AHMAD IBRAHIM SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018
6093 BIOLOGY

BIOLOGY PAPER 1 **6093 / 01**

Secondary Four Express **Date: 20 Aug 2018**

Duration: 1 hour

Name: ……( ) Class: ……

Instructions to Candidates:

There are **forty** 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 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.
The use of an approved scientific calculator is expected, where appropriate.

This question paper consists of **17** printed pages.

1 The diagram shows a typical plant cell after being placed in a concentrated salt solution for ten minutes.

Which numbered structures are partially permeable?

A 1 and 2 only
B 1 and 3 only
C 1 only
D 2 only

2 The diagram shows two plant cells, **X** and **Y**.
Cell **X** has a higher water potential than cell **Y**.

In which direction and by what process will water move between these two cells?

	direction	process
A	**X** to **Y**	active transport
B	**X** to **Y**	osmosis
C	**Y** to **X**	active transport
D	**Y** to **X**	osmosis

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3 A series of cell processes is listed below.

1 mineral ions entering root hair cells
2 glucose uptake by villus cells
3 water entering root hair cells

Which of these involve active transport?

A 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

4 A dish is filled with agar jelly containing starch. Four holes are cut in the jelly and each hole is filled as shown. After 30 minutes, which hole will be surrounded by the largest area without starch?

5 The table shows the results of an investigation of the absorption of products of digestion in the presence and absence of oxygen.

product of digestion	absorption in the presence of oxygen / arbitrary units	absorption in the absence of oxygen / arbitrary units
amino acids	5.3	1.7
fatty acids	1.9	2.0
glucose	6.4	2.3
glycerol	4.8	4.7

Which conclusion can be drawn from these results?

A All products of digestion are absorbed by both active transport and diffusion.
B All products of digestion are absorbed by diffusion only.
C Amino acids and glucose are absorbed by active transport only.
D Fatty acids and glycerol are absorbed mainly by diffusion.

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6 A geranium plant has leaves that are green in the centre but white around the edges.

The plant is destarched and then has one of its leaves partly covered with black paper on both sides of the leaf, as shown.

The plant is placed in bright light for 48 hours. The leaf is then tested for starch.

Which diagram correctly shows the areas that contain starch?

A

B

C

D

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7 The graph shows the effect of carbon dioxide (CO_2) concentration on the rate of photosynthesis.

What could be limiting the rate of photosynthesis at points **X** and **Y**?

	X	Y
A	carbon dioxide concentration	carbon dioxide concentration
B	carbon dioxide concentration	light intensity
C	light intensity	carbon dioxide concentration
D	light intensity	light intensity

8 A dicotyledonous plant, growing in a nutrient solution, is placed in a well-lit experimental chamber through which humid air is being passed slowly. The diagram below shows a section through a root of the plant.

The speeds of movement of the fluids in tissues **P** and **Q** are measured. The humid air is then replaced by dry air and the speeds of movement of the fluids change.

What are these changes?

	tissue **P**	tissue **Q**
A	greatly increased upward movement	greatly increased downward movement
B	greatly increased downward movement	little change
C	little change	greatly increased downward movement
D	little change	greatly increased upward movement

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9 During translocation in plants, which substance is moved and in which direction?

	substance	from	to
A	sucrose	anthers	stigmas
B	sucrose	leaves	roots
C	water	roots	leaves
D	water	soil	root hairs

10 Which process does **not** require energy?

A contraction of muscles
B synthesis of proteins
C tissue respiration
D transmission of nerve impulses

11 Which of the following correctly states whether each of the named vessels contain valves?
Key: Yes - ✓ No - ×

	aorta	capillaries	renal artery	renal vein
A	✓	✓	×	×
B	✓	×	×	✓
C	×	✓	✓	×
D	×	×	×	✓

12 The diagram represents part of the human circulatory system.

Where is the blood pressure highest?

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13 The graph shows pressure changes in the left ventricle and the left atrium in one cycle of contraction of the heart.

During which period of time are the ventricle muscles contracting?

14 The diagram represents a tissue with an adjacent capillary.

Which substances can 1, 2 and 3 represent?

	1	2	3
A	glucose	tissue fluid	carbon dioxide
B	oxygen	carbon dioxide	glucose
C	tissue fluid	glucose	oxygen
D	tissue fluid	oxygen	carbon dioxide

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15 The diagram shows part of the nervous system, including a reflex arc. It has been cut at **X**.

A bee stings a finger, as shown.

What are the effects of this sting?

	pain felt	arm moved
A	no	no
B	no	yes
C	yes	no
D	yes	yes

16 The urine of a person suffering from diabetes mellitus is likely to contain an abnormal amount of _____.

A amino acids
B fatty acids
C glucose
D urea

17 What happens to the diaphragm when breathing in?

	muscle action	shape
A	contraction	domed
B	relaxation	domed
C	contraction	flattened
D	relaxation	flattened

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18 The diagram represents part of a dialysis machine.

Which substance must be at the same concentration in the dialysis fluid and in the blood?

A glucose
B salt
C urea
D water

19 The diagram refers to the control of water potential in the blood.

Why is this a negative feedback system?

A It decreases the amount of water in the blood.
B It increases any change in the amount of water in the blood.
C It increases the amount of water in the blood.
D It reverses any change in the amount of water in the blood.

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20 The graph shows changes in a person's blood glucose concentration over four hours.

What might cause the changes at **X** and **Y**?

	X	Y
A	decreased insulin	decreased adrenaline
B	decreased insulin	increased adrenaline
C	increased adrenaline	increased insulin
D	increased insulin	increased adrenaline

21 The diagram shows a section through a flower.

After the flower is fertilised, which parts will develop into the fruit and the seed?

	fruit	seed
A	1	2
B	1	4
C	2	3
D	3	4

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22 New plants may be grown from groups of cells that are taken from other plants.

The diagram shows part of plant **X**.

From which structure will cell samples grow into new plants that are genetically identical to plant **X**?

23 The diagram shows a side view of the female reproductive system.

In which region are sperms released during sexual intercourse and where does fertilisation usually take place?

	sperms released	fertilisation
A	3	1
B	3	2
C	4	1
D	4	2

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24 The diagram shows the male reproductive and urinary systems.

Which structure produces the fluid part of semen?

25 When is ovulation most likely to occur?

A about halfway between the start of one menstruation and the next
B at the start of menstruation
C 1-5 days before the start of menstruation
D 5-10 days after the start of menstruation

26 Which statement about chromosomes is correct?

A Chromosomes are long DNA molecules called genes which are divided into sections.
B Chromosomes include a long molecule of DNA divided into sections called genes.
C Chromosomes include genes which are divided into sections called DNA molecules.
D Genes include long DNA molecules called chromosomes.

27 The results from mapping 100 nucleotides on a double-stranded DNA molecule are shown below.

nucleotide	quantity
adenine	26
guanine	24

How many cytosine nucleotides are present in this DNA molecule?

A 24
B 26
C 48
D 52

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28 Which diagram shows early anaphase of the first division of meiosis (anaphase I) of a nucleus containing two pairs of homologous chromosomes?

29 What is a correct description of the centrioles, nuclear envelope and spindle during each phase of mitosis in animal cells?

	phase	centrioles	nuclear envelope	spindle
A	anaphase	replicate	absent	present
B	metaphase	present	reforms	present
C	prophase	move apart	breaks up	forms
D	telophase	replicate	breaks up	breaks up

30 The diagram shows the blood group phenotypes of some members of a family.

Which member of the F_1 generation must be heterozygous, with codominant alleles?

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31 A variety of snail has an inherited condition that affects the thickness of the shell.

$S^t S^t$ have thick shells.
$S^t S^n$ have thin shells.
$S^n S^n$ do **not** survive.

Two heterozygous snails are mated.

What is the probability that a surviving snail of the next generation is a heterozygote?

A 0.00
B 0.25
C 0.50
D 0.67

32 Polydactyly is a rare condition that causes the development of extra fingers. This condition is caused by a dominant allele.

The diagram shows the inheritance of polydactyly in a family.

What is the probability that children of person **X** have inherited polydactyly from him?

A 0.00
B 0.25
C 0.50
D 1.00

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33 Flower colour is controlled by a single pair of alleles. The allele for red flowers is dominant to the allele for white flowers.

A plant homozygous for red flowers is crossed with a plant homozygous for white flowers. All the resulting plants have red flowers (F_1 generation).

When the F_1 generation are crossed with each other, 18 plants are obtained. 12 plants have red flowers and 6 have white flowers (F_2 generation).

What ratio is expected in the F_2 generation and what ratio has been obtained?

	expected ratio red to white	obtained ratio red to white
A	1:1	2:1
B	1:1	3:1
C	3:1	2:1
D	3:1	3:1

34 Which of the following is a result of natural selection?

A dogs that are friendly to humans
B grapes that contain no seeds
C mosquitoes that are resistant to insecticides
D onion crops that have a pleasant taste

35 In the commercial manufacture of insulin, a human gene is inserted into which of these?

A a chromosome of a human cell
B a protein molecule in a yeast cell
C the DNA of a bacterium
D the nucleic acid in a virus

36 A food chain is shown below.

grass → rabbit → fox → flea

Which pyramid of numbers matches this food chain?

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37 The diagram shows a food web from an ecosystem.

If the population of insects decreases, which other population will decrease the most?

A badgers
B lizards
C sagebrush
D squirrels

38 In a food chain, which trophic level has the most energy passing through it?

A carnivores
B decomposers
C herbivores
D producers

39 The diagram shows part of the carbon cycle.

Where in the cycle is there a food chain?

40 The diagram represents the flow of energy in an ecosystem during one year.
Which box represents the largest total mass of living organisms?

AHMAD IBRAHIM SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018
6093 BIOLOGY

BIOLOGY PAPER 2 **6093 / 02**

Secondary Four Express **Date: 15 Aug 2018**

Duration: 1 hr 45 mins

Name: ……( ) Class: ……

Instructions to Candidates:

Section A
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.
You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B. The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
Section A	**/ 50**
1 [8]	
2 [6]	
3 [5]	
4 [9]	
5 [8]	
6 [9]	
7 [5]	
Section B	**/ 30**
8 [10]	
9 [10]	
10 [10]	
TOTAL	**/ 80**

This question paper consists of **16** printed pages.

Section A

Answer **all** questions.

Write your answers in the boxes below.

1 Fig. 1.1 shows diagrammatically the action of enzymes on two different food molecules.

Fig. 1.1

(a) Identify the molecules **D**, **E**, **F** and enzyme **G** shown in Fig. 1.1.

D .....

E .....

F .....

G ..... [2]

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(b) It has been found that fresh pineapple contains an enzyme that can be used to make meat more tender.

Explain why the pineapple is placed on the meat a few hours before, rather than during, cooking.

…….....

…….....

……..

…….....[2]

(c) **(i)** Name the organ that makes bile.

……..…….[1]

(ii) Name the organ that produces lipase and is joined to the small intestine.

……..…….[1]

(iii) Describe the role of bile in the digestion of fats.

……..…….

……..…….

……..…….

……..…….[2]

[Total: 8]

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2 A student investigated the effect of light intensity on the rate of photosynthesis of algae. Fig. 2.1 shows the apparatus set up for the investigation.

Fig. 2.1

(a) Suggest and explain why a glass tank with water was placed between the lamp and the bottle in the investigation.

……..

……..

……..

…….....[2]

(b) The hydrogencarbonate indicator solution changes colour when the pH changes. At pH 8.4 it is red, at pH 7.6 it is yellow and at pH 9 it is purple.

Predict the colour of the hydrogencarbonate indicator solution in the bottle nearest the lamp at the end of the investigation. Explain your answer.

……..

……..

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……..

……..

……..

……..

…….....[4]

[Total: 6]

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3 Fig. 3.1 shows the events that occur during sexual reproduction in birds. The numbers in brackets indicate the number of chromosomes in the nuclei of the cells of the common emerald dove.

Fig. 3.1

(a) Name process **A** and cell **B**.

Process **A** ……

Cell **B** …… [1]

(b) State why cell **B** is described as a diploid cell.

……..

…….....[1]

(c) Sexual reproduction usually leads to variation. Suggest and explain why variation is an advantage for a species such as the common emerald dove.

……..

……..

……..

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…….....[3]

[Total: 5]

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4 Fig. 4.1 shows a person taking part in an experiment on the eye's response to light. The lamp was placed at different positions on the line **A** – **B**.

Fig. 4.1

Table 4.1 shows the diameter of the person's pupil when the light was placed at seven different positions.

Table 4.1

Position of lamp	Diameter of pupil / mm
1	3.1
2	4.0
3	4.5
4	4.9
5	3.8
6	2.4
7	1.7

(a) In which position was the lamp furthest from the eye.

…….....[1]

(b) Explain what is happening to the iris of the eye as the lamp moves from position **1** to position **2**.

……..

……..

……..

……..

……..

…….....[3]

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(c) **(i)** State the type of response being shown by the eye.

…….....[1]

(ii) Explain how does this response benefit the eye.

……

…….....

……

…….....[2]

(d) Fig. 4.2 shows a section of the eye.

Fig. 4.2

(i) Name **A** and **B**.

A: ……

B: ……

[1]

(ii) Describe the function of **B**.

……

…….....[1]

[Total: 9]

5 A man had three animals of the same species, one male and two females, and all of them had brown fur. He allowed them to breed and each female had eight young. In the first family, all the young had brown fur but in the second family, there were two offspring with yellow fur and six offspring with brown fur.

(a) In the space below, use a genetic diagram to illustrate how the offspring are produced in the second family.

[3]

(b) If the young from the first family were allowed to interbreed, explain why there are offspring with yellow fur in the next generation.

……..

……..

……..

……..

……..

…….....[3]

(c) State and explain the type of variation shown by the fur colour.

……..

……..

……..

…….....[2]

[Total: 8]

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6 Fig. 6.1 is a diagram of a developing mammalian fetus and part of the uterus wall.

Fig. 6.1

(a) Identify **A** and **B** and describe their functions.

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……..

……..

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……..

…….....[4]

(b) Suggest how smoking affects the supply of oxygen and nutrients to structure **C** during pregnancy.

……..

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……..

…….....[3]

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(c) Fig. 6.2 shows a section through structure **D** taken at **P** – **Q**.

Fig. 6.2

Based on your knowledge about structure **D**, state two ways in which the structure of **W** differs from the structure of **X**.

……..

……..

……..

…….....[2]

[Total: 9]

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7 Fig. 7.1 shows a town and surrounding countryside.

Fig. 7.1

(a) Downstream from point **X** in Fig. 7.1, plants in the river grow rapidly and in large numbers.

State **three** possible reasons for this.

……..

……..

……..

……..

……..

…….....[3]

(b) Explain why there are large numbers of bacteria but very few plants and animals in the water between the town and point **X**,

……..

……..

……..

…….....[2]

[Total: 5]

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Section B

Answer **three** questions.

Question **10** is in the form of an Either/Or question. Only one part should be answered.

8 Fig. 8.1 shows an apparatus used to investigate the uptake of water by a cut stem of a fresh green plant.

Fig. 8.1

(a) Draw an arrow on Fig. 8.1 to show the direction in which the air bubble moves when the plant takes up water. [1]

(b) The water enters the cut stem of the plant. Describe the path taken by the water from the point at which it enters the cut stem to the atmosphere around the shoot.

……..

……..

……..

……..

……..

…….....[3]

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(c) A student carried out an investigation using the apparatus shown in Fig. 8.1, of water uptake by the cut stem. The data collected is shown in Table 8.1.

Table 8.1

time of day	distance moved by bubble / mm per min
06.00	1
08.00	3
10.00	8
12.00 mid-day	16
14.00	14
15.00	11
18.00	2

Construct a line graph of the data on the grid below. [4]

(d) Describe the pattern of water uptake between 0600 and 1800 hours.

……..

…….....[1]

(e) Suggest two external factors that might have changed to cause this pattern of water uptake.

…….....[1]

[Total: 10]

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9 **(a)** State the equation for anaerobic respiration in humans.

…….....[1]

(b) Describe and explain the changes that occur to breathing rate and heart rate as a person climbs a mountain.

……..

……..

……..

……..

……..

…….[3]

(c) Suggest how mountain climbing may affect the concentration of anti-diuretic hormone (ADH) in the blood.

……..

……..

……..

…….[2]

(d) Describe the role of carbonic anhydrase in the excretion of carbon dioxide.

……..

……..

……..

……..

……..

……..

……..

…….[4]

[Total: 10]

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10 Either

(a) Describe how excretory products formed from excess amino acids are transported in the blood from their site of production to their site of removal from the human body.

……..

……..

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……..[5]

(b) Describe and explain the effects of excessive alcohol consumption.

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……..

……..[5]

[Total: 10]

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10 Or

(a) Describe the properties of enzymes.

……..

……..

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……..

……..

……..

……..[5]

(b) Outline the role of forests and oceans as carbon sinks.

……..

……..

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……..

……..

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……..

……..

……..

……..

……..[5]

[Total: 10]

End of Paper

Setter : Mr Teo Soon Hock

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Sec 4E Pure Bio Preliminary Exam 2018 Answer Scheme

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
D	B	A	A	D	B	B	D	B	C	B	B	B	D	A	C	C	A	D	D

21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
D	D	C	C	A	B	A	B	C	B	D	A	C	C	C	D	B	D	B	A

1	(a)		**D**: glycerol **E**: fatty acid **F**: maltose **G**: amylase Any 2 points, 1 mark.	[2]
	(b)		• During cooking, there is **strong heat** / the **temperature is high**, this **denatures the enzymes** in the fresh pineapples. • Therefore, the pineapple is placed a few hours before to **allow time for the enzyme to work** and enable the **meat to be tenderise**. / **placing enzymes in during cooking**, **meat cannot be tenderise**.	[2]
	(c)	(i)	Liver	[1]
		(ii)	Pancreas	[1]
		(iii)	• Bile salts **emulsify fats / oils** by **breaking fats into tiny fat droplets** and **increasing their surface area to volume ratio** for digestion. • Bile is an **alkaline fluid** which will neutralise the acidic chyme and provide **an alkaline medium / environment** for pancreatic and intestinal enzymes to function.	[2]
2	(a)		• The tank of water acts as **heat filter / absorbs heat from lamp / reduces heat effect of the lamp**. • This **maintains constant temperature** within the bottles / make sure temperature is not another variable.	[2]
	(b)		Colour prediction: **purple**	[1]
			• The bottle **nearest to the lamp** will receive the **highest light intensity** and thus the algae in the bottle will have the **highest rate of photosynthesis**. • CO_2 is an acidic gas / **forms carbonic acid** when dissolved in water. • CO_2 been used up / taken in / **absorbed by the algae for photosynthesis** • When there is **more photosynthesis than respiration**, the **concentration of CO_2** within the bottle **will decrease**. • This causes **pH to increase** / **be more alkaline** / **be less acidic**. Any 3 points.	[3]
3	(a)		Process **A** - meiosis Cell **B** - zygote	[1]
	(b)		The cell/nucleus has **two sets of chromosomes** / has **twice the number of chromosomes as the gametes**.	[1]
	(c)		• When the **environment / habitat / ecosystem <u>changes</u>**, **variation** within the genes will allow the species to be **better adapted** to these changes.	[3]

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			• For instance, some doves may have **alleles which give them resistance to diseases** / **enable them to camouflage from new predators**. • Variation enables **natural selection to occur** and enables the species to **evolve**. • Thus, **variation increases the chances of survival of the species** / reduces the chance of extinction by increasing the gene pool. Any 3 points.	
4	**(a)**		Position **4**	[1]
	(b)		As the lamp moves **from position 1 to position 2**, the **pupil dilates / enlarges**. This is brought about by the **contraction of radial muscles** and the **relaxation of circular muscles** in the **iris**. Hence, **increasing** the amount of **light entering the eye**.	[1] [1] [1]
	(c)	**(i)**	**Pupil reflex**	[1]
		(ii)	This is a reflex action and it **takes place very quickly / immediately**. The eye is **protected from excessive/too much light entering it** and **damaging the retina**.	[1] [1]
	(d)	**(i)**	**A**: Suspensory ligament **B**: optic nerve	[1]
		(ii)	Function: **Transmits nerve impulses** from the **photoreceptors** in the **retina** to the **brain**. **R**: signals; information; messages; receptors.	[1]
5	**(a)**		Parental phenotype : Brown fur x Brown fur Parental genotype : Bb x Bb Parental gametes : B b B b (gametes must be circled) Offspring genotype : BB Bb Bb bb Offspring phenotype : brown brown brown yellow Offspring phenotypic ratio : 3 brown : 1 yellow	[1] [1] [1]
	(b)		• The brown offspring in F_1 could be **heterozygous for brown colour**. • When these brown offspring interbreed, **each parent could then pass on one recessive allele to their offspring**. **ORA** • This offspring which is **homozygous recessive** will be yellow.	[1] [1] [1]
	(c)		**Discontinuous variation** **No intermediate** values / distinct / discrete / separate categories of **brown or yellow**.	[1] [1]
6	**(a)**		• **A** is the **amniotic sac** and **B** is the **amniotic fluid**. • **Supports and cushions the fetus**. • **Absorbs shocks** and as it cannot be compressed, **protects the fetus against physical injury**. • Amniotic fluid **lubricates and reduces friction** in the vagina or birth canal during birth • Allows fetus **space for movement during growth**. Any 3 points.	[1] [3]

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	(b)		• Structure C is the **placenta**. **Cigarette smoke** contains **nicotine** which causes the release of **adrenaline**. This will cause the **maternal arteries to become narrow** and the **blood supply to the placenta to decrease**. • **Cigarette smoke** also contains **carbon monoxide**, **which bind irreversibly to haemoglobin to form carboxyhaemoglobin**, reducing the ability of haemoglobin to carry oxygen in the red blood cells. • There will be a **decrease in oxygen and nutrients supplied to the placenta and hence to the fetus**, causing development of the fetus to be slower.	[3]
	(c)		• Structure W which is an **artery** has **thicker and more muscular walls** than structure X which is a **vein**, has thinner, less muscular walls. • X has **semi-lunar valves** but not W. • The walls of W are **more elastic** than the walls of X. • W has **narrower/smaller lumen** relative to diameter compared to X. Any 2 points.	[2]
7	(a)		• **Fertilisers** used by the farmer on crop plants contain **nitrates/ions/nutrients**, **excess** fertilisers that are **not absorbed by crops** are washed from farms to the river. • **Sewage from the town** contains **urine and faeces** and has **nitrates** and **phosphates**, which are nutrients for water plants and enable them to grow quickly. • **Cow dung from farm / Chemicals from the factories** have **nitrates** and **phosphates**, which are nutrients for water plants and enable them to grow quickly. • Drainage/Runoff from woodland contain **nitrates/ions/nutrients** and are washed into the river after the rain. Any 3 points.	[3]
	(b)		• **Bacteria** in **sewage / cow dung decompose** the faeces. • **They use up** the **oxygen** in the water through **aerobic respiration** as they grow and **multiply / reproduce**. • **With** a much **lower concentration of oxygen** present in water, this **led to the death** of other organisms as the **animals and plants** are **unable to respire**. Hence, there are very few plants and animals in the water. Any 2 points.	[2]
8	(a)		Arrow pointing to left, part above/below capillary tube	[1]
	(b)		• The **water molecule moves up the xylem vessel** by **transpiration pull** in the cut stem and enters the **xylem vessels** in the vascular bundles in the leaves. • **Water molecules then enters the mesophyll cells** and out of them to form a **thin film of moisture** over their surfaces. • **Water** will then **evaporate** from this thin film of moisture into the **intercellular air spaces** as **water vapour**. • **Water vapour** will then **diffuse out of the leaves through the stomata**. Any 3 points.	[3]
	(c)		• Scale of graph is correct	[4]

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			• Lines are smooth (accept either data plot / line of best fit)
			• Axes labelled with suitable scales
			  ○ y-axis: distance moved by bubble / mm per min
			  ○ x-axis: time of the day
			• Points are plotted correctly	

	(d)		The water intake **increases up to noon** and **then decreases**.	[1]
	(e)		• Light intensity • Humidity of air • Temperature of air • Wind speed / Air movement Any 2 points.	[1]
9	**(a)**		glucose → lactic acid + small amount of energy	[1]
	(b)		• When the person climbs a mountain, the person will be **breathing faster** and deeper and the heart will **beat faster**. • There will be **faster circulation of blood** which will supply **more oxygen** to the **muscles** to **release of more energy from aerobic respiration.** • The faster circulation of blood will also **remove carbon dioxide produced** by aerobic respiration more quickly.	[3]
	(c)		• During vigorous exercise, the **loss of water from the body** through **sweating increases**. • This causes a **decrease in water potential in the blood**, which stimulates **increased production of ADH in hypothalamus which is released from the pituitary gland into the blood stream** leading to an **increase in concentration of ADH** in the blood;	[2]
	(d)		• Carbon dioxide in the blood plasma **diffuses into red blood cells**, and carbonic anhydrase **catalyses the conversion of carbon dioxide into carbonic acid**. • Carbonic acid is converted into **hydrogencarbonate ions**; • Hydrogencarbonate ions is **transported in the blood plasma** towards the lungs; • At the lungs, hydrogencarbonate ions diffuse back into red blood cells and are **converted back into carbonic acid**; • **Carbonic anhydrase** then **catalyse the conversion of carbonic acid to carbon dioxide**; • Carbon dioxide then **diffuse out of the red blood cell into the blood plasma**, and diffuses into the **alveoli** before it is expelled when we breathe out. Any 4 points.	[4]
10E	**(a)**		• Excess amino acids are broken down in the **liver via deamination to form** excretory products such as **urea.** • The excretory products **leave the liver via hepatic vein** and are **transported to the kidney** via the **renal artery**. • They are filtered **from the blood** through the capillary walls of the **glomerulus into the Bowman's capsule** by **ultrafiltration**. • They travel from the **proximal convoluted tubule** of the kidney tubule to the **loop of Henle**, • and the **distal convoluted tubule**, then the **collecting duct**.	[5]

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			• They are then transported **via the ureter** to the **urinary bladder**. • The excretory products are removed from the human body **in the urine** through the **urethra**. Any 5 points	
	(b)		• Alcohol is **a depressant** and it **slows down some brain functions**. • This will also lead to **slower / longer / increased** reaction time. • Under the influence of alcohol, a person becomes carefree as alcohol takes away his inhibitions, leading to **a reduction in self-control**. • **Alcohol stimulates acid secretion in the stomach**, excess stomach acid increases the risk of **gastric ulcers**. • Prolonged alcohol abuse may lead to **cirrhosis of the liver / liver damage** and can result in **liver failure**. • There are also **social implications** when a person is addicted to drinking alcohol, such as **they may exhibit violent behaviour towards family / neglect work and family / commit crime while under influence of alcohol**.	[5]
10O	**(a)**		• Enzymes are **<u>biological</u> catalysts** that **speed up chemical reactions**. • Enzymes are **required in small amounts**. • They **remain <u>chemically</u> unchanged** at the end of a reaction. • Enzymes are **protein <u>in nature</u>**. • Enzyme activity is **affected by temperature and pH**. • Enzymes speed up chemical reactions by **lowering the <u>activation</u> energy of the reaction**. • Enzymes have a unique three-dimensional shape, and **an active site** which is has a specific shape that is **<u>complementary</u> to a specific substrate**. / Enzymes are **specific in nature**. Any 5 points.	[5]
	(b)		• The **plants** in the forests **absorb <u>atmospheric</u> carbon dioxide** which is used in **photosynthesis**. • In forests, **a large amount of carbohydrates / carbon compounds is stored** in **trees**. When trees die, their remains may be **buried <u>deep</u> in the ground**. After millions of years, these remains form **coal**, a **fossil fuel**. • Oceans are carbon sinks as **<u>atmospheric</u> carbon dioxide can dissolve / is soluble in the ocean's water**. • The carbon dioxide that dissolves in the ocean is **taken in by <u>phytoplankton</u> and** photosynthetic **<u>algae</u> in photosynthesis**. • The **carbon is stored as organic compounds such as carbohydrates, proteins and fats** in these producers. • When organisms in the oceans die, they may sink and be **buried <u>deep</u> in the seabed** and may form fossil fuels. This **stores carbon in the form of carbon compounds in the sea-bed**. Any 5 points.	[5]

Setter : Mr Teo Soon Hock

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Name:		Index Number:		Class:	

CATHOLIC HIGH SCHOOL
Preliminary Examination
Secondary 4

BIOLOGY **6093/01**

Paper 1 Multiple Choice **Monday 17 September 2018**

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, index number and class on the Answer Sheet in the spaces provided unless this has been done for you.

DO **NOT** WRITE ON THE MARGINS.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answer **A**, **B**, **C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate 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.
The use of an approved scientific calculator is expected, where appropriate.

For examiner's use only:	Paper 1	/ 40

This paper consists of **17** printed pages.

[Turn over

1 The diagram shows the relationship between phloem sieve tube elements, xylem vessel elements and companion cells.

Which is correct?

	1	2	3	4	5
A	companion cells	endoplasmic reticulum	phloem sieve tube elements	nucleus absent	xylem vessel elements
B	companion cells	nucleus	phloem sieve tube elements	cytoplasm	xylem vessel elements
C	phloem sieve tube elements	mitochondria	companion cells	nucleus	xylem vessel elements
D	xylem vessel elements	cytoplasm absent	phloem sieve tube elements	vacuole	companion cells

2 The diagram below shows the structure of a plant cell as seen using an electron microscope.

Which structures are involved in the process of enzyme synthesis within this cell?

A 1, 2, 4, 5 and 6
B 1, 3 and 6
C 2, 3, 5 and 6
D 3, 4 and 5

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3 Some processes found in humans are listed.

1 contraction of muscles
2 tissue respiration
3 synthesis of proteins
4 movement of ions in blood plasma
5 exchange of gases in the air sacs
6 transmission of nerve impulses

Which processes does **not** require energy?

A 1, 4 and 5 only
B 3, 4 and 5 only
C 2, 4 and 5 only
D 2, 4 and 6 only

4 Beetroot cells contain a water-soluble red pigment. Two test tubes were set up as described in the table.

tube A	Pieces of washed raw beetroot in water
tube B	Pieces of washed raw beetroot in water containing 3 drops of cyanide, a respiratory inhibitor.

After 30 minutes, the water in tube B contained a red pigment but the water in tube A did not. Which of the following statements are **incorrect** for tube B?

1 Pigment molecules passed out and were replaced by cyanide.
2 The cell membrane was unable to retain the red pigment.
3 Water entered the tissue by osmosis and caused the cells to burst.
4 Water passed out of the cells by osmosis and carried the soluble pigment with it.
5 The same result will occur if ethanol was used instead of cyanide.

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

5 Which of the following statements describe the uses of lipids?

1 It acts as a shock-absorber which protects blood vessels.
2 It forms a heat insulating layer for mammal.
3 It acts as a food reserve because it is miscible with water.
4 It is an essential component of a cell membrane.

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

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6 The data show the results of an investigation on osmosis using sticks of potato.

concentration of sugar solution / mol per dm^3	length of potato stick at start / mm	length of potato stick after 24 hours / mm
0.6	60	54

Which statements explain this change in length?

	movement of water	cause of the movement
A	into the potato cells	The sugar solution has a higher water potential than the potato cells.
B	into the potato cells	The sugar solution has a lower water potential than the potato cells.
C	out of the potato cells	The sugar solution has a higher water potential than the potato cells.
D	out of the potato cells	The sugar solution has a lower water potential than the potato cells.

7 When a lake begins to freeze, which properties of water are needed for fish to survive?

1 Water has a high surface tension.
2 Water has a high latent heat of vaporisation.
3 Water has a high thermal capacity.
4 Water has its maximum density at 4°C.

	1	2	3	4
A	✓	✓	✓	×
B	✓	×	✓	×
C	×	✓	×	✓
D	×	×	✓	✓

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8 An experiment was conducted to investigate the effect of temperature on the activity of the enzyme β-glucosidase. The enzyme was tested when in solution (free) and when immobilised in alginate beads. The results are shown in the graph below.

Which statement about the effect of immobilisation of β-glucosidase is correct?

A It increases the kinetic energy of the enzyme.
B It inhibits the activity of the enzyme.
C It reduces the optimum temperature of the enzyme.
D It stabilises the enzyme against denaturation.

9 The graph below shows curve X which represents the activity of an enzyme at 20°C.

Which curve represents the activity when the temperature is raised to 30°C and more substrate added?

A (1)
B (2)
C (3)
D (4)

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10 What are the characteristics of the lipase used in digestion?

	source	optimum pH	substrate
A	pancreas	8	lipid
B	small intestines	8	lipid
C	stomach	2	sucrose
D	liver	8	lipid

11 The diagram below shows the circulatory system in a human body.

After a lunch meal, what happens to blood vessel **M** when compared with that of blood vessel **N**?

1. Blood vessel **M** carries more oxygen.
2. Blood vessel **M** carries less carbon dioxide.
3. Blood vessel **M** carries more digested food.

A 1 only is correct
B 2 and 3 only are correct
C 1 and 2 only are correct
D 1, 2 and 3 are correct

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12 Translocation is the process whereby manufactured food is transported from photosynthesizing parts of the plant to other parts of the plant that requires the food. What are the main forms of food which are commonly translocated?

1 amino acids
2 glucose
3 starch
4 sucrose

A 1 only
B 1 and 2 only
C 1 and 4 only
D 1, 2 and 4 only

13 The graph below shows the net output of oxygen in spinach leaves as light intensity is increased. Temperature is kept constant during the experiment.

Which one of the following conclusions can be made based on the graph?

A At point T photosynthesis is no longer occurring.
B The optimal level of light intensity for photosynthesis is 40 AU.
C At point S the amount of oxygen output is a third of that at point P.
D Below 10 AU of light intensity the aerobic respiration rate is greater than the photosynthesis rate.

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14 The diagram below shows how sugar is made (process **X**) and four different ways in which plants use the sugars produced by photosynthesis.

Which of the following statements about the process **X** are correct?

1. **X** is called the light-independent stage of photosynthesis process.
2. **X** is called the light-dependent stage of photosynthesis process.
3. Energy is needed for the process **X** to take place.
4. Hydrogen available for the reduction process is from photolysis of water.
5. Process **X** occurs in the palisade cells, spongy cells and epidermal cells of green leaf.

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

15 The diagrams show an experiment on transpiration. Four leaves of the same species are balanced on two drinking straws. One or both sides of the leaves are covered in grease. Any difference in mass causes the heavier end to be lower.

At the start of the experiment the straws were positioned so that the leaves were level. Which leaves will be lower after an hour?

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

16 What are characteristics of transport of manufactured material in phloem?

	occurs in sieve tubes	occurs in companion cells	does not require energy	can occur in either direction
A	✓	×	×	✓
B	✓	✓	✓	×
C	✓	×	✓	✓
D	×	✓	×	✓

key: ✓= yes × = no

17 A human heart, when cut along plane XY as in diagram K produces a cut surface as shown in diagram L.

Blood filled regions are indicated by **R** and **S** respectively. Which of the following is not true? It is probable that blood

A would flow from **S** into the aorta.
B in **S** has come immediately from the left atrium.
C in **R** would leave the heart via the pulmonary vein.
D in S would have a higher concentration of oxyhaemoglobin than the blood in **R**.

18 The diagram shows the pressures in the left side of the heart during one heart beat. At which time in the heart beat cycle are all four of the heart valves closed?

19 The diagram shows the external structure of the heart.

In which two vessels would a deposit of cholesterol increase the likelihood of coronary thrombosis?

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

20 Which substances are formed during anaerobic respiration in animals and yeast?

	animals	yeast
A	alcohol	alcohol and lactic acid
B	alcohol and carbon dioxide	alcohol
C	lactic acid	alcohol and carbon dioxide
D	lactic acid and water	lactic acid

21 The graph shows the relationship between the average age at death and the number of cigarettes smoked per day.

Which of the following is a correct conclusion from the graph?

A Most people smoking 30 cigarettes a day die from lung cancer.
B Most people living longer than 74 years are non-smokers.
C Non-smokers live at least 4.5 years longer than people who smoke.
D People smoking five cigarettes a day live longer than those smoking 15 cigarettes a day.

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22 The diagram shows some of the reactions of carbon dioxide when it enters the blood from cells in a metabolically active tissue. Which reaction is catalysed by the enzyme carbonic anhydrase?

23 Some effects of smoking are listed.

1 paralyses cilia
2 increases heart rate
3 increases mucus production
4 is addictive
5 reduces the amount of oxygen in the blood
6 emphysema

Which effects are caused by nicotine?

A 1, 2 and 5
B 1 and 3
C 2 and 4
D 3, 4 and 6

24 The table shows the composition of a liquid found in the human body.

component	concentration / arbitrary units
amino acids	0.00
glucose	0.00
proteins	0.00
salts	1.50
urea	2.00

In a healthy person, which structure contains this liquid?

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25 The diagram shows an example of homeostasis in a person.

Which two letters represent negative feedback changes?

A W and X
B W and Y
C X and Z
D Y and Z

26 What happens when the core temperature of the body increases?

	diameter of surface blood vessels	urine production
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

27 Which type of cell stimulates the release of adrenaline?

A muscle cell
B adrenal gland
C red blood cell
D motor neurone

28 Which of the following statements about insulin is correct?

A Its secretion is controlled by the pituitary gland.
B It stimulates liver cells to take up glucose from the blood.
C It is transported out of the pancreas through the pancreatic duct.
D It catalyses the conversion of excess glucose to glycogen in the liver.

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29 A boy draws a dot and a cross as shown.

● X

He closes his right eye and looks at the cross with his left eye. He brings the drawing towards him until the dot disappears. Where does the image of the dot fall when it has disappeared?

30 An experiment was set up using four groups of insect-pollinated flowers in a field. In each group different parts of the flower were removed as shown below and insects were allowed to visit all the flowers.

