleon number 11?

A 2, 3
B 2, 4
C 2, 8, 1
D 2, 8, 6

22 The electronic structure of an element is shown.



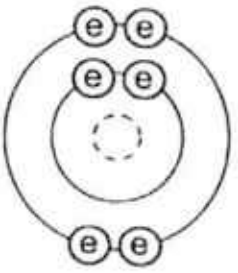
key

(e) electron

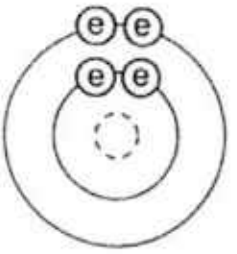
( ) nucleus

Which diagram shows the electronic structure of another element in the same group in the Periodic Table?

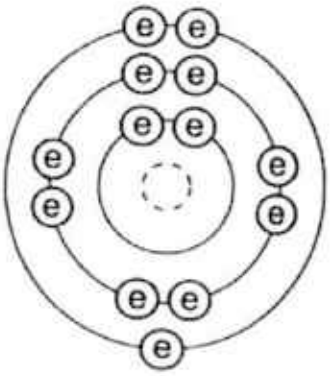
A



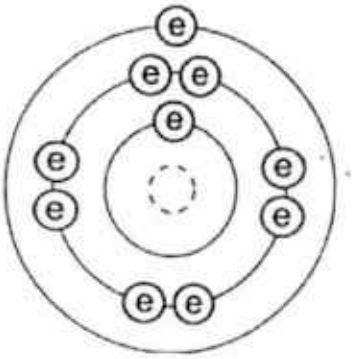
B



C



D



23 The electronic configuration of an ion is 2.8.8.

What could this ion be?

	S^{2-}	Ca^{2+}
A	×	×
B	×	✓
C	✓	×
D	✓	✓

24 The nucleon number and proton number of the lithium atom are shown by the symbol $^{7}_{3}Li$.

What is the correct symbol for the lithium ion in lithium chloride?

A $^{6}_{3}Li^{-}$

B $^{6}_{3}Li^{+}$

C $^{7}_{3}Li^{-}$

D $^{7}_{3}Li^{+}$

25 Which two elements react together to form an ionic compound?

element	electronic structure
W	2, 4
X	2, 8
Y	2, 8, 1
Z	2, 8, 7

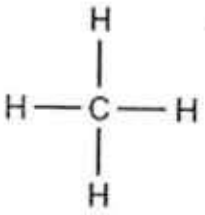
A **W** and **X**

B **W** and **Z**

C **X** and **Y**

D **Y** and **Z**

26 The diagram shows the structure of methane.



What is the total number of outer electrons used for bonding in this molecule?

A 2

B 4

C 8

D 10

27 An element, **Q**, is in the same group of the Periodic Table as chlorine. Which of the following can be a formula of a compound containing **Q**?

A Na_2Q

B AlQ_2

C CaQ

D MgQ_2

28 An aqueous solution of the organic compound methylamine has a pH greater than 7.

Which statement about methylamine is correct?

A It neutralises an aqueous solution of sodium hydroxide.

B It reacts with copper(II) carbonate to give carbon dioxide.

C It reacts with hydrochloric acid to form a salt.

D It turns blue litmus red.

29 Which of the following does not react with dilute sulfuric acid?

A magnesium metal

B magnesium nitrate

C magnesium hydroxide

D magnesium oxide

30 Ammonia may be obtained from ammonium chloride by heating with _____.

A aqueous calcium chloride

B aqueous sodium hydroxide

C dilute hydrochloric acid

D water

Zhonghua Secondary School
Mid-Year Examination 2016
Secondary 2 Express

NAME: _____ ( )

CLASS: _____

For Examiner's Use	
Section B	30
Section C	40
Total	

Section B

Answer **all** the questions.

Write your answers in the spaces provided on the question paper.

B1 At -250 °C, a sample of liquid air contains a mixture of oxygen and nitrogen. The boiling points of nitrogen and oxygen are as shown in Table 1.1.

Table 1.1

substance	boiling point / °C
nitrogen	-196
oxygen	-183

(a) A sample of liquid air in a container is allowed to **warm up** slowly.

With reference to Table 1.1, complete Table 1.2 below with the states of nitrogen and oxygen respectively.

Table 1.2

temperature(s)	state(s) of nitrogen	state(s) of oxygen
from -250 °C to -196 °C	liquid	
at -196 °C		
from - 196 °C to -183 °C		liquid

[2]

(b) In the space below, sketch to show how the temperature of the sample of the liquid air mixture will change as the sample is warmed up from -250 °C to -180 °C.

[3]

[Total: 5]

B2 Fig. 2.1 shows the energy flow in kilojoules (kJ) through a food chain.

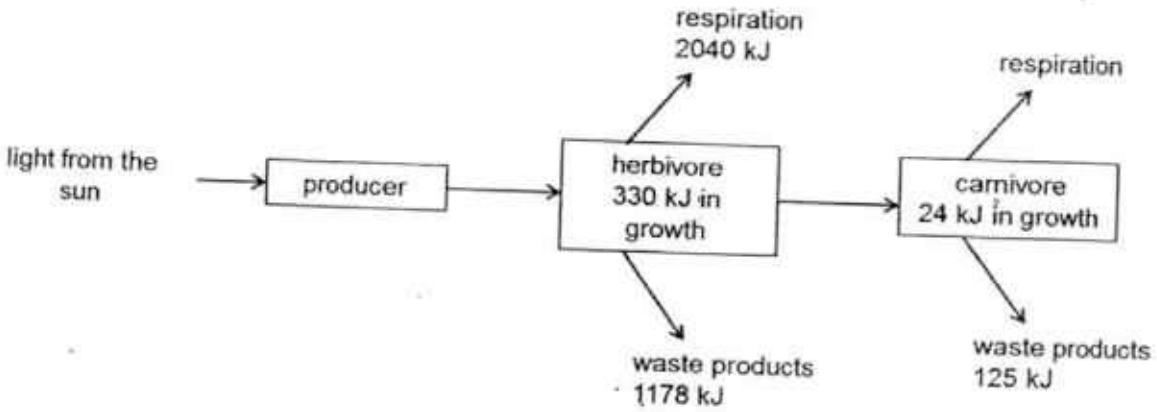


Fig. 2.1

(a) What is the amount of energy in kJ taken in by the herbivore? Show your working clearly.

_____

_____ [1]

(b) Calculate the percentage of energy taken in by the carnivore that is used for respiration.

_____

_____

_____

_____ [2]

(c) Based on the information in Fig. 2.1, construct a pyramid of energy.

[1]

(d) Suggest why this food chain could not have another trophic level.

_____

_____ [1]

[Total: 5]

B3 Fig 3.1 shows a longitudinal section through a human heart.

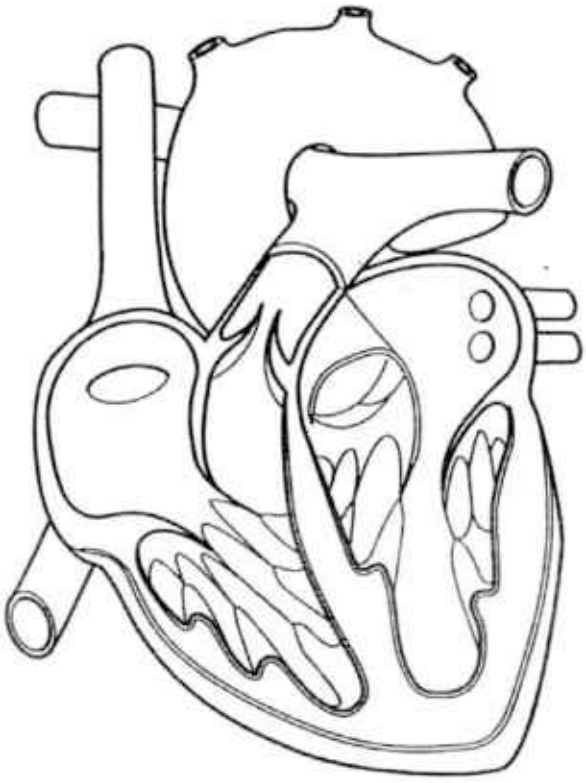


Fig 3.1

(a) Use label lines and the letters **P** and **Q** to label the following on Fig 3.1.

P pulmonary artery **Q** semi-lunar valve [2]

(b) Fig 3.2 is an X-ray showing narrowing in the blood vessels supplying muscles in the heart. A catheter is used to insert a dye into the blood vessels so that they appear clearly in the X-ray. The arrows indicate where there is narrowing of the blood vessels.

Fig. 3.2

(i) Name the blood vessels shown in Fig 3.2 and state one likely effect of the narrowing of the blood vessels.

blood vessel _____

effect _____

_____ [2]

(ii) State one way in which the condition in Fig 3.2 can be prevented.

_____

_____ [1]

[Total: 5]

B4 Fig. 4.1 shows a calendar page on which a woman has marked with a circle, the first day of her menstruation.

March 2016

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Fig. 4.1

(a) On Fig. 4.1, circle any three consecutive days within the fertile period. [1]

(b) Her menstrual cycle has 28 days.

With reference to Fig. 4.1, when will the first day of her next period be?

_____ [1]

(c) Fig. 4.2 and Fig. 4.3 below show the graphs for the menstrual cycle of the same woman on two consecutive months.

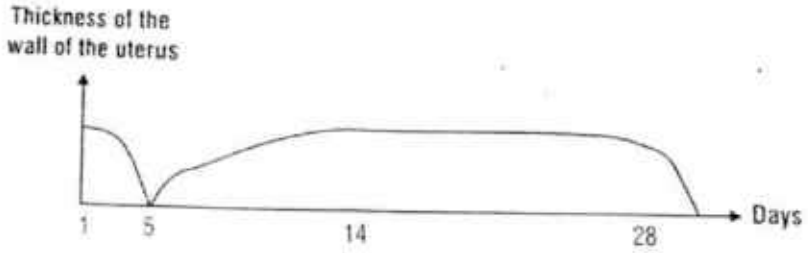


Fig. 4.2

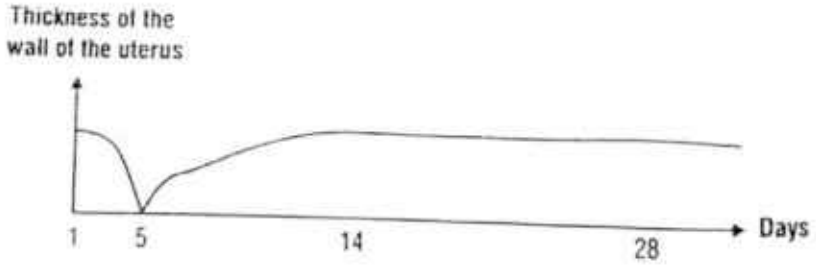


Fig. 4.3

(i) Name the hormone that is responsible for the thickening of the uterine lining after ovulation.

_____ [1]

(ii) Account for the difference in thickness after Day 28 observed in both Fig. 4.2 and Fig. 4.3.

_____

_____

_____ [2]

[Total: 5]

B5 Table 5.1 shows the atomic structure of six particles, represented by the letters **A** to **F**. The particles are atoms or ions. The letters are not the symbols of the elements.

Table 5.1

particle	electron	proton	neutron
A	6	6	6
B	2	2	2
C	12	12	12
D	10	12	12
E	6	6	8
F	10	13	14

Use the letters **A** to **F** to answer the following questions.

(a) Which particle has the greatest atomic mass?

_____ [1]

(b) Which particle is an atom in Group 0?

_____ [1]

(c) Which two particles are an atom and an ion of the same element?

_____ [1]

(d) Which two particles are isotopes of the same element?

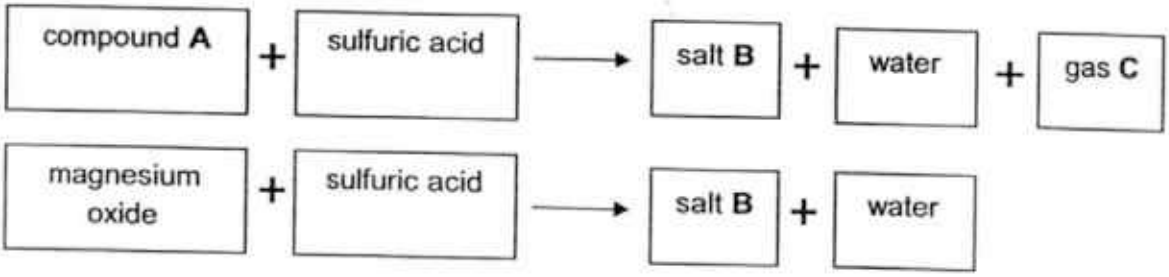
_____ [1]

(e) Which particle is an atom of a metallic element?

_____ [1]

[Total: 5]

B6 The equations below show two chemical reactions of sulfuric acid. Both reactions produced the same salt B.



(a) Write the chemical formula of the compounds labelled **A, B,** and **C**.

A: _____

B: _____

C: _____ [3]

(b) Describe a simple chemical test to identify gas **C**.

_____

_____ [2]

[Total: 5]

Section C

Answer all questions.

Write your answers on the lined paper provided.

C7 Fig. 7.1 shows a blood capillary and some living cells found near it. The arrows represent exchange of substances **B** and **C** between living cells and blood capillary.

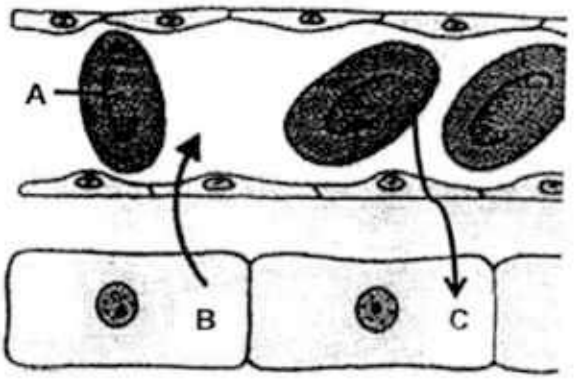


Fig. 7.1

(a) Identify cell **A** and substances **B** and **C**:

A _____

B _____

C _____ [3]

(b) Blood capillaries connect arteries to veins.

(i) What is the main function of a blood capillary?

_____

_____ [1]

(ii) How does the structure of the blood capillary make it well-suited for its function?

_____

_____

_____

_____ [2]

(c) Describe how substances **B** and **C** move across the capillary wall.

_____

_____

_____

_____ [2]

(d) Besides cell **A**, there is another type of cell usually found in blood. Name the cell and state its function in the human circulatory system.

_____

_____

_____ [2]

[Total: 10]

C8 Fig. 8.1 shows the male reproductive system.

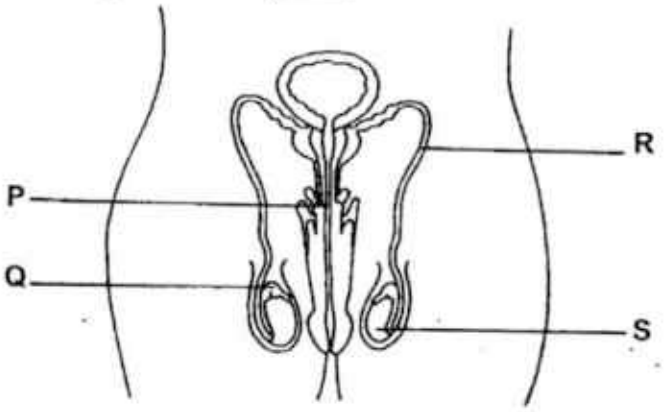


Fig. 8.1

(a) Name the following parts.

P : _____

Q : _____ [2]

(b) Explain how the functions of parts **Q** and **S** are related to each other.

_____

_____

_____ [2]

(c) A couple decides on a permanent birth control method which involves cutting and tying of part **R** of the male reproductive system.

(i) Name this male sterilisation method.

_____ [1]

(ii) Explain how this sterilisation method is an effective permanent birth control method.

_____

_____

_____ [2]

(d) Fig. 8.2 shows a diagram of a sperm.

Fig. 8.2

(i) In order for fertilisation to be successful, the sperm has to penetrate the egg. This is possible when an enzyme is released from part **X** of the sperm to break down part of the egg membrane.

On Fig. 8.2, label the part **X** which is responsible for releasing the enzyme. [1]

(ii) A student claims that a pair of identical twins is produced when an egg is fertilised by two sperms to form two zygotes.

State whether the student's claim is true or false. Explain your answer.

_____

_____

_____

_____ [2]

[Total: 10]

C9 Hydrogen chloride, HCl, is a compound.

(a) Draw a dot-and-cross diagram to show the bonding in a molecule of hydrogen chloride. Show only the outer electrons.

[2]

(b) State the type of bonding present in hydrogen chloride.

_____ [1]

(c) Hydrogen chloride dissolves in water to form an acidic solution (hydrochloric acid).

(i) Describe how you would use litmus paper to show that this solution is acidic.

_____ [1]

(ii) Which one of the following values is most likely to represent the pH of a dilute solution of hydrochloric acid?

Circle the correct answer.

pH 2 **pH7** **pH10** **pH14** [1]

(d) A student added some zinc powder into the test tube containing dilute hydrochloric acid.

(i) Give the chemical formula of the products formed.

_____ [2]

(ii) Describe a simple test to identify the gas produced.

_____

_____ [2]

(iii) The student repeated the experiment by replacing dilute hydrochloric acid with dilute sulfuric acid. Give the chemical name of the salt that is formed.

_____ [1]

[Total: 10]

C10 Two isotopes of potassium are ^{39}K and ^{40}K.

(a) Define the term *isotopes*.

_____

_____ [1]

(b) Complete the table about the number of particles found in one atom of each of these isotopes.

	number of protons	number of electrons	number of neutrons
^{39}K			
^{40}K			

[2]

(b) Potassium readily forms potassium oxide when reacted with oxygen in air.

(i) Write the chemical formula of potassium oxide

_____ [1]

(ii) Briefly describe how the potassium ions and oxide ions are formed in terms of electron transfer.

_____

_____

_____ [2]

(iii) Draw a dot-and-cross diagram to show the bonding in potassium oxide. Show only outer electrons in your diagram.

[2]

(iv) Give the chemical name and chemical formula of the salt that is formed when potassium oxide reacts with nitric acid.

chemical name: _____

chemical formula: _____

[2]
[Total: 10]

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	64 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	– Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La lanthanum 57 *	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– Ac actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	– Pa protactinium 91	238 U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lr lawrencium 103

Key

a X b	a = relative atomic mass X = atomic symbol b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

2E LSS MYE 2016 Answers

Section A

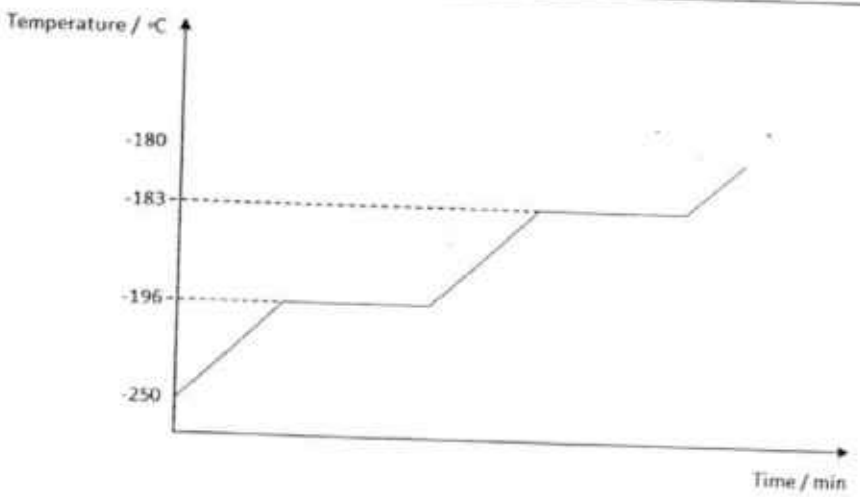
1. C	2. C	3. D	4. B	5. C	6. C
7. D	8. D	9. B	10. B	11. A	12. C
13. D	14. B	15. C	16. C	17. C	18. C
19. B	20. A	21. A	22. B	23. D	24. D
25. D	26. C	27. D	28. C	29. B	30. B

Section B

Qn	Answers	Marks
B1a		4 x ½ mark [Total: 2]

temperature(s)	state of nitrogen	state of oxygen
from -250 °C to -196°C	liquid	**liquid**
at -196 °C	**liquid and gas**	**liquid**
from - 196 °C to -183 °C	**gas**	liquid

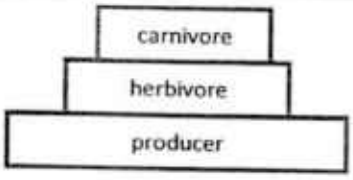
B1b

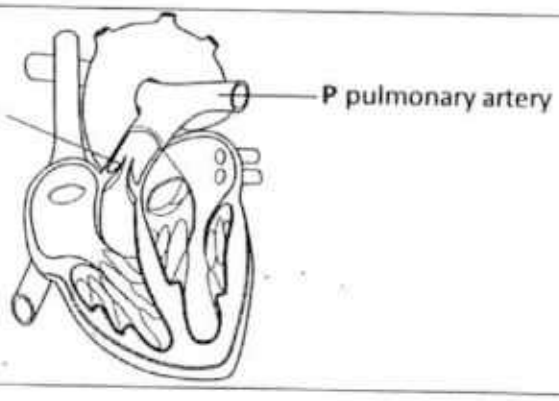


axis ½
shape ½

2 x ½ for constant temp at -196 °C and -183 °C
[Total: 2]

Qn	Answers	Marks
2(a)	Energy taken in by herbivore = 2040 + 330 + 1178 = 3548kJ	 ½ ½
2(b)	Percentage of energy used for respiration = (330 – 24 -125) / 330 x 100% = 54.8%	 1 1
2(c)		½ for correct

		width ½ for correct labels
2(d)	The amount of energy transferred from one trophic level to the next, gets progressively less / 10% transfer to next trophic level / insufficient energy for the organism in another trophic level;	1

3(a)		1 each
3(b)i	coronary arteries insufficient nutrients / oxygen to heart muscles	1 1
3(b)ii	Any 1: reduce fatty food / reduce cholesterol; stress management; avoid smoking; regular physical exercise;	1

B4a	[Circle either of the following: • Any 3 consecutive days from 13 – 17 March	1
B4b	30th March 2016	1
B4ci	• Progesterone.	1
Bcii	• The woman's menstruation started after the first menstrual cycle (Fig. 4.2) but did not start after the second menstrual cycle (Fig. 4.3). • This could mean that she is pregnant / fertilization was successful. • as the thickening of the lining is to prepare for fertilization.	1 ½ ½

B5	(a)	F (greatest number of protons and neutrons)	[1]
	(b)	B (Helium – proton number 2)	[1]
	(c)	C and D (both have same number of protons different number of electrons)	[1]
	(d)	A and E (both have same number of protons different number of neutrons)	[1]
	(e)	C (magnesium – proton number 12, number of electron = 12)	[1]

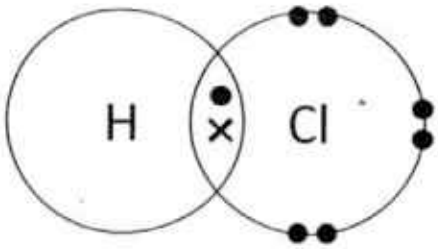
B6	(a)	A $MgCO_3$	[1]
		B $MgSO_4$	[1]
		C CO_2	[1]
	(b)	Bubble gas into limewater.	[1]
		A white precipitate is formed	[1]

Section C

Qn7	Answers	Marks
(a)	A – red blood cell B – carbon dioxide, urea C – oxygen	1 1 1
(b)(i)	For exchange of materials between blood and cells	1
(b)(ii)	Any one One-cell thick wall; to decrease diffusion distance [redacted]; [redacted] Small gaps between capillary cells; allow substances to pass through	1, 1 1, 1 1, 1
(c)	B diffuses from the body cell to the tissue fluid, into the blood plasma; C diffuses from the red blood cell to the tissue fluid, into the body cell	1 1
(d)	Any one Lymphocyte – produce antibodies to fight against harmful organisms [redacted] – [redacted] harmful organisms	1, 1 1, 1

C8a	P : urethra Q : epididymis	1 1
C8b	• The testis (part S) will produce sperms and male sex hormones such as testosterone. • The epididymis (part Q) will store inactive sperms from the testis (part S) before they are released into the sperm ducts.	1 1

C8ci	.Vasectomy	1
C8cii	• (As the sperm ducts are cut,) sperms cannot from entering the urethra or penis. • Ejaculation can still occur, but no sperms are released. / Since no sperm can be released, fertilisation cannot occur.	1 1
C8di		1
C8dii	• The claim is **false**. • Only **one** sperm nucleus enters the egg.	1 1

C9	**(a)**		[2]
	(b)	**Covalent bonding**	[1]
	(c)	**(i) Put a piece of blue litmus paper into the solution, it will turn red.**	[1]
		(ii) pH 2	[1]
	(d)	**(i) $ZnCl_2$ and H_2**	[2]
		(ii) insert a lighted splint into the test tube	[1]
		It will extinguished with a 'pop' sound	[1]
		(iii) Zinc sulfate	[1]

C10 (a) **Atoms of the same elements that has the same number of protons but different number of neutrons** [1]

(b)

	number of protons	number of electrons	number of neutrons
^{39}K	**19**	**19**	**20**
^{40}K	**19**	**19**	**21**

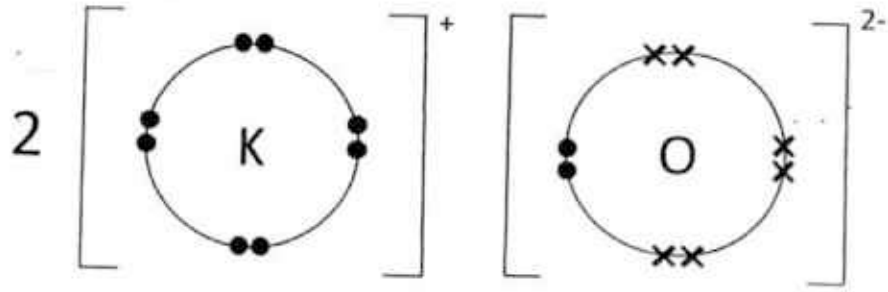
[1]
[1]

(b) (i) **K_2O** [1]

(ii) **Each potassium atom loses 1 valence electron to form a potassium ion** [1]

Each oxygen atom gains 2 valence electrons to form an oxide ion [1]

(iii)



[2]

(iv) chemical name: potassium nitrate [1]

chemical formula: KNO_3 [1]

. 2

Index Number	Class	Name

CHIJ ST JOSEPH'S CONVENT
SEMESTRAL ASSESSMENT 2

O

O

Lower Sec SCIENCE: PHYSICS module **5076**

Secondary 2 Express

Monday, 10 October 2016
1 hour 15 minutes

Candidates answer on the Multiple Choice Answer Sheet and Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your index number, class and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working
Do not use staples, paper clips highlighters, glue or correction fluid.

There are **2** sections.

Section A
There are **10** questions in Section A. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in the Multiple Choice Answer Sheet provided.

Section B
Answer **all** questions in Section B in the spaces provided.
The use of an approved scientific calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.
The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this paper is **50**.

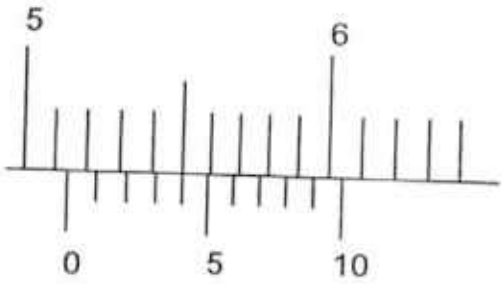
FOR EXAMINER'S USE	
Section A	10
Section B	40
Total	50

This document consists of **15** printed pages.

Setter(s) : Mr Pang Heng Cheun and Mr Tan Thuan Hock

Section A [10 marks]

1 A pair of vernier calipers is used to measure the width of a plastic block.



What is the width of the block?

A 5.14 cm
B 5.50 cm
C 5.54 cm
D 6.04 cm

2 An object that has a mass of 15 kg on Earth is taken to the Moon. The gravitational field strengths on Earth and on the Moon are 10 N/kg and 1.6 N/kg respectively.

What is the weight of the object on the Moon?

A 16 N
B 24 N
C 150 N
D 160 N

3 The table shows the observations of an experiment in which a sample of a solid is placed in four different liquids.

liquid	density of liquid / kg/m^3	observation
mercury	14 000	floats
sea-water	1 100	floats
pure water	1 000	sinks
paraffin	700	sinks

What is the density of the sample?

A between 700 kg/m^3 and 1 000 kg/m^3
B between 1 000 kg/m^3 and 1 100 kg/m^3
C exactly 700 kg/m^3
D exactly 1 000 kg/m^3

4 When a metal block is cooled, which property does not change?

A density
B mass
C volume
D surface area

5 A 10 kg ball, initially at rest at position **A**, rolls down a perfectly smooth slope.

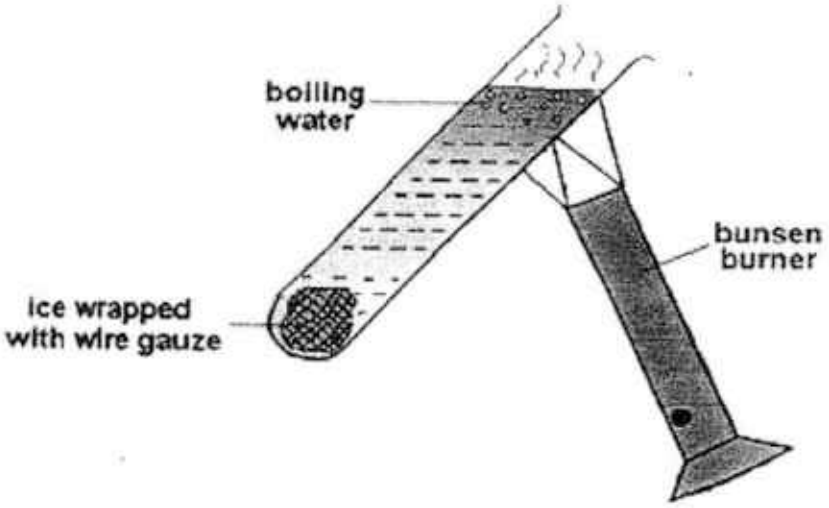
What is the kinetic energy of the ball when it is at position **B**? Gravitational field strength = 10 N/kg

A	50 J	**B**	125 J
C	250 J	**D**	500 J

6 Rays from an object O, after passing through a converging lens, come to a focus on the focal point. Which of the following is true?

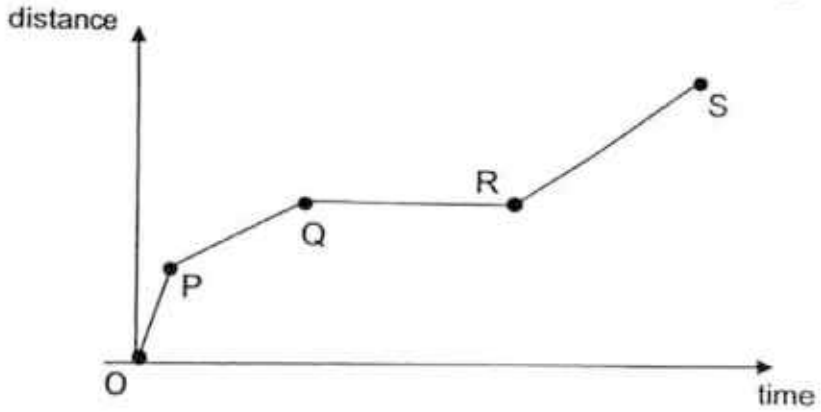
A the object is very small
B the object is very large
C the object is very far away
D the object is at a distance equal to the focal length from the lens

7 Boiling water and ice can exist at the same time in a test tube. What does this experiment show?



A water conduct heat well
B water conducts heat badly
C ice conducts heat well
D wire gauze conducts heat badly

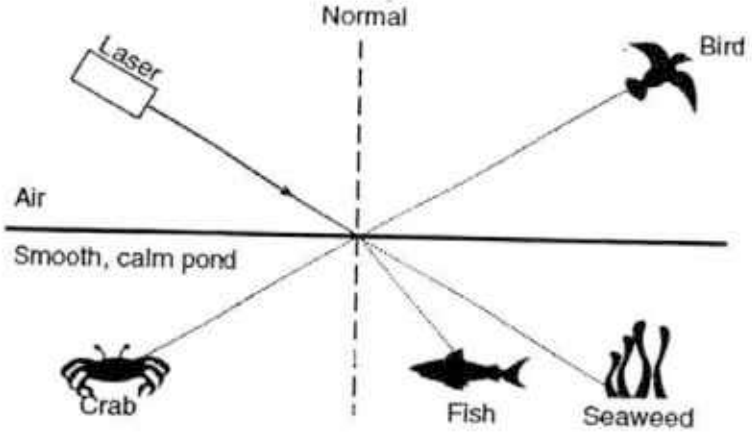
8 The graph shows how the distance travelled by a car changes with time.



Which section of the graph shows the car moving at the highest constant speed?

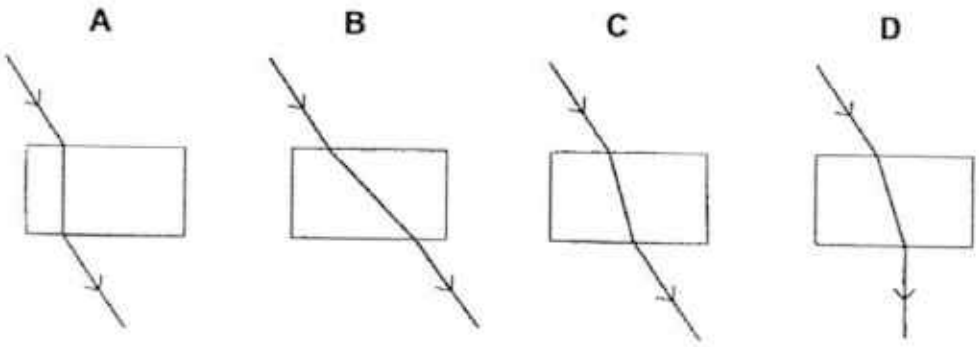
A OP
B PQ
C QR
D RS

9 A laser beam is directed at the surface of a smooth, calm pond as shown. Which organism could be illuminated by the laser light?



A the bird and the fish only
B the bird and the seaweed only
C the crab and the seaweed only
D the crab and the fish only

10 Which diagram correctly shows the path of a ray of light passing through a rectangular glass block?



Section B [40 marks]

Answer **all** questions in the spaces provided.

For Examiner's Use

1 A simple pendulum is made by hanging a metal ball of mass 350 g from a point **P** as shown in Fig. 1.1. Gravitational field strength is 10 N/kg.

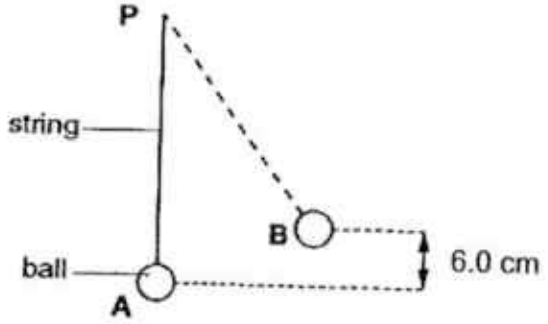


Fig. 1.1

(a) On Fig. 1.1, draw and label clearly the forces which act on the metal ball at position **A**. [2]

(b) The metal ball is displaced to **B**, released from rest at **B** and allowed to swing freely. The period of the pendulum is 1.4 s.

(i) What is the time taken for the metal ball to move from **B** to **A** when released?

time taken = ... [2]

(ii) What is the minimum work done needed to displace the metal ball from **A** to **B**?

minimum work done = ... [2]

2 Fig. 2.1 shows an arrow that represents a girl standing in front of a mirror. **F** represents the position of her forehead, **E** represents the position of her eyes while **T** represents the position of her toes.

For Examiner's Use

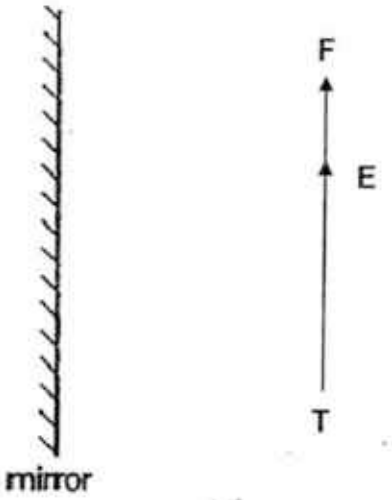


Fig. 2.1

(a) On Fig. 2.1, draw a ray to show how she can see the image of her toes in the mirror. [2]

(b) Indicate on the mirror the highest and lowest section of the mirror for the girl to see herself full-length in the mirror. Mark the highest point **H** and the lowest point **L**. [2]

3 Fig. 3.1 shows a 30 kg wooden crate being pushed at a constant speed to the top of a rough slope by applying a 80 N force along the direction of the slope. The crate takes 15 s to travel a distance of 60 m from the bottom to the top of the slope. The gravitational field strength is 10 N/kg.

For Examiner's Use

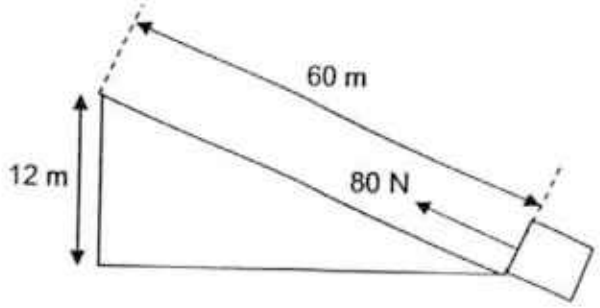


Fig. 3.1

(a) Calculate

(i) the work done when the 80 N force is used to pull the crate through a distance of 60 m up the slope,

work done = ... [2]

(ii) the power required to pull the crate up the slope.

power = ... [2]

(iii) the gain in gravitational potential energy of the wooden crate at the top of the slope,

gravitational potential energy = ... [2]

(b) **(i)** Calculate the work done against friction in pulling the crate up the slope.

For Examiner's Use

work done = ... [1]

(ii) Determine the magnitude of the frictional force on the slope as the crate travels on it.

frictional force = ... [1]

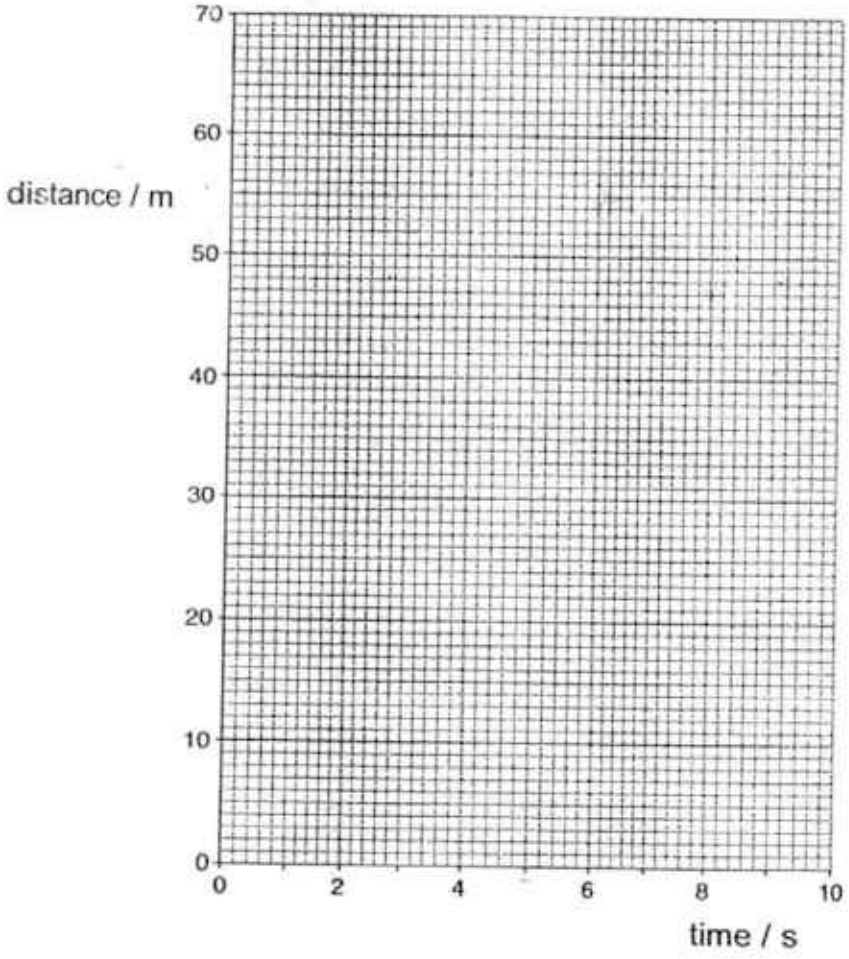
4 The total distance a cyclist travels from her start point is measured every second. The results for the first 10 seconds are shown in Table 4.1.

