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PASIR RIS CREST SECONDARY SCHOOL
Mid Year Examination
Secondary Three Express

CANDIDATE
NAME

CLASS

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INDEX
NUMBER

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Biology

Paper 1

6093

15 May 2019

Papers 1 and 2: 1 hour 40 minutes

Additional Materials: Optical Test Answer Sheet (OTAS)

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

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

Write your name, class and register number on the answer sheet in the spaces provided.

There are **20** questions in 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
20
Parent's Signature

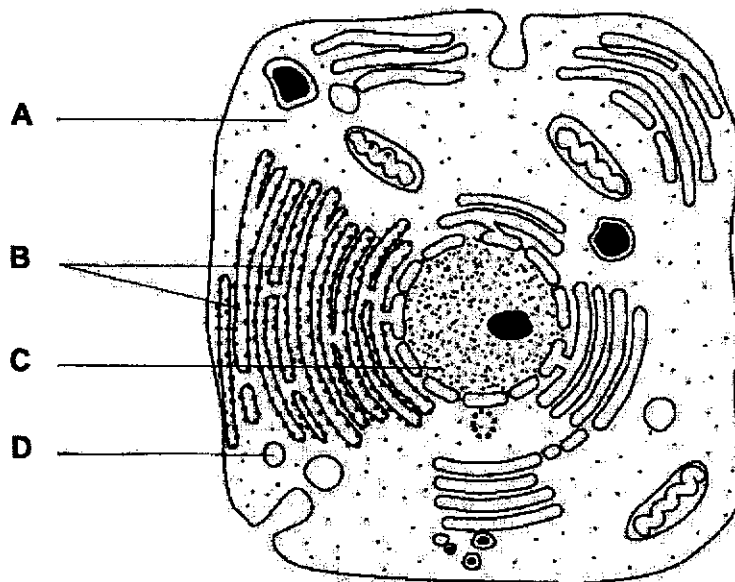
This document consists of **8** printed pages.

[Turn over

Answer **ALL** questions. Shade your answers in the OTAS provided.

- 1 The diagram shows an animal cell as seen with an electron microscope.

Which structure is **not** directly involved in the production and secretion of enzymes?



- 2 The photomicrograph shows the lower epidermis of a leaf.



Which term describes the lower epidermis?

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

- 3 Which adaptation of a red blood cell makes it suitable for efficient oxygen transport?

	nucleus	surface area to volume ratio of the cell
A	absent	high
B	absent	low
C	present	high
D	present	low

- 4 Which of the following structures is the smallest?

- A chromosome
- B DNA
- C gene
- D nucleus

- 5 A gene contains 1200 phosphate groups. Out of all the nitrogenous bases, 33.5% of them are adenine.

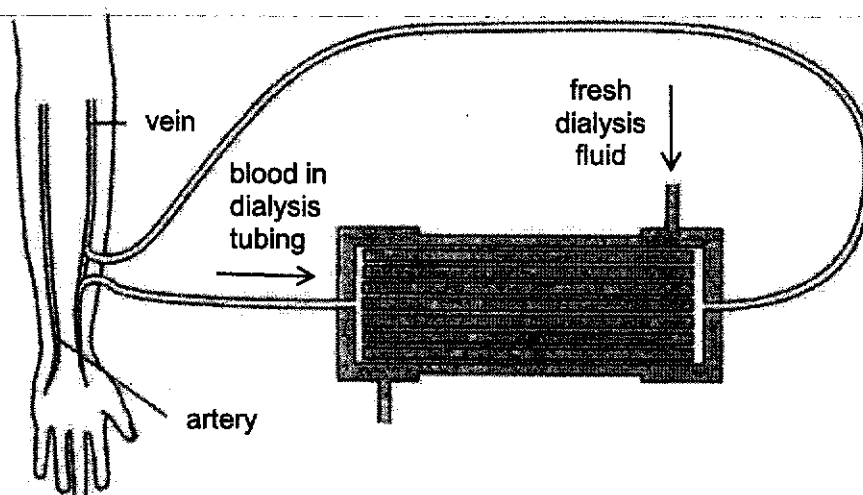
How many cytosine bases does the gene contain?