Which group would produce most seeds?

group of flowers	petals	stigmas	anthers
A	left	left	removed
B	removed	left	left
C	left	removed	removed
D	removed	removed	left

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31 A woman gave birth to a pair of twins **P** and **Q**. The diagram below shows their formation.

Which of the following characters of **P** and **Q** must be the same if they are brought up under the same environmental conditions?

1 sex
2 height
3 blood group

A 1 only
B 2 only
C 1 and 3 only
D 2 and 3 only

32 The diagram shows the result of the examination of a single cell from a woman's fetus.

Which of the following deductions are correct?

1 The cell is undergoing cell division.
2 The fetus is a male.
3 The fetus has a genetic disorder.

A 2 and 3 only
B 1 and 2 only
C 1 and 3 only
D 1, 2 and 3

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33 Purple or white flowers can be seen in a particular plant species. In this species, the colour of the flower is controlled by one gene.

In experiments to investigate the inheritance of flower colour in this plant species, four crosses were carried out. The phenotypes of the parents in each cross were recorded. In each cross, 40 offspring were produced. The phenotypes of the offspring were recorded and the results are displayed in the table below.

Cross	Phenotype of Parent 1	Phenotype of Parent 2	Number of offspring and their phenotypes
1	purple	white	40 purple offspring
2	purple	purple	31 purple and 9 white offspring
3	white	white	40 white offspring
4	purple	white	21 purple and 19 white offspring

From the information given, it can be stated that

A both parents in cross 1 are homozygous.
B the two parents with white flowers in cross 3 will have different genotypes.
C one parent in cross 2 will be heterozygous and the other parent will be homozygous.
D the parent with purple flowers in cross 1 will have the same genotype as the parent with purple flowers in cross 4.

34 The pedigree chart below shows the inheritance of a recessive condition known as human albinism. Only homozygous recessive individuals are albinos.

What is the probability of individual 9 being a heterozygous carrier?

A 0.00
B 0.25
C 0.50
D 1.00

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35 What describes two alleles of the same gene?

	relative position occupied on chromosome	characteristic controlled
A	different	different
B	different	same
C	same	different
D	same	same

36 Which statements about homologous chromosomes are correct?

1 They form pairs during mitosis.
2 They are not present in all cells.
3 They contain identical genes and alleles.
4 X and Y sex chromosomes are not homologous chromosomes.
5 They are inherited from the different parents.
6 They are two chromatids that are joined together to form one chromosome.

A 2 and 5
B 2, 3 and 5
C 1, 2 and 4
D 1, 3 and 6

37 A single substitution in an allele of the gene coding for haemoglobin results in sickle cell haemoglobin. The mRNA sequence for three amino acids for normal haemoglobin is shown.

CCUGAAGAG

The mRNA sequence for sickle cell haemoglobin is shown.

CCUGUAGAG

The table shows some of the triplet codes for two amino acids.

DNA triplet codes	amino acid
CTC	Glu
CTT	Glu
CAT	Val
CAC	Val

Which row is correct for the substituted DNA nucleotide of the allele and the substituted amino acid of the protein?

	DNA nucleotide	new amino acid
A	A	Glu
B	A	Val
C	T	Glu
D	T	Val

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38 In what order do the following processes occur to produce a population of bacteria that are resistant to a new antibiotic?

1 change in reproductive success of bacteria
2 increase in frequency of the resistance allele in the population
3 increase in genetic variation within the population
4 random mutation occurs in bacterial DNA

A 1 → 3 → 2 → 4
B 2 → 1 → 3 → 4
C 3 → 4 → 1 → 2
D 4 → 3 → 1 → 2

39 Four water samples are collected from different places along a river. The average number of organisms per species and the number of different species of organisms are counted. The table shows the results. Which water sample is most polluted?

	average number of organisms per species	number of species
A	650	5
B	280	30
C	400	17
D	420	43

40 The diagram shows a sewage treatment plant.

In which parts do aerobic and anaerobic bacteria become most active to help to digest sewage?

	aerobic bacteria	anaerobic bacteria
A	1	2
B	2	4
C	3	4
D	3	5

- The End -

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Name:		Index Number:		Class:	

CATHOLIC HIGH SCHOOL
Preliminary Examination
Secondary 4

A

BIOLOGY

6093/02

Paper 2

Thursday 13 September 2018
1 hour 45 minutes

Additional Materials: -

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
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, glue or correction fluid.
DO **NOT** WRITE ON THE MARGINS.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.
The number of marks is given in brackets [ ] at the end of each question or part question.

For examiner's use only:

Section A	/ 50
Section B	/ 30

This paper consists of **17** printed pages.

[Turn over

Section A

Answer **all** questions.
Write your answer in the spaces provided.

1 Some young grass plants were grown with their roots in a mineral solution that contained nitrate ions. The plants were divided into two batches, **N** and **P**.
Cyanide, which inhibits aerobic respiration, was added to the solution given to the plants in batch **P**.

The quantity of nitrate ions in the plants was determined at regular intervals for 70 hours. After 60 hours, the mineral solution was replaced by distilled water. The results are shown in Fig. 1.1.

Fig. 1.1

Using the data in Fig. 1.1,

(a) calculate the rate of absorption of nitrate ions in batch **N** between 40 and 60 hours. Show your working. [2]

_____ mg per hour

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(b) explain why the absorption of nitrate ions by the plants in batch **N** differs from that in batch **P**; [4]

.....

.....

.....

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(c) explain why the mean quantity of nitrate ions in **both** batches of plants decreased after 60 hours. [2]

.....

.....

.....

.....

[Total: 8 marks]

2 **(a)** State the name of **one** excretory substance, that is removed by the kidneys, that contains nitrogen. Explain why it is excreted. [2]

name .....

explanation .....

.....

(b) Blood is filtered as it flows through the kidneys.

(i) State the name of the structure within a kidney that filters the blood. [1]

.....

(ii) State **two** components of blood that do **not** pass through the filter. [1]

1 .....

2 .....

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(c) The filtrate which is formed from the blood in the kidneys contains many useful substances, which are reabsorbed into the blood. Fig. 2.1 is a photomicrograph of a cross-section of some of the cells that carry out reabsorption.

Fig. 2.1

(i) Complete the table by stating the letter in Fig. 2.1 that identifies each structure. [2]

structure	letter on Fig. 2.1
microvilli	
nucleus	
mitochondrion	

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(ii) The cells that line the kidney tubules, such as those in Fig. 2.1, absorb many compounds from the filtrate. Use Fig. 2.1 to explain how the cells are adapted for absorption. [5]

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[Total: 11 marks]

3 Fig. 3.1 is a transmission electron micrograph of a section through a blood vessel.

Fig. 3.1

(a) State the type of blood vessel shown in Fig. 3.1 **and** give **two** reasons for your choice. [3]

type of blood vessel .....

reason 1 .....

reason 2 .....

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(b) Fig. 3.2 is a graph showing how the blood pressure in the pulmonary artery and in the right ventricle changes during one cardiac cycle.

Fig. 3.2

Use Fig. 3.2 to state the time at which:

(i) the valve between the right ventricle and the pulmonary artery closes [1]

.....

(ii) the ventricle begins to contract. [1]

.....

(iii) State **and** explain the similarities and differences between Fig. 3.2 and a graph showing how the blood pressure for the **left** ventricle changes during the same cardiac cycle. [4]

.....

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[Total: 9 marks]

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4 Fig. 4.1 shows a potometer that is used for measuring rates of water uptake by leafy shoots.

Fig. 4.1

A student used the potometer shown in Fig. 4.1 to investigate the rate of water uptake of a leafy shoot under six different sets of conditions. The student changed two environmental conditions around the plant:

- temperature
- wind speed.

For each experiment, the apparatus was left in the conditions until the rate of water uptake by the leafy shoot became constant. The student took several measurements during each experiment and calculated the mean rate of movement of the gas bubble. The results are recorded in Table 4.1.

Table 4.1

experiment	temperature / °C	wind speed	mean rate of movement of gas bubble / mm h^{-1}
1	15	low	12
2	15	high	22
3	25	low	24
4	25	high	45
5	35	low	64
6	35	high	120

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(a) Using the data in Table 4.1, describe and explain the effect of the two conditions that the student changed during the investigation on the rate of water uptake. [5]

temperature

_____

_____

_____

_____

_____

wind speed

_____

_____

_____

_____

_____

The rate of water movement up the leafy shoot was measured before it was cut from the plant. The rate was found to be less than the rate of water uptake from the potometer when kept in the same temperature and windspeed conditions.

(b) Suggest why the rate of water movement in an intact shoot is less than that measured in the potometer. [2]

_____

_____

_____

_____

[Total: 7 marks]

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5 Fig. 5.1 shows part of a DNA molecule.

Fig. 5.1

(a)(i) Name **U** to **X**. [3]

U .....

W .....

X .....

(ii) Name the bonds indicated by **Z**. [1]

.....

(b) Describe **three** features of a polypeptide molecule that are different from those found in a DNA molecule. [3]

1 .....

.....

2 .....

.....

3 .....

.....

[Total: 7 marks]

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6 Resistance to the widely used poison warfarin is now extremely common in rats. Warfarin interacts with vitamin K to prevent its normal functions in the blood clotting mechanism.

Normal rats fed on warfarin suffer a fatal haemorrhage. Resistant rats apparently do not use vitamin K in the same way and maintain normal blood clotting times, even when they have eaten large amounts of warfarin. Warfarin resistance in rats is determined by a single dominant allele. Animals carrying the allele for resistance need large quantities of vitamin K.

genotype	resistance to warfarin	quantities of vitamin K required
homozygous recessive	not resistant (susceptible)	normal
heterozygous	resistant	slightly higher
homozygous dominant	resistant	extremely large

When warfarin is used continually the percentage of resistant rats remains at about 50% of the total rat population.

(a) Using the symbols **R** for the allele that confers warfarin resistance and **r** for the allele that produces no resistance, draw a genetic diagram to explain how resistant rats can produce warfarin susceptible offspring. [4]

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(b) Suggest why homozygous dominant rats are unlikely to survive in the wild. [1]

(c) Describe how natural selection operates to maintain the proportion of resistant rats at about 50% of the total population. [3]

[Total: 8 marks]

- End of Section **A** -

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Name:		Index Number:		Class:	

CATHOLIC HIGH SCHOOL
Preliminary Examination
Secondary 4

B

BIOLOGY

6093/02

Paper 2

Thursday 13 September 2018
1 hour 45 minutes

Additional Materials: -

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
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, glue or correction fluid.
DO **NOT** WRITE ON THE MARGINS.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.
The number of marks is given in brackets [ ] at the end of each question or part question.

For examiner's use only:

Section A	/ 50
Section B	/ 30

This paper consists of **17** printed pages.

[Turn over

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Section B

Answer **three** questions.

Question **9** is in the form of an **Either**/**Or** question. Only one part should be answered.

7 Fig. 7.1 shows a woman on a stationary bicycle. The mask fitted over her nose and mouth measures the composition of the air she breathes out.

Fig. 7.1

Table 7.1 shows the concentration of carbon dioxide in the air expired by the woman in the five minutes after she stopped exercising.

Table 7.1

time / min	percentage concentration of carbon dioxide / %
0	6.0
1	5.6
2	4.8
3	4.4
4	4.3
5	4.3

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(a)(i) Plot the data on the graph paper below. [4]

(ii) Describe and explain the results of the investigation. [6]

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(b) Explain why exercise is recommended for people with a high risk of developing coronary heart disease. [2]

.....

.....

.....

.....

[Total: 12 marks]

8 The flowers of pea plants can be pollinated by bees.

(a) State **three** features of flowers that would attract insects such as bees. [3]

1. .....

.....

2. .....

.....

3. .....

.....

(b) Successful pollination results in fertilisation. Describe the events that occur after pollen grains leave the anther of a flower until fertilization takes place. [5]

.....

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[Total: 8 marks]

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9 Either

(a) Describe how **named** components of the nervous system are involved in producing a reflex action. [6]

(b) Describe **one** example of a simple reflex action and explain the importance to the body of this action. [4]

[Total: 10 marks]

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9 Or

(a) Insulin is a hormone that is secreted by the pancreas.

(i) Define the term hormone. [3]

(ii) Describe the role of insulin in the body. [4]

(b) Explain how blood flow in the skin helps to maintain a constant body temperature in very hot conditions. [3]

[Total: 10 marks]

- End of Section **B** -

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Mark Scheme

6093/01 (40 marks)

1	A	2	C	3	C	4	D	5	C
6	D	7	D	8	D	9	A	10	A
11	C	12	C	13	D	14	A	15	D
16	C	17	C	18	B	19	D	20	C
21	B	22	C	23	C	24	A	25	A
26	C	27	D	28	B	29	B	30	A
31	A	32	C	33	A	34	C	35	D
36	A	37	B	38	D	39	A	40	C

6093/02
Section A (50 marks)

1 (a)	15 mg/20 hours **[1]** **A**: 55-40/60-40, 55-40/20, 15/60-40 0.75 (mg h^{-1}) **[1]**
1 (b)	ions/minerals/nitrates in batch **P** are absorbed (only) by diffusion **[1]** no/limited/less, energy for active absorption/transport **[1]** because (cyanide) inhibits, respiration (must be linked to explanation)/ATP synthesis **[1]** **A**: converse for batch **N** (*for above 3 marking points*) ions in batch **N** are absorbed by active transport (and diffusion) **[1]** (idea of) after 10 hours no concentration gradient in **P** **[1]** as rate of assimilation/use = rate of absorption (so concentration in plant remains constant) **[1]** active transport continues in **N** against a concentration gradient (after 10 hours) **[1]** reference to appropriate figs (linked to an <u>explanation</u> of different absorption rates) **[1]** **[max 4]**
1 (c)	no ions in distilled water **[1]** **R**: low ions concentration gradient out of the roots **[1]** ions lost by diffusion **[1]** ions, used in amination/amino acid synthesis/protein synthesis **[1]** **A**: ions assimilated **R**: used/utilized **[max 2]**
2 (a)	urea **[1]** **A**: ammonia / ammonium / creatin(ine) / uric acid toxic / poisonous / harmful / AW **[1]**
2 (b) (i)	<u>glomerulus</u> **[1]**
2 (b) (ii)	red (blood) cells / erythrocytes phagocytes / lymphocytes

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	named plasma proteins (e.g. albumen / fibrinogen / insulin / glucagon / thrombin / antibodies / clotting factors) platelets **[1]**
2 (c) (i)	microvilli – **E** nucleus – **A** mitochondrion – **C** **[all correct 2 marks, 1 – 2 correct 1 mark]**
2 (c) (ii)	(microvilli give a) large surface area **[1]** for diffusion / described as movement down a concentration gradient **[1]** lots of, mitochondria / **C** **[1]** **C** / mitochondria, are the site of (aerobic) respiration **[1]** **C** / mitochondria, release energy + for active transport **[1]** **R**: 'produces energy' (active transport needed for) movement against concentration gradient **[1]** **[max 5]**
3 (a)	capillary **[1]** *two from* single celled wall / AW **[1]** **A**: thin wall ref. to lumen diameter approx 7 µm **[1]** **A**: 5–8 µm / ref. to similarity to dimension of red blood cell in direct contact with tissue fluid **[1]** *if vein named, allow one mark for, thin wall (relative to lumen)* ***or*** *wide / AW, lumen (relative to wall thickness)*
3 (b) (i)	0.24 s / 0.25 s **[1]** **R**: no unit
3 (b) (ii)	0.08 s / 0.09 s **[1]** **A**: range **R**: no unit
3 (b) (iii)	*four from* *similarity* ref. to increases and decreases in pressure at same time **[1]** **A**: description for part of the graph e.g. starts to rise at same point as RV, returns to minimum at same point as RV idea that events in cardiac cycle occur are coordinated **[1]** **A**: described e.g. impulses pass up both ventricles at the same time, ventricles both contract at same time *difference* reaches higher, blood pressure / peak, (than RV) **[1]** *any two* systolic pressure higher in LV (than RV) **[1]** left ventricle pumps blood to (whole) body / RV only to lungs) **[1]** overcome greater resistance / ora for RV **[1]** walls of left ventricle, thicker / more muscular **[1]** more force exerted by LV **[1]**
4 (a)	higher temperature <u>and</u> higher wind speed gives higher / greater / faster (rate of) uptake / transpiration / water loss / movement of, water / bubble **[1]**

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	both conditions / AW increase water potential / diffusion gradient (between leaf and air) **[1]** *temperature* use of figs. (units required) to make a valid comparison **[1]** e.g. expts. 1 and 3 - 12 to 24 mm h^{-1} expts. 2 and 4 - 22 to 45 mm h^{-1} expts. 3 and 5 - 24 to 64 mm h^{-1} **A**: appropriate factor increase e.g. rate doubles **A**: figs. once only in temperature or wind speed (see below) ref to kinetic energy / speed of movement of molecules and rate of evaporation / transpiration / diffusion **[1]** warm air holds more water vapour / molecules than cold air / AW **[1]** **R**: water *wind speed* use of figs. (units required) to make a valid comparison **[1]** e.g. expts. 1 and 2 - 12 to 22 mm h^{-1} expts. 3 and 4 - 24 to 45 mm h^{-1} **A**: figs. once only in wind speed or temperature (see above) idea that air blowing over the surface of / around the leaf takes moist air / water vapour / molecules, away / reduces transpiration shells **[1]** (so) air, around leaf / outside stomata, does not become saturated / is less humid **[1]** **[max 5]**
4 (b)	*in intact plant* limited / less water available from the soil **[1]** slower rate of water uptake / absorption by the roots **[1]** water has to travel further / greater distances, in xylem vessels under tension / in small vessels **[1]** other factors (e.g. light intensity / humidity) could affect width / size / opening of stomata **[1]** (compared with controlled potometer investigation) **A**: reverse arguments for potometer **[max 2]**
5 (a) (i)	**U** – phosphate / PO_4 **[1]** **R**: phosphoric acid / phosphorus / P **W** – deoxyribose **[1]** **R**: pentose **X** – cytosine **[1]** **R**: nitrogenous base / pyrimidine / C
5 (a) (ii)	**Z** – hydrogen **[1]** **R**: H
5 (b)	*Assume answer is about polypeptide unless indicated otherwise.* ***R*** *if biologically incorrect.* polypeptide / DNA amino acids / nucleotides **[1]** one / single strand / chain / two / double (helix) strand / chains **[1]** peptide bonds / phosphodiester **[1]** **R**: between peptides / polypeptides 20 monomers / sub units / only 4 monomers / sub units **[1]** **A**: > 4 monomers / sub units / **R**: 4 bases no phosphate / PO_4 / has phosphate / PO_4 **[1]** **[max 3]**
6 (a)	parental genotype + Rr, Rr **[1]**

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	gametes + R, r **[1]** offspring genotype + RR, Rr, Rr, rr **[1]** offspring phenotype + resistant, resistant, resistant, susceptible **[1]** *penalise once if other symbols used*
6 (b)	suffer from vitamin K deficiency / require too much vitamin K **[1]**
6 (c)	warfarin will kill rats without resistance - homozygous recessive **[1]** homozygous dominant rats require too much vitamin K **[1]** heterozygous rats most likely to survive and produce offspring **[1]** only 50% of offspring will be heterozygous **[1]** **[max 3]**

Section B (30 marks)

7 (a) (i)	**A** labelling of axes (x-axis labelled time / min + y-axis percentage concentration of carbon dioxide / % **[1]** **R**: if wrong orientation **S** scale (graph needs to be more than half of the graph paper) **[1]** **P** all points plotted correctly **[1]** **L** line (a best-fit curve + no extrapolation) **[1]**
7 (a) (ii)	*description* carbon dioxide highest / higher, at 6.0% / (immediately) after exercise **[1]** decreases **[1]** comparative data quote **[1]** *explanation* removal of excess carbon dioxide **[1]** more energy used during exercise means higher rates of respiration **[1]** aerobic respiration releases carbon dioxide **[1]** oxygen not supplied fast enough (from lung / heart) / more oxygen required by muscles **[1]** <u>oxygen debt</u> **[1]** <u>anaerobic</u> respiration (in muscles) **[1]** (produces) lactic acid / lactate **[1]** lactic acid is, broken down / respired / converted to glucose / converted to carbon dioxide **[1]** **R**: remove lactic acid **[max 6]**
7 (b)	prevents blocked arteries / prevents thrombus formation **[1]** lowers blood pressure **[1]** lowers cholesterol / lowers fats / reduces risk of atheroma **[1]** weight loss / using fats / avoids obesity **[1]** lowers stress **[1]** (heart) muscle stronger / lower (resting) pulse **[1]** **[max 3]**
8 (a)	scent **[1]** nectar **[1]** nectar guides **[1]** colourful petals **[1]** large petals **[1]** **I**: sticky pollen / stigma *or* stigma / anther inside flower **[max 3]**
8 (b)	pollen lands on stigma **[1]**

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	pollen tube grows + through style **[1]** to ovary **[1]** (pollen nucleus / male gamete) enters ovule **[1]** through micropyle **[1]** male and female (gamete) / egg, nuclei fuse **[1]** **[max 5]**
9 E (a)	synapse (anywhere in sequence) **[1]** impulse / electrical pulse (anywhere in sequence) **[1]** **I**: signal / message receptor + detection of stimulus **[1]** ***then*** sensory neurone **[1]** relay / inter(mediate) / connector neurone **[1]** reference to CNS / brain / spinal cord **[1]** ***then*** motor neurone **[1]** effector / named effector **[1]** action of effector or described **[1]** **[max 6]**
9 E (b)	named stimulus / trigger for a specific reflex action **[1]** correct named receptor (e.g. retina) for stimulus given **[1]** action described correct for example given **[1]** importance of specific action explained **[1]**
9 O (a) (i)	chemical / substance + made by a gland **[1]** **I**: proteins travels in the blood (plasma) **[1]** alters/controls the activity of one or more specific target organs **[1]**
9 O (a) (ii)	controls blood, glucose / sugar, concentration / level **[1]** increased, uptake / respiration, of glucose **[1]** (simulates cells to) convert glucose to glycogen + in muscle / liver **[1]** (so) decreases blood glucose concentration **[1]** ref to, negative feedback / homeostasis **[1]** **[max 4]**
9 O (b)	arterioles / arteries, dilate **[1]** more blood flow (through capillaries) near the surface of the skin / AW **[1]** (more) heat loss from blood + by radiation **[1]**

KIASU ExamPaper

	Class	Register Number
Name:		

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DUNEARN SECONDARY SCHOOL
Preliminary Examination 2018

Biology 6093
Paper 1
Secondary 4 Express

19 Sep 2018 (Wednesday) **0930 - 1030** **1 Hour**

INSTRUCTIONS TO CANDIDATES
Write your name, class and register number in the spaces at the top of this page.

There are forty questions in this paper. Answer **ALL** questions. For each question, there are 4 possible answers, **A, B, C** and **D**. Choose the **one** you consider correct and shade in the OTAS provided.

Setter: Mr Ng Hock Ping

This question paper consists of **21** printed pages including the cover page.

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1 The diagram shows a cell found in an organ in the human body.

From its structures, what are the functions of this cell?

A intracellular digestion and storage of granules of product
B intake of substances and secretion
C secretion and transport of protective mucus
D uptake and transport of ions and molecules

2 The diagram below shows a pancreatic cell.

The order in which the parts of the cell play a role in the production and secretion of insulin is

A M, E, J, T
B T, J, M, E
C J, T, E, M
D E, M, T, J

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3 Students were asked to share a statement regarding a fact they know about cells. Which of the following statements are **incorrect**?

I. Glucose molecules are able to diffuse into the cells, but cannot diffuse out because cell membranes are partially permeable.
II. Green plants are able to photosynthesize, therefore all the cells in green plants contain chloroplast.
III. The nucleus is the control centre of the cell, and it communicates with the rest of the cell via electrical impulses.
IV. Cells are the basic units of all living things.

A **I** and **III** only
B **II** and **IV** only
C **I**, **II** and **III** only
D All of the above

4 Which processes can occur through a cell surface membrane?

	active transport	**diffusion**	**osmosis**
A	√	X	√
B	X	X	√
C	X	√	X
D	√	√	√

key
√ = yes
X = no

5 The apparatus shown can be used to compare the energy values of various food substances.

Which food substance would give the greatest rise in the temperature of water if 1 g of it were burnt?

A beef
B butter
C cooked rice
D potato

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6 The diagrams below represent food molecules of starch, protein and fat.

The following shows the mixtures of food taken from part of the human alimentary canal during digestion of the above food molecules.

Which of the following gives a correct identification to the locations of the food molecules?

	mouth	stomach
A	I	III
B	II	I
C	II	III
D	IV	III

7 Amylase solution is tested with Benedict's solution, biuret solution and iodine solution. Which colours are obtained?

	Benedict's solution	biuret solution	iodine solution
A	blue	blue	blue-black
B	blue	blue	brown
C	blue	purple	brown
D	red	purple	blue-black

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8 Hydrogen peroxide (H_2O_2) decomposes naturally into oxygen and water. The rate of this reaction can be increased by the addition of the enzyme, catalase. A student investigated the effect of hydrogen peroxide concentration on the rate of catalase activity and the graph below was obtained.

Which statement about the graph is **incorrect**?

A Between **W** and **X**, the number of H_2O_2 molecules is limiting.
B Between **X** and **Y**, the number of catalase molecules is limiting.
C Between **X** and **Y**, the number of H_2O_2 molecules is limiting.
D Between **X** and **Y**, the volume of oxygen produced per unit time/cm^3 remains the same.

9 The diagram demonstrates the 'lock and key' hypothesis of enzyme action.

What could **W**, **X**, **Y** and **Z** be?

	W	**X**	**Y**	**Z**
A	erepsin	fats	fatty acids	glycerol
B	erepsin	polypeptide	amino acids	amino acids
C	maltase	maltose	glucose	glucose
D	maltase	starch	glucose	fructose

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10 The following diagram represents a villus.

Which of the following shows the correct function of the structures labelled **1**, **2**, **3** and **4**?

	1	2	3	4
A	absorbs digested fats	absorbs glucose	produces enzymes	produces mucus
B	absorbs digested fats	absorbs glucose	produces mucus	produces enzymes
C	absorbs glucose	absorbs digested fats	produces enzymes	produces mucus
D	absorbs glucose	absorbs digested fats	produces mucus	produces enzymes

11 Which row describes photosynthesis?

	energy conversion	immediate product of photosynthesis	storage product of photosynthesis
A	chemical energy to light energy	glucose	starch
B	chemical energy to light energy	starch	glucose
C	light energy to chemical energy	glucose	starch
D	light energy to chemical energy	starch	glucose

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12 Some students investigated gaseous exchange in a green plant. The rate of oxygen production was plotted against carbon dioxide concentration.

What explains these results?

A Carbon dioxide controls the rate of respiration.
B Carbon dioxide controls the rate of photosynthesis.
C Oxygen controls the rate of photosynthesis.
D Oxygen controls the rate of respiration.

13 The blood of three people **S**, **T** and **V** were tested to determine their blood groups. The results are shown below.

Which of the following shows the correct blood types of people **S**, **T** and **V**?

	S	**T**	**V**
A	A	AB	O
B	A	O	AB
C	B	AB	O
D	B	O	AB

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14 The graph below shows the pressure changes in the left side of the heart.

Letters **O**, **A**, **B**, **C**, **D**, **E** and **F** represent time in seconds.

At which time frame does ventricular systole take place?

A between **A** and **C**
B between **A** and **D**
C between **A** and **E**
D between **O** and **A**

15 If a green plant was fed with water containing radioactive oxygen (^{18}O), radioactivity would finally be located in

A the carbon dioxide formed in respiration.
B the cellulose cell walls.
C the oxygen formed by photosynthesis.
D the starch granules in a leaf

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16 The diagrams show a plant in a flask of water. It is left for six hours on a warm and windy day in bright sunshine.

Which process explains the result shown in diagram **2**?

A active transport of water into the root hairs
B evaporation of water from the flask
C photosynthesis in the leaves of the plant
D transpiration from the leaves of the plant

17 Two people of equal body mass do the same amount of exercise.
One person is in good health. The other person has emphysema.
The breathing rate and volume of each breath are measured during exercise.
The results are shown in the table.

	during exercise	
	breathing rate / breaths per minute	**volume of each breath / cm3**
healthy person	20	1000
person with emphysema	30	500

Which statement does **not** explain these results?

A The healthy person has a slower breathing rate.
B The healthy person has a larger lung volume.
C The person with emphysema has damaged alveoli with smaller surface area.
D The person with emphysema has a larger volume of air exchanged per minute.

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18 The following reactions **X** and **Y** are catalyzed by the same enzyme, carbonic anhydrase found in red blood cells.

$$CO_2 + H_2O \underset{\text{reaction Y}}{\overset{\text{reaction X}}{\rightleftharpoons}} H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$$

What is the homeostatic function of these reversible reactions and where do reactions **X** and **Y** occur in the human body?

	homeostatic function	X	Y
A	acid-base balance	respiring tissues	lungs
B	acid-base balance	lungs	respiring tissues
C	CO_2-O_2 balance	respiring tissues	lungs
D	CO_2-O_2 balance	lungs	respiring tissues

19 Seals are marine mammals. When they dive under water, they are capable of respiring anaerobically for long periods. During this time, blood flow to the muscles is greatly reduced but the muscles are able to tolerate high concentrations of lactic acid.

The graph shows the concentrations of lactic acid and oxygen in the blood of a seal before, during and after a dive.

What explains the change in lactic acid concentration during time **X**?

A increased lactic acid production
B increased blood flow to the muscles
C increased rate of aerobic respiration
D reduced rate of anaerobic respiration

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20 A person begins to smoke a cigarette at time **Y**. The graph shows how their heart rate changes.

Which substance in cigarette smoke is the main cause of the change in heart rate between 10 and 18 minutes?

A carbon monoxide
B nicotine
C smoke particles
D tar

21 The diagram shows how a kidney dialysis machine works. Each shape represents a molecule found in blood or dialysis fluid.

Which shape represents urea?

A ○ **B** ● **C** □ **D** △

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22 The following table shows the volume of water lost in a student on a cool day.

water lost	volume of water lost / cm^3
urine	1500
faeces	100
expired air	400
sweat	800
total	2800

On a hot day, the student's water intake remains the same as on the cool day.
What would be the possible volume of water lost on the hot day?

A

water lost	volume of water lost / cm^3
urine	700
faeces	100
expired air	700
sweat	1300
total	2800

B

water lost	volume of water lost / cm^3
urine	1500
faeces	100
expired air	400
sweat	800
total	2800

C

water lost	volume of water lost / cm^3
urine	1900
faeces	300
expired air	100
sweat	500
total	2800

D

water lost	volume of water lost / cm^3
urine	1800
faeces	100
expired air	600
sweat	300
total	2800

23 The diagram below shows part of the nervous system in a human being.

Which of the labeled parts form the central nervous system?

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

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24 The diagram shows a section through an eye.
Which part is the receptor for the stimulus that results in a change in the size of the pupil?

25 The graph shows changes in the diameter of a person's pupils while outdoors on a sunny day.
At which time did the person take off a pair of sunglasses?

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26 The diagram shows a side view of the female reproductive system with a developing embryo.

In which part is fertilisation likely to have taken place?

27 The diagram shows the percentages of injecting and non-injecting drug users who suffer from HIV / AIDS in a particular part of the world.

What accounts for the difference between the two groups of drug users?

A Condoms are used more often by injecting drug users.
B Injecting drugs is more common in areas of dense population.
C The same needle may be used by several injecting drug users.
D There are more injecting drug users than non-injecting drug users in this part of the world.

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28 The diagram shows the stigma, style and ovary of a flower.

Where does fertilisation take place?

29 What are the conditions in a human cell just before the cell enters prophase?

	number of chromatids	number of molecules of DNA in nucleus	spindle present	nuclear envelope present
A	46	46	yes	no
B	92	46	no	yes
C	46	92	yes	yes
D	92	92	no	yes

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30 The diagram shows the chromosomes in a cell.

Which diagram shows the product of **one** division of the cell by mitosis?

A

B

C

D

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31 The diagram below represents one pair of homologous chromosomes during meiosis.

Crossing over occurs and random segregation takes place.
What are the genotypes of the resulting gametes?

A **ABG, abG, ABg, abg**
B **ABG, aBg, AbG, abg**
C **ABG, ABG, abg, abg**
D **ABG, aBG, Abg, abg**

32 The table shows the variation in foot length in a number of students.

foot length / cm	number of students
20.0–20.9	0
21.0–21.9	5
22.0–22.9	12
23.0–23.9	15
24.0–24.9	17
25.0–25.9	8
26.0–26.9	0

Which row identifies this type of variation and states its cause?

	type of variation	cause
A	continuous	genes and the environment
B	continuous	genes only
C	discontinuous	environment only
D	discontinuous	genes and the environment

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33 The colour of the fruit of tomato plants is determined by alleles of the same gene. A tomato plant with red fruit was crossed with a tomato plant with yellow fruit. Of the offspring, 26 plants had red fruit and 24 had yellow fruit.
Three explanations were suggested.

1 Both parents were homozygous.
2 One parent had two recessive alleles.
3 One parent was heterozygous.

Which of the explanation/s is/are **correct**?

A 1 only
B 3 only
C 1 and 2
D 2 and 3

34 What is the **correct** arrangement for the components in a nucleotide?

35 Which statements about natural selection are **correct**?

	natural selection can lead to better adapted species surviving	natural selection can lead to extinction of a species	natural selection can lead to gene mutations occurring
A	true	true	true
B	true	true	false
C	true	false	true
D	false	true	true

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36 The following six statements refer to genetically engineered plants.

1 Cross-pollination with weeds could produce new varieties of weeds.
2 Genetically engineered plants may have improved nutritional value.
3 Some plants can be genetically modified to give resistance to diseases.
4 The increased yield from genetically engineered plants allows a smaller area of land to be farmed.
5 The use of genetically engineered crops may explain the increase in allergies in children.
6 There is more research needed on the long term effects of genetically engineered crops on the environment.

Which statements about genetically engineered plants show potential benefits?

A 1, 2 and 3
B 1, 5 and 6
C 2, 3 and 4
D 3, 5 and 6

37 The graph shows changes in the populations of plant and animal plankton in a lake.

Consider the following statement in relation to the data provided by the graph.
'Population changes in animal plankton lag behind similar changes in plant plankton because the animals feed on the plants.'
Into which category does the statement fall?

A It is a reasonable interpretation of the data.
B It is a restatement of the data, not an interpretation.
C It is contradicted or not supported by the data.
D More data are required in order for this interpretation to be made.

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38 In the diagram below, arrows represent the movements of carbon compounds in the carbon cycle. **A**, **B**, **C** and **D** represent carbon compounds in animals, decomposers, plants and the atmosphere.

Which represents the producer?

39 Which of the following is **not** a conservation measure?

A banning the use of timber
B limiting the time a fishing vessel may fish
C planting new seedlings to replace trees that are cut down
D using nets of a specific mesh size

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40 The diagram below shows how sewage is treated before it is released into water bodies.

Which of the following **correctly** identifies **W**, **X**, **Y** and **Z**?

	W	X	Y	Z
A	Grit and coarse materials	Sludge	Glucose	Methane
B	Grit and coarse materials	Sludge	Oxygen	Sludge
C	Sludge	Microorganisms	Oxygen	Carbon dioxide
D	Sludge	Sewage	Chlorine	Microorganisms

End of Paper

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Name :	Class	Register number

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DUNEARN SECONDARY SCHOOL
Preliminary Examination 2018

Biology 6093
Paper 2
Secondary 4 Express

11 Sep 2018 (Tuesday) **1030 – 1215** **1 h 45 min**

INSTRUCTIONS TO CANDIDATES

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer questions 7, 8 and **9 Either** or **9 Or** in the spaces provided.
If all the questions are answered, only the first 3 will be taken into account.

Paper 1	**Paper 2**						Sub-total for P2 Section A	/50
	A1	A2	A3	A4	A5	A6	Sub-total for P2 Section B	/30
/40	B7	B8	B9(E)	B9(O)			**Total marks for Paper 2**	/80
							Overall marks	**/ 120**

Setter: Mr Ng Hock Ping

Parent's Signature: ……..

This question paper consists of **15** printed pages including the cover page.

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Section A [50 marks]
Answer all the questions in the spaces provided.

1 **Fig. 1.1** below shows two experiments to investigate the partial permeability of the Visking tubing.

Fig. 1.1

(a) Suggest what solution **X** was likely to have been.

.....[1]

(b) In experiment **1**, explain why

(i) solution **X** turned from colourless to blue-black;

.....

.....

.....[2]

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(ii) the iodine solution remained brown.

……...

……[1]

In experiment **2**, solution **X** and an enzyme were placed in a Visking tubing bag which was kept at 35°C for 30 minutes. After this time, the bag was placed in iodine solution. This experiment and the results are also shown in **Fig. 1.1**.

(c) In experiment **2**, explain

(i) why the bag was first kept at 35°C for 30 minutes;

……..

……[1]

(ii) why solution **X** did **not** turn blue-black.

……..

……[1]

At the end of experiment **2**, the student noticed a change in the condition of the Visking tubing bag after 24 hours.

(d) **(i)** What change might have been noticed?

……..

……[1]

(ii) Explain what caused this change.

……..

……..

……[2]

[Total: 9]

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2 The diagram shows a section through the human body divided into regions **P**, **Q**, **R** and **S**.

(a) Complete the table below by matching the letters from the diagram to the statements in the table. There may be one or more than one letter for each statement.

contains an organ which	region or regions
produces an acidic secretion	**R**
contains villi	
digests protein	
produces insulin	
contains bronchi	
secretes amylase	
ingests food	

[3]

(b) Compare and contrast the movement of air with food in region **Q**.

.....

.....

.....

.....

..... [3]

[Total: 6]

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3 The graph shows the effect on crop yield (amount harvested) of using fertilisers that contain nitrogen.