For Examiner's Use

time / s	distance travelled from the starting point / m
1	6
3	20
5	30
8	50
10	60

Table 4.1

(a) On the grid provided below, plot the results. Mark each point with a cross (x). Draw a line of best fit for your plotted points. [2]



(b) Calculate the gradient of the line drawn. Show your working and indicate on your graph how you do this.

For Examiner's Use

gradient = ... [2]

5 A ray of light approaches the surface of a triangular glass prism as shown in Fig. 5.1.

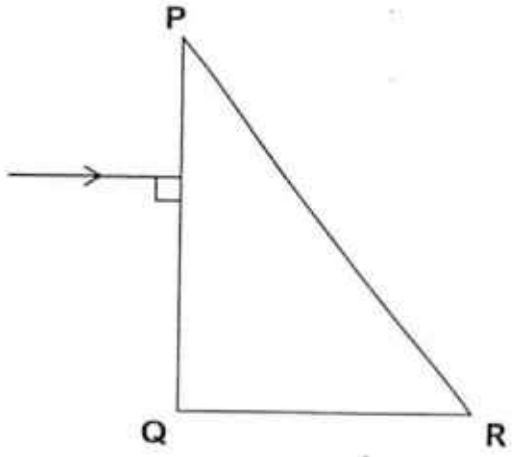


Fig. 5.1

(a) On Fig. 5.1, draw

(i) the ray of light when it enters at side **PQ** of the object,

(ii) the normal when the light ray strikes side **PR**,

(iii) the ray of light when it emerges from the object.

[3]

(b) State the change in the speed of light, if any, when the ray of light enters the side **PQ** of the glass prism.

..... [1]

6 Fig. 6.1 shows an object **O** placed in front of a thin converging lens. The focal length of the lens is 3.0 cm.

For Examiner's Use

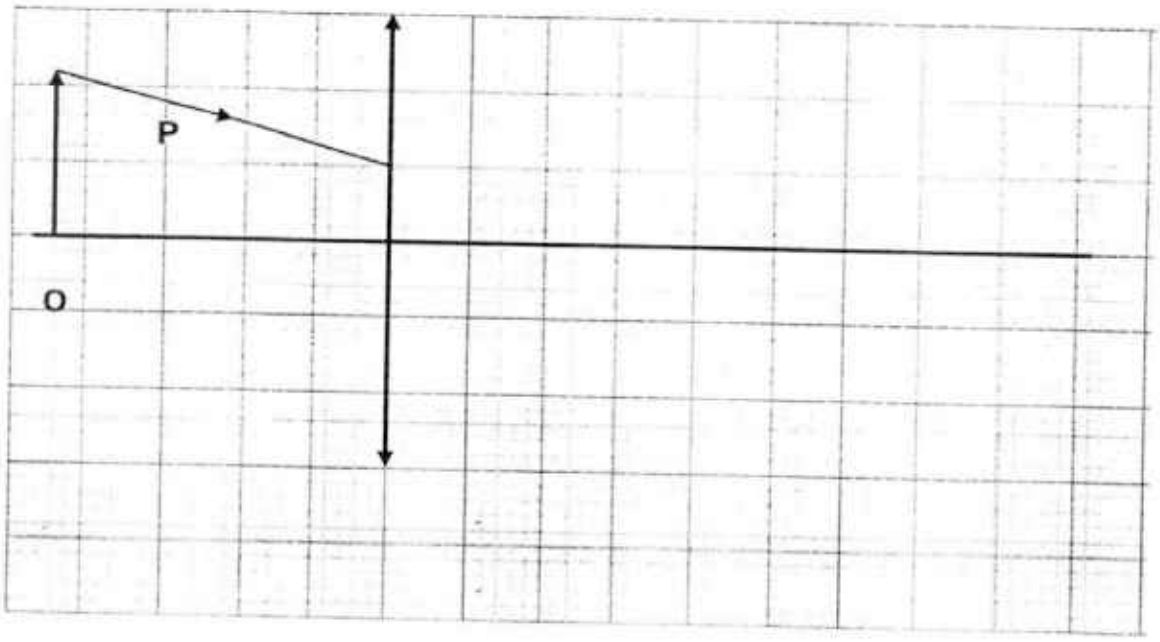


Fig. 6.1

(a) On Fig. 6.1,

(i) mark with "F" the focal point of the lens, [1]

(ii) draw light rays to locate the image of object **O** formed by the lens, [1]

(iii) complete the ray **P**. [1]

(b) The object is now moved to a position 6.0 cm away from the lens. Describe the image formed.

.....

.....

.....

..... [1]

For Examiner's Use

7 (a) Fig. 7.1 shows a filament lamp placed above a metal sheet. A thumbtack is attached to the other side of the metal sheet using wax.

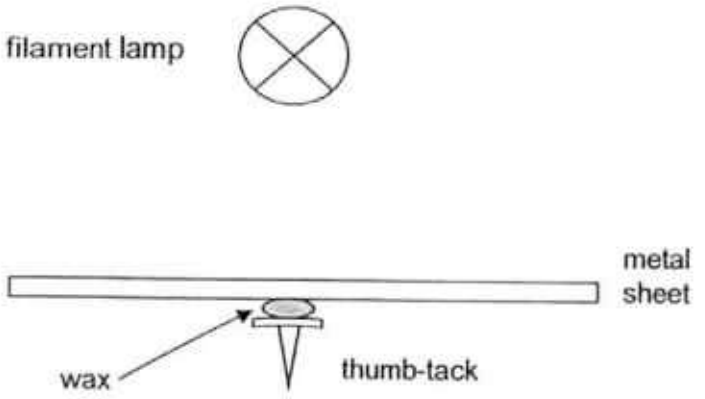


Fig. 7.1

The filament lamp is switched on. After some time, the wax holding the thumb-tack melts and the thumb-tack drops off.

(i) Explain how thermal energy from the filament lamp reaches the top part of the metal sheet.

.....

.....

.....

..... [2]

(ii) Explain how thermal energy from the top part of the metal sheet reaches the wax.

.....

.....

.....

..... [2]

(b) Fig. 7.2 shows a set of equipment placed on top of a house that uses solar energy to produce hot water.

For Examiner's Use

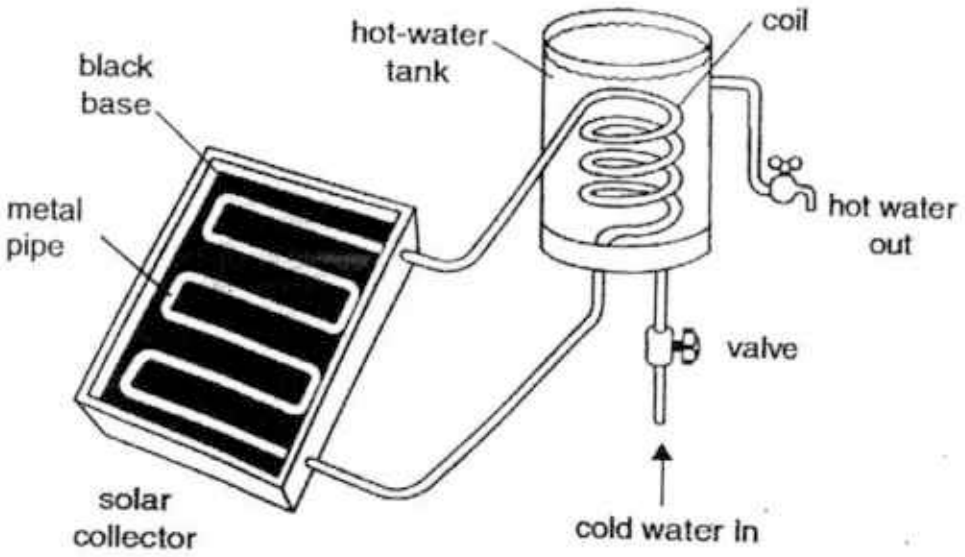


Fig. 7.2

(i) Which method of heat transfer takes place between the Sun and the solar collector?

..... [1]

(ii) The light rays from the Sun travels at a certain speed in air. State the magnitude and unit of the speed of these light rays.

..... [1]

(iii) Explain two features of the solar collector that increase the rate at which energy is absorbed from the Sun.

.....

.....

.....

.....

.....

..... [2]

(iv) The hot water tank loses heat rather quickly. Suggest a practical method to reduce the rate of heat loss from the tank. Explain.

For Examiner's Use

.....

.....

.....

.....

.....

..... [2]

End of Paper

Sec 2 Physics SA2 2016

Answer Scheme

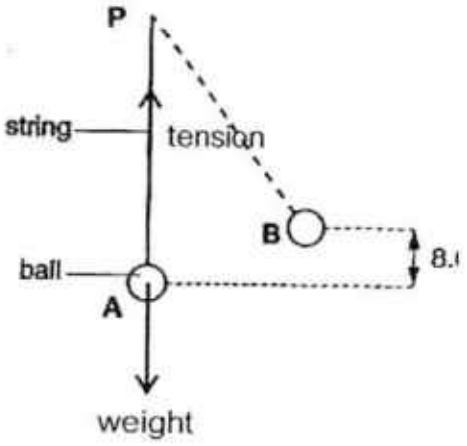
Section A

Question	1	2	3	4	5	6	7	8	9	10
Answer	A	B	B	B	D	C	B	A	A	C

Section B

Deduct 1 m per question for missing / wrong units
Deduct 1 m per question for answers not in 2~3 s.f.

1a)



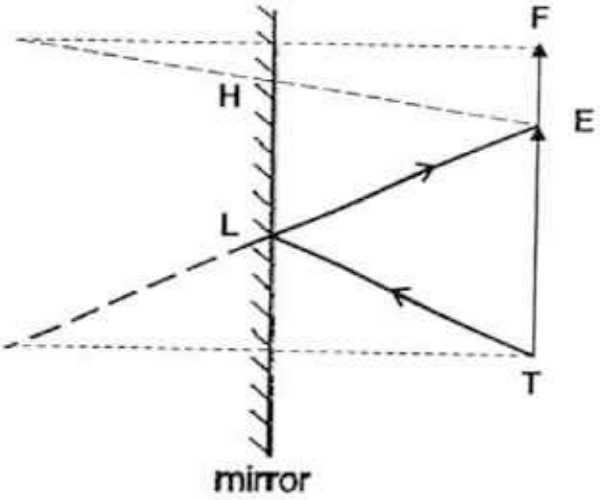
1 mark for the downward force acting on the metal ball, labelled weight or W

1 mark for the upward force acting on the metal ball, labelled tension or T
[this force should be on the string]

1bi) time taken from B to A
= 1.4 s / 4 [M1]
= 0.35 s [A1]

1bii) Min work done
= gain in GPE
= mgh M1
= (0.35 kg) (10 N/kg) (0.06 m)
= 0.21 J A1

2a)



1 mark for correct image position

1 mark for the light ray with correct direction arrows from point T to the eye

2b) 1 mark for both **H** and **L** correctly marked at midpoint
No need to show working / draw lines to locate position H

3ai) work done = Fd
= 80 x 60 [1]
= 4 800 J [1]

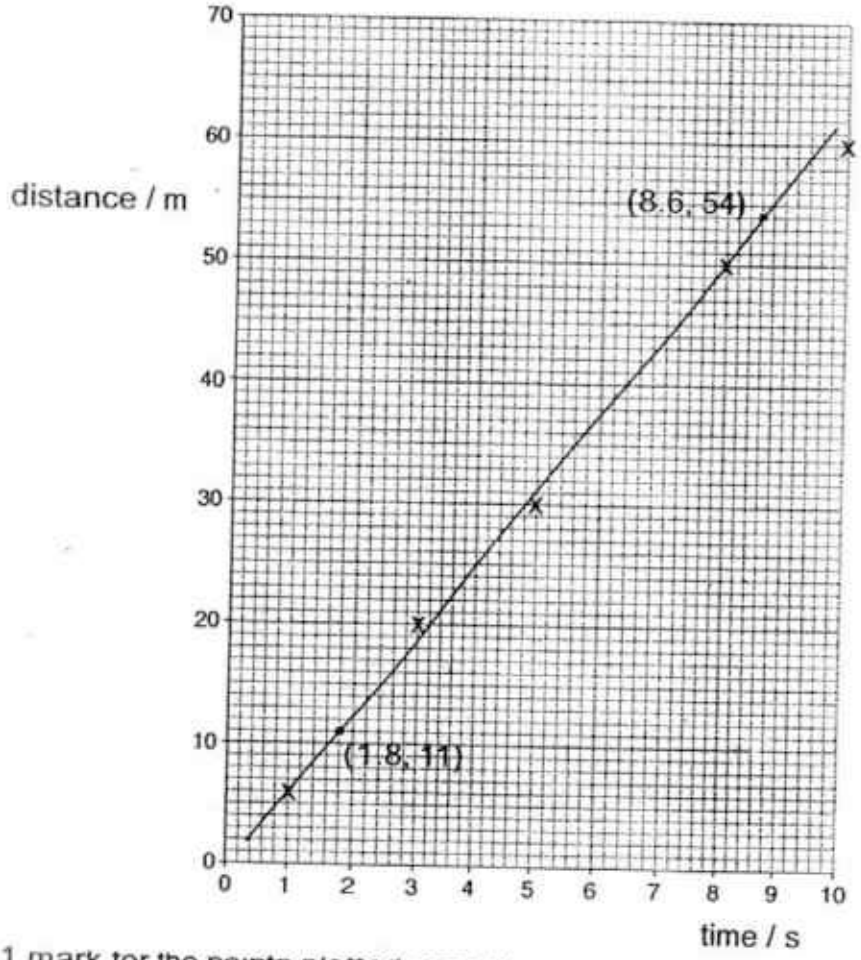
3aii) E_p gained = mgΔh
= 30 x 10 x 12 [1]
= 3 600 J [1]

3aiii) P = W.D. / t
= 4 800 / 15 [1]
= 320 W [1]

3bi) work done against friction
= 4800 – 3600
= 1200 J [1]

3bii) work done against friction = frictional force x d
1 200 = frictional force x 60
frictional force = 1 200 / 60
= 20 N [1]

4a)

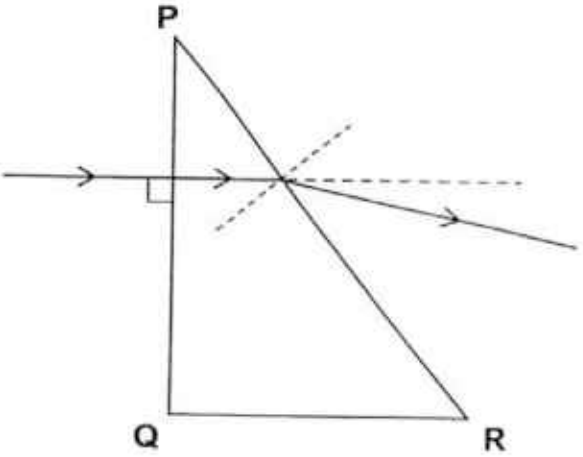


1 mark for the points plotted correctly
1 mark for the line of best fit

4b) 1 mark for the two selected points on the line of best fit, relatively far away points with coordinates clearly written

gradient = $(y_2 - y_1) / (x_2 - x_1)$
= $(54 - 11) / (8.6 - 1.8)$
= 6.3235
≅ 6.32 (3 sf) [1]

5a)



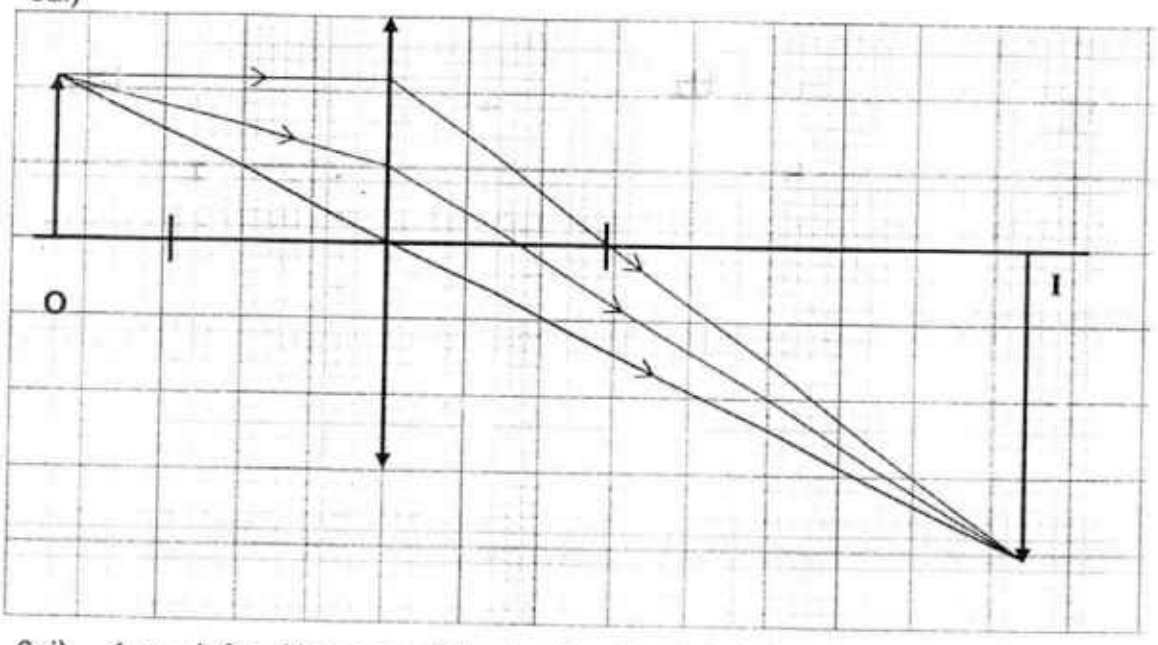
(i) 1 mark for the refracted ray of light which enters side **PQ** with no change in direction

(ii) 1 mark for the normal on side **PR** at the point where the refracted ray strikes the surface

(iii) 1 mark for the emergent ray of light refracted away from the normal

5b) The speed of light decreases. [1]

6ai)



6ai) 1 mark for either one of the two focal points labelled by 'F' [1]

6aii) 1 mark each for correct light ray with arrow [1]

6aiii) 1 mark for correct light ray with arrow [1]

6b) The image is still real and inverted, but the same size. [1]

7ai) Thermal energy is transferred from the filament lamp to the top part of the metal sheet by radiation [1] OR infra-red radiation [2]

Deduct 1 mark if candidate include conduction and/or convection

7aii) Thermal energy is transferred from the top part of the metal sheet to the wax by conduction. [1]

Via molecular vibration and/or free electrons diffusion [1]

7bi) radiation or infra-red radiation [1]

7bii) 3.0×10^8 m/s [1]

7biii) Black surfaces are good absorbers of infra-red radiation.

OR Metal is a good conductor of heat

OR The long pipe increases surface area and rate of infra-red radiation

2 marks for either 2 of the 3 stated

7biv) **Note:** There are various possible answers to this question. Marks can be given so long as sound use of physics concepts is shown in the students' responses.

1. The external surfaces of the water tank can be wrapped with a layer of aluminium foil. The shiny surface of the foil is a poor emitter of infra-red radiation.

2. The external surfaces of the water tank can be wrapped with a few layers of wool or cloth or styrofoam. These materials trap numerous pockets of air, which is a good heat insulator.

Index Number	Class	Name

CHIJ ST JOSEPH'S CONVENT
SEMESTRAL ASSESSMENT 2

O **O**

SCIENCE CHEMISTRY

Secondary 2 Express

Friday, 7 October 2016
50 minutes

Candidates answer on the Question Paper.
Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your index number, class and name on all the work you hand in.
Write in dark blue or black pen.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
There are **10** questions. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C**, and **D**. A mark will not be deducted for a wrong answer. Choose the **one** you considered correct and record your choice in **soft pencil** on the separate Answer Sheet.

Section B
Answer **all** questions in the spaces provided.

The number of marks is given in brackets [ ] at the end of each question or part question.
Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
Electronic calculator may be used in this paper.
The total of the marks for this paper is **40**.

A copy of the Periodic Table is printed on page **12**.

FOR EXAMINER'S USE	
A	
B	
Total	40

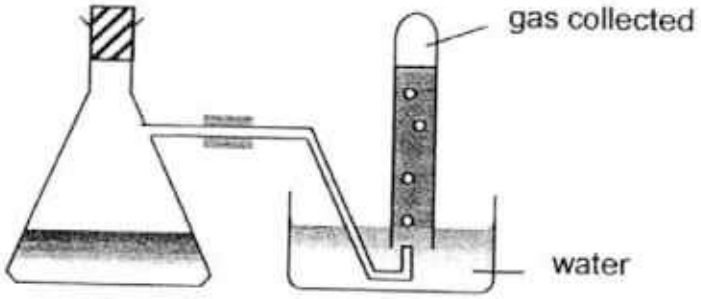
This document consists of **12** printed pages.

Setter(s) : Miss Ho Yan Yi and Mrs Ken Oh

Section A (10 marks)

Answer **all** questions.

1 A gas produced in a chemical reaction can be collected by the arrangement shown in the diagram below.



Some properties of four gases are given in the table below.

Which gas **cannot** be collected by this arrangement?

	name of gas	density of gas (g/cm^3)	solubility of gas in water
A	carbon dioxide	0.0018	slightly soluble
B	hydrogen chloride	0.0015	very soluble
C	methane	0.0007	insoluble
D	oxygen	0.0013	slightly soluble

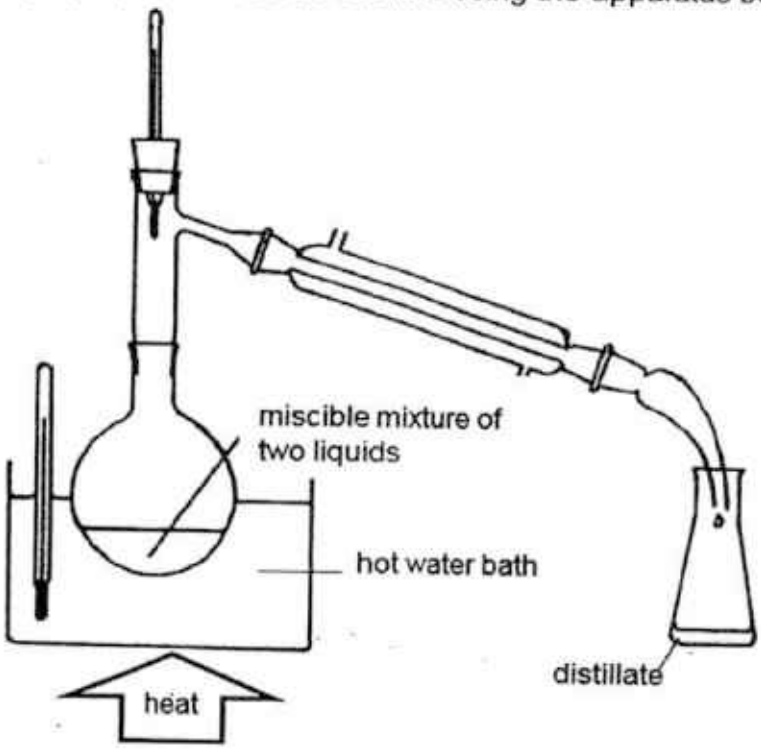
2 Which of the following list of substances contains an element, a compound and a mixture?

A argon, copper, ice
B carbon dioxide, bronze, nitrogen
C dry air, tap water, wax
D ethanol, crude oil, methane

3 When dry ice sublimes at room temperature,

A the temperature remains constant.
B the molecules rotate and slide over one another.
C the molecules breakdown to form gaseous atoms.
D the molecules move closer together in an orderly manner.

4 Which substance, **A**, **B**, **C** or **D** can be distilled using the apparatus below?

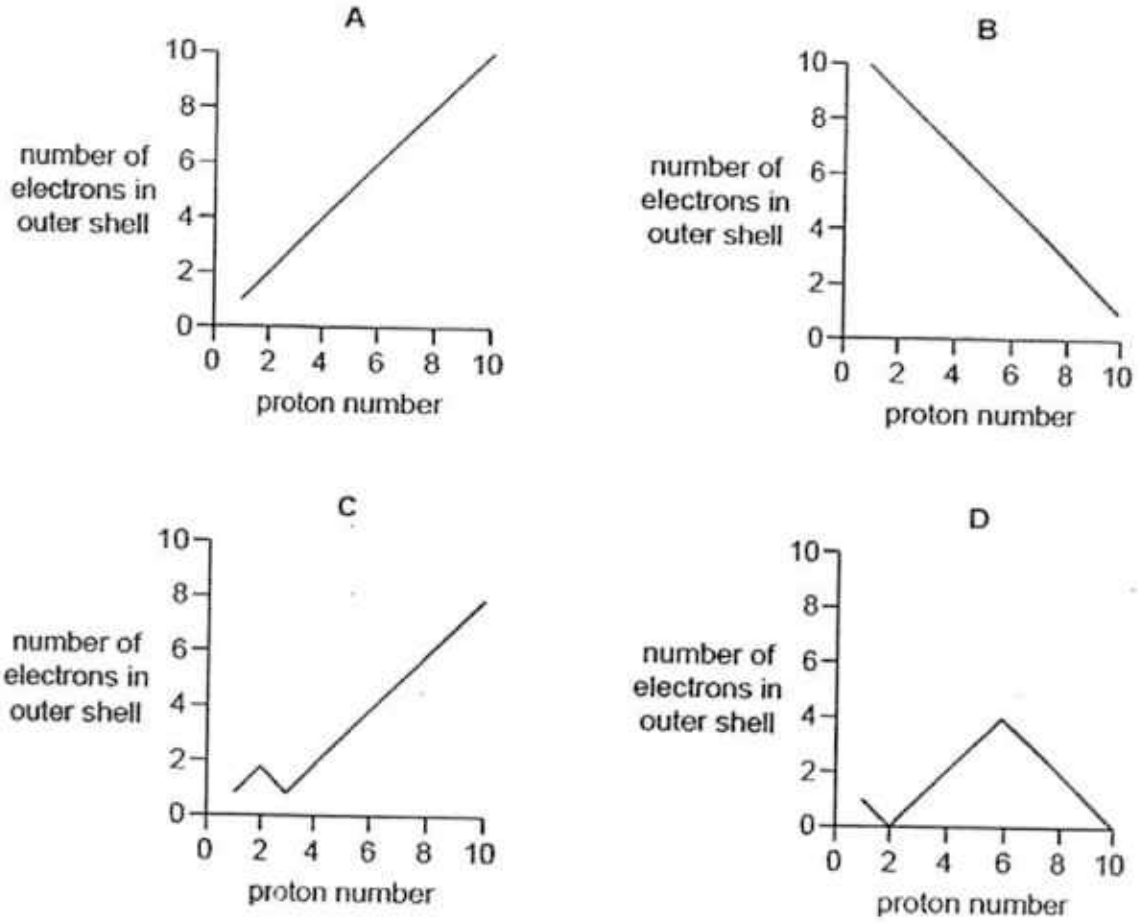


	melting point/ °C	boiling point/ °C
A	-138	0
B	-123	50
C	0	108
D	41	182

5 Both magnesium oxide, MgO, and aluminium oxide, Al_2O_3, are solids at room temperature, 25 °C.
MgO has a boiling point of 2852 °C and a melting point of 2600 °C.
Al_2O_3 has a melting pint of 2072 °C and a boiling point of 2880 °C.
Over which temperature range will both compounds conduct electricity?

A 25 to 2852 °C
B 2072 to 2852 °C
C 2852 to 2880 °C
D 2880 to 3600 °C

6 Which graph shows the number of electrons in the outer shell of an atom, plotted against the proton (atomic) number for the first ten elements in the Periodic Table?



7 An ion of an element X has 18 electrons, 20 protons and 19 neutrons. An isotope of atom of element X may have

A 18 protons, 22 neutrons and 20 electrons.
B 20 protons, 19 neutrons and 20 electrons.
C 18 protons, 22 neutrons and 18 electrons.
D 20 protons, 22 neutrons and 20 electrons.

8 Which compound would not form copper(II) sulfate by reaction with sulfuric acid?

A copper
B copper(II) oxide
C copper(II) carbonate
D copper(II) hydroxide

9 The chart shows the colour ranges of four different indicators.
Which indicator is blue in an acidic solution?

indicator	pH value													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	yellow							blue						
B	red							blue		yellow				
C		red								blue				
D		colourless									blue			

10 Carbon dioxide, sulfur dioxide and carbon monoxide are gases which have an adverse impact on the environment. In what ways do these gases affect our environment?

	carbon dioxide	sulfur dioxide	carbon monoxide
A	global warming	oxygen depletion in blood	forms acid rain
B	oxygen depletion in blood	oxygen depletion in blood	global warming
C	global warming	forms acid rain	oxygen depletion in blood
D	oxygen depletion in blood	global warming	forms acid rain

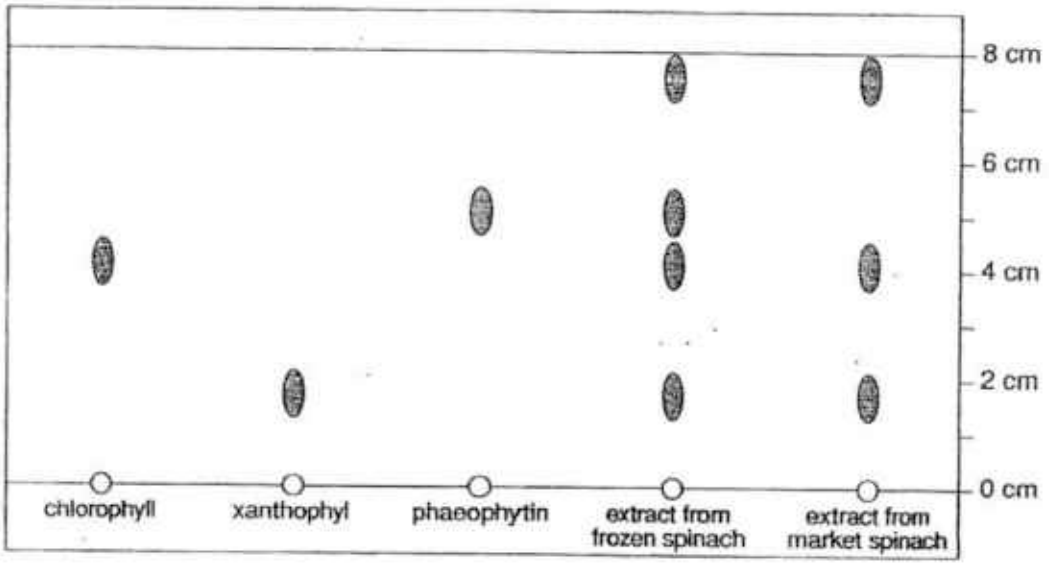
Section B (30 marks)

Answer **all** questions.

For examiners use

1 Chlorophyll is a green pigment found in green leaves. 'Old chlorophyll' can decompose into phaeophytin, a grey pigment molecule.

A student carried out a chromatographic exeriment to compare the extract of spinach leaves obtained from two different sources, using ethanol as the solvent, and he obtained the following chromatogram.



(a) Describe a difference in the property between chlorophyll, xanthophyll and phaeophytin as shown in the chromatographic above.

.....

..... [1]

(b) Describe the result obtained for the extract from frozen spinach.

.....

..... [2]

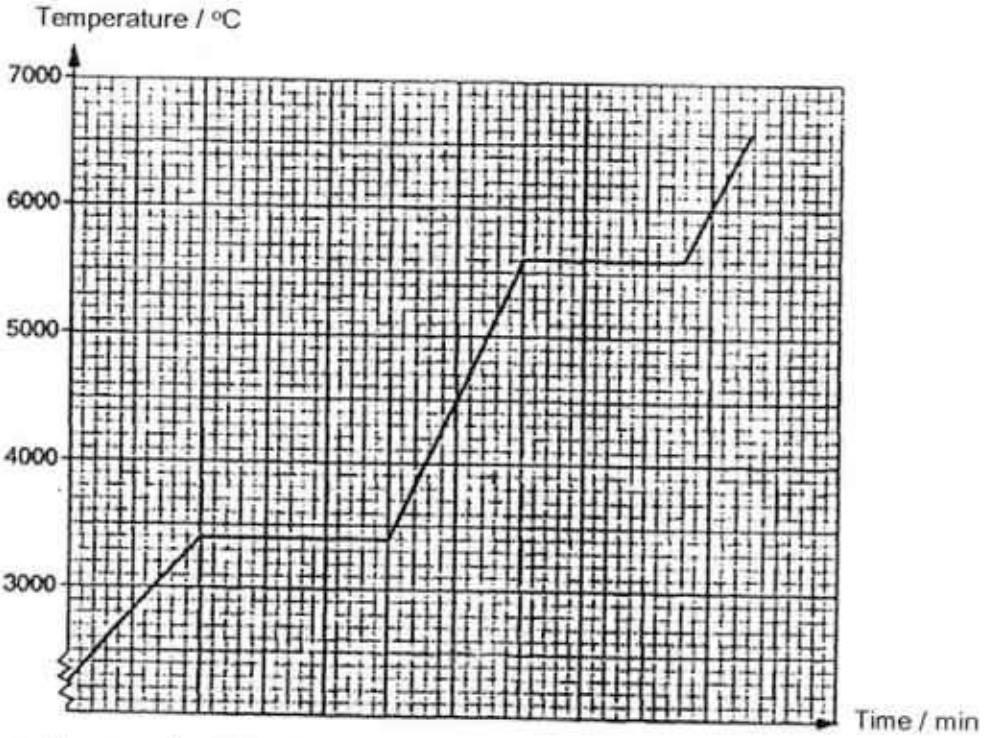
(c) The student concluded that spinach bought from the market is fresher than frozen spinach. Explain his reasoning.

.....

..... [2]

For examiners use

2 In a light bulb, the tungsten wire may get so hot that it melts and breaks. The graph below shows the heating curve for tungsten.



(a) From the graph, state the temperature at which tungsten wire breaks.

..... [1]

(b) Using the graph, explain whether the wire is made up of pure tungsten or an alloy containing mainly tungsten.

.....

..... [1]

(c) Describe the changes, if any, in the movement of the particles in tungsten if it is heated from 5000 °C to 6000 °C.

.....

..... [2]

(d) When tungsten, W, is heated strongly in the presence of oxygen, it oxidises, forming **only** a bronze-coloured solid, tungsten (IV) oxide.

(i) Write the chemical formula of tungsten (IV) oxide: .....

(ii) Hence, write the equation to represent the reaction in **d(i)**.

..... [3]

For examiners use

(e) If there is a leakage of oxygen into the bulb and the reaction in **d(i)** occurs, would the bulb still be able to light up?

Explain with reference made to bonding and structure.

.....

.....

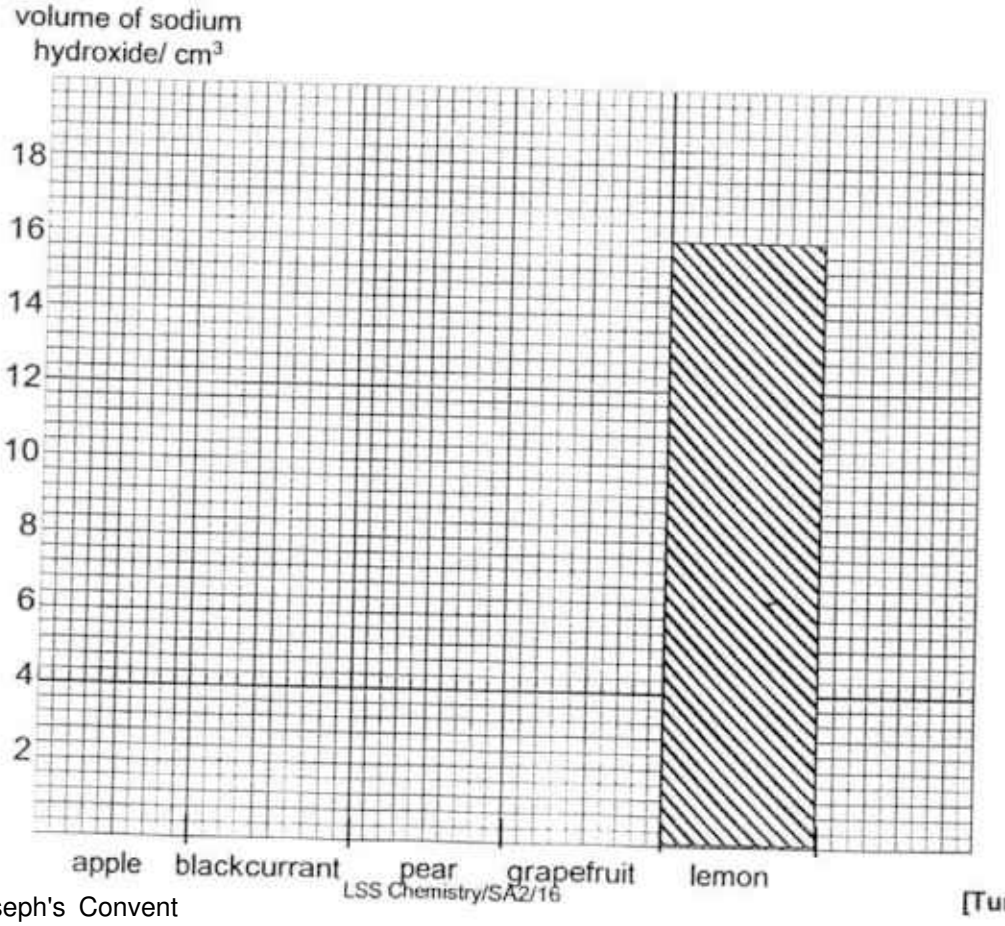
..... [3]

4 An experiment is carried out to compare the acidity of various fruit juices. Five drops of Universal Indicator are added to exactly 25.0 cm^3 of each fruit juice. Aqueous sodium hydroxide is then added to each sample until the Universal Indicator shows that the solution is neutral.

The results obtained are shown in the table.

fruit juices	volume of sodium hydroxide added/ cm^3
apple	9.00
blackcurrant	12.00
grapefruit	14.00
lemon	16.00
pear	6.00

(a) Complete the bar chart below, an example has been shown.



[2]

(b) Which fruit juice is the most acidic? ..... [1]

For examiners use

(c) Circle the following list, four items of apparatus you need to carry out this experiment.

pipette	**Bunsen burner**	**conical flask**	**plastic dropper**
test tube	**thermometer**	**burette**	**measuring cylinder**

[2]

5 Ammonium chloride is a white crystalline solid which decomposes upon strong heating to form ammonia gas and hydrogen chloride gas. Both gases diffuse into the air.

(a) Construct a balanced chemical equation to show the decomposition reaction of ammonium chloride.

..... [1]

(b) (i) Define relative molecular mass.

.....

.....

(ii) Calculate the relative molecular mass of ammonia gas and hydrogen chloride gas.

You **must** show your working clearly to be awarded marks.

relative molecular mass of ammonia gas: .....

relative molecular mass of hydrogen chloride gas: .....

[3]

For examiners use

(c) The rate of diffusion of gases is closely related to its molecular mass. The table below shows this relationship.

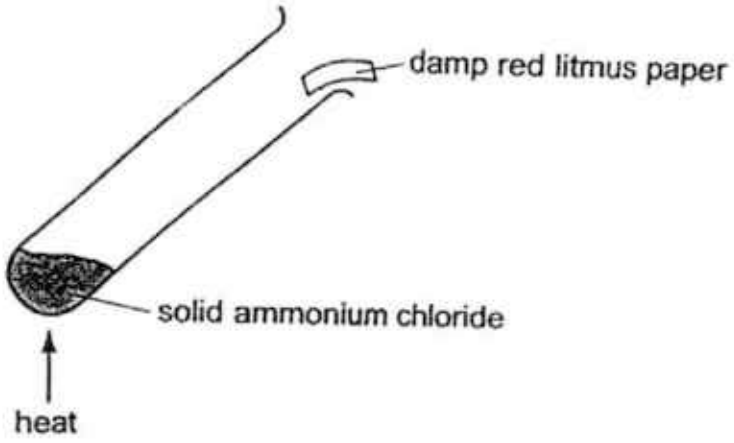
gas	relative molecular mass	rate of diffusion
helium	4	1.0
methane	16	0.5
oxygen	32	0.35
sulfur dioxide	64	0.25
heptane	100	0.2

From the above table, state the relationship between the molecular mass and the rate of diffusion.

