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FAJAR SECONDARY SCHOOL
2018 PRELIMINARY EXAMINATIONS
SECONDARY 4 EXPRESS/5 NORMAL (ACADEMIC)

CANDIDATE NAME	
CLASS	INDEX NUMBER

SCIENCE (BIOLOGY) 5077/5078
Paper 1 Multiple Choice

Setter: Ms Seah AH
Additional Materials: OTAS Sheet

Date: 13 September 2018
Duration: 1 Hour

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 Question Paper and OTAS Sheet in the spaces provided.

There are **twenty** 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 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 an approved scientific calculator is expected, where appropriate.

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This document consists of **11** printed pages and **1** blank page.

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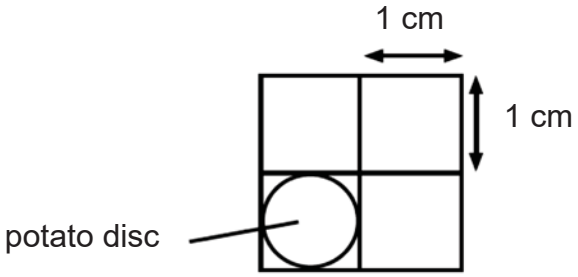
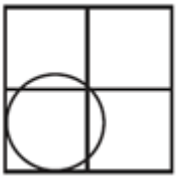
1 The diagram below shows the initial diameter of a potato disc.

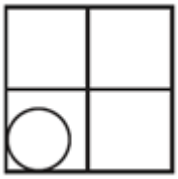


The potato disc was placed in distilled water for one hour.
Which diagram correctly shows the change in the diameter of the potato disc?

A

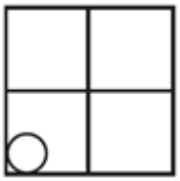


B

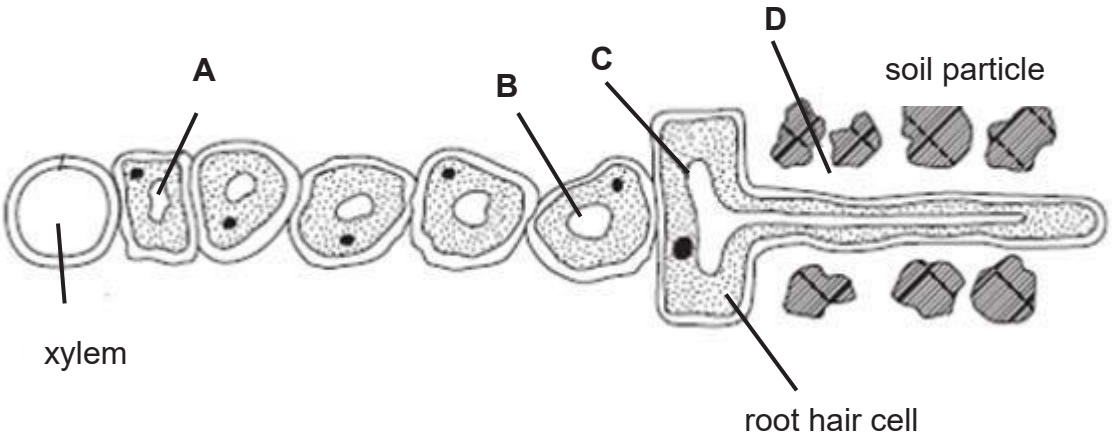


C

D



2 The diagram shows part of a plant root in the soil. The root is absorbing water.
At which labelled point is the water potential highest?



3 A solution gives the following results when tested.

test	observations
biuret test	solution changed from blue to violet
Benedict's test	solution changed from blue to brick red precipitate
iodine solution	solution remained yellow
ethanol emulsion test	solution remained clear

What does the solution contain?

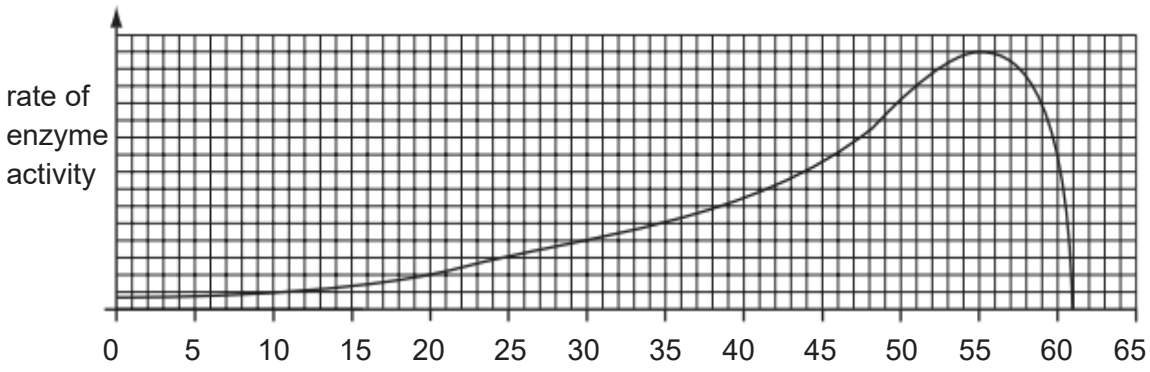
A fat and protein

B protein and reducing sugar

C protein and starch

D reducing sugar and starch

4 The graph shows how temperature affects the rate at which an enzyme works.



What does the graph show about this enzyme?

A The enzyme is denatured by temperatures above 65 °C.

B The enzyme is denatured by temperatures below 8 °C.

C The enzyme works fastest at 55 °C.

D The enzyme works fastest at 61 °C.

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5 Which processes are functions of the liver?

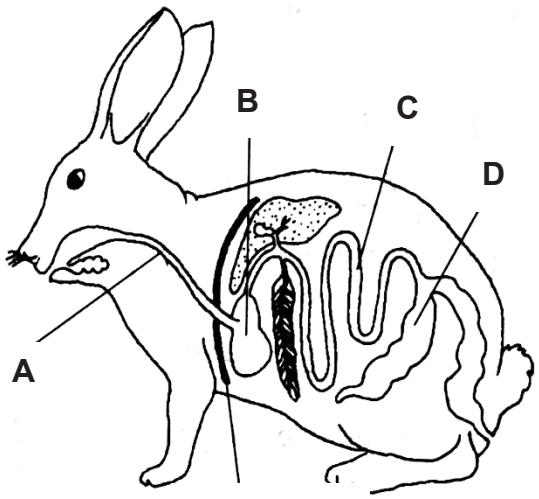
	absorbing food	assimilating food	helping with digestion of food
A	✓	✓	✓
B	✓	✓	×
C	✓	×	✓
D	×	✓	✓