(a) Use the information in the graph to describe the effect on crop yield of using an increasing mass of fertiliser.

.....

.....

.....

..... [3]

(b) The nitrogen in the fertiliser is in the form of nitrates.
Describe how the nitrogen in the fertiliser is absorbed by roots of the crop plants and transported to the leaves for use to give an increased yield.

.....

.....

.....

.....

.....

.....

..... [4]

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(c) Suggest and explain why a farmer may decide to use a mass of fertiliser per hectare which is less than that needed for a maximum crop yield.

.....

.....

.....

.....

.....

.....[3]

[Total: 10]

4 The diagrams show the bud of an insect-pollinated flower and a magnified transverse section through the same flower bud. The transverse section was taken at the position shown by the dotted line.

(a) Complete the table to show the name of each of structures **A** to **D** and to state one function of each structure.

letter	name of structure	function
A		
B		
C		
D		

[4]

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(b) The diagram shows a transverse section through the stem of this plant and a magnified section of the vascular bundle.

(i) Label on the magnified section of the vascular bundle in the diagram, the positions of each of the following tissues:

- xylem,
- phloem. [2]

(ii) State **one** function of xylem tissue.

.....

.....[1]

[Total: 7]

5 **(a)** Describe the cause of each of the following:

(i) Down's syndrome, ...

.....

.....

.....[2]

(ii) sickle cell anaemia .....

.....

..... [1]

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(b) Two parents, one with blood group **B** and the other with blood group **A**, have a child with blood group **O**. The parents decide to have another child.

(i) Complete the genetic diagram to show the possible blood groups for the second child of these parents.

genotypes of parents ..... x .....

gametes ....

possible genotypes of child ....

possible blood groups of child ....

[4]

(ii) State the probability of each of the following for the second child of these parents:

- being the same sex as the first child

……..

…….. ..... [1]

- having the same blood group as the first child

……..

…….. ..... [1]

(iii) Name the type of inheritance shown by the alleles that produce the blood group **AB**.

……..... [1]

[Total: 10]

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6 **Fig. 6.1** shows the relationships between a number of organisms living together in a South American rainforest.

For Examiner's Use

Fig. 6.1

For Examiner's Use

(a) **Fig. 6.2** is an incomplete food web for these organisms. Complete **Fig. 6.2** by:

- writing the name of an organism in each box,
- completing the arrows to show the flow of energy.

[4]

Fig. 6.2

(b) Which type of pollination (self or cross) is likely to be found in the Brazil nut tree. Give a reason for your answer.

.....

.....[1]

(c) Suggest the possible effects on the community in the rainforest if the orchids were killed by disease and poached by orchid collectors.

.....

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 8]

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Section B [30 marks]
Answer **three** questions in the spaces provided.
Question **9** is in the form of an **Either/Or** question.
Only one part should be answered.

7 During a health examination, the heart rate of a patient was measured based on the number of "lub-dub" sounds heard for 5 seconds. This measurement was taken every minute for 7 minutes. The counts were recorded in **Table 7** below.

Table 7 : Heart rate of patient

Time/min	0	1	2	3	4	5	6	7
Number of "lub-dub" sounds heard for 5 seconds	6	6	9	12	9	7	6	5
Heart rate/min^{-1}								

(a) **(i)** Calculate the heart rate of the patient and fill up **Table 7**. [1]

(ii) Plot the heart rate of the patient in the grid below.

[3]

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(b) Explain how the "lub-dub" sounds are generated in the heart.

……

……

…… [2]

(c) Suggest an activity the patient could be carrying out during this period.

……

…… [1]

(d) Give a detailed explanation how a **named** hormone could cause this change observed in the patient during the health examination.

……

……

……

……

……

…… [3]

[Total: 10m]

8 The diagram shows a magnified transverse section through a leaf.

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Name each of **T**, **U**, **V** and **W** and explain the importance of each in the process of photosynthesis.

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T .....

.....

.....

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.....

.....

U .....

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.....

.....

V .....

.....

.....

.....

.....

.....

W .....

.....

.....

.....

.....

.....[10]
[Total: 10]

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9 Either

(a) Describe **one** example of a simple reflex action and explain the importance to the body of this action.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) Describe how **named** components of the nervous system are involved in producing a reflex action.

.....

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.....

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.....[6]

[Total: 10]

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9 Or

(a) Explain the concept of control by negative feedback.

.....

.....

.....

.....

.....

.....

.....

.....[4]

(b) Describe how **two named** components of the skin are involved in regulating body temperature in **hot** conditions.

.....

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.....

.....[6]

[Total: 10]

End of Paper

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Dunearn Secondary School
Preliminary Examination 2018
Secondary 4 Express Biology 6093
MARK SCHEME

Paper 1: Multiple Choice Questions (40 marks)

1. **D**	11. **C**	21. **D**	31. **A**
2. **C**	12. **B**	22. **A**	32. **A**
3. **C**	13. **C**	23. **B**	33. **D**
4. **D**	14. **A**	24. **D**	34. **B**
5. **B**	15. **C**	25. **C**	35. **B**
6. **B**	16. **D**	26. **B**	36. **C**
7. **C**	17. **D**	27. **C**	37. **A**
8. **C**	18. **A**	28. **A**	38. **B**
9. **C**	19. **B**	29. **D**	39. **A**
10. **A**	20. **B**	30. **B**	40. **B**

Paper 2 Section A: Structured Questions (50 marks)

No	Answer Key	Mark
1(a)	Starch solution	1
(b) (i)	Small iodine molecules; diffuse through the Visking tubing ;	1 1
(ii)	Large starch molecules + unable to diffuse	1
(c) (i)	Optimum temperature for enzyme + digestion of starch	1
(ii)	Starch has been completely digested to maltose/reducing sugar	1
(d) (i)	The liquid level in the visking tubing has increased while the water level outside has decreased.;	1
(d) (ii)	Osmosis of water molecules has occurred due to the low water potential inside the Visking tubing	1 1
	Total	9
	Marker's comments: Small molecules of iodine are usually omitted Unable to recognize the optimal temperature rather than timing Glucose is the final product of digestion rather than maltose Leading to diffusion of glucose	
2 (a)		0 right = 0 mark 2 rights = 1 mark 4 rights = 2 marks 6 rights = 3

contains an organ which	**region or regions**
produces an acidic secretion	(R)
contains villi	R / S
digests protein	R / S
produces insulin	R
contains bronchi	Q
secretes amylase	P + R
ingests food	P

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		marks
(b)	Air – inhale and exhale through the trachea, bronchi, bronchioles and into the alveoli; pressure differences Food – peristalsis + oesophagus; Rhythmic contraction and relaxation of longitudinal and circular smooth muscle and antagonistic muscles in diaphragm and rib cages create both movements OR involuntary actions	1 1 1
	Total	6
	Marker's comments: Definition of process is given but no comparison or contrast was presented	
3 (a)	no fertiliser **+** yield is 200 (kg / hectare crop yield) **/** increased / more crop yield **;** reference to 150 (kg / hectare fertiliser) **or** 5600 (kg / hectare crop yield) **;** high fertiliser / above 150 **+** no increase in crop yield **;**	1 1 1
(b)	root hair **+** active transport / against concentration gradient / diffusion / down concentration gradient **;** **move along with the transpiration stream /up the xylem in the stem to the leaves;** production **AW** of **+** amino acids / protein **+** increased **AW +** growth **;**	1 1 1 1
(c)	run-off / leaching **AW ;** eutrophication **or** correct description of process **+** harm to animals **;** high cost / expensive **/** possible economic return not beneficial over increased cost **AW ;**	1 1 1
	Total	10
	Marker's comments: Mostly well-done except no reference to the quantities for some students. Most students just emphasized on eutrophication and miss out on leaching and cost	
4 (a)	**letter name of structure function** **(A)** sepal / calyx **;** protect **;** **(B)** petal / corolla **;** attract / landing platform **;** **(C)** stamen / anther **;** produces / contains **AW +** pollen / male gamete / male nucleus **;** **Or** filament **;** support anther **;** **(D)** ovary / carpel / pistil **;** produces / contains **AW +** ovum / ovule / egg / female gamete **;** **or** forms **AW** fruit / site of fertilisation **;**	 1 1 1 1
(b) (i)	'xylem' labelled on inside **+** 'phloem' labelled separately on outside of at least one oval vascular bundle **;**	1 1
(b) (ii)	**1** transports / carries **AW +** water / ions / minerals **;** **2** support **;**	1
	Total	7
	Marker's comments: Well-done for most except for some students who are not able to recognize the structures	
5 (a) (i)	*(Down's syndrome)* inherited / genetic mutation **+** chromosome **(**reference to	

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	chromosome 21); **with** one extra **or** 3 instead of 2 **or** 47 not 46 **or** 24 not 23 in **+** gamete/egg/sperm **;** *(sickle cell anaemia)*	1 1
(ii)	inherited / genetic mutation **+** gene **with** homozygous recessive / two recessive alleles **;**	1
(b) (i)	I^BI^O **+** I^AI^O **or** BO **+** AO **;** I^B **+** I^O **+** I^A **+** I^O **or** B **+** O **+** A **+** O **or** gametes correct for stated parent genotypes **;** I^AIB **+** I^BI^O **+** I^AI^O **+** I^OI^O **or** AB **+** BO **+** AO **+** OO **or** possible genotypes of child correct for stated gametes **;** AB **+** B **+** A **+** O **or** possible blood groups of child correct for stated genotypes **;**	1 1 1 1
(b) (ii)	*(same sex)* 50% / half / ½ / 0.5 / 2 in 4 / 1 in 2 / 1:1 **;** *(same blood group)* 25% / quarter / ¼ / 0.25 / 1 in 4 / 1:3 **;**	1 1
(b) (iii)	codominance / codominant **;** **R** incomplete dominance	1
	Total	10
	Marker's comments: Well done except for the definition	
6 (a)		3
(b)	Cross-pollinated ; specialized pollinator, bumble bees	1 1
(C)	less nectar **for** male bees **+** lack scent/female bees **+** not attracted **;** less reproduction of bees **+** less pollination **+** less trees/less nut / fruit production **;** loss of jobs (for humans) / negative economic impact **AW ;** less food for agoutis **+** death / reduced population **+** of agoutis **OR** agoutis seek other food **+** less food for jaguars/death / reduced population **+** of jaguars **OR** jaguars seek other food **;**	1 1 1 1 Max 3
	Total	8
	Marker's comments: Well done for most of the students	
Paper 2 Section B: Free Response Questions (30 marks)		
7 (a)		

0	1	2	3	4	5	6	7
6 X	72	108	144	108	84	72	60

1

	60/5 =72							

	correct axes and scale ; correct plot points ; best fit curve ;	1 1 1
(b)	"lub" formed by closing of AV valves; atrial diastole + ventricular Systole; "dub" formed by closing of SLV; ventricular diastole;	1 1
(c)	name any example of exercise that would result in rise in heart rate;	1
(d)	secretion of **adrenaline** by adrenal gland; into bloodstream and carried to heart + (stimulates increase in heart rate and rise in blood pressure) liver cells convert glycogen to glucose + (more glucose in bloodstream); oxygen and glucose carried faster to muscles; increased aerobic respiration to release more energy;	1 1 1 1 1 1 1 Max 3

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	Total	10
	Marker's comments: Some students are not able to explain in details the closing of the valves is caused by the contraction and relaxation of the ventricular muscles.	
8	(***T***) Palisade mesophyll ; Main site of photosynthesis with numerous chloroplasts **;** Densely packed cylindrical cells to maximise sunlight absorption **;** (***U***) phloem**;** transport **+** dissolved manufactured food/ sucose + amino acids **;** from leaves to all parts of the plant **;** (***V***) Spongy mesophyll **;** air / intercellular **+** spaces **for gaseous exchange/**diffusion **of carbon dioxide and oxygen** water film **AW +** evaporation / water vapour **;** (***W***) stoma / stomata **controlled by** guard cell **;** open / close **+** reference **to** diffusion of **carbon dioxide, oxygen and water vapour**	 1 1 1 Max 3 1 1 1 1 1 1 1 1 max 3
	Total	10
	Marker's comments: Details of answer in relation to photosynthesis are often left out.	
9 E (a)	named stimulus / trigger for a specific reflex action **;** correct named receptor for stimulus given **;** action described correct for example given **;** importance of specific action explained **;**	1 1 1 1
(b)	synapse (anywhere in sequence) **;** impulse / electrical pulse (anywhere in sequence) **;** receptor **+** detection of stimulus **;** **then** sensory neurone **;** relay / inter(mediate) / connector neurone **;** reference to CNS / brain / spinal cord **;** **then** motor neurone **;** effector / named effector **;** action of effector or described **;**	1 1 1 1 1 1 1 1 1 Max 6
	Total	10
	Marker's comments:	

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	Less student attempted this question as confidence in giving and example and relate the example is weak.	
9 O (a)	parameter / condition e.g. temperature ; change from set point / norm **AW +** detected ; reference to communication or named method (e.g.nerve / impulse / hormone) ; reference to control centre / coordinator / hypothalamus / brain ; response / corrective mechanism(s) **or** reversal /correction of initial change / return to set point or norm ;	1 1 1 1 1 Max 4
(b)	any two from nerve ending / blood vessels / sweat gland / hair *(nerve ending)* detects / receptor ; change / increase in temperature ; impulse / (message) to brain ; *(blood vessels)* dilate ; more blood to surface of skin ; reference to capillaries ; reference to increased radiation / heat loss ; *(sweat gland / duct)* secretion / release / skin surface **+** sweat ; reference to evaporation ; *(hair)* lowers ; less air trapped / loss of insulation ;	 1 1 1 1 Max 3 1 1 1 1 Max 3 1 1 1 1 1 1 Max 6
	Total	10
	Marker's comments: Most attempted this question and able to do well.	

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Candidate Name:	Class	Index No.
	4E1	

FUHUA SECONDARY SCHOOL

Secondary Four Express

Preliminary Examination 2018

4E

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BIOLOGY 6093/01

27 Aug 2018
1045 - 1145
1 hour

Additional Material: OMR sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on the OMR and this question booklet.

There are **forty** 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 OMR.

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

PARENT'S SIGNATURE	FOR EXAMINER'S USE
	/ 40

This question paper consists of 21 printed pages including this page.

1 The diagrams show structures associated with a leaf.

What is the level of organisation of the part shown in detail?

A cell **B** organ **C** organ system **D** tissue

2 The photomicrograph shows part of an animal cell.

Which of the following describes the correct functional relationship between structure **X** and the rough endoplasmic reticulum?

A Polypeptides synthesised at the rough endoplasmic reticulum are transported to **X** to be stored for regular use in the cytoplasm.

B Polypeptides synthesised at **X** are packaged into vesicles that move to the rough endoplasmic reticulum for further modification.

C Polypeptides synthesised at the rough endoplasmic reticulum are transported to **X** where they are modified into functional proteins for secretion.

D Polypeptides synthesised at **X** are packaged directly for secretion without moving to the endoplasmic reticulum.

3 The diagrams show four plant cells with the arrows representing the direction of movement of molecules.

Which diagram(s) represents the occurrence of active transport?

A 1 only **B** 2 only **C** 1 and 4 **D** 2 and 3

4 The diagram shows a xerophytic leaf in different conditions, **P** and **Q**.

condition **P** condition **Q**

Which statements about the cells in layer **X** of the leaf in each of the conditions **P** and **Q** are correct?

1 water potential in **P** is higher than in **Q**
2 cells may be turgid in **P** and plasmolysed in **Q**
3 turgidity of cells in **P** is lesser than in **Q**
4 no net diffusion of water into **X** in either **P** or **Q**

A 1 and 4

B 2 and 3

C 1, 2 and 4

D 1, 2, 3 and 4

5 Which substance(s) contains carbon, hydrogen, oxygen and nitrogen?

1 cellulose
2 deoxyribonucleic acid
3 glucagon

A 2 only **B** 1 and 2 **C** 1 and 3 **D** 2 and 3

6 Invertase catalyses the conversion of sucrose to glucose and fructose.

$$\text{sucrose} \xrightarrow{\text{invertase}} \text{glucose} + \text{fructose}$$

Three different enzyme inhibitors of invertase **X**, **Y** and **Z,** which prevent the above reaction from occurring, were investigated. The percentage inhibition of invertase was measured at different concentrations of inhibitor.

The graph shows the result of the investigation.

Which is/are valid conclusion(s) from these results?

1 The higher the concentration of inhibitor **X**, the lesser the amount of sucrose is broken down.
2 The production of glucose and fructose using inhibitor **Y** is higher than when inhibitor **Z** is used.
3 The production of glucose and fructose at an inhibitor concentration of 2 arbitrary units is lower than at an inhibitor concentration of 4 arbitrary units, for all inhibitors.

A 1 only **B** 3 only **C** 1 and 2 **D** 2 and 3

7 The diagram shows a food bolus moving down the oesophagus.

Which row identifies the muscles and their actions at region **W**?

	muscle **X**		muscle **Y**	
	muscle type	muscle action	muscle type	muscle action
A	circular	contracting	longitudinal	relaxing
B	circular	relaxing	longitudinal	contracting
C	longitudinal	contracting	circular	relaxing
D	longitudinal	relaxing	circular	contracting

8 A student carried out three food tests on two unknown samples as shown below.

contents	food test carried out after contents were mixed for 20 minutes		
	Benedict's test	biuret test	iodine test
2 cm^3 **X** and water	blue	blue	blue-black
5 cm^3 **X**, 2 cm^3 **Y** and 1 cm^3 sodium hydroxide solution	red precipitate	violet	blue-black

Which of the following represents **X** and **Y**?

	X	**Y**
A	starch	saliva
B	starch	pancreatic juice
C	maltose	pancreatic juice
D	maltose	intestinal juice

9 The diagram shows the label from a bottle of gin.

What will happen, during the next few hours, after a person drinks a large volume of gin?

A Their judgement of distance will improve.

B Their muscle control will be reduced.

C Their reaction time will decrease.

D Their urine output will decrease.

10 A student investigates the effect of different colours of light on the rate of photosynthesis.

In three separate experiments, red, blue or green light was shone onto an aquatic plant. The number of oxygen bubbles produced by the plant was counted.

Each experiment was carried out three times and the average number of bubbles was calculated.

colour of light	average number of bubbles produced / minute
red	48
blue	37
green	12

What explains the results?

A Chlorophyll absorbs red and blue light more than green light.

B Green light is absorbed by the water.

C Most of the green light is absorbed by the chlorophyll.

D Red light is used least in photosynthesis.

11 The graph shows the concentration of oxygen in the air spaces of a green leaf of a plant during a 12-hour period.

Which statement about carbon dioxide in the air spaces during time **X** is correct?

A Carbon dioxide is being produced because the rate of photosynthesis is greater than the rate of respiration.

B Carbon dioxide is being produced because the rate of respiration is greater than the rate of photosynthesis.

C Carbon dioxide is being used because the rate of photosynthesis is greater than the rate of respiration.

D Carbon dioxide is being used because the rate of respiration is greater than the rate of photosynthesis.

12 The graph shows the loss of mass in a potted plant due to transpiration.

What could have occurred at point **X** on the graph?

A A plastic bag was placed around the plant.

B The lower epidermis was sealed with petroleum jelly.

C The plant was placed into a dark cupboard.

D Warm moving air was blown over the plant.

13 The diagrams show transverse sections of parts of a plant.

Which labelled structures mainly transport amino acids and mineral ions?

	amino acids	mineral ions
A	1 and 3	2 and 4
B	1 and 4	2 and 3
C	2 and 3	1 and 4
D	2 and 4	1 and 3

14 Below are correct statements comparing blood and tissue fluid in a capillary bed.

- **W** lacks large plasma proteins and red blood cells.
- **X** is at a lower pressure than **Y** and contains red blood cells and large plasma proteins.
- **Y** is at a higher pressure than **W** and contains red blood cells and large plasma proteins.

Which correctly identifies **W**, **X**, and **Y**?

	W	**X**	**Y**
A	blood entering capillary	tissue fluid	blood leaving capillary
B	blood leaving capillary	blood entering capillary	tissue fluid
C	tissue fluid	blood entering capillary	blood leaving capillary
D	tissue fluid	blood leaving capillary	blood entering capillary

15 The graph shows changes in the volume of the ventricles during the cardiac cycle.

Which valves open and close at **P** and **R**?

	atrioventricular valve at **P**	semilunar valve at **R**
A	closes	closes
B	closes	opens
C	opens	closes
D	opens	opens

16 The table shows the blood test results of two students, **X**, and **Y** for blood transfusion.

		donor	
		X	**Y**
recipient	**X**	no agglutination	agglutination
	Y	no agglutination	no agglutination

Which of the following may be the blood types of students **X** and **Y**?

	student **X**	student **Y**
A	A	AB
B	A	O
C	B	B
D	AB	O

17 The diagram shows the rib cage and some of the muscles involved in breathing as seen from the side.

What happens when the intercostal muscles shown in the diagram contract?

A The diaphragm moves down.

B The lungs inflate.

C The pressure inside the lungs decreases.

D The ribs move down.

18 The diagram shows some of the reactions of carbon dioxide when it enters the blood from cells in a metabolically active tissue.

Which reaction is catalysed by the enzyme carbonic anhydrase?

19 Which of the effects listed occur as a result of inhaling both carbon monoxide and nicotine from cigarette smoke?

1 increased heart rate
2 increased risk of cardiovascular disease
3 increased risk of emphysema
4 increased risk of lung cancer

A 1 and 2

B 3 and 4

C 1, 2 and 3

D 2, 3 and 4

20 The graph shows the effect of drinking 1 litre of water and 1 litre of concentrated salt solution on the urine output in a healthy person.

Which correctly identifies each line and the explanation for it?

	drinking 1 litre of water		drinking 1 litre of concentrated salt solution	
	line	explanation	line	explanation
A	X	less ADH to be produced	Y	more ADH to be produced
B	X	more ADH to be produced	Y	less ADH to be produced
C	Y	less ADH to be produced	X	more ADH to be produced
D	Y	more ADH to be produced	X	less ADH to be produced

21 The bar charts show the relative levels of some substances in the blood before and after passing through a certain organ in the human body.

Which organ has the blood passed through?

A kidney

B liver

C lungs

D small intestine

22 The diagram shows some structures in a section through human skin.

Which structures contain muscles that relax when the surrounding temperature is too hot?

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

23 The graph shows the blood sugar level of a person who has consumed 50 g of glucose at the time indicated.

At which time of the two-hour period would the secretion of insulin and glucagon increase?

	increased amount of insulin	increased amount of glucagon
A	10.30	11.00
B	10.30	11.30
C	11.00	10.30
D	11.30	10.30

24 The nerve pathway of a simple reflex arc is shown below.

Where should a cut be made so that a response is enabled without sensation of pain?

25 A person is sitting in a brightly lit room. After five seconds, a light is turned off. Five seconds after that, the light is turned on again.

Which graph shows the changes in the diameters of their pupils?

26 The diagram shows a potato plant reproducing asexually by tubers.

Four observations were made about the potato plant.

1 There is one parent plant.
2 The tubers are attached to the parent.
3 The tubers are genetically identical to the parent.
4 The tubers store food.

Which of these observations describe asexual reproduction?

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

27 The table below shows information about the flowers of three different plants.

flower characteristics	plant **A**	plant **B**	plant **C**
petal colour	white	purple	bright yellow
aroma	none	pungent smell	sweet smell
petal size	0.3 cm	10.0 cm	4.0 cm
nectar volume	none	medium amount	large amount

Which inference is valid concerning the method of pollination for plants **A**, **B** and **C**?

A All three plants are wind pollinated.

B All three plants are insect pollinated.

C Plant **A** is wind pollinated but plants **B** and **C** are insect pollinated.

D Plants **A** and **B** are insect pollinated but plant **C** is wind pollinated.

28 The diagram shows a fetus in the uterus.

Which substance will be at a lower concentration at **X** than at **Y**?

A carbon dioxide and glucose

B carbon dioxide and urea

C glucose and oxygen

D oxygen and urea

29 The diagram shows the menstrual cycle of a woman in the month of September.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	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				

key

= ovulation

= menstruation

Why fertilisation would **not** take place if sperms are released into the vagina on the 8th September?

A Sperms are washed out of the female uterus by the menstrual flow.

B Sperms can survive in the female reproductive system for only 3 or 4 days.

C Sperms must be released after ovulation for fertilisation to take place.

D The uterus lining is washed out of the female body during menstruation.

30 A student examined the cells in the growing region of an onion root and obtained the data below.

stage	number of cells
interphase	886
prophase	73
metaphase	16
anaphase	14
telophase	11

What percentage of cells in mitosis contains chromosomes that appear as two chromatids?

A 97.5 % **B** 95.9 % **C** 78.1 % **D** 8.9 %

31 The diagram shows two homologous chromosomes in early prophase I of meiosis in an animal cell. Two genes, **A**/**a** and **B**/**b**, whose loci occur on the homologous chromosomes are also shown.

Which row of diagrams is a possible representation of these chromosomes as they progress from anaphase I to prophase II?

	anaphase I	prophase II
A		
B		
C		
D		

32 The photomicrograph shows cells in different stages of mitosis.

In which order do these stages occur?

A 3 → 5 → 2 → 1 → 4

B 3 → 5 → 1 → 2 → 4

C 4 → 3 → 5 → 1 → 2

D 4 → 5 → 1 → 2 → 3

33 Which correctly shows situations in which DNA and RNA are both involved?

	replication	transcription	translation
A	√	√	✕
B	√	✕	√
C	✕	✕	√
D	✕	√	✕

key
√ involved
✕ not involved

34 Genetic engineering can be used to introduce new characteristics into animals and plants.

Which characteristic is **not** likely to be introduced into a cereal crop plant by genetic engineers?

A resistance to bacterial diseases

B resistance to fungal diseases

C resistance to insecticides

D resistance to viral diseases

35 The table shows the percentage of nitrogenous bases in four samples of nucleic acids.

Which base is adenine?

sample	percentage of nitrogenous bases / %				
	A	**B**	**C**	**D**	uracil
1	19	31	31	19	nil
2	26	24	24	26	nil
3	25	25	nil	25	25
4	18	32	32	18	nil

36 The family tree shows the inheritance of the ability to smell flowers called freesias. The allele for the ability to smell freesias is dominant.

key

Which individual's symbol is **not** correct?

37 One gene has two codominant alleles, A^E and A^F and one recessive allele, A^G.

How many different genotypes and phenotypes are possible?

	genotypes	phenotypes
A	3	3
B	4	6
C	6	4
D	6	6

38 In the leopard, coat colour is controlled by a single gene with two alleles, H and h. There are two varieties - black panthers and spotted leopards.

The diagram shows a cross between a spotted leopard and a black panther.

All the offspring in the F1 generation were spotted leopards. The results of a cross between two animals of the F1 generation are also shown.

What are the genotypes of the original two parents?

	spotted leopard	black panther
A	HH	hh
B	HH	Hh
C	Hh	hh
D	hh	HH

39 The graph shows the quantities of toxins that accumulate in four populations, each at different trophic levels in a food chain.

Which is most likely to be herbivores?

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40 The diagram shows part of a food web.

Which is a pyramid of numbers based on this food web?

A

B

C

D

END-OF-PAPER

Candidate Name:	Class	Index No.
	4E1	

FUHUA SECONDARY SCHOOL

Secondary Four Express

Preliminary Examination 2018

4E

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BIOLOGY 6093/02

21 Aug 2018
1125 - 1310
1 hour 45 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.
The last question is in the form of Either/ Or.

You are advised to spend no longer than 1 hour on Section A and no longer than 45 minutes on Section B.

Electronic calculator may be used.

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

PARENT'S SIGNATURE	FOR EXAMINER'S USE		
	50	30	80

This question paper consists of 23 printed pages including this page.

Section A: Structured Questions [50 marks]
Answer all questions.
Write your answer in the spaces provided.

1 Fig. 1.1 shows part of the flowering head of a tree.

Fig. 1.1

Structure **D** contains stomata similar to those found in the leaves.
K and **L** represent gases that pass into and out of the leaves and flowers during daylight hours.

(a) The flowers are very pale pink in colour. Suggest the identity of gases **K** and **L**. Explain your answer.

K ..... **L** .....

explanation .....

.....

.....

.....

..... [4]

(b) State the function of structure **E**.

..... [1]

(c) Fig. 1.2 shows the effect of the concentration of carbon dioxide on the rate of photosynthesis in apple plants at 20 ^{0}C.

Fig. 1.2

(i) A farmer grows apple plants in a large greenhouse.

Calculate the percentage change in the rate of photosynthesis of the apple plant when the carbon dioxide concentration is decreased from 0.08 % to 0.04 % in the greenhouse.

percentage change = ... % [1]

(ii) Explain why the farmer would **not** use a concentration of carbon dioxide higher than 0.08 %.

.....

.....

.....

..... [2]

[Total: 8]

2 Fig. 2.1 shows the life cycle of *C. elegans*.
The diploid number of this species is 12.

Fig. 2.1

(a) Define the term *diploid.*

.....

..... [1]

(b) State the number of chromosomes found in each cell of the embryo.

..... [1]

(c) Suggest why there is very little genetic variation in the offspring of the adult shown in Fig. 2.1.

.....

.....

.....

.....

..... [2]

(d) **(i)** Identify the type of cell division that occurs at **P**.

..... [1]

(ii) Explain why the cell division identified in **(d)(i)** occurs at **P**.

.....

.....

.....

..... [2]

[Total: 7]

3 Two common genetic conditions, glaucoma and albinism, affect the human eye.

(a) Fig. 3.1 shows a drawing of a section through a human eye.

Fig. 3.1

(i) Glaucoma is caused by a build-up of pressure within the eye which may damage structure **X** as shown in Fig. 3.1.

Suggest how a person with untreated long term glaucoma may have vision loss and absence of pupil reflex.

.....

.....

.....

.....

..... [3]

Fig. 3.2 shows part of a family tree in which some of the people have the type of glaucoma that is caused by the recessive allele, **g**.

key:

○	female without glaucoma	□	male without glaucoma
●	female with glaucoma	■	male with glaucoma

Fig. 3.2

(ii) With reference to Fig. 3.2, state **and** explain the genotype of individual **1**.

.....

.....

.....

.....

..... [3]

(iii) State the probability of a male child with glaucoma from parents who are both heterozygous.

..... [1]

(b) Tyrosinase is an enzyme that functions in the production of dark brown pigment, melanin, normally present in the iris of eyes. The tyrosinase gene can be found on human chromosome number 11.

Fig. 3.3 shows how the colour of iris varies according to the distribution of relative amount of melanin present in iris.

Fig. 3.3

The role of tyrosine in melanin production is shown below:

$$\text{tyrosine} \xrightarrow{\text{tyrosinase}} \text{dihydroxyphenylalanine} \longrightarrow \text{melanin}$$

(i) Explain how a gene mutation on chromosome number 11 may result in formation of blue iris.

.....

.....

.....

..... [2]

(ii) Using the information given in the question, state **and** explain if iris colour is a continuous or discontinuous variation.

.....

..... [1]

[Total: 10]

4 Kidneys are important body organs involved in excretion.

(a) Define the term *excretion*.

.....

.....

..... [1]

Three samples of urine were obtained from different people to check if their kidneys are functioning normally. Benedict's test and biuret test were performed using the three urine samples.

Table 4.1 shows the results.

Table 4.1

sample	Benedict's test	biuret test
A	green precipitate	colourless solution
B	blue solution	colourless solution
C	blue solution	violet colouration

(b) Using the information from Table 4.1, explain which sample could be from a person with

(i) high blood pressure,

.....

.....

..... [2]

(ii) diabetes.

.....

.....

..... [2]

(c) A person with kidney damage needs to undergo the process of dialysis to take place several times each week.

(i) State one way in which blood returning from the dialysis machine will differ from blood leaving the body to enter the dialysis machine.

.....

..... [1]

(ii) Suggest **and** explain how the efficiency of dialysis is affected if the dialysis fluid contains a small amount of urea.

.....

.....

.....

..... [2]

[Total: 8]

5 Fig. 5.1 shows a carbon cycle with the arrows representing the various processes happening in the cycle.

Fig. 5.1

Table 5.1 shows the amount of carbon transferred in the various processes of the cycle per year.

Table 5.1

processes	flow of carbon in gigatons of carbon per year
decomposition	11
A	90
B	110
C	140
combustion	8
fossil fuel formation	15

(a) Arrows **A** and **B** represent the same process.
State the equation, in symbols, to represent this process.

..... [1]

(b) Using the information in Fig. 5.1 and Table 5.1, explain how forests can act as a carbon sink.

.....

.....

.....

.....

..... [3]

(c) Fig. 5.2 shows the direction of flow of a river near a fertiliser factory. The concentration of dissolved oxygen and nitrate of river water taken from site **A** to site **B** were measured as shown in Fig. 5.3.

Fig. 5.2

Fig. 5.3

With reference to Fig. 5.2 and Fig. 5.3, explain the appearance of large numbers of dead fish in the region marked **X** in Fig. 5.3.

.....

.....

.....

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.....

.....

..... [3]

[Total: 7]

6 Fig. 6.1 shows an organ, **X**, and its associated blood vessels **P**, **Q** and **R**.

Fig. 6.1

Organ **X** is involved in the following processes:
• the metabolism of amino acids,
• the breakdown of chemical substances, including alcohol.

(a) Name blood vessel **R**.

..... [1]

(b) Samples of blood of a healthy person were taken from blood vessels **P** and **Q** to determine the concentration of blood glucose after a meal.

Fig. 6.2 shows the concentration of glucose in the two blood vessels 1 hour after the meal.

Fig. 6.2

(i) Describe **and** explain the difference in the blood glucose concentration of the blood samples taken from blood vessels, **P** and **Q**.

.....

.....

.....

..... [2]

(ii) State the blood glucose concentration of blood sample taken from blood vessel **Q**, 6 hours after the meal.

..... [1]

[Total: 4]

7 Fig. 7.1 shows the core body temperature of a cyclist before, during and after a race.

Fig. 7.1

(a) Name the process by which the core body temperature returns to a set point of 37.0 ^{0}C is achieved.

..... [1]

(b) Explain how sweat glands assist in the control of the core body temperature from 09.15 to 10.30.

.....

.....

.....

.....

..... [3]

(c) Plants transpire while humans sweat to prevent overheating.
An investigation on transpiration was carried out at four different humidity levels as shown in Fig. 7.2. All other conditions were kept constant.

Fig. 7.2

The distance moved by the meniscus in five minutes at each humidity level is recorded and shown in Table 7.1.

Table 7.1

relative humidity	distance moved by meniscus in five minutes / mm
1 (least)	53
2	44
3	37
4 (most)	32

(i) State one conclusion that can be drawn from the results in Table 7.1 about the effect of humidity on the rate of transpiration.

.....

..... [1]

(ii) State one other environmental change that can result in the same outcome on the rate of transpiration as the increase in relative humidity.

..... [1]

[Total: 6]

Section B: Free-Response Questions [30 marks]
Answer all the questions in this Section in the spaces provided.
The last question is in the form of Either/Or.

8 Table 8.1 shows data for the percentage of genetically modified (GM) crops such as soy bean and wheat grown in the USA from 1996 to 2014.

Table 8.1

year	percentage of GM crops / %	
	soy bean	wheat
1996	7	3
2000	34	7
2004	65	20
2008	80	35
2012	83	55
2014	84	68

(a) On Fig. 8.1, draw a line graph to show how the percentage of each GM crop shown in Table 8.1 changes from 1996 to 2014.

Label the graphs drawn for each GM crop clearly.

Fig. 8.1

[4]

(b) With reference to the graph drawn in **(a)**, compare the changes in the GM soy bean and wheat crops grown from 1996 to 2014.

.....

.....

.....

.....

.....

..... [3]

(c) Fig. 8.2 shows two possible uses of the same area of land to produce food.

Fig. 8.2

Use the information in Fig. 8.2 and your own knowledge, explain why it would be more efficient use of the land to grow wheat as a food source for humans, as compared to rearing lambs.

.....

.....

.....

.....

.....

..... [4]

[Total: 11]

9 **(a)** Respiration releases energy. Some energy is used for greater muscle contraction during vigorous exercise.

Outline **two** other uses of energy in the human body.

1 .....

.....

2 .....

..... [2]

(b) Blood samples were taken from a person's finger before, during and after vigorous exercise and tested for lactic acid.

The results of the test for lactic acid are shown in Fig. 9.1.

Fig. 9.1

With reference to Fig. 9.1, describe **and** explain the changes in blood lactic acid concentration during and after exercise.

[7]

[Total: 9]

Either

10 **(a)** Describe the similarities and differences in structure and function of root hairs and villi.

(i) similarities

.....

.....

.....

.....

..... [3]

(ii) differences

.....

.....

.....

.....

..... [3]

(b) Describe **and** explain how water molecules from the xylem in the leaf reaches the atmosphere through the leaf.

.....

.....

.....

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.....

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..... [4]

[Total: 10]

OR

10 **(a)** Blood flows through different types of blood vessels after leaving the heart. Draw a line on Fig. 10.1 and Fig. 10.2 to show how the mean blood pressure and diameters of the vessels that blood flows through vary.

Fig. 10.1

Fig. 10.2 [3]

(b) Using the lines drawn in **(a)** and your biological knowledge, explain the difference in the mean blood pressure in an artery and in a vein.

.....

.....

.....

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.....

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..... [4]

(c) Suggest how a narrowed coronary artery may affect heart function.

.....

.....

.....

.....