- A 198
- B 396
- C 402
- D 804

- 6 Which of the following row correctly states the cell parts where transcription and translation occur?

	transcription	translation
A	cytoplasm	ribosome
B	cytoplasm	rough endoplasmic reticulum
C	nucleus	ribosome
D	nucleus	rough endoplasmic reticulum

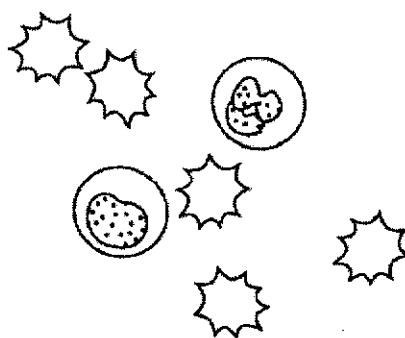
- 7 Dialysis serves to remove metabolic wastes such as urea from the blood of a person with kidney failure. Blood cells and proteins remain in the bloodstream. A diagrammatic representation of the mechanism in dialysis is shown.



Which of the following is required for dialysis to occur most efficiently?

	permeability of dialysis tubing	concentration of urea in fresh dialysis fluid
A	full	high
B	full	low
C	partial	high
D	partial	low

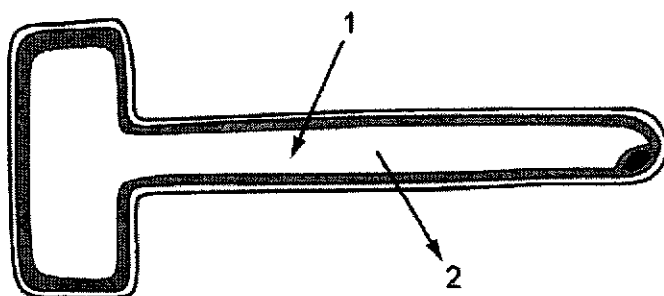
- 8 The diagram shows cells in fresh blood, after the blood was placed in solution X.



Which statement describes solution X?

- A The water potential of the solution X is equal to that of pure water.
- B The water potential of solution X is equal to that of the cytoplasm.
- C The water potential of solution X is higher than that of the cytoplasm.
- D The water potential of solution X is lower than that of the cytoplasm.

- 9 The diagram shows a root hair cell of a plant grown in soil that is regularly watered.



Which arrows show the direction in which it is possible for nitrate ions and water molecules to move?

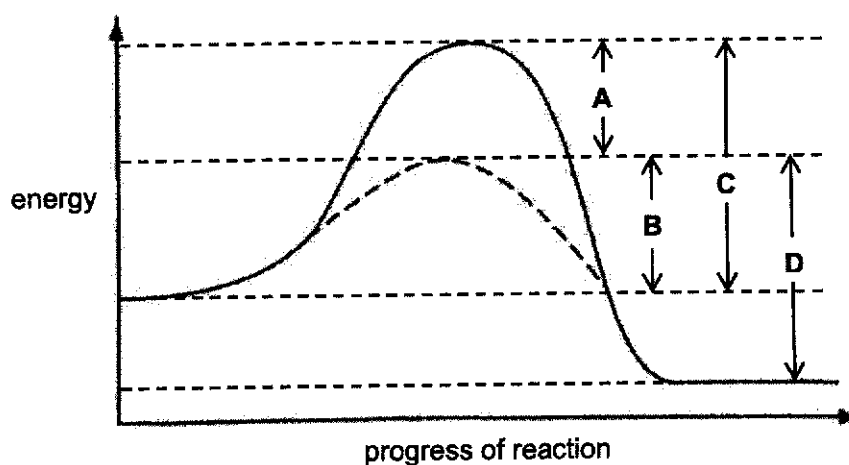
	nitrate ions	water molecules
A	1 only	1 only
B	1 only	1 and 2
C	1 and 2	1 only
D	1 and 2	1 and 2

- 10 Which property of water makes it suitable as a transport medium?

- A It has a high specific heat capacity.
- B It is a reactant in chemical reactions.
- C It is a solvent for many chemicals.
- D It is transparent.

- 11 The graph shows changing energy levels during a reaction, with and without the presence of the enzyme specific to this reaction.