key

✓ = is a function

× = is not a function

6 The diagram shows the digestive system of a rabbit.
In which structure is lipase produced?



7 On a sunny day, how does water vapour move through the stomata of a leaf?

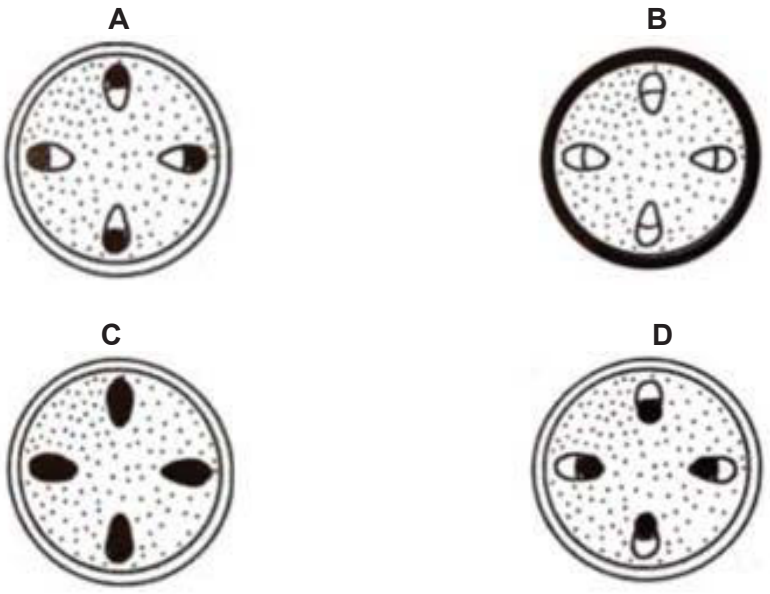
A into the leaf by diffusion

B into the leaf by respiration

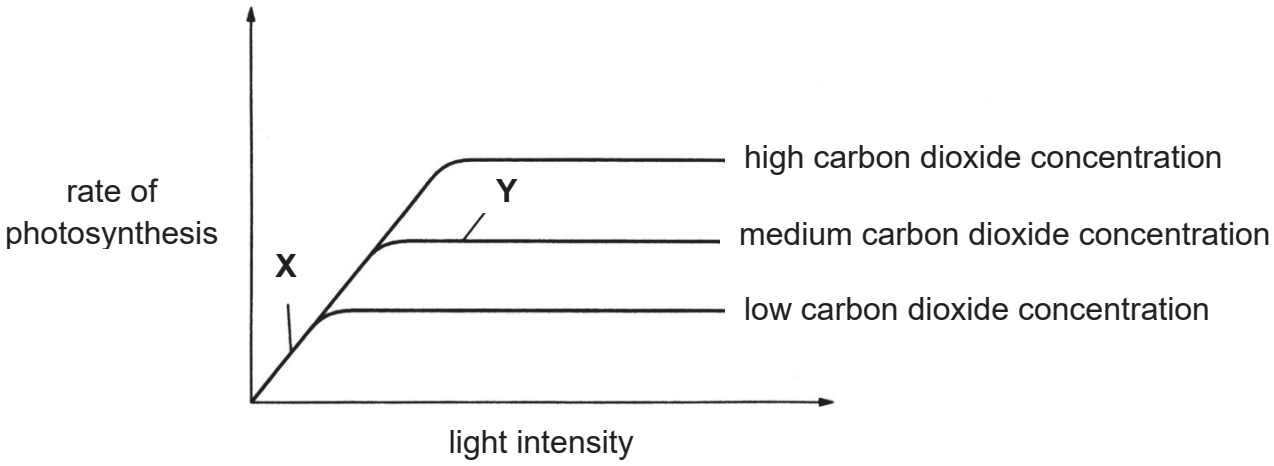
C out of the leaf by diffusion

D out of the leaf by respiration

8 A plant was placed in a bell-jar in a brightly lit area. The air in the bell-jar contains carbon dioxide that has been radioactively labelled.
After an hour, a cross-section of the plant's stem was placed on photogenic film which turns black when exposed to radioactivity.
Which diagram shows the area where the film becomes black?



9 The graph below shows the effect of light intensity on the rate of photosynthesis.



What is the factor that is limiting the rate of photosynthesis at points **X** and **Y**?

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

[Turn over

10 The following statements are the characteristics of blood transported by a blood vessel in the human body.

- High concentration of oxygen
- Low concentration of carbon dioxide
- Low blood pressure

What is this blood vessel?

A aorta

B vena cava

C pulmonary vein

D pulmonary artery

11 After finishing a race, an athlete still continues to breathe more quickly and deeply than normal for several minutes.
Which statement correctly explains this observation?

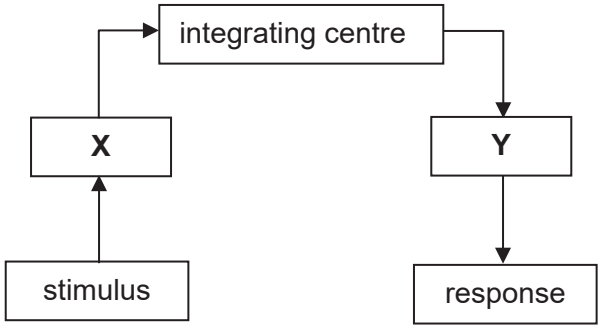
A to remove carbon dioxide produced during anaerobic respiration

B to remove urea produced from the breakdown of amino acids

C to take in extra oxygen to break down lactic acid

D to replace stored glycogen in muscles

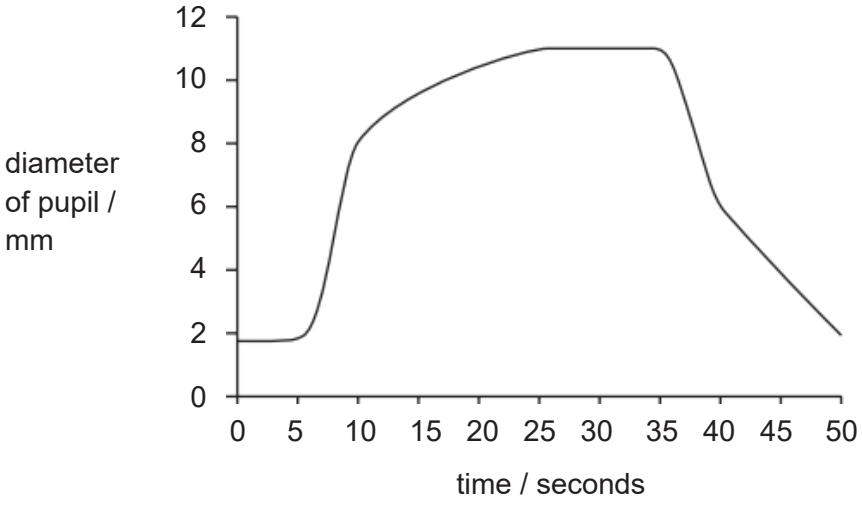
12 The diagram shows the main components involved in coordination and response towards stimulus.



What are represented by **X** and **Y**?

	X	Y
A	effector	receptor
B	receptor	effector
C	brain	spinal cord
D	spinal cord	brain

13 The graph shows the changes in the size of the pupil of the eye as the light intensity of the surroundings is changed.



Which time period shows the light intensity increasing?