..... [3]

[Total: 10]

END-OF-PAPER

FUHUA SECONDARY SCHOOL
PURE BIOLOGY 6093
SECONDARY 4 PRELIMINARY EXAMINATION 2018
MARK SCHEME

PAPER 1 : MULTIPLE CHOICE QUESTION
TOTAL: 40 MARKS

1	2	3	4	5	6	7	8	9	10
D	C	B	C	D	A	A	B	B	A
11	12	13	14	15	16	17	18	19	20
B	D	D	D	A	A	D	C	A	C
21	22	23	24	25	26	27	28	29	30
A	C	B	A	B	A	C	C	B	C
31	32	33	34	35	36	37	38	39	40
D	C	D	C	B	B	C	A	C	A

PAPER 2 (TOTAL: 80 MARKS)
SECTION A: STRUCTURED QUESTIONS (50 MARKS)

Abbreviations

;	separates marking points
/	alternatives
()	contents of brackets are not required but should be implied
R	reject
A	accept (for answers correctly cued by the question, or guidance for examiners)
Ig	ignore (for incorrect but irrelevant responses)
AW	alternative wording (where responses vary more than usual)
AVP	alternative valid point (where a greater than usual variety of responses is expected)
ORA	or reverse argument
underline	actual word underlined must be used by candidate (grammatical variants excepted)
+	statements on both sides of the + are needed for that mark

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Qn		Suggested marking points	Marks
1	(a)	K: Oxygen/O_2 ; L: carbon dioxide/CO_2/water vapour ; explanation no chlorophyll/no chloroplasts + No photosynthesis ; respiration; **A** transpiration if water vapour given for L ;	4 (max 4)
	(b)	E (Anther) produces/manufacture pollen grains/male gametes ;	1
	(c)(i)	(16-20)/20 x100% = -20% Sign + answer ;	1
	(c)(ii)	Maximum rate of photosynthesis is reached ; Ig Graph levels off/remains constant. Concentration of carbon dioxide is not the limiting factor/ another **named** factor such as light intensity, temperature is the limiting factor ;	2
		Total:	8
2	(a)	containing only two complete set of chromosomes ;	1
	(b)	12 ;	1
	(c)	*Any 2 points below:* gametes from same individual ; self-fertilisation/described ; only new source of variation is mutation ; variation produced by meiosis ;	2 (max 2)
	(d)(i)	Meiosis ;	1
	(d)(ii)	*Any 2 points below:* reduction division/chromosome number is halved ; prevents doubling of chromosome number, with each generation/when nuclei of gametes fuse together/at fertilization ; reference to haploid (cells/gametes/sex cells) ; production of gamete/sex cells ;	2 (max 2)
		Total:	7
3	(a)(i)	absence/lack of nerve transmission ; effectors: brain + iris muscles/circular and radial muscles in iris not receiving any nerve transmission **AW** ; no nerve transmission along/via/through motor neurone (from the brain) to (effector or the iris muscle) ; Ig: identification of X as sensory neurone or optic nerve	3
	(a)(ii)	genotype of individual 1 is Gg ; **AND** *Any 2 points below:* individual 4/5 has 2 copies of the recessive allele/genotype is gg/homozygous recessive ; individual 4/5 inherits a copy each from individual 1 and 2/individual 1 and 2 each pass down a recessive allele, g to individual 4/5 ; individual 1 is not affected due to presence of a dominant allele present ;	[1] [2] (max 3)
	(a)(iii)	1/8 or 0.125 or 12.5 %	1

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	(b)(i)	*Any 2 points below:* Change in the base sequence of DNA causing a different protein to be formed **AW ;** Change in the shape of the active site, so tyrosine cannot fit/bind to the active site ; dihydroxyphenyalanine cannot be synthesized from tyrosine if tyrosinase is absent + precursor of melanin is dihydroxphenylalanine **AW** ;	2 (max 2)
	(b)(ii)	Discontinuous variation + no intermediate phenotypes/distinct/separate categories ;	1
		Total:	10
	4(a)	Removal of metabolic waste products from the body ;	1
	(b)(i)	Sample C + presence of proteins ; Protein is <u>forced</u> out of glomerulus/capillary/into Bowman's capsule/into the glomerular filtrate ;	2
	(b)(ii)	Sample A + presence of reducing sugar such as glucose ; Too much glucose in the blood and thus not <u>all</u> glucose in the filtrate is reabsorbed into capillaries ;	2
	(c)(i)	*Any 1 point below:* Lower pressure ; Less/no urea ; Reference to increase/decrease + concentration of ions **AW** ;	1 (max 1)
	(c)(ii)	*Any 2 points below:* Reduced/less efficient in removing urea ; Gentler/less steep concentration gradient of urea between blood and dialysis fluid ; slower rate of diffusion of urea from blood into dialysis fluid ;	2 (max 2)
		Total	8
5	**(a)**	$C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$ R: word equation/unbalanced equation/wrong formula	1
	(b)	*Any 3 points below:* Stores/removes more carbon than it releases **ORA** ; Supported with data from the table (110 Gigatons for release vs 140 Gigatons for storage) ; Reference to photosynthesis exceeds respiration **ORA** ; Photosynthesis removes carbon from atmosphere while respiration releases carbon into atmosphere ;	3 (max 3)
	(c)	Rich in nitrates **AW** + algae bloom/excessive algae growth + sunlight unable to penetrate and reach below ; Reference to **<u>aerobic</u>** bacteria rapidly multiply using nutrients from dead organic remains, further depleting dissolved oxygen; Reference to fishes die due to lack of dissolved oxygen ;	3
		Total	7
6	**(a)**	Hepatic artery ;	1
	(b)(i)	*Any 2 points below:* (concentration high) in the blood vessel P (hepatic portal vein) is blood with glucose absorbed from the intestine ; concentration is lower in the blood vessel Q (hepatic vein) ; Action of insulin to stimulate the conversion of excess glucose to glycogen in the liver/ glucose absorbed into liver cells ;	2 (max 2)
	(b)(ii)	7 mmol dm^{-3} ; Note: units must be quoted.	1
		Total:	4

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7	**(a)**	negative feedback ;	1
	(b)	*Any 3 points below:* Release more sweat ; Evaporation of water (in sweat) ; uses heat from body / skin / blood / refer to removal of latent heat of vaporisation ; results in evaporative cooling ;	3 (max 3)
	(c)(i)	*Any 1 point below:* Rate of transpiration decreases as relative humidity increases ORA ; The higher the relative humidity, the shorter the distance moved by the meniscus ORA;	1 (max 1)
	(c)(ii)	*Any 1 point below:* Decrease in temperature ; Decrease in wind speed ; Decrease in light intensity ;	1 (max 1)
		Total	6

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SECTION B: FREE RESPONSE QUESTIONS (30 MARKS)

Qn		Suggested marking points	Marks
8	**(a)**	Appropriate scale used (occupation of graph > 50% of grid provided) ; Points plotted correctly for both curves ; Graph labelled – soy bean and wheat ; Correct graph type – Point to point. (Reject if extrapolation from origin) ;	4
	(b)	Both increase in growth ; Growth for soybean is more than growth for wheat ; Soybean growth levels off/become relatively constant but wheat growth continue to increase ;	3
	(c)	*Any 4 points below:* More food produced + Comparative data manipulation (12000 loaves vs 1200 portions of meat OR 25x more mass/10x more food products) ; Fewer levels in food chain **AW** ; Less energy lost/more efficient ; Energy loss between/within trophic levels ; e.g of energy lost in animal's metabolism/ respiration/movement/excretion ; Correct reference to herbivore/carnivore + human ; Correct reference to primary/secondary + consumer ;	4 (max 4)
		Total	11
9	**(a)**	*Any 2 points below*: Cell division/cell growth/tissue repair/reproduction/embryo development ; Transmission of nerve impulses ; Maintenance of constant body temperature ; Chemical reactions ; Active transport of absorbed named substances in to villi/in small intestine ; Excretion (selective reabsorption of glucose /ions) ; AVP ;	2 (max 2)
	(b)	*Description:* Lactic acid concentration increases, steeply/quickly/**AW**, during exercise ; Decreases steeply, then gradually after exercise ; Any use of figures (e.g peak at 13.2 mmol dm^{-3} at 15 minutes) ; **AND** *Any 4 points below for explanation:* Oxygen, demand increases/does not reach muscles fast enough/**AW** ; Anaerobic respiration ; Provides/releases energy or **A** Produces ATP ; **R**: produce/makes energy Anaerobic respiration produces lactic acid ; Lactic acid diffuses from muscles into the blood ; Lactic acid, is broken down/respired/oxidised/converted to glucose/**AW** in the liver ; Reference to <u>oxygen debt</u> ;	7 (max 7)
		Total:	9

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10E	**(a)(i)**	*Any 3 points below (2 structural + 1 functional or 1 structural + 2 functional)* Structural similarities: Long/elongated ; Provides large surface area ; Functional similarities: Absorption/uptake of ions/salts/minerals/named/water ; Active transport/diffusion involved ;	3 (max 3)
	(a)(ii)	*Any 3 points below (2 structural + 1 functional or 1 structural + 2 functional)* Structural differences: Cell wall vs no cell wall ; (root hair) part of one cell ; (villi) many cells/multicellular ; Reference to absence of blood vessels/lacterals/**ORA**; AVP ; Functional differences: Root hairs + absorb from the soil ; Villi + absorb from the gut/small intestine ; Villi + absorb from amino acids ; Villi + absorb glucose ; Vili + absorb lipids/glycerol/fatty facids ;	3 (max 3)
	(b)	Any 4 points below: Pathway: (xylem) → mesophyll cells → intercellular air spaces → (atmosphere); Process: osmosis for xylem to mesophyll cells + down water potential gradient ; Process: diffusion of water vapour from intercellular air space to atmosphere ; Through stomata ; Evaporation of water/ reference to water vapour formation ;	4 (max 4)
		Total:	10
10O	**(a)**	Mean blood pressure (decreases but not touching zero); Diameter: Line decreases (lowest at capillaries) followed by increase ; Vein diameter drawn to be higher than the artery;	3
	(b)	*Any 4 points below:* Reference to heart/ventricle + pump/source of pressure ; Pressure relates to distance from heart/pump **A**: arteries take blood from/are close to heart ; Resistance/friction ; Narrow lumen (in artery) **ORA** for vein ; Thick/muscular/elastic walls (in artery) ; Generation of tissue fluid in capillaries ;	4 (max 4)
	(c)	*Any 3 points below:* Less blood flow containing oxygen/glucose (through coronary artery) **R**: no blood flow ; to cardiac/heart muscle/muscle cells ; Less aerobic respiration/described of the muscle cells (**R**: no aerobic respiration) ; Heart muscle/cells cannot contract much/less forceful contraction (**R:** no contraction) ;	3 (max 3)
		Total:	10

THE END

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Geylang Methodist School (Secondary)
Preliminary Examination 2018

BIOLOGY **6093/01**

Paper 1 **Sec 4 Express**

Additional materials: Optical Answer Sheet **1 hour**

Setter: Mrs Cheryl Tang **20 Aug 2018**

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, papers clips, highlighters, glue or correction fluid on the Optical Answer Sheet.
Write your name, class and index number on the Optical Answer Sheet provided.

There are **forty** 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 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.

This document consists of **22** printed pages.

[Turn over

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1 The diagram below shows a plant cell in a leaf of a tree.

Which of the following correctly shows the pathway involving the synthesis of a protein molecule needed for the development of a fruit?

A 1 → 2 → 5 → 4
B 1 → 6 → 5 → 9
C 2 → 5 → 7 → 1
D 7 → 1 → 2 → 5

2 The diagram shows blood passing through an arteriole into a capillary. Part of the capillary wall has been cut away to show the blood.

What is the level of organisation of the structures labelled P and Q?

	P	Q
A	organ	cell
B	organ	tissue
C	tissue	cell
D	tissue	tissue

3 Strips of plant tissue were immersed in a range of sucrose solutions of different concentrations.

Their lengths were measured before immersion and after 30 minutes in the different solutions.

The graph shows the ratio of their initial length to final length.

Which concentration of sucrose solution, in mol dm^{-3}, has the same water potential as the cell sap before immersion?

A 0.10
B 0.25
C 0.45
D 0.80

4 Where and how does carbon dioxide enter a plant?

	where	how
A	root hair cells	active uptake
B	root hair cells	diffusion
C	stomata	active uptake
D	stomata	diffusion

5 The diagram shows a biological molecule.

What type of molecule is this likely to be?

A fat
B glycogen
C protein
D sucrose

6 A mixture of food gives the following results on testing:

a purple colour in the biuret test;
a blue colour when heated with Benedict's solution;
a yellow colour with iodine;
a white emulsion with ethanol.

What does the mixture contain?

A fat and protein
B protein and reducing sugar
C reducing sugar and starch
D starch and fat

7 Protease enzyme breaks down protein to amino acids.

In the 'lock and key' hypothesis, what is the lock and what is the key?

	lock	key
A	amino acid	protease
B	protease	amino acid
C	protease	protein
D	protein	protease

8 Four flasks labelled Q, R, S and T were prepared. The contents of each flask are given in the table below.

flask	contents of flask	experiment temperature (°C)
Q	20 cm^3 of starch + 5 cm^3 salivary amylase	35
R	20 cm^3 of starch + 2 cm^3 salivary amylase	35
S	20 cm^3 of starch + 5 cm^3 boiled salivary amylase	35
T	20 cm^3 of starch + 5 cm^3 salivary amylase	10

Equal volumes of samples from each flask were obtained and tests for starch were done at 5-minute intervals. Each experiment was carried out over a time span of 25 minutes. The results of the experiments are shown in the graph.

Which of the following shows the accurate trends for reactions in flasks Q and S?

	Q	S
A	4	1
B	1	4
C	3	1
D	3	2

9 Rachel has a damaged liver due to excessive drinking. Many functions of the body will be affected.

Which of the following function will **not** be affected?

A secretion of digestive enzymes
B formation of urea
C production of bile
D formation of glycogen

10 The graph shows the changes in blood glucose concentration during periods of rest and exercise.

What causes the change in blood glucose level between **X** and **Y**?

	glucagon secretion	insulin secretion	glycogen stored in liver
A	decreases	increases	increases
B	decreases	increases	decreases
C	increases	decreases	decreases
D	increases	decreases	increases

11 The graph shows how the rate of photosynthesis of a plant varies with light intensity at two different carbon dioxide concentrations. The temperature is kept constant at 20 °C.

Which factor is limiting the rate of photosynthesis at point X?

A availability of chlorophyll

B availability of water

C concentration of carbon dioxide

D intensity of light

12 The chart below shows the distribution of stomata on the upper and lower epidermis of the leaves of four plants.

Which of these plants would be found floating on the surface of a pond?

13 The diagram shows pressure changes in the left side of the heart during part of the human cardiac cycle.

At which point do the atrioventricular valves open?

14 The diagram below shows the mammalian blood vessels connected with the small intestines and the liver.

Which of the following is correct?

	blood vessel X	blood vessel Y
A	more urea	less urea
B	more oxygen	less oxygen
C	more carbon dioxide	less carbon dioxide
D	valves present	valves absent

15 The life span of red blood cells is approximately 120 days. New red blood cells are released into the bloodstream from the bone marrow. Unlike typical cells in the body, they do not reproduce by mitosis.

What is the likely explanation for this?

A Red blood cells have haemoglobin which inhibits cell division.

B Red blood cells move around constantly, so they are not able to remain stationary for cell division to occur.

C Red blood cells have lost their nuclei, so they are not able to carry out cell division.

D Red blood cells are too small for cell division to take place.

16 The photomicrograph shows an aphid feeding on a branch of a woody tree, *Tilia*. The fluid extracted by the aphid consists of sieve element sap. The high turgor pressure in the sieve element forces the cell contents through the food canal of the aphid. Once every 30 minutes, a droplet of undigested sap exits from the aphid. Plants exhibiting extensive aphid damage can have a variety of symptoms, such as decreased growth rates, stunted growth, low yields and death.

Which of the following pairs of observation and explanation is correct?

	observation	explanation
A	sieve element sap	rich in solutes, especially sucrose and amino acids.
B	high turgor pressure in sieve element	numerous mitochondria in sieve tubes to carry out active transport.
C	undigested sap	product of defecation and not excretion.
D	variety of symptoms	due to low levels of manufactured food substances left for *Tilia* plant.

17 A plant was enclosed in an environment that contained radioactive carbon dioxide for 24 hours. The leaf, stem and root of the plant was then sectioned to detect radioactivity. The diagram below shows a leaf, stem and root of the plant.

Which of the numbered parts would show radioactivity?

	leaf	stem	root
A	1	3	5
B	1	4	5
C	2	3	6
D	2	4	6

18 The graph shows the concentration of lactic acid in the blood vessel leaving the leg muscle of a runner before, during and after a race.

What is the concentration of lactic acid 15 minutes after the race has finished?

A 32 mg/cm^3

B 46 mg/cm^3

C 70 mg/cm^3

D 92 mg/ cm^3

19 The diagram shows the gas exchange surface of a person who has just smoked a cigarette.

Substance P can cause cancer.

What is substance P?

A carbon dioxide
B carbon monoxide
C nicotine
D tar

20 The diagram shows the flow of blood and dialysis fluid through a kidney machine.

Which substances have the lowest concentration at X and the highest concentration at Y?

	lowest concentration at X	highest concentration at Y
A	glucose	salts
B	salts	glucose
C	urea	water
D	water	urea

21 The diagram shows a glomerulus and Bowman's capsule of a mammalian nephron

What happens if the diameter of the blood vessel is enlarged at X?

A More sodium will appear in the urine.

B Less glucose will appear in the urine.

C Water reabsorption will be decreased.

D The rate of urine production will be reduced

22 The hypothalamus detects a rise in blood temperature above normal.

Which of the following would correct it?

	arterioles in the skin	sweat glands	hair erector muscles
A	constrict	active	relax
B	constrict	inactive	contract
C	dilate	active	relax
D	dilate	inactive	contract

23 Four processes that take place in the human body are listed.

1. absorption of amino acids through the villi
2. maintenance of constant body temperature
3. production of lactic acid in muscles
4. regulation of blood glucose concentration

Which two processes are directly controlled by negative feedback?

A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

24 The diagram represents a central nervous system. X, Y, and Z show possible sites where the system can be blocked by a local anaesthetic.

Of four men, one had no anaesthetic block and the other three had only one anaesthetic block at X, Y or Z.

One of the men can feel a pinprick on his leg but cannot move it.

Where is the anaesthetic block for this man?

A block is at X
B block is at Y
C block is at Z
D no block

25 Tom was waiting at a taxi stand in the middle of the night when a robber came up to him and demanded money from him at knife point.

Which of the following are likely to take place in Tom's body at that moment?

(i) relaxation of radial muscle in the iris
(ii) dilation of arterioles supplying blood to the gastro-intestinal tract
(iii) dilation of arterioles supplying blood to skeletal muscle
(iv) increased heart rate

A (i), (ii) and (iv)
B (iii) and (iv)
C (ii) and (iii)
D (iii) only

26 The flow diagram shows the pupil reflex.

Which words complete the flow diagram?

	X	Y	Z
A	motor	ciliary body	contract
B	motor	iris	relax
C	sensory	ciliary body	relax
D	sensory	iris	contract

27 New plants may be grown from groups of cells that are taken from other plants. The diagram shows part of plant X.

From which structure will cell samples grow into new plants that are genetically identical to plant X?

28 The diagram shows the flower of a species of grass that is growing extensively in a grassland.

Both the male and female reproductive parts matured within 48 hours of each other three days ago.

Assuming normal climatic conditions, where can intact pollen grains be found in the flower above?

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

29 Which precautions should be taken to prevent the spread of HIV?

1 avoidance of any direct skin contact with another person
2 medical staff wearing gloves when treating patients
3 not sharing soap used by another person
4 prevent exchange of body fluids being in direct contact
5 treatment of blood products to destroy the virus

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

30 The diagram shows part of the male urinary and reproductive systems in side view.

What is transported in the tubes labelled 1, 2, 3 and 4?

	1	2	3	4
A	urine only	urine only	urine and sperm	sperm only
B	sperm only	urine and sperm	urine only	urine only
C	urine only	urine and sperm	sperm only	urine only
D	urine and sperm	urine only	sperm only	urine only

31 The diagram shows the life cycle of a species of plant.

During which stage does meiosis occur?

32 The diagram below shows animal cells undergoing various stages of mitosis.

Identify the stages of mitosis occurring in the cells labelled X, Y and Z.

	X	Y	Z
A	anaphase	prophase	interphase
B	anaphase	telophase	prophase
C	prophase	metaphase	telophase
D	prophase	anaphase	telophase

33 A woman with blood type A marries a man with blood type B. They have children with each of the four blood groups.

Which of the following statements correctly describes the children in this family?

A Some of the children would have the same genotypes as the parents.

B None of the children would be homozygous for any of the blood type alleles.

C All the children would have at least one copy of the I^O.

D Each of them would have either one I^A or one I^B allele.

34 The diagram shows the change that occurs in the frequency of phenotypes in an insect population over 10 generations.

Which of the following best explains the change in the frequency of phenotype over 10 generations?

A A decrease in the adaptive value of allele *a*.

B A decrease in the mutation rate of allele *a*.

C An increase in the adaptive value of allele *a*.

D An increase in the population of this insect.

35 A person with Down's syndrome is born with 47 chromosomes in each of his/her cells, instead of 46.

What could cause this?

A A mutation happened during the production of the egg cell.

B More than one sperm fused with the egg at fertilisation.

C Radiation caused a change in structure of a gene in the father's sperm.

D The mother was exposed to harmful chemicals while she was pregnant.

36 The chart shows the inheritance of coat colour in mice. The allele for brown coat (B) is dominant of the allele for white coat (b).

What are the genotypes of individuals P and Q most likely to be?

	P	Q
A	BB	Bb
B	BB	BB
C	Bb	Bb
D	Bb	BB

37 In an experiment, cows were used to make 'designer milk' containing human antibodies.

The diagram shows the first three stages of the process.

In which stages in the diagram above are transgenic cells present?

A stages 1 and 2

B stages 1 and 3

C stages 2 and 3

D stages 1, 2 and 3

38 The diagram shows a short section of a molecule of DNA.

Which of the following sets of labels is correct?

	1	2	3
A	ribose	sugar-phosphate backbone	adenine
B	ribose	phosphate	cytosine
C	deoxyribose	sugar-phosphate backbone	guanine
D	deoxyribose	phosphate	thymine

39 The diagram shows some organisms (not drawn to scale), which live in the same habitat.

Which of the following is a food chain for this habitat?

A grass → zebra → lion → oxpecker bird
B grass → zebra → tick → oxpecker bird
C oxpecker bird → lion → zebra → grass
D oxpecker bird → tick → zebra → grass

40 The population sizes of four different species of insect were monitored over a period of 40 years. The results are shown on the graph.

Which species is in the greatest danger of extinction?

End of Paper

Geylang Methodist School (Secondary)
Preliminary Examination 2018

Candidate Name	
Class	
Index Number	

BIOLOGY **6093/02**

Paper 2 **Sec 4 Express**

Additional materials: Nil **1 hour 45 minutes**

Setter: Mrs Cheryl Tang **20 Aug 2018**

READ THESE INSTRUCTIONS FIRST

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

Section A

Answer **all** questions in the spaces provided on the question paper.

Section B

Answer **all** the questions.

Write your answers in the spaces provided on the Question Paper.

Write an **E** (for Either) or an **O** (for Or) next to the number 10 in the grid below to indicate which question you have answered.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes for Section B.

At the end of the examination, hand in 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	
8	
9	
10	
Total	

This document consists of **20** printed pages and **2** blank pages.

[Turn over

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Section A (50 marks)

Answer **all** questions.
Write your answers in the spaces provided.

1 A group of students investigated the effect of soaking small onion bulbs in different concentrations of sodium chloride solution. They peeled off the outer papery leaves of the onion bulbs and divided the onions into 6 batches, each with 10 onions.

The onions were surface dried with paper towels and weighed. The mean mass of the onions in each batch was calculated. The onions were then left in sodium chloride solutions for three hours.

After three hours the students surface dried the onions and weighed them again. Their results are given in Table 1.1.

Table 1.1

concentration of sodium chloride solution / g dm^{-3}	mean mass of onions / g		percentage change in mass/ %
	before soaking	after soaking for 3 hours	
0	147	173	+17.7
25	153	165	+7.8
50	176	172	-2.3
100	154	149	-3.2
150	149	142	-4.7
200	183	175	

(a) **(i)** Explain why the students calculated the percentage change in mass of the onions.

.....

.....

.....[2]

(ii) Calculate the percentage change in mass of the onions that were in the most concentrated solution of sodium chloride. Show your working. Write your answer in Table 1.1.

[1]

(b) The students plotted a graph of the results as shown in Fig. 1.1.

Fig. 1.1

(i) Complete the graph using your answer to **(b)(i)**. [1]

(ii) Use the graph in Fig. 1.1 to estimate the concentration of the sodium chloride solution that has the same water potential as the onions.

.....

[1]

(c) Using the term **water potential**, explain why the onions change in mass when soaked in dilute solutions of sodium chloride.

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.....[2]

[Total: 7]

2 Fig. 2.1 shows parts of the alimentary canal that lie in the upper part of the human body.

Fig. 2.1

(a) **(i)** Name the part labelled **E**

.....[1]

(ii) Name the process that carries food from **F** to **G.**

.....[1]

(b) Suggest why the walls of part **H** are normally coated with mucus.

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.....[4]

(c) Sometimes, particularly when a person is lying flat, partly digested food returns into structure **E** through the valve at **G**. This can cause discomfort known as heartburn.

(i) Suggest why heartburn is not a biologically accurate name for this condition.

.....[1]

(ii) Suggest and explain why medications for this condition are often alkaline in nature.

.....

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.....[2]

[Total: 9]

3 The menstrual cycle involves monthly changes in the ovary and the uterus.

(a) Fig. 3.1 shows the sequence of changes within the ovary that occur during the menstrual cycle.

Fig. 3.1

(i) Name structures **R** and **S**.

R .....

S ..... [2]

(ii) State the name of the process that is occurring at **T**.

.....[1]

(b) The ovary secretes hormones that control the growth and maintenance of the lining of the uterus.

Name the hormone that stimulates:

(i) the growth of the lining of the uterus during the first half of the menstrual cycle

.....[1]

(ii) the maintenance of the lining of the uterus during the second half of the menstrual cycle.

.....[1]

[Total: 5]

4 There are many different drugs available to treat high blood pressure. Fig. 4.1 shows the mean heart rates of two groups of people, **J** and **K**, over a five-year period.

From the start, and throughout the period, group **K** were treated with a drug called a beta-blocker. Group **J** did not take any form of medication.

Fig. 4.1

(a) **(i)** State the term used to describe group **J**.

.....[1]

(iii) Using information from Fig. 4.1, describe the effect on the heart of taking beta-blockers.

.....

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.....[3]

(b) On Fig. 4.1, draw a curve to show the expected effect on the mean heart rate of Group **J** if, after three years, half of them started to take beta-blockers. [3]

(c) Some other drugs reduce blood pressure by having an effect on blood vessels.
Suggest how these drugs may cause a decrease in blood pressure.

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.....

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.....[2]

[Total:9]

5 A particular type of flower displays co-dominance and has multiple alleles. The alleles for purple (**P**) and red (**R**) are co-dominant and both the red and purple alleles are completely dominant to the white allele (**W**).

Plant **1** produces purple flowers with patches of red. Plant **2** produces pure purple flowers.

(a) Explain how you use the results of a test cross with Plant **2** to determine if Plant **2** is heterozygous or homozygous for flower colour.

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.....[3]

(b) Suppose the results of the test cross displayed that **Plant 2** is heterozygous. Using a genetic diagram, determine the ratios of the phenotype from a cross of **Plant 1** and **Plant 2**. [4]

[Total: 7]

6 Fig. 6.1 shows a sloth. The sloth is a mammal that lives in the trees of the South American rainforests.

Fig. 6.1

Sloths have the following features:

- They are extremely slow moving.
- Some tear leaves from trees using their lips and the teeth at the back of their mouths.
- They have no front teeth.
- They climb down the tree to deposit their faeces in a hole they dig near the foot of the tree.
- They lose over a quarter of their body weight when they defaecate, which may be once every 6–8 days.
- Their fur is often green since it contains single-celled, plant-like organisms (algae).
- Their fur also contains blood-sucking mosquitoes and many small animals such as adult moths that feed on the algae and on the hair of the sloth.
- Moths lay their eggs in the faeces of the sloth on which the moth larvae feed.
- The major predators of the sloth are jungle cats and the harpy eagle.

(a) Complete the food web in Fig. 6.2 to show the feeding relationships of the organisms mentioned on page 11. [4]

Fig. 6.2

(b) Suggest and explain an advantage to the sloths of the algae that live in their fur.

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.....[2]

[Total:6]

7 Fig. 7.1 shows flowers from the same species of plant at different stages, **D** and **E**, in their development.

Fig. 7.1

(a) The flowers are cross-pollinated by an insect. Explain why the insect must visit flower **D** before visiting flower **E**.

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.....[3]

(b) Suggest how flowers of this species are adapted to be pollinated by an insect such as a bee.

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.....[4]

[Total: 7]

End of Section A

Section B (30 marks)

Answer **three** questions.
Question 9 is in the form of an **Either/Or** question.
Only one part should be answered.

Write your answers on the separate writing paper provided.

8 A student investigated the effect of wind speed on the rate of transpiration of some leaves.

Five leaves were taken from a tree and each of them was weighed on a balance. Each leaf was then hung on a piece of wire. Fans were used to blow air at different speeds over each leaf. After 12 hours, the student weighed each leaf again. The results are shown in Table 8.1.

Table 8.1

wind speed/ ms^{-1}	initial mass / g	final mass / g	change in mass / g
0	5.7	3.8	
1	5.3	3.3	
3	5.9	3.7	
6	5.1	2.5	
8	5.3	2.6	

(a) Complete Table 8.1. [2]

(b) Plot a graph on the grid provided on the next page to show the effect of wind speed on the change in mass of the leaves. [4]

(c) Use your graph to determine the change in mass at wind speed of 5 ms^{-1}. Show on the graph how you obtained your answer.

change in mass ..... [1]

(d) The students kept a constant light intensity during her investigation.

Predict and explain the effect of increasing light intensity on water loss from leaf.

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.....[3]

(e) A student criticised the results by saying that the change in mass does not allow for a fair comparison between leaves.
Suggest a more appropriate calculation and explain why it gives a fairer comparison.

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.....[2]

[Total: 12]

9 Researchers in Michigan investigated the rate of photosynthesis in leaves of big-tooth aspen trees, *Populus grandidentata*, by placing some of the growing leaves inside transparent boxes.

The researchers measured the uptake of carbon dioxide by the leaves over a range of temperatures from 10–40 °C. They carried out their measurements at two different concentrations of carbon dioxide:

H – 325 ppm carbon dioxide which is close to the concentration in the atmosphere;

J – 1935 ppm carbon dioxide which is a very high concentration.

The results are shown in Fig. 9.1.

Fig. 9.1

(a) Describe how the results for the aspen leaves in batch **J** differ from the results for the aspen leaves in batch **H**. Use data from Fig. 8.1 in your answer.

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..... [3]

(b) Use the results in Fig. 9.1 to suggest **and** explain the likely effect on plant growth of an increase in carbon dioxide concentration in the atmosphere as a result of the combustion of fossil fuels.

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.....[5]

[Total: 8]

10 Either

A person is sitting in the shade reading a book when he looks at the bright sky to see an aeroplane flying past. Explain the changes in

(a) the lens of the eye,

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.....[6]

(b) the pupil of the eye

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.....[4]

[Total: 10]

10 Or

(a) Describe the role of the cilia in the trachea.

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.....[3]

(b) Fig. 10.1 shows components of the human gas exchange surface and an associated blood vessel.

Fig. 10.1

State the characteristics, and describe the roles, of each of the components shown in Fig. 10.1.
You should make reference to **named** structures in your answer.

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[7]

[Total: 10]

End of Paper

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GEYLANG METHODIST SCHOOL (SEC)
PRELIMINARY EXAM 2018
SEC 4E P BIOLOGY ANSWERS

PAPER 1

1	2	3	4	5	6	7	8	9	10
A	**C**	**C**	**D**	**B**	**A**	**C**	**B**	**A**	**C**
11	12	13	14	15	16	17	18	19	20
C	**C**	**D**	**B**	**C**	**A**	**C**	**C**	**D**	**C**
21	22	23	24	25	26	27	28	29	30
D	**C**	**D**	**B**	**A**	**D**	**D**	**C**	**D**	**A**
31	32	33	34	35	36	37	38	39	40
A	**B**	**A**	**C**	**A**	**A**	**B**	**D**	**B**	**C**

PAPER 2 Section A

1 (a) (i) - start mass of the onions is different / not all are the same [1];
- use of percentage change in mass allows for valid / fair comparison to determine water potential of the onion [1];

(ii) 183 – 175 = 8 ;

$\frac{8}{183} \times 100 = -4.4$ [1];

(b) (i) line finished to – 4.4

(ii) 44 g dm^{-3};
with indication how value was obtained from graph [1]
otherwise 0 m

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(c)

- movement of water by osmosis through partially permeable membrane(s) [1];
- When onion cell sap has lower water potential than sodium chloride solution / sodium chloride solution has higher water potential than onion cell sap, water enters the onion cells and causes the cells to swell and eventually gain in mass;

2 (a) (i) oesophagus [1]
(ii) peristalsis [1]

(b)
- The presence of food in H, stomach, stimulates the gastric glands to secrete gastric juice which contains hydrochloric acid and inactive pepsinogen. Hydrochloric serves to activate pepsinogen to pepsin [1].
- The mucus also serves to prevent corrosion by acid [1].
- The walls of stomach is coated with mucus to serve as a protection / barrier which prevents damage / breakdown by pepsin [1] on the stomach walls which are made of protein [1].
- The mucus also serves as lubrication during peristalsis in the stomach [1]

[max 4m]

(c) (i) The heart is not involved / no connection between E and the heart [1].
(ii) There are less mucus in E [1].
Acid from stomach damages the cells / walls of E [1].
The acid is neutralised by the alkaline nature of the medication [1].

3 (a) (i) **R** corpus luteum [1]
S (Grafiaan) follicle [1]
(ii) ovulation [1]
(b) (i) oestrogen [1]
(ii) progesterone [1]

4 (a) (i) control
(ii) During the first four months, the heart rate decreases rapidly/ AW [1] from 85 to 62 beats per minute [use of data from Fig. 4.1 – 1m] .

The heart rate remains (more or less) constant between 59 – 62 beats per minute [1].

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(b) line / curve starts at 36 months drops with similar gradient to line K [1];
to between 70 and 74 bpm [1];
levels to run parallel with the J and K [1];

(c) prevent constriction of muscular wall in arteries / arterioles [1];
with larger lumens / dilation / widens / AW, reduces fats deposits;
OR
less resistance / friction / AW to blood flow. [1]

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5 (a)

- Cross Plant 2 with a white flowered plant (test cross); [1]
- If all offspring have purple flowers, Plant 2 is homozygous; [1]
- If 50% of offspring have purple flowers and 50% of offspring have white flowers, plant 2 is heterozygous; [1]

(b) Let the allele for purple flower be P, the allele for red flower be R and the allele for white flower be W.

Offspring phenotype ratio: 2 purple: 1 purple with patches of red: 1 red

Genetic diagram – 1m;
Phenotype ratio – 1m;
Correct genotype of plant 1 and 2 – 1m;
Correct crossing – 1m;

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6 (a) top: harpy / eagle + (jungle) cat + mosquito [1];
middle: sloth (left) + moth (right) [1];
bottom: (tree) + algae [1];
any 4 arrow heads correct [1]; [total – 4m]

(b) camouflage / less easily seen ;
so not eaten / escape predators (or named) ;
slow moving / cannot escape quickly ; [max 2m]

7 (a)

- For flower D, the anther(s) / stamen(s) are visible.
- The pollen are matured / produced / present / released.
- The stigma is closed / immature AW / does not receive pollen.
- As for flower E, the stigma is open / mature / able to receive pollen.
- The anthers are withered AW OR reference to no pollen produced / present.

[max 3 – 3m]

(b) 1 large / colourful petal(s) present for bee landing/ platform on petal.
2 petals are scented to attract bees to visit the flower to help in pollination;
3 presence of nectar(ies) / (nectar) guides on petals to guide bees to the inside of flower;
4 The pollen is stick(y) / hooked so as to attach to bee;
5 The bee makes contact AW with anther / stigma while collecting nectar;
[any 4 – 4m]

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Section B

8 (a)

change in mass / g
3.8 – 5.7 = -1.9
3.3 – 5.3 = -2.0
3.7 – 5.9 = -2.2
2.6 – 5.1 = -2.5
2.6 – 5.3 = -2.7

- calculate correctly to 1dp [1];
- with negative sign to indicate loss in mass [1]

(b) axes labelled [1];
scales of x-and y-axes [1];
plot points correctly [1];
draw best fit line [1];

(c) [-2.43g] read from graph + correct units [1]

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(d) As light intensity increases, the rate of water loss from the leaf increases [1].

This is because the size of stomata increase [1] with increased light intensity, leading to an increase in the rate of diffusion of water vapour out of the stomata [1].

(e) calculate the percentage change in mass [1] instead of absolute mass; as the original mass of the leaves are not the same [1];

9 (a)

- carbon dioxide uptake of batch J is higher than batch H (at all temperatures except at 10 °C);
- peak / optimum / maximum uptake of J is 35°C and is of higher temperature than batch H which is 25°C only;
- data recorded in J between 35 – 40°C (but not for H);
  [correct use of comparative data between J and H with correct units, which must be stated at least once. Otherwise, 1m deducted]

(b)

- With the combustion of fossil fuels, high concentration of CO_2 is present in the environment.
- Plant growth is likely to increase due to higher rate of photosynthesis (with more carbon dioxides) resulting in more glucose / starch being produced.
- Glucose is used for respiration to provide energy (for growth) / more cellulose for cell walls / more protein for enzymes / cell membranes.
- Carbon dioxide is a greenhouse gas / reference to (enhanced) greenhouse effect. This causes increase in global temperatures and increased rate of photosynthesis.
- As enzymes are involved in photosynthesis, increase in temperature affects enzyme activity / cause denaturation of enzymes.
- In the long run, rate of photosynthesis will slow down.
- any relevant consequence of global warming ;
- Any other valid point; e.g. relevant use of data
  [max 5]

10E (a) ref. in either (a) or (b) to reflex action [1]; neurones/ impulses [1]

When the person looks up to see the aeroplane, his ciliary muscles relax [1].
This causes the suspensory ligaments to tighten [1], resulting in the lens being pulled [1] and become thinner / longer focal length /AW [1].
This reflex action [1] enables him to focus on the distant object [1].
[max. 6]

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(b) When the person turns from reading book in the shade to looking at the aeroplane in brighter light [1], the retina detected the change in light intensity.
An impulse is sent to the circular muscles in iris to contract, radial muscles to relax [1]. Thus, the pupil becomes smaller [1];
[max. 4*]
[*to include either of the first two marking points]

10O (a) Mucus is secreted by the gland cells to tranp dust particles and bacteria [1].