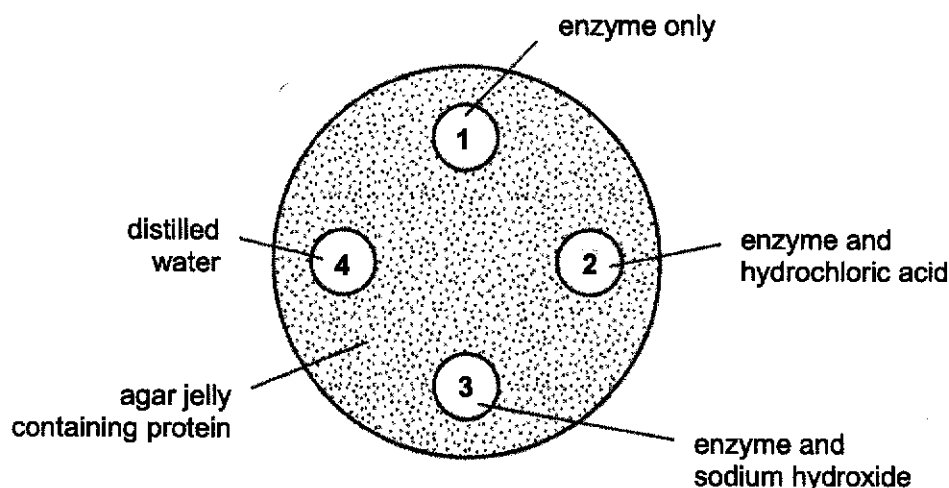
Which arrow represents the activation energy of the reaction without the enzyme?



12 Which statement about enzymes is true?

- A All enzymes have an optimum temperature of 37 °C.
- B Enzymes are needed in small amounts.
- C Rate of enzyme action always doubles with every 10 °C increase in temperature.
- D The orientation of the enzyme and substrate is not crucial when forming enzyme-substrate complexes

For questions 13 and 14, refer the diagram below of a petri dish being filled with agar jelly containing protein. Four holes are cut in the jelly and each hole is filled as shown.



13 After 30 minutes, the largest area without protein was around hole 3.

From which part of the human digestive system was the enzyme likely taken?

- A intestinal wall
 - B pancreas
 - C salivary gland
 - D stomach wall
- 14 The contents from hole 1 was removed after 30 minutes and placed in a test tube. An equal volume of sodium hydroxide was mixed with it and 1% copper sulfate solution was added drop-wise.

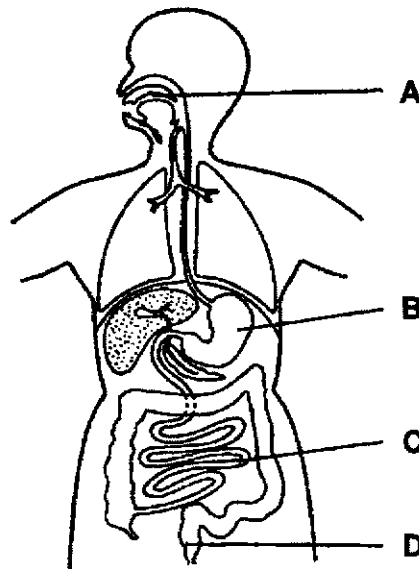
Which colour would be observed after the 1% copper sulfate solution was added?

- A no colour
- B blue
- C orange
- D violet

15 Which of the following is **not** an essential step in setting up an experiment to investigate the action of lipase on fats?

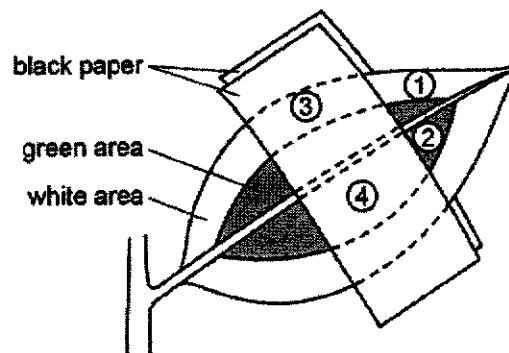
- A Adding the same volume of lipase to each test tube.
- B Keeping the mixture in each test tube at pH 8.
- C Keeping the test tubes at a constant temperature of 30°C.
- D Purifying the lipase by boiling it before use.

16 At which part of the human alimentary canal does **most** water absorption take place?



17 A plant has leaves that are partly green and partly white. The plant was destarched and a leaf was partly covered by black paper.

The plant was placed in bright light for several hours. Four discs were then cut from the leaf in the positions shown.