A 5 to 10 seconds

B 10 to 15 seconds

C 25 to 35 seconds

D 35 to 40 seconds

[Turn over

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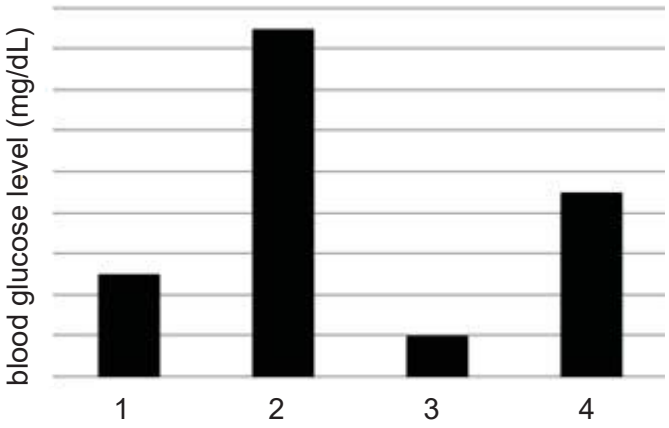
14 Four people had the following descriptions with regards to their body and dietary conditions.

- Normal, has not eaten for 24h
- Normal, before lunch
- Normal, 3h after lunch
- Diabetic, 3h after lunch

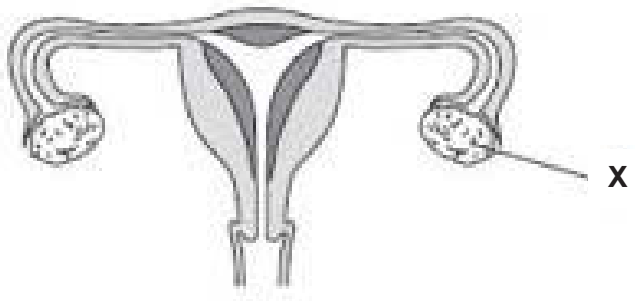
They were then tested for their blood glucose levels.
The graph shows the blood glucose levels of the 4 people.



Which row correctly describes the graph?

	1	2	3	4
A	normal; before lunch	normal; 3 hours after lunch	normal; has not eaten for 24 hours	diabetic; 3 hours after lunch
B	normal; before lunch	diabetic; 3 hours after lunch	normal; has not eaten for 24 hours	normal; 3 hours after lunch
C	normal; has not eaten for 24 hours	diabetic; 3 hours after lunch	normal; before lunch	normal; 3 hours after lunch
D	normal; 3 hours after lunch	diabetic; 3 hours after lunch	normal; has not eaten for 24 hours	normal; before lunch

15 The diagram shows the female reproductive system.



What is the function of the part labelled **X**?

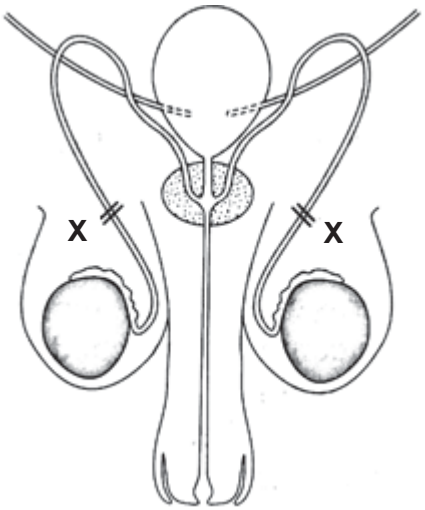
A gamete production and hormone secretion

B gamete production only

C hormone secretion only

D zygote production and hormone secretion

16 What would be the result of cutting the tubes marked **X**?



A Male sex hormones could not reach blood.

B The flow of urine would be prevented.

C The production of sperm would stop.

D The sperm could not be transported out of the urethra.

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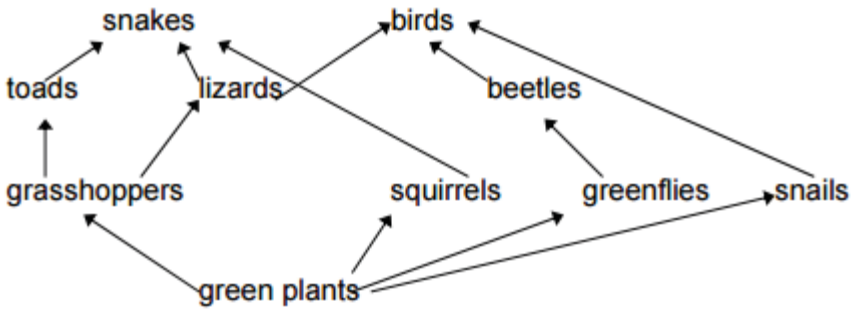
17 A gene of a particular organism contains 29% thymine (T).
Which row would best represent the percentage distribution of the other nucleotides in this gene?

	adenine (A)	cytosine (C)	guanine (G)
A	21 %	29 %	21 %
B	21 %	21 %	29 %
C	29 %	21 %	21 %
D	29 %	21 %	29 %

18 The diagram shows a food web in a woodland.



In this food web, a lizard is _____.

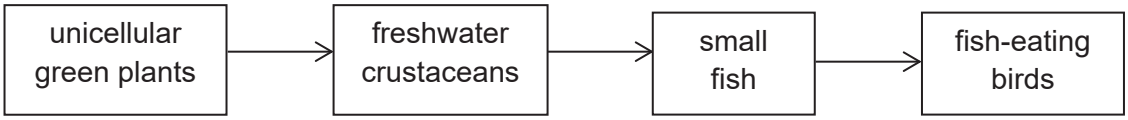
A a carnivore

B a decomposer

C a herbivore

D a producer

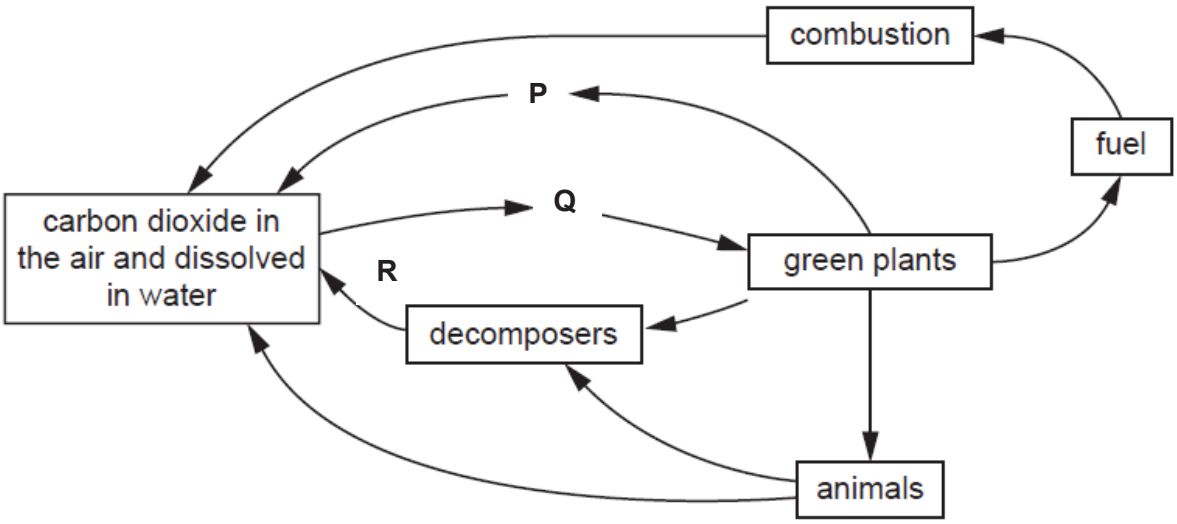
19 A farmer sprays insecticide on his crops for a year. The insecticide washes off into a lake where it is absorbed by the producer to enter the food chain.