.....

..... [1]

(d) A sample of ammonium chloride was heated in the experiment shown below. A piece of moist red litmus paper was placed at the mouth of the test tube to follow the reaction.



Describe the changes, if any, to the moist red litmus paper from the start of the experiment until all the white crystalline solid has decomposed. Explain using all relevant information from parts **(b)** and **(c)**.

.....

.....

.....

..... [2]

For examiners use

(e) Shortly after the heat was removed, some white crystalline powder was observed at the mouth of the test tube.

(i) Suggest the identity of the white crystalline powder.

.....

(ii) Using Kinetic Particle theory, suggest an explanation for the formation of the white crystalline powder.

.....

.....

.....

..... [3]

End of Paper

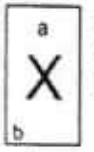
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	64 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	– Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La lanthanum 57 *	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– Ac actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	– Pa protactinium 91	238 U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lr lawrencium 103

Key



a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

LSS Chemistry/SA2/16

13

2016 Sec 2 Exp Sci Chem Mark Scheme

MCQs

1	B		6	C
2	B		7	D
3	A		8	A
4	B		9	A
5	~~C void~~ all students to be awarded 1m		10	C

Section B (30 marks)

Q1	**(a)**	**Phaeophytin** is the **most** soluble/ **Xantophyl** is the **least** soluble/ **Chlorophyll** is **less** soluble **than phaeophytin**/ Chlorophyll **more** soluble than xanthophyll Accept answers as long as students **compare** the solubility between phaeophytin, chlorophyll and xantophyl	[1]	
	(b)	Frozen spinach contains 4 pigments/ **Phaeophytin, Xantophyl and Chlorophyll** and **an unknown** substance Surprisingly, many students are not able to do well in this question. Many gave discussion on phaeophytin only. Also, many students ignored the unknown substance. Some students did not realise that this chromatogram is on plants pigments and discuss their answers in terms of colours from inks and dyes. These will not be awarded any credit.	[1] [1]	
	(c)	Spinach bought from the market **does not contain phaeophytin** which can **only be found when old chlorophyll decomposes/ decomposition**. Weaker students did not pinpoint correctly phaeophytin as the pigment that indicates the freshness. Some did not elaborate on their answers hence losing the 2nd marking point.	[1] [1]	
2	**(a)**	3400 °C Students failed to read the information given in the question that it "melts and break". Hence the correct temperature should be at the melting point.	[1]	

	(b)	It is **pure** as it **melts/ boils at a fixed temperature**/at one temperature. • Many students wrongly identified that tungsten is an alloy as they have based their answers on HIGH melting point/boiling point. • All students should note that most metals do also have high melting and boiling point. • The graph shows that there is a FIXED melting point and a FIXED boiling point, hence based on this tungsten is a PURE metal.	[1]	
	(c)	PARTICLES **sliding over one another** **to move rapidly/faster in all directions** Irrevelant discussion on energy and arrangement seen in several scripts. Students must focus their discussion on CHANGES in MOVEMENT of PARTICLES during boiling process. Weaker students have based their answers on melting process and will not be awarded any marks.	[1] [1]	
	(d)	(i) WO_2 /allow BOD for W_2O_4 (ii) $W + O_2 \rightarrow WO_2$ /allow ecf; marking on balancing equation	[1] [1]	*1m shifted to Q5b*
	(e)	The bulb will not light up as **TUNGSTEN OXIDE** has **a giant ionic lattice structure** with **strong electrostatic forces of attraction / ionic bond** (between oppositely charged ions) Hence the **ions are fixed in position** / ions are **not free** and **mobile** to conduct electricity. Students must mention that a new compound/ tungsten oxide is formed. No credit will be given to *IT has a giant ionic lattice structure/ there is an ionic lattice structure, if* throughout the answers with no reference to the new compound/tungsten oxide. Also, some students regurgitate the points on ions in aqueous and molten state. These are irrelevant to the scenario which is on SOLID STATE IONIC COMPOUND. Many weak students wrongly identify tungsten oxide as a covalent compound.	[1] [1] [1]	

4	(a)	All heights must be correct for 2 m, only accept 1 mistake for 1 mark. Some students were **imprecise in their drawing** such that the height of the bars are not exactly at the required level. Some even **drew with pen** such that when there is a mistake, they had to cancel their answers. This made the **bar chart hard to read/ unclear** thus losing marks. Some students also **didn't read the labels** given on the X axis carefully such that they drew the incorrect height for the wrong fruit.	[2]	
	(b)	Lemon Common mistake is pear → students **mistook the value in the table as the pH**	[1]	
	(c)	Pipette ('**exactly** 25.0 cm^3 of each fruit juice') Conical flask (conical flask is for containing and mixing of substances so they would not splash out) Plastic dropper ('drops of Universal indicator') Burette ('sodium hydroxide added to each sample… neutral') Any 2 for 1m	[2]	
5	(a)	$NH_4Cl \rightarrow NH_3 + HCl$ Cannot have 'heat' or 'ΔH' at reactants or products side of the equation, but accepted if these are put on arrows. Many students wrote the equation in **the opposite direction** which is **not** the decomposition of ammonium chloride.	[1]	
	(b)	(i) Relative molecular mass is the **<u>average mass of a molecule compared to 1/12 the mass of a C-12 atom</u>**. 2 points marked separately Very few students obtained the full marks for this because they missed out important words like 'mass' and 'average' or mistook M_r for A_r. (ii) NH_3= 17; HCl =36.5 No working→ Minus 1m Mr write as Ar→ Minus 1m Units (%, ug, g)→ Minus 1m Final answer write opposite but working all correct→ Award 1m only Final answers entirely wrong with some form of working→ 0m Allow full ecf if formula is stated wrongly in part (a). Many students used the proton number as the mass number! Proton number is not the mass number! Many students also thought that magnesium chloride is MgCl. It should be $MgCl_2$.	[1] [1] [1] [1]	

	(c)	The greater the molecular mass and slower the rate of diffusion.	[1]	
	(d)	**Moist red litmus will turn blue then red again**. Mr of NH_3 is smaller than Mr of HC*l*, **NH_3 will diffuse faster than HCl**, therefore reaches the red litmus paper first. Allow 1m if students mention moist red litmus paper turns blue due to ammonia gas. Many students are vague in their answer, repeating that both ammonia and hydrogen chloride gas are given out so the litmus paper turns blue. It is not clear if it was due to ammonia or hydrogen chloride gas. There was however, a handful of hopefuls who managed to accurate give an account of why red turns blue then red again.	[1] [1]	
	(e)	(i) NH_4Cl (ii) When NH_3 and HC*l* reaches the **top of the testtube/ mouth** of the testtube, it is **cooler**, **molecules loses energy**, cools and **combine/ react/form** back NH_4Cl Majority failed to read the question. Question asked for formation of white crystalline solid but many wrote to explain about the opposite process.	[1] [1] [1]	

4

GAN ENG SENG SCHOOL
End-of-Year Examination 2016

CANDIDATE NAME

CLASS

INDEX NUMBER

SCIENCE
Paper 1 Multiple Choice

Sec 2 Express

11 Oct 2016
Papers 1 & 2: 2 hours

Additional Materials: OTAS

Calculators are allowed in the examination

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and index number on the OTAS.

There are **thirty** questions in Section A. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the answer you consider correct and record your choice in soft pencil on the separate OTAS.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Read the instructions on the OTAS very carefully.

You may proceed to answer Paper 2 as soon as you have completed Paper 1.

Any rough working should be done in this booklet.

A copy of the Periodic Table is inserted on page 13.

Total marks
30

This paper consists of 13 printed pages including of the cover page

Answer **all** the questions with the most suitable option **A, B, C** or **D**.

1 Which of the following statements is **not** true to describe particles in a liquid?

A The forces of attraction between the particles are moderately strong.
B The particles cannot be compressed.
C The particles can move randomly.
D The particles have very large spaces between them.

2 A uranium atom has an atomic number of 92 and nucleon number of 235. An isotope of this atom has ..... and another isotope of uranium has .....

A 143 neutrons, 146 neutrons
B 146 neutrons, 143 protons
C 95 protons, 92 protons
D 143 protons, 146 neutrons

3 Which statement is correct about an atom of an element?

A The atom can gain 3 electrons to form a positive ion.
B The atom can lose 2 protons to form a negative ion.
C The atom cannot lose electrons if its atomic number is 18.
D The atom is electrically neutral when it becomes an ion.

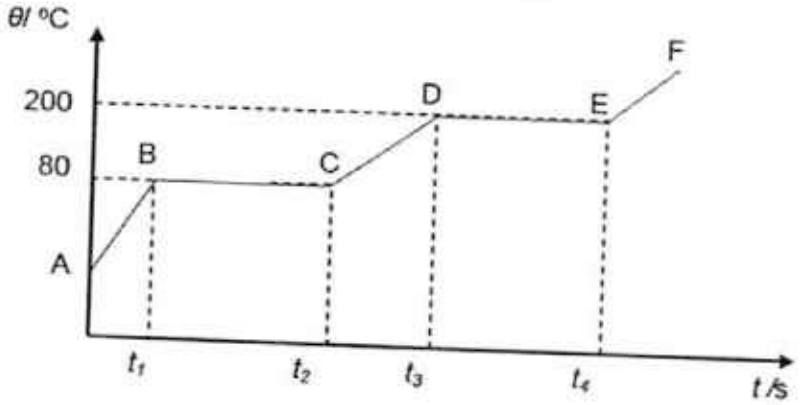
4 In which one of the following sets do all three particles have the same total number of electrons?

A	Cl^-	Br^-	I^-
B	F^-	Mg^{2+}	Be^{2+}
C	Na^+	Al^{3+}	Ar
D	K^+	Ca^{2+}	Cl^-

5 Which of the following does **not** describe a chemical change?

A Heating sugar to form a black substance.
B Mixing iron filings and sulfur to form a grey mixture with yellow specks.
C Adding vinegar to egg shells or marble chips to produce bubbles of gas.
D Mixing hydrochloric acid with sodium hydroxide to form sodium chloride.

6 The graph below shows how the temperature of substance **X** varies with time as it is being heated.



Which of these statements below is/are true about the graph?

I) The freezing point of substance **X** is 80°C.
II) The boiling point of substance **X** is 200°C.
III) Steam starts to form at time t_4.
IV) The bonds between substance **X** molecules are stronger at period BC than at DE.

A II, IV
B I, II, III
C I, II, IV
D III, IV

7 A tank of water is left in the open under sunlight. Water evaporates.
Which statement about the evaporation of water is **false**?

A A liquid can evaporate faster when you blow the air above the liquid surface.
B Evaporation of water can take place at any temperature.
C Only the water particles at the top surface of the water tank escape into the atmosphere. The rest of the water below the surface remains as liquid.
D The temperature of the remaining water remains the same.

8 At 30 °C, a substance changes from the state in which its particles changed from a regular arrangement to an irregular arrangement.
Which statement is true?

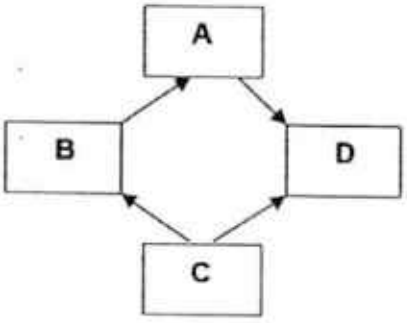
A The forces of attraction in between the particles change from strong to very strong.
B The freezing point of the substance is 30 °C.
C The motions of particles change from vibration about fixed points to moving freely and rapidly.
D The spaces in between particles change from closely packed to far apart from one another.

9 What **must** happen during a chemical reaction?

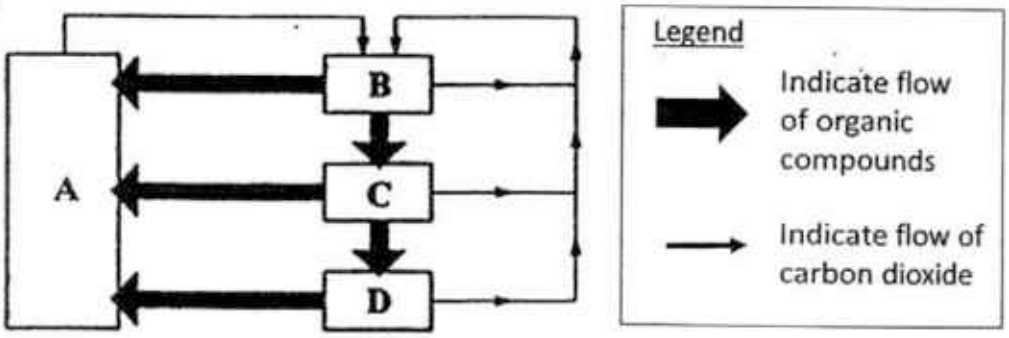
I) New product(s) is/are formed.
II) Heat is released.
III) Colour of the substance changes.
IV) Light is produced.

A I only
B I and III only
C I, II and III only
D I, II, III and IV

10 The diagram below shows a food web in an ecosystem. Which box represents a omnivorous organism?



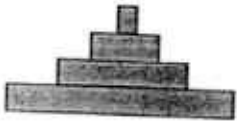
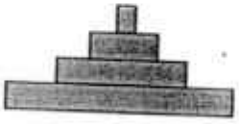
11 The diagram represents the flow of substances within a balanced ecosystem. The boxes are various trophic levels. Which box represents producers?



12 Consider the following food chain below :

Tree → caterpillar → birds → snakes

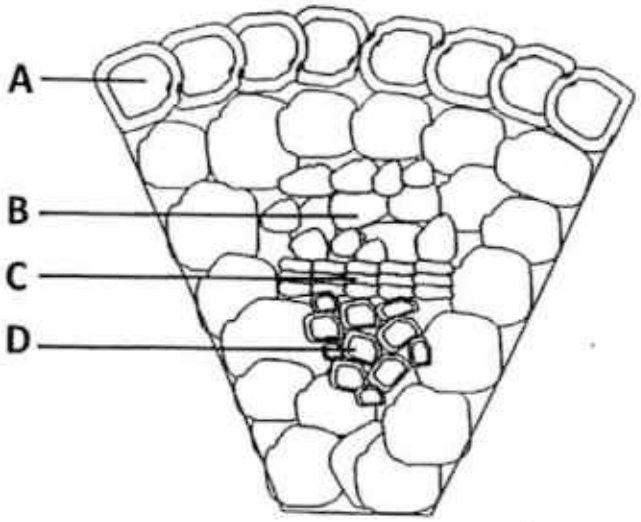
Which of the following correctly illustrates the pyramid of energy and reason for the change in the amount of energy?

	pyramid of energy	reason for the change in the amount of energy
A		The number of cells in the organisms decreases.
B		Energy is lost to the environment as heat during respiration.
C		Energy is accumulated along the food chain
D		Each consumer is able to store chemical potential energy as it consumes food in its lifetime.

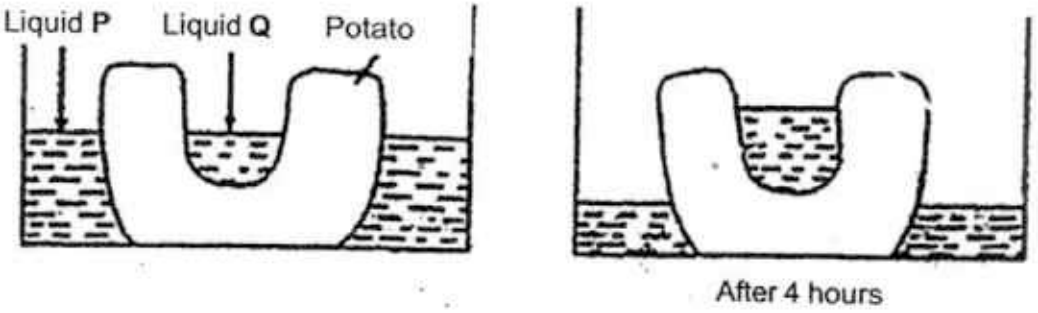
13 Which of the following sets of conditions will the rate of transpiration be the highest?

	Wind speed	Temperature	Light Intensity	Humidity
A	Low	Low	Low	High
B	Low	High	High	High
C	High	High	Low	Low
D	High	High	High	Low

14 A leafy shoot is placed in a beaker containing a solution of a coloured dye. The diagram shows a part of section of the stem after two days. Which part is now most coloured by the dye?



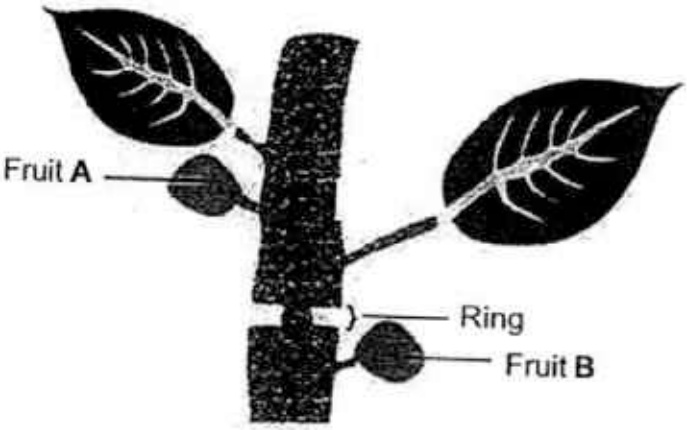
15 An experiment was set up as shown below using a peeled potato shaped into a cup.



Which of the following can be deduced based on the results after four hours?

A Liquid **P** is a dilute sucrose solution and **Q** is distilled water.
B Liquid **P** is a dilute sucrose solution and **Q** is a concentrated sucrose solution.
C Liquid **P** is a concentrated sucrose solution and **Q** is distilled water.
D Liquid **P** is a concentrated sucrose solution and **Q** is a dilute sucrose solution.

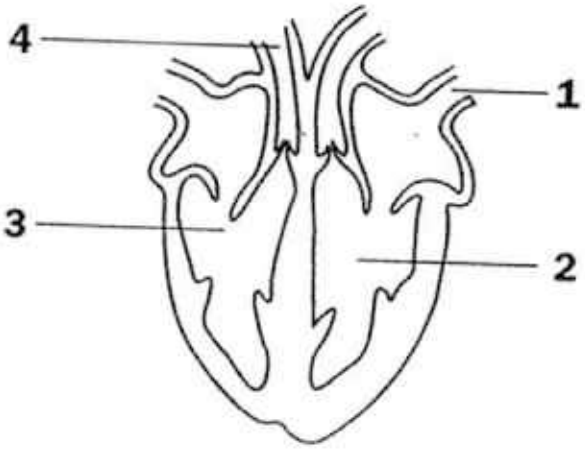
16 The diagram below shows a stem of a potted plant with a ring of bark containing phloem removed. The leaves still remained alive after 10 days.



Which of the following observations made on day 10 about fruit **A** and fruit **B** is correct?

A Fruits **A** and **B** increase in size.
B Fruit **A** increases in size while fruit **B** decreases in size.
C Fruit **A** decreases in size while fruit **B** increases in size.
D Fruit **A** and **B** remain the same size.

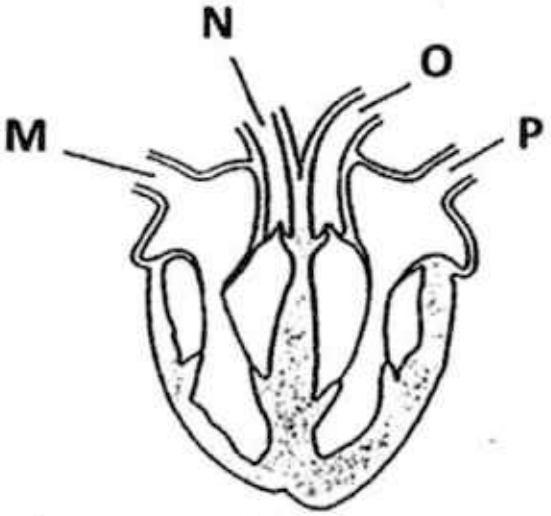
17 The diagram below shows a section of the human heart.



Which of the numbered part(s) of the heart carries/carry oxygenated blood?

A 1
B 4
C 1 & 2
D 3 & 4

18 The diagram below shows a section through a human heart.



Which one of the following sequences shows the correct sequence of blood flowing through the heart?

A P → O → N → M
B M → N → P → O
C N → M → O → P
D M → N → O → P

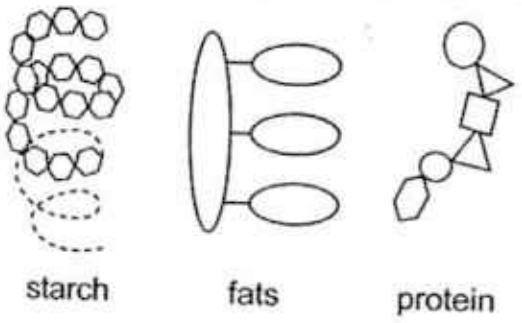
19 Carbohydrate digestion mainly happens in ..... .

A mouth and stomach
B mouth and small intestine
C stomach and small intestine
D small intestine and large intestine

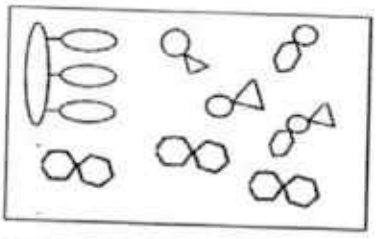
20 What is assimilation?

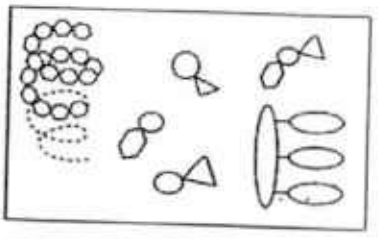
A It is the process by which the body removes the excess or unwanted food.
B It is the process by which the body breaks down the food into small diffusible molecules.
C It is the process by which the body takes in food to obtain the nutrients required.
D It is the process by which the body makes use of the small food molecules and converts it to useful materials.

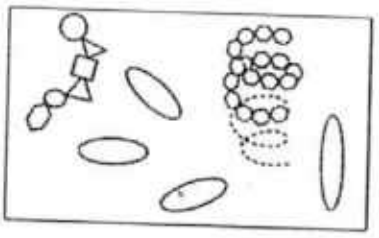
21 The diagram below shows three different types of food molecules before ingestion.

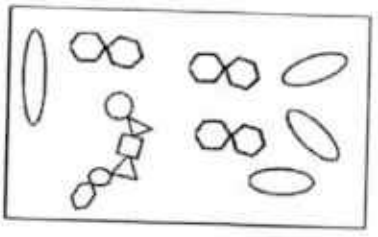


Which one of the following best shows how these molecules look like in the stomach?

A


B


C


D


22 Which of the following comparison(s) is/are **false** for the questions regarding photosynthesis, respiration and breathing?

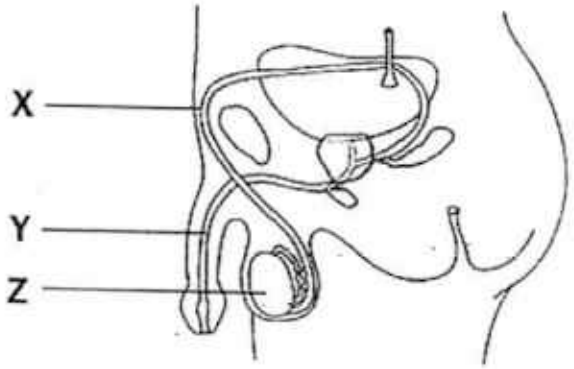
Question	Photosynthesis	Respiration	Breathing
I) Where does it take place in?	leaves of plants only	lungs of humans only	lungs of humans only
II) What is the main purpose?	convert light energy to food	release energy from food	gaseous exchange
III) Is oxygen used up?	no	yes	yes
IV) Is carbon dioxide produced?	no	yes	no

A I & II
B I & III
C II & III
D II & IV

23 Risk of Human Immunodeficiency Virus (HIV) infection is not reduced by.....

A keeping to one sexual partner.
B sharing food with HIV patients.
C using condom during sexual intercourse.
D avoiding drug abuse, which involves sharing of syringe and needles.

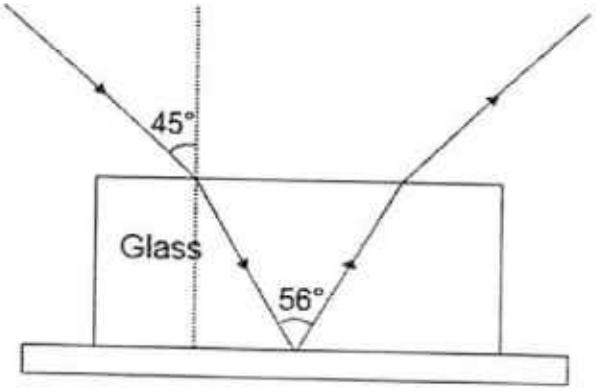
24 The diagram below shows parts of the human male reproductive system.



Which of the following sets of parts correctly match with the functions?

	produces sperm	passage way for sperm	passage way for urine and semen
A	X	Y	Z
B	X	Z	Y
C	Z	X	Y
D	Z	Y	X

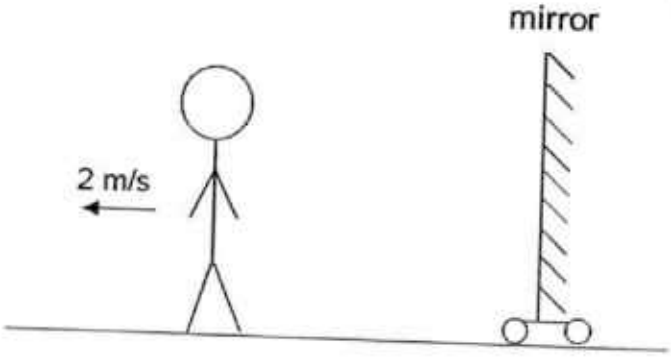
25 A piece of glass was placed on top of a polished mirror surface as shown in the figure below.



What is the critical angle of glass?

A 28.1°
B 41.6°
C 45.0°
D 58.5°

26 The diargram below shows a man and a stationary mirror.



A man is walking at a speed of 2 m/s leftward while the mirror is stationary. What is the speed of the man's image during this period?

A 2 m/s rightward
B 4 m/s rightward
C 8 m/s rightward
D stationary

27 In the night under the sodium (yellow lamps), Inspector Alan saw a man appearing in black T-shirt robbing an old woman and ran into a shop. Inspector Alan gave chase and entered the shop which was lit with white lights. Inside the shop, he saw four men in different coloured T-shirts (blue, green, red and yellow) and none of them was wearing black. Inspector Alan knew the culprit straightaway and arrested him.

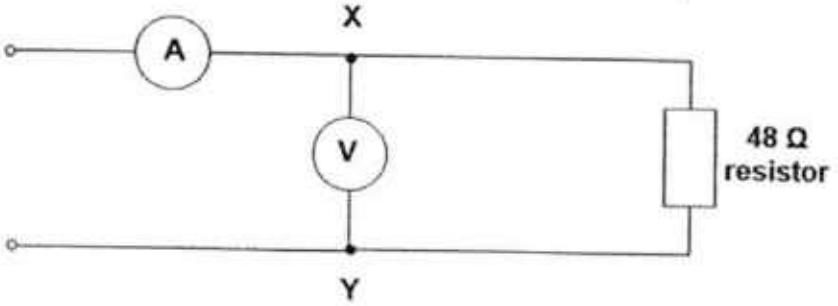
Who did Inspector Alan arrest?

A The man in blue T-shirt.
B The man in green T-shirt.
C The man in red T-shirt.
D The man in yellow T-shirt.

28 Why can birds stand on an overhead transmission line without suffering any harm?

A Their feet have very high resistance.
B Their feet are very good electrical insulators.
C Their bodies can withstand very high current.
D There is no potential difference between their feet.

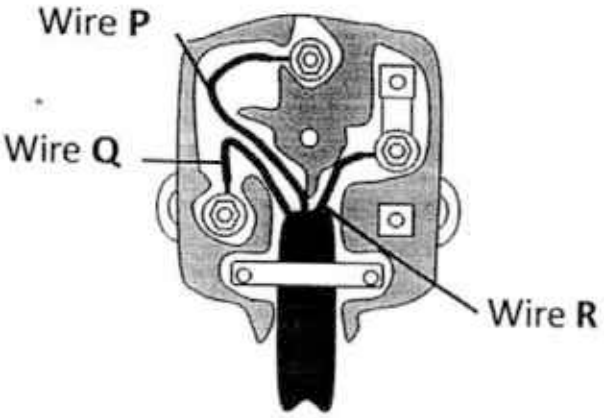
29 The diagram shows an electric circuit.



Which two readings are obtained when a suitable power supply is connected between terminals **X** and **Y**?

	Voltmeter reading / V	Ammeter reading / A
A	6	0.25
B	6	4
C	12	0.25
D	12	4

30 The diagram below shows a three pin plug.



Which of the following statements is **not** correct?

A Wire **P** is the wire that carries current when there is a current leakage.
B Wire **Q** is the wire that enables current to flow through the appliance.
C Wire **R** is the wire that carries current to the appliance.
D Wire **P** is the wire that is not needed when the appliance has a metallic outer casing.

END OF PAPER

The Periodic Table of the Elements

Group

I	II											III	IV	V	VI	VII	0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

Key: a X b
a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

E

GAN ENG SENG SCHOOL
End-of-Year Examination 2016

CANDIDATE NAME

CLASS

INDEX NUMBER

SCIENCE
Paper 2

Sec 2 Express

11 Oct 2016
Papers 1 & 2: 2 hours

Candidates answer on the Question Paper.

Calculators are allowed in the examination

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Section A
Answer **all** questions.

Section B
Answer question **8** and **three other** questions.
In calculations, you should show all the steps in your working, giving your answer at each stage.
Enter the numbers of the Section B questions you have answered on the dotted lines in the grid below.

At the end of the examination, hand in your answers to Paper 1 and Paper 2 separately.
The number of marks is given in brackets [ ] at the end of each question or part question.

A copy of the Periodic table is inserted on page **18**.

For Examiner's Use	
Section A	30
Section B	40
Q8	
.....	
.....	
.....	
Total	70

This paper consists of **18** printed pages including of the cover page

SECTION A (30 marks)

Answer **all** the questions in this section.

1 A student cut five similar-sized pieces of potato and weighed each one. He placed each piece of potato in a different concentration of sugar solution for 60 minutes. He then re-weighed each piece of potato. His results were shown in the table in the table below.

concentration of sugar (%)	mass of potato (g)		Percentage change in mass (%)
	start	end	
0.0	6.37	7.16	+12.4
0.2	6.12	6.58	+7.5
0.4	6.27	6.42	+2.4
0.6	6.26	6.10	–2.6
0.8	6.33	5.85	–7.6

(a) Name the process that caused the change seen in the change of mass of each piece of potato.

..... [1]

(b) Explain for the difference in percentage change in mass of the potato pieces placed in 0.4 % sugar solution and 0.6 % sugar solution.

.....

.....

.....

..... [2]

(c) Suggest the concentration of sugar of the potato strips before the experiment.

..... [1]

[Total: 4 marks]

2 Over a period of several months, a student recorded some activities of the wild life in a particular habitat. The following observations appeared in her notebook.

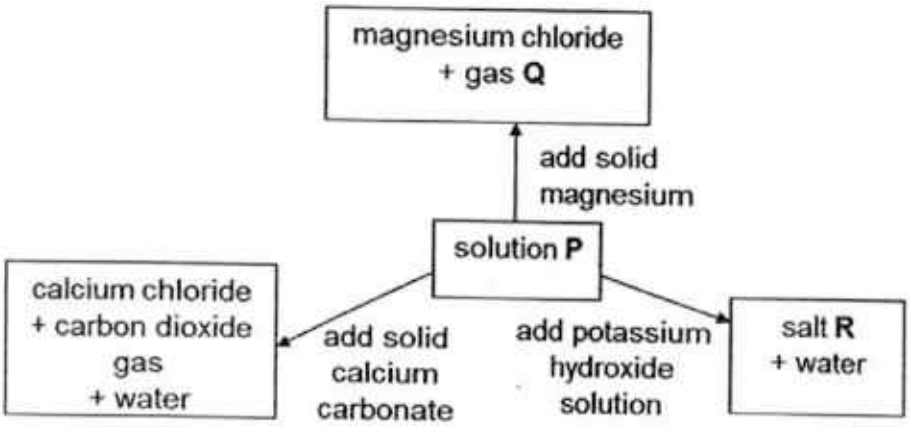
I. Young shoots of bean plants covered with aphids sucking food substances from the stems.
II. A hawk, which usually catches mice, swoop to take a small yellow bird near a bean plant. Noticed that this species of small yellow bird often visit the bean field to eat aphids and blue butterflies.
III. A species of butterfly visiting flowers of bean plants to collect its nectar.
IV. A species of mouse is often seen nibbling at bean seeds.
V. Spider's web is seen constructed between two bean plants with a ladybird caught in it.
VI. Ladybirds are seen to feed on aphids.
VII. Bacteria colonies are seen in the rotting body of a mouse.

Based on the above observations, construct a complete food web in the space given below.

[4]

[Total: 4 marks]

3 The figure below shows some chemical reactions involving solution **P**.



State the name of the unknown substances:

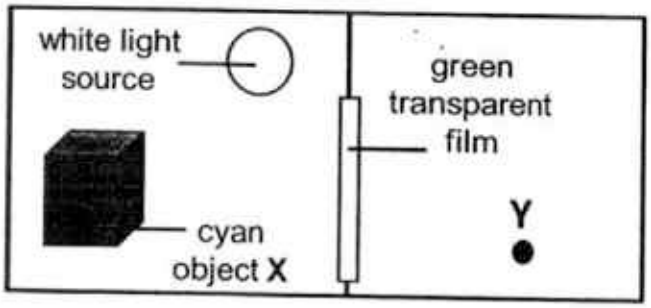
(a) solution **P**: ..... [1]

(b) gas **Q**: ..... [1]

(c) salt **R**: ..... [1]

[Total: 3 marks]

4 The set up below shows a cyan object under white light. A transparent coloured film is also placed at the position as shown in the set-up. The white light source is the only light source in the set-up. All the walls of the set up are black in colour.



(a) State the colour of object **X** as seen from position **Y**. Explain your answer.

.....

.....

.....

..... [3]

[Total: 3 marks]

5 The table below shows the electronic configurations of atoms of the six elements **U** to **Z**. The letters are not the symbols of the elements.
(The letters can be used once, more than once, or not at all.)

Element	Electronic Configuration
U	2.1
V	2.2
W	2.5
X	2.8.7
Y	2.8.8
Z	2.8.8.1

Using **only** the letters given in the table above, identify

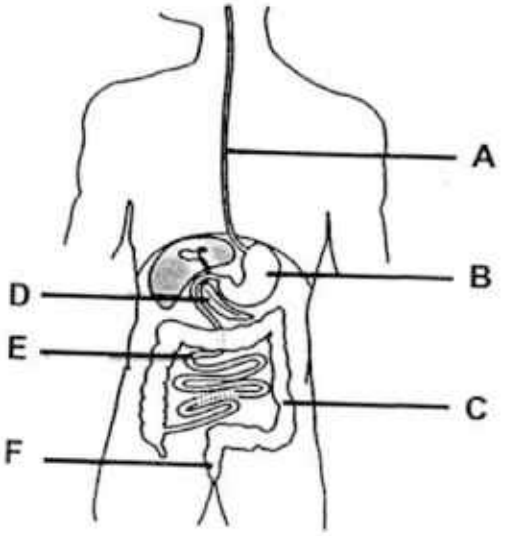
(a) two elements in the same period of the Periodic Table. ..... [1]

(b) an element which forms a negatively charged ion. ..... [1]

(c) a noble gas. ..... [1]

[Total: 3 marks]

6 The figure below shows the human digestive system.



(a) Using the letters **A** to **F**, state one region which

(i) digests only proteins. .....

(ii) absorbs water. .....

(iii) does not produce enzyme. .....

(iv) stores faeces. .....

[2]

6 (b) Explain how digestion is affected when the bile duct is blocked.

.....

.....

.....

.....

..... [3]

(c) A disease in cows causes the inner wall of the small intestine to become smooth and flat. Infected cows rapidly lose weight and usually die. Explain why this change to the intestinal wall causes the cows to die.

.....

.....

..... [2]

[Total: 7 marks]

7 (a) You are given two cells of 1.5 V each, some connecting wires, 2 ammeters, 1 voltmeter, a switch and 2 light bulbs that will only light up when the potential difference across each light bulb is 3.0 V. Complete a circuit diagram in the space below connecting all the electrical components given to enable you to calculate the resistance of each light bulb.

[4]

(b) The first light bulb has a voltmeter reading of 3.0 V and an ammeter reading of 20 mA. Calculate the resistance of the light bulb.

..... [2]

[Total: 6 marks]

SECTION B (40 marks)

Answer **Q8** and any 3 other questions in this section.

8 **(a)** The word equation given below represents the burning of magnesium in air. A shiny greyish solid was observed before the reaction but a black solid is observed after the reaction.

magnesium + oxygen → magnesium oxide

(i) Construct the chemical equation for the reaction above.

..... [2]

(ii) Briefly describe an experiment to confirm if the above reaction is exothermic. Explain how the observation confirm that the above reaction is exothermic.

.....

.....

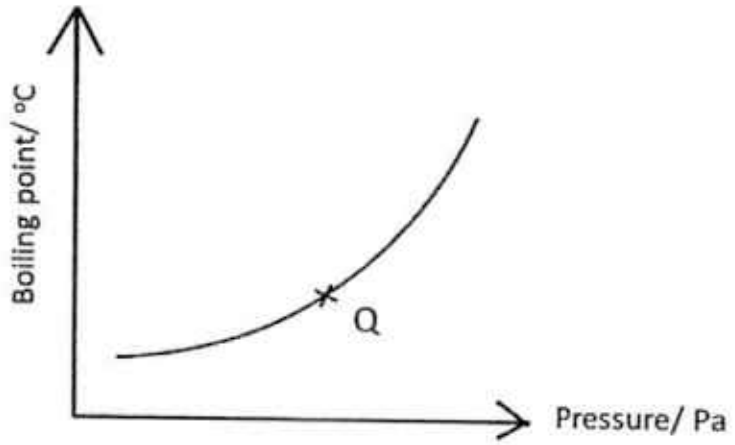
.....

..... [2]

(iii) Lithium can react with oxygen to form lithium oxide. Draw a dot and cross diagram of lithium oxide. Show all electrons.

[2]

8 **(b)** The graph below shows how the boiling point of water changes with pressure.



(i) Determine the state(s) of water at point **Q**.

Q: ..... [1]

(ii) From the graph, deduce the relationship between the boiling point of water and pressure.

.....

..... [1]

(iii) With reference to the graph, explain how pressure cooker works.

.....

.....

.....