The cilia on the epithelial cells in trachea sweeps / moves up dust-trapped mucus up the trachea away from lungs [1].

Thus, preventing infection of the lungs [1].

(b) reference to diffusion of oxygen / carbon dioxide + exchange AW [1];

The alveolus / air sac has large surface area [1].

Both the alveolus and blood capillary have a one cell thick wall [1] which allows for faster diffusion of oxygen and carbon dioxide [1].

There is a layer of moisture lining the alveolar wall for dissolving gases before being diffused across the walls of alveolus to capillary wall [1].

The red blood cells / erythrocytes has no nucleus. This gives it a biconcave shape which increase surface area to volume ratio for exchange of oxygen into and out of the cells. [1]

Red blood cells contain haemoglobin which combine with oxygen to become oxyhaemoglobin. It is being transported to oxygen poor cells and oxygen is then released from haemoglobin and diffused into the cells [1].

Carbon dioxide is being transported in the plasma in the form of hydrogen carbonate ions. When it reaches the lungs, the hydrogen carbonate ions diffuses into the red blood cells where they are converted into carbonic acid and then into water and carbon dioxide. Carbon dioxide then diffuses out of the red blood cells, out of the blood capillary and into the alveoli, where it is expelled when breathing out [1].

[max 7m]

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JUNYUAN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018
SECONDARY FOUR EXPRESS

CANDIDATE NAME

CLASS | | | | INDEX NUMBER | | |

BIOLOGY 6093/01

Paper 1 **16 Aug 2018**

1 hour

Candidates answer on the Multiple Choice Answer Sheet

Additional materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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

There are **forty** 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 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.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **19** printed pages.

[Turn over

1 The table identifies the various organelles within the cell by describing the function of membrane surrounding each organelle.

organelle	1	2	3	4	5	6
function of membrane	allows exit of mRNA	protein synthesis	transport enzymes	lipid synthesis	allows oxygen to enter	allows carbon dioxide to enter

Which row correctly identifies the organelles?

	1	2	3	4	5	6
A	chloroplast	vesicle	smooth ER	ribosome	nucleus	mitochondrion
B	nucleus	ribosome	vesicle	smooth ER	golgi bodies	mitochondrion
C	nucleus	ribosome	vesicle	smooth ER	mitochondrion	chloroplast
D	nucleus	smooth ER	golgi bodies	ribosome	vesicle	chloroplast

2 Some processes listed occurs in flowering plants.

1 ion uptake by root hairs
2 water uptake by root hairs
3 ion movement up the xylem in the stem
4 water vapour loss by the mesophyll cells of the leaves

Which processes are controlled by cell surface membranes?

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

3 Which statement is true?

A Crenation occurs in all types of cells occur in a hypertonic solution.
B Plasmolysis of onion cells occurs when cytoplasm shrinks against the cell wall.
C Potato tissues are flaccid when there is a loss of cells.
D Turgidity of cells is dependent on the concentration of cell sap.

4 The stalk of an *Ipomoea aquatica* (local name: kang kong) is a hollow stem. Pieces of the stem are cut and placed in solutions of different water potential.

The diagram shows how the pieces of stem would look like after soaking in the solutions for 20 minutes.

Which of the following correctly identifies the types of solutions I, II, III and IV?

	solution I	solution II	solution III	solution IV
A	pure water	1mol/dm^3 sucrose solution	0.1mol/dm^3 sucrose solution	3mol/dm^3 sucrose solution
B	20% sucrose solution	5% sucrose solution	10% sucrose solution	0.1% sucrose solution
C	pure water	0.5mol/dm^3 salt solution	1.0mol/dm^3 salt solution	5mol/dm^3 salt solution
D	1% salt solution	10% salt solution	5% salt solution	pure water

[Turn over

5 Snake venoms are harmful because they contain enzymes that destroy blood cells and tissues. The damage caused by a snake bite could be slowed down by

A applying ice to the bite area
B drinking large amounts of water
C increasing blood flow to the area
D inducing vomitting

6 Which of these are basic biological molecules of chromatin threads?

A **B** **C** **D**

7 Which of the following graph shows the rate of reaction when the hot mixture of starch and salivary amylase are cooled down from 100 °C to 0 °C?

For questions 8 and 9 refer to the diagram below.

8 When the digested food are present in the organ R, digestive enzymes are released into organ R from organ Q. In addition, organ P contracts and releases bile into the organ R.

Extracts from organ R were tested using food test. Which of the following is likely to represent the results from the food test?

	food tests			
	iodine test	Benedict's test	Biuret test	fat emulsion test
A	blue-black	brick red precipitate	blue	clear
B	brown	blue	blue	white emulsion
C	brown	blue	violet	clear
D	blue-black	brick red precipitate	violet	white emulsion

9 A receptor detects the concentration of a digested food absorbed into the bloodstream to be higher than normal, and produces a chemical that triggers a negative feedback by the effector. Which organ is the receptor and the effector?

	receptor	effector
A	O	Q
B	P	R
C	Q	O
D	R	P

[Turn over

10 The graph represents the cross-sectional area, velocity and blood pressure of five different blood vessels.

Which of the following represents lines I, II and III?

	line I	line II	line III
A	blood pressure	cross-sectional area	velocity
B	velocity	blood pressure	cross-sectional area
C	cross-sectional area	velocity	blood pressure
D	velocity	cross-sectional area	blood pressure

11 The graph shows changes in the blood pressure in the left ventricle of the heart. During which period is the atrio-ventricular valves are forced to close and semi lunar valves opened?

For questions 12 and 13, refer to the graph below which shows the effect of light intensity on the rate of photosynthesis at three concentrations of carbon dioxide.

12 At which point is light intensity the limiting factor for the three experiments?

A 0 – 1 arbitrary unit
B 1 – 2 arbitrary units
C 2 – 3 arbitrary units
D 3 – 4 arbitrary units

13 At which point on the graph does carbon dioxide concentration start to become the limiting factor for the graph at 0.3 % carbon dioxide?

A W
B X
C Y
D Z

14 A plant is exposed to different environmental conditions. Which set of conditions would cause the plant to wilt the most?

	light intensity / lux	temperature / °C	relative humidity / %
A	150	15.0	70.0
B	250	35.0	60.0
C	400	15.0	50.0
D	800	35.0	30.0

[Turn over

Question 15 and 16 refers to the diagram that shows some tissue cells of a green plant that was left exposed to radioactive carbon dioxide gas for several hours. Subsequently the plant was left for aphids to feed on it. The radioactive carbon dioxide gas has no effect on the aphids.

15 Which tissue will detect traces of radiation upon diagnosis?

A 1 and 2
B 1 and 3
C 2 and 3
D 3 only

16 As the aphid feeds on the cell sap, droplets of undigested sap exits from its abdomen as a result of high turgor pressure from the cells. Which statement is incorrect?

A Plants infested with aphids suffer from stunted growth rates and low yields.
B The cell sap is rich in sucrose and amino acids.
C The undigested cell sap is a product of egestion and not excretion.
D The high turgor pressure is a result of transpiration pull.

17 The diagram shows a simple illustration of the human circulatory system. The parts labelled 1, 2, 3, 4, 5 and 6 represent the blood vessels.

Which one of the following statements is correct?

A 1 contains more urea than 2.
B 2 contains more glucose than 5.
C 4 contains more oxygen than 5.
D 6 contains more carbon dioxide than 3.

18 The graph shows the breathing rate and energy released during a period of exercise.

At which point in time is an oxygen debt incurred?

[Turn over

19 The graph shows changes in the concentrations of various chemical substances in the thigh muscles of a person running vigorously on a threadmill.

Which of the following is true?

A Line J represents glycogen
B Line K represents carbon dioxide
C Line L represents oxygen
D Line M represents lactic acid

20 The graph shows how the pressure and volume inside the lungs change during one complete breath. At which point are the muscles of the diaphragm starting to contract?

21 The graph shows the changes in a person's blood glucose concentration over a 24-hour period.

Which time shows a period of fasting that might trigger the secretion of glucagon into the blood stream?

A W only
B W and Y
C X and Y
D Z only

22 John injures his hand in a car accident. Shortly after that, he can feel the objects he touches with his hand but is unable to move his hand away from them. What could have caused this?

A Receptors in his hand are damaged.
B Relay neurones in his hand no longer function.
C The nerve connection is cut only between the receptors in his hand and his central nervous system.
D The nerve connection is cut only between his central nervous system and the effectors in his arm.

23 Our eyes feel strained when we read small prints for a long period of time. Which of the following is the correct explanation for the incident described above?

A The suspensory ligaments become stretched.
B The retina will no longer record clear images.
C The optic nerve will no longer transmit impulses to the brain.
D The ciliary muscles become fatigued.

[Turn over

24 A student draws a dot and a cross as shown.

With his right eye closed, the student looks hard at the cross with his left eye. He brings the drawing towards him until the dot disappears.

On which point inside his eye does the image of the dot fall, when it disappears?

25 The diagram shows part of the womb of a pregnant woman.

Which of the following statements is correct?

A Progesterone is needed to maintain structure M.
B Structure O only protects the foetus from fluctuations in temperature.
C Structure P contains the gaseous water products of the foetus.
D The artery in N transports glucose and amino acids to the foetus.

26 The diagram shows a nephron and associated blood vessels.

Which graph shows the concentration of glucose present in each part of the kidney tubule?

[Turn over

27 The diagram represents three properties of gametes. Which area describes all male gametes of both plants and animals?

28 The following data regarding two different plant species was obtained.

plant	average diameter of pollen grain/mm	average mass of pollen grain/mm	texture of pollen grain
X	15	200	smooth,dry
Y	45	1800	spiky, sticky

The following conclusions were made from the data above.

1 Plant X is more likely to be cross-pollinated.
2 Plant Y is more likely to be self-pollinated.
3 Plant X is more likely to have stigmas which have a larger surface area than those of plant Y.
4 Plant Y is more likely to produce a larger number of pollen per unit time to achieve the same efficiency of pollination as plant X.

Which conclusion(s) is/are valid?

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

29 A plant is heterozygous for a pair of alleles that are codominant. This plant is self-pollinated and the resulting seeds are germinated and allowed to grow. Which ratios are expected in the offspring?

	Ratio of phenotypes	Ratio of genotypes
A	1:2:1	1:2:1
B	1:2:1	3:1
C	3:1	1:2:1
D	3:1	3:1

30 The family tree shows the inheritance of a genetic disease. This disease is caused by a recessive allele, b.

Which females have the Bb genotype?

A 1, 6 and 7 only.

B 1, 7 and 12 only.

C 7, 9 and 15 only.

D 9, 12 and 15 only.

31 A gene containing 600 bases is transcribed and translated to produce a functional protein in the cell. Which of the following correctly represents the numbers of the respective structures?

	number of nucleotides	number of mRNA formed	number of codons on the mRNA	number of polypeptide formed
A	300	1	200	1
B	300	600	600	600
C	600	600	600	600
D	600	1	200	1

[Turn over

32 A diploid cell contains two pairs of homologous chromosomes. Each pair is heterozygous for a pair of alleles Aa and Bb respectively. After meiosis, how many different combinations of these alleles could be produced in the haploid daughter cells?

A 2
B 4
C 8
D 16

33 The figure shows an event that occurs during synapsis of two homologous chromosomes.

Which of the statements is not true to describe the figure above?

A Crossing over occurs between 2 chromatids at the centromere.
B Crossing over occurs between homologous chromosomes from a male and another from a female.
C Crossing over occurs forming 5 chiasmata.
D Crossing over produces new combinations of alleles along its chromosomes.

34 The wall of a pollen grain is made of chemically stable materials. Because of this, pollen grains have the ability to remain well preserved for thousands of years in soil and sediment. What is the key advantage to the plant for having such pollen grain walls?

A It allows pollen to serve as a valuable fossils record for the study of ancient plants.
B It prevents the pollen tube from growing out before the pollen grain reaches the stigma of a compatible species.
C It protects the vital genetic material in the pollen grain.
D It provides weight to the pollen grain, allowing it to cling easily to the surfaces of the insect pollinators

35 The diagram shows how genetically identical frog can be developed from unfertilized frog eggs. The diploid number (2n) frogs is 26.

Which combination of numbers correctly identifies the number of chromosomes in each of the type of cells in the diagram?

	V	W	X
A	13	13	26
B	13	26	13
C	13	26	26
D	26	26	13

36 Changes in the climate may lead to the melting of sea ice and the thawing of ice on the land in the Antarctic that has been frozen for a very long time. What could lead to evolution in this situation?

A Animals adapt their features to suit the new environment.
B Previously advantageous features may become disadvantageous.
C Seed dormant for thousands of years could germinate.
D There would be less competition for space to live.

[Turn over

37 The statements refer to natural selection.

1 Competition between organisms alters their genes.
2 More organisms are produced than reach maturity.
3 Organisms inherit characteristics from their parents.
4 Organisms vary in their adaptations.
5 Only one species can occupy an ecological niche.
6 Well-adapted organisms survive and reproduce.

Which four statements summarise the theory of evolution by natural selection?

A 1, 2, 3 and 5
B 1, 2, 4 and 5
C 2, 3, 4 and 6
D 2, 3, 5 and 6

38 The following list gives some features of the processes of artificial selection and genetic engineering.

I The organism's genotype is altered.
II The new variety can make a substance previously only made by a different species.
III The process involves working with many generations of the organism over a long period of time.
IV The gene for the useful characteristic is transferred from one species to another.

Which of the above features refer to genetic engineering and artificial selection?

	genetic engineering	artificial selection
A	I, II, IV	III
B	I, III, IV	I and II
C	II and IV	II and III
D	I, II, III and IV	I, II and III

39 A tree has insect larvae burrowing in the leaves. The emerging insects are eaten by birds and have parasitic fleas living amongst their feathers.

1 2 3 4

Which represents the correct pyramid of biomass, energy and numbers for this food chain?

	pyramid of biomass	pyramid of energy	pyramid of numbers
A	2	1	4
B	1	2	3
C	2	2	3
D	1	2	4

40 The graph shows the annual changes in a lake of the following factors:

- number of producers
- number of primary consumers
- quantity of nutrients
- intensity of light

Which of the following graph correctly matches the factors listed?

A W represents the quantity of nutrients
B X represents the intensity of light
C Y represents the number of producers
D Z represents the number of primary consumers

End of Paper

JUNYUAN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018
SECONDARY FOUR EXPRESS

CANDIDATE NAME

CLASS | | | | INDEX NUMBER | | |

BIOLOGY 6093/02

Paper 2 **16 August 2018**

1 hour 45 mins

Candidates answer on the Question Paper.

No Additional materials are required

READ THESE INSTRUCTIONS FIRST

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

Section A
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer **all** questions.
Question **8** is in the form of **Either/Or** question. Only one part should be answered.
Write your answers in the spaces provided on the Question Paper.

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The use of an approved scientific calculator is expected, where appropriate.
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 **80**.

This document consists of **17** printed pages.

[Turn over

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Section A

Answer all questions

1 Figs 1.1 and 1.2 show photomicrographs of transverse sections through a leaf and the lining of the trachea of a mammal respectively.

Fig 1.1

Fig 1.2

(a) Identify A and state the main function. [1]

……..

……..

(b) Identify B and explain how the carbon dioxide concentration at B would vary over a 24-hour period. [3]

……..

……..

……..

……..

(c) Explain why Fig 1.1 is thin, flat and well-supplied with veins. [2]

……..

……..

……..

……..

(d) Label on Fig 1.1, the two functional structures that constitutes the vein. [1]

(e) **(i)** State the similarity in the way C and D are arranged. [1]

……

……

(ii) With reference to their functions, explain why it is advantageous for the cells to be arranged this way. [2]

……

……

……

……

[10 marks]

2 Fig 2.1 represents a model of the biological control system involved in body temperature regulation.

Fig 2.1

(a) If stimulus, S was an external environmental temperature 20°C lower than the human body, name the location in the body where you would find receptor, T. [1]

……

(b) Name and describe how two effectors would bring about a physiological response that would alter the stimulus, S. [2]

……

……

……

……

……

[Turn over

(c) If the Fig 2.1 now represents the nervous system where the effector, V is a gastric gland in the stomach. Describe the reflex action resulting in the release of gastric juice in the stomach after food is being tasted in the mouth. [4]

……..

……..

……..

……..

……..

[7 marks]

3 Fig 3.1 shows two graphs on transpiration rate of leaves and water potential of leaf cells of cotton plants during three hours of daylight respectively.

Fig 3.1

(a) Describe the relationship between the transpiration rate and water potential of leaf cells of cotton leaves from 0 to 0.5 hour. [2]

……..…

……..…

……..

(b) Describe what happens to the leaf cells when there is an increase rate of transpiration. [1]

……..…

……..…

[3 marks]

4 An ecologist is studying the warm freshwater ecosystem in Cambodia. The table 4.1 shows a part of her report on the ecosystem.

trophic level	examples of organisms	dry mass (g/m^2)	energy (kJ/m^2)
tertiary consumers	fish, crocodiles	2	35
secondary consumers	birds, frogs, insects, turtles	11	220
primary consumers	snails, tadpoles, small fish	93	630
producers	algae, aquatic plants	198	14600

Table 4.1

(a) The dry masses and energy contents of the organisms at each trophic level has been measured and recorded.

(i) State one advantage of analysing dry masses and energy contents over the counting of organisms numbers at each trophic level. [1]

.....

.....

(ii) Suggest a difficulty faced by the ecologies in order for her to obtain the data for the table 4.1. [1]

.....

.....

(b) For this ecosystem in Cambodia, draw on the graph below a pyramid of biomass. An accurate diagram of the scale $1cm^2 = 20\ g/m^2$ should be drawn. [2]

[Turn over

(c) One of the primary consumers, *Rhabdostyla* became a subject of interest in this ecological study. It thrives very well in the freshwater habitats with very low concentration of solutes. This is due to the presence of a contractile vacuole that helps it to expel excess water (as show in Fig 4.1).

Fig 4.1

(i) Explain, using the term water potential, why *Rhabdostyla* needs to expel excess water? [2]

.....

.....

.....

.....

.....

In an investigation, individual *Rhabdostyla* were placed into different concentrations of solute in water. The rate of water excreted by the contractile vacuole of each organism were determined as tabulated in the results shown in table 4.2.

% concentration of solute in water	0	4	8	12	16
rate of water excreted /$\mu m^3 s^{-1}$	17.0	10.5	3.0	0.5	0.1

Table 4.2

(ii) Describe and explain the relationship shown in the table. [3]

.....

.....

.....

.....

.....

(d) In another study, the ecologist focuses on turtle population. Data of energies associated with one turtle over a period of a year is recorded in table 4.3.

Energy associated with one turtle	Energy (Kj/year)
• energy available to the turtle	20935
• energy in the undigested waste	1065
• energy found in the excreted waste	53
• energy released to the environment as heat	20400
• energy used for growth in the turtle	482

Table 4.3

(i) Describe how the energy is 'made available' and subsequently 'used for growth' in the turtle'? [2]

……..…...

……..……...

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……..……...

(ii) Calculate the total amount of energy available for decomposers from this turtle in one year. Show your working in the given space below. [1]

(e) Upon analysing the carcass of the turtle when it died, the ecologist found an unusually high amount of nanoplastics in its body. Explain why it is possible for a high amounts of nanoplastics found in the turtle's body? Use examples of organisms in table 4.1 to illustrate your answer. [3]

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[15 marks]

[Turn over

5 Fig 5.1 shows a tray of tobacco seedlings. The seedlings are all grown from the seeds of a plant. Some of the seedlings appear very pale in the photograph because their leaves contain no chlorophyll. These seedlings are called 'albino seedling'. The rest of the seedlings with dark leaves have chlorophyll in them and are normal.

Fig 5.1

(a) Count the numbers of normal seedlings and albino seedlings. Record your results in a suitable table below. [2]

(b) Determine the approximately ratio of normal to albino seedlings and draw the variation graph to show the type of variation this represents. [2]

(c) The seedlings in Fig 5.1 is the F1 generation from two parent tobacco plants. A single gene, C, controls chlorophyll production, draw a genetic diagram to predict the genotypes and phenotypes of both parent plants. [3]

(d) Explain why these albino seedlings is less advantaged when compared to the normal seedlings? [3]

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[Turn over

(e) Albinism occurs in humans too and is known to be caused by an autosomal recessive genetic condition that results in the body's inability to make the pigment, melanin which gives in the skin, hair and eyes its colour. The allele A represents the normal condition while the allele a represents the albino condition. Fig. 5.2 shows the homologous pair of chromosomes during a stage in meiosis in a carrier.

Fig 5.2

(i) State the identity of alleles I and II. [2]

I……

II……..

(ii) Name the stage of meiosis shown in Fig. 5.2. [1]

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(iii) In the outline of the four gametes shown below, draw the chromosomes containing the albino gene found in the nuclei of the four gametes formed. Include the positions and identity of the alleles for the albino gene on the chromosomes. [2]

[15 marks]

Section B

Answer all three questions.
Question 8 is in the form of Either / Or question.
Only one part should be answered

6 Two experiments were carried out to find the effect of removal of the liver and kidneys from 2 different rabbits of the same species.
Experiment A: The kidneys were removed at time 0 and blood urea concentration was recorded. Eight hours later, the liver was removed and blood urea concentration was recorded.
Experiment B: The liver was removed at time 0 and the kidneys were removed eight hours later. In both, blood urea concentration was recorded after the organs were removed respectively
The blood urea concentration of the rabbits was measured from 0 to 16 hours. The results were tabulated in table 6.1.

time (hours)	blood urea concentration (mg per 100cm^3 of blood)	
	experiment A	experiment B
0	10	10
4	17	5
8	22	3
12	22	3
16	21	3

Table 6.1

(a) Plot a graph to compare the trends of results between experiments A and B. [3]

[Turn over

(b) Describe and explain the change in blood urea concentration of the rabbits used in experiment B. [4]

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(c) Which rabbit will die first? Give a reason to support your answer. [2]

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(d) A human patient suffers from damaged kidneys. What advice would you give to the patient? Explain. [1]

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[10 marks]

7 Fig 7.1 shows the concentration of two reproductive hormones, X and Y in the blood of an adult human female.

Fig 7.1

(a) With reference to Fig 7.1, describe how the concentration of hormone X and Y affects the thickness of the endometrium from

(i) day 1 to 7 [2]

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(ii) day 11 to 19 [2]

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[Turn over

(b) On the day 15, the ovum was fertilized and the resultant zygote developed into an embryo. By day 20, the embryo was implanted into the endometrium. Complete and explain the graph in Fig 7.1 for hormone Y from day 19 to 41. [3]

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(c) In the first 8 weeks of pregnancy, the ovary is responsible for regulating of hormone Y. After the 8th week, the placenta takes over this role. Describe three other functions of the placenta. [3]

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[10 marks]

EITHER

8E Bacteria plays an important role in biotechnology eg. in biomedical (mass production of insulin) and in sewage treatment plants, However it is also a cause for concern such as massive eutrophication in many parts of the world. Discuss. [10]

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[10 marks]

[Turn over

OR

8O **(a)** Compare the importance of chloroplasts and mitochondria and how living things are dependent on them. [5]

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(b) Both photosynthesis and respiration are enzyme-based reactions. Discuss the properties of enzyme. [5]

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End of Paper

[Turn over

Pure Biology Preliminary Examination Marking Scheme

Section A

Question	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40
Answers	C,A,D, C,A	D,B,D, C,D	B,A,C D,C	D,C,D, B,A	A,D,D C,A,	B,A,C, A,C	D,B,A, C,A	B,C,A, C,B

Section B

No.	Answers		Remarks
1a	A: Cuticle Protects the inner parts of leaf	1	Upper epidermis
1b	B: Guard cell ○ In day / light, CO_2 conc is low in intercellular air space ○ CO_2 diffuse into mesophyll cells (raw material) from atmosphere for photosynthesis ○ In night / dark, CO_2 conc is high so CO_2 diffuse out of cells to intercellular air space	1 1 1	
1c	Thin and flat ○ Light can easily reach all mesophyll / photosynthetic cells ○ Short diffusion distances for gases (e.g. O_2 and CO_2) Well supplied with veins ○ Water and minerals readily conducted to all cells Translocation of simple sugars away from leaves	1 1	

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1d		1	ok
1ei	The cells are closely packed	1	ok
1eii	For palisade cells, The arrangement maximised the area that is able to trap sunlight For epithelial cells, The arrangement maximised the area that is able to trap foreign particles that enter the trachea	1 1	
2a	Thermoreceptors in the skin	1	
2b	Skin arterioles – Vaso constrict – less blood flow to the skin Sweat glands – become less active – less sweat Hair erector muscle – Contract – hair stand Skeletal muscles – Shivering	2	
2c	S- food detected by T – taste receptor in tongue Impulses generated and transmitted to U – brain via sensory neurone In the brain, impulse sent to relay neurone and then to motor neurone To V – gastric gland, secretes gastric juice.	1 1 1 1	
3a	From 0 to 0.5 hours, the transpiration rate decreases from 17.5mg per litre per minute to 2.8mg per litre per minute, the water potential will increase -1.2MPa to -0.75MPa.	1 1	1 mark citing data.
3b	Increase rate of transpiration will reduce the water potential in the leaf cells resulting in cells being plasmolysed / flaccid	1	
4ai	It is more accurate as it shows that biomass / energy is lost from one trophic level to the next	1	

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4aii	It is tedious to weigh / calculate energy contents of all the organisms at each trophic level	1	
4b	Tertiary consumers 0.1 cm^2 Secondary consumers 0.55 cm^2 Tertiary consumers 4.65 cm^2 Tertiary consumers 9.9 cm^2	2	1 mark for correct drawing of pyramid/ drawn to scale 1 mark for correct values written
4ci	Water potential inside the cell is lower than water potential in fresh water; water molecules enter the cell by osmosis leading to expansion and bursting of cell	1 1	
4cii	When % concentration of solute in water increases from 0-16%, rate of water excreted decreases from 17-0.1 $\mu m^3 s^{-1}$. This is because as % concentration of solute in water increases, water potential deceases, leading to water potential become almost the same as the water potential in the cell, rate of excretion becomes minimal to maintains the integrity of the cell	1 1 1	Minus 1 mark without the data
4di	Energy comes from the organisms / food it eats [1] Cells divide during growth and this requires energy obtain during cellular respiration [1]	2	
4dii	1065 + 53 =1118 kJ/year	1	To include calculation
4e	Nanoplastics are non-biodegrable and are absorbed by the algae/aquatic plants When these algae are eaten by the snails, is not excreted from bodies of snails, rather it is stored in their adipose / fat tissues. As the snails are being consumed by frogs and then to fish, it is passed up the food chains, increasing in the concentration of nanaplastics stored in bodies of organisms. This is called bioaccumulation	1 1 1	
5a			1 mark for proper /neat/labelled table drawn 1 mark for right count

	normal seedlings	albino seedlings
Number of seedlings	57(51-63)	19 (17-21)

5b	3:1 Discontinuous variation 		1 mark for correct ratio 1 mark for graph

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5c

Parental phenotype	normal		x	normal	
Parental genotype	Cc			Cc	
Gametes	C	c		C	c
F1 genotype	CC	Cc		Cc	cc
F1 phenotype	normal	normal		normal	albino

Parental phenotype: Both normal
Parental genotype: Both Cc

5d Albino seedlings are unable to photosynthesise and therefore will not be able to grow and develop into adulthood to reproduce and pass down their genes to the next generation — 1, 1, 1

5ei I – A; — 1
II – A; — 1

5eii Prophase I; — 1

5eiii — 2

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	SECTION B		
6a		1 1 1	Correct X and Y axis label Title, appropriate scale and size Points plotted correctly, allow for 1 error

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6b	This is because when the liver is removed first, the organ responsible for the production of urea is absent Since the kidney is still present at first, being the excretory organ responsible for the removal of urea/formation of urine the urea concentration present in the blood is continuously removed. blood urea concentration is decreases steeply. With the kidney's removal 8 hours later, the blood urea concentration remains low at 3 mg per 100cm^3 of blood as there is no more excretion and production of urea. .	1 1 1 1	Minus 1 mark with no data
6c	The rabbit in experiment A will die first because the amount of urea in the blood will be at toxic levels to kill the rabbit and without the kidneys to remove it, the urea concentration will remain at high levels	1 1	
6d	Reduce intake of proteins As proteins digested to excess amino acids Formation of more urea	1 1	
7ai	Low level of hormone Y causes the breakdown of endometrium / uterine lining Menstruation occurs	1 1	
7aii	Increased concentration of hormone X causes the repair of endometrium Endometrium thickens with blood vessels	1 1	
7b	Graph drawn should show gradual increase of hormone Y all the until Day 41 and level above hormone X Progesterone continues to be secreted by ovary/ progesterone level increases Caused thickening of uterine lining / endometrium to support growth of embryo [reject foetus]	1 1 1	
7c	Allows oxygen and dissolved food substances (name 2) to diffuse fom mother's blood to foetal blood Allows metabolic waste (name 2) to diffuse from foetus blood to mother's blood Allows protective antibodies to diffuse from mother's blood into foetal blood.	1 1 1	
EITHER			
8E	• Bacteria plasmids were used to insert the human insulin gene • Becomes a recombinant plasmid • Enters into the bacteria upon mixing • Bacteria will use the new gene to mass produce insulin. • Aerobic bacteria decompose biodegradable organic matter in the waste water in the aeration tanks • Anaerobic microbes act on the sludge to break down the organic matter in the digester.	1 1 1 1 1	

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	• Bacteria secrete enzymes to digest the solid matter into simpler, soluble one, thus reducing the mass of sewage. • Leeching of nitrogenous waster cause profuse growth and multiplication of the algae and weeds • Blocking sunlight and the lack of sunlight causes submerged algae and plants die • Bacterial numbers increase sharply, due to the decomposition of the dead organisms • Oxygen content of water decreases leading to the death of other marine life, such as fishes	1 1 1 1 1
OR		
8O(a)		

Respiration	Photosynthesis	
Energy is released	Energy is stored as carbohydrates	1
Oxygen is used, carbon dioxide and water is given off	Oxygen is given off, carbon dioxide and water is used	1
A catabolic process, breakdown of glucose molecule	A anabolic process, buildup of glucose molecule	1
Occurs all times, independent of light and chlorophyll	dependent of light and chlorophyll	1
Results in the loss of biomass	Results in the gain in biomass	1

8O(b)	Enzymes are proteins and are biological catalysts by lowering the activation energy. They are specific in their actions. They can only act on specific substrate because of the presence the active sites. They form temporary enzyme-substrate complex to form products. Enzymes are reusable because they remain chemically unchanged and therefore minute amounts is needed for a reaction to take place. Enzymes are sensitive to changes to temperature and Ph. At low temperatures enzymes are inactive, rate of enzymes are slow As temperature increases, enzymes increases kinetic energy, increasing frequency of molecule collisions increasing chances of enzyme –substrate formation At optimum temperature, rate of enzymes activity is fastest.	1 1 1 1 1

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	After optimum temperature, enzymes denature and no longer react with substrate. Rate of enzyme activity decreases.		

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2018 Preliminary Examination

Secondary 4 Express

NAME			
CLASS		INDEX NUMBER	

BIOLOGY **6093/1**

Additional Materials: Multiple Choice Answer Sheet **12 September 2018**

Setter: Mrs Dorothy Goh **1 hour**

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Answer **all** questions.
Write in soft pencil.
Do not use staples, paper clips, highlighters and glue or correction fluid.
Write your class, name and index number on the Multiple Choice Answer Sheet in the spaces provided.

There are **forty** 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** pencil on the separate Multiple Choice Answer Sheet.

This document consists of **22** printed pages including the cover page.

[Turn over

1 The diagram shows cells in the epidermis of a leaf.

To complete the diagram, which structural features should be added to the cells P and Q?

	P		Q	
	chloroplast	nucleus	chloroplast	nucleus
A	✓	✓	✗	✗
B	✓	✗	✓	✓
C	✗	✓	✓	✗
D	✗	✗	✗	✓

2 Which of the following is not a property of the plasma membrane?

A composed of cellulose and protein

B fully impermeable to starch

C fully permeable to water

D fuses with ribosomes to release protein out of cell

3 Absorption of mineral ions in plants requires energy from respiration.
Which observation best supports this idea?

A Carbohydrates is stored in the roots.

B Living roots give off carbon dioxide.

C The root hairs have a large surface area.

D Uptake of nitrates is reduced at lower oxygen concentrations.

4 Four potato strips were each placed in a petri dish of either 5% sucrose solution or distilled water for 20 minutes.
In which of the following petri dishes will result in the potato cells being plasmolysed?

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5 Ethanol emulsion test and biuret test were carried out separately on peanuts. Which of the following correctly describes the results?

	ethanol emulsion test		biuret test	
	observation	conclusion	observation	conclusion
A	remains clear	fats is absent	blue solution remains	protein is absent
B	remains clear	fats is present	violet mixture observed	protein is present
C	white emulsion formed	fats is absent	blue solution remains	protein is absent
D	white emulsion formed	fats is present	violet mixture observed	protein is present

6 Which of the following statements describe the fate of excess glucose in the liver?

I It is broken down to release energy.

II It is broken down to fats.

III It is deaminated to produce urea.

IV It is stored as glycogen.

A I and II

B I and IV

C II and III

D II and IV

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7 The cell wall of a plant cell is removed using an enzyme. What would happen if this cell is then placed in distilled water?

A It would take more time for the cell to become turgid.

B Proteins in the cytoplasm would leave through the cell surface membrane.

C The cell would become smaller as water passes out.

D The cell would burst as water moves into it.

8 Two hours after eating a meal of fried potatoes and vegetables, one would least expect

A a decrease in concentration of fats in lymph vessels.

B a high concentration of glucose in the veins leaving the liver.

C an increase in urea in blood leading to the liver.

D less glucose in blood entering the liver than in that leaving the liver.

9 If the pancreatic duct of a mammal becomes blocked, which symptom would the mammal show?

A decreased blood insulin level

B decreased protein digestion

C increased bile in the blood

D increased blood glucose level

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10 The diagram shows the transverse section of a leaf.

Which structures are capable of carrying out photosynthesis?

A I, II and IV

B I, II and V

C II, III and IV

D II, III and V

11 A plant stem was dissected into several different tissues. Each tissue was tested for the presence of starch, protein and reducing sugar. The results are shown in the table.

Which tissue is the xylem?

	starch	protein	reducing sugar
A	absent	absent	absent
B	absent	present	present
C	present	absent	absent
D	present	present	present

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12 The effect of light intensity on the rate of photosynthesis in two plant species was investigated in a laboratory. Species 1 grows best in sunny areas and species 2 grows best in shady areas.

Which graph correctly shows how the rate of photosynthesis of these two species will vary with light intensity?

A

B

C

D

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13 The diagrams show the movement of blood in the right side of the heart in a cardiac cycle.

Which of the following correctly shows what is happening at stages 1, 2 and 3?

	1	2	3
A	atrial systole	ventricular systole	atrial and ventricular diastole
B	atrial systole	atrial and ventricular diastole	ventricular systole
C	atrial and ventricular diastole	ventricular systole	atrial systole
D	ventricular systole	atrial systole	atrial and ventricular diastole

14 A pulse can be felt when the thumb presses the wrist of the left hand.
This pulse is produced because

A of the alternate stretching and recoiling action of the artery.

B the arteries carry oxygenated blood.

C the veins have larger lumen than the arteries.

D the wall of the arteries is thicker than that of the veins.

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15 The active ingredient in brand A pesticide inhibits the synthesis of the plasma protein prothrombin in the liver. This pesticide most likely kills pests by

A causing the accumulation of amino acids in the blood.

B preventing the clotting process when bleeding.

C preventing the maintenance of glucose level in the blood.

D stimulating the breakdown of red blood cells.

16 Tar and carbon monoxide are present in tobacco smoke. What are their effects on health?

	tar	carbon monoxide
A	causes high blood pressure	binds to haemoglobin irreversibly
B	causes high blood pressure	is addictive
C	causes lung cancer	binds to haemoglobin irreversibly
D	causes lung cancer	is addictive

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For questions **17** and **18**, refer to the diagram.

17 The primary aim of this experiment is to demonstrate that

A carbon dioxide is present in the atmosphere.

B oxygen is absorbed to support the metabolic activities of the rat.

C the rat releases carbon dioxide.

D the rat releases energy in the form of heat.

18 This experiment is improperly set up. Correction should be made by

A covering bottle R with a piece of black cloth throughout the experiment.

B immersing sections 1, 3 and 5 into the solutions.

C immersing sections 2, 4 and 6 into the solutions.

D replacing the lime water with hydrogen carbonate indicator solution.

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19 Which of the following does not help to promote survival of an organism living in a dry environment?

A larger glomerulus

B longer large intestine

C longer loop of Henle

D more sebaceous glands in skin

20 The diagram below shows a nephron. Reabsorption of glucose and amino acids takes place in the section labeled P.

How is section P adapted to carry out its function?