Which row correctly represents the levels of insecticide in these organisms at the end of the year?
ppm = parts per million

	unicellular green plants / ppm	freshwater crustaceans / ppm	small fish / ppm	fish-eating birds / ppm
A	0.05	0.5	0.05	0.05
B	0.05	0.05	0.05	0.05
C	0.05	0.5	5.0	25.0
D	25.0	5.0	0.5	0.05

20 The diagram shows the carbon cycle.



What are processes **P**, **Q**, and **R**?

	P	**Q**	**R**
A	photosynthesis	photosynthesis	respiration
B	respiration	respiration	photosynthesis
C	photosynthesis	respiration	photosynthesis
D	respiration	photosynthesis	respiration

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FAJAR SECONDARY SCHOOL
2018 PRELIMINARY EXAMINATIONS
SECONDARY 4 EXPRESS/5 NORMAL (ACADEMIC)

CANDIDATE NAME							
CLASS				INDEX NUMBER			

SCIENCE (BIOLOGY) 5077/5078
Paper 4
Setter: Ms Seah AH Date: 29 August 2018
No Additional Materials Required Duration: 1 hour 15 minutes

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.
You may use pencil for any diagrams, graphs, tables 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 **two out of three** questions.
Write your answers in the spaces provided on the question paper.

In calculations, you should show all steps in your working, giving your answer at each stage.
The number of marks is given in brackets [ ] at the end of each question or part question.

Electronic calculators can be used in this paper.
The total of the marks for this paper is 65.

For Examiner's Use	
Paper 1	20
Paper 4	
Section A	45
Section B	20
Total	85

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Paper 4
Section A [45 marks]

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

1 Fig 1.1 shows a cell from the palisade mesophyll layer of a leaf.

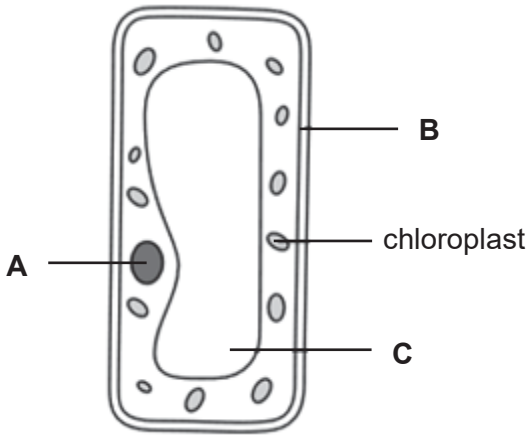

Fig. 1.1

(a) Name the structures labelled **A**, **B** and **C**.

A ……

B ……

C …… [3]

(b) Name the process carried out by the chloroplasts and explain why all animal cells depend on this process.

name of process ……

explanation ……

…… [2]

(c) Suggest one link between the functions of chloroplasts and the function of mitochondria.

……..

……..

…….. [2]

[Turn over

For Examiner's Use

(d) State one difference you would expect to see between this plant cell and

(i) a root hair cell,

……..

…….. [1]

(ii) a xylem cell.

……..

…….. [1]

[Total: 9]

[Turn over

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2 Fig. 2.1 shows a mammalian heart with glass tubes, **X** and **Y**, securely attached to the vena cava and the pulmonary artery.

Water was poured into tube **X**, and rose up tube **Y** until both tubes were filled to the level shown.

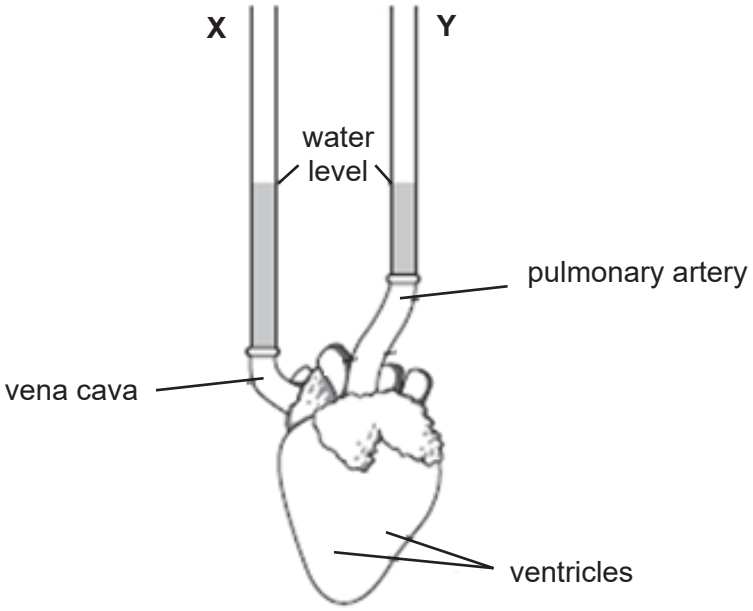

Fig. 2.1

(a) When water was poured into tube **X**, two chambers in the heart were filled with water. Name these two chambers.

1 ……..

2 …….. [2]

(b) The ventricles were squeezed once by hand.

Suggest what would happen to the level of water in tube **X** and in tube **Y** when the ventricles were squeezed.

X ……

Y …… [1]

[Turn over

For Examiner's Use

(c) Fig. 2.2 shows the contraction and relaxation of the atria and ventricles during several heartbeats.
Each square represents a time of 0.1 second.

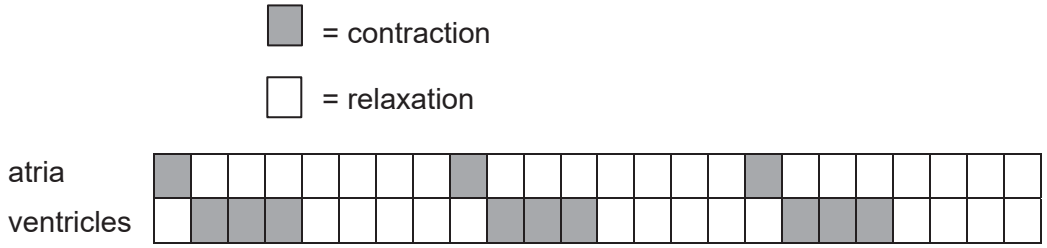

Fig. 2.2

(i) For how long do the ventricles contract during one heartbeat?

…….. second [1]

(ii) How many heartbeats does the diagram show?

……..… heartbeats [1]

(iii) During exercise, the rate of blood flow to the heart muscles increase.
Explain the advantage of this increase in the rate of blood flow.

……..

……..