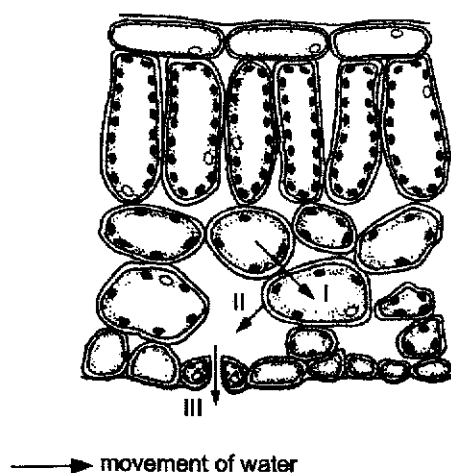
Which discs would be stained blue-black by iodine solution?

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

18 What is the function of chlorophyll?

- A It converts carbon dioxide into carbohydrates.
- B It traps light energy and converts that into chemical energy.
- C It stores the products of photosynthesis.
- D It stores the raw materials needed for photosynthesis.

19 The diagram below shows the cross section of a dicotyledonous leaf. The numbered arrows indicate the movement of water across the cells and out of the leaf.



Which of the above arrows will be affected by water potential?

- A I only
 - B II only
 - C I and II
 - D I, II and III
- 20 Ringing the branches of a fruit tree results in the production of larger fruits at the end of the branches.

Which of the following explains the above phenomenon?

- A Less mineral salts can be transported to the branches to support growth.
- B Less organic nutrients are transported away from the branches.
- C More oxygen can reach the branches to facilitate energy release.
- D More water can be transported to the branches for more cell growth.

End of Paper 1



PASIR RIS CREST SECONDARY SCHOOL
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Biology

Paper 2

6093

15 May 2019

Papers 1 and 2: 1 hour 40 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 (40 marks) and Section B (20 marks)

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

Electronic calculators may be used.

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

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60
Parent's Signature

This document consists of 12 printed pages.

[Turn over

SECTION A [40 Marks]

Answer **ALL** questions. Write your answers in the spaces provided.

- 1 Fig. 1.1 shows a photomicrograph of a cell viewed under electron microscope.



Fig. 1.1

- (a) (i) Name structure A.

..... [1]

- (ii) Identify the molecule that can be extracted from structure A, and describe the importance of this molecule for the normal functioning of the cell.

molecule

importance

..... [2]

- (b) State the function of structure B.

.....

..... [1]

(c) The solution from structure **C** was tested with Benedict's solution.

(i) Describe the steps involved in a Benedict's test.

.....

.....

.....

.....

.....

..... [3]

(ii) Suggest and explain the expected observations for Benedict's test for the solution from structure **C**.

.....

.....

.....

..... [2]

[Total: 9]

- 2 Five strips were cut from a potato. The strips were then placed in sugar solutions of different concentrations. After four hours, the change in length of each potato strip was measured.

Fig. 2.1 shows the results of the experiment.

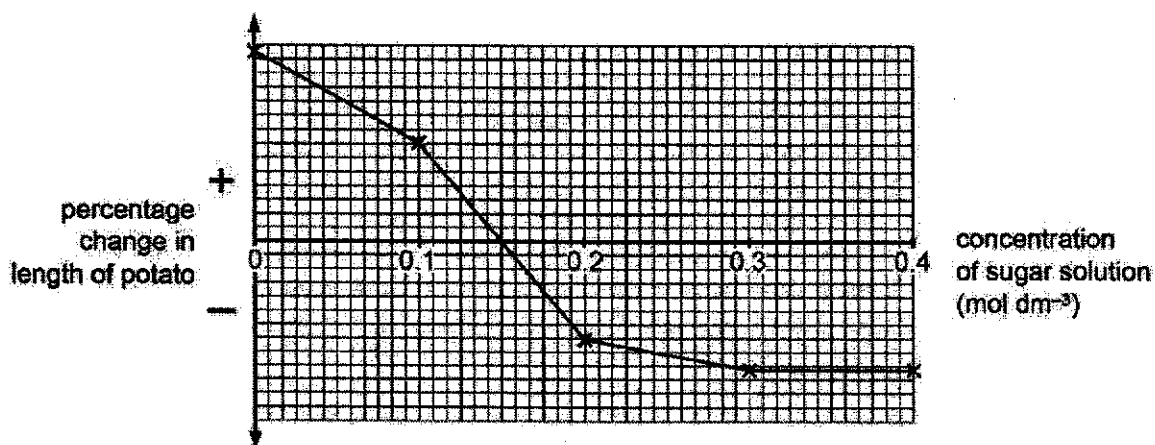


Fig. 2.1

- (a) (i) With reference to Fig. 2.1, state the concentration of the potato cell sap.