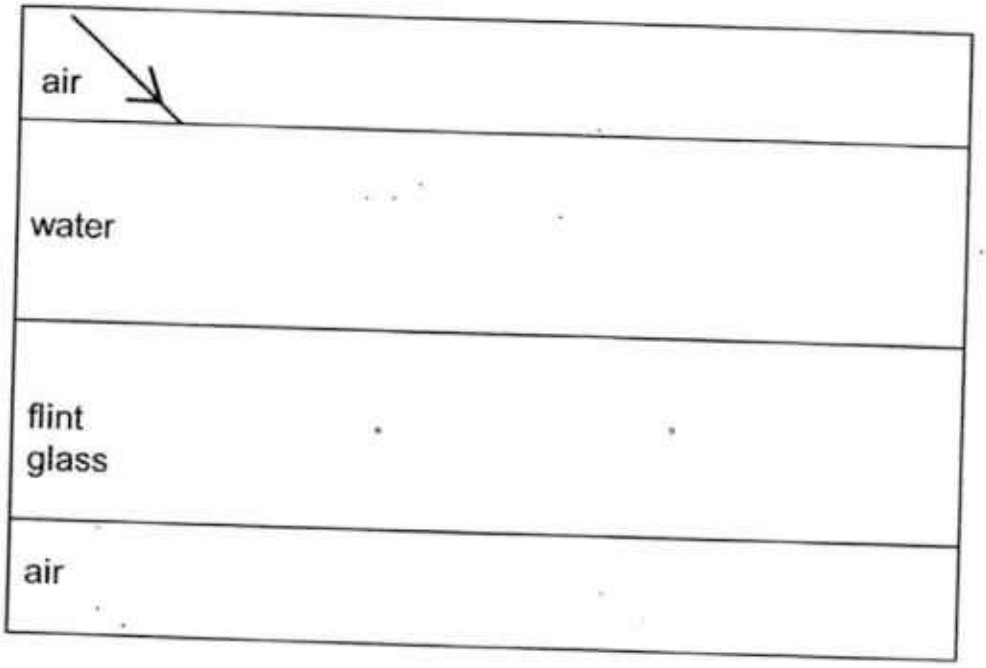
..... [2]

[Total: 10 marks]

9 The list below shows the refractive indices of the various optical media.

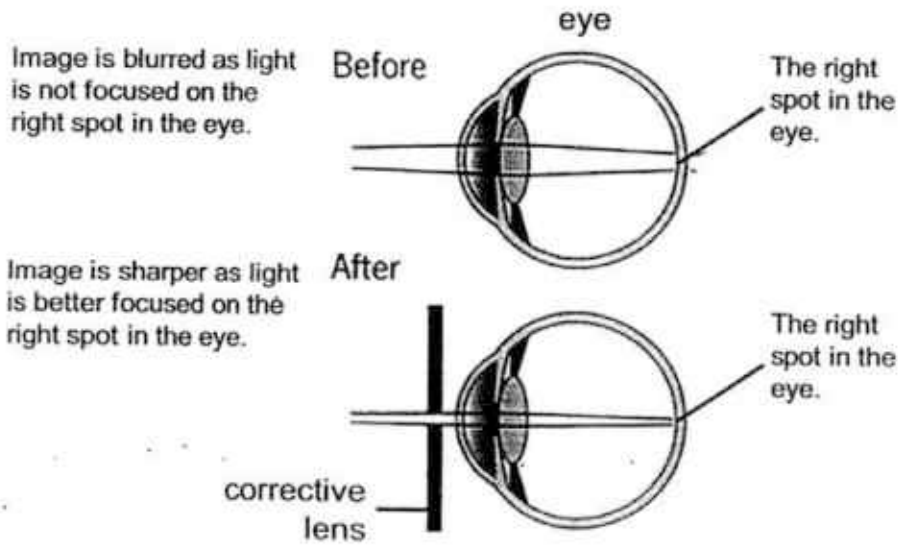
Optical medium	Refractive index
air	1.00
water	1.33
crown glass	1.52
flint glass	1.61
diamond	2.42

(a) Complete the diagram below to show how a light ray would travel through all four layers of optical media. You **do not** need to provide an accurate drawing or indicate the value of every angle of incidence and angle of refraction. The incident ray has been drawn.



[3]

9 (b) Glass is the material that is often used to make corrective lenses in spectacles. The diagram below shows that corrective lenses work by refracting light in order to help the eye to focus light more effectively.



State the better choice of glass (crown glass or flint glass) to be used to make such corrective lens that is more effective in focusing light onto the right spot in the eye. Explain your answer.

.....

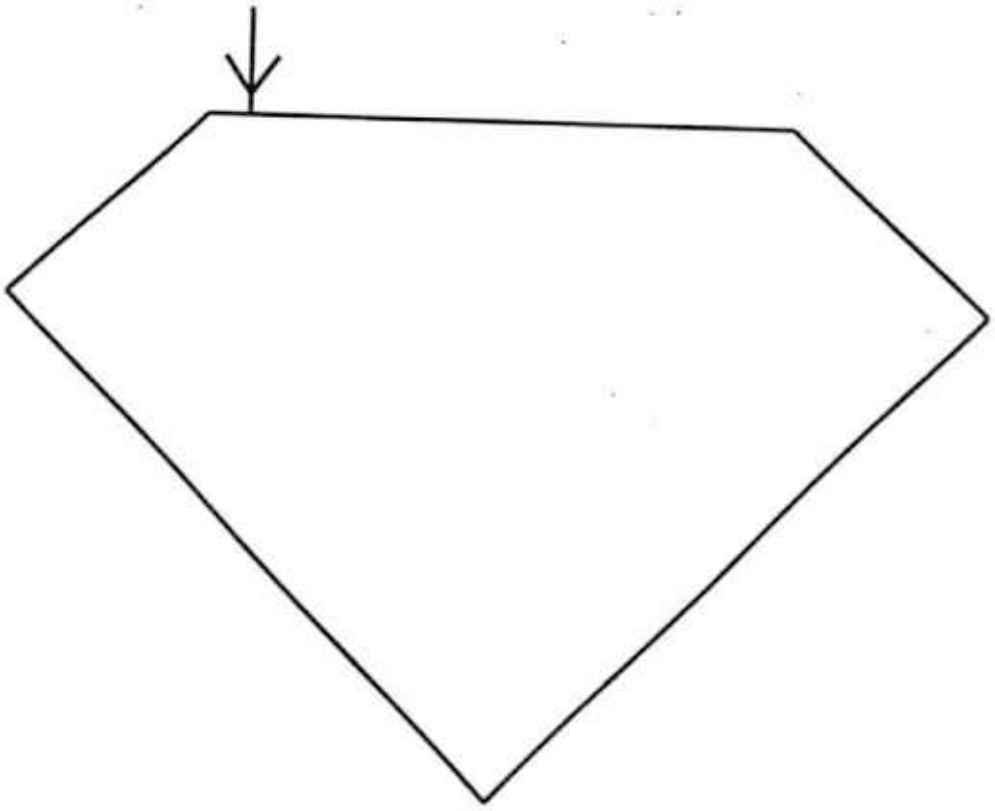
.....

..... [2]

9 (c) Calculate the critical angle of diamond.

critical angle of diamond = ... [2]

(d) Complete the diagram accurately (to scale) to show the exact path of the light ray as it enters the diamond. Indicate the value of every angle of angle of incidence and angle of refraction / reflection. You may need to use a protractor for this question.



[3]

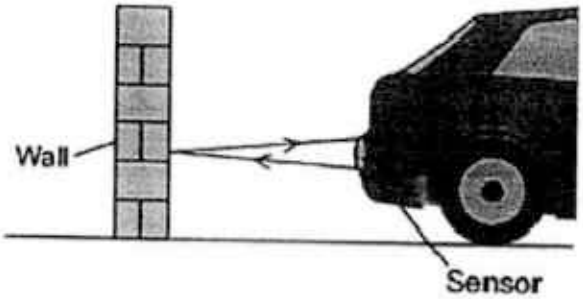
[Total: 10 marks]

10 **(a)** Some cars have parking sensors that use ultrasound. Ultrasound waves are sound waves with frequencies above the range of human hearing.

(i) Circle the ultrasound frequency.

5000 Hz 10 000 Hz 30 000 Hz [1]

(ii) The diagram shows a sensor on the back of a car. The parking sensors emit and detect ultrasound waves when the car is put into reverse gear. When the ultrasound waves hit an obstacle, the waves bounce back to the car.



The time between emitting the ultrasound waves and receiving them back at the car is 0.004 s. Given the speed of ultrasound waves in air is 330 m/s, calculate the distance between the wall and the back of the car.

distance = ... [2]

(b) Explain why a sound wave cannot travel through vacuum.

.....

.....

.....

.....

..... [2]

10 (c) The speed of ultrasound waves in water is 1500 m/s while the speed of ultrasound waves in solid is 5500 m/s. Explain why ultrasound has different speeds in air, water and solid.

.....

.....

.....

.....

.....

.....

..... [3]

(d) Describe one useful application of sound and one scenario that sound is disruptive.

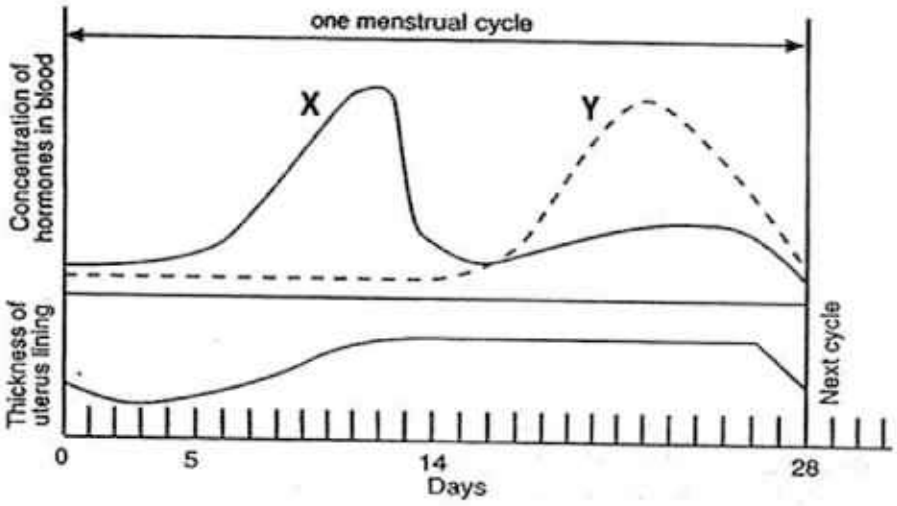
.....

.....

..... [2]

[Total: 10 marks]

11 **(a)** The figure below shows the main events that occur during a menstrual cycle.



The two female sex hormones that are involved in the menstural cycle are oestrogen and progesterone. Progesterone is released to maintain the thickness of the uterus lining. Oestrogen is released to repair the uterus lining.

(i) Identify hormone **X** and **Y**.

X: ..... **Y**: ..... [2]

(ii) The release of hormone **Y** is triggered by a biological event. Suggest the name of the biological event.

..... [1]

(iii) Suggest and explain how the concentration of hormone **Y** after day 22 would be different if the woman gets pregnant.

.....

.....

..... [2]

11 (b) Compare the structure of the egg cell and the sperm cell with reference to their functions.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Explain the term 'contraception' using spermicide as the example.

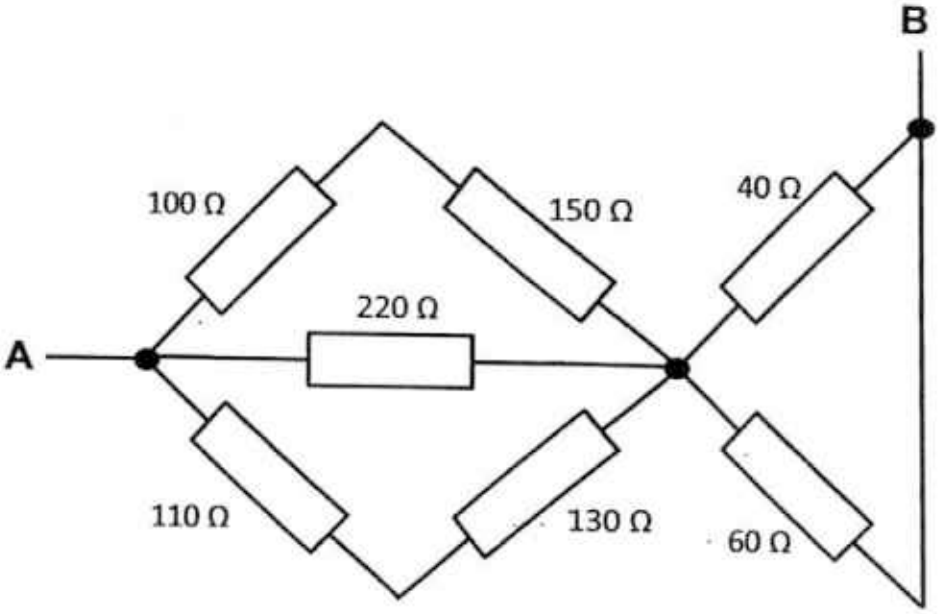
.....

.....

..... [1]

[Total: 10 marks]

12 (a) Calculate the effective resistance between point **A** and **B** of the circuit shown below.



..... [4]

12 (b) The label below shows the specifications of a battery pack.

Capacity: 5000 mAh Input: 5 V, 1 A Output 1: 5 V, 1A Output 2: 5V, 500 mA Caution: 1. Do not dispose in fire or water. 2. Never attempt to disassemble or reassemble.

(i) Calculate the power needed to charge the battery pack.

..... [2]

(ii) Calculate the electrical energy needed to charge the battery pack for 3 hours.

..... [2]

(iii) Given that 1 KWh is equal to 3.6 MJ and the cost of electricity is 20 cents per kWh.
Calculate the cost of charging the battery pack for 3 hours.

..... [2]

[Total: 10 marks]

END OF PAPER

The Periodic Table of the Elements

Group

I	II											III	IV	V	VI	VII	0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

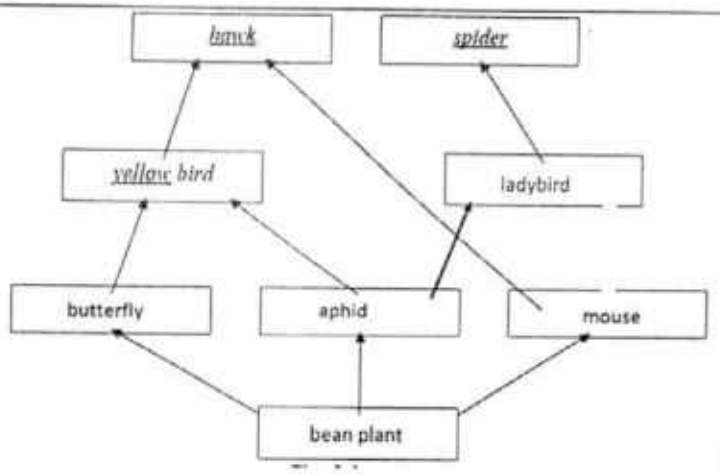
Key: $^{a}_{b}X$

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

Paper 1					
1	D	11	B	21	A
2	A	12	B	22	B
3	C	13	D	23	B
4	D	14	D	24	C
5	B	15	B	25	B
6	C	16	B	26	A
7	D	17	C	27	A
8	B	18	B	28	D
9	A	19	B	29	C
10	D	20	D	30	D

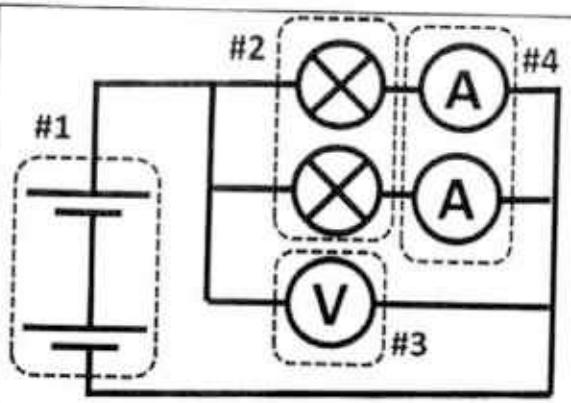
Q		Answer	m	remark
1	a	**osmosis**	1	no mark if 'diffusion' or 'active transport' is mentioned along with 'osmosis'.
	b	1. The cell sap of the potato has a **lower water potential** than 0.4% sugar solution, 2. thus the **water move into the cells** of the potato from the sugar solution via osmosis. 3. The cell sap of the potato has a **higher water potential** than 0.6% sugar solution, 4. thus the **water move out of the cells** of the potato into the sugar solution via osmosis. both #1 and #3 point must be correct for 1 mark. both #2 and #4 point must be correct for 1 mark.	2	**Rej:** • move in/out of potato piece / … of sugar solution (the main focus is the movement of water into or out of cells due to water potential gradient) • Mention of "partially permeable membrane" alone is insufficient as the potato is not covered by one single giant membrane. • Sugar / sugar solution enters / leaves … • water concentration / more water No mark for explanation for only either 0.4% or 0.6% sugar solution explanation. The question asked for 'explain the difference'. No mark for answers without reference to the either 0.4% and 0.6% sugar solutions. upper sec: the term 'cell sap' must be used for plant cells. (although not penalised in sec 2)
	c	**0.5%** (accept: 0.4% < x < 0.6%)	1	**Rej:** answers in range or without unit (%) [0.5 can mean 50%]

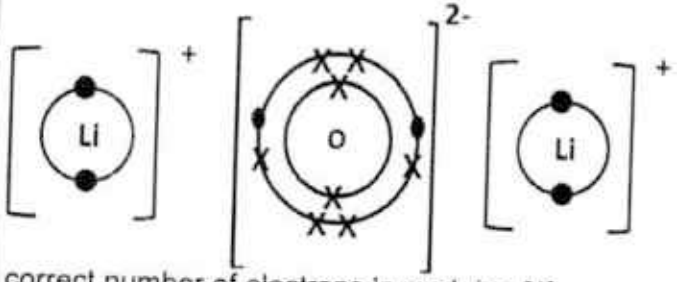
2	 **each food chain is worth 1 mark. #**	4	**each food chain is worth 1 mark. #** (no mark if food chain is broken) • Bean plant → butterfly → yellow bird → hawk • Bean plant → aphid → yellow bird → hawk • Bean plant → aphid → ladybird → spider • Bean plant → mouse → hawk **-1 mark <u>max</u>** if student included <u>decomposer</u> in food web **-1 mark <u>max</u>** if student split up the bean plant into its <u>parts</u> while still get the rest of the food web correct / <u>name part</u> of bean plant (a part of the organism that is being fed on is not considered as a separate entity in a food web/ chain) **-1 mark for <u>each</u>** <u>extra arrow</u> # no mark for a food chain without / with wrong arrow / double-directional arrow. *note: each organism to be presented as singular (although not penalised in sec 2)

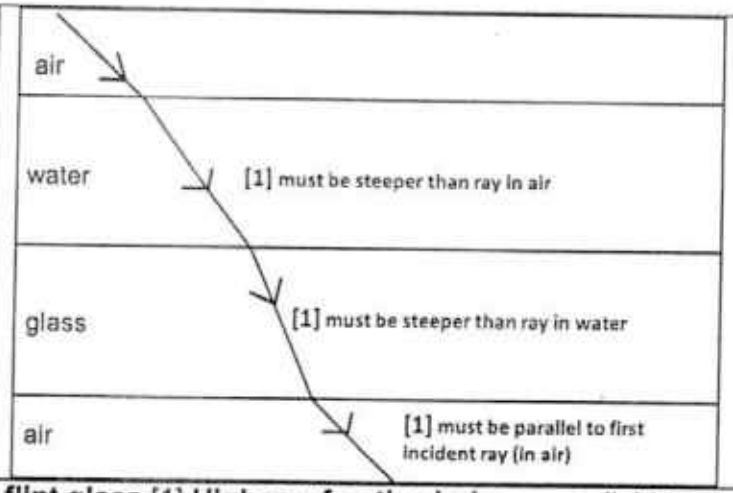
3	a	hydrochloric acid	1	
	b	hydrogen	1	
	c	potassium chloride	1	

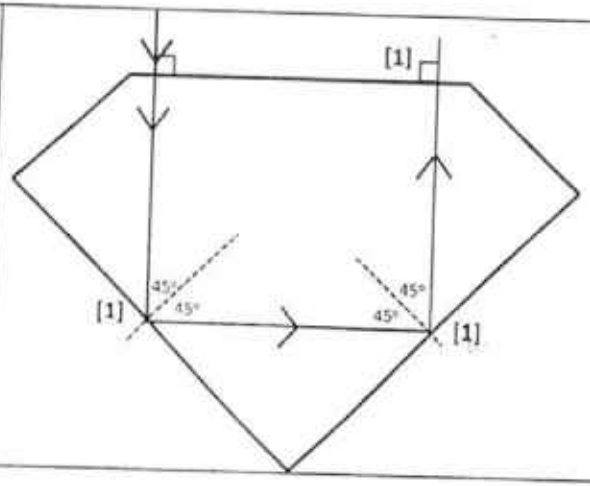
4	1. green [1]. 2. Cyan object **reflects green and blue light.** [1] 3. The green coloured transparent film **absorbs the blue light** and allows **green light to pass through**.[1] *	3	#2 **Rej:** Cyan is blue and green; Reflect cyan (light need to be mentioned as colour cannot be reflected, only light can) #3 **Rej:** green light <u>reflected</u> / <u>absorbed and reflected</u> (although some of the green light rays are reflected off the green transparent film, most green light rays passes through film)* many students missed out the "green light to pass through"

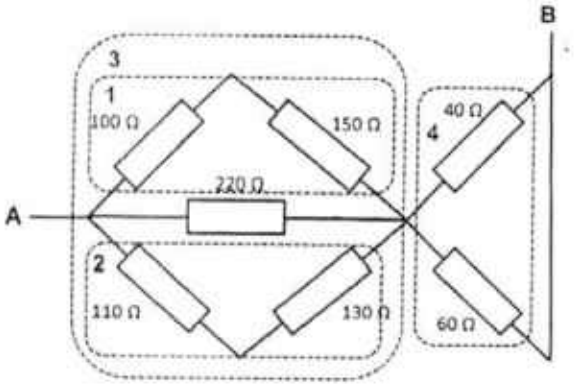
5	a	U,V, W (any 2) or X, Y	1	No penalty for giving more than 1 correct answer. No mark if one or more of the additional answer is wrong.
	b	X or W	1	
	c	Y	1	
6	a	I. B II. C / E III. A / C / F IV. F (2 correct = 1 mark)	2	No penalty for giving more than 1 correct answer. No mark if one or more of the additional answer is wrong.
	b	1) **Bile** from gall bladder **cannot reach small intestine** [1]. 2a) The **larger fat droplets** will not be broken up into **smaller droplets / emulsification** cannot take place / the **surface area to volume ratio** of fat droplets remain **small.** [1] 2b) **Lipase** will **not** be able to break down fats **effectively / fast**. OR **Rate of digestion** of **fats** will **decrease**. [1] OR 3a) Not enough bile to **neutralise the hydrochloric acid** from stomach and there will not be **alkaline** pH for **pancreatic and intestinal enzymes** to work. [1] 3b) **Rate of digestion** of **fats, proteins and carbohydrate** will **decrease**. [1]	3	**1) Rej:** explain that liver produced bile without mentioning the bile is unable to reach the small intestine. (Small intestine concept is important as it shows student understands that fat digestion occurs in small intestine.) **2a) Rej:** • Fats cannot be broken down into smaller molecules (bile is not an enzyme) • Explain how bile works but did not explain the implication of the lack of bile directly. • Function of bile without directly explaining the consequences of the lack of bile. **3a/ 3b) Rej:** take longer time to digest ____ . (The transit time of food substances in the digestive system is fixed. Food cannot stay for infinite time to wait for complete digestion.) **3a Rej:** create slightly alkaline environment (was the initial pH acidic or very alkaline?)
	c	A smooth surface means **less surface area** for **diffusion** of **digested food** molecules through the intestinal wall. [1] **Absorption** of nutrients will be **less efficient / slower** and there will **not be enough / less nutrients** for the cow to stay alive. [1]	2	**Rej:** no absorption/ harder to absorb **Rej:** Explain how villus works but did not explain the implication of the lack of villus directly. No mark given for malnutrition alone as this does not reflect real understanding of the science. **Rej:** insufficient food

7	a	 #1: 2 cells in series to provide the sufficient EMF [1] #2: 2 light bulb in parallel [1] #3: both ammeters connected in series to each of the 2 bulbs (accept: 1 ammeter connected in series to the cells, can use $I = I_1 + I_2$) [1] #4: a voltmeter in parallel to the light bulb [1] -1 mark for incomplete circuit (due to gaps / open switch)	4	Most students are able to understand that the ammeter are connected in parallel to the voltmeter while the light bulb are in parallel.
	b	R = V/I = 3.0 V / 0.02 A [1] = 150 Ω [1]	2	Students converted the current wrongly from mA to A.

8	ai	$2Mg + O_2 \rightarrow 2MgO$ • correct chemical formulae [1]; Balanced equation [1]	2	Students unable to balance the chemical equation as they are not able to write down the correct chemical formula. E.g. oxygen is O_2.
	aii	Set up **a boiling tube** with **water** and **thermometer**. Place **magnesium under the boiling tube** and light it up with a flame. [1] The **temperature of water will increase** to show that combustion **releases heat** in the process. [1]	2	Poorly done. Unable to relate the increase in temperature in surrounding to exothermic reaction.
	aiii	 correct number of electrons in each ion [1] correct charge of each ion [1] -1 m for symbols other than dot and cross used	2	Most students are able to draw the ionic bonding.
	bi	Q: Liquid and gas	1	Most students only indicate liquid or gas. Unable to recognise that there are two states present.
	bii	The boiling point of water **increases** as pressure increases.	1	Most students are able to indicate the relationship between pressure and boiling point.
	biii	The **pressure** in the pressure cooker **increases** and the **boiling point of water increases**. [1] Food can be **cooked faster** at **higher temperature**. [1]	2	Most students are able to indicate the increase in pressure causes increase in boiling point but most did not mention that the food can be cooked faster.

9	a		3	For the last light ray in air, allow ±2° deviation from the first incident ray(in air) No arrows at all, or wrong direction of arrow(-1m)
	b	**flint glass** [1] **Higher refractive index** cause light to be **bent more towards the normal** and causes the light to focus better. [1]	2	Accept also **refracts more** instead of **bent further.** Accept **refracted angle is larger.** Accept **optically denser** instead of higher refractive index. Note: students who did not indicate bending with reference to normal are marked correct. But in sec 3, students MUST indicate direction of bending with reference to the NORMAL
	c	n = 1/ sin c [1] c = $\sin^{-1}$ (1/2.42) = 24.4° [1]	2	Some students mix up c and n.

9	d		3	Marking scheme changed • Shape of path in general matches (U shape) **with** arrows correctly drawn. If no arrows drawn then no mark given [1m] • Angles (incident/reflected ray) equal and correct (Allow ±1° tolerance between incident and reflected ray values) [1m] **ALL** Angles are **labelled** correctly[1m] e.g. If angle labelled 45° but actual measured is 42°, then no marks. (Allow ±1° between actual measured and labelled value)
10	ai	30 000 Hz	1	
	aii	distance = speed x time taken for sound to reach the wall from car = 330 m/s x (0.004 s x 0.5) [1] = 0.66 m [1]	2	Most common mistake is not dividing the distance by 2 [0 marks] Another issue is the non-use of SI units (metres).
	b	• Vacuum has **no particles**. [1] • **No collision** of particles to allow **energy** to be **transferred** from the first particle to the next particle. [1]	2	Most used matter, instead of particles. Most describe the transfer of energy as vibrations {accepted}
	c	• Sound travels as **one particle collides with the adjacent particle** and **energy is transferred** from the first particle to the next particle. [1] • **Solid** particles are **very closely packed** while **water** particles are **closely packed** and **air** particles are **far apart** from each other. [1] • **Energy can be transferred** from a **solid** particle to the next **very rapidly**, energy can be transferred from a **water** particle to the next **less rapidly** while energy can be transferred from an **air** particle to the next **slowly**. [1]	3	Most are able to describe the differences between the spaces from solid to liquid and the effect the space has on the speed of transfer of sound. Yet almost all are unable to explain how sound travels [point 1]
	d	Useful: car horn to warn others of danger. [1] Disruptive: sound pollution from airplanes. [1]	2	

11	ai	Hormone X: Oestrogen [1] Hormone Y: Progesterone [1]	2	Mix up of hormones despite information in the question
	aii	ovulation	1	Most stated puberty/pregnancy Both unaccepted as ovulation is the trigger of the rise of progesterone.
	aiii	Concentration of hormone Y would **remain at high level** after day 22 and **instead of decreasing**. [1] This is to **maintain** the thickness of **uterine lining** for **implantation** of the embryo. [1]	2	Some students state decreasing since there is no more period after pregnancy. This is incorrect as it does not explain the hormone level correctly.
	b	Both sperm and egg has a **nucleus** [1] to **contain chromosomes**. [1] Sperm has a **tail** but an egg **does not**. [1] Sperm **is motile** and can travel from **vagina to oviduct** but the egg **is not motile**. [1]	4	Most mention the tail (flagellum) found in sperm which renders it motile. A significant number failed to mention nucleus and chromosomes, but chose to state the difference in sizes. This does not relate to function. (unaccepted) A few mentioned enzymes in the acrosome for digesting the wall of the ovum (accepted)
	c	Spermicide **kills sperm cells** and **prevent the fusion of sperm and egg**, thus **preventing pregnancy**.	1	Some students mention spermicides prevent pregnancy but failed to mention the killing of sperms (unaccepted)
12	a		4	Weak in identifying the 3 branches of (100 Ω +150 Ω), 220 Ω and (110 Ω+130 Ω) in parallel. Also some students wrongly identified 40 Ω and 60 Ω to be in series

		$R_1 = 100 + 150 = 250\ \Omega$ $R_2 = 110 + 130 = 240\ \Omega$ [1] $1/R_3 = 1/R_1 + 1/R_2 + 1/220\ \Omega$ $R_3 = 1/(1/250 + 1/240 + 1/220) = 78.665\ \Omega$ = (3.s.f.) [1] $1/R_4 = 1/40 + 1/60$ $R_4 = 1/(1/40 + 1/60) = 24\ \Omega$ [1] $R_{AB} = R_3 + R_4 = 78.7\ \Omega + 24\ \Omega = 102.7\ \Omega = 103\Omega$ (3.s.f.) [1] (- 1 mark once only if the answers lacks unit)		
	bi	P = IV = 1 A x 5 V [1] = 5 W [1]	2	Some students could not identify the correct values to substitute into formula
	bii	E = Pt = 5 W x (3 x 60 x 60 s) [1] = 54 000 J [1] **OR** E = Pt = 0.005 kW x 3 h [1] = 0.015 kWh [1]	2	Allow ECF but only award method mark Some students convert to MJ but only divided 54000 J by 1000 instead of by 1000000.
	biii	cost = E x rate = 54 000 J x (20 ¢ / 3.6 x 1000 000 J) [1] = 0.3 ¢ [1] **OR** cost = E x rate = 0.015 kWh x 20 ¢ [1] = 0.3 ¢ [1]	2	Allow ECF but only award method mark Common mistake is wrong conversion of J to kWh

Class	Index Number	Name

HENDERSON SECONDARY SCHOOL

END- OF-YEAR EXAMINATION 2016
SECONDARY 2 EXPRESS

LOWER SECONDARY SCIENCE

MONDAY 10 October 2016

2 hours

Additional materials:
Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your Name, Index number and Class on all the work you hand in.
For Booklet A, write in soft pencil.
For Booklet B, write in dark blue or black pen. You may use a soft pencil for any diagrams or graphs.

Booklet A – Section A
There are **thirty** questions in Section A. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft 2B pencil** on the separate Multiple Choice Answer Sheet.

Read the instructions on the Answer Sheet very carefully.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 12.

Hand in Booklet A, Booklet B and OTAS separately.

Booklet A

This document consists of **12** printed pages.

Setter: Mrs Michelle Do

[Turn over

Section A (30 marks)

1 Which one of the following elements has a relative atomic mass of 7?

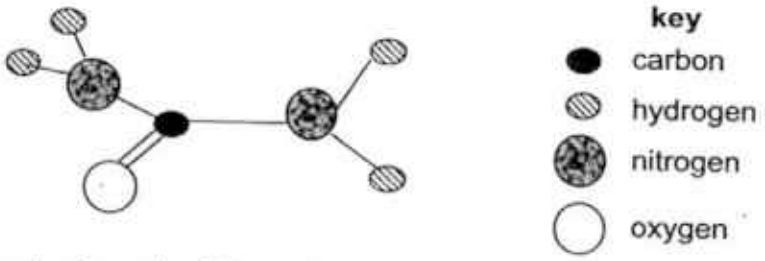
A lithium

B magnesium

C nitrogen

D oxygen

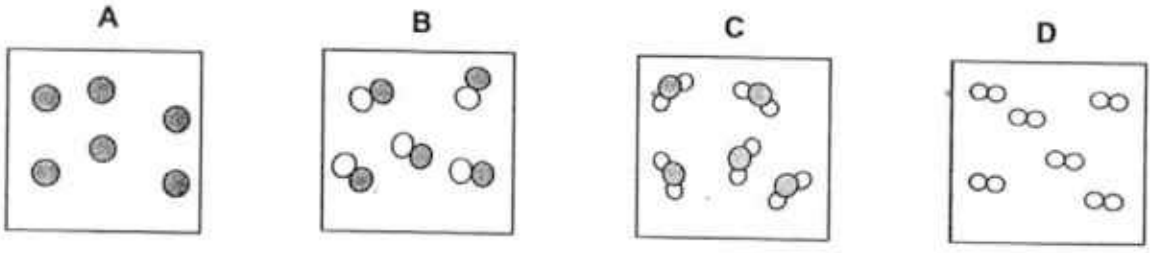
2 The diagram below shows a molecule.



What is the molecular formula of this molecule?

A $(CH_2)_2NO$ B $(CH)_2N_2O$ C $(NH_2)_2CO$ D $(OH_2)_2CN$

3 Which of the following diagrams best represent the particles of the gas argon, **Ar**?



4 Which two atoms have the same number of neutrons?

A $^{11}_{5}B$ and $^{11}_{6}C$

B $^{1}_{1}H$ and $^{4}_{2}He$

C $^{23}_{11}Na$ and $^{24}_{12}Mg$

D $^{16}_{8}O$ and $^{32}_{16}S$

5 Sodium reacts with oxygen to form sodium oxide. Which of the following statements is **true**?

A Sodium oxide can be broken down into simpler substances by electrolysis.

B Sodium oxide has the same properties as sodium and oxygen.

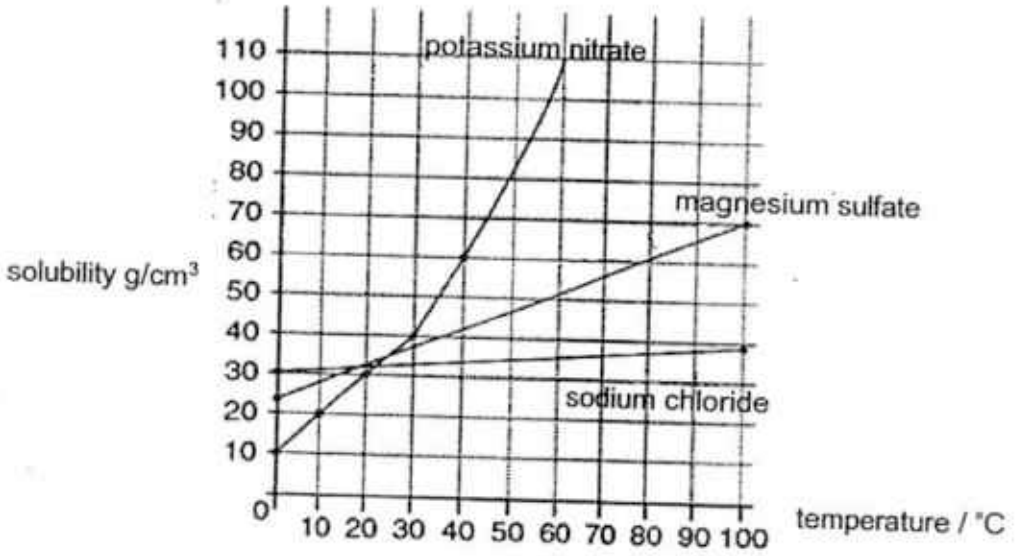
C The substance formed has the same mass as sodium.

D Two non-metals have combined chemically to form a compound.

6 Which of the following differences between a metal and a non-metal is **not** true?

	metal	non-metal
A	high boiling point	low boiling point
B	high density	low density
C	brittle	malleable
D	shiny surface	dull surface

7 The graph below shows how temperature can affect the solubilities of three different salts.



Which of the following statements is/are **true** regarding the solubilities of the salts?

I Potassium nitrate has a higher solubility than magnesium sulfate at 50°C.
II Potassium nitrate has the lowest solubility at 0°C.
III Sodium chloride's solubility increases very slightly with an increase in temperature.

A I and II only B I and III only C II and III only D I, II and III

8 Both solutions **F** and **G** are of the same volume and consist of the same type of solute and solvent. Solution **F** contains the maximum amount of solute. Solution **G** contains a small amount of solute.

Which of the following statements about the solutions **F** and **G** is **false**?

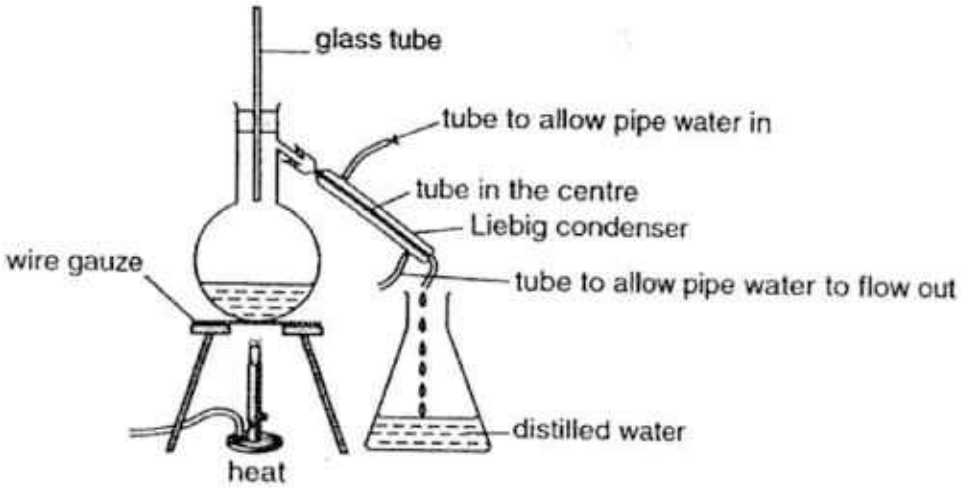
A Solution **F** has more solute than solution **G**.

B Solution **F** is a saturated solution.

C Solution **G** can dissolve more solute.

D Solution **G** is less dilute than solution **F**.

9 The diagram shows the apparatus used for distillation.



Which of the following is/are wrongly arranged?

I flow of water in and out of the condenser
II glass tube
III wire gauze

A I and II only B I and III only C II and III only D I, II and III

10 Which of the following processes is/are involved in distillation?

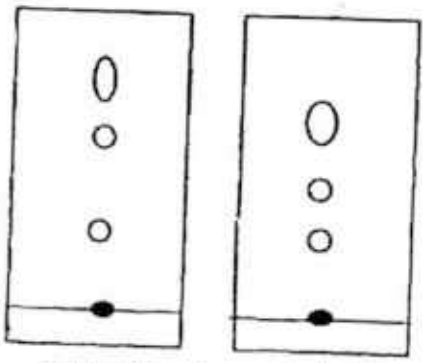
A boiling only

B boiling and condensation

C condensation only

D evaporation only

11 Two students were investigating the components of the same food colouring using paper chromatography. The chromatograms obtained are shown below.



student **1** student **2**

Why are the two chromatograms different?

A Student **1** used more of the food dye for the chromatography.

B Student **1** placed insufficient solvent in the set-up.

C Student **2** exposed the chromatography set-up to the air.

D Student **2** used a different solvent which had a different dye solubility.

12 When you mix two different substances,

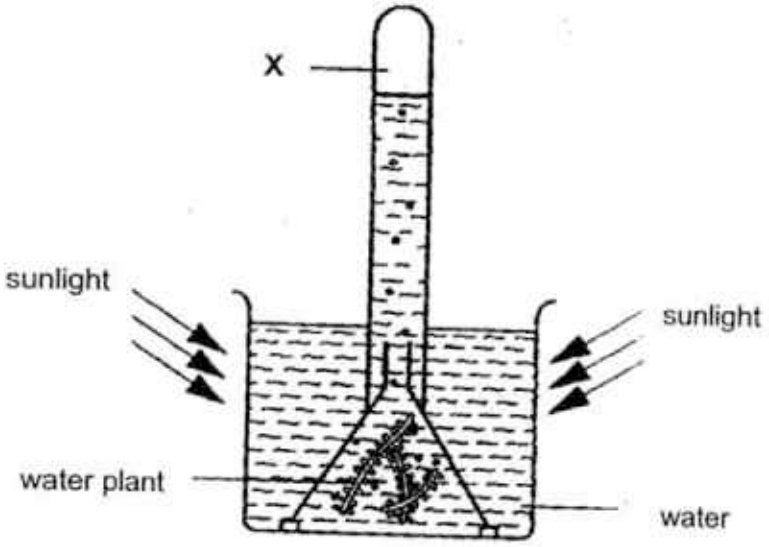
A a new substance is always formed.

B new substances may or may not be formed.

C no new substance is formed.

D two or more new substances are always formed.