…….. [2]

[Total: 7]

[Turn over

For Examiner's Use

3 Fig. 3.1 shows changes in the hormones oestrogen and progesterone during a woman's menstrual cycle.

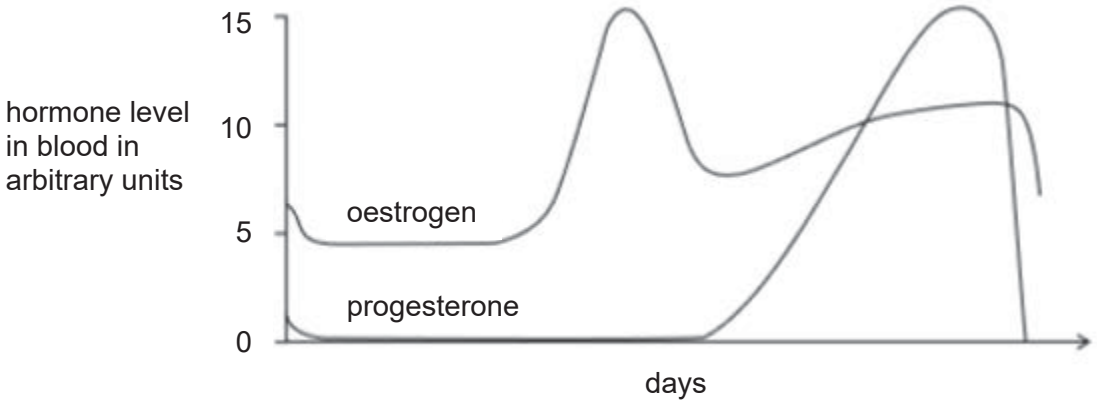

Fig. 3.1

(a) On Fig. 3.1, indicate using

(i) a letter **O**, the day when ovulation is most likely to occur. [1]

(ii) a letter **M**, the day when menstruation is likely to start. [1]

(b) Describe the effect of oestrogen on the female reproductive system.

……

……

…… [2]

(c) Fertilisation normally takes place in the oviducts.

(i) State what happens to the level of progesterone if fertilisation occurs.

……..

…….. [1]

(ii) Describe the early development of the fertilised egg.

……..

……..

…….. [2]

[Total: 7]

[Turn over

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4 Fig. 4.1 shows part of a flower involved in sexual reproduction.

It has been separated into three sections **A**, **B** and **C**.

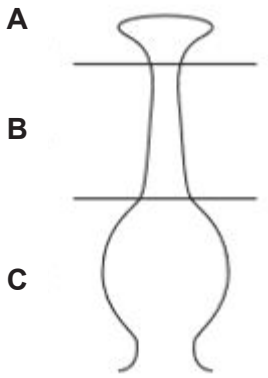


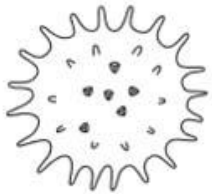
Fig. 4.1

(a) Complete the table by giving the correct letter for the section that matches each statement.
Each letter may be used once, more than once or not at all.
The first one has been done for you.

Statement	Section letter
This is the stigma	**A**
This is where fertilisation occurs	
This is where the pollen grains land at pollination	
This is where most pollen tube growth occurs	
This is where a seed will develop	

[2]

(b) The drawing shows a pollen grain from an insect-pollinated flower as seen using a microscope.



Suggest how the structure of this pollen grain shows it is from an insect-pollinated flower.

……..

…….. [1]

[Turn over

For Examiner's Use

(c) In this plant, pollen is produced before the carpel has finished growing.
By the time the carpel is ready for pollination, pollen production has stopped.

(i) Suggest why this happens.

……..

…….. [1]

(ii) In what way is this an advantage to the plant?

……..

……..

…….. [2]

[Total: 6]

5 A geneticist was asked to investigate the inheritance of acatalasia in dogs.

The normal allele is represented by **B** and the mutant allele is represented by **b**.

Fig. 5.1 to show the inheritance of acatalasia in a family of dogs. The shaded symbols indicate the dogs with acatalasia.

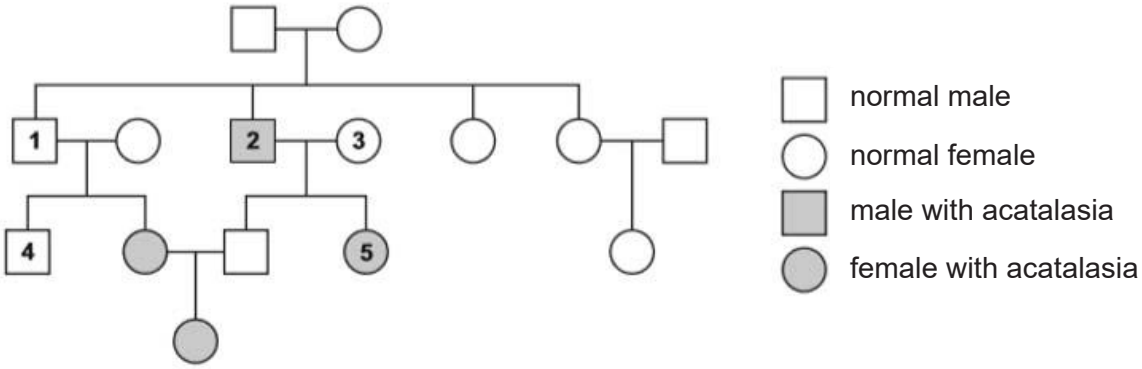


Fig. 5.1

(a) Explain what is meant by the terms

(i) allele

……..

…….. [1]

(ii) genotype

……..

…….. [1]

[Turn over

For Examiner's Use

(b) State the genotype of the dogs identified as **1**, **2** and **3** in Fig. 5.1.

1 ……..

2 ……..

3 …….. [3]

(c) The geneticist crossed dog **4** with dog **5**. Approximately half of the offspring had acatalasia and half the offspring did not have acatalasia.
Draw a genetic diagram to show how this is possible. [4]

[Total: 9]

[Turn over

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6 The table shows the comparison of air breathed in and out of a person.

	% of air breathed	
	in	out
carbon dioxide	0.03	4.03
nitrogen	78	78
oxygen	20	16
others	1.97	1.97

(a) Which two features of the alveoli help to bring about the changes?

1. ……..……...

…..……...

2. …..……...

…..……... [2]

(b) (i) Name the reaction in the body which uses up oxygen and produces carbon dioxide.

…….. [1]

(ii) Write a word equation for this reaction.

…….. [1]

(c) State and explain the effect on the concentration of oxygen carried in the red blood cells when breathing in air containing tobacco smoke.

……..

……..

……..

……..

…….. [3]

[Total: 7]

[Turn over

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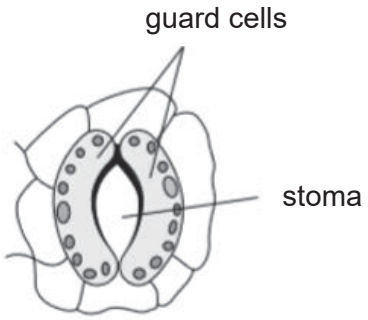
Section B [20 marks]

Answer any **two** questions from this section.

7 Stoma is found mainly on the underside of leaves.



An experiment is carried out to examine the effect of the size of stomata on the rate of transpiration.

Table 7.1 shows the rate of transpiration in still air and in moving air.

size of stomata in μm	rate of transpiration in mg m^{-2} s^{-1}	
	stiil air	moving air
0	0	0
4	22	70
8	46	140
12	48	165
16	50	210
20	50	248
24	50	264

Table 7.1

(a) Define the term transpiration.

……

…….. [1]

(b) Water lilies float on the surface of ponds.
Stoma is found on the upper surface of a water lily rather than the lower surface.
Suggest a reason for this adaptation.