..... [1]

- (ii) Explain your answer to (i).

.....

 [3]

- (b) (i) State the condition of the **cells** in the potato strip that was soaked in 0.3 mol dm^{-3} sugar solution for 4 hours.

..... [1]

- (ii) Suggest and explain the appearance of a potato plant grown in soil solution of similar concentration as the 0.3 mol dm^{-3} sugar solution.

.....

.....

.....

..... [2]

- (c) Suggest how the results of the experiment could be made more reliable.

.....

..... [1]

[Total: 8]

- 3 Fig. 3.1 shows the cross section of a villus.

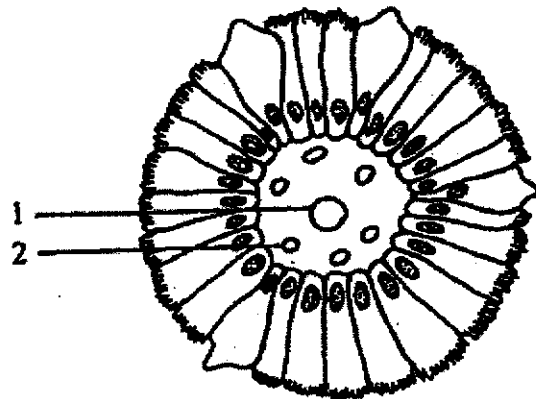


Fig. 3.1

- (a) Name the nutrients transported in vessels 1 and 2 shown in Fig. 3.1.

vessel 1

vessel 2 [3]

(b) Describe and explain **two** ways in which the villus is adapted for its function.

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 7]

4 (a) (i) State the chemical equation for photosynthesis.

..... [2]

(ii) Respiration occurs in photosynthetic cells and the process produces carbon dioxide.

Explain why carbon dioxide enters instead of exiting the leaves during the day.

.....

.....

.....

.....

.....

.....

..... [3]

- (b) Fig. 4.1 shows three graphs of the rate of photosynthesis carried out under different sets of conditions. Sections **W** and **X** refer to graph 1, section **Y** refers to graph 2 and section **Z** refers to graph 3.

Rate of photosynthesis

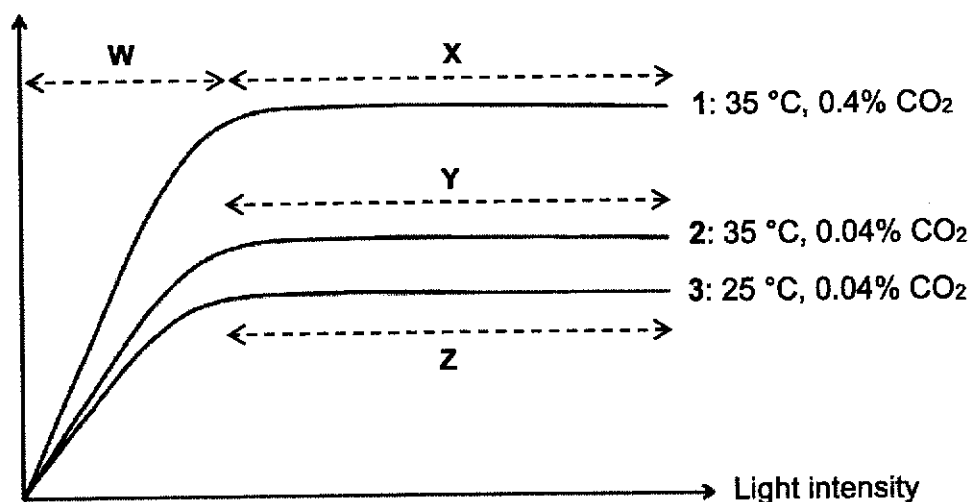


Fig. 4.1

- (i) Suggest a way to measure the **rate** of photosynthesis.

