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SECONDARY 4

G3 Express Exam Paper

G3 Science Biology

(Paper 1 & 4)

1	Assumption Eng	Prelim
2	Beatty Sec	Prelim
3	Geylang Meth	Prelim
4	Serangoon Sec	Prelim
5	Yio Chu Kang	Prelim
6	Yishun Sec	Prelim

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Class:

**ASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2024**

**SCIENCE (BIOLOGY)
5088 / 01**



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LEVEL: Sec 4 Express

DATE: 28 August 2024

CLASSES: Sec 4/2 & 4/3

DURATION: 1 hour (for both
Science components)

Additional Materials provided: 1 sheet of OAS paper

INSTRUCTIONS TO CANDIDATES

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

Write your NAME, INDEX NUMBER and CLASS at the top of this page and on the OAS paper.

This paper consists of 1 section.

There are 20 questions in this section. Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D**. Choose the correct answer and record your choice in soft or 2B pencil on the OAS paper provided. **DO NOT** fold or bend the OAS paper.

At the end of the examination, hand in your OAS paper and question booklet separately.

This Question Paper consists of 10 printed pages including this page.

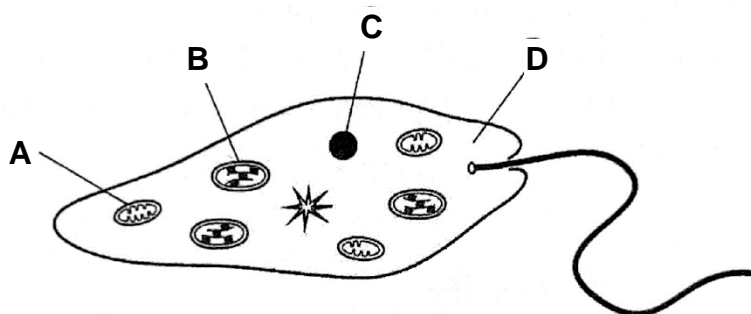
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MULTIPLE-CHOICE QUESTIONS [20 marks]

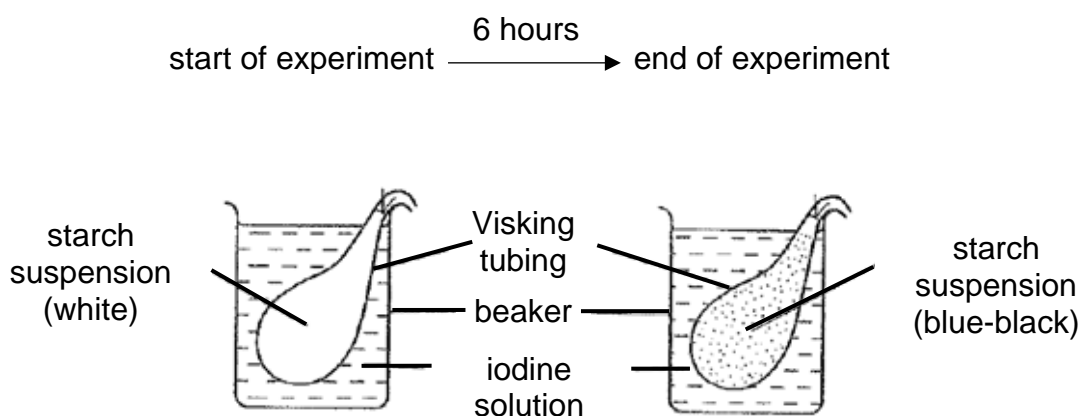
For each question, **there are four** possible answers **A, B, C** and **D**. Choose the one you consider correct and record your choice in the OAS paper provided.

- 1 The diagram shows an organism called Euglena. Euglena is a single-celled organism that can photosynthesise.

Which label points to the structure that enables it to photosynthesise?



- 2 The diagram shows an experiment.



Why has the starch suspension changed colour?

- A Iodine has diffused in through the membrane.
- B Iodine has diffused out through the membrane.
- C Starch has diffused in through the membrane.
- D Starch has diffused out through the membrane.

3 Which substance is the basic unit that forms glycogen?

- A** amino acids **B** fatty acids **C** glucose **D** glycerol

4 Which of the following is/are functions of proteins?

- 1 provide thermal insulation
- 2 repair of tissues
- 3 serve as biological catalyst to speed up reactions
- 4 transport of water

- A** 1 and 2 only **B** 2 and 3 only
C 2 and 4 only **D** All of the above

5 An unknown food sample was tested and the following results were obtained.

- A white emulsion when mixed with ethanol and water.
- A violet colour in the biuret test.
- A blue colouration was observed when heated with Benedict's solution.
- A yellowish brown colour with iodine.

What does the food sample contain?

- A** The sample contains fats and proteins.
B The sample contains fats and starch.
C The sample contains proteins only.
D The sample contains starch only.

6 Starch is digested to maltose by the enzyme amylase.

According to the 'lock-and-key' hypothesis, which option correctly identifies the 'lock' and the 'key'?

	'lock'	'key'
A	amylase	maltose
B	amylase	starch
C	starch	amylase
D	starch	maltose

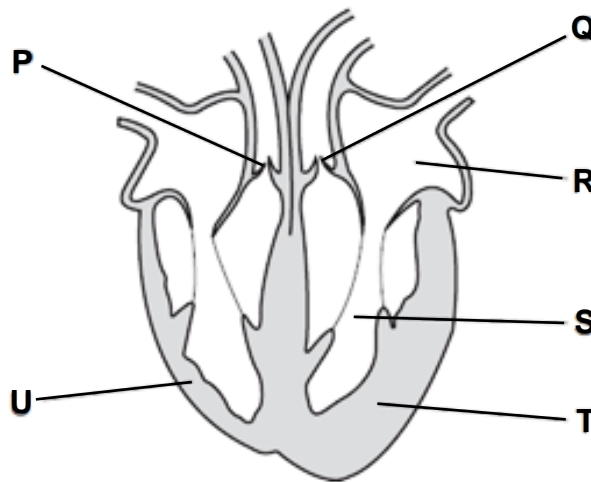
- 7 The table below shows the characteristics of the blood flowing through a blood vessel in the body.

concentration of oxygen	high
concentration of carbon dioxide	low
blood pressure	high

Which blood vessel has these characteristics?

- A** aorta
- B** pulmonary artery
- C** pulmonary vein
- D** vena cava

- 8** The diagram shows a section through the human heart.



Which feature suggests that blood leaves the heart at different pressures, when going to the lungs and to the body?