……

…….. [1]

[Turn over

(c) Plot a graph to show the effect of stomata on transpiration rate in still and moving air. Use a ruler to join your points with straight lines. [3]

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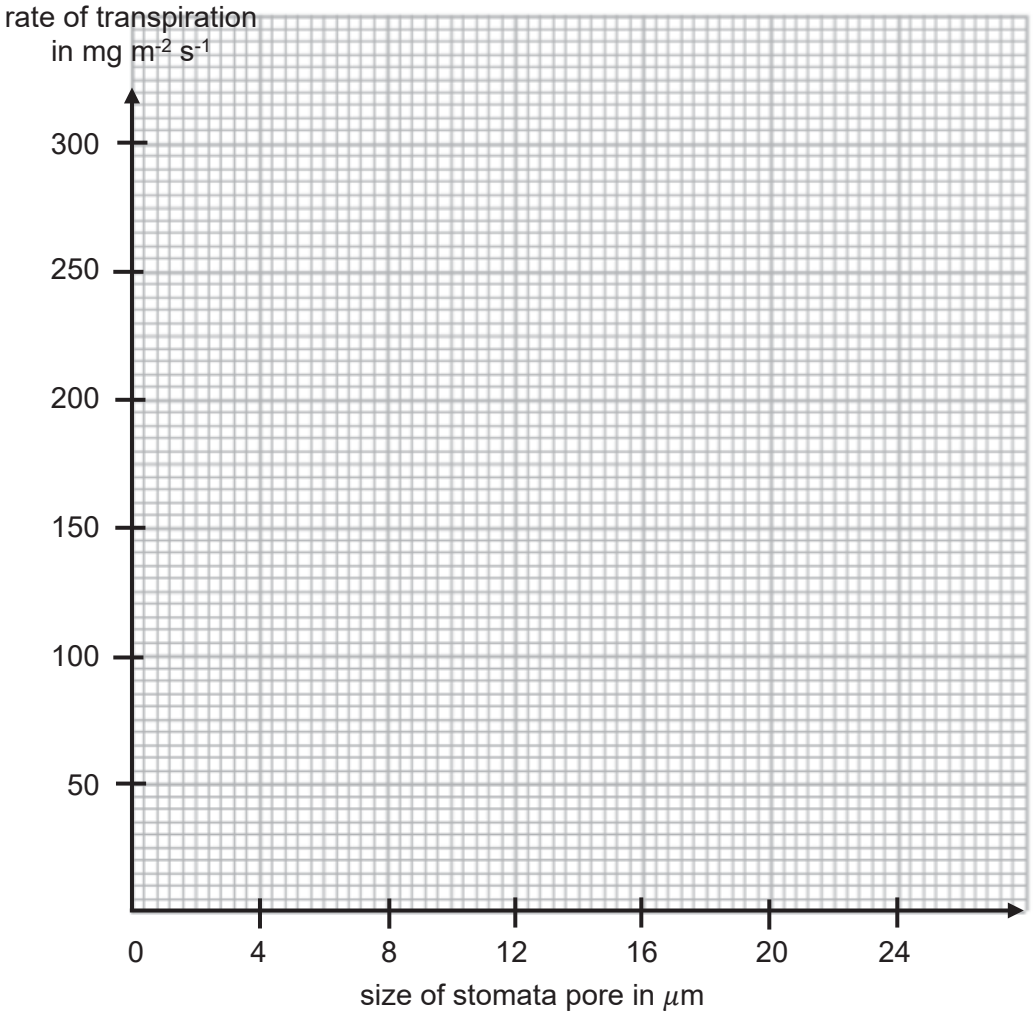

(d) Use the graph to compare the effect of increasing stomatal pore size on transpiration rate in still and moving air.

.....

.....

..... [2]

(e) Explain the effect that moving air has on transpiration rate.

.....

.....

.....

.....

..... [3]

[Total: 10]

[Turn over

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8 The brown plant hopper is a serious insect pest of rice. Spraying with pesticides is a common way to control it. However, brown plant hoppers have become resistant to pesticides.

Fig. 8.1 shows the effect of spraying pesticides against populations of this insect pest.

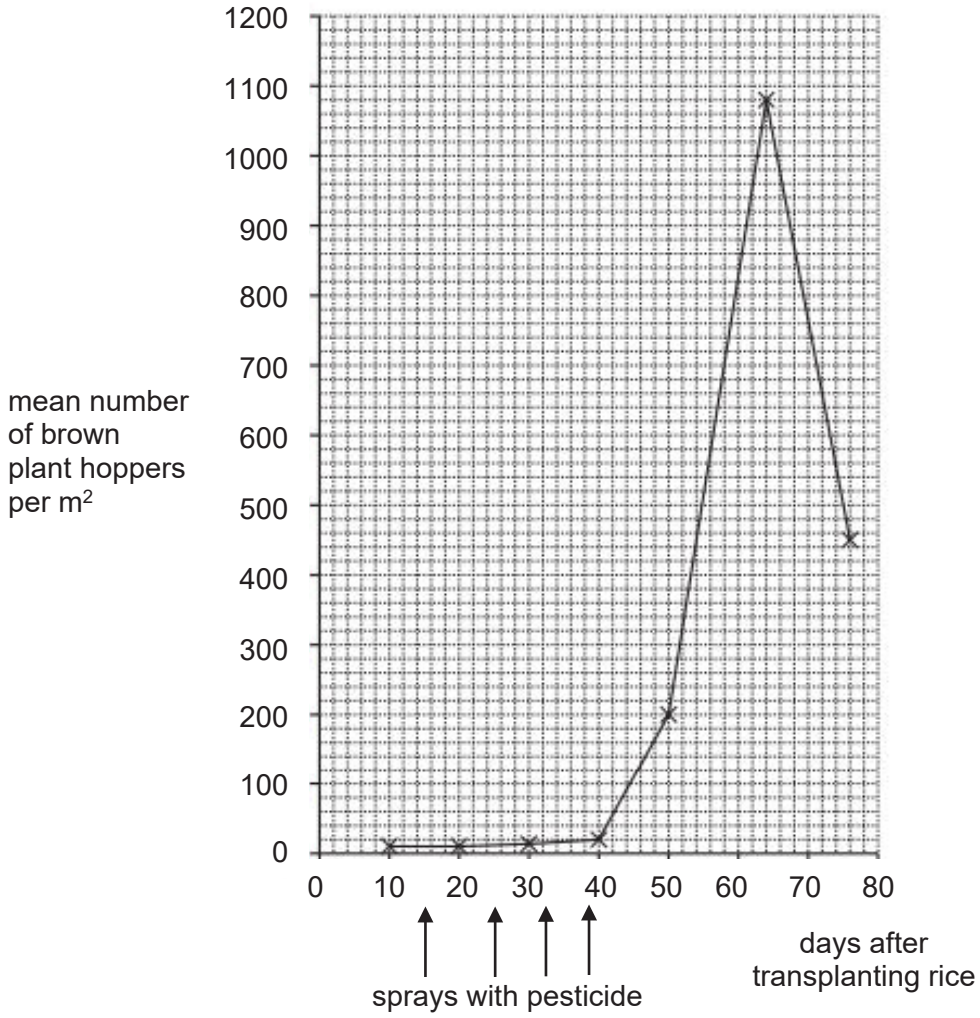

Fig. 8.1

(a) Use Fig. 8.1 to describe the effect of pesticides on populations of the brown plant hopper.