.....
 [1]

- (ii) Using each letter (**W**, **X**, **Y** or **Z**) not more than once, state the section of the graph in Fig. 4.1 where the limiting factor is

carbon dioxide concentration,

light intensity,

and temperature.

[3]

[Total: 9]

- 5 (a) Define *transpiration*.

.....
 [2]

- (b) Fig. 5.1 shows a cross section of a celery stem as seen under a light microscope.

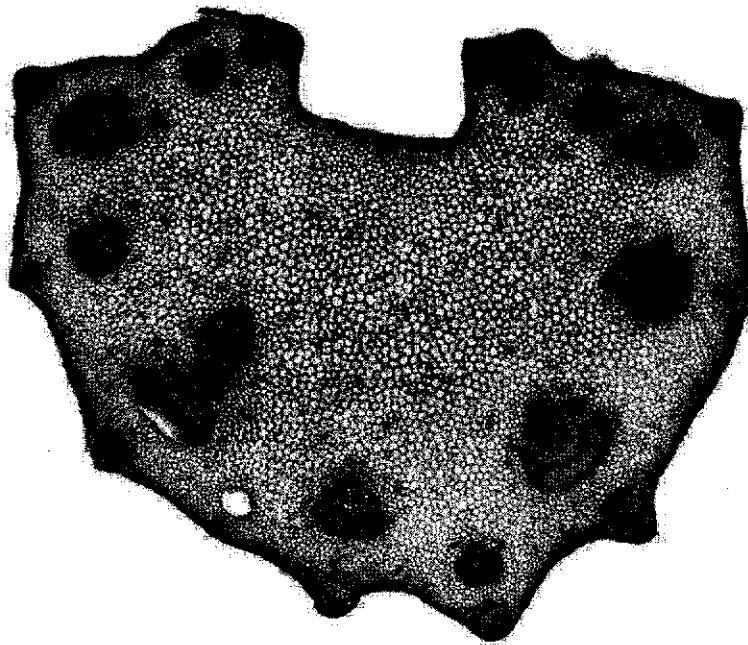


Fig. 5.1

- (i) On Fig. 5.1, name and label any **one** group of tissues that transport mineral salts. [1]
- (ii) State the other function of the tissues identified in (i) and explain how they are adapted for this function.

.....

 [2]

- (III) With reference to the structure of the tissues identified in (I), explain why active transport of mineral salts **cannot** take place in these tissues.

.....

.....

.....

..... [2]

[Total: 7]

SECTION B [20 Marks]

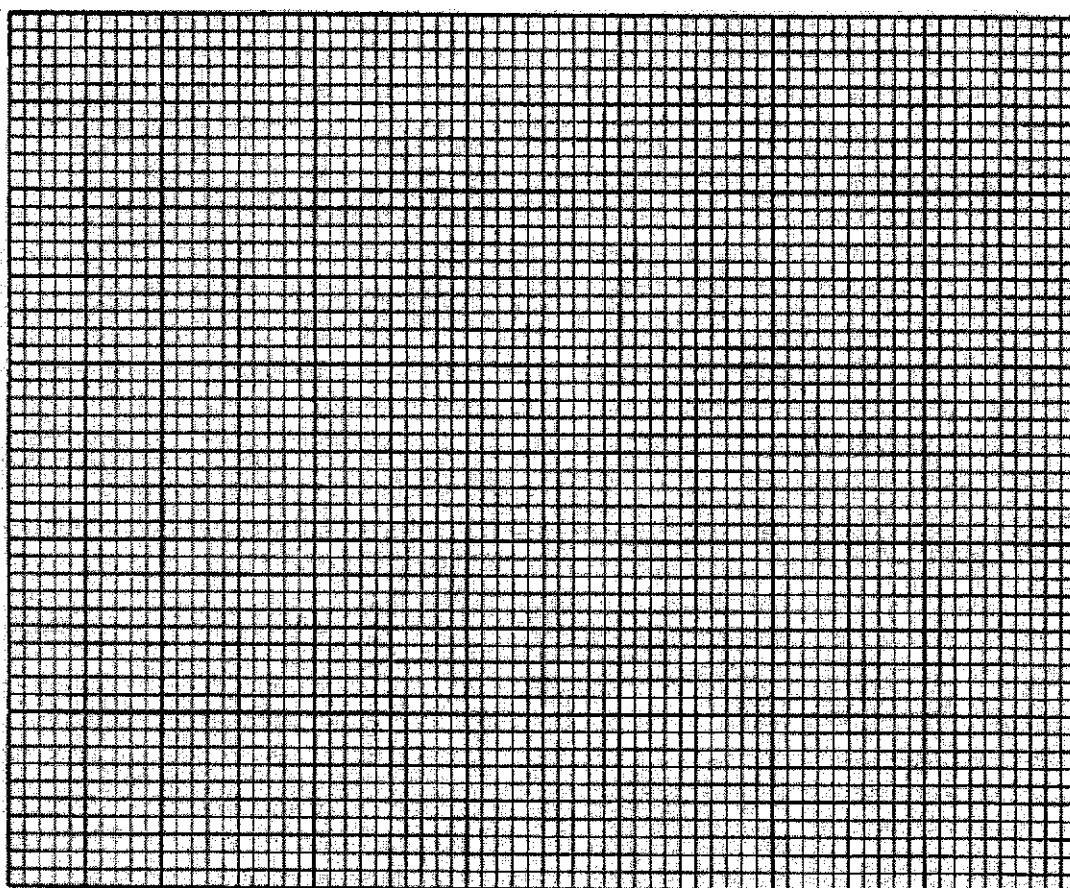
Answer **ALL** questions. Write your answers in the spaces provided.