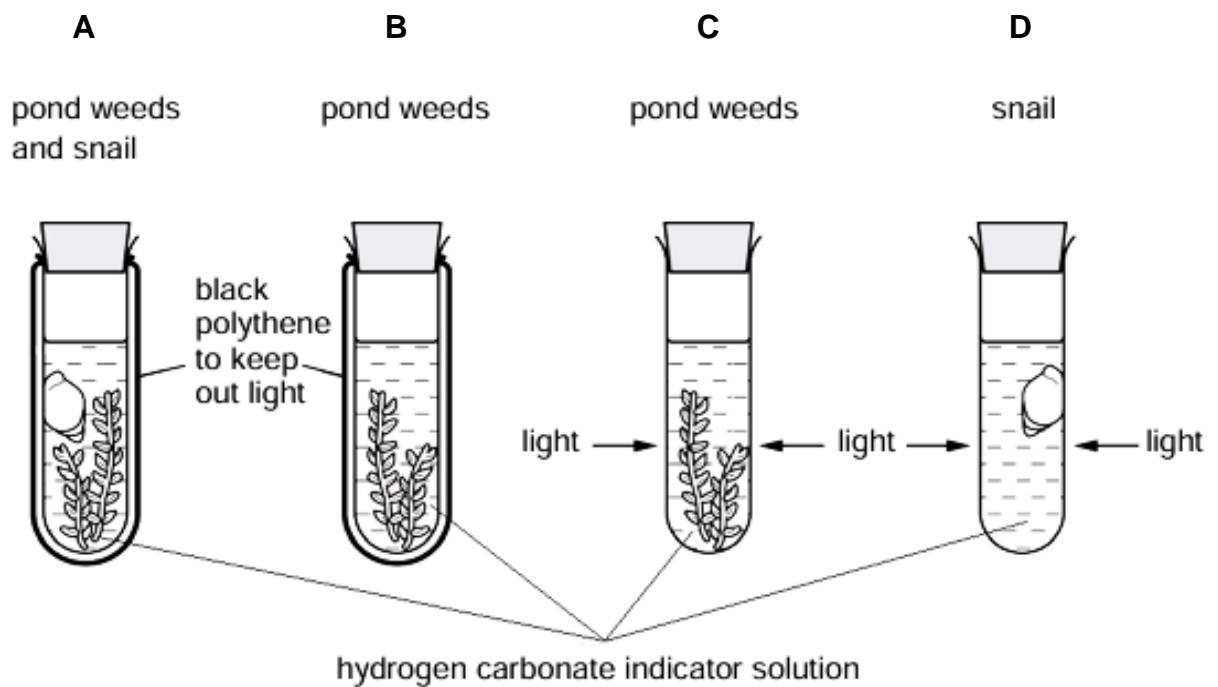
- A** Chambers **R** and **S** have different volumes.
- B** The walls of the atria are thinner than the walls of the ventricles.
- C** Valve **P** is stronger than valve **Q**.
- D** Wall **T** is more muscular than wall **U**.

- 9 Four test-tubes with hydrogen carbonate indicator solution are set up as shown below.

Hydrogen carbonate indicator solution stays red if there is no change in carbon dioxide concentration. The indicator turns yellow if the carbon dioxide concentration increases and purple if the carbon dioxide concentration decreases.

After 10 minutes, the indicator in one of the test-tubes turned purple.

Which test-tube turned purple?

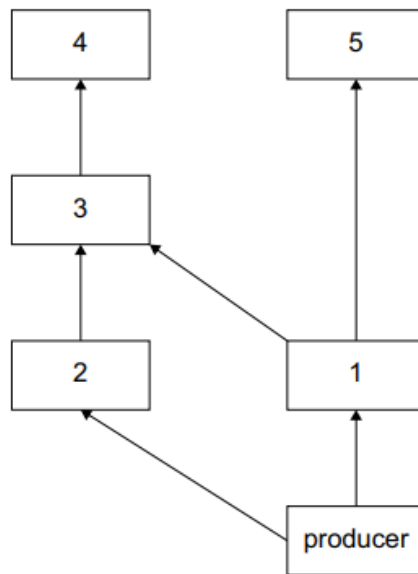


- 10 Which option indicates a common mode of transmission for the diseases?

	disease	mode of transmission
1	coronary heart disease	direct contact
2	HIV	malnutrition
3	influenza	respiratory droplets
4	pneumococcal disease	contaminated food and water

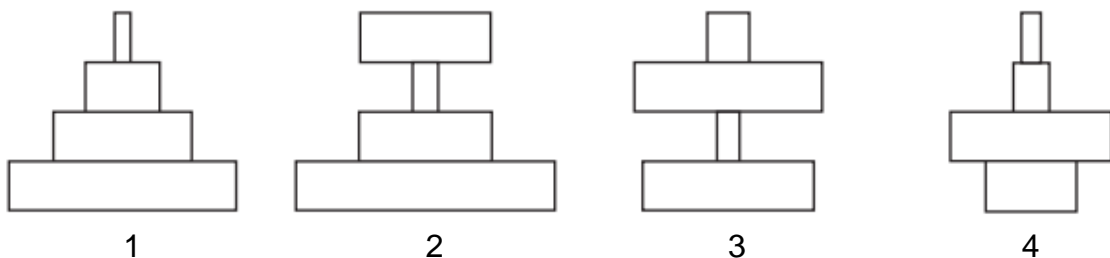
- A** 1 and 2 only **B** 2 and 3 only
C 3 and 4 only **D** All of the above

- 11 The diagram shows a food web.



Which organisms occupy the same trophic level?

- A** 1 and 4 **B** 2 and 3 **C** 2 and 5 **D** 3 and 5
- 12 The diagram shows four ecological pyramids.



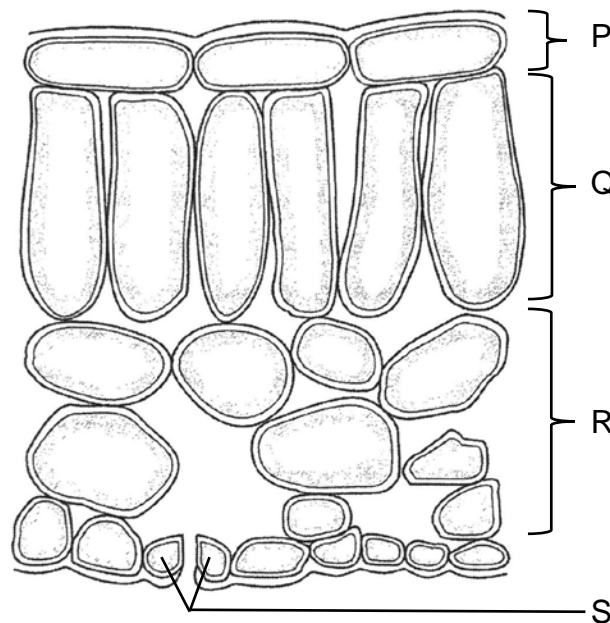
In a food chain, grass is eaten by cows. The cows have insects living on their skin. The insects are eaten by birds.

Which row shows the pyramid of biomass and pyramid of numbers in this food chain?

	pyramid of biomass	pyramid of numbers
A	1	3
B	1	4
C	3	1
D	3	2

- 13** Which statement about carbon sinks is correct?
- A** All carbon sinks are fossil fuels.
 - B** Carbon sinks emit more carbon dioxide than they absorb.
 - C** Carbon sinks remove carbon dioxide permanently from the atmosphere.
 - D** Increasing carbon sinks could reduce global warming.
- 14** The same number of cells from regions P to S were isolated from a green leaf, placed in a solution of 1.5% sodium hydrogencarbonate and exposed to the same light intensity.