……..

……..

……..

……..

……..

……..

……..

…….. [3]

[Turn over

For Examiner's Use

(b) (i) Rice growing has involved the destruction of forests.
Describe the long-term effects of deforestation on the environment.

……..

……..

……..

……..

……..

……..

……..

…….. [4]

(ii) Suggest reasons for the importance of conservation of plant and animal species in the forest.

……..

……..

……..

……..

……..

…….. [3]

[Total: 10]

[Turn over

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9 Adam carried out an experiment on the fat content of a milk sample.
Fig. 9.1 shows a sequence of steps in the experiment.
The pH indicator used is colourless when the pH is 7 or less, and purple when the pH is over 7.

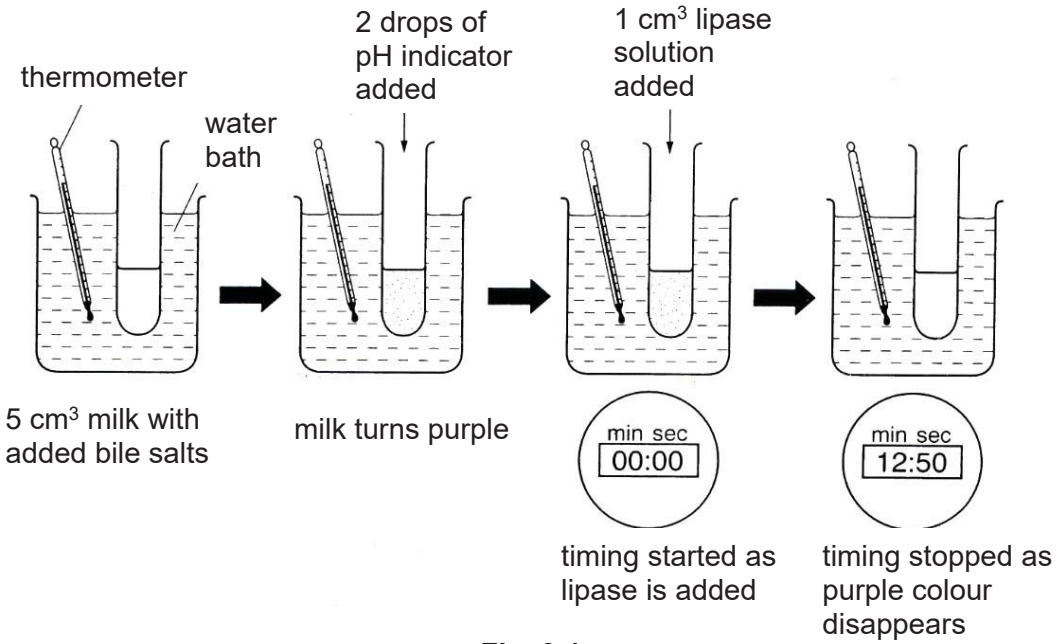

Fig. 9.1

The experiment was carried out at different temperatures.
The times taken for the pH indicator to lose its colour are shown in Table 9.1.

Table 9.1

temperature / ºC	0	10	20	30	40	50	60
time taken for indicator to lose its colour/min	35	21	16	9	6	31	40

(a) Based on table 9.1, describe and explain the effect of increasing temperature on the activity of the enzyme, lipase.

……

……

……

……

……

……

……

……

……

…… [6]

[Turn over

For Examiner's Use

(b) Describe the role of bile salts in the digestion of fats.

……..

……..

……..

…….. [2]

(c) Lipase will only act on fat molecules.
Use the lock and key hypothesis to explain why.

……..

……..

……..

…….. [2]

[Total: 10]

--- END OF PAPER ---

2018 4E Science Prelim Answer Scheme

Answers to Section A

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

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

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1 **(a)** A – nucleus
B – cell membrane
C – vacuole

[1m each] 3

(b) Name of process – photosynthesis [1 m] 2

Explanation [Any suitable answer; 1 m]
- Produce oxygen for respiration
- Produce glucose / food

(c)
- During **photosynthesis**, **glucose** will be made in the chloroplasts.
- The mitochondria will break down the **glucose** to release energy during **respiration**.

[1m each] 2

(d) **(i)** The root hair cell is elongated / has a protrusion / does not have chloroplasts but the plant cell is not elongated/ does not have a protrusion / has chloroplasts 1

(ii) The plant cell contains chloroplasts/ nucleus but the xylem does not contain chloroplasts/ nucleus. 1

2 **(a)** 1 – right atrium
2 – right ventricle 2

(b) X – remains the same level
Y – increase 1

(c) **(i)** 0.3 1

(ii) 3 1

(iii)
- To transport more oxygen to the **heart**
- For respiration to release more energy

2

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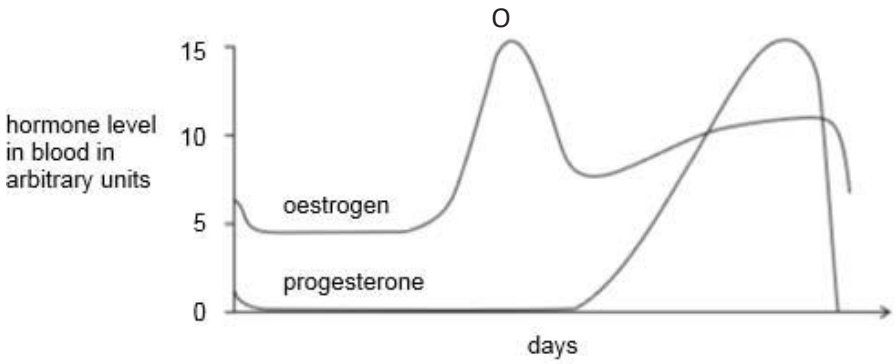
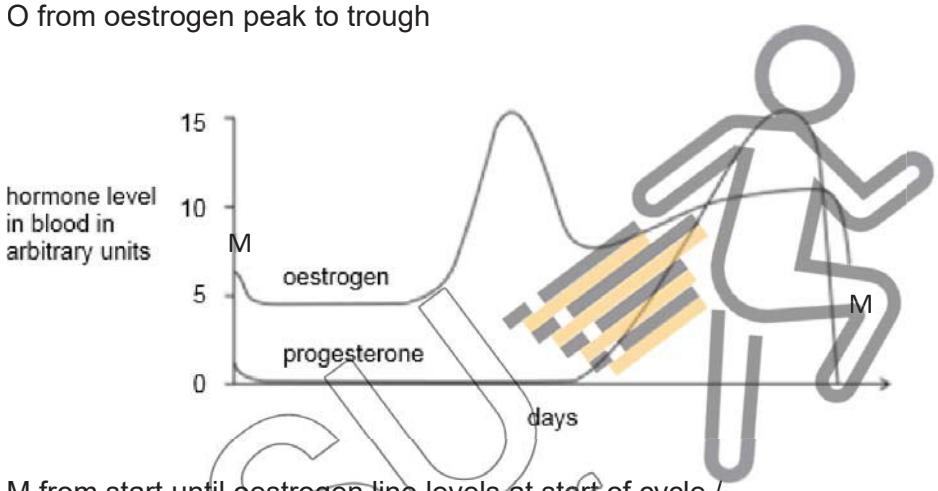
3 (a) (i)