- 6 An experiment was carried out to determine the effect of temperature on the rate of enzyme action. The results are shown in Table 6.1.

Table 6.1

Temperature /°C	5	15	25	35	45	55
Rate of enzyme action /arbitrary units	0	4	9	23	31	0

- (a) Plot a graph of rate of enzyme action against temperature in the grid below.



[4]

- (b) With reference to your graph, describe the effect of temperature on the rate of enzyme action.

.....

.....

.....

.....

.....

..... [3]

- (c) Explain why the rate of enzyme action was zero at both 5 °C and 55 °C.

5 °C

.....

.....

.....

.....

55 °C

.....

.....

..... [4]

- (d) Name **one** factor that has to be kept constant during the experiment.

..... [1]

[Total: 12]

- 7 (a) Excessive alcohol consumption can cause liver damage, leading to serious health problems.**

Describe the functions of a healthy liver.

[5]

- (b) Discuss three social implications of excessive alcohol consumption.**

[3]

[Total: 8]

End of Paper 2

PRCS Secondary 3 Express Pure Biology
Mid-Year Examination 2019
Mark scheme

Paper 1

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

Paper 2 Section A

1	(a)	(i)	Nucleus	[1]
		(ii)	- DNA - It codes for the synthesis of various polypeptides needed for the cell to function / AW	[1] [1]
	(b)		It is the site of <u>aerobic respiration</u> for release of <u>energy</u> for cell activities	[1]
	(c)	(i)	- Add 2cm³ of Benedict's solution to 2cm³ of sample - Shake test tubes to mix contents - Place test tube in <u>boiling</u> bath - For no more than 5 minutes - Observe for any precipitate formed	[1] ea max 3m
		(ii)	- A red <u>precipitate</u> would be formed - Vacuole contains cell sap, where <u>reducing sugars</u> are temporarily stored	

2	(a)	(i)	0.15 mol dm ⁻³	[1]
		(ii)	- No change in length of the potato - No osmosis occurred - no difference in water potential between cell sap and sugar solution - Cell sap has same sugar concentration of 0.15 mol dm⁻³	[1] ea max 3m
	(b)	(i)	Plasmolysed/Plasmolysis	[1]
		(ii)	- As the plant <u>cells</u> lose <u>turgidity</u> - The plant will <u>wilt</u>/cannot be held upright/become limp or flaccid	[1] [1]
	(c)		Increase the number of potato strips used for each concentration	[1]