Sodium hydrogencarbonate releases carbon dioxide in solution.



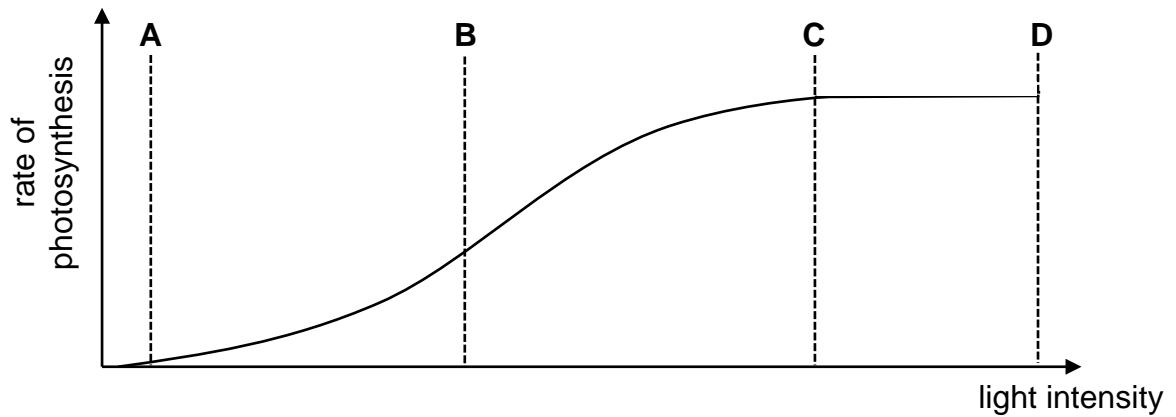
Gas released by each group of cells in 30 minutes was collected and tested.

Which group(s) of cells released oxygen gas?

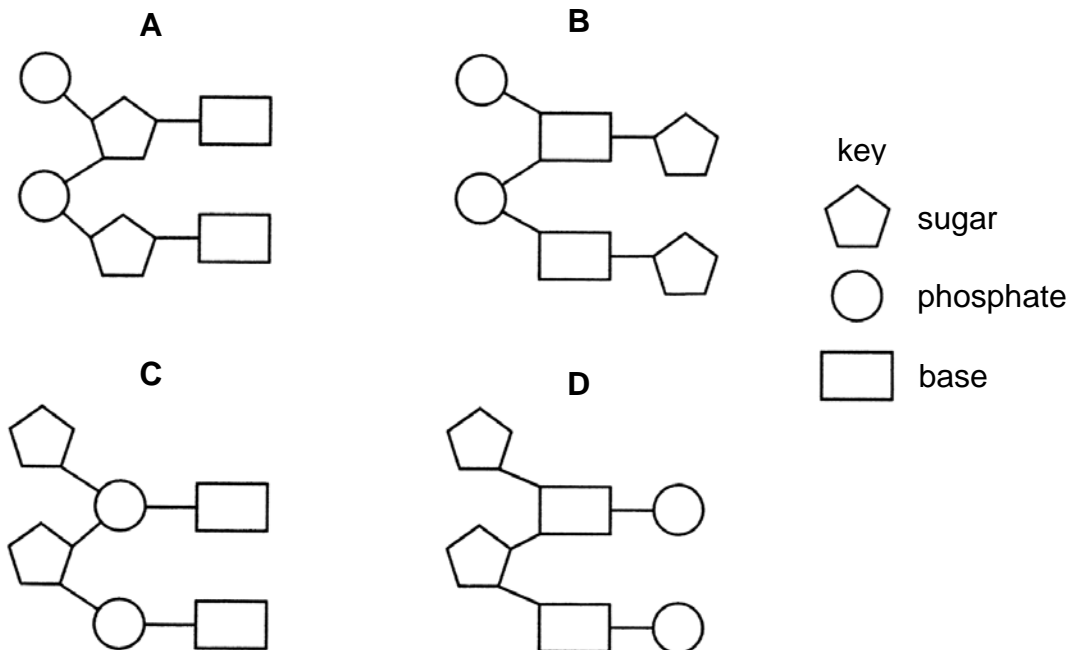
- | | |
|------------------|---------------------|
| A P and R | B P and S |
| C Q only | D Q, R and S |

- 15 The graph shows the rate of photosynthesis in a plant exposed to normal atmospheric conditions but different light intensities.

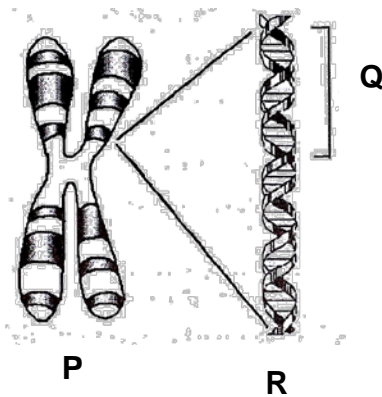
At which part of the graph did carbon dioxide concentration become a limiting factor?



- 16 Which diagram shows the structure of two nucleotides in a DNA molecule?



- 17 The diagram illustrates the relationship between chromosomes, genes and DNA.



Identify structures **P**, **Q** and **R**.

	P	Q	R
A	chromosome	DNA	gene
B	chromosome	gene	DNA
C	DNA	chromosome	gene
D	gene	chromosome	DNA

- 18 The diagram shows breeding rats where the allele for grey fur is dominant to white fur.



Which two individuals are definitely heterozygous for fur colour?

- A** 1 and 4 **B** 2 and 3
C 2 and 5 **D** 3 and 6

- 19 Which two characteristics show continuous and discontinuous variation?

	continuous	discontinuous
A	eye colour	height
B	weight	eye colour
C	height	weight
D	gender	eye colour

- 20 The chromosomes in four human cell samples are examined. What row shows an example of a chromosome mutation?

human cell samples	total number of chromosomes per cell	number of X chromosomes per cell	number of Y chromosomes per cell
A	23	0	1
B	23	1	0
C	46	1	2
D	46	2	0

- End of Paper -

Name: ()

Class:

ASSUMPTION ENGLISH SCHOOL PRELIMINARY EXAMINATION 2024

SCIENCE (BIOLOGY) 5088 / 04



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LEVEL: Sec 4 Express**DATE:** 27 August 2024**CLASSES:** Sec 4/2 & 4/3**DURATION:** 1 hour 15 minutes

Additional Materials provided: NIL

INSTRUCTIONS TO CANDIDATES**Do not open this booklet until you are told to do so.**

Write your NAME, INDEX NUMBER and CLASS at the top of this page. This paper consists of 2 sections.

SECTION A (55 marks)**STRUCTURED QUESTIONS**

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

SECTION B (10 marks)**FREE RESPONSE QUESTIONS**

Answer **one** question. Write your answers in the spaces provided on the question paper.

For Examiner's Use	
Paper 1	/20
Paper 4 Section A	/55
Paper 4 Section B	/10
Paper 5	/15
Total Marks	/100

This Question Paper consists of **19** printed pages including this page.