13 The diagram shows apparatus that has been in sunlight for several hours.



Compared with atmospheric air, the gas collected at **X** has

A the same composition.

B more carbon dioxide.

C more oxygen.

D more nitrogen.

14 Which of the following pollutants can dissolve in rain water to form acid rain?

I carbon monoxide
II oxides of nitrogen
III smoke particles
IV sulfur dioxide

A **I** and **III** only **B** **I** and **IV** only **C** **II** and **IV** only **D** **II**, **III** and **IV** only

15 Which of the following is a luminous object?

A aluminium tin

B glass

C the moon

D the sun

16 What type of mirror is used as security mirrors in shops?

A concave mirror

B convex mirror

C curved mirror

D plane mirror

17 Which of the following will affect the refractive index of a simple glass block?

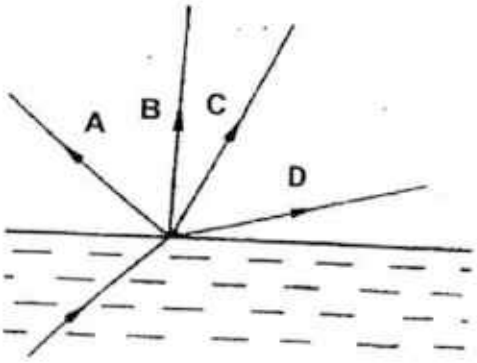
A angle of incidence

B density of glass

C shape of the glass

D thickness of the glass

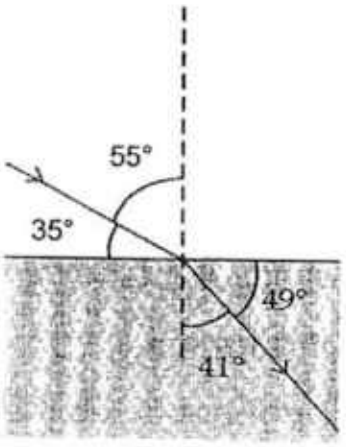
18 Which letter shows the correct path of a light ray passing from an optically denser object into an optically less dense object?



19 A fish in a pond appears to be 1.6 m from the surface of a pond. Given that the refractive index of water is 1.33, what is the real depth of the fish?

A 0.84 m B 1.20 m C 2.13 m D 2.93 m

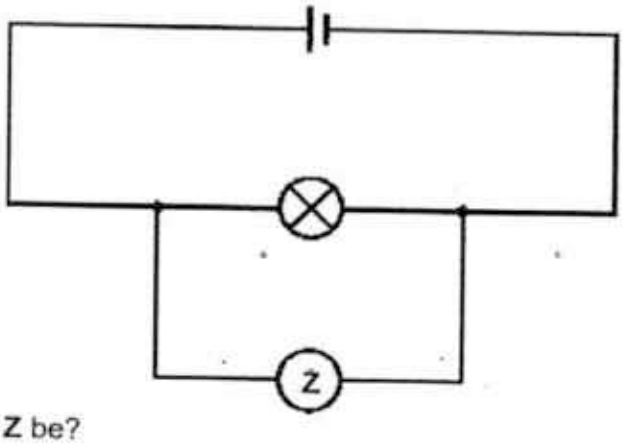
20 The diagram below shows an incident ray from air and striking a transparent solid.



What is the refractive index of the solid?

A 0.76 **B** 0.87 **C** 1.09 **D** 1.25

21 A student sets up a circuit to measure the potential difference across a light bulb as shown below.



What should component **Z** be?

A ammeter

B potentiometer

C resistor

D voltmeter

22 An electric torch's light became dimmer and eventually stopped giving out light. Which of the following is a valid hypothesis based on this observation?

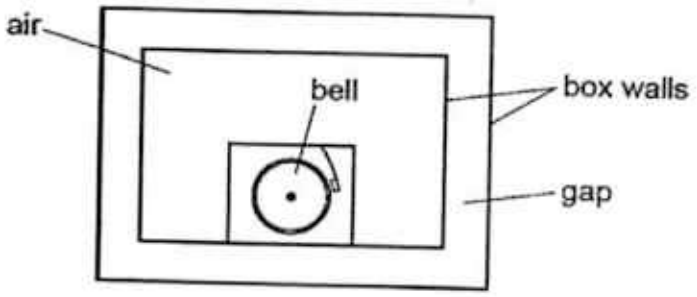
A The batteries need to be replaced.

B The bulb is the wrong type.

C The switch of the torch has to be replaced.

D The torch is old.

23 The diagram below shows an electric bell enclosed in a box. Various materials were placed in the gap and the loudness of the sound heard from the outside was compared.



Which of the following materials in the gap will result in the loudest sound?

A air

B foam

C vacuum

D wood

24 A girl saw a flash of lightning. She heard a loud sound of thunder after 5 seconds. How far is the lightning from her location? Assume the speed of sound to be 330 m/s and assume the time taken for light to travel is negligible.

A 66 m B 330 m C 1500 m D 1650 m

25 In a guitar, plucking harder will give a ..... sound while plucking a shorter string will give a ..... sound.

A higher ; louder

B louder ; higher

C lower ; softer

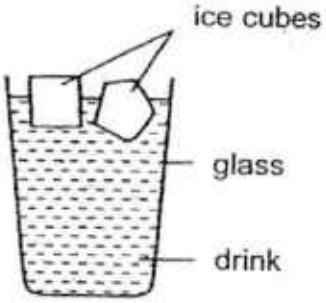
D softer ; lower

26 Astronauts in space communicate via radio. Which of the following statements are reasons for this?

I The radio transmits sound in the form of waves.
II Their voices cannot be heard outside their soundproof suits.
III They cannot see each other in space.

A I and II only B I and III only C II and III only D I, II and III

27 Amber puts some ice cubes in a glass of drink to lower the temperature of a drink.



What is the main process by which the liquid at the bottom of the glass cools?

A conduction

B convection

C diffusion

D sinking

28 In cold countries, glass windows consist of two pieces of glass separated by a thin layer of air. The layer of air helps reduce heat loss from the inside of the buildings to the surroundings by

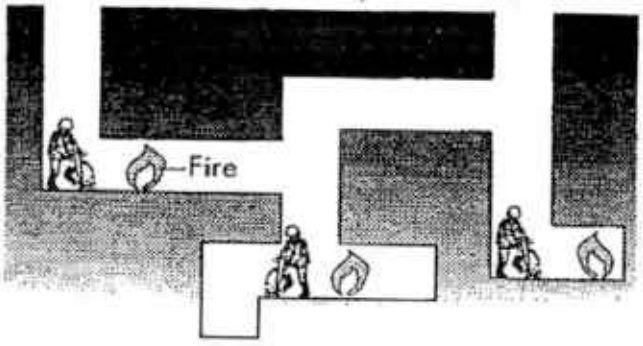
A absorbence.

B conduction.

C convection.

D radiation.

29 The diagram shows some workers working underground. They light a fire in the tunnels.



Which of the following is the correct reason for doing this?

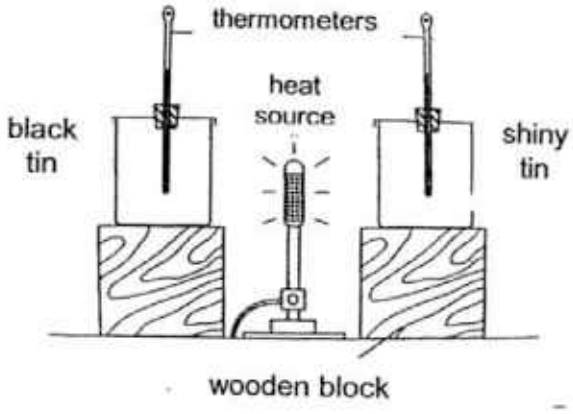
A The heat from the fire keeps the workers warm.

B The heat is needed to set up a convection current so that the air is circulated.

C The light from the fire is necessary to see clearly in the dark.

D The smoke produced by the fire is used for signalling to people above ground.

30 A set up of two tins are shown below.



After 20 minutes, it is observed that the thermometer in the black tin shows a faster and higher rise in temperature. This shows that, compared to shiny surfaces, black surfaces are

A better absorbers of heat.

B better radiators of heat.

C poorer absorbers of heat.

D poorer radiators of heat.

- End of Booklet A -

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	64 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	– Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La lanthanum 57 *	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– Ac actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	– Pa protactinium 91	238 U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lr lawrencium 103

Key

a
X
b

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

12

6

Class	Index Number	Name

HENDERSON SECONDARY SCHOOL

END-OF-YEAR EXAMINATION 2016
SECONDARY 2 EXPRESS

LOWER SECONDARY SCIENCE

MONDAY 10 October 2016
2 hours

READ THESE INSTRUCTIONS FIRST

Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your Name, Index number and Class on all the work you hand in.
For Booklet A, write in soft pencil.
For Booklet B, write in dark blue or black pen. You may use a soft pencil for any diagrams or graphs.

Booklet B – Sections B and C
Answer **all** questions in Section B and Section C.
Write your answers in the spaces provided on the question paper.
In calculations, you should show all the steps in your working, giving your answer at each stage.

The number of marks is given in brackets [ ] at the end of each question or part question.

Section	Mark
A	/30
B	/40
C	/30
Total:	/100

Hand in Booklet A, Booklet B and OTAS separately.

Booklet B

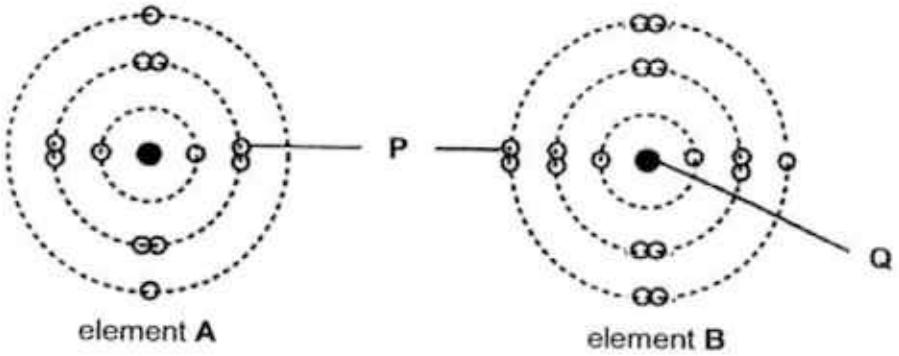
This document consists of **15** printed pages.

Setter: Mrs Michelle Do

[Turn over

Section B (40 marks)

1 **(a)** The diagrams below show the electronic structure of two different atoms of elements **A** and **B**.



(i) Identify **P** and **Q**.

..... [1]

(ii) Using the Periodic Table, identify element **A** and element **B**.

.....[1]

(b) Another element, **X**, exists in two forms, as shown below.

$^{79}_{35}\mathbf{X}$ $\qquad$ $^{81}_{35}\mathbf{X}$

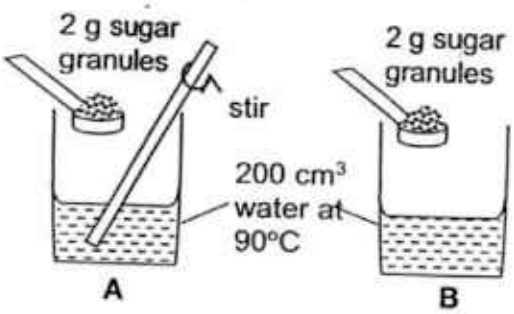
X-79 atom $\qquad$ **X-81 atom**

Explain the relationship between these two atoms.

.....

.....[2]

2 Study the two experimental set-ups, **A** and **B**, shown below.



(a) Which set up allows sugar to dissolve faster?

.....[1]

(b) Assuming that only 1 g of sugar dissolves in set-up **A**, what is the solubility of sugar at 90°C?

.....[1]

3 The following shows information about an experimental set up investigating the time taken to dissolve substance **P**.

cup	substance **P**	temperature of water/°C
I	50 g of **P** in cube form	40
II	50 g of **P** in cube form	80

(a) Compare cups **I** and **II**, identify the dependent variable and independent variable. [1]

Dependent variable: .....

Independent variable: .....

(b) **(i)** What is the difference between a saturated solution and an unsaturated solution?

..... [1]

(ii) How can you dissolve more **P** in the same volume of solvent without heating the mixture?

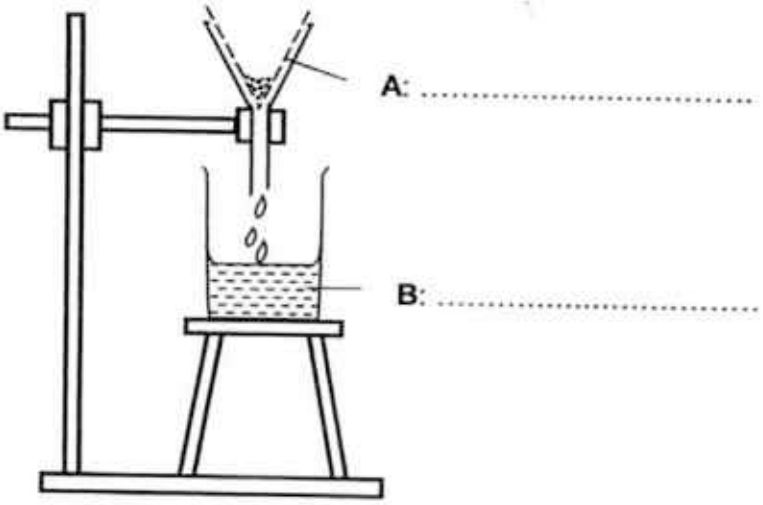
.....[1]

(c) State **two** observations that you could make to determine that a mixture of solid **P** and an excess of water is a solution.

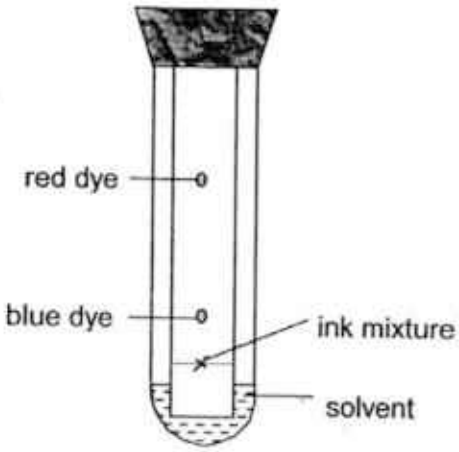
.....

.....[2]

4 (a) The diagram below shows a set-up to separate a mixture.
Label the different parts of the set-up shown. [1]



(b) The diagram below shows another separation process.



State and explain which dye is more soluble in the solvent.

.....

.....[2]

(c) A student wanted to separate a mixture of solids **Y** and **Z**. The following table shows the solubilities of **Y** and **Z** in different solvents.

solvent	Y	Z
alcohol	soluble	insoluble
water	insoluble	insoluble

Using the information given above, describe how the student could obtain solids **Y** and **Z** separately from the mixture.

.....

.....

.....

.....

.....

.....[4]

5 (a) A student wants to investigate the chemical properties of a solution. The student decided to use different natural food extracts as indicators to test if a solution is acidic, alkaline or neutral. The colours of three food extracts, **P**, **Q**, and **R**, are shown in the table below.

food extract	colour of in neutral solution	colour in acid	colour in alkali
P	orange	purple	red
Q	green	pink	blue
R	green	green	green

State which food extract(s) is/are suitable be used as an indicator. Explain why.

.....

.....

.....[2]

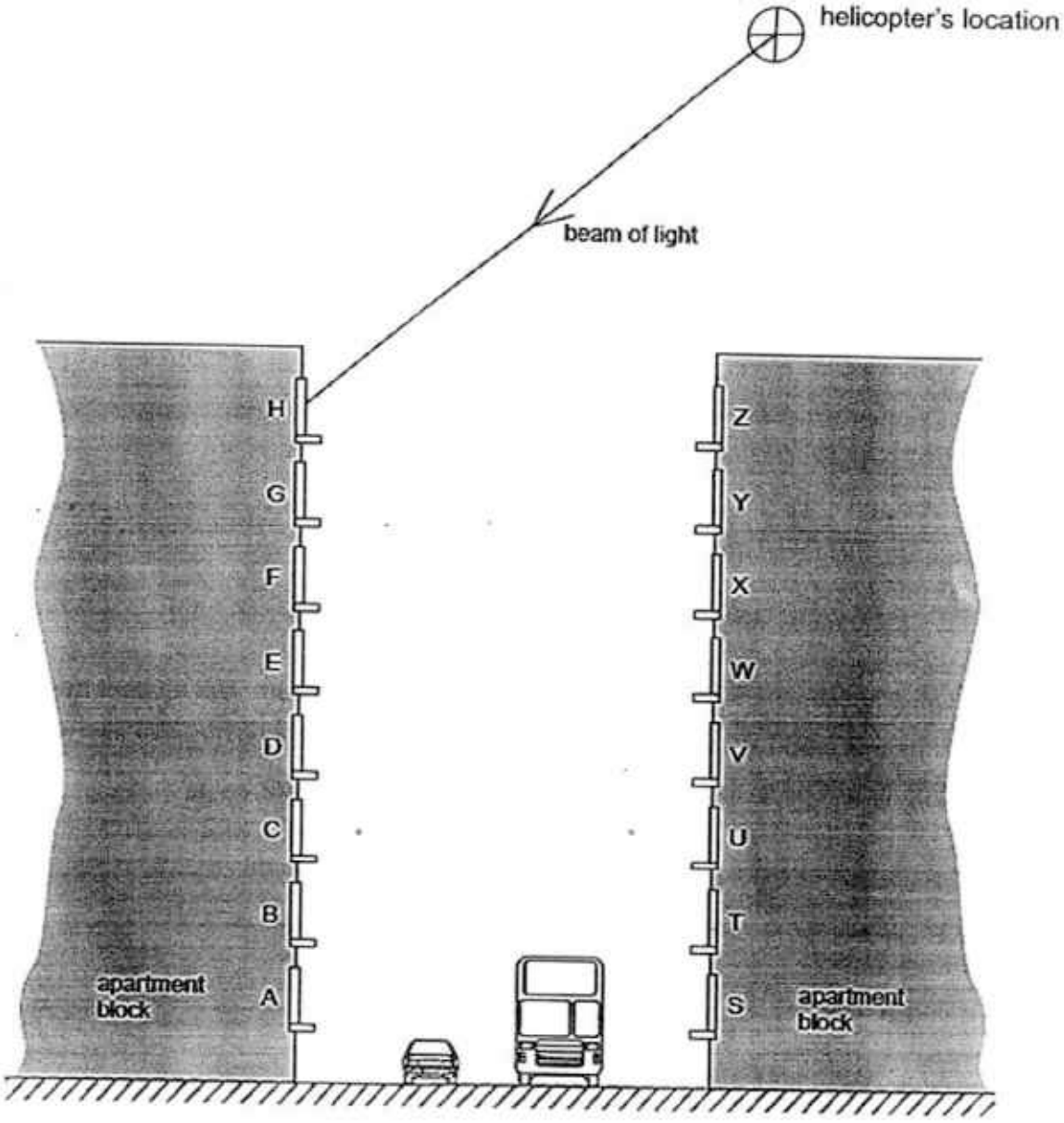
(b) Explain whether a datalogger or Universal Indicator is more useful at determining pH.

.....

.....

.....[2]

6 The diagram shows two blocks of apartments on each side of a road. A beam of light from a helicopter is hitting the top window **H** of the block of apartment on the left.



(a) Complete the diagram above with the following.

(i) the normal at the point where the beam hits window **H** [1]

(ii) the angle of reflection (r) at the point where the beam hits window **H** [1]

(b) Which window does the beam hit next, after a reflection from window **H**.

.....[1]

(c) Identify windows other than **H**, which may also receive light directly from the helicopter.

.....[1]

7 **(a)** A microwave oven has a power rating of 7.5 kW.

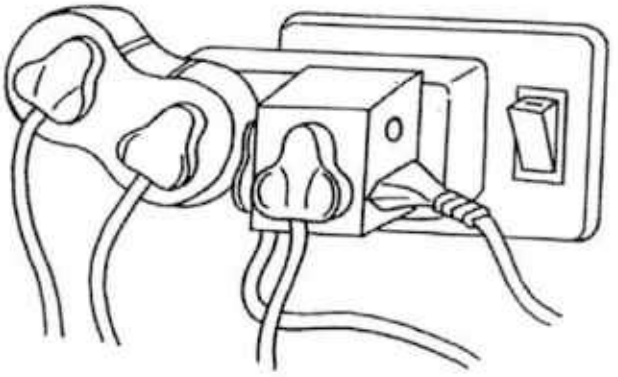
(i) If the oven is used for 2 hours each day, calculate the energy consumption of the oven in kWh in one day.

Energy consumption = ... kWh [1]

(ii) If the cost of energy consumption is $0.25 per kWh, calculate the total cost of using the oven for 2 hours per day over 30 days.

Total cost = $ ..... [2]

(b) Study the picture below that shows an electrical power outlet in a house.



(i) Explain why the house might be in danger.

.....

..... [2]

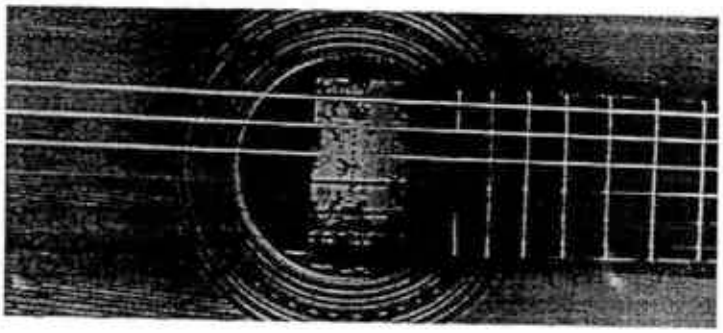
(ii) Suggest a precaution the people in the house can take to avoid the danger.

.....

..... [1]

8 The diagram shows a guitar and a close-up showing the guitar's strings. Sounds are produced when the strings are plucked.

a guitar



guitar strings

State and explain how the sound will change for each of the following situations.

(a) The string is plucked harder.

.....

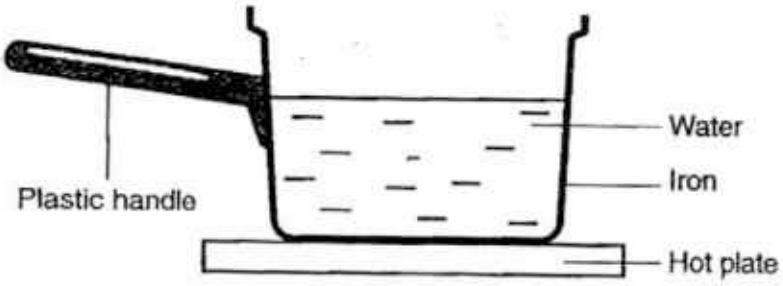
.....[2]

(b) A thinner string is plucked.

.....

.....[2]

9 A saucepan with a thick iron base contains water and is placed on a flat electric hot plate.



(a) State the process by which heat energy is

(i) transferred from the hot plate to the water.

.....[1]

(ii) spread throughout the water.

.....[1]

(b) State **one** reason why the water reaches boiling point more rapidly with a lid on the pan.

.....

.....[1]

(c) The sides of saucepans are often polished. Explain how this reduces heat loss.

.....

.....[1]

- End of Section B -

Section C (30 marks)

10 **(a)** Classify the following as *chemical* or *physical* changes.

(i) expansion of a metal ball .....

(iii) mixing citric acid with baking soda .....

(ii) extracting aluminium from aluminium oxide .....

(iv) using electricity to cover a key with a thin layer of chromium .....

[2]

(b) State the type of chemical reactions for the following.

(i) burning of paper .....

(ii) exposing iron to air and water .....

(iii) heating copper carbonate strongly .....

(iv) reacting hydrogen with oxygen to form water .....

[2]

(c) State **two** differences between thermal decomposition and combination.

.....

.....

.....[2]

(d) Complete the following word equations.

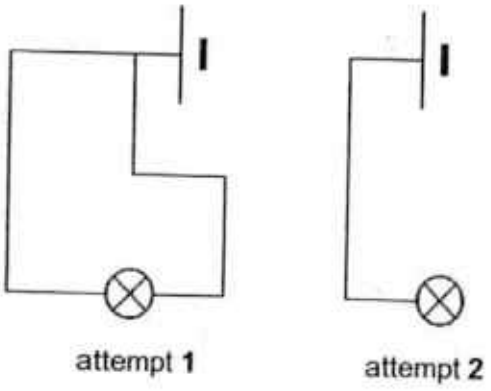
(i) ammonia solution + sulfuric acid → ..... + water

(ii) zinc + hydrochloric acid → zinc chloride + ...

(iii) ..... + ... → potassium nitrate + carbon dioxide + water

[4]

11 **(a)** A student made two unsuccessful attempts to light up a light bulb as shown below.



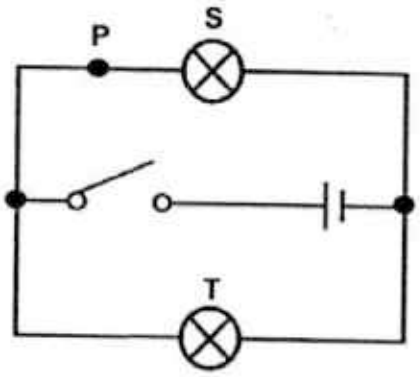
(i) Give **one** reason why the light bulb did not light up in attempt **1** or attempt **2**.

.....

..... [1]

(ii) In the space below, draw a circuit diagram to show how you would connect the light bulb to the electric cell so that the light bulb will light up. [1]

(b) The diagram below shows a diagram of a circuit set up by a student.



(i) Another bulb was connected at point **P**. How would this affect the brightness of bulb **S**? Explain your answer.

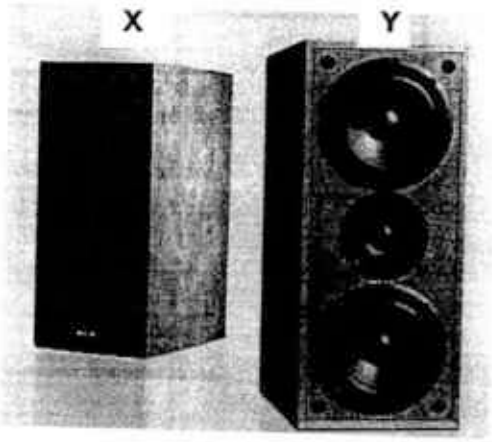
.....

.....

..... [2]

(ii) In the circuit diagram above, draw an ammeter at a position where the overall current of the circuit can be measured. [1]

(c) The figure below shows two speaker units, **X** and **Y**, on sale at an electronics store. The salesperson claims that the sound quality of the two speakers are comparable but speaker **X** has a higher price because it is energy-saving.



The table below gives the power and prices of both speakers.

speaker	**X**	**Y**
energy rating (kW)	2.2	3.6
energy use per hour (kWh)	2.2	3.6
price ($)	700	560

Using the information provided in the table, a person needs to decide which speaker has more value for money.

(i) If the speaker will be used for 1 hour daily, calculate the costs per month of using each speaker. Assume that a month has 30 days and that the cost of electricity is $0.25 per kWh.

Cost of using speaker **X** per month = $ .....

Cost of using speaker **Y** per month = $ ..... [2]

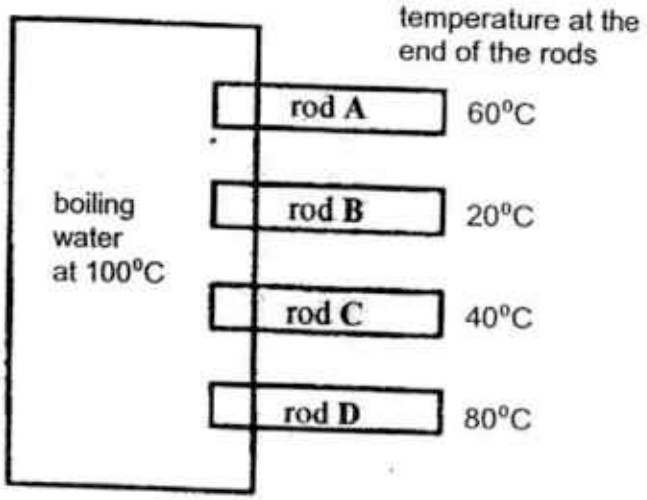
(ii) What is the monthly cost savings of using speaker **X**?

..... [1]

(iii) Speaker **X** costs $140 more than speaker **Y**. If a person purchases speaker **X**, it will take a few months before this $140 is regained through the monthly cost savings in **(ii)**. Calculate the number of months that a person needs to use the speaker to regain the $140. Round up your answer to the nearest month.

Number of months = ... [2]

12 **(a)** A student placed one end of four different rods **A** to **D** of the same size in a beaker of boiling water. The temperature of the ends of the rods are measured after 5 minutes.



(i) Rank the rods from the best to the poorest conductor of heat. Explain your answer.

.....

.....

..... [2]

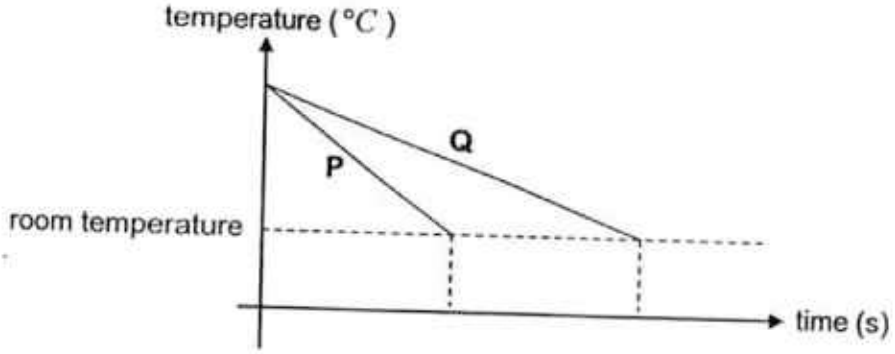
(ii) The student took rods **A** and **D** out of the water and heated one end of each rod over a flame. After 10 minutes of heating, the students observed that the heated rod **A** turned red-hot but not rod **D**. Explain this observation.

.....

.....

..... [2]

(b) Two identical cups with the same volume of boiling water under the same surrounding conditions are left to cool to room temperature. One can is painted silver and the other painted black. Two graphs **P** and **Q** are plotted in accordance to the results of this experiment. Each graph represents a can that cools to room temperature at a specific time.



(i) Describe the heat transfer processes in this experiment

.....

.....

.....

..... [3]

(ii) Which graph represents the black cup and the silver cup? Explain.

.....

.....

.....

..... [3]

– End of Booklet B –

HENDERSON SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2016

2E SCIENCE

Marking Scheme

Section A (30 marks)

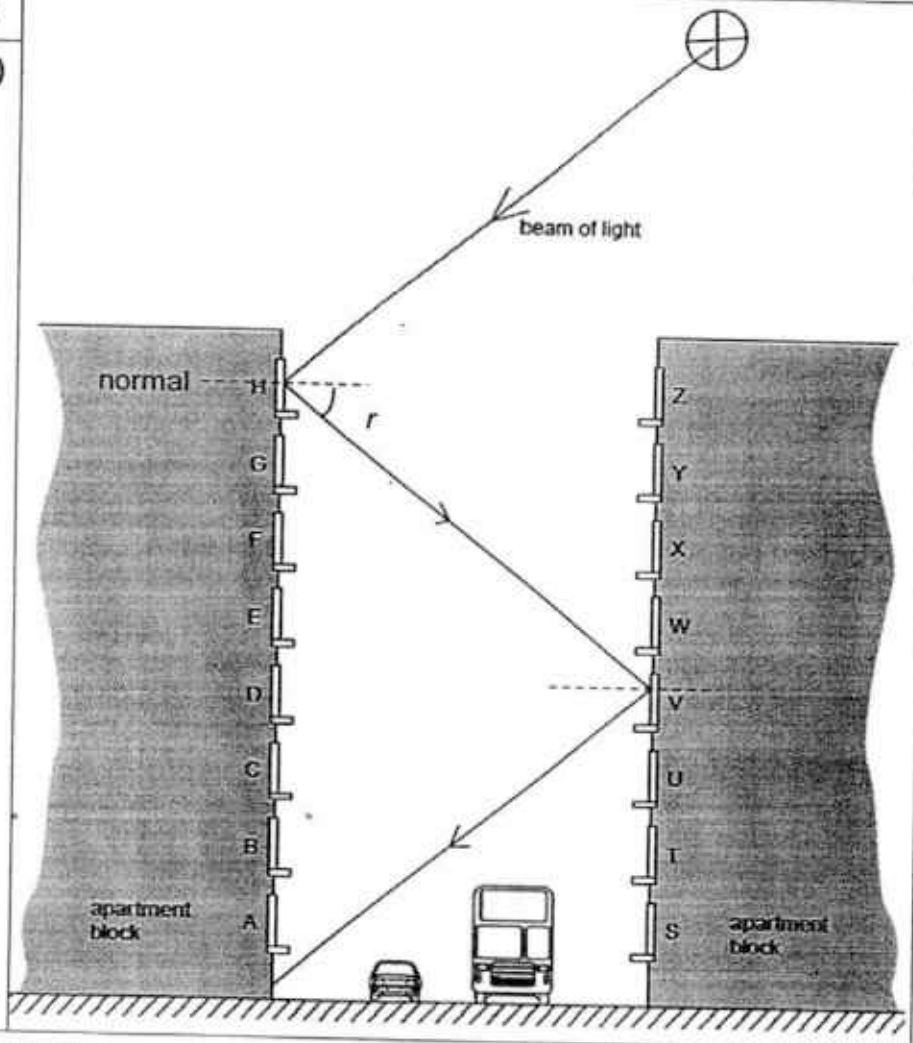
1	2	3	4	5	6	7	8	9	10
A	C	A	C	A	C	D	D	A	B

11	12	13	14	15	16	17	18	19	20
D	B	C	C	D	B	B	D	C	D

21	22	23	24	25	26	27	28	29	30
D	A	D	D	B	A	B	B	B	A

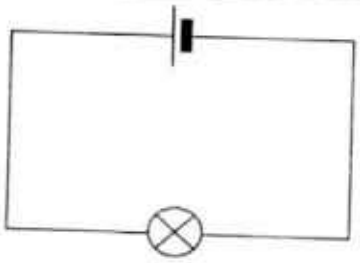
Section B (40 marks)

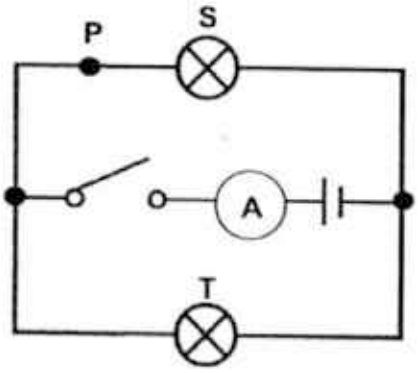
Qn			Answers	Remarks
1	(a)	(i)	**P** – electron, **Q** - nucleus	[1]
		(i)	**A** – magnesium, **B** - chlorine	[1]
	(b)		They are isotopes [1] Because both have 35 protons but X-81 has two extra neutrons. [1] (Same number of protons but different number of neutrons/ atomic mass/ nucleon number.)	[2] must refer to data
2	(a)		**A**	[1]
	(b)		0.5 g sugar per 100cm^3 of water	[1] (or 1g/200cm^3)
3	(a)		Dependent variable – time taken to dissolve Independent variable – temperature of water	[1]
	(b)	(i)	A saturated solution has the maximum amount of solute/dissolved solids whereas more solute/solids can still dissolve in an unsaturated solution.	[1]
		(ii)	Change the solvent (to one where the **P** has a higher solubility).	[1]
	(c)		A solution is clear/lets light through but a suspension is opaque/does not let light through. [1] When left to sit, a suspension will have particles that settle to the bottom, but a solution will not. [1] When filtered, a suspension will leave a residue, but a solution will not. [1]	[2] for any 2
4	(a)		**A** – filter paper, **B** - filtrate	[1] for both
	(b)		The red dye is more soluble in the solvent [1] because it travels a further distance on the chromatogram than the blue dye. [1]	[2]
	(c)		Add alcohol and stir to dissolve **Y**. [1] Filter resultant mixture. [1] **Z** is the residue. [1] Evaporate alcohol from filtrate to get **Y**. [1]	[4]
5	(a)		Extracts **P** and **Q** can be used as indicators [1] because they show different colours in acidic/alkaline/neutral (at least 2) solutions(OR at different pHs). [1]	[2]

	(b)		A datalogger is more useful [1] Because it can be used to differentiate pH more finely compared to Universal Indicator [1] OR to one decimal place whereas Universal Indicator can only differentiate pH to whole numbers. [1]	[2]
6	(a)	(i)		[1] for normal
		(ii)		[1] for reflected ray and angle *r*
	(b)		window V	[1]
	(c)		All windows from A to G.	[1]
7	(a)	(i)	Energy use in 1 day = 7.5 kW x 2 h = **15 kWh**	[1]
		(ii)	Energy use in 30 days [1] = 15 kW x 30 days = 450 kWh Cost [1] = 450 kWh x $ 0.25 per kWh = **$ 112.50**	[2] 1m energy use 1m cost
	(b)	(i)	Too many appliances using one outlet. [1] High current drawn can cause an electrical fire. [1]	[2]
		(ii)	One appliance to one outlet, especially heating appliances.	[1]
8	(a)		Louder sound [1] because a higher amplitude is produced. [1]	[2] No contradictions

	(b)		Higher pitch [1] because a thinner string has a higher frequency [1]	[2] No contradictions
9	(a)	(i)	conduction	[1]
		(ii)	convection	[1]
	(b)		Reduce heat lost via convection.	[1]
	(c)		Shiny surfaces are poor emitters of heat.	[1]

Section C (30 marks)

Qn			Answers	Remarks
10	(a)	(i)	physical	[2] 1m for 2
		(ii)	chemical	
		(iii)	chemical	
		(iv)	chemical	
	(b)	(i)	combustion	[2] 1m for 2
		(ii)	rusting/oxidation	
		(iii)	thermal decomposition	
		(iv)	oxidation/combustion/ combination	
	(c)		Thermal decomposition occurs in the presence of heat but combination does not require heat. [1] Thermal decomposition breaks down one reactant into two or more products, but combination has two or more reactants and results in one or more products. [1]	[2]
	(d)	(i)	ammonia solution + sulfuric acid → ammonium sulfate + water	[1]
		(iii)	zinc + hydrochloric acid → zinc chloride + hydrogen	[1]
		(iv)	potassium carbonate + nitric acid → potassium nitrate + carbon dioxide + water	[2]
11	(a)	(i)	Attempt 1: circuit does not have energy supply/electric cell [1] Attempt 2: circuit is open / Not a complete circuit [1]	either for [1]
		(ii)		[1]
11	(b)	(ii)	The brightness of bulb **S** will decrease. [1] New bulb is connected in series to bulb **S**. [1]	[2]

Qn			Answers	Remarks
11	(b)	(ii)		[1] ammeter in series with electric cell on main branch
	(c)	(i)	Cost of speaker X per month = 2.2 kWh x 30 days x $0.25 per kWh = $16.50 Cost of speaker Y per month = 3.6 kWh x 30 days x $0.25 per kWh = $27	[2] 1m working 1m both answers
		(ii)	Electricity cost saved by **X** per month [1] = $27 – $16.50 = $10.50	[1] for working or answer allow e.c.f.
		(iii)	Number of months for **X** to result in cost savings over **Y** [1] = $140/$10.50 per month = 13.3 ≈14 months (rounded up)	[2] 1m working 1m answer allow e.c.f.
12	(a)	(i)	Rank: D, A, C, B The best conductor of heat will transfer heat to the opposite end the fastest [1]	[2]
		(ii)	Rod A conducts heat away from the heated end more slowly than rod D.[1] Thus the heated end of rod A does reaches higher temperatures (gets red-hot). [1]	[2]
	(b)	(i)	Heat is transferred by conduction from the water to the cup. [1] and by conduction and radiation from the cup to the air. [2]	[3]
		(ii)	P represents the black cup whereas Q represents the silver cup [1] because silver surfaces cools at a slower rate than black ones. [1] silver surfaces are poor radiators of heat compared to black surfaces.[1]	[3]

- End of Examination Marking Scheme -

12

Name : ..... ( ) Class : .....