1

O from oestrogen peak to trough

(ii)



1

M from start until oestrogen line levels at start of cycle /
From where progesterone peaks to end of cycle [either one]

(b)

- Repairs and thicken the uterine lining
- Increased level of oestrogen results in ovulatio

[1m each]

2

(c) (i) Remains high

1

(ii)

- Fertilised egg divides to become embryo
- Travels to uterus and embedded into the uterine lining

[1m each]

2

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4 **(a)**

Statement	Section letter
This is the stigma	A
This is where fertilisation occurs	C
This is where the pollen grains land at pollination	A
This is where most pollen tube growth occurs	B
This is where a seed will develop	C

2

All correct – 2 m
2/3 correct – 1 m

(b) Has a rough surface / hair-like structures / spikes to stick to insect 1

(c) **(i)** To prevent self-fertilisation 1

(ii)
- Greater genetic variation
- Offspring can inherit beneficial qualities from both parents

2

[1m each]

5 **(a)** **(i)** Different forms of the same gene 1

(ii) Genetic make-up of an organism inherited from the parents 1

(b) 1 – Bb
2 – bb
3 – Bb

3

[1m each]

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(c)

Parental Phenotype	Normal	x		Acatalasia
Parental Genotype	Bb	x		bb
Gamates	B b	x		b b
F_1 Genotype	Bb	Bb	bb	bb
F_1 Phenotype	Normal	Normal	Acatalasia	Acatalasia
F_1 Phenotypic ratio	Normal : Acatalasia 1 : 1			

4

1m – genotype of parents
1m – crossing
1m – genotype of F1
1m – ratio

6 **(a)**

- Surrounded by blood
- One cell thick;
- Has a thin film of moisture;

2

(b) **(i)** Respiration 1

(ii) oxygen + glucose → carbon dioxide + water + large amounts of energy 1

(c)

- Tobacco smoke contains carbon monoxide
- Carbon monoxide will combine with haemoglobin in red blood cells too
- Oxygen concentration in the red blood cells will thus decrease

3

[1m each]

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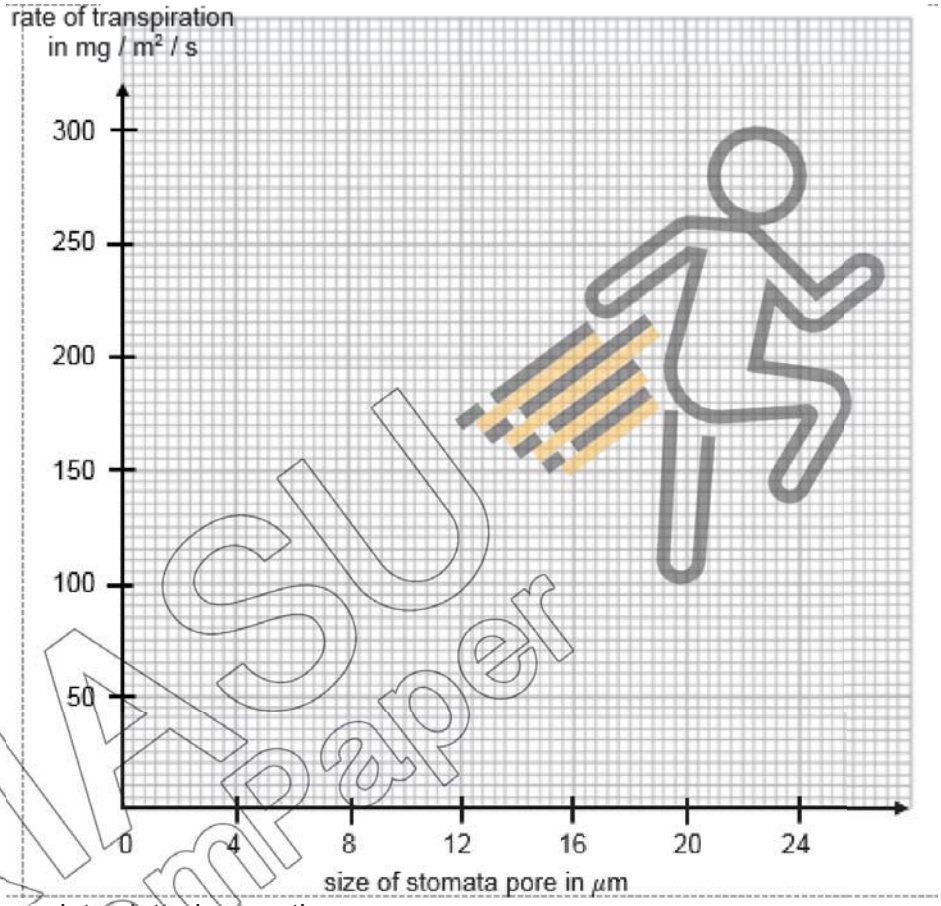
7 **(a)** Loss of water vapour from the stomata 1

(b)
- Allow carbon dioxide in
- Allow transpiration / water loss

1

[Any 1; ignore gas exchange]

(c) 3



P1 – points plotted correctly
L1 – lines drawn
K1 – Key still air and moving air

(d)
- Level off in still air / continues to increase in moving air / more increase in moving air
- Ref to data

2

[1m each]

(e)
- Takes water vapour away / blows water vapour away / less water vapour outside
- Increases / maintains concentration gradient
- Diffusion occurs

3

[1m each]

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8 **(a)**

- numbers of brown plant hoppers remain low, up to 40 days / low numbers when spraying occurs (days 15 to 38)
- rapid increase when spraying stopped
- ref to numbers with unit; eg increase to maximum of over 1000 per m^2

3

[1m each]

(b) **(i)**

- soil erosion - loss of topsoil
- eroded soil resulted in flooding
- desertification occurs – due to absence of leave canopy
- climate change - effect on carbon dioxide in the atmosphere
- disruption to food chain ; loss of habitat
- extinction / loss of biodiversity

4

[1m each; any 4]

(ii)

- As a food source
- Economic importance – eg rainforests are a source of raw materials for industries
- Maintenance of biodiversity
- Maintenance of a balanced ecosystem
- Scientific value – studies on wildlife gives insights on human beings
- Preservation of natural scenery and wildlife

3

[1m each; any 3]

9 **(a)**

- At low temperature, more time is needed for indicator to change colour
- Because the enzymes are inactive; Low kinetic energy
- As temperature increase, less time is needed for indicator to change colour
- More kinetic energy and higher chances of favourable collision between substrate and enzyme
- Until the optimum temperature (40°C), least time is needed for indicator to change colour as the enzymes are most active.
- As temperature increase, more time is needed for indicator to change colour because the enzymes are denatured.

6

[1m each]

(b)

- Bile emulsify fats
- Increase surface area thus faster digestion of fats by lipase

2

[1m each]

(c)

- Enzymes have an active site;
- Active site is complementary to its substrate; only the substrate is able to fit into the active site for reaction

2

[1m each]

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159