[Turn over

SECTION A – STRUCTURED QUESTIONS (55 marks)

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

- 1 A student peeled a layer of cells from the inside of an onion bulb. He placed them in a drop of water on a microscope slide and covered them with a cover slip.

Fig 1.1 shows what he saw when viewing the cells through a microscope.

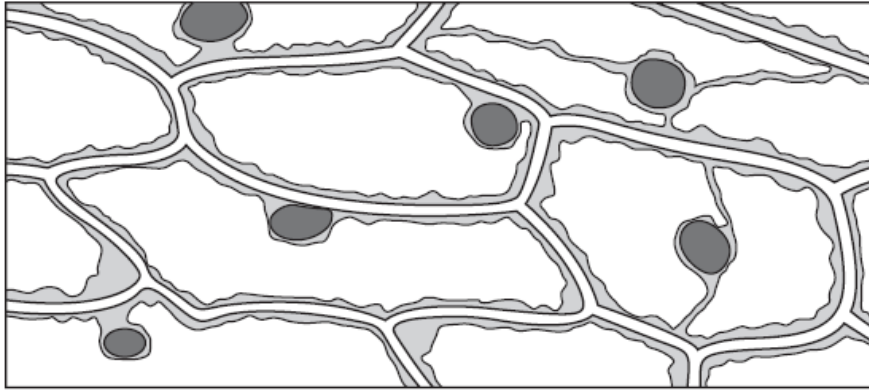


Fig. 1.1

- (a) State two ways in which the cells in Fig. 1.1 differ from animal cells.

.....

 [2]

The student replaced the water on the slide with a drop of concentrated sugar solution. He waited for five minutes and then looked at the cells through the microscope again.

Fig. 1.2 shows what he saw.

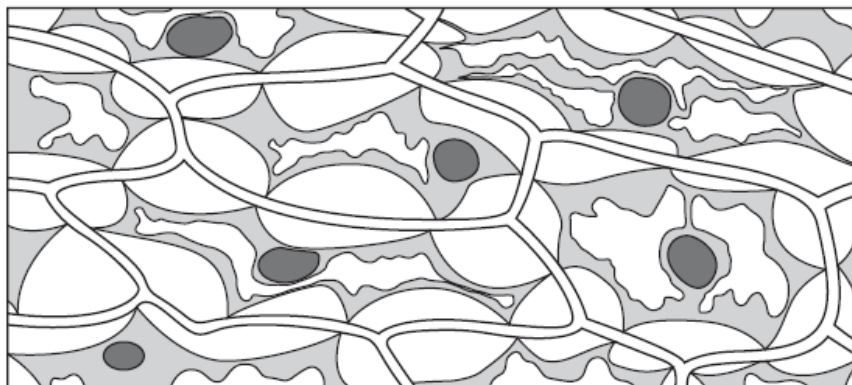


Fig. 1.2

- (b) (i) Label the partially permeable membrane on one of the cells in Fig. 1.2. [1]

- (ii) Describe and explain the appearance of the cells in Fig. 1.2.

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.....

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..... [3]

- 2 Fig. 2.1 shows the level of blood sugar and hormones **J** and **K** in a healthy person.

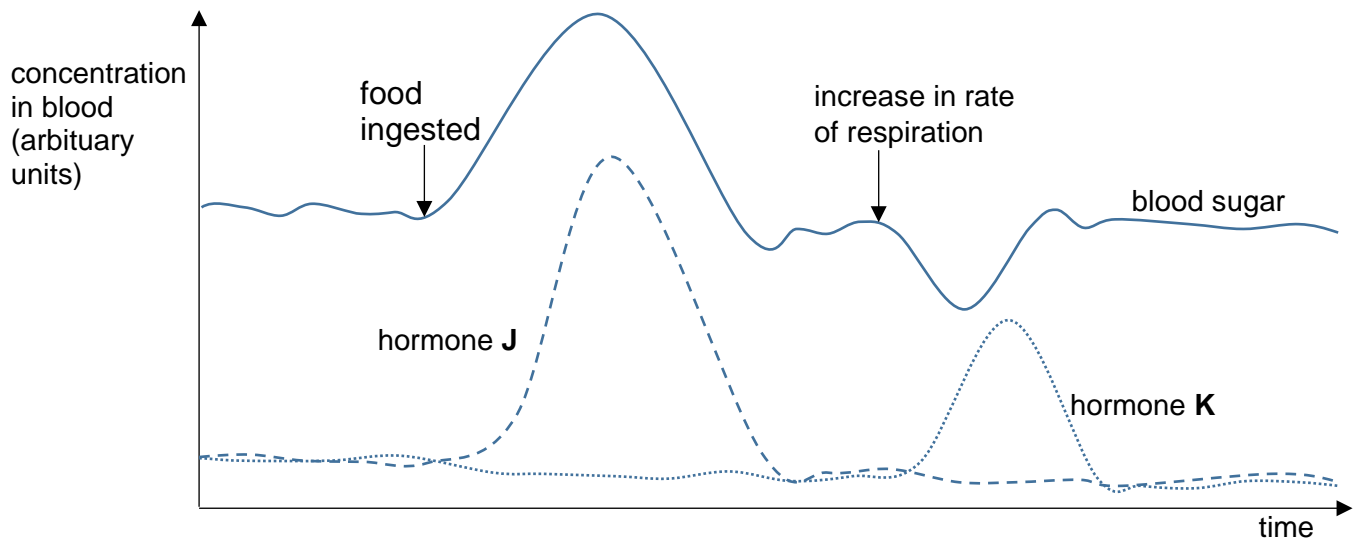


Fig. 2.1

- (a) Identify this 'blood sugar'.

..... [1]

- (b) Define what is meant by a *hormone*.

.....

 [2]

- (c) (i) Suggest the identities of hormone **J** and **K**.

hormone **J** hormone **K** [1]

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

hormone **J**

 hormone **K**
 [2]

- (d) State two effects of hormone J in the control of blood glucose concentration in the human body.

.....

.....

.....

..... [2]

- 3 Varicose veins are veins that have become enlarged and swollen. Varicose veins are often found on the leg such as shown in Fig. 3.1.



Fig. 3.1

Fig. 3.2 compares between a normal vein and a varicose vein.

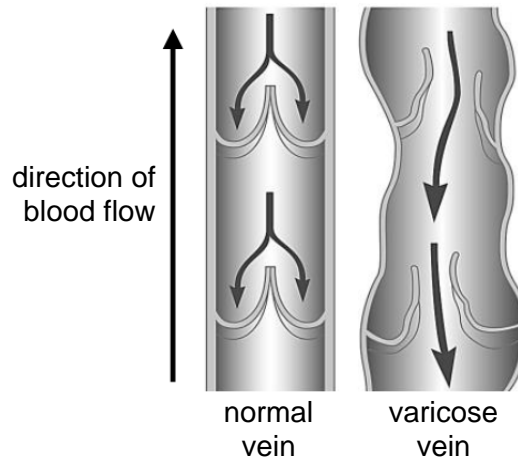


Fig. 3.2

- (a) By comparing both veins in Fig. 3.2, suggest why varicose veins can become enlarged as seen in Fig. 3.1.