ST JOSEPH'S INSTITUTION

END-OF-YEAR EXAMINATION
(SECONDARY 2)

LOWER SECONDARY SCIENCE

PAPER 2

5 OCTOBER 2016

1 hour 45 minutes

0800 – 0945 hrs

Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

1. Answer all the questions in the spaces provided on the question paper.
2. Write in dark blue or black pen. You may use a soft pencil for any diagrams, graphs or rough working.
3. Use pi (π) value preprogrammed in calculator.
4. Express your final answer in 3 significant figures where appropriate, show all working, and include units in all your working.
5. Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Section A									
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10

Section B		
B1	B2	B3

For Markers Use	
Section A	/40
Section B	/30
Total	/70

This document consists of **19** printed pages.

[Turn over]

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

*58-71 Lanthanoid series

†90-103 Actinoid series

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

Key: $^{a}X_{b}$

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

Section A (40 marks)

*Answer **all** questions in the spaces provided.*

A1 A student comes up with the hypothesis that the more weight a toy car has, the faster it will move down a slope. He makes use of the set up shown in **Figure A1** below to test his hypothesis.

Figure A1

a. Based on his hypothesis, state the [2]

i. dependent variable;

.....

ii. independent variable;

.....

b. State one control variable in the experiment. [1]

.....

c. Briefly describe the steps the student should carry out in order to test his hypothesis. [2]

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A2 A golf ball at rest on a rough surface is given a light push and it rolls in the direction shown in **Figure A2**.

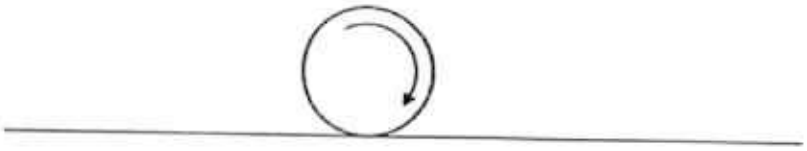

Figure A2

a. On the diagram, **draw** and **label** one vertical force and one horizontal acting on the golf ball. [2]

b. Explain why the golf ball comes to a stop eventually. [1]

.....

.....

A3 **Figure A3** shows an electric circuit and the conventional current flow.

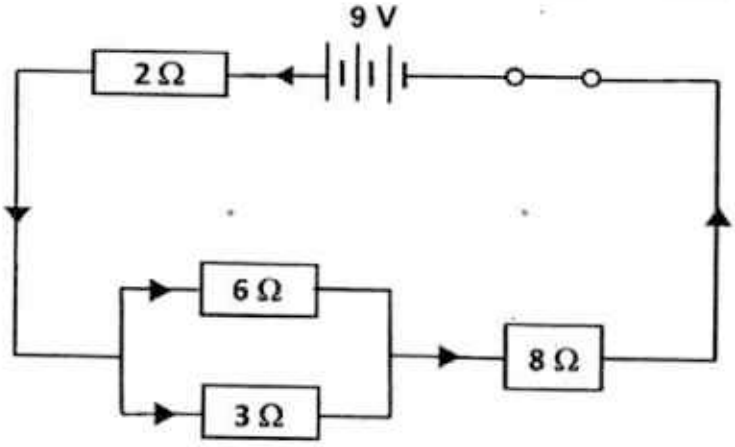

Figure A3

a. Calculate the effective resistance of the circuit.

Effective resistance = ... [2]

b. Calculate the potential difference across (i) 2 Ω resistor, and (ii) 8 Ω resistor.

i. Potential difference across 2 Ω resistor = ...

ii. Potential difference across 8 Ω resistor = ... [1]

A4 The table below shows the number of protons, neutrons and electrons of five particles represented by the letters **L** to **P**. The particles are atoms or ions. The letters representing the particles are not the symbols of the elements.

Particle	Electrons	Protons	Neutrons
L	6	6	6
M	1	1	0
N	12	12	12
O	10	12	12
P	18	16	8

Use the letters **L** to **P** to answer the following questions.

a. Which of the above particles is a metal? Use the electronic structure of the particle to support your answer. [2]

.....

.....

.....

.....

b. Particles **L** and **M** are involved in bonding to form a particle with the chemical formula of LM_4.

i. Write down the electronic structure of particles **L** and **M** below. [1]

L: .....

M: .....

ii. Hence, state the type of bonding between particles **L** and **M**, giving a reason for your choice. [2]

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A5 Peter was conducting an experiment using aqueous sulfuric acid and aqueous sodium hydroxide shown in **Figure A5** below. Both are colourless solutions.

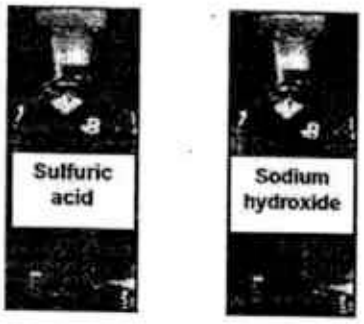

Figure A5

a. Write down the chemical formula for the solutions. [2]

i. Sulfuric acid : .....

ii. Sodium hydroxide : .....

b. Peter filled three beakers with sulfuric acid, sodium hydroxide and water respectively. However, he did not label the beakers and thus he had difficulty identifying the solutions as all of them are colourless.

Describe a simple test that Peter can conduct to identify the beaker containing sulfuric acid from the rest. [2]

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A6 **Figure A6** below shows the cross-section of plant organs that are involved in the movement of substances in a green plant.

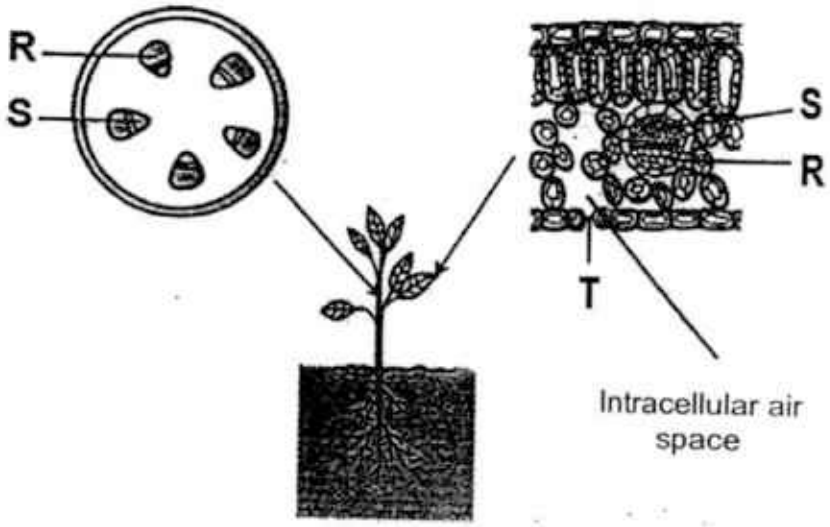

Figure A6

a. Identify the parts labelled; [1]

R: .....

S: .....

b. Identify **T** and name the cells that control the opening of **T**. [1]

.....

c. State and define the process which is responsible for the movement of water molecules from the intracellular air space to the surrounding environment via **T**. [2]

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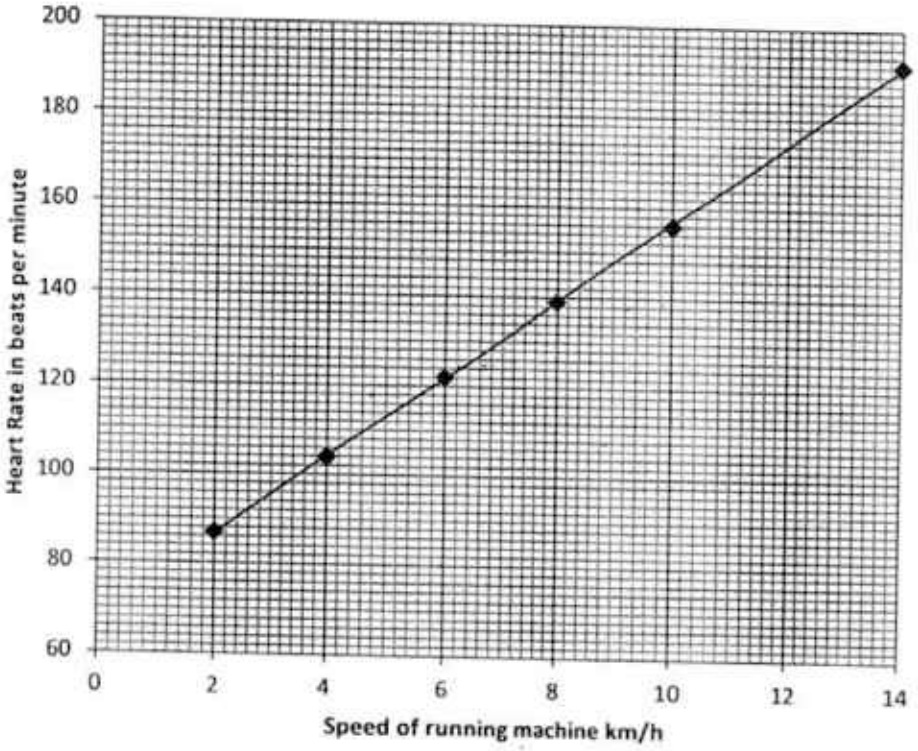
A7 A scientist monitors the heart rate of an athlete exercising on a running machine. Results of her experiment are shown in the table and plotted graph below.

speed of running machine in km / h	2	4	6	8	10	14
heart rate in beats / minute	87	104	122	139	156	192



a. Use your graph to state the heart rate of this athlete when he is running at a speed of 12 km / h. [1]

.....

b. Use ideas about aerobic respiration to explain the shape of the graph. [3]

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.....

c. The heart pumps blood around the body. This supplies oxygen for aerobic respiration in the body cells.

i. How is oxygen carried in the blood? [1]

.....

.....

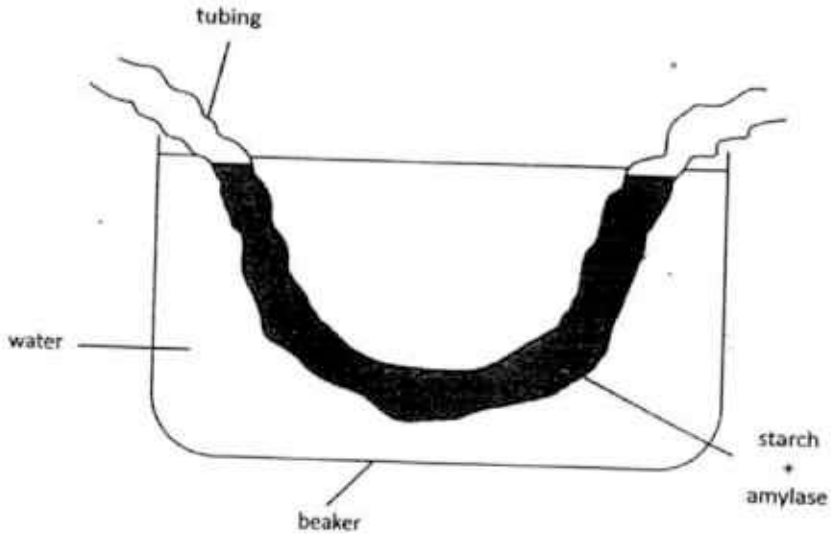
ii Arteries are blood vessels that may carry oxygenated and deoxygenated blood. Name one artery that carries deoxygenated blood and explain why. [2]

Name of artery: .....

Explanation: .....

.....

A8 **Figure A8** shows a model of digestion and absorption in the alimentary canal. This model comprises of a beaker containing water. A tubing containing starch solution and amylase is immersed in the water. The tubing is permeable to water and sugars but not starch.



In this model, what represents,

a. the small intestine: ..... [1]

b. the blood: ..... [1]

c. the food: ..... [1]

A9 The female reproductive system is shown in **Figure A9**.

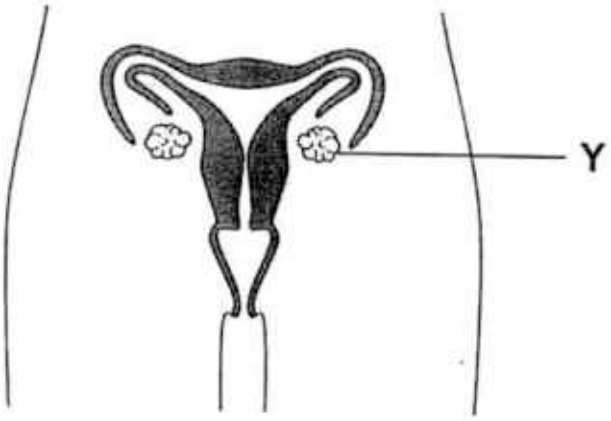


Figure A9

a. On **Figure A9**, mark the oviducts with the letter **X**. [1]

b. State the process that occurs at **Y**? [1]

.....

A10 **Figure A10** shows the number of adults with HIV/AIDS in sub-Saharan Africa between 1985 and 2005.

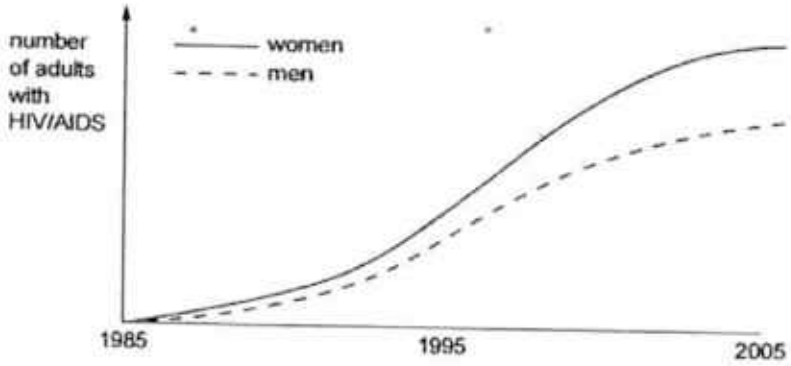


Figure A10

a. State two trends shown by the graph. [2]

i. .....

.....

ii. .....

.....

10

b. Suggest two ways by which the spread of HIV/AIDS may be reduced. [2]

i. .....

.....

ii. .....

.....

Section B (30 marks)

Answer all question in the spaces provided on the question paper.

B1 **Figures B1(i)** and **B1(ii)** show a 3-pin fused plug and an exposed power cable.

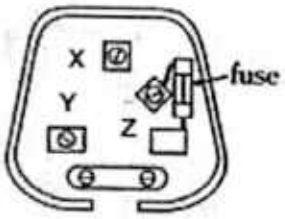


Figure B1(i)

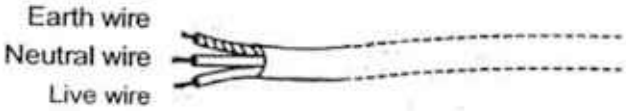


Figure B1(ii)

a. Complete **Table B1** by: [3]

(i) Using the letters **X**, **Y** and **Z** for the terminals, and
(ii) Identifying the corresponding colour of the wires connected to the terminals.

Terminals of 3-pin plug	Terminals of 3-pin plug	Colour of wires
	Earth	
	Neutral	
	Live	

Table B1

b. What is the purpose of the earth wire? [1]

.....

.....

.....

.....

c. The 3-pin plug is connected to an electrical appliance which has an operating current of 8 A.

	Fuse 1	Fuse 2	Fuse 3
Current rating	8 A	10 A	13 A

Which of the following three fuses **1**, **2** or **3** shown above is most suitable to be used in the plug? Explain your choice. [1]

.....

.....

.....

d. The power rating of the appliance is 90 W and it is switched on for 30 minutes each day.

i. Calculate the amount of electrical energy, in kWh, used by the appliance in a week.

Electrical energy used by appliance in a week = ... [2]

ii. Given that 1kWh costs 27 cents, calculate the cost of using the appliance for a month.

Cost of using the appliance = ... [1]

e. Describe one electrical hazard in household electrical circuits. [2]

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B2 Since the beginning of the industrial revolution in the early 1800s, fossil fuel-powered machines have driven an unprecedented burst of human industry and advancement. The unfortunate consequence, however, has been the emission of billions of tonnes of carbon dioxide and other greenhouse gases into Earth's atmosphere.

a. Draw a dot and cross diagram of a carbon dioxide molecule showing only valence electrons in the space provided below. [2]

b. Carbon dioxide in the atmosphere can be absorbed by the ocean water. This helps to reduce the amount of carbon dioxide in the air. When carbon dioxide dissolved in the ocean, it reacts with water according to the flow chart shown in **Figure B2b(i).**

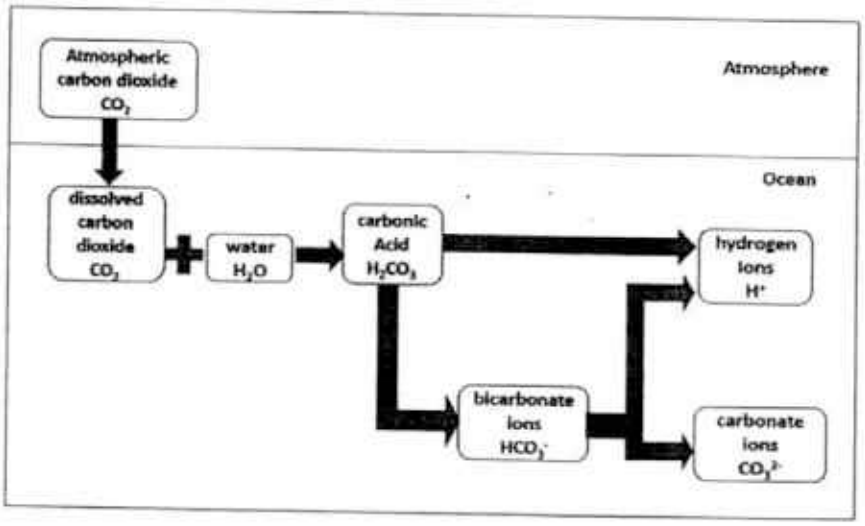

Figure B2b(i)

Figure B2b(ii) below shows how the concentration of carbon dioxide affects the acidity of the ocean water.

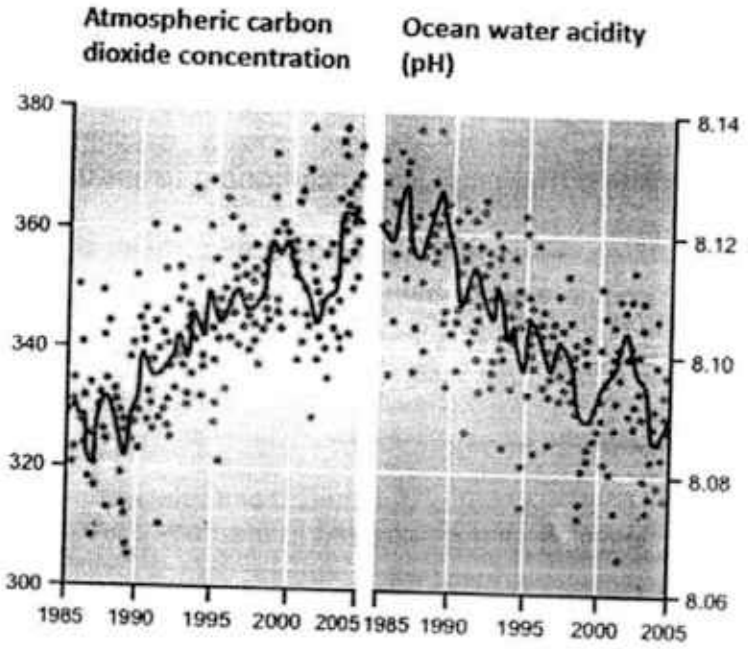

Figure B2b(ii)

i. Explain in terms of hydrogen ions, why there is a general decrease in ocean pH from 1985 to 2005. [2]

.....

.....

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.....

ii. The key component in the shells and skeletons of many marine species is calcium carbonate ($CaCO_3$). Laboratory studies were made on a marine species pteropod's shell. The shell when placed in sea water with pH levels projected for the year 2100, slowly dissolves after 45 days.

Explain why the pteropod's shell dissolve in the sea water. [1]

.....

.....

.....

.....

c. Scientists say they have found a workable way of reducing carbon dioxide levels in the atmosphere by adding lime to seawater. And they think it has the potential to dramatically reverse carbon dioxide accumulation in the atmosphere. *(Cath O'Driscoll in SCI's Chemistry & Industry magazine)*

Lime is the name of a natural mineral, calcium oxide. It can be obtained by heating calcium carbonate (limestone).

i. Write down the electronic configuration of a calcium atom and an oxygen atom. [1]

Calcium: .....

Oxygen: .....

ii. Hence, draw a dot and cross diagram of calcium oxide showing all the electrons in the space provided below. [2]

iii. Describe with the help of a word equation, how lime (calcium oxide) can help reduce the ocean's acidity (carbonic acid). [1]

.....

.....

iv. Suggest another way to help reduce the ocean's acidity level. [1]

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B3 a. **Figure B3a** below shows the various organs in the human digestive system.

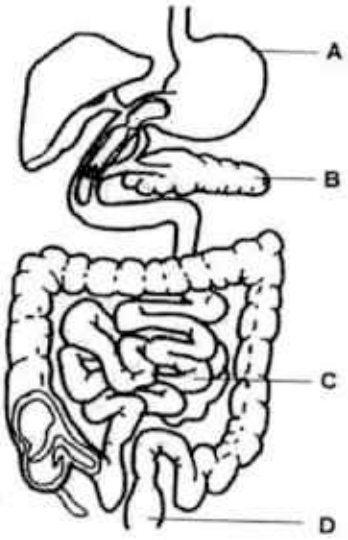


Figure B3a

i. Identify the following parts. [2]

A: ..... C: .....

B: ..... D: .....

ii. Amylase is an enzyme that helps digest carbohydrates. Name the two organs where amylase is produced. [1]

.....

.....

iii. Give the word equation for any one of the enzymatic action named in **(a)(ii)**. [1]

.....

.....

b. Enzymes are affected by changes in pH. In general, enzymes have an optimum pH.

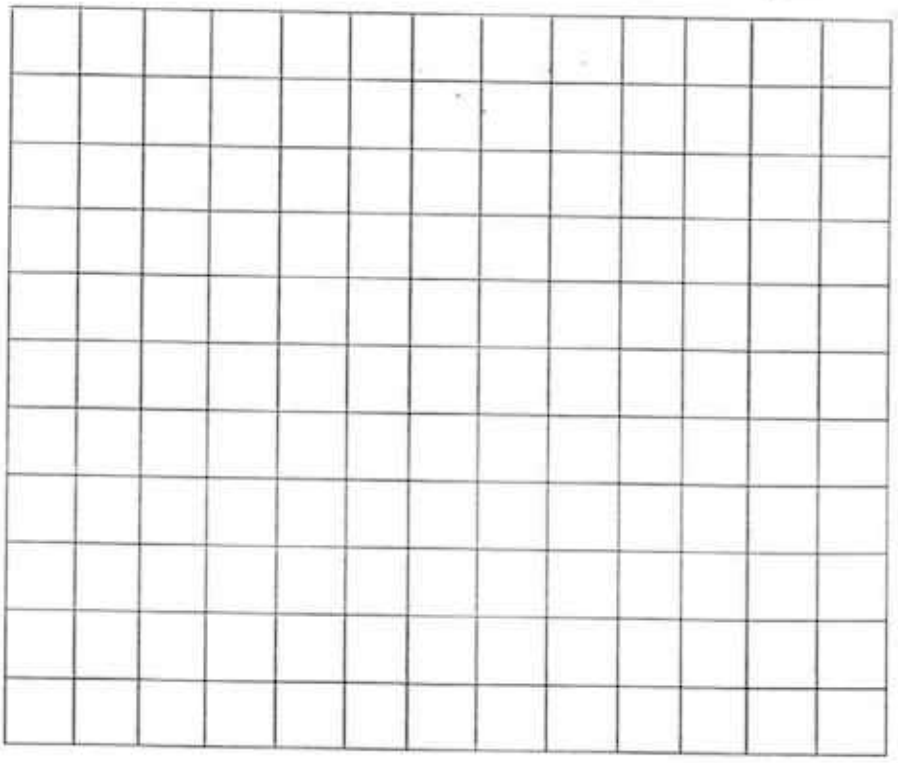
However, the optimum is not the same for each enzyme. The following procedure demonstrates the effect of pH on the activity of the enzyme trypsin.

1. 10 ml of a protein solution is added to each of five numbered test tubes.
2. The pH of each of the test tubes is maintained.
3. An equal mass of trypsin solution is added to each test tube.
4. The temperature is kept constant at 37°C.
5. The results are recorded at the end of the three hours in the table below.

Test Tube	pH	Mass of Product / g
1	2.0	0.3
2	3.5	0.8
3	7.0	1.7
4	8.5	3.5
5	10.0	2.1

i. Using the data from the table, draw a line graph of the "Mass of Product vs. pH" (plot the pH on the x-axis). [3]

Scale
X-axis: use 1 square = 1 unit
Y-axis: use 1 square = 0.5 gram



ii. Explain why a smaller mass of product is found in test tubes **1** and **2** than in others. [2]

.....

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.....

iii. Describe the relationship between pH and the mass of product formed. [1]

.....

.....

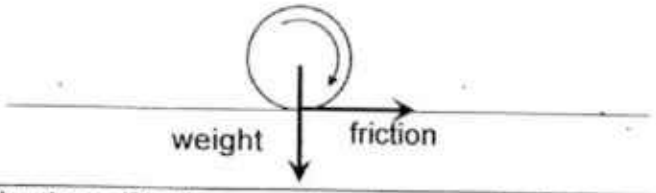
End of paper

Answers to LSS Sec 2 – Paper 2

End-of-Year Examination 2016

Section A

A1	a.	Based on his hypothesis, state the		[2]
		i.	dependent variable;	
			Time taken	
		ii.	independent variable.	
			Weight of toy car	
	b.	Control variable		
		Height from which toy car is released/slope used/gradient of slope		
	c.	Briefly describe the steps the student should carry out in order to test his hypothesis.		[2]
		Measure weight of toy car Release toy car from fixed point Record time taken to reach fixed point at the bottom of slope [Calculate speed using distance/time if dependent variable is speed] Repeat using toy car of different weight		

A2	A golf ball is given a light push and it rolls in the direction shown in the diagram.	
	(a) On the diagram, draw and label two forces acting on the golf ball.	[2]
		
	(b) Explain why the golf ball comes to a stop eventually.	[1]
	Kinetic energy of the ball is converted to heat and sound due to friction therefore the ball stops eventually.	

A3	(a)	$\frac{1}{R} = \frac{1}{6} + \frac{1}{3} = \frac{1}{2}$ $R = 2\,\Omega$ $\therefore$ effective resistance, $R_{total} = 2 + 2 + 8 = 12\,\Omega$	[2]
	(b)	$I_1 = \frac{\varepsilon}{R_{total}} = \frac{9}{12} = 0.75\text{ A}$	[2]
	(i)	$\therefore$ potential difference across 2 ohm resistor = 0.75 × 2 = 1.5 V	
	(ii)	$\therefore$ potential difference across 8 ohm resistor = 0.75 × 8 = 6 V	

	(c)	$I_2 = \frac{9-6-1.5}{6} = 0.25\ A$	

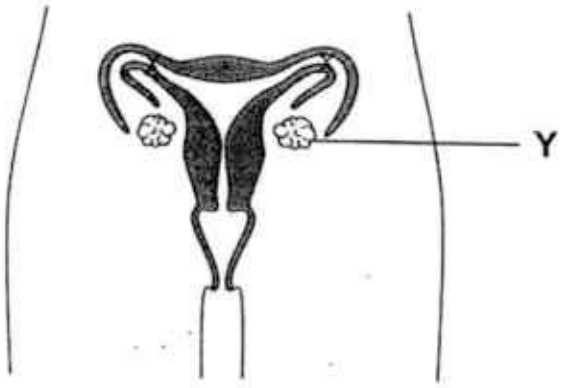
A4	a.		Particle N is a metal because N's electronic structure is 2,8,1. It has 1 valence electron thus it is in group I in the periodic table / it will form a cation of 1+ charge.	[2]
	b.	i.	L : 2,4 M : 1	[1]
		ii.	Covalent bonding. One atom of L shares its four valence electrons with four atoms of M forming four single L-M bonds to reach stable octet electronic configuration.	[2]

A5	a.	Sulfuric acid : H_2SO_4 Sodium hydroxide : NaOH	[2]
	b.	Add a few drops of universal indicator /methyl orange to each beaker separately. If it is sulfuric acid, universal indicator will turn from green to red (UI) /orange to red (methyl orange. Or dip both red and blue litmus paper into each of the beakers. If it is sulfuric acid, it will turn from blue litmus red. Or add some calcium carbonate into each of the beakers. There will be effervescence observed in the beaker with sulfuric acid	[2]

A6	a.	R Phloem S Xylem	[1]
	b.	Stoma. The guard cells control the opening are of T.	[1]
	c.	Transpiration. The process whereby plants lose water through evaporation from aerial parts of the plant (mainly the stomata of leaves)	[2]

A7	a.		read +/− one small square from graph (expect 174)	[1]
	b.		at higher speed muscles are used more / more active / contract more frequently; respiration rate increases so more oxygen / oxygenated blood needed; heart rate increases to supply more oxygen / oxygenated blood	[2]
	c.	i.	It is carried by haemoglobin in red blood cells	[1]
		ii.	Pulmonary artery. Blood coming from the head and the rest of the body is deoxygenated.	[2]

A8		In this model, what represents,	
	a.	tubing	[1]
	b.	water	[1]
	c.	Starch (do not accept starch and amylase)	[1]

A9	The female reproductive system is shown in Figure A9.  Figure A9		
	a.	On Figure A9, mark the oviducts with the letter X.	[1]
	b.	State and explain briefly the process that occurs at Y?	[1]
		Ovulation.	

A10	a.	State two trends shown by the graph.	[2]
		Any two of the following: i. number of affected people increasing ii. fastest increase in 1990s any 3 iii. rate of increase slows (after 1998) iv. more women affected than men	
	b.	Suggest two ways by which the spread of HIV/AIDS may be reduced.	[2]
		Any two of following: i. education / make people aware ii. Don't share needles iii. use of condoms iv. fewer sexual partners / abstinence	

Section B

B1 (a) [3]

Terminals of fused plug	Wires of power cable	Colour codes of wires in power cable
X	**Earth**	green/yellow
Y	**Neutral**	blue
Z	**Live**	brown

[1/2 mark for each correct answer]

(b) [1]

The purpose of the earth wire is to divert excess current flowing on the external metal parts of appliance to the ground/electrical socket, if the live wire touches the metal case. This is so that the user will not get an electric shock.

(c) [1]

10 A. Fuse value chosen should be slightly higher than rated current. This ensures that the current is cut off as soon as a fault develops in the appliance. [idea that current may increase to a value that causes appliance to be damaged if not cut once fault develops]

(d) [3]

(i) E = 0.09 kW × ½ h × 7 days = 0.315 kWh [1m for correct conversion of W to kW and minutes to hours]

(ii) cost = 0.315 kWh × 27 cents per kWh × 4 = 34.0 cents

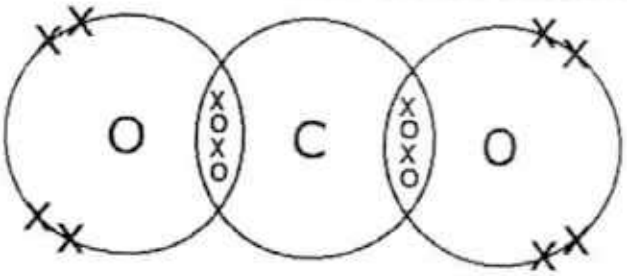
allow ecf

(e) [2]

Any one of the following:

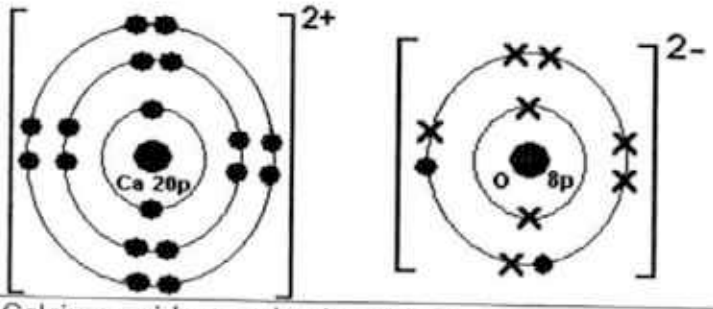
- Worn insulation – may cause electric shock if user comes into contact with bare live wire
- Overloading – may cause overheating and electrical fires if current is too high
- Damp conditions – result in short circuit and electric shocks if user with damp hands handle electrical appliances

B2 a. i. [2]



ii. [2]

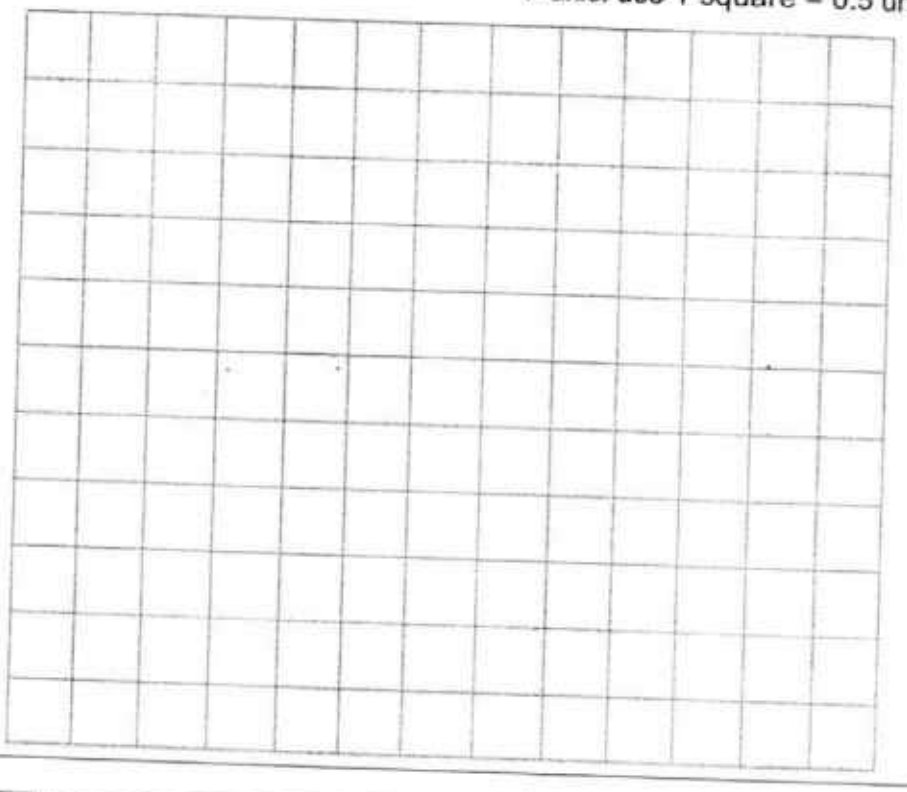
When carbon dioxide dissolves in the ocean, it forms carbonic acid which ionizes (partially) to produce hydrogen ions. This increases the total concentration of hydrogen ions in the ocean decreases the pH value.

		iii.	The calcium carbonate in the shell reacts with the acid / hydrogen ions present in the ocean to form salt, carbon dioxide and water.	[1]
	b.	i.	Ca (2,8,8,2) O (2,6)	[1]
		ii.		[2]
		iii.	Calcium oxide + carbonic acid → calcium carbonate + water	[1]
		iv.	By reducing the emission of carbon dioxide / using energy efficiently and conserving energy so that less energy is produced by burning fossil fuel which will produce carbon dioxide.	[1]

B3	a.	i	A Stomach B Pancreas C Small intestine D Rectum	[2]
		ii	Mouth. Pancreas	[1]
		iii	Starch – Salivary amylase → maltose , <u>or</u> Starch – Pancreatic amylase → maltose	[1]

	b.	i	Using the data from the table, draw a line graph of the "Amount of Product vs. pH" (plot the pH on the *x*-axis). Axis + Plotting + Line	[3]

Scale
X-axis: use 1 square = 1 unit
Y-axis: use 1 square = 0.5 unit



		ii	Less products are found in test tubes 1 and 2 than in the others as these tubes are placed in an acidic environment. Trypsin which is found in the small intestine works best in an alkaline condition and thus more products are found in the other tubes.	[2]
		iii	The amount of product formed increases from an acidic condition (low pH) till an alkaline condition (higher pH).	[1]

NAME	CLASS	INDEX NO.

Parent's / Guardian's Signature: _____ Date: _____

ST. PATRICK'S SCHOOL
END-OF-YEAR EXAMINATIONS 2016

SUBJECT : GENERAL SCIENCE

LEVEL : SECONDARY 2 EXPRESS

DATE : 07 OCT 2016

DURATION : : 2 HOUR

INSTRUCTIONS TO CANDIDATES

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

1. Write your name, class and index number on the **Question Paper** and the **Optical Answer Sheet** in the spaces provided. **It is also required that you SHADE your index number on the Optical Answer Sheet.**
2. This paper consists of **Three (3) Sections: Section A, Section B** and **Section C.**
3. Answer **ALL** questions in **Section A** on the **Optical Answer Sheet** provided.
4. Answer **ALL** questions in **Section B** in the spaces provided.
5. Answer **ANY THREE FULL** questions out of 4 in **Section C** on the **writing paper** provided. Start each question on a new sheet of paper.
6. Calculators may be used where necessary. **Give answers to Three (3) significant figures.**
7. **DO NOT DETACH** any sections from this paper.
8. At the end of the examination, arrange your answers to **Section C in order** and **tie with the string provided.**
9. Submit the **Optical Answer Sheet, this paper and answers to Section C SEPARATELY.**

INFORMATION FOR CANDIDATES:
The number of marks is given in brackets [ ] at the end of each question.

For Examiner's Use Only

Section	A (30 m)	B (40 m)	C (30 m)	Total (100 m)	Grade	Target Grade
Score						

This question paper consists of 24 printed pages.
A copy of the Periodic Table has been printed on page 24.

SECTION A : [30 marks]

*Each question is provided with **four** possible answers (**A**, **B**, **C** and **D**). Select the most appropriate answer and **shade** your answer in the **Optical Answer Sheet** provided.*

1 Which one of the following statements about mass is true?

A Mass varies according to location.
B Mass and weight are equal and interchangeable.
C Mass varies according to the amount of matter in the object.
D Mass varies according to the shape the object is molded into.

2 Which of the following properties make(s) copper a suitable material for electrical wiring?

I High ductility
II High malleability
III High melting point
IV High electrical conductivity

A I and II only
B III and IV only
C II, III and IV only
D I, II, III and IV

For questions **3** and **4**, refer to the data, which shows the number of hours and electrical energy consumed by Timothy's home appliance in a day.

Appliance	Electrical energy consumed per day (kWh)	Duration of usage per day (hour)
W	2.5	1
X	3.5	1
Y	17.0	17
Z	21.0	14

3 Which one of the following appliances has the lowest power rating?

A W
B X
C Y
D Z

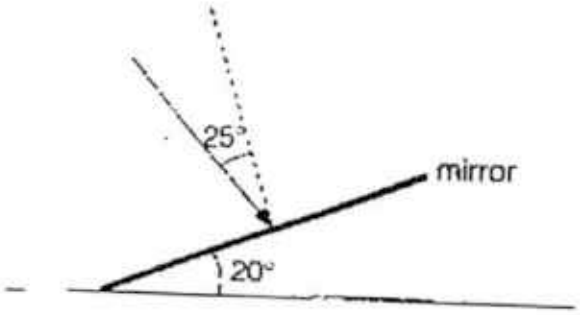
4 If the power supply company charges $ 0.20 per kWh, what is the total cost of energy consumed by all the appliances in 30 days?

A $ 8.80
B $ 117.80
C $ 264
D $ 3534

5 Which one of the following is true of a fuse?

A A fuse should be fixed on the earth wire.
B A fuse can only be found in a three-pin plug.
C A fuse of any current rating can be used in a circuit.
D A fuse blows when too large a current flows through the circuit.

6 A plane mirror is inclined at 20 ° to the horizontal floor. A light ray strikes at an angle of incidence of 25 °.



What is the angle of reflection?

A 5 °
B 20 °
C 25 °
D 45 °

7 Which one of the following colours is not found in the spectrum of white light?

A Black
B Violet
C Yellow
D Indigo

8 What colour would a yellow shirt appear under cyan light in a dark room?

A Red
B Green
C Blue
D Black

9 Isaac accidentally caused a dent in his ping-pong ball. Which one of the following will restore the ball to its original shape?

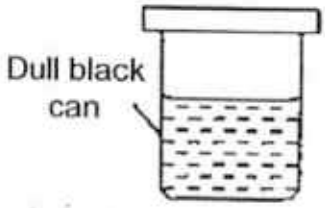
A Place the ball in hot water.
B Place the ball in the freezer.
C Squeeze the ball on all sides.
D Heat the ball over a non-luminous flame.