PRCS Secondary 3 Express Pure Biology
Mid-Year Examination 2019
Mark scheme

3	(a)	vessel 1: glucose amino acids vessel 2: fats (R: fatty acids and glycerol)	[1] [1] [1]														
	(b)	Any two of the following: <table><tr><th>Structure [1]</th><th>Adaptation [1]</th><th>Function</th></tr><tr><td>One-cell thick epithelium</td><td>Shorter diffusion distance</td><td>Faster absorption of nutrients</td></tr><tr><td>Large number of mitochondria in epithelial cells</td><td>Release energy for active transport of glucose and amino acids</td><td>More absorption of nutrients</td></tr><tr><td>Microvilli on epithelial cells</td><td>Increase SA:V ratio</td><td>Faster absorption of nutrients via diffusion</td></tr><tr><td>Dense network of capillaries transport absorbed nutrients away from villus</td><td>Maintains high concentration gradient</td><td>Faster absorption of nutrients via diffusion</td></tr></table>	Structure [1]	Adaptation [1]	Function	One-cell thick epithelium	Shorter diffusion distance	Faster absorption of nutrients	Large number of mitochondria in epithelial cells	Release energy for active transport of glucose and amino acids	More absorption of nutrients	Microvilli on epithelial cells	Increase SA:V ratio	Faster absorption of nutrients via diffusion	Dense network of capillaries transport absorbed nutrients away from villus	Maintains high concentration gradient	Faster absorption of nutrients via diffusion
Structure [1]	Adaptation [1]	Function															
One-cell thick epithelium	Shorter diffusion distance	Faster absorption of nutrients															
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Microvilli on epithelial cells	Increase SA:V ratio	Faster absorption of nutrients via diffusion															
Dense network of capillaries transport absorbed nutrients away from villus	Maintains high concentration gradient	Faster absorption of nutrients via diffusion															

4	(a)	(i)	- Balanced equation: $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ - light and chlorophyll	[1] [1]
		(ii)	- Rate of photosynthesis <u>higher</u> than rate of respiration in the day - Carbon dioxide used for photosynthesis, concentration of carbon dioxide in leaves <u>lower</u> than surrounding - Carbon dioxide (molecules) <u>diffuse</u> in, down a concentration gradient	[1] [1] [1]
			(b)	(i)
	(b)	(ii)	- CO₂: Y - Light: W - Temp: Z	[1] [1] [1]

5	(a)	• Loss of water <u>vapour</u>		[1]
		• Through <u>aerial</u> parts of a plant, especially stomata of leaves		[1]
	(b)	(i)	• Xylem, position correctly identified	[1]
		(ii)	• Provide mechanical support to plant	[1]
			• Thick, lignified walls	[1]
(iii)	• xylem lack cell membrane • to maintain a region of higher concentration OR: • xylem lack <u>mitochondria</u> • cannot carry out <u>aerobic respiration</u> • to <u>release energy</u> for active transport		[1] ea max 2m	

Paper 2 Section B

6	(a)	- Line of best fit - Axes: correct labels with units - Data points correctly plotted - Scale for each axis	[1] [1] [1] [1]
	(b)	1. As temperature increased from 5°C to °C, rate of reaction increased from 0 arbitrary units (au) to au. 2. At 45°C, rate of reaction was at a maximum of 31 au. 3. As temperature increased further to 55°C, rate of reaction decreased to 0 au. Max 2 marks if no values are quoted.	[1] [1] [1]
	(c)	At 5 °C: 1. Enzyme is inactive (due to low kinetic energy) 2. Less effective collision with substrate At 55 °C: 1. Enzyme is denatured 2. Shape of active site changes 3. Substrate no longer fits in active site Award mark only once for the following: No enzyme substrate complex formed	[1] ea, max 4m
	(d)	Any of the following: - pH - enzyme concentration - substrate concentration - type of enzyme (considering specificity of enzymes)	

7	(a)	Regulation of glucose concentration - when blood glucose concentration is too high/above norm, <u>excess</u> glucose is converted to glycogen for storage in liver - when blood glucose concentration is too low/below norm, glycogen in liver is broken down/hydrolysed into glucose Deamination (max 2) - Deamination of <u>excess</u> amino acids - Forming ammonia - Which is converted to urea Bile production (max 2) - Bile is produced by liver - To emulsify fats into smaller droplets - For faster digestion of fats by lipase Detoxification - Breakdown of alcohol into acetaldehyde - By alcohol dehydrogenase Breakdown of red blood cells and iron storage - Red blood cells are broken down in liver - Iron from red blood cells are stored in liver	[1] ea max 5m
	(b)	- Drink-driving - Family violence - Low productivity at work	[1] ea, max 3m

*PRCS Secondary 3 Express Pure Biology
Mid-Year Examination 2019
Mark scheme*

		• Neglect	
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