.....

.....

.....

..... [2]

- (b)** Suggest why this condition does not often occur in arteries.

.....
.....
.....
..... [2]

- (c)** The blood flow in varicose veins may slow down, causing blood clots to form. Outline the process of blood clotting.

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.....
.....
..... [3]

4 Fig. 4.1 shows the carbon cycle.

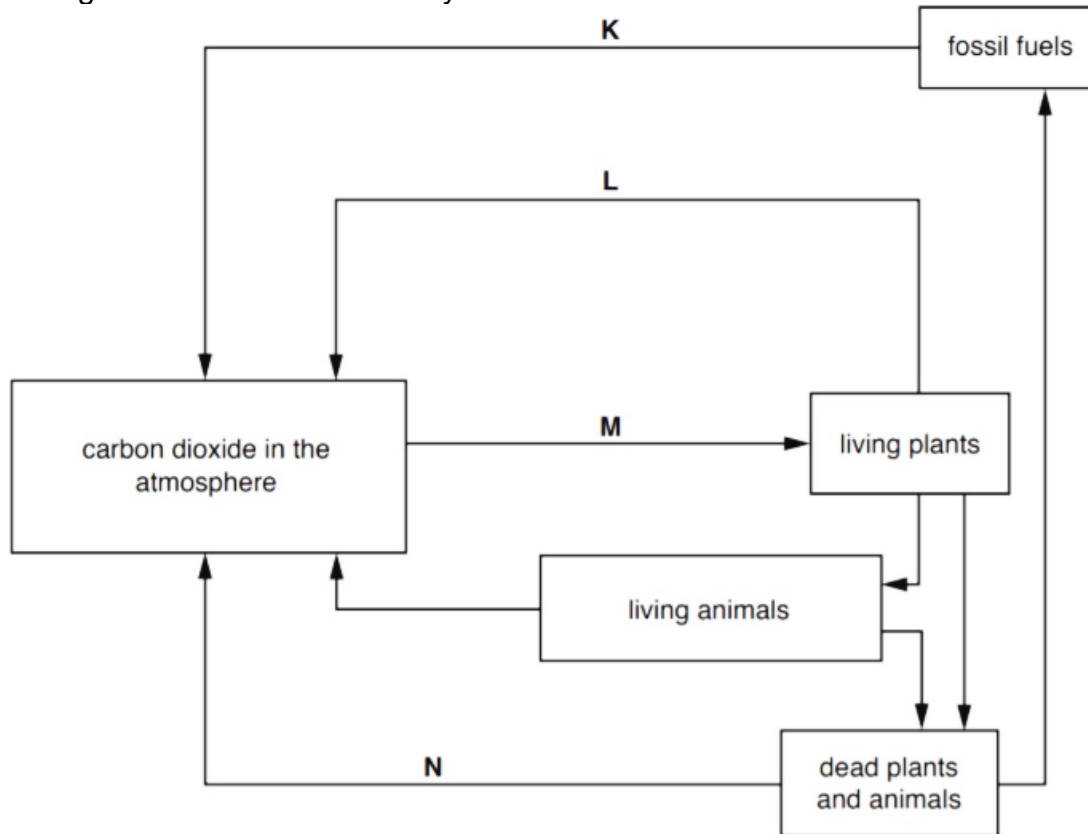


Fig 4.1

(a) Name the processes K, L, M & N.

K:

L:

M:

N:

[4]

(b) Explain the importance of decomposition in the carbon cycle.

.....

.....

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.....

.....

..... [3]

- 5 Fig. 5.1 shows an experiment set up to compare the loss in mass of two identical plants potted in damp soil over a period of time. The plants were placed in a dark room and were not watered throughout the experiment.

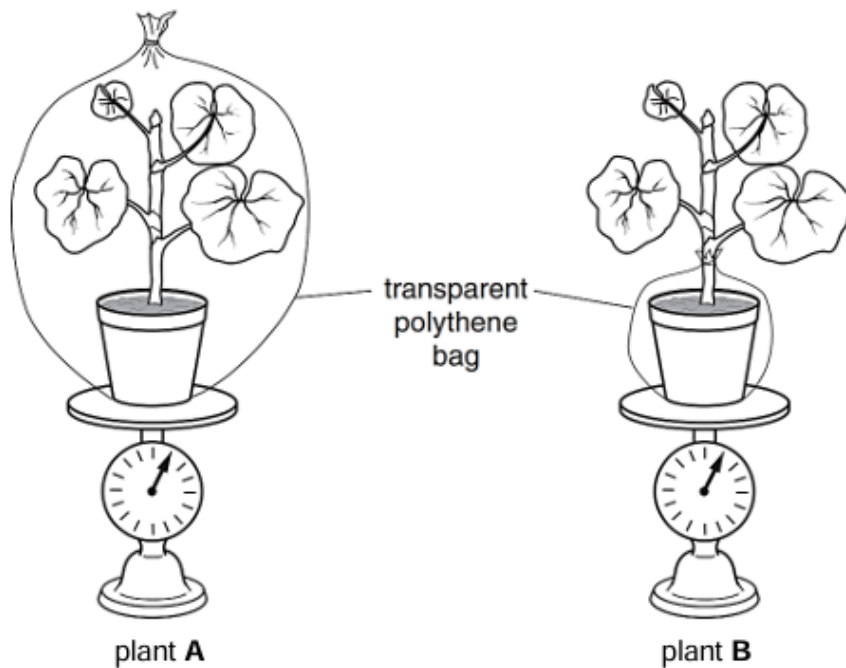


Fig. 5.1

Fig. 5.2 is a graph showing the loss in mass of the plants over the next five days.