10 When you stand on bare feet with one foot on the stone floor and the other on the carpet, the stone floor feels colder than the carpet. What is the most likely explanation?

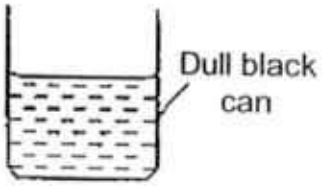
A Air is unable to circulate through the carpet fibres.
B The stone floor is at a lower temperature than the carpet.
C The carpet radiates more heat towards your feet as compared to the stone floor.
D The stone floor conducts more heat away from your feet as compared to the carpet.

11 Four similar cans contain the same volume of water initially at 90 °C. Which one of the following cans of water will be the warmest after 5 minutes?

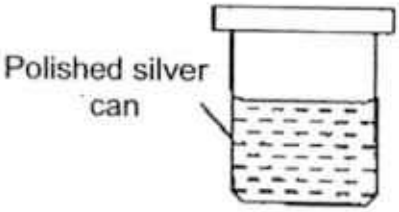
A



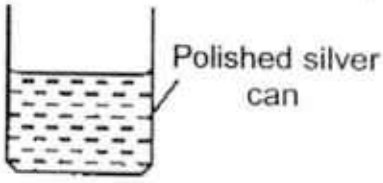
B



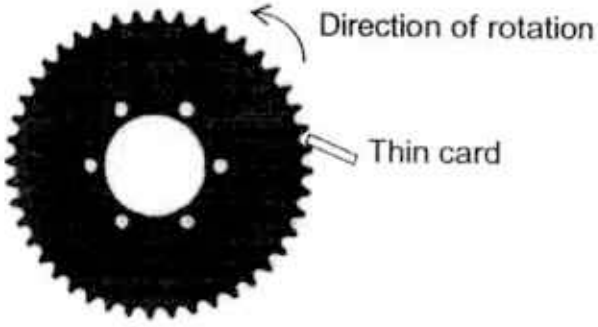
C



D



12 A piece of thin card is held against the teeth of a wheel. When the wheel is turned at a high speed, a note is heard. Which one of the following will **lower** the pitch of the note?



A Use a thinner card.
B Turn the wheel more quickly.
C Use a wheel that has fewer teeth.
D Press the card against the wheel with a smaller force.

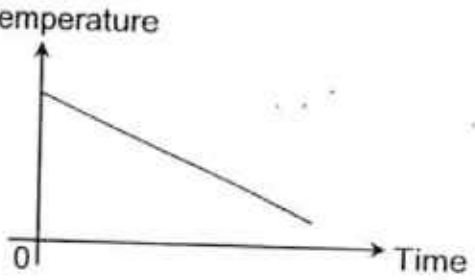
13 Which one of the following is **not** an atom?

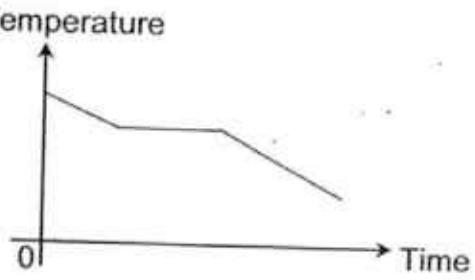
	Neutrons	Protons	Electrons
A	7	8	8
B	8	9	10
C	11	10	10
D	11	11	11

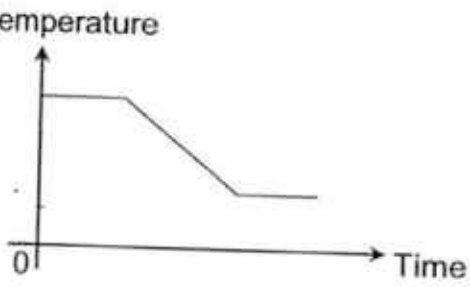
14 Shane found an unknown element. He later finds that it has 5 electrons more than a sodium atom. What element could it be?

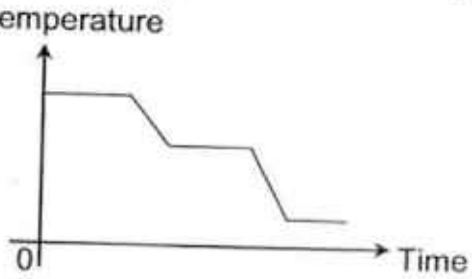
A Silicon
B Sulfur
C Carbon
D Fluorine

15 Which graph shows the temperature change when steam at 120 °C is cooled to 20 °C?

A


B


C


D


16 Which one of the following is the reason why matter expands upon heating?

A Heat energy causes the particles to move faster and become further apart.
B Heat energy causes the particles to move faster and become closer together.
C Heat energy causes the particles to move slower and become further apart.
D Heat energy causes the particles to move slower and become closer together.

17 What happens when the temperature of a solution is increased?

A Rate of dissolving decreases.
B The solution will become diluted.
C Solubility of the solute increases.
D Less solute can be dissolved in the solvent.

18 Which one of the following groups contains mixtures only?

A Air, milk, carbon
B Salt, sugar, water
C Sulfur, oxygen, steel
D Milk, seawater, blood

19 Which one of the following is an important factor for the successful use of paper chromatography?

A Presence of heat
B Difference in colours
C Difference in boiling points
D Difference in solubility of dyes

20 Which one of the following products is incorrect when the reactant undergoes combustion in air?

	Reactant	Product
A	Sulfur	Hydrogen sulfide
B	Carbon	Carbon dioxide
C	Hydrogen	Water
D	Magnesium	Magnesium oxide

21 Which one of the following is a balanced chemical equation?

A $K_2MnO_4 + Cl_2 \rightarrow KMnO_4 + 2KCl$
B $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$
C $4NaHCO_3 \rightarrow 2Na_2CO_3 + H_2O + 2CO_2$
D $Al + NaOH + 4H_2O \rightarrow NaAl(OH)_4 + 2H_2$

22 A ring of bark is removed from a balsam plant.

What causes the swelling in the stem above the removed ring?

A Accumulation of salts and water due to the removal of the xylem tissue.
B Accumulation of salts and water due to the removal of the phloem tissue.
C Accumulation of food materials due to the removal of the xylem tissue.
D Accumulation of food materials due to the removal of the phloem tissue.

23 Which one of the following processes is responsible for pulling water up a plant?

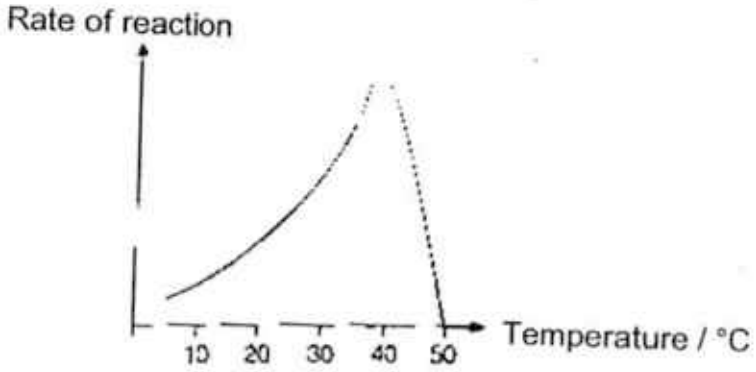
A Osmosis
B Diffusion
C Transpiration
D Photosynthesis

24 Where does chemical digestion take place?

I Mouth
II Stomach
III Small intestine
IV Large intestine

A I and II only
B III and IV only
C I, II and III only
D I, II, III and IV

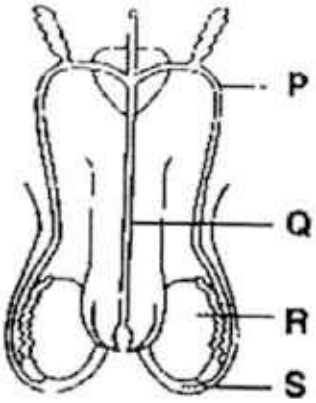
25 The graph shows the relationship between temperature and the rate of an enzymatic reaction.



Which one of the following statements is most appropriate?

A The enzymes are inactive at 40 °C.
B The enzymes denature at low temperatures.
C The optimum temperature for the reaction is 50 °C.
D The enzymatic activity increases with temperature up to 40 °C.

26 The diagram shows the reproductive system of a man.



What are the structures **P**, **Q**, **R** and **S**?

	P	Q	R	S
A	Sperm duct	Urethra	Testis	Scrotum
B	Sperm duct	Urethra	Scrotum	Testis
C	Urethra	Sperm duct	Scrotum	Testis
D	Urethra	Sperm duct	Testis	Scrotum

27 Which one of the following correctly describes ligation?

A It is a permanent contraceptive method.
B It is performed to the sperm ducts of a man.
C It prevents implantation of embryo from occurring.
D It involves the removal of the ovaries from a woman.

28 A newly wedded couple decides to do some family planning to avoid pregnancy. In which week should the couple not have sexual intercourse if the woman's menstrual period started on 5 Feb?

Week	Feb						
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
A	1	2	3	4	5	6	7
B	8	9	10	11	12	13	14
C	15	16	17	18	19	20	21
D	22	23	24	25	26	27	28
	29						

29 A campaign is introduced to the public to reduce the spread of HIV. Which one of the following advice should be included?

A Do not hug people who are carriers of HIV.
B Do not talk with people who are carriers of HIV.
C Do not share cups with people who are carriers of HIV.
D Be faithful and have sexual intercourse with one partner only

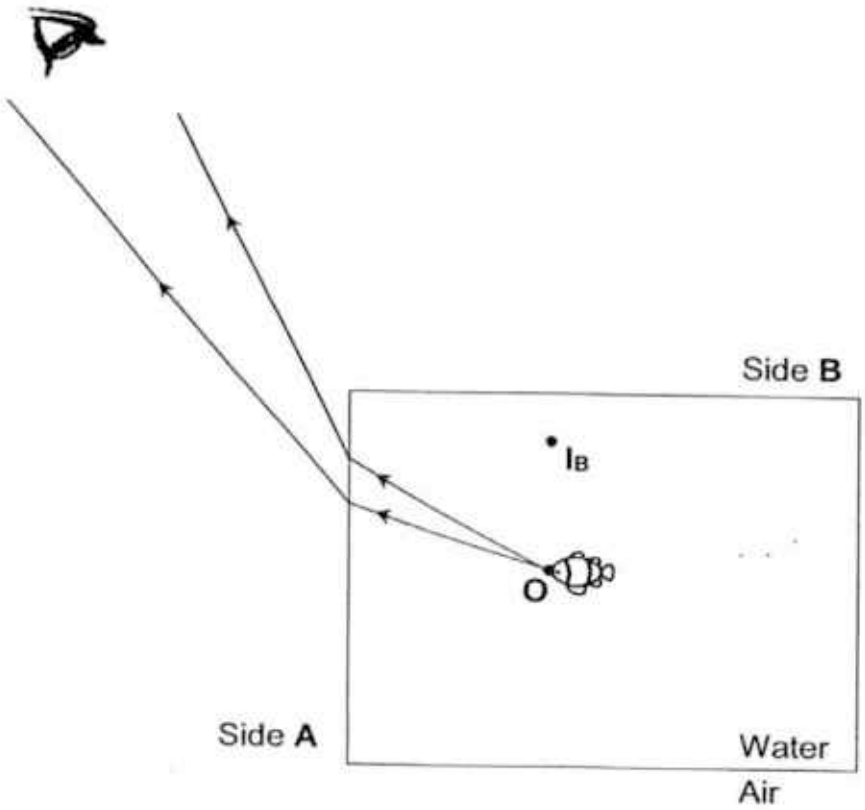
30 Which one of the following about sexually transmitted infections (STIs) is correct?

A STIs are only caused by bacteria.
B All STIs are fatal and untreatable.
C STIs cannot be passed on from mothers to their babies.
D People infected by STIs look and feel healthy in the early stages of infection.

SECTION B : [40 marks]

Answer **ALL** *questions in this section. Show your workings and write your answers in the space provided.*

1 The diagram shows a plan view of a fish tank containing a clownfish.



Joel can see two images of the clownfish when he looks from side **A** and side **B** of the tank.

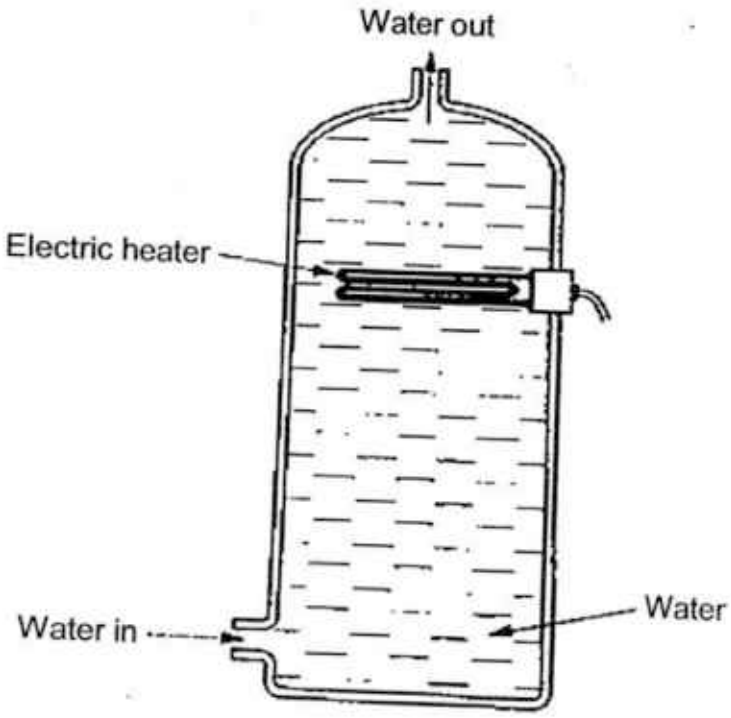
(a) The two rays of light, from the clownfish, that is refracted at side **A** of the fish tank has been drawn.

With the help of these two rays, locate and label the position of the image, I_A, of the clownfish due to the refraction at side **A**. **[2]**

(b) The image of the clownfish can also be seen due to the refraction at side **B**. The position of the image is located at I_B.

Complete the ray diagram by drawing two light rays from the clownfish, to show how Joel sees the image from side **B**. **[3]**

2 The diagram shows a hot-water tank with an electric heater.



(a) Explain how the water above the heater becomes warm.

.....

.....

.....

.....

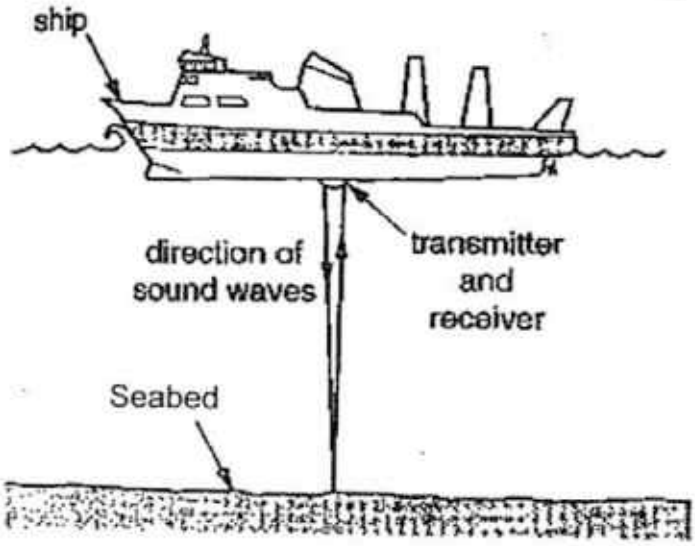
..... [3]

(b) Explain why the heater would not be able to heat up the water at the bottom of the tank.

.....

..... [2]

3 A ship is making use of an echolocation device to determine the depth of the sea beneath it.



(a) The speed of sound in water is 1500 m/s. The time taken for the sound pulse to reach the seabed and then return to the ship is 1.8 s.

Calculate the distance between the ship and the seabed.

[2]

(b) Briefly explain how sound is transmitted through water.

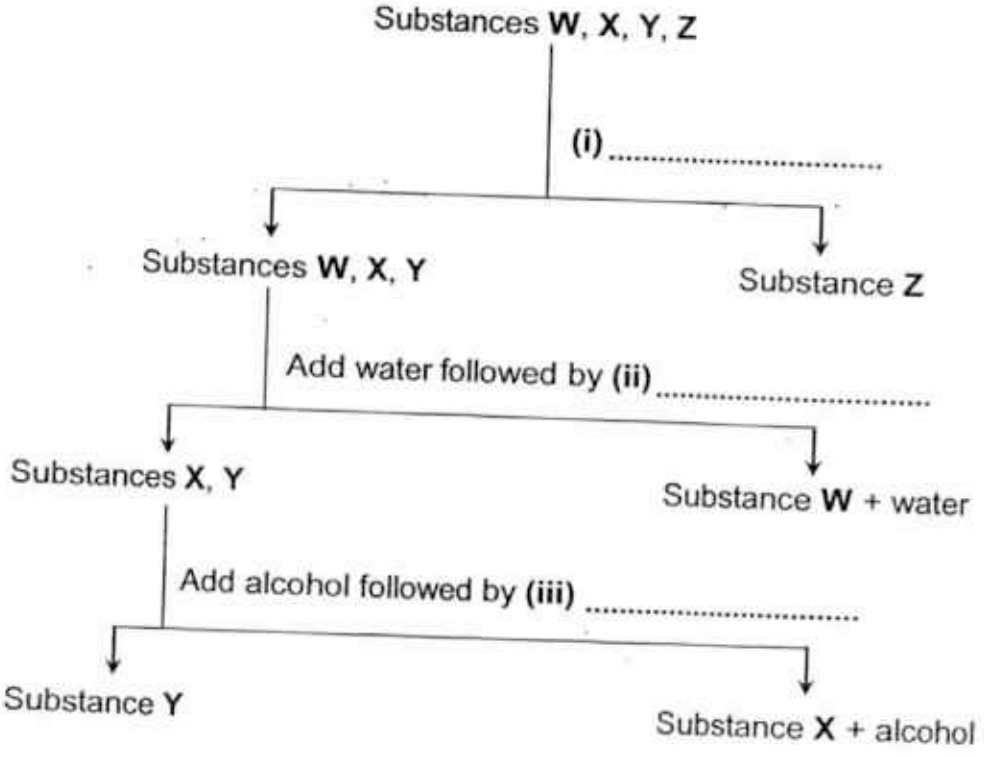
.....

..... [2]

4 Alex was given a mixture of four different solid substances, **W**, **X**, **Y**, and **Z**. Below is some information about these substances.

	W	**X**	**Y**	**Z**
Soluble in water	Yes	No	No	No
Soluble in alcohol	Yes	Yes	No	No
Attracted to magnet	No	No	No	Yes
Effects of heat	Does not decompose	Decomposes	Does not decompose	Does not decompose

(a) Alex conducted a series of separation techniques to separate each of the substances **W**, **X**, **Y** and **Z** from the mixture. Complete the flow chart by filling in the blanks with suitable separation techniques.



[3]

(b) To obtain pure and dry samples of substance **W**, Alex performed evaporation to dryness to the mixture obtained in **(a)(ii)**. He decided to use the same method to obtain pure dry samples of substance **X** as well.

Suggest **two** reasons why it is unwise to do the same for substance **X**.

.....

..... [2]

(c) Hence, name a suitable separation technique to obtain a pure and dry sample of substance **X** from the mixture obtained in **(a)(iii)**.

..... [1]

5 Photochromic lenses are eyeglass lenses that darken automatically when exposed to sunlight, then turn clear again when you return indoors.

Low sunlight

Moderate sunlight

Bright sunlight

The lenses contain silver chloride (AgCl), which decomposes into silver and chlorine when stimulated by sunlight. The metallic silver appears as very small 'flakes', which are evenly distributed in the mass of white silver chloride, making the lenses look grey. In the absence of sunlight, silver and chlorine recombine, making the lenses clear again.

(a) Write down the word equation for the decomposition of silver chloride in photochromic lenses.

..... **[1]**

(b) Hence, write down a balanced chemical equation for the decomposition reaction.

..... **[2]**

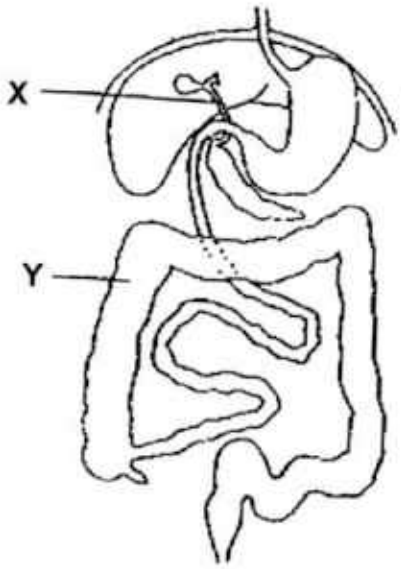
(c) A student commented that the photochromic lens is an example of both a chemical change because new substances are formed, and a physical change because it is reversible.

Do you agree with the student? Explain why.

.....

..... **[2]**

6 The diagram shows the human alimentary canal.



(a) Name the secretion, which passes down tube **X** and explain how it helps in fat digestion.

.....

..... [2]

(b) In cases of diarrhoea, name the major process in region **Y**, which is no longer occurring naturally.

..... [1]

(c) Cellulose is a complex carbohydrate.

(i) There are no enzymes in the human body that digests cellulose. State what happens to cellulose in the human alimentary canal.

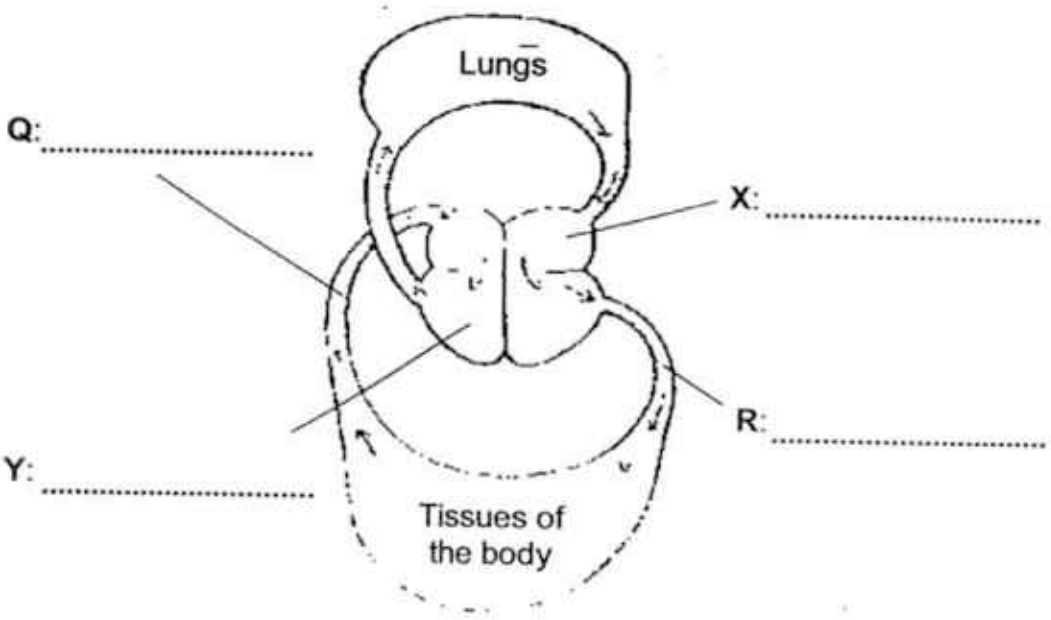
..... [1]

(ii) Unlike humans, many herbivorous mammals have a large appendix containing bacteria, which digest the cellulose cell wall of plants.

Suggest the likely end product of cellulose digestion in herbivorous mammals.

..... [1]

7 The diagram represents the human circulatory system.



(a) On the diagram,

(i) label the blood vessels **Q** and **R**, **[2]**

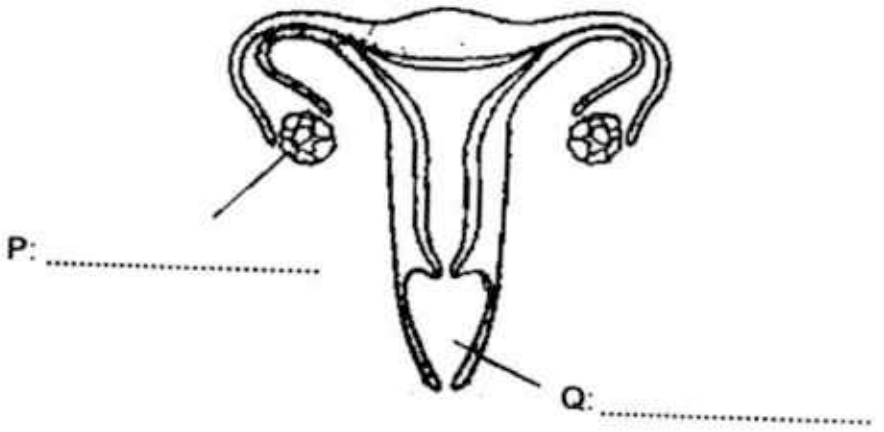
(ii) label structures **X** and **Y**. **[2]**

(b) State **one** difference between the structure of blood vessel **R** and that of a blood capillary.

.....

..... **[1]**

8 The diagram shows the reproductive organ of a woman.



(a) Label parts **P** and **Q**.

[2]

(b) By studying the diagram carefully, indicate why this woman is infertile. Explain your answer.

.....

..... [2]

(c) Place an **X** on the diagram to show where a fertilized ovum would be implanted in a healthy woman.

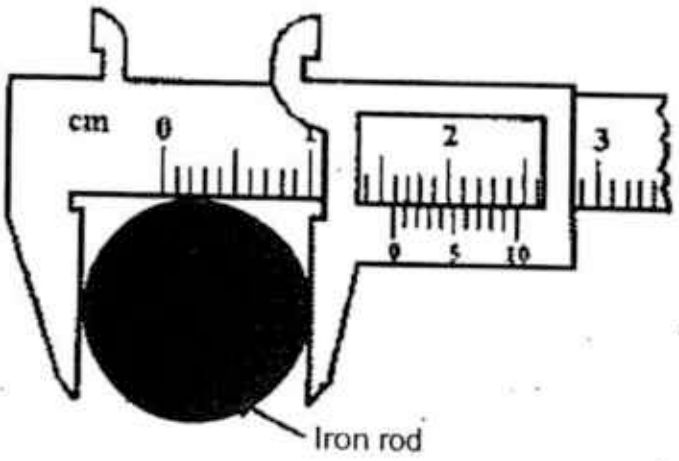
[1]

SECTION C: [30 marks]

Each question carries **10 marks**. *Answer any* **THREE FULL** *questions in this section. Show your workings and write your answers on the writing paper provided.*

1 (a) Gabriel plans to determine the purity of an iron rod by calculating its density.

(i) To find the diameter of the iron rod, he makes use of a pair of vernier calipers.



What is the diameter of the iron rod? [1]

(ii) Given that the length and mass of the iron rod is 4.60 cm and 70 g respectively,

(A) calculate the volume of iron rod, [1]
(Take π = 3.142, volume of cylinder = $\pi r^2 h$)

(B) and hence, calculate the density of the iron rod. [2]

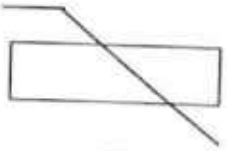
(b) An ironsmith heats solid iron to 1538 °C in order to for it to melt and be cast into spherical ball bearings.

(i) Using diagrams, draw out the particles of solid iron and molten iron. [2]

(ii) Hence, describe the differences in the arrangement and movement of the particles in solid iron compared to molten iron. [2]

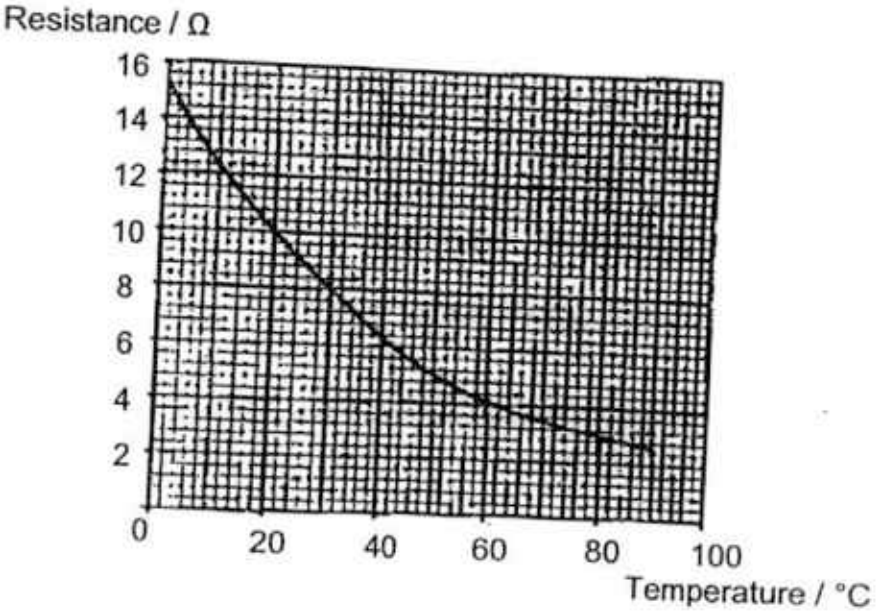
(iii) Explain why the density of molten iron is lower than that of solid iron of equal mass. [2]

2 The resistance of an electrical component **X**, as shown in the diagram, changes with temperature.



X

The following graph shows the variation of the resistance of **X** with temperature.

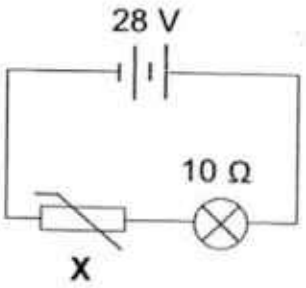


(a) From the graph, determine the resistance of **X**

(i) at 20 °C, **[1]**

(ii) at 60 °C. **[1]**

(b) The electrical component **X** is connected in series with a 10 Ω light bulb and a 28 V battery as shown in the diagram.



(i) For a temperature of 60 °C, using your answer in **(a)(ii)**, calculate

(A) the total resistance of the circuit, **[1]**

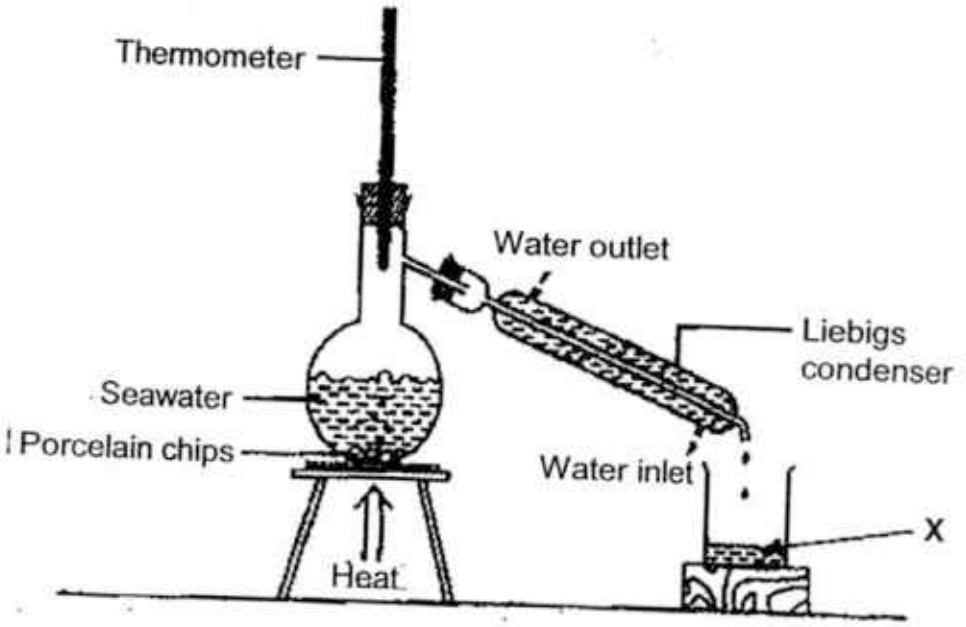
(B) the total current in the circuit, **[2]**

(C) the potential difference across the light bulb. **[2]**

(ii) When the temperature decreases, state and explain what happens to the current in the circuit. **[2]**

(iii) Hence, deduce the brightness of the light bulb. **[1]**

3 (a) The diagram shows the apparatus used for the distillation of seawater.

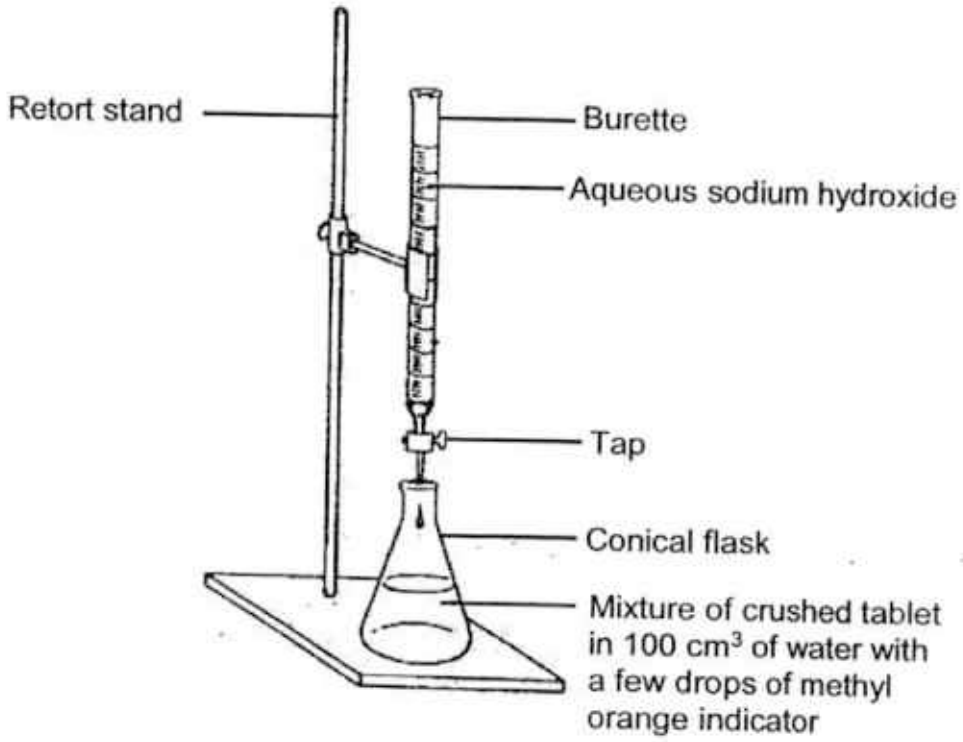


(i) What is the function of the porcelain chips in the seawater? [1]

(ii) What is the function of the thermometer? [1]

(iii) What is **X** known as? Identify the liquid. [2]

(b) Aspirin is a medication used to treat pain and fever. It is made from a weak acid, salicylic acid. The following experimental set-up is used to find out the concentration of acid found in aspirin.



A few drops of methyl orange indicator is added to the conical flask containing a mixture of a crushed tablet in 100 cm^3 of water. Then, aqueous sodium hydroxide is slowly released from the burette into the conical flask until the point where the mixture is of pH 7.

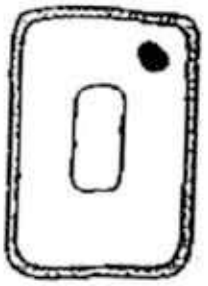
(i) State the likely pH of the mixture in the conical flask at the start of the experiment. **[1]**

(ii) Name the reaction involved in the experiment. **[1]**

(iii) Hence, state the general equation for this reaction. **[1]**

(iv) It is later found that methyl orange indicator is not suitable for this experiment. Explain why, and suggest a suitable indicator for the experiment. **[3]**

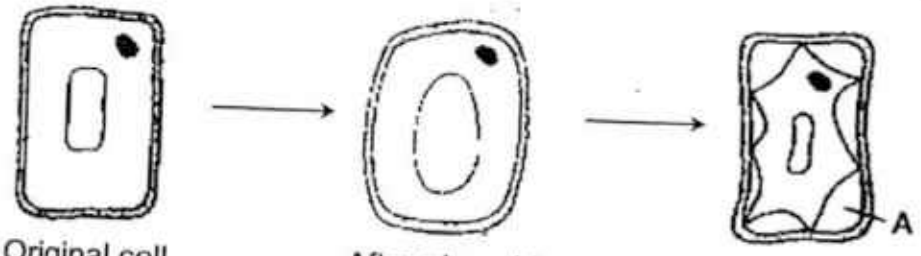
4 (a) The following shows a cell from an organism.



(i) Name the type of living organism in which a cell similar to the one above could be found? [1]

(ii) State **two** reasons for your choice in **(a)(i)**. [2]

(b) The cell is placed in solution **X** for 10 minutes, and is then transferred into solution **Y** for another 10 minutes. **Figure I** and **Figure II** show the appearance of the cell after being placed in **X**, and then **Y** respectively.