A A high hydrostatic pressure is created at section P as the renal tubule becomes narrower.

B The cells lining the walls of the tubule at P have numerous mitochondria to release energy for active transport.

C The cells lining the walls of the tubule at P have numerous pores to help in passive transport only.

D The walls of the tubule at P is a few layers thick to ensure effective reabsorption.

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21 The table shows a medical report of a patient after some diagnostic tests. He had been given cakes for breakfast eight hours before the tests.

diagnostic test	glycogen content in liver	protein in urine	sugar in urine	urea in urine
result	normal amount	present	present	present

Which diagnosis about the patient's body is correct?

	pancreas	Bowman's capsule in kidney	convoluted tubules in kidney
A	-	+	+
B	-	+	-
C	+	-	-
D	+	-	+

Key

+ = healthy

- = malfunctioning

22 How does the sweat glands and hair respond to an increasing body temperature?

	sweat glands	hair
A	Decreased production of sweat leads to greater heat loss by evaporation.	Hair lays down and allows heat to be lost easily via the skin surface.
B	Decreased production of sweat prevents greater heat gain from the environment.	Hair stands and creates a layer of air that prevents heat gain from environment.
C	Increased production of sweat leads to greater heat loss by evaporation.	Hair lays down and allows heat to be lost easily via the skin surface.
D	Increased production of sweat prevents greater heat gain from the environment.	Hair stands and creates a layer of air that prevents heat gain from environment.

23 Which of the following statements is not an example of homeostasis?

A Increase in the rate of expiration to remove excess carbon dioxide from the body.

B Sweating during strenuous physical activity.

C The conversion of excess blood glucose into glycogen for storage.

D The removal of undigested waste materials from the body.

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The diagram shows the structure of the mammalian skin. Refer to the diagram for Questions **24** and **25**.

24 Identify the structures labelled I, II, III and IV.

	I	II	III	IV
A	blood capillary	nerve ending	sweat gland	hair erector muscle
B	hair erector muscle	blood capillary	nerve ending	sweat gland
C	sweat gland	hair erector muscle	blood capillary	nerve ending
D	sweat gland	nerve ending	hair erector muscle	blood capillary

25 Which of the following would be the result of an increase in the diameter of V?

A decreased sensation of pain

B heat loss is increased at the skin surface

C heat loss is reduced at the skin surface

D increased sensation of pain

26 Which structure causes the greatest refraction of light that enters the eye?

A conjunctiva

B cornea

C lens

D iris

27 Adrenaline not only functions as a hormone in our body but can also be administered as a drug in life-saving situations. Under which condition(s) would the administration of adrenaline be useful?

1 low blood glucose concentration
2 low heart rate
3 low water potential of blood

A 3 only

B 1 and 2 only

C 2 and 3 only

D 1, 2 and 3

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28 The trigeminal nerve in humans connects the brain with both the teeth and the skin of the face. When the dentist administers a local anesthetic by injection, the patient can no longer feel the pain and cannot smile properly.

What does this conclude about the trigeminal nerve?

A It carries impulses from the brain to the teeth and back to the skin.

B It contains both motor and sensory neurones.

C It contains mainly motor neurones.

D It contains mainly sensory neurones.

29 Which statement about pollen grains is correct?

A An embryo is formed when a pollen grain fuses with the female gamete.

B Pollen grains are the male gametes of a plant.

C Pollen grains can only germinate if they land on the stigma of another flower.

D The sugary fluid of a stigma stimulates pollen grains to germinate.

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30 The diagrams show carpels from four different flowers. Which carpel is associated with wind pollination?

31 The diagram shows a female reproductive system.

Which correctly shows the regions where the following events occur?

	implantation	fertilisation	meiosis
A	P	Q	R
B	R	P	Q
C	R	Q	P
D	T	R	P

32 The diagram shows the changes which take place during a woman's menstrual cycle.

What is occurring at the time of ovulation?

A A fall in the level of oestrogen and a rise in progesterone.

B A fall in the level of progesterone and a rise in oestrogen.

C A fall in the levels of oestrogen and progesterone.

D A rise is the levels of oestrogen and progesterone.

33 *Drosophila melanogaster* is a type of fruit fly with a diploid number of chromosomes. Cell division occurs in the *Drosophila melanogaster* in a similar way to humans. Each somatic cell has 8 chromosomes. Which statement about this type of fruit fly is correct?

A After fertilisation, the zygote has 8 chromosomes.

B After mitosis, the daughter cells produced have 4 chromosomes each.

C It can produce gametes with 4 different genetic combinations.

D It can produce gametes with 8 chromosomes.

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34 The diagram shows a cell at anaphase I of meiosis.

Which diagram shows a normal gamete that can be produced from this cell?

35 The table shows the percentage of nucleotides found in an octopus and a starfish.

source of DNA	adenine (%)	cytosine (%)	guanine (%)	thymine (%)
octopus	28	22	22	28
starfish	28	22	22	28

Which of the following best explains why these two animals differ greatly in their physical characteristics?

A Amino acids used to produce proteins are different in both animals.

B Deoxyribose is used in the DNA of the octopus but ribose is used in the DNA of starfish.

C The sequences of DNA are different in both animals and thus code for different proteins in their bodies.

D The two animals follow different base pairing rules in their DNA strands.

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36 A short length of DNA has 80 thymine and 60 cytosine bases. What is the total number of nucleotides in this DNA segment?

A 120

B 140

C 280

D 560

37 Samuel and Sandy made four statements about themselves.

	Samuel	Sandy
1	I am a man.	I am a woman.
2	I am 175cm tall.	I am 160cm tall.
3	I have brown eyes.	I have blue eyes.
4	I am poor at Biology.	I am very good at Biology.

Which statements describe characteristics that show discontinuous variation?

A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

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38 A species of snails has an inherited condition that affects its shell. The table shows the phenotypes and genotypes of this species:

genotype	phenotype
S^NS^N	Snails with hard shells.
S^AS^N	Snails with brittle shells.
S^AS^A	No embryo formed.

Two heterozygous snails were crossed. Which proportion of their offspring will have hard shells?

A 0%

B 25%

C 33%

D 75%

39 The diagram shows a river flowing into the sea. The river is polluted by untreated sewage. At which point (**A**, **B**, **C** or **D**) will the oxygen level be the lowest?

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40 The following diagram shows an ecological pyramid of energy.

Which statement is always true?

A Energy flows upwards from organisms in level 4 to organisms in level 1.

B Level 1 is occupied by a photosynthetic organism.

C The number of organisms in level 4 exceeds those in level 3.

D Toxins become more concentrated from organisms in level 1 down to organisms in level 4.

End of Paper

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KUO CHUAN PRESBYTERIAN SECONDARY SCHOOL

2018 Preliminary Examination

Secondary 4 Express

NAME			
CLASS		INDEX NUMBER	

BIOLOGY

6093/2

No Additional Materials are required.

23 August 2018

Setter: Mrs Dorothy Goh

1 hour 45 minutes

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.
Write your Class, index number and name on all the work you hand in.
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, glue or correction fluid.

Section A
Answer **all** questions.
Write your answers in the spaces provided in the Question Paper.

Section B
Answer **all** questions.
Write your answers in the spaces provided in the Question Paper.

Electronic calculators may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.
At the end of the examination fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Parent's Signature	
For Examiner's Use	
Section A	
Section B	
Total	100

This document consists of **19** printed pages including the cover page.

[Turn over

Section A
Answer **all** questions.
Write your answer in the spaces provided.

1 Fig. 1.1 shows a section of a person's head and throat.
Fig. 1.2 shows the same person swallowing a bolus of food.

Fig. 1.1

Fig. 1.2

(a) Identify structures **B** and **C** shown on Fig. 1.1.

B: .....

C: ..... [1]

(b) Name the process that will carry the bolus from the oesophagus to the stomach.

..... [1]

(c) Describe and explain what happens to structure **A** when the person swallows the bolus.

.....

.....

..... [2]

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(d) **(i)** Name a chemical process that may be taking place in the bolus.

…… [1]

(ii) Describe the process in **(d) (i)**.

……

……

……

…… [2]

[Total:7]

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2 Fig. 2.1 shows an experimental set-up measuring the rate of photosynthesis by counting the number of bubbles released per minute.

Fig. 2.1

(a) Suggest a purpose for the use of the bubbler.

……..

…… [1]

(b) **(i)** Identify the type of gas found in the bubbles produced.

…… [1]

(ii) State the chemical equation for photosynthesis.

…… [1]

(c) **(i)** Describe why the rate of bubbles evolved can be taken as a measure of the photosynthetic rate.

……

……

……

…… [2]

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(ii) Suggest two reasons why the rate of photosynthesis measured by this method may be less than expected.

……

……

……

…… [2]

(d) State the importance of photosynthesis to animals.

……..

……..

…….. [2]

[Total:9]

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3 Fig. 3.1 shows the changes in the blood pressure during the cardiac cycle.

Fig. 3.1

(a) State the duration of ventricular systole.

..... [1]

(b) Using points **A** to **H**, identify when

(i) the bicuspid valve is first closed: ..... [1]

(ii) the semi-lunar valve is first opened: ..... [1]

(iii) the ventricles have the least volume of blood: ..... [1]

[Total: 4]

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4 Fig. 4.1 shows the model of a nephron. It is used to demonstrate how the nephron functions.

Fig. 4.1

(a) Identify the labelled structures in the mammalian body that are represented by:

T: …….

U: …… [1]

(b) State and describe the purpose of tightening the tubing near part **U** with a screw clip.

……...

……...

……...

……... [2]

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(c) Suggest one type of cell or organic compound in the mammalian body that can be represented by the coarse sand in the mixture present in the reservoir.

…….. [1]

(d) Identify one biological process illustrated by the above model. State the significance of this process in the human body.

……...

……...

……...

…….. [2]

.

[Total:6]

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5 Fig. 5.1 shows the structure of a flower.

Fig. 5.1

(a) Identify structures **B** and **C** in Fig. 5.1 and suggest how cross pollination can be ensured in this species.

……

……

…….. [2]

(b) Using Fig. 5.1, outline the events occurring following pollination leading to fertilisation of **E**.

……

……

……

……

……

……

…….. [4]

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(c) Table 5.2 shows a recording of the lengths of 5000 fully grown standard petals of this species growing in a certain area.

Table 5.2

standard petal length, x /mm	frequency
5 ≤ x < 10	2
10 ≤ x < 15	0
15 ≤ x < 20	0
20 ≤ x < 25	0
25 ≤ x < 30	1755
30 ≤ x < 35	925
35 ≤ x < 40	50
40 ≤ x < 45	100
45 ≤ x < 50	975
50 ≤ x < 55	1193
55 ≤ x < 60	0

(i) State the type of variation shown by the standard petal length in this species.

…….. [1]

(ii) State one possible cause to account for the frequency recorded for a standard petal length of 5 ≤ x < 10.

……

……... [1]

[Total:8]

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6 Scientists have created *RR2*, a genetically engineered soybean plant resistant to a variety of chemical herbicides. This was done by transferring a gene from a bacterium to the soybean plant.

(a) Outline the necessary steps used to transfer the gene from a bacterium to a plant cell.

……

……

……

……

……

……

……

……

…… [4]

(b) *RR2* soybean plants and wild-type soybean plants have yellow flowers. In a genetic experiment, pollen grains from a wild-type soybean plant were brushed onto the stigmas of an *RR2* plant.

Results showed that there were 115 offspring plants with yellow flowers and 41 offspring plants with purple flowers.

Using F^Y and F^P to represent the alleles for yellow and purple flowers respectively,

(i) write out all the possible genotypes for flower colours in the offspring plants;

…….. [1]

(ii) write out the genotypes for flower colours of the parent plants.

RR2 soybean plant genotype ……..

wild-type soybean plant genotype …….. [2]

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(c) State two reasons why the observed phenotypic ratio of the offspring plants in **(b)** was not the same as the expected ratio.

…….

…….

…… [2]

[Total:9]

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7 Fig. 7.1 shows what happens to the energy as it passes through an herbivorous ox.

Fig. 7.1

(a) State two ways in which energy may be used within the ox.

1. …….

2. ……... [2]

(b) The bird on the ox's back is an oxpecker that feeds both on blood-sucking parasites (ticks) living on the ox, and on blood from the ox's wounds.

(i) In the space below, draw one possible food chain linking the organisms shown. Indicate on your drawing where energy enters the chain.

[2]

(ii) Explain why there must always be fewer oxpeckers than ticks in this food web.

…….

…….

…….

…… [3]

[Total:7]

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Section B (30 marks)
Answer **three** questions in the spaces provided.
Question 10 is in the form of Either/Or question.

8 Fig. 8.1 shows the concentration of dissolved oxygen and the number of bacterial cells along a river, 100m downstream from point **X**. The river is polluted due to human activities.

Fig. 8.1

Biological oxygen demand (BOD) is used by ecologists to measure the oxygen amount required by aerobic microorganisms to decompose organic matter in a sample of water.

Table 8.2 shows the data for relative BOD value for the same river length.

Table 8.2

distance from point X of river /m	relative BOD value /arbitrary unit
0	1.0
20	2.0
40	6.0
60	5.0
80	3.0
100	2.0

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(a) **(i)** Using the data provided in Table 8.2, sketch a graph of relative BOD in Fig. 8.1 over the distance of 100 m. Label this graph as relative BOD. [2]

(ii) Describe the relationship between the relative BOD value and the number of bacterial cells between 20m and 40m downstream of point **X**.

……..

…….. [1]

(b) **(i)** Using the information provided in Fig. 8.1, estimate the distance downstream from point **X** where the river was polluted.

……. [1]

(ii) On Fig. 8.1, complete the graph for the number of fish in the river till 100m downstream from point **X**. [1]

(c) A factory was built some distance away from the river.
Five weeks later, samples of water taken from the river downstream showed traces of a non-excretable toxin.
It was observed that the dead bodies of herons (large birds that feed on fish) were found. It was also observed that the population of fish remained in healthy numbers.
With reference to bioaccumulation and bioamplification, explain the observations.

…….

…….

…….

…….

…….

…… [5]

[Total:10]

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9 **(a)** Describe the significance of each of the following features of a dicotyledonous leaf in terms of the process named:

(i) the distribution of chloroplasts in the process of photosynthesis.

……..

……..

……..

……..

…….. [4]

(ii) stomata in the process of gas exchange.

……..

……..

…….. [2]

(b) Describe how **two named tissue** involved in transport are arranged in the roots and stems.

…….

…….

…….

…….

…….

…….

…….

…… [4]

[Total:10]

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10 Either

(a) A bacterial gene, which can boost photosynthesis, has been inserted into a new variety of soybean plant. These new plants are resistant to glyphosate, a herbicide that disrupts photosynthesis by killing plants including weeds.

Suggest and explain the advantages and disadvantages of growing this new variety of soybeans in the field.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

(b) Explain, using a named example, how mutations may lead to genetic diseases.

.....

.....

.....

.....

.....

..... [4]

[Total:10]

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10 Or

Fig. 10.1 shows how a frog was cloned.

Fig. 10.1

(a) State the type of cell division that occurs at **P** and **Q**.

.....

..... [2]

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(b) Is the transfer of nucleus from the cell of frog **B** to the egg of frog **A** a process of fertilisation? Explain your answer.

.....

.....

.....

.....

.....

..... [4]

(c) Describe the behaviour of the chromosomes during mitosis.

.....

.....

.....

.....

.....

..... [4]

[Total:10]

End of paper

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PRELIMINARY EXAM 2018
BIOLOGY
SECONDARY 4 EXPRESS

MARKING SCHEME

Paper 1 – Multiple Choice Questions (40 marks)

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

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

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

Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
C	A	A	D	C	C	A	C	B	A

Paper 2(Section A) – Structured Questions (50 marks)

1	(a)		B: trachea C: tongue Both correct 1 mark, 1/0 correct no marks	1
	(b)		peristalsis	1
	(c)		1. [describe] structure covers the trachea 2. [explain] prevents the entry of food / prevents food from going to the lungs / prevents choking	1 1
	(d)	(i)	Digestion / enzyme action / hydrolysis	1
		(ii)	1. [describe the enzyme action] amylase from saliva acting on the bolus 2. [describe final product] digesting starch into maltose	1 1
			Total	**7**

2	(a)		1. To ensure all the bubbles are the same size 2. Act as an electronic counter 3. To slow down bubbling to make it more visible Accept any other plausible answers	1
	(b)	(i)	Oxygen	1
		(ii)	$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light energy}} C_6H_{12}O_6 + 6O_2 + 6\,H_2O$ No marks if 1 no condition stated	1

			2 imbalance equation 3 word equation	
	(c)	(i)	1. The gas produced is a by-product of photosynthesis 2. The rate of gas production is related quantitatively to the formation of carbohydrates / proportional to the rate of photosynthesis	1 1
		(ii)	1. [suggest] Some oxygen is used during respiration while the plant is photosynthesizing 2. [suggest] some oxygen produced is dissolved in the water	1 1
	(d)		1. During photosynthesis, light energy is converted into chemical energy which is stored in carbohydrates 2. Animals cannot produce their own food and hence depends on the photosynthesis for the energy source.	1 1
			Total	**9**

3	(a)	0.3s (units included)		1
	(b)	(i)	G	1
		(ii)	A	1
		(iii)	B (to C)	1
			Total	**4**

4	(a)	T: glomerulus U: efferent arteriole		1
	(b)	1. [state] The purpose is to reduce the lumen size of the tubing near U / making tubing narrower 2. [describe] so as to set up a high pressure in T and enables the small molecules to pass through tubing at a fast rate		1 1
	(c)	Red blood cells / blood plasma proteins / fats / platelets		1
	(d)	1. [biological process] Ultrafiltration 2. [state the significance] Filters the excretory products e.g. urea and water which may be in excess amounts in the body while retaining cells and nutrients e.g. red blood cell and plasma proteins which are essential in maintaining the water potential of blood OR 3. [biological process] Excretion 4. [state the significance] the removal of metabolic waste from the body as accumulation of such waste may harm the body processes		1 1
			Total	**6**

5	(a)		1. B is stigma and C is anther 2. Anther will mature first, releasing pollen grains before stigma mature mature/ OWTTE OR 3. Anther is located below the stigma / OWTTE OR 4. Pollen grains of flowers on one plant can only be accepted by mature stigmas of flowers on another plant.	1 Max 1
	(b)		1. When the pollen grain lands on the mature B, pollen grain germinates to form pollen tube 2. As pollen tube grows, it secretes enzymes to digest through the stigma and style, growing towards the ovary, carrying two male gametes 3. When it reaches D at an opening known as micropyle, it absorbs the cell sap and burst to release the male gametes 4. One of the male gametes fuses with ovum, and E is formed.	1 1 1 1
	(c)	(i)	continuous variation	1
		(ii)	Mutation took place, resulting in very short petals.	1
			Total	**8**

6	(a)		1. [isolate the desirable gene] using a restrictive enzyme to cut the gene from bacterium to produce sticky ends 2. [prepare a plasmid] cut open the bacterial plasmid using the same restrictive enzymes to produce complementary sticky ends on the plasmid 3. [insert the desirable gene into the plasmid] join the two cut ends together with DNA ligase 4. [uptake of the vector by the plant] mix the cells with the plasmid and using heat shock to allow plasmid to enter the plant cell.	1 1 1 1
	(b)		(i) F^YF^Y, F^YF^P, F^PF^P (ii) RR2 soybean plant: F^YF^P Wild-type soybean plant genotype: F^YF^P	1 1 1
	(c)		1. Each <u>fertilisation is random and independent</u> 2. When the <u>sample size is too small</u>, the observed ratio may not be the same as the expected ratio	1 1
			Total	**9**

7	(a)	1. muscle contraction / movement 2. impulses	Max 2

		3. temperature maintenance 4. cell division / growth / repair 5. metabolic or anabolic reactions 6. active transport any two rej: excretion / digestion / reproduction / respiration	
	(b) (i)	sun grass → ox → oxpecker OR grass → ox → tick → oxpecker	1 1
	(b) (ii)	1. [overall energy description] energy is lost along the food chain resulting in less energy received by the last organism compared to its prey 2. [reason] as organisms use energy for various activities 3. [conclusion] hence to supply sufficient energy and nutrients for oxpeckers, the number of oxpeckers need to be less than ticks	1 1 1
		Total	**7**

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Paper 2 (Section B) - Free Response (30 marks)

8	(a)	(i)	1. Correct plotting of points 2. Best fit line (smooth curve) Penalise 1 mark for no label	 1 1
		(ii)	1. Between 20m to 40m downstream, as the bacterial cells increase from 2 arbitrary units to 8 arbitrary units, the BOD value increase from 2 arbitrary units to 6 arbitrary units	1
	(b)	(i)	20m ± 5m	1
		(ii)	The shape of the fish population should follow the pattern of the oxygen graph as closely as possible.	1
	(c)		1. The toxic has entered the small fish and is not excreted and stored in the fatty tissue 2. Over time, the toxic level accumulates in the body, the process is known as bioaccumulation. 3. However, the concentration may not be high enough to cause the fish to die, that is why the fishes appear healthy 4. When the herons consume more of these fishes, the toxin entered the body of the heron, and as it cannot be excreted, it is also stored in the fatty tissue of the heron. 5. The concentration of the toxic substance increases to a fatal level in the heron and as a result, the herons die. This effect is known as bioamplification.	1 1 1 1 1
			Total	**10**

9	(a)	1. [state the location of chloroplasts] palisade mesophyll, spongy mesophyll, guard cells R: stomata 2. [state why chloroplast are found in palisade and spongy mesophyll] chloroplasts are found in palisade and spongy mesophyll because the leaf is the main site for photosynthesis 3. [explain for distribution] as palisade mesophyll layer / cells are found nearer the leaf surface, palisade mesophyll has more chloroplasts to allow the leaf to absorb more sunlight to allow rapid rate of photosynthesis to take place 4. [explain why chloroplast are found in guard cells] to allow guard cells to photosynthesise and in turn control the size of the stomata	1 1 1 1
	(b)	1. [purpose of stomata] allow the exchange of gases (oxygen given out and carbon dioxide taken in) to take place via diffusion during photosynthesis 2. [purpose of stomata] allow the exchange of gases (oxygen taken in and carbon dioxide given out) to take place via diffusion during respiration 3. [purpose of stomata] to allow water vapour to diffuse out during transpiration	1 1 1

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	(c)	1. [arrangement of xylem in the roots] xylem occupies the centre of the roots 2. [arrangement of xylem] xylem <u>arranged in bundles / in pairs with phloem</u> around the edge of the stem with xylem being on the inner side. 3. [arrangement of phloem in roots] phloem is arranged around the xylem 4. [arrangement of phloem in stems] phloem are <u>arranged in bundles / in pairs with xylem</u> around the edge of the stem with phloem being on the outer side.	1 1 1 1
		Total	**10**

10 E	(a)	1. [advantage] farmers can obtain higher yield when growing this new variety of soya plants 2. [explain] as the rate of photosynthesis increase, faster growth is observed. OR 3. [advantage] farmers can use herbicides to kill weeds 4. [explain] as soya beans are unaffected by herbicide but weeds are affected 5. [explain] leading to lesser competition for the soya bean plants. 6. [disadvantage] Formation of superweeds, weeds that are not easily removed in future by the same herbicide. 7. [explain] This will create even greater competition for nutrients and space for growth with the soya bean crops. OR 8. [disadvantage] Population of insects that feeds on weeds and help in pollination will be reduced 9. [explain] since there will be drastic drop in weed population in the field / useful insects will be killed, links in food web are broken which will upset the ecological balance	Any 3 pair
	(b)	[named condition] Sickle cell anaemia. 1. Mutation results in change in structure of gene controlling haemoglobin production 2. Mutated gene leads to production of haemoglobin S, which causes red blood cells to become sickle-shaped 3. The shape interferes with the oxygen-carrying property of red blood cells and condition can be fatal/ clogging OR [named condition] Down syndrome 1. During meiosis, the female gamete produced have one having an extra chromosome in the 21st pair 2. Fertilization between a normal sperm and a ovum subsequently results in the zygote having one extra	1 1 1 1 1 1 1

		chromosome in the 21st pair; 3. Affected child has characteristic facial features and exhibits mental and physical difficulties OR [named condition] Albinism 1. Mutation in the gene controlling production of pigment (melanin) 2. Results in absence of pigment in the skin, hair and eyes of animals 3. Individual has reddish white skin, white hair, iris appears red, very sensitive to light	1 1 1 1 1
		Total	**10**

10 O	(a)	1. [correct identification] Step P: meiosis and Step Q: mitosis	1;1
	(b)	1. [state] it is not fertilisation 2. [explain for frog A] frog A contributed an egg without nucleus 3. [explain for frog B] frog B contributed a diploid nucleus 4. [explain why it is not fertilisation] it does not involve fusion of nuclei of two different gametes]	1 1 1 1
	(c)	1. [stages in mitosis] At prophase, sister chromatids condense and the chromosomes becomes visible. 2. [stages in mitosis] At metaphase, chromosomes are aligned at the equatorial plane. 3. [stages in mitosis] At anaphase, daughter chromosomes are pulled towards the opposite poles 4. [stages in mitosis] At telophase, chromosome unwinds to become chromatin threads	1 1 1 1
		Total	**10**

END

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PASIR RIS CREST SECONDARY SCHOOL
Preliminary Examination
Secondary Four Express

CANDIDATE NAME	

CLASS	4	/		INDEX NUMBER		

Biology 6093/01

Paper 1 **14 September 2018**

1 hour

Additional Materials: Optical Test Answer Sheet (OTAS)

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and register number on the answer sheet in the spaces provided.

There are **forty** 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 Answer Sheet.

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

For Examiner's Use
40
Parent's Signature

This document consists of **17** printed pages.

[Turn over

Answer **ALL** questions. Shade your answers in the OTAS provided.

1 The diagram shows a typical animal cell.

Which structure synthesises and transports lipids?

2 A student cuts out four cylinders of potato from the same potato.
Each cylinder is 30 mm long. The cylinders are all of the same diameter.

The potato cylinders are placed in sugar solutions of different concentrations. After one hour, the lengths of the cylinders are measured again. The results are shown in the table.

Which potato cylinder has been placed in a solution with a water potential closest to that of the potato cells?

	starting length/ mm	length after one hour/ mm
A	30	33
B	30	31
C	30	27
D	30	26

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3 Which row defines active transport?

	cell membrane needed	movement of ions	energy needed
A	no	down a concentration gradient	yes
B	no	up a concentration gradient	no
C	yes	down a concentration gradient	no
D	yes	up a concentration gradient	yes

4 Which chemical elements are present in **both** fats and proteins?

A carbon, hydrogen and nitrogen only
B carbon, hydrogen and oxygen only
C carbon, oxygen and nitrogen only
D carbon, oxygen, hydrogen and nitrogen

5 A sample of milk is tested with Benedict's solution. After boiling, a yellow precipitate is observed.

Which conclusion is correct?

A A high concentration of glucose is present.
B A low concentration of sucrose is present.
C No reducing sugars are present.
D Reducing sugars are present.

6 Which of the following tests shows the presence of an enzyme in a biological washing powder?

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

7 Which of the following blood vessels transports blood with the highest glucose concentration?

A aorta
B hepatic artery
C hepatic portal vein
D vena cava

[Turn over

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8 What describes the upper cuticle of a leaf?

A a permeable layer allowing water to enter the leaf
B a single layer of cells containing many chloroplasts
C a single layer of transparent cells allowing light to enter the leaf
D a thin non-cellular layer preventing water loss from the leaf

9 Two test-tubes, **E** and **F**, were set up, each containing a solution of red hydrogencarbonate indicator. Hydrogencarbonate indicator remains red when the carbon dioxide concentration remains unchanged. It turns yellow when the carbon dioxide concentration increases and turns purple when the carbon dioxide concentration decreases.

Similar pieces of the same aquatic plant were placed into tubes **E** and **F**. Tube **E** was uncovered while tube **F** had a black light-proof cover. The tubes were left in a warm room in sunlight for four hours.

What would be the colour of the hydrogencarbonate indicator in the two tubes after four hours?

	tube **E**	tube **F**
A	purple	red
B	purple	yellow
C	red	yellow
D	yellow	red

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10 The graph shows the rate of photosynthesis of a plant at increasing light intensities at two different carbon dioxide concentrations. The temperature is kept constant.

What may be limiting the rate of photosynthesis at **P**, **Q** and **R**?

	P	Q	R
A	carbon dioxide	light intensity	carbon dioxide
B	carbon dioxide	light intensity	light intensity
C	light intensity	carbon dioxide	carbon dioxide
D	light intensity	carbon dioxide	light intensity

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11 The cut shoot of a plant is placed in a beaker containing a solution of blue dye for one hour, as shown.

The stem of the shoot is then cut through at **S**, and examined under a microscope.

In which region of the stem is the blue dye most concentrated?

12 During translocation in plants, which substance is moved and in which direction?

	substance	from	to
A	sucrose	anthers	stigmas
B	sucrose	leaves	roots
C	water	roots	leaves
D	water	soil	root hairs

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13 The diagrams show a plant in a flask of water. It is left in the light at 16 °C for six hours.

What explains the change in mass after six hours?

A absorption of water into the root hairs
B evaporation of water from the flask
C photosynthesis in the leaves of the plant
D transpiration from the leaves of the plant

14 An oxygen molecule diffuses directly from the air in an alveolus to haemoglobin in a red blood cell. What is the minimum number of cell surface membranes through which this molecule must pass?

A 2
B 3
C 4
D 5

15 Which set of values best represents the blood pressures in an artery, a network of capillaries and a vein?

	pressure/ kPA		
	artery	capillary network	vein
A	0.6	4.0	13.0
B	4.0	0.6	13.0
C	13.0	0.6	4.0
D	13.0	4.0	0.6

[Turn over

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16 How does tissue fluid differ from blood plasma?

A Tissue fluid contains lesser proteins.
B Tissue fluid contains more dissolved food.
C Tissue fluid does not contain dissolved oxygen.
D Tissue fluid does not contain white blood cells.

17 The graph shows changes in the blood pressure in the left ventricle of the heart.

During which period is the left **atrium** contracting?

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18 The diagram illustrates changes in air pressure taking place inside the lungs during a complete cycle of breathing.

Which position on the graph corresponds to the point at which the ribs are beginning to be raised?

19 The diagram shows three types of cells.

Which cells are found in alveoli and in bronchi?

	alveoli	bronchi
A	**T**	**U** and **V**
B	**T** and **U**	**V**
C	**U** and **V**	**T**
D	**V**	**T** and **U**

[Turn over

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20 What are the effects of the following activities on pulse rate when compared to resting pulse rate?

	slow walking	fast running
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

21 A person drinks a large amount of water.

How does this affect the water potentials of the liquids in the renal arteries, the renal veins and the ureters?

	water potential in renal arteries	water potential in renal veins	water potential in ureters
A	higher	higher	higher
B	higher	little change	higher
C	lower	lower	little change
D	lower	lower	lower

22 The diagram shows a person sweating in hot weather.

Which part is played by sweat glands during the process of sweating?

A effector
B receptor
C sense organ
D stimulus

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23 Which process occurs in a kidney dialysis machine?

A Large protein molecules are removed from the blood plasma.
B Materials pass out of the blood down a concentration gradient.
C Oxygen is used up in removing materials from the blood.
D Pressure forces dialysis fluid into the blood.

24 The diagram shows part of the nervous system, including a reflex arc. It has been cut at **P**.

A bee stings a finger, as shown.

What are the effects of this sting?

	pain felt	arm moved
A	no	no
B	no	yes
C	yes	no
D	yes	yes

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25 Which changes take place in the eye when a person looks up from reading a book to view a distant object?

	ciliary muscle	lens
A	contracts	becomes thicker
B	contracts	becomes thinner
C	relaxes	becomes thicker
D	relaxes	becomes thinner

26 What is meant by negative feedback?

A A change away from a set point causes a change back towards the set point.
B A change away from a set point causes further change away from the set point.
C A change towards a set point causes a change away from a set point.
D Changes away from a set point were provided.

27 Which changes occur in the body when a person is shocked?

	increases in	decreases in
A	diameter of pupils in the eye	speed of peristalsis
B	rate of conversion of glycogen to glucose	diameter of pupils in the eye
C	rate of urine production	rate of conversion of glycogen to glucose
D	speed of peristalsis	rate of urine production

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28 The diagram shows a section through a flower.

Which labelled structures contain cells which are haploid?

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

29 Male and female sea urchins release their sperms and eggs into the water where fertilisation takes place.

How can their reproduction be described?

A asexual reproduction which results in genetically dissimilar offspring
B asexual reproduction which results in genetically identical offspring
C sexual reproduction which results in genetically dissimilar offspring
D sexual reproduction which results in genetically identical offspring

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30 The diagram shows a foetus in the uterus.

Where is the concentration of oxygen highest?

A an artery at **X**
B an artery at **Y**
C a vein at **X**
D a vein at **Y**

31 The statements describe events during the mitotic cell cycle.

1. Chromosomes migrate to opposite poles of the spindle.
2. Chromosomes arrange themselves at the equator of the spindle.
3. Chromosomes condense and the nuclear membrane disappears.
4. Centromeres divide.

What is the correct order of three of these events in the mitotic cell cycle?

A 2 → 3 → 4 **B** 3 → 2 → 4 **C** 3→ 4 → 2 **D** 4 → 2 → 1

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32 The diagram shows part of a DNA molecule.

Which part is a nucleotide?

33 DNA from a chromosome is analysed and 20% of its bases are found to be cytosine.

What is the percentage of adenine found in the same DNA molecule?

A 20 **B** 30 **C** 40 **D** 60

34 The gene for insulin production can be removed from human pancreatic cells and added to the genetic material of a harmless bacterium.

What would be the next stage in using this process to treat diabetes?

A Add the transgenic bacterium to human food.
B Inject the transgenic bacterium into the blood of a person with diabetes.
C Put the transgenic bacterium into a fermenter to multiply rapidly.
D Use the transgenic bacterium in a nasal spray.

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35 Over several hundred years, the milk production of a particular type of mammal in the wild has steadily increased.

How has this been achieved?

A artificial selection
B continuous variation
C genetic engineering
D natural selection

36 Which statement is **always** true of dominant allele?

A They cannot undergo mutation.
B They give a greater chance of survival than recessive alleles.
C They give the same phenotype in heterozygotes and homozygotes.
D They occur more frequently in the population than recessive alleles.

37 In fruit flies, the allele for a black coloured body is recessive to the allele for a grey coloured body. In an investigation, a black-bodied fly is crossed with a grey-bodied fly.

What will be the body colour of the offspring if the grey-bodied fly is heterozygous?

A all black
B all grey
C 50% black and 50% grey
D 75% grey and 25% black

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38 Earlobes can either be attached to the cheek or 'free' (unattached). This characteristic is controlled by a single gene. The allele for attached earlobes is recessive.

The diagram shows the inheritance of earlobe attachment in one family.

Which two individuals must be heterozygous for earlobe attachment?

A 1 and 7 **B** 3 and 4 **C** 5 and 8 **D** 6 and 9

39 Within an ecosystem, the top consumers in most food chains are few in numbers.

Which statement explains this?

A Energy losses occur at each trophic level.
B Energy losses occur within the consumers' digestive systems.
C Top consumers are large in size.
D Top consumers have a low reproductive rate.

40 The diagram shows a food chain.

grass → rabbit → fox → flea

Which pyramid of numbers matches this food chain?

End of Paper 1

[Turn over

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PASIR RIS CREST SECONDARY SCHOOL
Preliminary Examination
Secondary Four Express

CANDIDATE NAME	

CLASS	4	/		INDEX NUMBER		

Biology 6093/02

Paper 2 **12 September 2018**

1 hour 45 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your candidate name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use a 2B pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A (50 marks)
Answer **all** questions.
Writ your answers in the spaces provided on the question paper.

Section B (30 marks)
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Electronic calculators may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.
The number of marks is given in brackets [ ] at the end of each question or part question

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80
Parent's Signature

This document consists of **16** printed pages.

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Section A (50 marks)

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

1 Fig. 1.1 shows parts of the alimentary canal that lie in the upper part of the human body.

Fig. 1.1

(a) **(i)** Name the part labelled **E**. …… [1]

(ii) Name and describe the process that moves food from **F** to **G**.

name of process ……..

description of process …….

…….

……. [3]

(b) A sore can develop on the wall of organ **H** in Fig. 1.1. This sore is called an ulcer, which can cause a person pain. The pain may be relieved by taking a drug that stops the release of acid produced by the cells in the wall of organ **H**.
Suggest and explain how the processes taking place in organ **H** may be affected in a person taking this drug.

…….

…….

……. [2]

[Total: 6]

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2 **(a)** Define the term *hormone*.

…….....

…….....

…….....

……..... [3]

(b) **(i)** State the name of the hormone that is involved in the control of the water potential of the blood.

…….. [1]

(ii) Describe and explain how reduced secretion of the hormone named in **(b)(i)** would affect the composition of urine.

……..

……..

……..

…….. [3]

[Turn over

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(c) Table 2.1 shows the concentration of some compounds in the fluids of a glomerulus, a renal capsule and a collecting duct of the kidney.

Table 2.1

compound	concentration/ g per 100 cm^3		
	blood plasma entering glomerulus	filtrate in renal capsule	urine in collecting duct
water	90	90	96
proteins	8.0	0.0	0.0
glucose	0.1	0.1	0.0
urea	0.03	0.03	2.0

With reference to Table 2.1,

(i) explain why proteins occur in the blood entering the glomerulus but not in the filtrate in the renal capsule,

……..

……..

…….. [2]

(ii) explain why there is glucose present in the filtrate but not in the urine, and

……..

……..

…….. [2]

(iii) explain the difference in the concentration of urea between the filtrate and urine.

……..

……..

…….. [2]

[Total: 13]

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3 **(a)** Name the organ that breaks down alcohol in the human body.