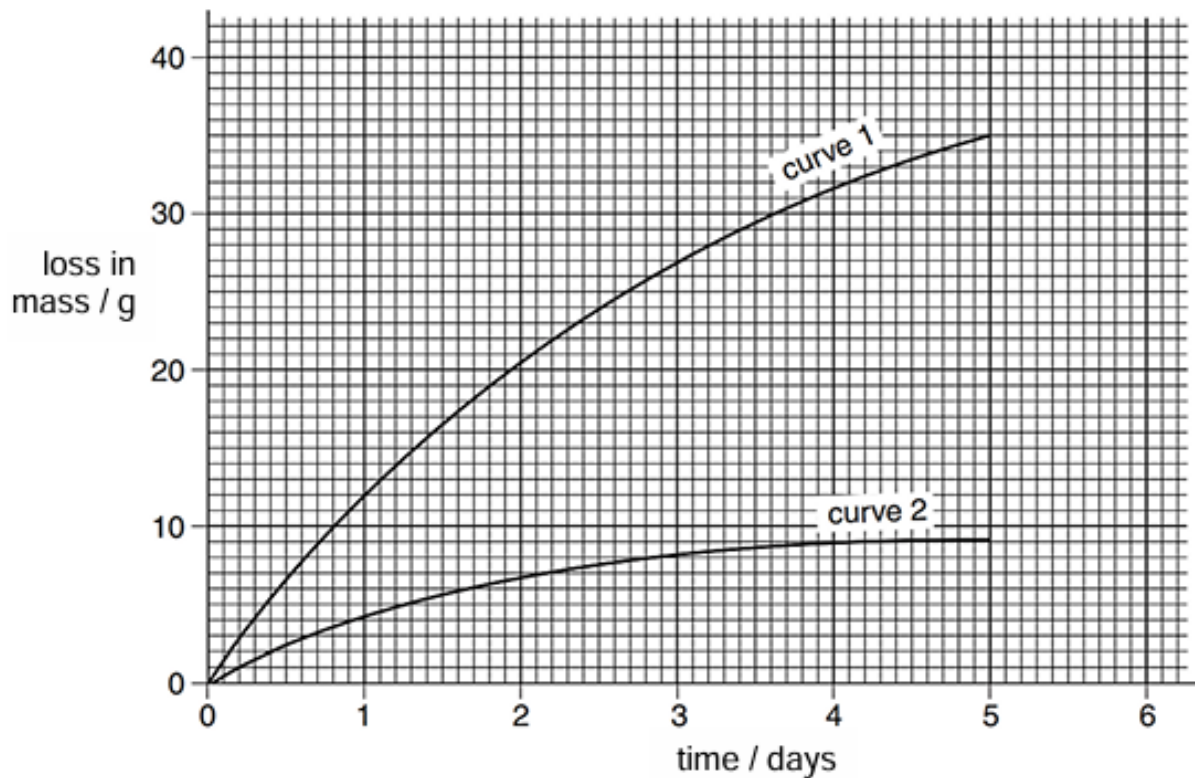


Fig. 5.2

- (a) (i) Which plant gives the result shown by curve 1?

plant [1]

- (ii) On Fig. 5.2, continue curve 1 to day 6 and calculate the mass that would be lost by this plant between day 5 and day 6. Show your working.

loss in mass = g [2]

- (b) (i) Name the process responsible for this loss in mass.

..... [1]

- (ii) Explain how this process is affected by the polythene bag around plant **A**.

.....

 [2]

- (c) Explain the effect on the loss of mass in plant **B** if there is a thin layer of petroleum jelly on the lower surfaces of all the leaves.

.....

 [2]

- (d) Name the chemical process which produces water inside a mesophyll cell in a leaf.

..... [1]

- 6 In humans, a person will have attached earlobes only if he/she is homozygous for this trait.

The pedigree chart in Fig. 6.1 shows the inheritance of this trait in a particular family.

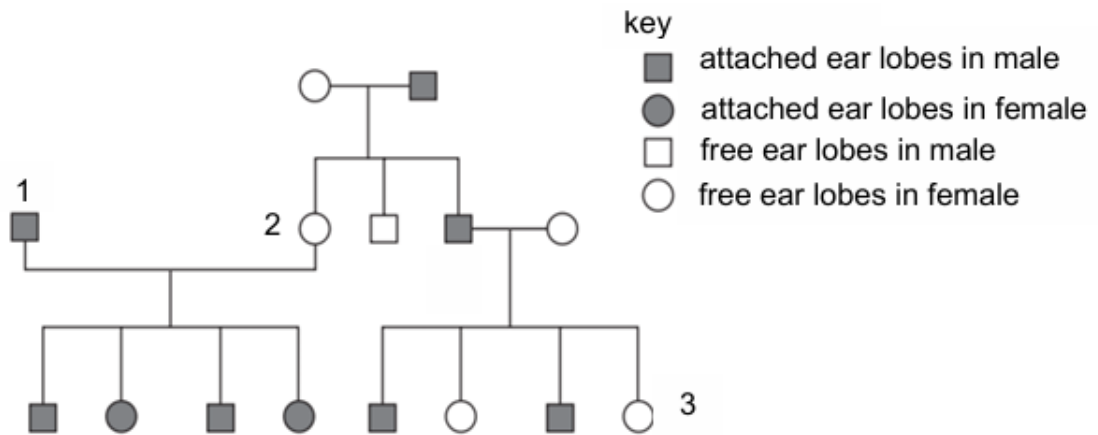


Fig. 6.1

- (a) Let T and t represents alleles for free and attached ear lobes respectively. State and explain the genotype of individual 3.

.....

.....

.....

..... [3]

- (b) Using a Punnett square, show the probability of individual 1 and 2 having a child with attached ear lobes.

		individual 2	
individual 1			

Probability: [3]

- (c) Compare your answer in (b) to the four children of individual 1 and 2 in Fig. 6.1. Suggest a reason for the difference.

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..... [2]

- 7 An investigation was carried out to determine the effect of temperature on an enzyme-controlled reaction.

Fig. 7.1 shows how the equipment was set up for investigation. The first temperature tested was 20°C.