Original cell

After placed in solution **X** for 10 minutes

Figure I

After placed in solution **Y** for 10 minutes

Figure II

(i) The solutions used are concentrated salt solution and distilled water. Identify **X** and **Y**. [2]

(ii) Explain what has occurred to cause the cell to appear as it does when it is placed in solution **X**. [3]

(iii) What will be found in region **A** of **Figure II** after the cell is placed in solution **Y**? Explain your answer. [2]

DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

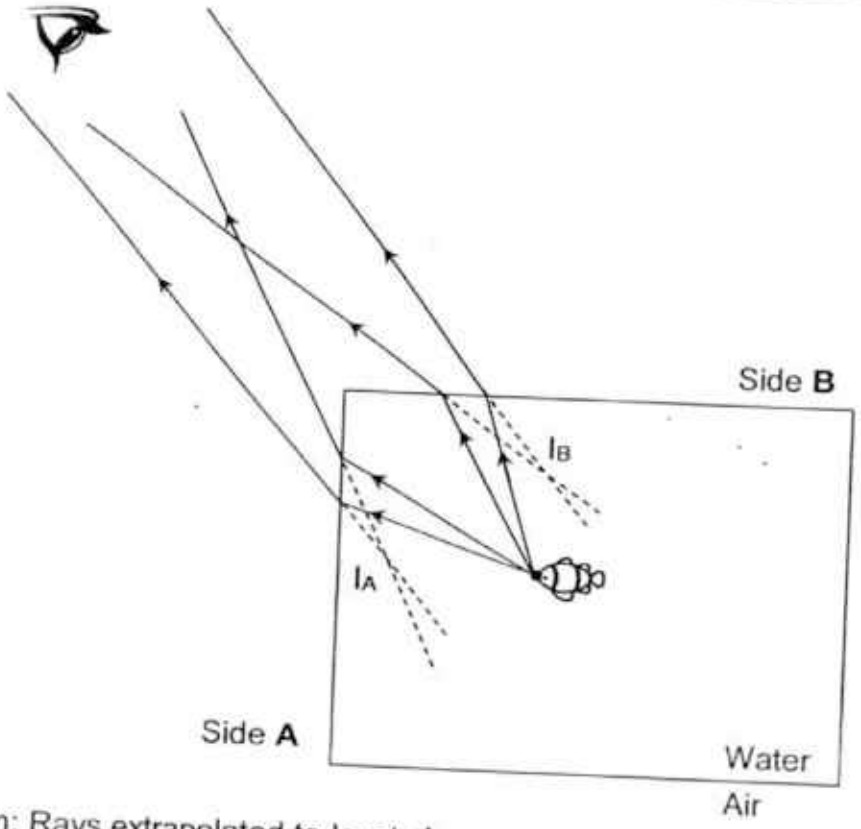
Version 11

2016 SA2 Sec 2 EXP Science Answers

Section A [Total 30m]

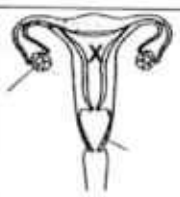
1.	C	11.	C	21.	B
2.	D	12.	C	22.	D
3.	C	13.	B	23.	C
4.	C	14.	B	24.	C
5.	D	15.	B	25.	D
6.	C	16.	A	26.	A
7.	A	17.	C	27.	A
8.	B	18.	D	28.	C
9.	A	19.	D	29.	D
10.	D	20.	A	30.	D

Section B [Total 40m]

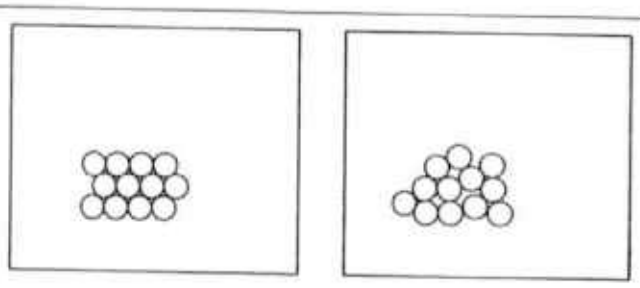
1	 1m: Rays extrapolated to locate I_A. 1m: Label I_A at the point of intersection of the extrapolations. 1m: Two rays drawn extrapolated from I_B to eye. 1m: Direction of arrows from fish towards the eye. 1m: Rays from fish that bend away from the normal at side **B**.	5m	Total 5m

2a	Water around the heater gets heated up, becomes less dense [1] compared to the water around it and rises [1/2]. As the warm water rises, it pushes the cooler water to the bottom / cooler water sinks. [1/2] Convection currents will be set up [1].	3m	Total 5m
2b	There are no convection currents [1] set up below the heater as cooler water, being denser, will remain at the bottom of the tank. Water is also a poor conductor of heat [1] and will only be heated up by conduction very slowly. 1m: The water molecules will be pushed upwards and get heated up via conduction as they pass through the heater.	2m	
3a	Distance to and from the seabed = 1500 * 1.8 = 2700 m [1] Distance between ship and seabed = 2700 / 2 = 1350 m [1]	2m	Total 4m
3b	Sound is transmitted through vibrations [1] of water molecules forming regions of the compression [½] and rarefactions [½].	2m	
4a	Magnetic separation [1] Filtration [1] Filtration [1] Accept: Use of magnet, Magnet, Magnetism, Magnetic pull, Magnetic attraction Reject: Filter paper, Filter funnel Ignore mild spelling errors	3m	Total 6m
4b	The solvent, alcohol, is flammable. [1] **X** will decompose under strong heating. [1]	2m	
4c	Crystallisation	1m	
5a	Silver chloride → Silver + Chlorine Accept: Silver chloride + heat / sunlight → Silver + Chlorine Reject: Silver chloride → Silver + Chloride	1m	Total 5m

5b	$2\ AgCl \rightarrow 2\ Ag + Cl_2$ 1/2m: Correct chemical formula for Silver (Ag) 1/2m: Correct chemical formula for chlorine gas (Cl_2) 1m: Correct balancing (Awarded only if the chemical formula of all three substances are correct) Deduct 1m for using "=" instead of "→" Reject: AG, CL, CL_2, Cl^2 Reject: Sunlight → $2\ AgCl \rightarrow 2\ Ag + Cl_2$ Reject: $2\ Ag + Cl_2 \rightarrow 2\ AgCl$	2m	
5c	Disagree [1]. It is not a physical change as it is <u>not reversible by physical means</u> [1]. Accept: It is only a chemical change as the change is <u>only reversible by chemical means</u>. Accept: It is only a chemical change as <u>no physical change can result in formation of new substances</u>. Reject all explanations if "Agree".	2m	
6a	Bile [1]. It <u>emulsifies</u> [1] fats. Accept: It <u>increases the surface area</u> of fats. Accept: It physically <u>breaks down fats into smaller droplets</u>.	2m	Total 5m
6b	Absorption of water (and mineral salts).	1m	
6ci	It remains <u>undigested</u>. Accept: It is <u>excreted as faeces</u>. Accept: It passes through the canal as digestive fibre. Reject: It turns fats into fibre.	1m	
6cii	Glucose 1/2m: Maltose Reject: Sucrose, Starch, Glycogen, Maltase	1m	
7a	**Q**: Vena Cava OR Vein **R**: Aorta OR Artery **X**: Left [0.5] atrium [0.5] **Y**: Right [0.5] ventricle [0.5] Reject: Pulmonary artery, Pulmonary vein	1m each [4]	Total 5m
7b	The capillary is one-cell thick but **R** has <u>thicker and more muscular walls</u>.	1m	

8a	**P**: Ovary **Q**: Vagina 1/2m: **Egg** / Ovum Reject: Ovule	1m each [2]	
8b	The fallopian tubes / oviducts are blocked [1]. This will prevent any sperms from reaching and fertilising any released ovum / egg [1]. 1/2m: The **ovary tubes** are blocked. Reject: This will prevent implantation of the ovum from taking place.	2m	Total 5m
8c	 (Accept anywhere within the uterus)	1m	

Section C [Total 30m]

1ai	(i) 1.57 cm	1m	
1aii	A. Volume = 3.142 * $(1.57 / 2)^2$ * 4.60 = 8.91 cm^3 (3 s.f.)	1m	
	B. Density = 70 / 8.90642317 [1] = 7.86 g/cm^3 (3 s.f.) [1]	2m	
1b	(i) 	2m	Total 10m
	(ii) Solid iron particles are packed tightly in a fixed, regular pattern while molten iron particles are randomly arranged. [1] Solid iron particles vibrate about their fixed positions while molten iron particles are free to slide past one another. [1]	2m	
	(iii) Particles of liquids are usually spaced slightly further apart compared to that of solids, resulting molten iron to have a larger volume compared to solid iron given equal masses. [1] Since density is the measure of mass per unit volume [1], molten iron will be less dense compared to solid iron.	2m	

2a	(i) 10 Ω	1m	Total 10m
	(ii) 4 Ω	1m	
2bi	A. Total resistance = 10 + 4 = 14 Ω ECF from **2a** to be awarded.	1m	
	B. Current = 28 / 14 [1] = 2 A [1] ECF from A to be awarded.	2m	
	C. P.d. across light bulb = 10 * 2 [1] OR 28 * 10 / 14 = 20 V [1] ECF from A and B to be awarded.	2m	
2bii	When temperature decrease, the total resistance in the circuit increases. [1] Hence current in the circuit decreases. [1]	2m	
2biii	Since current in the circuit decreases, brightness of Y decreases.	1m	

3a	(i) It is to ensure a smooth boiling process.	1m	Total 10m
	(ii) It is to measure the temperature of the vapour entering the Liebigs Condenser. Accept: It is to measure boiling point of water 1/2m: It is to measure temperature of air in the flask 1/2m: It is to measure temperature of heat supplied Reject: It is to ensure constant temperature	1m	
	(iii) **X** is the distillate [1]. It is water [1].	2m	
3b	(i) 3 ≤ pH < 7 Accept: pH 1 or pH 2	1m	
	(ii) Neutralisation reaction	1m	
	(iii) Acid + Alkali → Salt + Water	1m	
	(iv) Methyl orange changes from red to yellow at pH 4 [1]. The mixture is hence, still acidic and has not reached pH 7. [1] He could use litmus / universal indicator / red cabbage indicator / pH meter / bromothymol blue / phenolpthalein instead. [1] 1m: Methyl orange does not change colour at pH 7. 1/2m: Methyl orange shows **orange** even when the solution is acidic, neutral or alkaline. Reject: Cabbage	3m	

4a	(i) Plant. Accept: Leaf cell, fern, fungi, root cell	1m	
	(ii) It has a cell wall [1] and one central large vacuole [1]. Accept: It has a regular / fixed shape Accept: It has no chloroplast (if (i) stated fungi / root cell) Reject all answers if (i) stated Animal cell.	2m	
4b	(i) **X** is distilled water [1] and **Y** is concentrated salt solution [1].	2m	
	(ii) There must have been a higher water potential in **X** compared to that in the cell [1]. This resulted in osmosis [1] to take place where water molecules will move through the partially permeable cell membrane [1] into the cell, causing the cell to appear turgid. 1/2m: water **osmosized** into the cell Reject: cell absorb water	3m	Total 10m
	(iii) Solution **Y** will be found in **A**. [1] The cell membrane pulls away from the cell wall as the cell becomes flaccid, creating space for solution **Y** to enter [1] through the permeable cell wall. Accept: Salt solution will be found in **A**. Accept: The cell wall is fully permeable. Reject: The cell membrane pulls away from the cell wall. Reject: Salt will be found in **A**. Reject all explanations if "salt" or "**Y**" was not mentioned at all.	2m	

7

Name:	Index Number:	Class:

YIO CHU KANG SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2016
SECONDARY TWO EXPRESS

SCIENCE (PHYSICS)

Friday 7 October 2016 2 hours
(For Biology and Physics)

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on the cover page.
The Science Examination consists of two components: Science (Biology) and Science (Physics).
You are required to complete the two components in two hours.

Write in dark blue or black ink.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

SECTION A: Multiple Choice Questions
This section consists of **ten** multiple choice questions. Answer **all** questions.
For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in the bracket provided.

SECTION B: Structured Questions
This section consists of structured questions. Answer **all** questions.
Write your answers in the spaces provided.
The number of marks is given in brackets [ ] at the end of each question or part question.

The use of an approved scientific calculator is expected, where appropriate.

For Examiner's Use

Section A	/ 10
Section B	/ 40
Total	/ 50

Parent's / Guardian's signature

Name of Setter: Mr Phua Yong Bin

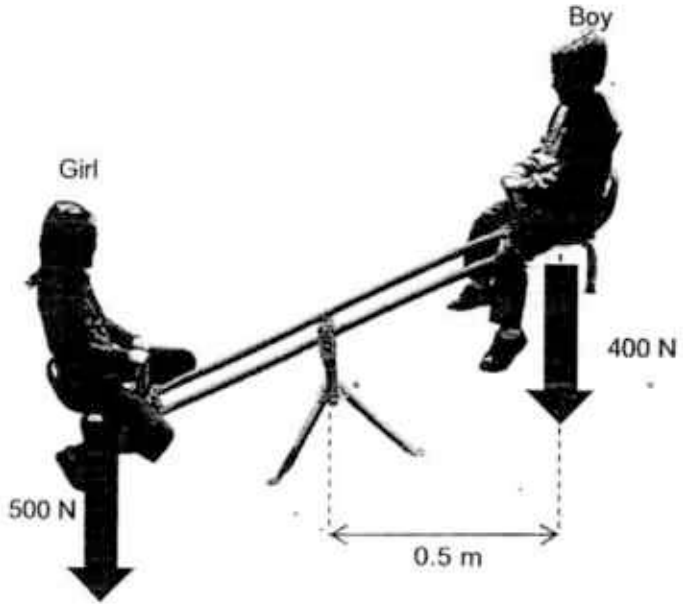
This document consists of **15** printed pages and **1** blank page.

SECTION A [10]: Multiple Choice Questions
Answer **all** questions in the brackets provided.

1 Which of the following is an example of a contact force?

A electrostatic force
B friction force
C gravitational force
D magnetic force ( )

2 The picture below shows two children on a see-saw. The boy weighs 400 N and the girl weighs 500 N. Both children are 0.5 m away from the pivot.



What is the direction of the moment due to the weight of the boy?

A anticlockwise
B clockwise
C downward
D upward ( )

3 A ball is thrown straight up into the air. It moved from P to Q as shown in Fig 3.1 and dropped from Q to P as shown in Fig 3.2.

Fig 3.1

Fig 3.2

Which one of the following is correct?

	Potential energy of ball from P to Q	Kinetic energy of ball from Q to P
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

( )

4 A hearing aid is attached to the ear to help people who suffer from hearing loss.

What is the main function of a hearing aid?

A To decrease the amplitude of sounds sent from the surroundings.
B To decrease the frequency of sounds sent from the surroundings.
C To increase the amplitude of sounds sent from the surroundings.
D To increase the frequency of sounds sent from the surroundings. ( )

5 Fireworks is the main highlight of every year's National Day Parade.

Edward said that it took 4 seconds for him to hear the fireworks, after seeing them explode in the night sky.

If sound travels at 300 m/s, how far away was Edward from the fireworks?

A 75 m

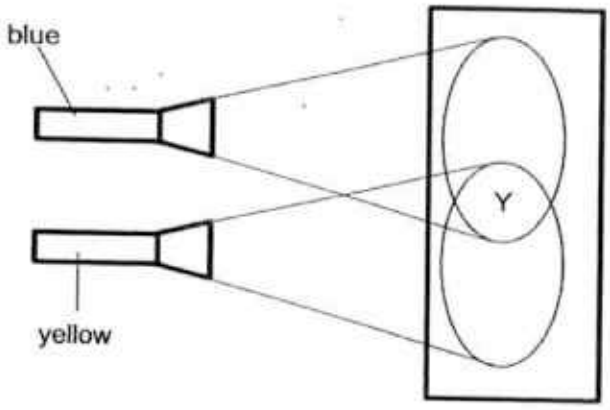
B 120 m

C 600 m

D 1200 m

( )

6 Blue and yellow light are shone on a white screen as shown in the diagram below.



What colour is region Y?

A blue

B green

C yellow

D white

( )

7 Which of the following statements correctly describes how a parallel beam of light will be reflected when it hits an uneven surface?

A The beam will be reflected as convergent rays of light.

B The beam will be reflected as diffused rays of light.

C The beam will be reflected as divergent rays of light.

D The beam will be reflected as parallel rays of light.

( )

8 Amy looks at herself in front of a plane mirror.

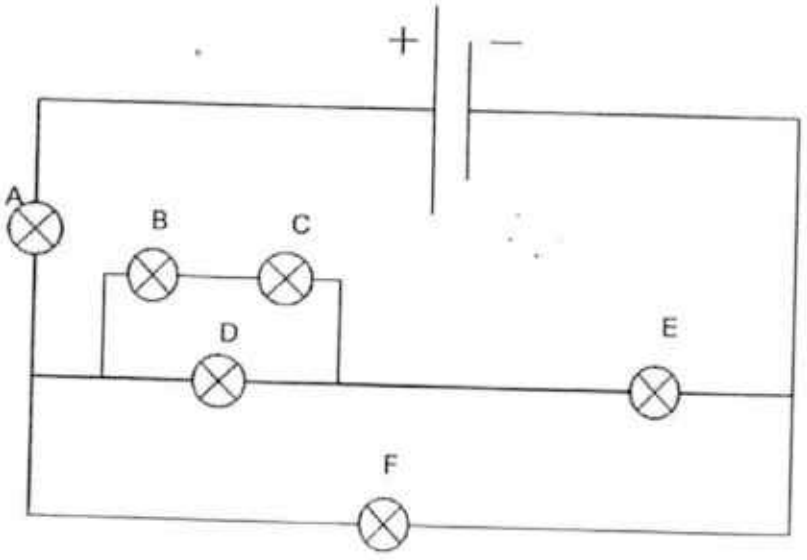
Which of the following statements correctly describes her image?

A Her image appears to be laterally inverted.
B Her image appears to be nearer.
C Her image appears to be real.
D Her image appears to be smaller. ( )

9 Which of the following statements is the definition of current?

A Current is defined as the flow of charge per resistance.
B Current is defined as the flow of charge per unit time.
C Current is defined as the flow of charge through a component.
D Current is defined as the flow of electricity. ( )

10 Study the circuit below. All bulbs and battery are in working condition.



Which one of the following correctly states the number of bulbs that would still be lit, when one or more bulbs are disconnected?

	Bulb(s) disconnected	Number of bulb(s) still lit
A	A	1
B	B & D	2
C	C	3
D	E & F	4

( )

SECTION B [40]: Structured Questions
Answer **all** questions in the spaces provided.

11 Fig 11.1 shows an experiment conducted by an engineer, to test the softness of soil. The engineer places a brick on the soil and measures the depression caused by the brick.

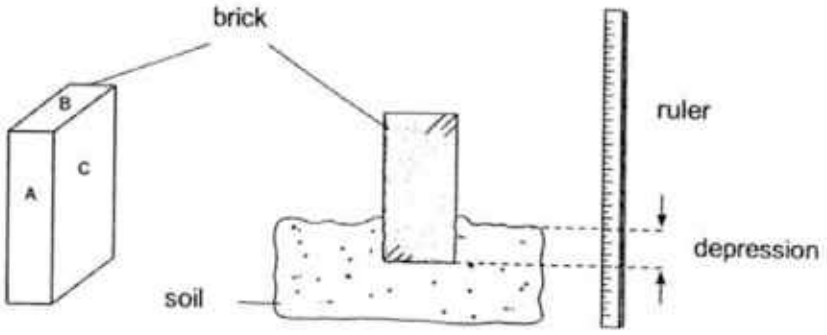


Fig 11.1

Which face of the brick, A, B or C, would cause the deepest depression?
Explain your answer.

.....

.....

.....

..... [2]

12 **(a)** Fig. 12.1 below shows a book at rest on the table.

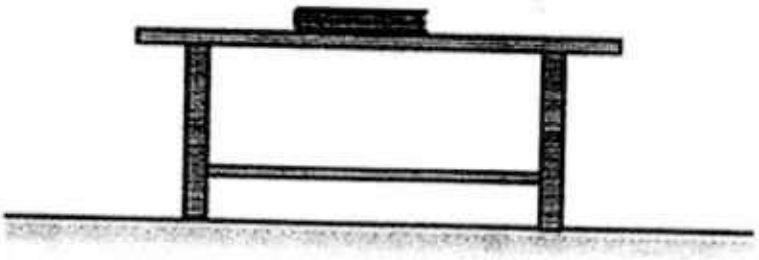


Fig 12.1

(i) On the picture above, draw arrows to represent the weight and normal contact force acting on the book. Label the forces drawn. [2]

(ii) If a horizontal force is applied on the book, state the change in motion of the book.

.....

..... [1]

(b) The book is now placed on a mass balance, as shown in Fig. 12.2 below.

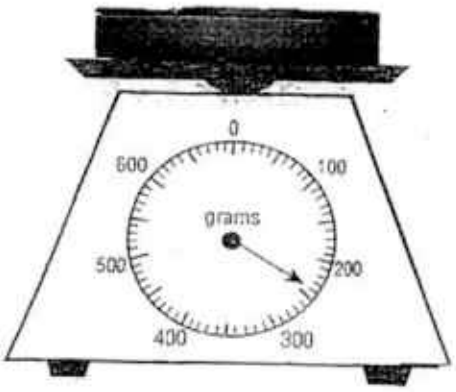


Fig 12.2

(i) State the mass of the book in kg.

mass = ... kg [1]

(ii) Taking acceleration due to gravity to be 10 m/s^2,

Calculate the weight of the book.

weight = ... N [1]

13 Fig 13.1 below shows a father carrying his baby home from the carpark and climbing up three levels of stairs to his flat. The carpark is 20 m away from the stairs and each level of the flat is 2.5 m high.

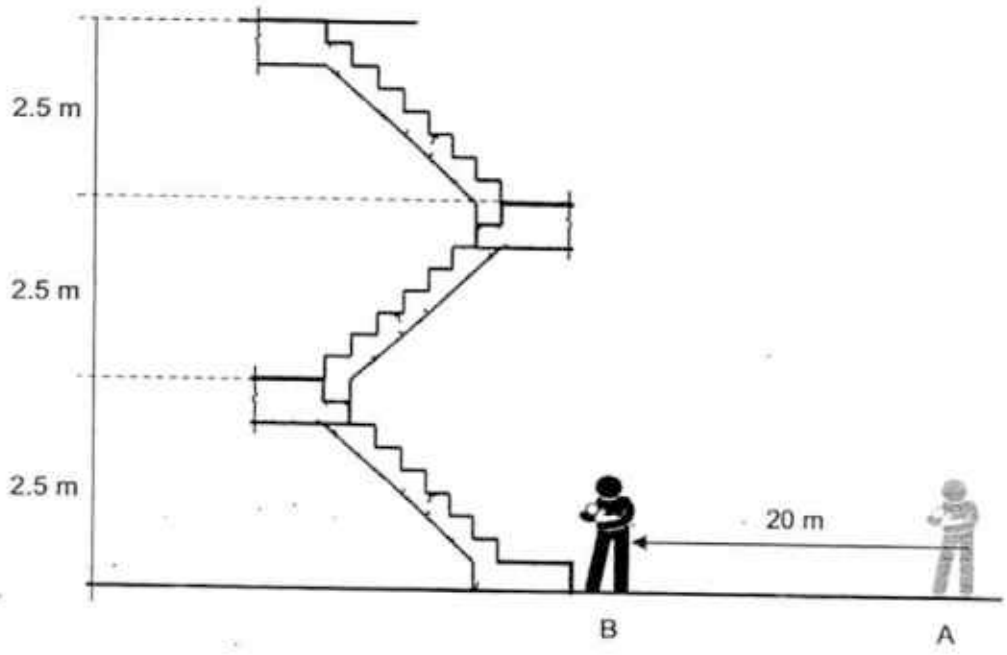


Fig 13.1

(a) The father weighs 600 N and the baby weighs 50 N.

(i) State and explain the work done by the father in carrying the baby as he walks from point A to B.

.....

..... [2]

(ii) Calculate the work done by the father when he climbs three levels up the stairs with his baby.

Work done = ...J [2]

14 Fig 14.1 shows a particular sound wave.

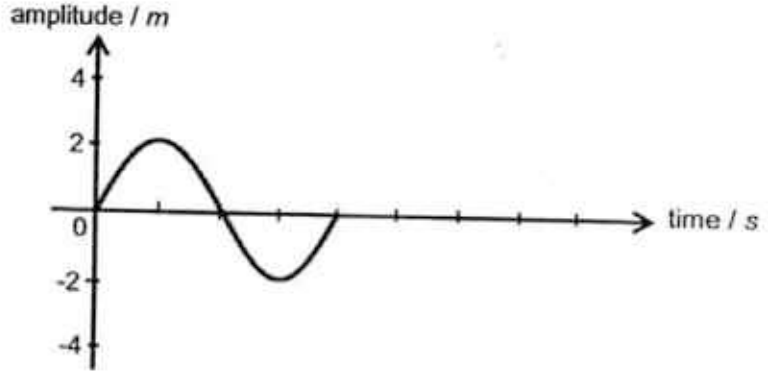
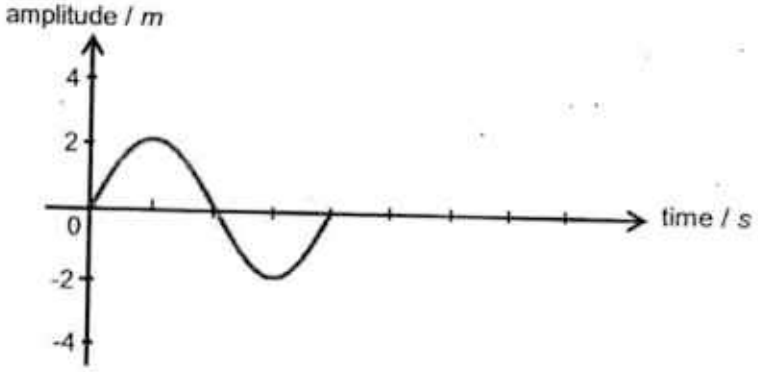


Fig. 14.1

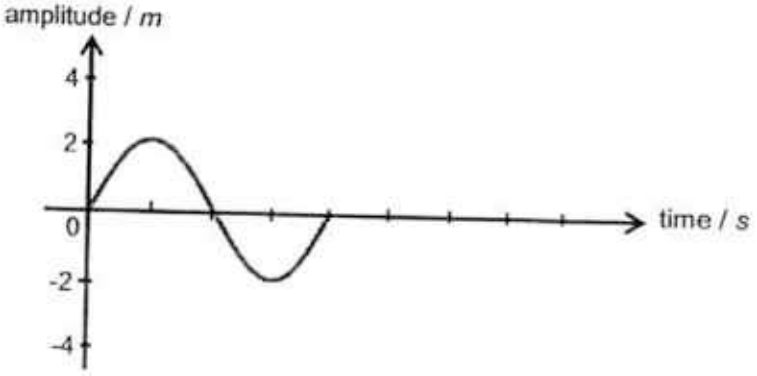
(a) On the axis provided below,

(i) draw a sound wave which has twice the loudness as the original sound.



[1]

(ii) draw a sound wave which has twice the pitch as the original sound.



[1]

(b) Explain why sound energy travels faster through solids than through air.

.....

.....

..... [2]

15 One of nature's most splendid masterpieces is the rainbow. Fig. 15.1 shows a light ray striking a raindrop.

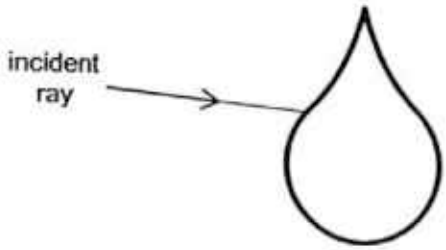


Fig. 15.1

(a) The part where light ray strikes on the surface of the raindrop has been magnified in Fig. 15.2 and 15.3 below. Part of the light ray is reflected while another is refracted as it enters the rain drop.

(i) In Fig 15.2, draw and label the normal and the reflected ray.

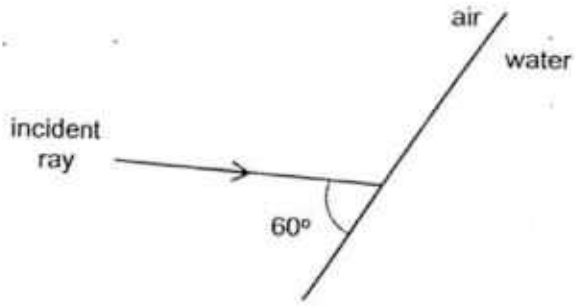


Fig. 15.2

[2]

(ii) State the angle of reflection.

angle of reflection = ... ° [1]

(iii) In Fig 15.3, draw and label the normal and the refracted ray.

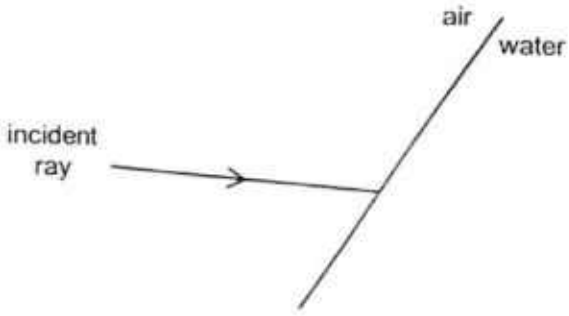


Fig. 15.3

[2]

(iv) State if the angle of refraction is bigger than, equal to or smaller than the angle of incidence.

..... [1]

(b) Explain how a rainbow can be formed from visible white light in nature.

.....

.....

.....

.....

..... [2]

16 Fig 16.1 below shows a schematic diagram of the electrical circuit in Mr Goh's house.

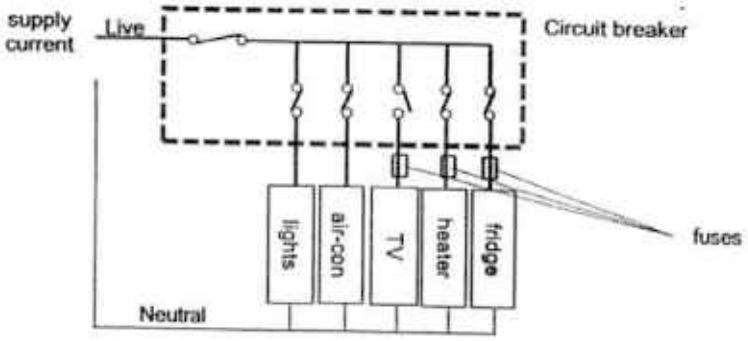


Fig. 16.1

(a) **(i)** Explain how the fuses protect the appliances from being damaged.

.....

.....

..... [1]

(ii) State one difference between a circuit breaker and a fuse.

.....

.....

..... [1]

(b) Fig. 16.2 below shows the lighting circuit for Mr Goh's living room.

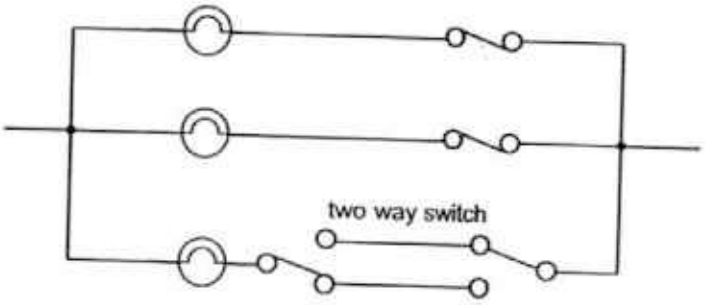


Fig. 16.2

(i) Each light bulb has a resistance of 20 Ω.

Calculate the effective resistance of all three light bulbs when they are connected.

Effective resistance = ... Ω [2]

(ii) Explain how the two way switch works.

.....

..... [1]

(iii) Suggest one location in the house where the two-way switch would be useful.

.....

..... [1]

(iv) Mr Goh wishes to install a fourth light bulb in his living room which can be switched on or off without affecting the other bulbs.

Draw on Fig. 16.2 above to show how this light bulb should be connected to the existing circuit. [1]

17 State one advantage and one disadvantage of generating electricity from a hydroelectric power plant.

.....

.....

.....

..... [2]

18 State one effect of an electric current and provide an example of its application.

.....

..... [2]

19. Fig. 19.1 below shows the packaging for a 60 W LED light bulb.

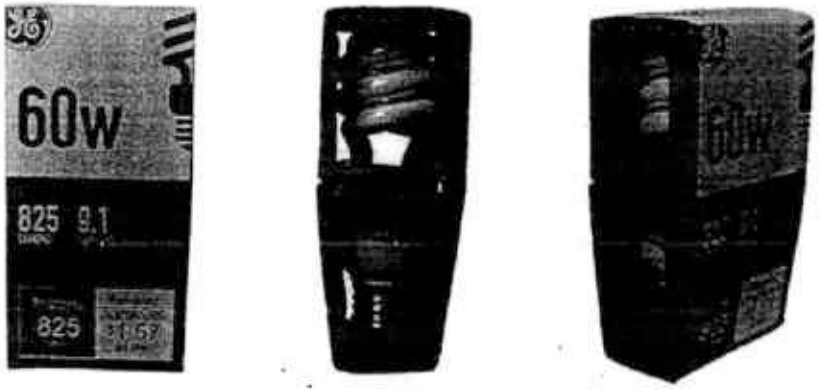


Fig. 19.1

(a) Explain what '60 W' means.

.....

..... [1]

(b) A 240 W light bulb and a 60 W LED light bulb were both switched on for 24 hours. The cost of electricity is $ 0.25 / kWh.

Calculate how much money can be saved by using the LED light bulb.

Savings = $ ..... [3]

20 Fig 20.1 below shows Mr Goh's electrical socket connected to multiple plugs, with all of them switched on at the same time.

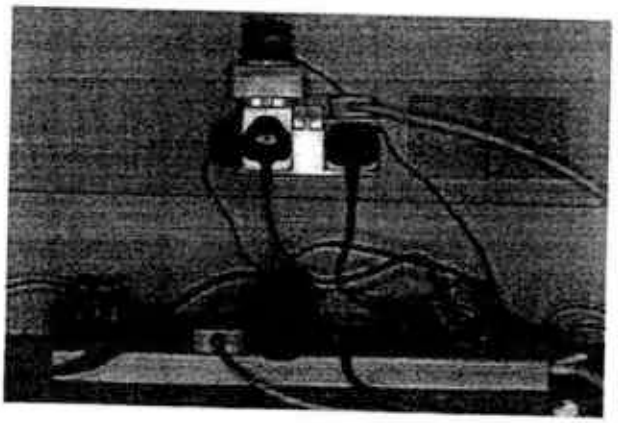


Fig. 20.1

Describe the electrical hazard that would possibly occur from Fig. 20.1.

.....

..... [2]

END OF PAPER

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YIO CHU KANG SECONDARY SCHOOL
MARKING SCHEME

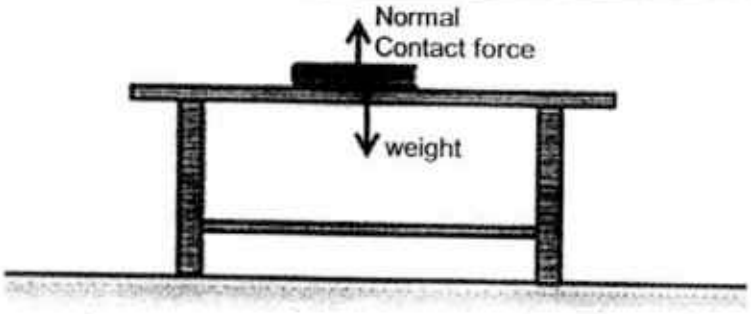
Exam: EOY 2016 Subject: SCIENCE (Physics) Level: 2E

SECTION A (MCQ)

01.	B	Friction force is present whenever there is contact.
02.	B	Boy moves clockwise
03.	D	Ball PE increases as it gains height. Ball KE increases as it falls
04.	C	Increase loudness (amplitude) of sound sent from surroundings so that the ear can hear clearly.
05.	D	Distance travelled by the sound = speed x time taken Distance travelled by the sound = 300 x 4 Distance travelled by the sound = 1200 m
06.	D	Yellow (red + green) + blue = white
07.	B	When a parallel beam of light hits an uneven surface, diffused ray of light will be reflected.
08.	A	Image formed by plane mirror will be laterally inverted.
09.	B	Current is defined as the flow of charge per unit time.
10.	B	When B & D blow, A & F will still light up.

SECTION B

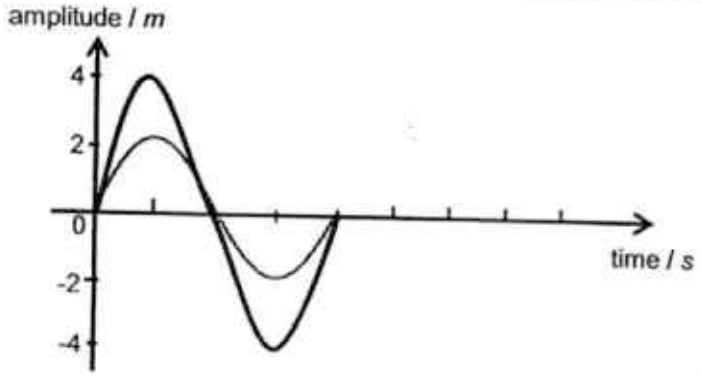
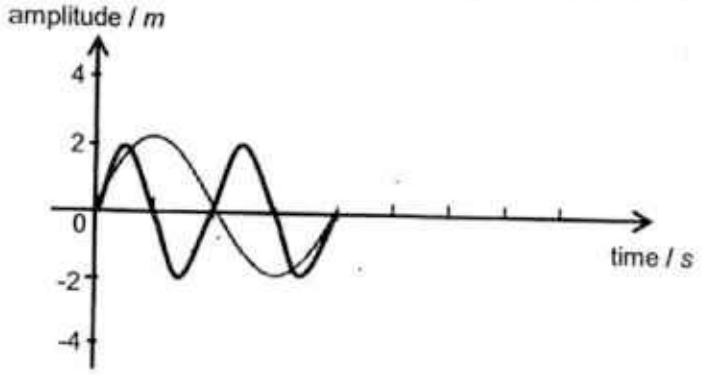
11		Face **B** would cause the deepest depression. Pressure is defined as force acting per unit area. As face B has the smallest area of contact, it will generate the greatest pressure, which causes the deepest depression.	[1] [1]

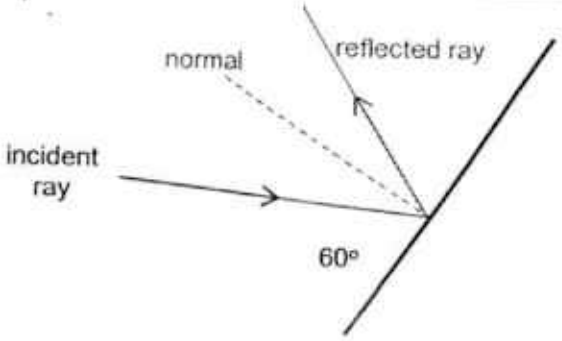
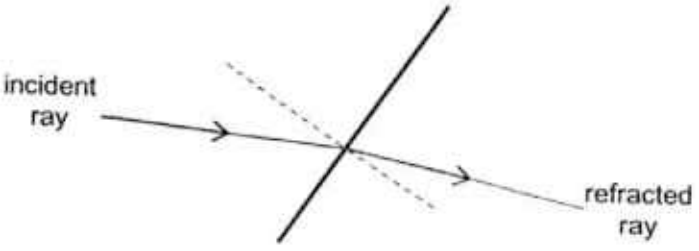
12	(ai)		[1] for **each** correct arrow AND label.
	(aii)	The book will start to move.	[1]
	(bi)	240 g = 0.24 kg	[1]
	(bii)	Weight = 0.24 x 10 = 2.4 N	[1] for ans

13	(ai)	The work done by the father is 0 J. As the force of carrying the baby is upwards, while he is moving horizontally. OR force is perpendicular to that of distance travelled.	[1] [1]
	(aii)	$Work\ done = Force \times distance\ moved$ $Work\ done = 650 \times 7.5$ $Work\ done = 4875\ J$	[1] [1]

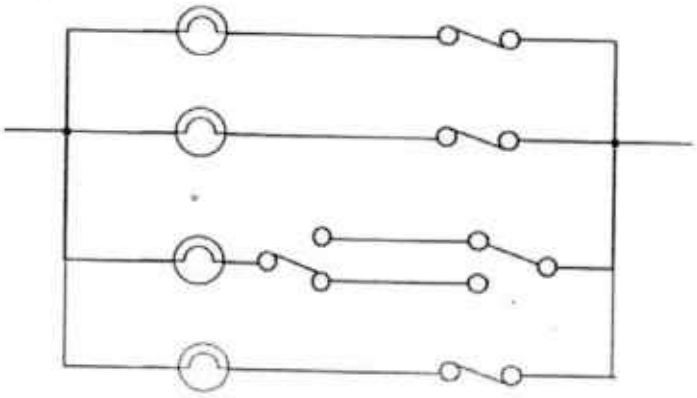
14		One advantage of using a hydroelectric power plant is that it does not produce pollutants OR, it uses renewable source of energy. One disadvantage is that it requires a large amount of land to be flooded OR destroys ecosystem due to flooding OR it prevents nutrients from flowing down a river.	[1] any one [1] any one

15		An effect of a current is the Heating effect. One application is the Electric kettle OR; lighting effect, Light bulb OR; chemical effect, electroplating OR; Magnetic effect, telephone speaker	[1] effect [1] application

16	(ai)	 Same frequency, amplitude doubled.	[1]
	(aii)	 Same amplitude, frequency doubled (Two cycles within same time..	[1]
	(b)	Sound energy is transferred by the vibration of particles. Particles in solid are packed closely in an orderly manner while particles in air are spaced far apart. Therefore, it is easier for particles in solids to transfer the vibration than in air. As a result, sound travels faster in solid than in air.	[1] [1]

17	(ai)		[1] normal [1] reflected ray accurate
	(aii)	Angle of reflection = 30 °	[1]
	(aiii)		[1] normal [1] refracted ray bends towards normal

	(aiv)	Angle of refraction is smaller than angle of incidence.	[1]
	(b)	When light enters and exits the raindrop, different colours of the white light are refracted towards the normal through different angles. This causes the white light to disperse into different colours. Thus creating the rainbow.	[1] [1]

18	(ai)	When excessive current enters the circuit, the fuse will "blow"/the wire inside the fuse will melt and creates an open circuit to prevent any more current from entering, thus protecting the appliance.	[1]
	(aii)	The fuse needs to be replaced every time it blows, but the circuit breaker does not need to be replaced.	[1]
	(bi)	All bulbs are connected in parallel. $\frac{1}{R_{Total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ $\frac{1}{R_{Total}} = \frac{1}{20} + \frac{1}{20} + \frac{1}{20}$ $\frac{1}{R_{Total}} = \frac{3}{20}$ $\frac{R_{Total}}{1} = \frac{20}{3}$ $R_{Total} = 6.67\ \Omega$	[1] working [1] ans
	(bii)		[1] extension by parallel with swtich
	(biii)	When one switch is on, it can be off by the switch on the other end.	[1]
	(biv)	At both ends of a long corridor or at the start and end of a staircase.	[1]

19	(a)	60 W means that 60 J of energy would be converted within 1 second.	[1]
	(b)	Energy usage of light bulb = 0.24 kW x 24 = 5.76 kWh Energy usage of LED bulb = 0.06 kW x 24 = 1.44 kWh Savings = (5.76 – 1.44) x 0.25 = $ 1.08 Ans = $1.08	[1] Energy usage by bulb [1] Energy usage by LED [1] savings

20		Electrical fire is likely to occur as a large current will be drawn from the socket/mains when all appliances are switched on at the same time.	[1] [1]