..... [1]

(b) Fig. 3.1 shows a computer model of the enzyme alcohol dehydrogenase, which is the enzyme responsible for breaking down alcohol.

Fig. 3.1

Enzymes have a specific three dimensional shape.
Explain why the shape of an enzyme is important.

.....

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..... [3]

[Turn over

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(c) Table 3.1 shows the enzyme activity of alcohol dehydrogenase at different temperatures.

Table 3.1

temperature/ °C	enzyme activity/ arbitrary units
30	115
42	175

(i) The information in Table 3.1 shows that an increase in temperature increases the activity of alcohol dehydrogenase.
Explain why an increase in temperature causes an increase in enzyme activity.

……..

……..

……..

……..

……..

…….. [3]

(ii) State **one** factor, **other than** temperature, that affects enzyme activity.

…….. [1]

[Total: 8]

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4 Blood clots can form if the lining of an artery becomes damaged.

One cause of heart attack is a blood clot in a coronary artery that supplies the muscle of the heart with blood.

(a) Explain how a blood clot is formed.

.....

.....

.....

..... [3]

(b) Explain how a blood clot can cause a heart attack.

.....

.....

.....

..... [3]

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(c) One risk factor for cardiovascular disease (CVD) is a high concentration of blood cholesterol.

(i) Table 4.1 shows the death rate due to CVD and the ratio of fatty acids in the diet for four countries.

Table 4.1

country	death rate from CVD/ deaths per 100 000	ratio of unsaturated to saturated fatty acids in diet
Finland	503	0.175
USA	408	0.275
Italy	235	0.350
Japan	115	1.000

Using the information in Table 4.1, describe the relationship between the ratio of fatty acids in the diet and the death rate from CVD.

……..

…….. [1]

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(ii) Table 4.2 shows information about four fatty acids found in some food.

Table 4.2

fatty acid	type of fatty acid	effect on blood cholesterol concentration	percentage of fatty acid in each food/ %			
			beef	butter	olive oil	corn oil
palmitic	saturated	raises	25	30	9	13
stearic	saturated	raises	29	11	3	3
oleic	unsaturated	no effect	34	19	77	31
linoleic	unsaturated	lowers	2	2	11	53

Using the information from Table 4.1 and Table 4.2, explain what changes a person could make to their diet to reduce their risk of developing CVD.

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…….. [4]

[Total: 11]

[Turn over

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5 Read the following passage.

> Catfish are a commercially important species of freshwater fish used as a human food source. In the wild, catfish are found in all types of large freshwater habitats, such as rivers, lakes and reservoirs. In North America, they are often maintained in catfish ponds, which are artificially constructed habitats. Each pond functions as a self-sustaining ecosystem with its own community of organisms. Catfish feed on living and dead fish, amphibians, insects and even dead mammals found on the bottom of the pond. Different species of phytoplankton are always present in these ponds. They are small organisms found suspended in the water and they are essential for the growth of all other pond organisms.

(a) With reference to the passage, explain what is meant by

(i) *consumers*, and

……..

……..

…….. [2]

(ii) *producers.*

……..

……..

……..

…….. [3]

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(b) Studies on the energy efficiency of raising catfish in ponds show that only 15 – 20% of the energy taken in by the catfish population in their food is used to increase their total biomass.

(i) Explain why only some of the energy taken in by the catfish is used to increase biomass.

……..

……..

……..

…….. [3]

(ii) In the wild, only about 10% of the energy taken in by the catfish in their food is used to increase biomass.
Suggest why this percentage is lower in the wild than in the pond.

……..

…….. [1]

(c) Explain the effects of excess dead fish and faeces egested from the catfish on the environment.

……

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…… [3]

[Total: 12]

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Section B (30 marks)

Answer **three** questions.
Question **8** is in the form of an **Either/ Or** question. Only one part should be answered.

6 Table 6.1 shows the percentage of smokers in a particular country and the number of deaths from lung cancer in that country during the years 1920 to 2010.

Table 6.1

year	percentage of population that were smokers	deaths from lung cancer per 100 000 people
1920	30	100
1930	35	150
1940	45	200
1950	60	250
1960	40	550
1970	30	700
1980	25	800
1990	20	700
2000	20	525
2010	18	500

(a) Draw a bar chart of the data for the number of deaths from lung cancer on the grid. ‘

[4]

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(b) Describe and explain the relationship between the number of smokers and the number of deaths from lung cancer shown in Table 6.1.

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..... [3]

(c) Explain why a pregnant woman is advised not to smoke.

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..... [3]

[Total: 10]

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7 **(a)** Describe the part played by an ovule in the reproduction of a plant.

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..... [4]

(b) State the products of an ovary in a woman and describe the roles of each of these products.

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..... [6]

[Total: 10]

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8 Either

(a) A student went from bright light into a dark room.
Describe the changes that took place in **named** components of the student's eyes.
Use ideas about neurones to explain how the response is achieved.

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..... [6]

(b) Suggest why these changes that take place in the eye are controlled by the nervous system, rather than by a hormone.

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..... [4]

[Total: 10]

[Turn over

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8 Or

(a) Describe the two forms of variation found within a natural population.

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..... [5]

(b) Explain how variation is important for the long-term survival of the species.

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..... [5]

[Total: 10]

End of Paper 2

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Pasir Ris Crest Secondary School
Secondary Four Express Pure Biology Preliminary Exam 2018
Mark Scheme

Paper 1

1	2	3	4	5	6	7	8	9	10
C	**B**	**D**	**B**	**D**	**B**	**C**	**D**	**B**	**C**
11	12	13	14	15	16	17	18	19	20
D	**B**	**D**	**D**	**D**	**A**	**A**	**C**	**A**	**D**
21	22	23	24	25	26	27	28	29	30
B	**A**	**B**	**A**	**D**	**A**	**A**	**A**	**C**	**A**
31	32	33	34	35	36	37	38	39	40
B	**A**	**B**	**C**	**D**	**C**	**C**	**A**	**A**	**D**

Paper 2 Section A

No.	Answers	Marks
1	(a) (i) oesophagus (1)	1
	(ii) peristalsis (1) **+** the continuous, coordinated, alternate muscular contraction and relaxation (1) of the <u>walls</u> of the alimentary canal (1) to push food forward **OR** circular muscles contract + longitudinal muscles relax so lumen narrows to push food forward (1) circular muscles relax while longitudinal muscles contract so lumen widens for food to enter (1)	3
	(b) less bacteria killed (1) less proteins digested (1) pH of stomach <u>higher than optimum</u> (1) protease/pepsin cannot function at maximum rate/ AW (1)	max 2
		[Total: 6]
2	(a) chemical substance produced by endocrine gland + in small amounts (1) transported to target organs by blood + alters activity of target organs (1) destroyed in the liver when not needed (1)	3
	(b) (i) Antidiuretic hormone/ADH	1
	(ii) urine becomes more diluted (1) walls of collecting duct and distal convoluted tubule are less permeable to water (1) lesser water reabsorbed into blood (from glomerular filtrate by osmosis) (1)	3

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	(c) (i) proteins are too large/AW (1) cannot pass through partially permeable capillaries wall/ not filtered in glomerulus (1)	2
	(ii) small molecule + can be filtered from blood into Bowman's capsule (so present in filtrate) (1) all glucose <u>reabsorbed</u> into blood at proximal convoluted tubule (by diffusion and active transport) (1)	2
	(iii) higher urea concentration in urine than filtrate (1) water content decreases as water molecules are <u>reabsorbed</u> into blood (1)	2
		[Total: 13]
3	(a) liver (1)	1
	(b) enzyme's active site (1) must have complementary shape to substrate (1) to make enzyme–substrate complex/ allow substrate to bind to enzyme/ so that substrates can be converted to products (faster) (1)	3
	(c) (i) at higher temperature, enzyme and substrate have higher kinetic energy (1) frequency of effective collision between enzymes and substrate increases (1) rate of enzyme-substrate complex formation increases (1)	3
	(ii) pH	1
		[Total: 8]
4	(a) (platelets release) thrombokinase converts prothrombin to thrombin (in the presence of Ca^{2+} ions) (1) thrombin converts soluble fibrinogen to insoluble fibrin (1) fibrin entangles red blood cells to form a clot (1)	3
	(b) reduced oxygen supply to cardiac muscles (1) cardiac muscles cannot respire and release energy (1) cardiac muscles die + part of the heart muscle stops contracting (1)	3
	(c) (i) as ratio of unsaturated to saturated fatty acids in diet increases from 0.175 to 1.000, death rate from CVD decreases from 503 to 115 (1)	1

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	(ii) 1. increase ratio of unsaturated fats to saturated fats in their diet/ eat more unsaturated and less saturated fat (1) 2. because countries with low ratio of unsaturated to saturated fatty acids have high death rates due to CVD (1) 3. reduce animal fats/ increase plant oils (1) 4. because animal fats/beef/butter have high percentage of saturated fatty/palmitic/stearic acids (1) **OR** plant oils/olive and corn oil have a higher percentage of unsaturated fatty/ linoleic/ oleic acids (1) **OR** saturated fatty/palmitic/stearic acids raise blood cholesterol (1) **OR** unsaturated fatty acids reduce/ do not raise blood cholesterol (1)	4
		[Total: 11]
5	(a) (i) organisms that obtain energy by feeding on other organisms (1) catfish are consumers which obtain energy by feeding on living and dead fish (accept other named examples from passage) (1)	2
	(ii) absorbs and converts light energy into chemical energy in food (1) provides food for other organisms in the community/ occupies first trophic level in food chain/web/AW (1) phytoplankton is the producer (1)	3
	(b) (i) energy is used by catfish for movement/ muscle contraction/ active transport/transmission of nerve impulses/protein synthesis/ AW (1) most energy is lost as heat during respiration (1) some energy is trapped in faeces and excretory waste (1)	3
	(ii) wild catfish needs to use more energy to swim and hunt for food (1)	1
	(c) any three points: - waste contains toxins (1) - bodies of dead fish and faeces contain nutrients/ nitrates and phosphates (1) - causes eutrophication/ enrich water body with nitrates and phosphates so algae absorb nitrates from water and grow profusely (1) - overcrowding of algae reduces sunlight reaching submerged plants (1) - water plants cannot photosynthesize and die (1) - bacteria decompose dead plants, grow and reproduce quickly (1) - bacteria respire aerobically and reduce amount of dissolved oxygen (1) - aquatic organisms lack oxygen for aerobic respiration and die (1)	max 3
		[Total: 12]

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Paper 2 Section B

No.	Answers	Marks
6	(a) suitable scale (1) labelled axes with units (1) accurate plots (1) consistent widths of bars (1) *deduct 1 mark if there are no gaps between bars for bar chart	4
	(b) general increase in number of deaths from lung cancer as number of smokers increase (1) cigarette contains tar which is carcinogenic/ causes uncontrolled cell division (1) *award 1 mark for citing data to support relationship	3
	(c) cigarette contains nicotine (1) nicotine constricts blood vessels + reduce blood/nutrient/oxygen supply to foetus (1) babies born smaller and lighter (1) *accept alternative answers that describe how other chemicals in tobacco smoke cause negative effects to the foetus	3
		[Total: 10]
7	(a) contains female gamete/ female nucleus/ egg cell (1) in ovary (1) fertilized by male gamete/ male nucleus (1) to form zygote/ embryo (1)	4
	(b) produces haploid ovum/ egg (1) fertilized by sperm to form zygote (1) ovary produces oestrogen and progesterone (1) oestrogen thickens uterine lining (1) oestrogen causes development of sex organs/ secondary sexual characteristics (named) (1) progesterone maintains thickness of uterine lining for implantation (1)	6
		[Total: 10]
8	**Either** (a) photoreceptors detect the decrease in light intensity (1) and produce nerve impulses (1) nerve impulses are sent along optic (sensory) nerve to the brain (1) brain returns nerve impulses along motor nerve to radial <u>iris</u> muscles (1) radial <u>iris</u> muscles contract + circular <u>iris</u> muscles relax (1) pupil dilate/ AW (1)	6

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	(b) nervous response is faster than hormonal response (1) fast transmission of nerve impulses allows brain to interpret impulse and coordinate response quickly (1) nervous response is short-lived while hormonal response may be long-lived (1) pupil reflex must be short-lived so that changes can occur to components of eye quickly to view objects at changing light intensities (1)	4
		[Total: 10]
8.	**Or** (a) continuous variation + discontinuous variation (1) continuous variation shows gradual change/ range between extremes (1) traits affected by genes and environment (1) discontinuous variation shows few and distinct differences (1) traits controlled by genes alone (1) accept any correct example linked to form of variation (1) (b) some variations are advantageous/beneficial (1) competition in organisms' habitat/ environment (1) organisms survive breeds/reproduce (1) and pass advantage/ beneficial gene/ allele over many generations (1) continuous adaptation to the changing environment lead to evolution/ natural selection (1) give rise to new species (1)	max 5 max 5
		[Total: 10]

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West Spring Secondary School
PRELIMINARY EXAMINATION 2018

BIOLOGY

6093/01

SECONDARY 4 **Express**

Name _____ ( ) **Date** 03 Sep 2018

Class _____ **Duration** 1 hour

Additional Materials: 1 OTAS

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper-clips, highlighters, glue or correction fluid.
Write your name and index number on the Answer Sheet in the spaces provided.

There are **forty** 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 answer sheet.

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.
The use of approved scientific calculators is allowed for this paper.

This document consists of **15** printed pages including the cover page.

Setter(s) Ms Zhou Siyang **[Turn over**

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1 Some organisms live at the bottom of the seas where it is very dark. To synthesise glucose, they use energy from chemicals in the very hot water that comes out of volcanoes.

What is a distinguishing feature of these organisms?

A They do not need oxygen.
B They do not contain chloroplasts
C They do not contain mitochondria.
D Their enzymes are easily denatured by heat.

2 What are the similarities between a neurone and a sieve tube element in phloem?

1 Both lack nuclei.
2 Both are living cells.
3 Both are specialised cells.
4 Both have large surface areas to volume ratio.

A 3 only
B 1 and 4 only
C 2 and 3 only
D 1, 2 and 3 only

3 The diagram shows a typical animal cell with cell components that are involved in the synthesis and secretion of an enzyme.

Which of the following identifies correctly the route taken by an amino acid molecule from the point it is synthesised and as it passes through these cell components?

A 2 → 4 → 1 → 3
B 2 → 1 → 4 → 3
C 3 → 2 → 1 → 4
D 3 → 4 → 1 → 2

4 Which diagram illustrates the process of active transport?

A

B

C

D

5 Identical pieces of potato are placed in sucrose solutions of different concentrations. After three hours, the mass of each potato piece is measured.

Which graph shows the results of this experiment?

A

B

C

D

6 In lactose intolerance, insufficient lactase is produced to digest lactose into molecules small enough to be absorbed by the small intestine. The lactose remains in the lumen of the small intestine and the contents of the small intestine become more hypertonic than usual. Which of the following would be a consequence of this?

A More water will be absorbed by the walls of the small intestine.
B Less lactose will remain in the lumen of the small intestine.
C The intestinal contents become very dry.
D The intestinal contents will contain more water.

7 A student was asked to identify the two food substances in each of three test-tubes.

The table shows the results of the student's tests.

test - tube	reagent added to test-tube		
	Biuret solution	Benedict's solution	iodine solution
X	purple	brick-red	brown
Y	blue	blue	blue-black
Z	purple	blue	blue-black

Which conclusion is consistent with the results?

A Egg white and sucrose had been placed in tube X.
B Maltose and starch had been placed in tube Z.
C Maltose and sucrose had been placed in tube X.
D Starch and sucrose had been placed in tube Y.

8 Four equal masses of different foods were burned as shown.

The temperature of the water was measured before and after each food sample was burned. The results are shown in the table. Which food sample is likely to contain the most fats?

	water temperature at the start/°C	water temperature at the end/°C
A	16	37
B	17	95
C	18	87
D	19	22

9 The following is a list of laboratory steps.

1 add copper(II) sulfate drop by drop
2 shake well to mix
3 place in a boiling water-bath
4 add Benedict's solution
5 add sodium hydroxide solution

Arrange the steps in the order which they need to be carried out to show the presence of a protein.

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

10 A scientist investigated four species of insects. As all the insects look physically familiar, he investigated the digestive enzymes found in their guts.

From the data that he gathered, which insect feeds **only** on human blood?

insect	enzyme(s) present in insect guts			
	amylase	protease	sucrase	lipase
A	-	-	-	+
B	+	-	+	-
C	-	+	-	+
D	+	+	+	-

key: + present; - absent

11 Cubes of hard-boiled egg white are placed in test-tubes containing 5 cm^3 of water. Other substances are added to each tube as shown in the chart. The tubes were left for eight hours and then tested for amino acids.

tube	solution added	results for amino acids
1	pepsin	absent
2	pepsin + alkali	absent
3	none	absent
4	pepsin + acid	large amounts
5	boiled pepsin + acid	traces
6	acid	traces
7	alkali	absent

Which tubes show that pepsin is an enzyme?

A 1 and 6
B 2 and 7
C 4 and 5
D 5 and 6

12 The diagram shows the liver and its associated blood vessels.

If a person is fasting, which blood vessel would have the highest concentration of glucose after 24 hours?

13 Which row shows the most likely number of chloroplasts in three types of cell in a leaf?

	vascular bundle cell	epidermal cell	mesophyll cell
A	15	8	8
B	8	15	8
C	0	8	15
D	0	0	15

14 The diagram represents the gaseous exchange on the surface of a fish.

Which conditions would result in the maximum rate of diffusion of oxygen across the gaseous exchange surface?

	amount of dissolved oxygen in water	amount of dissolved oxygen in blood plasma	rate of blood flow
A	large	small	fast
B	large	small	slow
C	small	large	fast
D	small	large	slow

15 The diagram illustrates a simple potometer which measures water uptake in plants.

Which combination of conditions would result in the fastest uptake of water?

A bright light and humid air
B bright light and high temperature
C high humidity and high temperature
D moving air and low temperature

16 The diagram below shows the condition of a stoma at different times of the day.

X Y

Which of the following shows the most probable times at which the stoma is being observed?

	X	Y
A	1.50 pm	9.30 am
B	2.00 pm	7.30 pm
C	10.00 pm	11.00 am
D	11.30 pm	3.15 am

17 An experiment was conducted on a young plant, using an aphid stylet (mouth part) to measure the rate of translocation. The same plant was then placed in a bell jar together with a chemical which absorbs oxygen. It was observed that the rate of translocation decreased and eventually stopped.

Which of the following best explains the above observation?

A Companion cells no longer produced sufficient energy.
B Mitochondria in the xylem vessels ceased to function.
C Photosynthesis could not occur in the plant placed in the bell jar.
D Translocation occurred only by diffusion.

18 The diagram shows someone blowing up a balloon.

How do the proportions of gases in the air inside the balloon compare with the air outside the balloon?

	oxygen	carbon dioxide	water vapour
A	more	less	more
B	more	less	less
C	less	more	more
D	less	more	less

19 The diagram shows a dialysis machine.

Which process(es) does not happen along X?

A active transport
B diffusion
C osmosis
D osmosis and diffusion

20 The graph shows the effect of antidiuretic hormone (ADH) on the regulation of water content in blood plasma.

Which part(s) of the graph reflect(s) the effect of increased ADH secretion?

A M only
B N only
C M and P
D N and O

21 Which of the following statements about a voluntary action is true?

A It always involves the contraction of muscles.
B It always involves the spinal cord.
C It is always initiated by a sense organ.
D It is always initiated in the brain.

22 In an accident, a patient's spinal cord was severed at the neck region.

Which of the following are the possible effects of this?

1 inability to carry out reflex actions below the neck
2 inability to perceive sensory stimuli below the neck
3 inability to voluntarily move muscles below the neck

A 1 only
B 1 and 2 only
C 2 and 3 only
D 1, 2 and 3

23 Which of the following diagrams, **A**, **B**, **C** or **D**, shows the correct sequence of neurons in a reflex arc?

24 Which structures cover the pupil at the front of a human eye?

A conjunctiva and sclera
B cornea and conjunctiva
C cornea and retina
D retina and sclera

25 The graph shows the changes in the size of the pupil of the eye as the light intensity of the surroundings is changed.

Between which times is the light intensity increasing?

A 5 to 10 seconds
B 10 to 25 seconds
C 25 to 35 seconds
D 35 to 40 seconds

26 The diagram shows the curvature of the lens in a person's eye. The shape of the lens changes as the person watches two motorbikes go past at different speeds.

During which period was a motorbike moving towards the person at the higher speed?

27 Glycogen can undergo the following chemical change:

glycogen → glucose

Which hormone(s) can be responsible for this chemical change?

	adrenaline	glucagon	insulin
A	√	x	√
B	√	√	x
C	x	√	x
D	x	x	√

Key:
√ = responsible
x = not responsible

28 A person with diabetes mellitus is receiving treatment with insulin injections. The graph shows how this person's blood glucose concentration changed during part of one day.

At which point was an insulin injection given?

29 Which of the following occurs in meiosis but **not** in mitosis?

A Chromatids of chromosomes cross and twist around each other.
B Chromosomes line up independently along the equator.
C Sister chromatids are held together at the centromere.
D Sister chromatids separate during anaphase.

30 The diagram shows part of a flower after it has been pollinated.

Which labelled structures are diploid and which are haploid?

	diploid	haploid
A	1	4
B	2	1
C	3	2
D	4	5

31 The diagram below shows two plants of the same species.

plant 1 plant 2

Which arrow(s) indicate(s) a process that would lead to sexual reproduction?

A 2 only
B 2 and 3
C 1, 2 and 3
D 1, 2 and 4

32 Which one of the following statements correctly describes the sequence of events that follows after the pollen grain lands on the stigma?

A The pollen grain forms a pollen tube which grows down the style to the ovule carrying the male gamete, which then fuses with the female gamete.
B The pollen grain passes down the style and fuses with the female gamete in the ovule.
C The pollen grain releases male gametes which digest their way through the stigma and style and then fuse with the female gametes in the ovule.
D The pollen grain releases male gametes which swim towards the ovule in the ovary, then fuse with the female gametes.

33 The diagram shows the changes in the thickness of the uterus lining of a woman during her menstrual cycle.

At which period of time is the woman most likely to be fertile?

34 You are a doctor treating a childless couple. Upon detailed study, you discover that the sperms from the husband are not strong enough to swim to meet the egg. As such, you decide to fertilise the egg in the laboratory and implant the embryo back into the wife. In the diagram, at which location would you place the embryo?

35 Genetic cross of pure bred red four o'clock flowers with pure-bred white four o'clock flowers resulted in F1-hybrid offspring that all had pink flowers. When the F1 plants were self-pollinated, the resulting F2-generation plants had a phenotypic ratio of 1 red: 2 pink: 1 white.

The most likely explanation is …….

A pink flowers are the result of a blending of the red and white genotypes.
B flower colour is due to two or more complementary genes.
C heterozygous plants have a different phenotype from the pure bred parents because of codominance of the dominant allele.
D flower colour inheritance in four o'clock flower does not obey Mendelian laws.

36 The drawing shows fruit flies produced in a genetic experiment. The number of each type represents the ratio resulting from crossing two types of flies.

Assume that F represents the dominant allele and f represents the recessive allele involved in the cross.

Which of the following crosses would produce this ratio?

A FF x FF
B FF x ff
C Ff x Ff
D Ff x ff

37 A person with Down's syndrome is born with 47 chromosomes in each cell, instead of 46.

What could cause this?

A More than one sperm fused with the egg at fertilisation.
B Mutation happened during the production of the egg cell.
C Radiation caused a change in structure of a gene in the father's sperm.
D The mother was exposed to harmful chemicals while she was pregnant.

38 How many adenine molecules are present in a DNA molecule of 4000 bases, if 20% of the base molecules are cytosine?

A 600
B 800
C 1200
D 2400

39 Which of the following statements correctly describes an advantage that genetic engineering has over artificial selection?

A It is a quicker process, as only one species is required for beneficial traits to be passed down to offspring.
B It always creates organisms that are more suited to their natural environment.
C Genetically modified food is always more nutritious and safe for all consumers.
D There is a higher chance of offspring receiving the beneficial trait from the genetically engineered parent compared to using artificial selection.

40 The diagram shows the positions of four farms and the concentrations of nitrate at different points in a river.

Which farm is likely to have been using too much fertiliser on its land?

West Spring Secondary School

PRELIMINARY EXAMINATION 2018

Biology **6093/02**

SECONDARY 4 EXPRESS

Name _____ ( ) **Date** **13 Sep 2018**

Class _____ **Duration** **1 h 45 min**

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on the cover page.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A (50 Marks)
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.
Show **all** relevant working.

Section B (30 Marks)
Answer all the questions.
Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used

Information for Candidates
You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.
The number of marks is given in [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
Section A	/50
Section B	/30
Total	/80

This document consists of **18** printed pages including the cover page.

Setter(s) Mdm Ho Soo Yin **[Turn over]**

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Section A

Answer **all** questions.

Write your answer in the spaces provided.

1 Fig. 1.1 shows a food web in an ecosystem.

Fig. 1.1

(a) Draw a pyramid of numbers for a food chain involving caterpillars.

[1]

(b) It is known that consumers at the highest trophic level receive the highest amount of insecticides. Based on the pyramid of numbers you have drawn in **(a)**, explain why this is so.

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.....[3]

(c) Explain the observations of the following populations when snakes are removed from this food web.

(i) The grasshopper population increases initially but decreases afterwards.

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..... [3]

(ii) The caterpillar population was constant for a while but decreases afterwards.

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..... [2]

[Total: 9]

2 A surgeon carried out a biopsy on a child who was not gaining the weight expected for his age. A small sample of tissue was removed from inside the child's small intestine.

Fig. 2.1 shows the appearance of the villi in a normal healthy child and that of the child patient's small intestine of the same age. Both diagrams are to the same scale.

healthy child child patient

Fig. 2.1

(a) With reference to Fig. 2.1, state one difference between the villi of the healthy child and that of the patient.

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.....[1]

(b) Describe and explain three **other** features of a healthy small intestine that help to maximise the absorption of digested food.

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.....[3]

(c) The child was diagnosed as suffering from coeliac disease. This is a condition in which an individual lacks a particular enzyme needed to digest gluten. Gluten is a protein found in wheat. A dietician was asked to advise the family on a suitable diet for the child. The child's parents found it hard to understand why the child could digest proteins present in meat but was unable to digest gluten. How might the dietician have explained to them, using his knowledge of enzymes?

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.....[3]

[Total: 7]

3 Fig. 3.1 shows the structure of a male flower of a maize plant.

Fig. 3.1

(a) With reference to Fig. 3.1, explain how two features of this flower adapt it for wind pollination.

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.....[2]

(b) The corn borer is an insect pest of maize. The larvae feed on the leaves of the maize plants. The adults can fly but do not feed on maize plants.

Much of the maize that is grown in the USA has been genetically modified to produce Bt toxin, which is lethal to insects that feed on the leaves. However, many populations of the corn borer have now evolved resistance to the Bt toxin.

Explain how this resistance could have evolved.

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.....[3]

(c) The recessive allele, r, of the gene in corn borers confers resistance to Bt toxin. Larvae that are homozygous for the normal, dominant allele R, or that are heterozygous, are killed when they on Bt maize.

State the genotype of the corn borers that successfully turn from larvae into adults in the fields where Bt maize is grown.

.....[1]

(d) In order to reduce the number of corn borers resistance Bt toxin, farmers in the USA are required to grow up to 50% of their maize as non-Bt varieties. The non-Bt maize is grown in separate areas close to the fields of Bt maize. This is called the High Dose Refuge (HDR) strategy.

Almost all corn borer larvae feeding on this non-Bt maize have the genotypes RR or Rr. The HDR strategy assumes that, when these become adults, they will interbreed with the adults developing in the Bt maize fields.

Explain how the HDR strategy could reduce the proportion of corn borers that are resistance to the Bt toxin.

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.....[2]

[Total: 8]

4 Fig. 4.1 shows a kidney nephron and its blood supply.

Fig. 4.1

(a) Name the parts labelled **A** and **C**.

A: .....

C: .....[2]

(b) Table 4.1 shows the composition of samples obtained from **C** and **E**.

Table 4.1

substance	composition in **C** / g/cm^3	composition in **E** / g/cm^3
water	91	9.4
urea	0.02	2.4
glucose	0.1	0.0
protein	7.5	0.0
salts	0.5	1.1
creatinine	0.002	0.13

Some materials from **C** were not found in **E**. Explain what has happened to these materials.

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..... [4]

[Total: 6]

5 Fig. 5.1 shows a section of lung tissue from a smoker.

Fig. 5.1

In a smoker, the walls between the gas exchange structures in the lungs can break down, resulting in the damaged features visible in Fig. 5.1. One of these damaged features is labelled **H**.

(a) (i) Name the gas exchange structures which are damaged in Fig. 5.1.

.....

..... [1]

(ii) Name the smoking-related disease resulting in the damaged feature labelled **H** in Fig. 5.1.

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..... [1]

(b) Smoking-related diseases may increase the risk of respiratory diseases of the gas exchange system. Describe **and** explain how smoking can increase the risk of these diseases.

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(c) From one cigarette, a smoker will inhale between 14 and 20 mg of carbon monoxide.

Describe the effects of carbon monoxide on haemoglobin.

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.....[2]

[Total : 7]

6 Fig. 6.1 shows a graph of the number of people, worldwide, estimated to be newly infected with the human immunodeficiency virus (HIV) in the years 1990 to 2008.

Fig. 6.1

(a) Use the information in Fig. 6.1 to describe the changes in the number of people newly infected with HIV.

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.....[3]

(b) Suggest the possible explanations for the decrease in the number of people newly infected with HIV.

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.....[2]

[Total: 5]

7 Fig. 7.1 shows the stages in the process of genetic engineering to produce the hormone insulin.

Fig. 7.1

(a) State the type of reproduction that takes place in stage **M** of Fig. 7.1. Use your knowledge of the process of cell division to explain why it is important that this type of reproduction occurs.

type of reproduction .....

explanation .....

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..... [3]

(b) Name the condition in humans that is treated using insulin produced by the bacteria in stage **N** of Fig. 7.1.

..... [1]

(c) Fig. 7.2 shows the chromosomes in a skin cell of a small deer found in North America at prophase of mitosis.

(i) State the diploid chromosome number of the deer.

..... [1]

(ii) On Fig. 7.2, shade a pair of homologous chromosomes. [1]

(iii) During the formation of eggs in the ovary of the female deer, the chromosome number changes. State what happens to the chromosome number and explain why this change is necessary.

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..... [2]

[Total: 8]

Section B

Answer **three** questions.

Question **10** is in the form of an **Either/Or** question. Only one part should be answered.

8 Table 8.1 shows the rate of photosynthesis of two different plants over a range of light intensities.

Table 8.1

light intensity / lux	rate of photosynthesis / mg carbohydrate produced per unit area per min	
	plant **R**	plant **S**
5	2	3
10	5	10
20	9	29
30	19	46
40	23	49
50	32	54
60	42	58
70	55	60
80	72	60
90	72	60

(a) Plot the data for all the light intensities in the range of 5 to 90 lux on the grid.

[3]

(b) State, with a reason, which plant would grow best in shady conditions.

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.....[2]

(c) Explain why, at light intensity above 80 lux, the rate of photosynthesis in both plants might increase if they were:

(i) supplied with higher concentrations of carbon dioxide;

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..... [2]

(ii) exposed to 40 °C.

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..... [2]

(d) Suggest why the rate of photosynthesis may fall when a plant wilts.

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..... [2]

[Total: 11]

9 Fig. 9.1 shows a longitudinal section of the heart of man.

Fig. 9.1

(a) Explain the difference in the thickness of the left ventricle and the right ventricle.

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.....[3]

(b) Explain how the structures labelled in Fig. 9.1 ensure that blood flows in the correct direction.

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(c) Outline the effects of atherosclerosis in coronary arteries and the resulting effects on the heart itself.

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[Total: 9]

10 either

(a) Describe and explain the events that occur after the body temperature falls, which will allow the body temperature to return to its normal level.

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(b) Explain what is meant by control by 'negative feedback'.

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[Total: 10]

10 or

Carbon flows through the ecosystem in the carbon cycle whereas energy flows in a non-cyclical manner.

(a) Explain how carbon, in the form of organic matter in the producer, flows through the ecosystem.

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.....[7]

(b) Explain why energy has to be constantly supplied to the ecosystem.