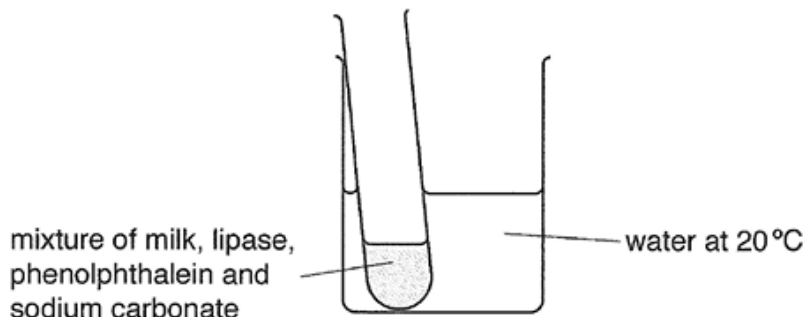


Fig. 7.1

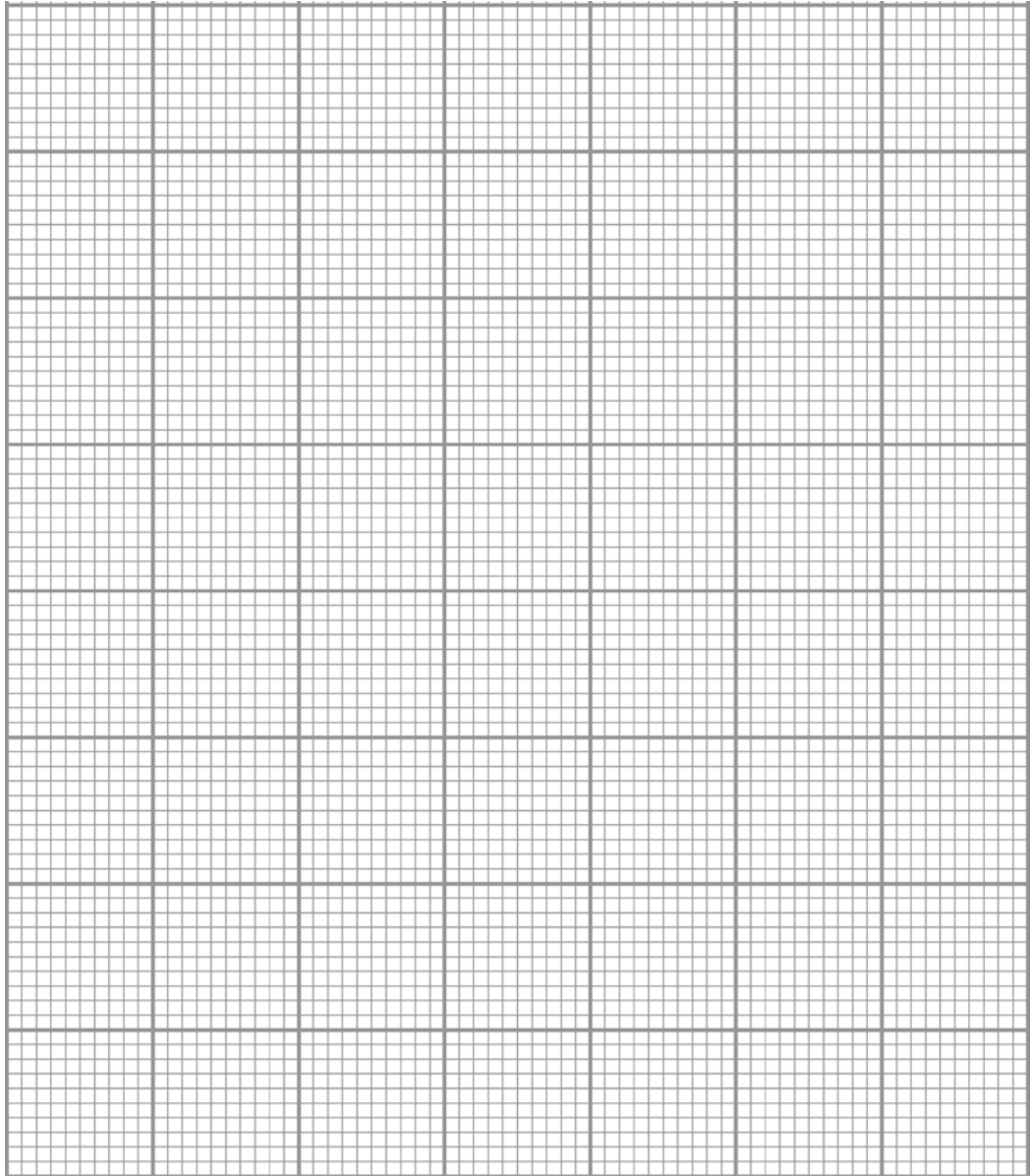
Milk contains milk fat. Phenolphthalein is an indicator that is pink in alkaline conditions above pH 8 and becomes colourless when the pH drops below pH 8. Sodium carbonate is used to make the solution alkaline.

In total, eight different temperatures were tested and the mixtures in all eight test tubes were pink at the start of the investigation. Table 7.1 shows the results of the investigation.

Table 7.1

temperature / °C	time taken to become colourless / minutes
20	18.0
25	10.5
30	4.0
35	2.5
40	5.5
45	12.0
50	20.5
55	> 60

- (a) Plot the data for all the temperatures in the range 20°C to 50°C, on the grid. Do not include the results for 55°C.



[4]

- (b) Using the graph, state the optimum temperature for enzyme lipase in this reaction.

..... [1]

(c) Explain why the phenolphthalein becomes colourless.

.....

.....

.....

.....

.....

..... [3]

(d) Explain why the phenolphthalein did not change colour at 55°C.

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.....

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..... [2]

SECTION B – FREE-RESPONSE QUESTIONS (10 marks)

Answer **one** question from this section.

- 8 Fig. 8.1 shows the changes in the concentrations of two hormones during one menstruation cycle.

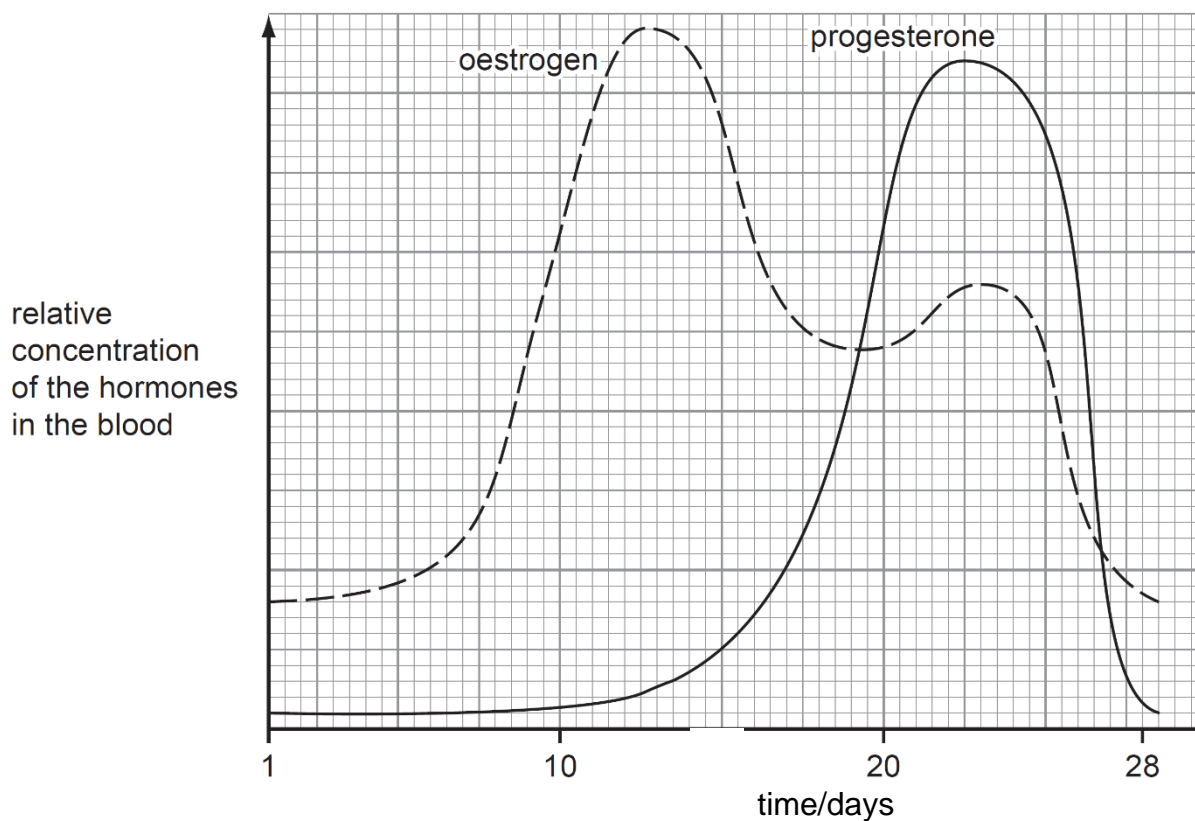


Fig. 8.1

- (a) With reference to Fig. 8.1 and your knowledge of the menstrual cycle, describe the levels of the two hormones in relation to the thickness of the uterine lining from day 10 to day 28.

.....

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..... [4]

- (b) Describe and explain what differences you would expect in the thickness of the uterus lining and concentration of hormones if an egg is fertilised during this cycle.