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.....[3]

[Total: 10]

~ END OF PAPER ~

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Biology Prelim 2018 Paper 1 Answer Scheme

1	2	3	4	5	6	7	8	9	10
B	C	B	A	C	D	D	B	D	C
11	12	13	14	15	16	17	18	19	20
C	D	D	B	B	C	A	C	A	B
21	22	23	24	25	26	27	28	29	30
D	C	A	B	D	A	B	A	A	B
31	32	33	34	35	36	37	38	39	40
D	A	B	B	C	C	B	C	D	A

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SECONDARY 4 EXPRESS BIOLOGY

PRELIMINARY EXAMINATION, 2018

SUGGESTED MARK SCHEME P2

Section A				
		Answers	**Marks**	**Remarks**
1	**(a)**		[1]	
	(b)	1. Leaves that contain insecticides are eaten by the caterpillars. As these insecticides are not <u>biodegrable/are not broken down</u>, they accumulate in the bodies of caterpillars./ bioaccumulation ; 2. As birds feed on the caterpillars and hawks feed on these birds, the concentration of insecticides increases along the food chain. ; 3. Highest concentration of insecticides will be found <u>in hawks</u>. ; 4. This is known as <u>bioamplication/bioaccumulation</u> ; **Reject: indigestible**	[1] [1] [1] [1]	Point 1 is a must Point 2, 3 and 4, any 2 Max 3 marks
	(c) (i)	1. Initially, the grasshopper population increases as there are less predators feeding on them and they can <u>reproduce</u> more. ; 2. However, their population decreases later dramatically due to the <u>competition for food</u>. ; 3. The flowering plant is the only producer of food in this food web/does not produce enough food for the growing population. ;	[1] [1] [1]	
	(c) (ii)	1. Initially, the caterpillar population remains constant because they belong to two different food chains / snakes do not prey on them./have not lost source of food or predator ; 2. However, both grasshoppers and caterpillars feed on the same food source (leaves of flowering plant), an increase in the population of grasshopper provides competition for food with the caterpillars. ; Or No snakes, grasshopper population increases, more food for birds, bird population increases, more caterpillars are eaten	[1] [1]	

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2	**(a)**	The healthy child has more villi /more protrusion patient has fewer villi / The healthy child's villi are longer / patient has shorter villi / Patient's villi are not properly formed/ Healthy child has villi separated/ Healthy child has larger surface area for villi;	[1]	Any 1 point **Reject: Villi has more folds,**
	(b)	1. Microvilli provide a larger surface area to volume ratio for food to be absorbed faster. ; 2. Each villus is supplied with a network of blood capillaries to maintain a steep diffusion gradient for rapid diffusion of food substances. ; 3. The villi are thin walled / one cell thick walls of villi provide a short diffusion distance for digested food to pass through the walls quickly. ; 4. The small intestine is long to allow more time for digested food to be absorbed ; 5. Mitochondria are found in the cells of the epithelium to help in the absorption via active transport.	[1] [1] [1] [1] [1]	Any 3 points
	(c)	1. Enzymes are specific in action / Each protein must be digested by one specific enzyme. ; 2. Each enzyme has an active site. 3. The shape of the active site is complementary to shape of substrate / only allows a particular substrate to fit in to form an **(enzyme-substrate complex) not necessary** ; 4. Hence, the enzyme which digests protein in the meat cannot digest protein in gluten. ;	[1] [1] [1] No mark	
3	**(a)**	1. Anthers, outside flower / exposed, to allow wind to carry pollen away / 2. Long / flexible filaments/pendulous stamens, to allow wind to dislodge the pollens / 3. No / small petals, to allow anthers to be exposed to the wind / less energy is channelled to produce large petals and more energy channelled to make pollens instead 4. Anthers large to produce large quantities of pollen	[1] [1]	Any 2 points
	(b)	1. (Genetic) mutation occurs in the corn borer ; (there are variation in some corn borers) 2. Mutated Corn borers more likely to survive / have selective advantage ; 3. These corn borers grow into adults and are likely to breed / reproduce ; 4. Hence, the mutated gene / resistance alleles are passed on to the next generation ; 5. This leads to increase in frequency of allele for resistance ;	[1] [1] [1]	Any 3 points
	(c)	rr	[1]	
	(d)	1. When non-resistant borers from outside breed with resistant borers, many offspring will not be resistant ; 2. Because many of the offspring will be Rr / heterozygous/less will be rr ; 3. Detail e.g. results of rr / RR **and** rr x Rr	[1] [1]	Max 2 points

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4	**(a)**	**A**: renal artery **C**: glomerulus (A:blood capillaries) **Accept: similar spelling**	[1], [1]	
	(b)	1. During ultrafiltration at the glomerulus, small molecules are filtered out into the proximal convoluted tubule ; 2. Glucose molecules are small enough to move into/ pass into the Bowman's capsule. ; 3. However, glucose molecules are useful and all are selectively reabsorbed into the blood capillaries. ; 4. Proteins are too large to enter the Bowman's capsule therefore remain in the bloodstream ;	[1] [1] [1] [1]	
5	**(a) (i)**	Alveoli / air sacs ; **Reject: alveolar wall**	[1]	
	(ii)	emphysema ;	[1]	
	(b)	1. Tar and irritants present in the cigarette smoke paralyses cilia lining the air passages ; 2. Dust particles trapped in the mucus lining the air passages cannot be removed ; 3. Increasing the risk of chronic bronchitis and emphysema ; 4. Tar causes lung cancer ;	[1] [1] [1] [1]	Any 2 from point 1, 2 or 3 if point 4 is given as one of the answer
	(c)	1. Carbon monoxide combines with haemoglobin to form (**carboxyhaemoglobin**) **– no need write this** ; 2. Hence it reduces the ability of haemoglobin to carry oxygen to the rest of the body cells / decreases oxygen level in the blood;	[1] [1]	
6	**(a)**	1. number of infected people increases steeply from 1990 until 1996 / 1997 ; 2. peaks at 3.5 million / any figure between 3 to 4 million ; 3. decrease from 1996 / 1997 ; 4. number of new cases in 2008 is greater than in 1990 ;	[1] [1] [1] [1]	Any 3 points With at least 1 mention of the data
	(b)	1. reduce risk of infection by using condoms / protection during sexual intercourse ; 2. abstinence ; 3. not sharing needles / using sterile needles ; 4. treat blood (products) / testing potential blood donors or donated blood ; 5. increase accuracy in contact tracing ; 6. increased awareness of precautions / risks / transmission ; 7. increased use of antiviral drugs to reduce transmission ; 8. some strains are less infective than others ; 9. less reporting of new cases ;	[1] [1]	Any 2 points

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7	**(a)**	asexual reproduction 1. Asexual reproduction results in the production of genetically identical offspring. ; 2. Since the transgenic bacterium already contains the insulin gene, by reproducing asexually, many identical copies of this bacteria are produced and hence more insulin gene can be produced. ;	[1] [1] [1]	
	(b)	Diabetes mellitus	[1]	
	(c)(i)	6	[1]	
	(c)(ii)	Shade any 2 chromosomes of the same size	[1]	
	(c)(iii)	The chromosome number became half / 3/ chromosome numbers become haploid ; So that when the nucleus of the female gamete fuse with the nucleus of the male gamete, diploid number of chromosomes in the zygote / species is restored.	[1] [1]	
Section B				
8	**(a)**		[1] [1] [1]	Axis correct Points Correct best fit graphs drawn
	(b)	Plant S ; At low light intensity (0 to 40 lux), the rate of photosynthesis increases at much faster rate compared to plant R. ; Or Plant 2 is able to produce 29 mg of carbohydrate at 20 lux but plant R needs more than 40 lux of light **(accept this type of answer as above)**	[1] [1]	

	(c) (i)	1. Since above 80 lux, the rate of photosynthesis is constant for both plants, light intensity is <u>no longer the limiting factor ;</u> 2. Since carbon dioxide is essential for photosynthesis to take place/it might be a limiting factor, the rate of photosynthesis might increase when its concentration is increased ;	[1] [1]	
	(c) (ii)	1. Photosynthesis is an enzyme dependent process ; 2. Increasing the temperature to 40 °C might increase the enzyme activity which will in turn increase the rate of photosynthesis ;	[1] [1]	
		3.		
	(d)	Wilting is caused when leaf cells lose their turgidity / became flaccid 1. Stomata closes, carbon dioxide diffusion into cells may decrease ; 2. leaf folds up, reducing exposed surface, light energy absorbed may reduce; 3. Less water for photosynthesis; Rate of photosynthesis falls	 [1] [1] [1]	Ignore first sentence Any 2 points
9	**(a)**	1. Left ventricle has thicker / more muscle than the right ventricle ; 2. Left ventricle pumps blood to the rest of the body / systemic circulation which is a longer distance / further away / at higher pressure ; 3. Right ventricle only pumps blood to the lungs which is a short distance from the heart ;	[1] [1] [1]	Reject : ventricle wall needs to withstand high pressure
	(b)	1. When pressure in right atrium is greater / higher than pressure in the ventricles, the valves open to allow blood to flow from right atrium into right ventricle ; 2. When the right ventricle contracts, the pressure in right ventricle is greater than pressure in right atrium, causing the valves to close. ; 3. Hence, the blood can only flow in one direction which is to the pulmonary arteries ;	[1] [1] [1]	
	(c)	1. fat / cholesterol / deposited in, plaque formed in wall of artery narrows lumen of artery ; 2. blood flow reduced / restricted (in coronary arteries) and less oxygen / glucose, supplied to heart muscle for aerobic respiration **(to release energy)-not necessary** ; 3. heart attack / heart failure / cells in heart might die ;	[1] [1] [1]	 Reject: no oxygen flows to heart muscles

10	**Either**			
	(a)	When the body temperature drops, 1. it stimulates temperature receptors in our skin, which send	 [1]	 Point 1 is a

		nerve impulses to the hypothalamus. The hypothalamus will send nerves impulses to the relevant body parts to bring about the following changes: 2. less active sweat glands/sweating stops (**Accept**: inactive) 3. less evaporation of water in sweat and less heat of vaporisation is lost from the body (**Reject**: no evaporation) 4. Vasoconstriction of arterioles/ blood vessels (**Reject**: capillaries/veins) 5. Results in less blood to capillaries and less heat is lost by convection, radiation and conduction 6. Increase in metabolic rate to increase the amount of heat released within the body 7. Shivering might occur which generates heat 8. Hair erector muscles contract, causing the hairs to stand. This helps to trap a layer of air which can reduce heat loss as air is an insulator of heat	[1] [1] [1] [1] [1] [1] [1]	must Point 2 to 8, any 6 points
	(b)	Negative feedback is 1. A change in level / of set point/ in norm triggers /causes / a response / reaction / sequence of events ; 2. Which leads to restoration to original level ; 3. An example is when water potential in the body increases above norm, it is detected by the receptor in the body. The body will respond and returns the water potential to the norm. ; Or point 3, students can give any other relevant examples (temperature regulation, glucose regulation)	[1] [1] [1]	
10	**Or**			
	(a)	1. Plants contain carbon in the form of organic matter such as starch / protein/fat/cellulose. ; 2. Glucose in the plant is used during respiration, releasing carbon dioxide into the atmosphere. ; 3. Animal feed on plant and carbon is incorporated into body tissues (fats, proteins, glycogen) ; 4. Glucose in the animal is used during respiration to release carbon dioxide into the atmosphere. ; 5. Death of animal / plant result in decomposition ; 6. Respiration by decomposers release carbon dioxide into the atmosphere ; 7. Combustion of fossil fuels release carbon dioxide into the atmosphere ; 8. Photosynthesis by green plants remove carbon dioxide from the atmosphere to form glucose / organic matter again ;	[1] [1] [1] [1] [1] [1] [1]	Any 7 points
	(b)	1. Respiration of living organisms, <u>energy is lost as heat</u> to the environment ; 2. Egested/excreted materials/dead organisms/uneaten body parts contain trapped chemical energy ; 3. Living organisms cannot use heat energy to do work / cannot be recycled ;	[1] [1] [1]	

KIASU ExamPaper

ZHONGHUA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2018

SECONDARY 4E

Candidate's Name	Class	Register Number
	4E4	

BIOLOGY **6093 /01**

14 September 2018
1 hour

Additional Materials: OTAS

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, index number and class on the OTAS in the spaces provided.

There are **forty** 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.

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.

Setter: Ms Rozianna & Mr Goh Tze Mian
Vetter: Mr Tan Li Chun

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Section A

Answer **all** the questions in the OTAS.

1 Which structures are present in a root hair cell?

	nucleus	chloroplast
A	✓	✓
B	✓	×
C	×	✓
D	×	×

key
✓ = present
× = absent

2 Pancreatic tissue from a freshly killed mouse was removed. It was placed in a warm isotonic saline solution and radioactively labelled amino acids were added. Samples of the tissue were later removed, sections cut and the sites of radioactivity determined at regular intervals.

Which of the following represents the order in which radioactivity appeared in the organelles?

A Golgi apparatus, rough endoplasmic reticulum, secretory vesicles

B Golgi apparatus, rough endoplasmic reticulum, smooth endoplasmic reticulum

C rough endoplasmic reticulum, Golgi apparatus, secretory vesicles

D rough endoplasmic reticulum, smooth endoplasmic reticulum, Golgi apparatus

3 A student created the setup shown below.

However, he forgot all about it and left the setup overnight.

Which of the following correctly states the appearance of the potato tuber after 12 hours?

A The bottom half would be flaccid while the top half will be turgid.

B The bottom half would be turgid while the top half will be flaccid.

C It would have uniform turgidity.

D It cannot be inferred from the given data.

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4 The diagram shows three plant cells labelled P, Q and R. The arrows show the direction of net movement of water molecules by osmosis.

What is the correct order of salt concentration in the cells, from the highest to the lowest?

	highest	middle	lowest
A	P	Q	R
B	P	R	Q
C	Q	P	R
D	R	P	Q

5 The diagram represents how an enzyme molecule changes in shape.

What explains this change?

A It has been placed in a concentrated salt solution.

B It has been placed in a dilute salt solution.

C It has been heated to 70°C.

D It has been cooled to 5°C.

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6 A student had samples of four types of biological molecules – water, carbohydrates, proteins and fats. 100g of each sample was added to a calorimeter and the temperature change of the water as a result of the combustion of the sample was recorded in the table below.

Which of the samples contained fat?

sample	temperature change /°C
A	0
B	25
C	37
D	70

7 What is the enzyme that controls a reaction in which both the enzyme and the substrate can denature at high temperatures?

A amylase

B insulin

C lipase

D protease

8 As a seed begins to germinate, it uses enzymes to speed up the rate of

A digestion.

B osmosis.

C photosynthesis.

D transpiration.

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9 The diagram below shows the structure of a leaf of a dicotyledonous plant.

What are the functions of the parts labelled on the diagram?

	1	2	3	4
A	gaseous exchange	photosynthesis	reducing evaporation	transport
B	photosynthesis	gaseous exchange	transport	reducing evaporation
C	photosynthesis	reducing evaporation	gaseous exchange	transport
D	transport	reducing evaporation	gaseous exchange	photosynthesis

10 Bread contains dietary fibre, fat, protein and starch.

Which substance contributes least to the energy obtained by a person eating the bread?

A dietary fibre

B fat

C protein

D starch

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11 Which of the following would not be an expected consequence of the removal of the pancreas?

A diabetes

B increased pH of the duodenum

C reduced protein digestion

D reduced glycogen production in liver and muscle cells

12 The diagrams show a plant in a flask of water. It is left for six hours on a warm and windy day in bright sunshine.

Which process explains the result shown in diagram 2?

A active transport of water into the root hairs

B evaporation of water from the flask

C photosynthesis in the leaves of the plant

D transpiration from the leaves of the plant

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13 The diagram shows a transverse section from the middle of a root of a dicotyledonous plant.

In which tissue are sugars and amino acids transported?

14 Which of the following would be consequence(s) of a leaky bicuspid valve?

1 A heart attack would occur.
2 There would be reduced blood pressure in the aorta.
3 The heart would stop beating.
4 The blood leaving the aorta would be less oxygenated.

A 2 only
B 2 and 4
C 1, 2 and 3
D 1, 2, 3 and 4

15 There is a ring of muscle at the origin of a blood capillary network found near the skin.

Which of the following statements related to this ring of muscles is true?

A When constricted, it will increase blood flow in the capillary network.

B When constricted, it will not affect the blood pressure in the capillary network.

C When dilated, it can cause the skin to turn redder.

D When dilated, it will increase the blood pressure in the preceding arteriole.

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16 The table shows features of some blood vessels.

Which is the pulmonary artery?

	feature			
	muscle layer	lumen	direction of blood flow	blood
A	thick	narrow	away from the heart	deoxygenated
B	thick	wide	away from the heart	oxygenated
C	thin	narrow	towards the heart	oxygenated
D	thin	wide	towards the heart	deoxygenated

17 The graph shows how the pressure and volume inside the lungs change during one complete breath.

At which point are the muscles of the diaphragm starting to contract?

18 What causes emphysema?

A blockage of the bronchioles

B destruction of the alveolar walls

C inflammation of the walls of the airways

D overproduction of mucus

19 Uric acid is a human metabolic waste product.

Which of the following correctly explains the presence of uric acid in the body?

A It is absorbed from consumed food.

B It is produced in the breakdown of DNA.

C It is produced in the breakdown of excess amino acids.

D It is produced by bacteria found in the large intestine.

20 How is sweat different from urine?

A The production of urine is continuous but that of sweat is not.

B Sweat is always more concentrated than urine.

C Sweat is always more dilute than urine.

D More urea is excreted in urine than sweat.

21 A logistics officer spent twenty minutes in a walk-in freezer to check on the condition of frozen food products. Some changes occurred in the officer's body in response to the decrease in environmental temperature and are listed as follows:

1 brain sends impulses

2 blood vessels in the skin constrict

3 skin temperature changes

4 temperature receptors in the skin detect change

What is the correct sequence of events that took place?

A 2 → 1 → 4 → 3

B 3 → 1 → 4 → 2

C 4 → 1 → 2 → 3

D 4 → 2 → 1 → 3

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22 The table shows the blood flow through the skin, heart muscle and kidneys at rest and during exercise.

region	blood flow / cm^3 per min	
	at rest	during exercise
skin	340	980
heart muscle	190	835
kidneys	930	347

Which of the following statement correctly explains the data in the table?

A The blood flow to the skin is increased during exercise so that the skeletal muscles will receive more oxygen and glucose to sustain aerobic respiration.

B The blood flow to the kidneys is reduced during exercise because sweat is being lost and so the removal of water and nitrogenous waste products can be reduced.

C The blood flow to the heart muscle is increased to pump more oxygenated blood and glucose to the skeletal muscles.

D The blood flow to the kidneys is lower than the skin and heart muscle during vigorous exercise because blood pressure is low.

23 Which of the following does not describe the peripheral nervous system?

A It consists of cranial and spinal nerves.

B It helps in the maintenance of body temperature.

C It sends nerve impulses to and from the central nervous system.

D It is capable of processing stimuli to bring about a reflex action.

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24 The diagram shows the relationship between two organs and the responses they bring about in the body.

If the response of the target organ is controlled by negative feedback, the product of the endocrine gland

A inhibits the target organ with no effect on response.

B stimulates the target organ with no effect on response.

C stimulates the target organ while the response inhibits secretion of the product.

D inhibits the target organ while the response stimulates secretion of the product.

25 A student touched a live electrical wire (with electricity running through it) with his hand and his fist immediately closed. Which of the following best explains this?

A Electricity removed the myelin sheath around his neurones and caused his hand muscles to contract.

B His pain receptors were stimulated and his fist closing was the result of a reflex action.

C Motor neurones were stimulated by the electricity and caused the contraction of his hand muscles.

D The electricity stimulated his heat receptors and the dilation of skin arterioles, causing his fist to close.

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26 The diagram shows the distribution of blood vessels in the uterine lining and placenta of a pregnant woman.

Which substance will increase in concentration in the blood as it flows from 1 to 2?

A amino acids

B carbon dioxide

C glucose

D oxygen

Questions **27** and **28** refer to the photomicrograph showing an event taking place in the oviduct.

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27 The graph shows changes in the uterine lining of a woman from 8th June to 9th July.

Which date will the event in the above photomicrograph most likely take place?

A 10th June **B** 14th June

C 22nd June **D** 30th June

28 Which comparison between cells **P** and **Q** is correct?

A Cells **P** and **Q** can undergo meiotic cell division.

B Cell **P** has a higher concentration of mitochondria than cell **Q**.

C Cell **P** has a smaller number of chromosomes than cell **Q**.

D Cells **P** and **Q** may contain either X or Y chromosomes.

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29 The primrose, *Primula vulgaris*, is a small herbaceous, yellow flowered plant which is common in cooler areas of the Northern hemisphere including alpine and Artic areas. The flowers of the primrose have different flower shapes (polymorphic), which are adaptions for pollination. 'Thrum-eyed' primroses have a short style. 'Pin-eyed' primroses have a much longer styles. Some populations of primrose consist almost entirely of plants with intermediate flowers. These populations are common where there are fewer winged insects.

The diagrams show polymorphic flowers of primroses.

Which of these statements are correct?

1 Cross-pollination will be favoured in pin-eyed primrose.

2 Self-pollination is more likely to occur with intermediate flowers.

3 Primroses with pin-eyed flowers are likely to show more genetic diversity than primroses with intermediate flowers.

4 Primroses with intermediate flowers are likely to be better able at adapting to varying environmental conditions than pin-eyed and thrum-eyed primroses.

A 1 and 2

B 1, 2 and 3

C 2 and 3

D all of the above

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30 The diagrams show four different stages of a type of cell division.

In which structure will the cell division shown above, will occur the slowest?

A in the anther sac

B in the bone marrow

C in mature cells of a petal

D in the root cap

31 The diagram represents the nucleus of a cell (where 2n = 4) in late prophase of meiosis.

Which diagram represents a cell of the same species in anaphase II of meiosis?

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32 The table shows the percentage of nucleotides found in an octopus and a starfish.

source of DNA	adenine / %	cytosine / %	guanine / %	thymine / %
octopus	28	22	22	28
starfish	28	22	22	28

Which best explains why these two animals differ greatly in their physical characteristics?

A Different amino acids are used to produce different proteins in both animals.

B Deoxyribose is used in DNA of the octopus but ribose is used in the DNA of starfish.

C The two animals follow different base pairing rules in their DNA strands.

D The DNA sequences in both animals are different, thus code for different proteins in their bodies.

33 Below is a sequence of bases on a messenger RNA molecule.

AUCGAAGUUCGU

It was transcribed from the template strand of a DNA molecule.

What is the sequence of bases on this template strand of DNA?

A TGATGGACCTTG

B ATCGAAGTTCGT

C TAGCTTCAAGCA

D UGCUUGAAGCUA

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34 In each of the pedigree trees shown below, persons with a genetic disease are indicated by shaded boxes.

Which pedigree tree shows an inherited genetic disease as a recessive trait?

35 Sickle-cell anaemia is a disease caused by recessive alleles that results in fatality during adolescence.

If two sickle-cell carriers mate, what percentage of adults would be homozygous?

A 25% **B** 33%

C 50% **D** 75%

36 Cats have the same inheritance pattern as humans in sex determination. In addition, the gene for cat coat colour lies on the X-chromosome. The allele for orange fur is X^O while the allele for black fur is X. Cats with heterozygous genotype have tortoise-shell coat colour (patches of orange and black).

With reference to monohybrid inheritance and sex determination, which offspring cannot be produced when a tortoise-shell female cat is mated with an orange male cat?

A black female

B orange female

C orange male

D tortoise-shell female

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37 The diagram shows a pyramid of numbers.

Which food chain is best represented by this pyramid of numbers?

A grass → antelope → lion → flea

B mahogany tree → caterpillar → finch → lice

C microscopic plants → microscopic animals → small fish → shark

D pond plant → snail → large beetle → fish

38 Which statements about evolution are correct?

1 Phenotypic variation must be present for evolution to take place.
2 Selective breeding and natural selection do not take place at the same time.
3 A change in environmental conditions promotes evolution.
4 Artificial selection caused the removal of harmful mutations during evolution.

A 1 and 2

B 1 and 3

C 2 and 4

D 3 and 4

39 The graph shows changes in part of a lake after it has been polluted by fertilizer discharge from a nearby farm. At which time will the oxygen concentration in the water be lowest?

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40 The diagram shows how sewage is treated before it is released into water bodies.

Which correctly identifies **W**, **X**, **Y** and **Z**?

	W	X	Y	Z
A	sludge	microbes	oxygen	carbon dioxide
B	sludge	sewage	chlorine	microbes
C	grit and coarse materials	sludge	glucose	methane
D	grit and coarse materials	sludge	microbes	sludge

End of paper

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ZHONGHUA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2018

SECONDARY 4E

Candidate's Name	Class	Register Number
	4E4	

BIOLOGY **6093 /02**

13 September 2018
1 hour 45 minutes

Additional Materials: NIL

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

Answer **all** questions.

Write your answers in the spaces provided on the question paper

Section B

Answer all **three** questions, the last question is in the form either/or.

Write your answers on the separate answer papers provided.

You are advised to spend no longer than one hour on **Section A** and no longer than 45 minutes on **Section B**.

At the end of the examination, fasten all your work securely together.

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

All essential working must be shown clearly.

For Examiner's Use	
Section A	50
B9	10
B10	10
B11	10
Total	80

Setter: Ms Rozianna & Mr Goh Tze Mian
Vetter: Mr Tan Li Chun

This document consists of **18** printed pages, including this cover page.

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Section A

Answer **all** the questions.

Write your answers in the spaces provided on the question paper.

1 A teacher wants to demonstrate the movement of substances. He placed two colours of candies (**X** and **Y**) in an alternating pattern along the perimeter of a plate. He then filled the plate with water. The final setup is shown in Fig. 1.1.

Fig. 1.1

The result of the experiment after 10 minutes is shown in Fig. 1.2.

Fig. 1.2

(a) Describe what had happened to cause the colours from the candies to form a pattern in the water.

.....

.....

.....

..... [2]

Total marks:	

A student suggested to add hot water instead so that the pattern formation occurs faster by *active transport*, since hot water has more energy than room temperature water.

(b) Explain why the student's explanation of *active transport* is incorrect.

.....

.....

.....

..... [2]

The teacher then created a more elaborate setup as shown in Fig. 1.3. He then let the experiment run for 10 minutes.

Fig. 1.3

(c) Draw arrows from the labelled candies (**X** and **Y**) on Fig. 1.3, to show the net movements of the colour molecules throughout the experiment. [1]

Total marks:	

2 Fig. 2.1 shows a plant called the ghost plant. It is called a ghost plant because it is often completely white in colour.

Fig. 2.1

The ghost plant has an unusual feeding relationship with an underground fungus and with a nearby tree, as shown in Fig. 2.2

Fig. 2.2

Total marks:	

(a) The flow of nutrients in the feeding relationship is shown by the arrow on Fig. 2.2.

Suggest one nutrient that flows from the tree to the ghost plant.

..... [1]

(b) Suggest why the leaves of the ghost plant do not possess stomata or large intercellular spaces.

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..... [4]

3 Table 3.1 shows the loss of water vapour by two similarly-sized potted plants, A and B, grown in the same environment over a period of 14 hours.

Table 3.1

time of day / hours	water vapour loss / arbitrary units	
	plant A	Plant B
06.00 – 08.00	1.0	5.2
08.00 – 10.00	2.0	13.8
10.00 – 12.00	5.8	14.8
12.00 – 14.00	4.8	9.2
14.00 – 16.00	3.6	6.8
16.00 – 18.00	3.0	4.4
18.00 – 20.00	2.0	1.0

Total marks:	

(a) Suggest reasons for each of the following:

(i) the difference between the total amount of water vapour lost by plants A and B during the 14-hour period,

.....

.....

.....

..... [2]

(ii) the change in rate of water vapour loss by plant A from 06.00 hours to 12.00 hours.

.....

..... [1]

(b) The leaves of plant B have their lowest temperature at 12.00 hours.

Suggest reasons for this.

.....

.....

.....

..... [2]

4 Fig. 4.1 shows a kidney and its associated structures. The arrows show the direction of flow of fluids in these structures.

Fig. 4.1

Total marks:	

(a) Table 4.1 shows the relative concentrations of various substances in structures **C** and **D**.

Complete the table to show the possible concentrations of these substances in structure **E**.

Table 4.1

substance	relative concentration in structure		
	C	**D**	**E**
amino acids	0.00	0.05	
glucose	0.00	0.10	
mineral ions	1.50	0.72	
proteins	0.00	8.00	
urea	2.00	0.03	

[5]

(b) Explain how the relative concentrations of glucose might change in structures **C**, **D** and **E** in a person with diabetes.

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..... [3]

Total marks:	

5 Fig. 5.1 shows a horizontal section of the human eye and the pathway taken by light rays as they leave an object.

Fig. 5.1

(a) Complete the diagram by continuing the lines from the object to show how the light rays produce a focused image on the retina. [2]

(b) **(i)** State how the appearance of the pupil in the eye will change when a person moves from an area of dim light into an area of bright light.

..... [1]

(ii) Explain how this change is brought about by the structures in the eye.

.....

.....

..... [1]

(c) The change in appearance of the pupil when entering an area of bright light is a reflex action.

(i) Define *reflex action*.

.....

.....

..... [2]

Total marks:	

(ii) Suggest why one should avoid consuming drugs that prevent this reflex action from occurring.

.....

.....

..... [2]

6 Fig. 6.1 shows a pair of chromosomes during meiosis in a cell in the human testis. The positions of the alleles of some genes are indicated.

Fig. 6.1

(a) Deduce, with reasons, whether the chromosomes are

(i) autosomes or sex chromosomes

.....

.....

.....

.....

(ii) homologous or non-homologous

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..... [4]

(b) State the cell division stage that this cell is undergoing.

..... [1]

Total marks:	

(c) At the end of meiosis, each of the chromatids in Fig. 6.1 will be in a different haploid cell.

Fig. 6.2 represents the chromatids inside the haploid cells.

Determine the combinations of alleles that would be present on each chromatid by indicating the gene sequence in Fig. 6.2.

Fig. 6.2

[2]

7 Fig. 7.1 shows a family tree and the blood groups of each individual.

Fig. 7.1

(a) During a blood transfusion in humans, blood group O is considered universal donor. Explain why there is no agglutination in the recipient with blood group AB despite the presence of both antibodies a and b in blood group O.

.....

..... [1]

(b) State the number of heterozygous individuals in generation II.

..... [1]

Total marks:	

(c) Is it possible for individuals 6 and 7 to have produced an offspring with blood type O? Construct a full genetic diagram in the space below to justify your answer.

[4]

8 An experiment was conducted to study the feeding relationships between four different species, **P**, **Q**, **R** and **S**. The organisms were separated into four different groups and placed into three covered containers.

Table 8.1 shows the contents of these containers at the beginning of the experiment and at the end of two weeks.

Table 8.1

container	contents at the beginning	contents after two weeks
I	**P**	disappeared
	R	unchanged
	S	unchanged
II	**R**	disappeared
	Q	unchanged
	S	unchanged
III	**P**	unchanged
	Q	dead
	S	disappeared

Total marks:	

(a) Explain the following

(i) the disappearance of species **P** in container **I** and

.....

..... [1]

(ii) the death of species **Q** in bottle **III**.

.....

..... [1]

(b) **(i)** Construct a food chain to show the feeding relationship of the four species of organisms.

..... [1]

(ii) Which species in the food chain will get the least energy? Explain your answer.

.....

.....

.....

..... [2]

(c) Predict what would happen if all four species were placed into one container.

.....

..... [1]

Total marks:	

Section B

Answer all **three** questions, the last question is in the form **EITHER** / **OR**.

Write your answers in the spaces provided.

9 Peas and beans belong to the same plant group, legumes. Seeds of legumes are known to contain protein.

(a) **(i)** Describe a practical test you could carry out on a fresh pea seed to show it contains protein.

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..... [3]

(ii) Describe an investigation you could carry out using this test to compare the protein content of fresh pea seeds and fresh bean seeds.

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..... [3]

Total marks:	

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Seeds of legumes are known to contain higher levels of protein than any other food plants. Table 9.1 shows the approximate masses of protein found in 100 g masses of some fruits and vegetables.

Table 9.1

type of fruit or vegetable	carrot	lentil	pea	potato	soya bean	tomato
mass of protein in g / 100g	1.0	23.5	19.0	5.0	22.0	1.5

(b) **(i)** Draw a bar chart on the grid below to show the protein content of these foods.

[3]

(ii) Of the types of fruits and vegetables named in Table 9.1, suggest which are legumes.

..... [1]

Total marks:	

10 **(a)** Compare and contrast gaseous exchange in humans and plants.

[3]

(b) Explain why the respiration rate of humans is relatively high and constant, while that of plants may vary widely.

[7]

Total marks:	

EITHER

11 Fig 11.1 shows the flow of energy through a part of the carbon cycle.

Fig. 11.1

(a) Describe how energy flows through this part of the carbon cycle with reference to what happens at each of the points **A** to **F**.

.....

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..... [7]

Total marks:	

(b) Describe the harm to the environment as a result of human activities at points **D**, **E** and **F**.

.....

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..... [3]

OR

11 **(a)** In the past, insulin for insulin-deficient patients is extracted from the pancreas of slaughtered cattle and pigs.

In the recent years, human insulin can be produced via the insertion of appropriate genes into microorganism.

Describe how this process is carried out through the use of genetic engineering techniques.

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..... [5]

Total marks:	

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(b) Discuss the advantages and disadvantages of such genetic engineering procedures as compared to the traditional method.

.....

.....

.....

.....

..... [3]

(c) State two other applications of genetic engineering.

.....

.....

..... [2]

End of paper

Total marks:	

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ZHONGHUA SECONDARY SCHOOL
2018 PRELIM EXAMINATION
Secondary 4E Biology

PAPER 1 [40 marks]

1.	B	6.	D	11.	B	16.	A	21.	C	26.	B	31.	C	36.	A
2.	C	7.	D	12.	D	17.	A	22.	C	27.	C	32.	D	37.	A
3.	C	8.	A	13.	B	18.	B	23.	D	28.	B	33.	C	38.	B
4.	D	9.	A	14.	A	19.	B	24.	C	29.	B	34.	D	39.	D
5.	C	10.	A	15.	C	20.	D	25.	C	30.	C	35.	B	40.	D

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ZHONGHUA SECONDARY SCHOOL
2018 PRELIM EXAMINATION
Secondary 4E Biology
PAPER 2 Section A [50 marks]

Qn	Solutions	Marks	Remarks
1a	**Pigment / Colour molecules/particles** dissolved in the water Net movement of molecules from candies to centre of plate via **diffusion**	1 1	A few answers did not include "molecule". Many answers did not include net movement.
1b	Active transport requires a layer of **living cells** which uses **energy released from respiration.**	1 1	Some still have misconception that respiration "produces" energy.
1c	 Candy **X** – all around Candy **Y** – to the sides and towards candy X	1m for correct arrows	

448

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2a	carbohydrate / sucrose / glucose / sugar ; amino acids ; mineral salts / ions / nitrate ;	Any 1	
2b	1. no chlorophyll ; 2. no photosynthesis ; 3. **carbohydrates** obtained from other organism / cannot make carbohydrates 4. no CO2 requirement ; 5. reduced need for gas diffusion / gas exchange ; 6. ref. reduced / no transpiration / description ;	Max 4	Green colour comes from the pigment, chlorophyll and not chloroplast. Weaker answers just had "food", instead of specifying the nutrient. *Common answers*

449

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3ai	1 plants may be of different species ; 2 plant B + more / fast(er) transpiration ; 3 plant B + more / big(ger) leaves ; 4 plant B + more stomata / pores / guard cells OR stomata bigger / wider AW ; 5 plant B + better / big(ger) root system / absorbs more water ; 6 plant B + thin(ner) (waxy) cuticle ; 7 plant A + sunken stomata / hairy leaves ;	Max 2	
3aii	1 increased + light (intensity) ; 2 increased + temperature / heat ; 3 reference to wind OR increased + air movement ; 4 decreased + humidity ; 5 stomata / pores / guard cells + open /wider ;	Max 1	
3b	highest / fastest rate of transpiration / evaporation ~~(with) reference to previous 4 hours / between 8:00–12:00 / from 8:00~~ ; (evaporation) cools (plant /leaves) / removes latent heat / temperature falls ;	1 1	Weaker answers did not link amount of water vapour loss to rate of transpiration / evaporation.

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4a	(amino acids) 0.05 ; (glucose) 0.10 to 0.15 ; (mineral ions) 0.72 to 2.22 ; (proteins) 8.00 ; (urea) 0.03 to 2.03 ;	1 1 1 1 1	
4b	C would contain some / more / high (glucose) / D would contain more / high (glucose) / E would contain more / high (glucose) ; lack of Insulin ; glucose would not be converted into glycogen ; kidney unable to/doesn't reabsorb all glucose ;	Max 3	In summary, **C, D and E have more glucose**. *not often seen*

5a	Rays continue to be parallel until it hits cornea Rays converge at cornea and lens Rays **meet before retina** and continues to hit on retina	½ ½ 1	Weaker answers had rays meeting **on** the retina.
5bi	pupil narrows / decreases in diameter / constricts (Reject contracts)	1	
5bii	**Circular muscles on iris** contract	1	
5ci	A fast / rapid / **immediate** response or reaction to a stimulus Automatic / **involuntary** / no involvement of conscious thought / cannot be controlled [Reject no involvement of the brain]	1 1	

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5cii	Too much light enters the inner part of eye Damage photoreceptors / rods / cones on the retina	1 1	
6ai	Autosomes Both chromosomes are of the same length/size ; OR As it belongs to a male organism, sex chromosomes X and Y have different length /size ;	1 1	
6aii	Homologous; Paired to form bivalent / crossing over between chromosomes ; OR Same gene sequence / same size and shape ;	1 1	
6b	Prophase I	1	

6c	ABC, abc, Abc, aBC	0.5m each	
7a	The antibodies a, b from the donor will be diluted by the high volume of plasma from the recipient.	1	Weaker answers had misconception that agglutination is dependent only on antibodies of recipient + antigen of donor.
7b	6	1	Many students indicated “5”.

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7c	Parental phenotype: A x B Parental genotype: I^AI^O x I^BI^O Gametes **(circled):** I^A I^O I^B I^O Random fertilization: Offspring genotype: I^AI^B I^AI^O I^BI^O I^OI^O Offspring phenotype: AB A B O **There is a** 25% **chance** of the couple having a child with blood group O	1 1 1 1	

8ai	P was eaten up by R	1	
8aii	Species R (source of food) was not available for Q	1	
8bi	S → P → R → Q	1	ECF allowed if evidence shown in ai and aii
8bii	Q; 90% of the energy is lost at every trophic level of the food chain / 10% of the energy is transferred from one trophic level to another;	1 1	
8c	Only species Q will exist in the bottle, while species S, P and R will disappear as there is no predator for Q present in the bottle;	1	

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9ai	seed ground / cut up /crushed ; add biuret solution / sodium or potassium hydroxide + copper sulphate; blue changes to purple/lilac/mauve/violet;	1 1 1	Biuret's = wrong
9aii	**same mass**/volume of each tissue tested ; **same volume**/concentration of reagent added ; left for **same length of time**; deeper/ darker colour = more protein ORA;	Any 2 1	This question is poorly done. Very few answers had the first 2 marks. Many students used "number of drops of Biuret solution" to deduce concentration of protein, which is wrong as the colour change is gradual.

9bi	1. axes fully labelled + linear scale for mass; 2. correct 'plots'; 3. sides of bars ruled + of equal width + space between each bar;	1 1 1	Best scale → 2cm = 5 Any wrong plots = 0m
9bii	pea + (soya) bean + lentil;	1	

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10a	**Compare (similarities)** same gases exchanged – CO_2, O_2 and water vapour ; both require a thin film of moisture to dissolve gases ; gas exchange moves by diffusion ; **Contrast (differences)** muscles in humans / no muscles in plants ; ref. intercostals / diaphragm ; humans need to keep (constant) supply of O_2 (to blood) / remove CO_2 (from blood) / ref. higher metabolic rate / rate of respiration in humans ; ref. production of (some of their own) oxygen by photosynthesis ; lungs / no lungs ; ref. stomata/spongy mesophyll in plants / not in humans / ref. alveoli in humans / no alveoli in plants ; stomata compared to mouth/nose ; intracellular spaces compared to lungs / alveoli ;	Max 3	Answers must have at least one similarity and one difference.

455

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10b	**(High respiration rate)** humans active / move / muscle N action (or described) / ORA ; requires large quantities of / more N energy / ORA ; high body temperature in humans / ORA ; activity of enzymes / high metabolic rate / ORA ; humans complex / named organs, e.g. brain, kidneys, heart ; **(Constant respiration rate)** homeostasis ; temperature constant in humans / thermoregulation ; rate dependent on external temperature in plants ; rate dependent on stage of life cycle, e.g. germination / growing season ;	4m 3m	R humans are larger This question was very poorly done. Common misconceptions: • breathing rate = respiration rate • photosynthesis can take over the role of respiration • photosynthesis happens in the day and respiration happens only at night

E11a	A – Sun releases light energy B – Light energy is absorbed by chlorophyll by trees / plants B – during photosynthesis to produce organic compounds (carbohydrates) B – light energy transformed into chemical energy C – death of the trees and buried in ground at high pressure	1 1 1 1 1	

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	D – decomposition of remains of trees leading to formation of fossil fuels E – fossil fuel / coal burned in industries / factories F – release of carbon dioxide into atmosphere	1 1 1 max 7	
E11b	D – mining of fossil fuels resulting in depletion of resources / scarring of countryside / damaging habitats [Reject: soil erosion] E and F – combustion of fossil fuels in factories releases oxides of sulfur or oxides of nitrogen resulting in acid rain E and F – combustion of fossil fuels releases carbon dioxide, leading to greenhouse effect	1 1 1	
O11a	Use **restriction enzyme** to cut gene that codes for insulin production in human to **create sticky ends** Use **same restriction enzyme** to cut bacterial **plasmid** to create complementary sticky ends as well Use **DNA ligase** to insert gene of interest into plasmid and join them up Use **heat or electric shock to increase permeability** of bacterial membrane to recombinant plasmid Once inserted into bacterial cell, plasmid replicates when bacterial cell replicates, producing new insulin Use of **fermenter to reproduce bacteria**	1 1 1 1 1 1 1 Max 5	*seldom mentioned*

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O11b	**Advantages** Mass production of desired proteins is possible ; Risk of disease transmission from cattle or pigs is eliminated ; elimination of hindrance of use due to religious reasons ; Desirable traits can be selected and replicated in offspring ; Cheaper to mass produce ; **Disadvantages** Risk that wrong gene is altered which may cause cancer ; Genetic manipulation may pose yet unknown health risks to recipient ; Expensive to engineer ;	Max 3	Answer must contain at least one advantage and one disadvantage.
O11c	Disease-resistant genes can be inserted into plants to increase crop yield/ grow pest- or disease-resistant crops Desirable characteristics of crop can be genetically selected and selectively grown at various times of the year to provide continuous supply to market / grow seasonal crops at any time of the year *Any other logical answers are accepted, like increasing nutritional value of food or increasing growth rate of organism, as long as the example is not too similar to the production of insulin.*	1 1	

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