.....

.....

.....

.....

.....

..... [3]

- (c) A woman suspects that her partner might have Acquired Immune Deficiency Syndrome (AIDS), caused by the Human Immunodeficiency Virus (HIV). She is worried that it might spread to her through her partner's cough. The doctor advised that this is not true.

State **two** ways in which HIV is transmitted and suggest **one** way in which she can reduce the risk of getting infected.

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..... [3]

- 9 (a) Explain how the alveoli are adapted for gaseous exchange.

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..... [6]

- (b) Fig. 9.1 shows a microscopic view of the alveoli of a healthy person and the alveoli of a person affected by emphysema.

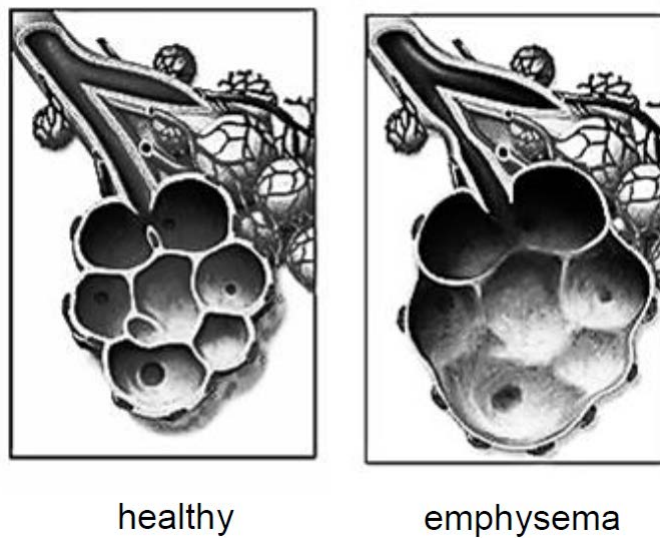


Fig. 9.1

With reference to Fig. 9.1, state and explain the differences between the healthy alveoli and the alveoli affected by emphysema.

.....

.....

.....

..... [2]

- (c) Patients with emphysema experience sore throats and coughs like patients infected with the influenza virus.

State two reasons why emphysema is not an infectious disease.

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..... [2]

- End of Paper-





ASSUMPTION ENGLISH SCHOOL
Sec 4 (Biology) 5088 Marking Scheme
Preliminary Examination 2024

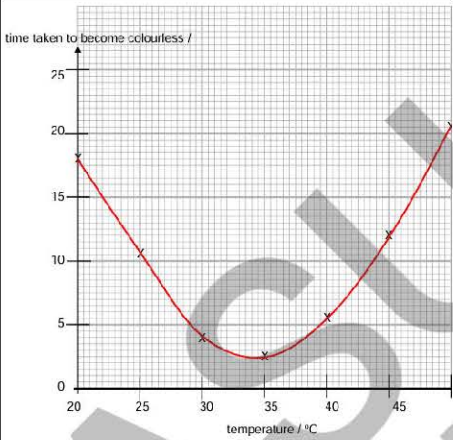
Paper 1 (20 m)

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
B	A	C	B	A	B	A	D	C	C
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
D	A	D	D	C	A	B	D	B	C

Paper 4 Section A (55 m)

1	a	presence of cell wall; large central vacuole;	1 1
	b i	correctly pointed to the partially permeable membrane and labelled ;	1
	b ii	Water leaves the cells by <u>osmosis</u> ; as water potential of the sugar solution is <u>lower</u> than that of the cell sap; cells become plasmolysed / where the vacuole shrinks and cell membrane pulls away from the cell wall;	1 1 1
			6
2	a	glucose	1
	b	hormone is a chemical substance; produced by a gland; carried by the blood; which alters the activity of one or more specific target organs; <i>Any 2 = 1m</i>	2
	ci	J: insulin, K: glucagon	1
	cii	Use info from graph J is secreted <u>after increase in blood glucose</u> and <u>reduces blood glucose to normal levels.</u> K is secreted <u>after decrease in blood glucose</u> and <u>increases blood glucose back to normal levels.</u>	1 1
	d	Don't repeat answer in cii <ul style="list-style-type: none"> Insulin stimulates/causes the liver to convert excess glucose into glycogen for storage; increase cell permeability to glucose for increased rate of glucose uptake; increase metabolic rate / respiration rate to oxidise glucose; <i>Any 2</i>	2
			8

3	a	Valves cannot close fully / damaged, causing backflow of blood; accumulation of blood causes swelling;	1 1									
	b	arteries carry blood at high pressure allowing blood to flow in one direction; absence of valves prevent blood from accumulating like in veins;	1 1									
	c	damaged tissues and platelets activates enzyme; which converts the soluble fibrinogen to insoluble fibrin; fibrin threads form a mesh and trap blood cells, forming a clot;	1 1 1									
			7									
4	a	K – combustion L – respiration M – photosynthesis N - decomposition	4									
	b	Decomposition breaks down nutrients locked in dead matter or excretory products and release them as simpler molecules like carbon dioxide ; (importance) - it aids in the recycling of carbon through the ecosystem; The plants will use the carbon dioxide in photosynthesis to form sugar/ nutrients to be used by the plants and animals.	1 1 1									
			7									
5	ai	plant B	1									
	aii	<i>continue curve 1 to 37 g or 38 g smoothly ; 37 or 38 – 35 = 2 or 3 g ;</i>	1 1									
	b i	Both plants in dark room, reject photosynthesis. Transpiration	1									
	b ii	Bag increases humidity / water vapour in air / prevents air movement ; results in less evaporation / less transpiration / less water loss ;	1 1									
	c	Loss in mass lower than B (without jelly) ; as there are more stomata on lower surfaces, less water is lost (compared to no jelly applied);	1 1									
	d	respiration	1									
			9									
6	a	Genotype: heterozygous / Tt Her father is homozygous recessive while her mother is heterozygous; Individual 3 inherited a recessive allele from the father and the dominant allele from the mother.	1 1 1									
	b	1 mark for correct parental genotype 1 mark for correct offspring genotype <table border="1"><tr><td></td><td>T</td><td>t</td></tr><tr><td>t</td><td>Tt</td><td>tt</td></tr><tr><td>t</td><td>Tt</td><td>tt</td></tr></table> 50%		T	t	t	Tt	tt	t	Tt	tt	2 1
	T	t										
t	Tt	tt										
t	Tt	tt										

	c	Even though there is a 50% chance for each of their child to have attached/free earlobes, all four children have attached earlobes; due to random fusion of gametes OR small sample size.	1 1
			8
7	a		4
	b	Students answer match graph line.	1
	c	When the milk fat was broken down by lipase, fatty acids and glycerol were produced; The fatty acids neutralised the sodium carbonate in solution; Thus, pH in the setup dropped to below 8, causing the phenolphthalein to become colourless.	1 1 1
	d	At 55 °C, lipase was denatured by the high temperature of 55 °C; thus, milk fat is not broken down and fatty acids are not produced to neutralise sodium carbonate;	1 1
			10

Paper 4 Section B (10 marks)

8	a	From day 10 to 13, oestrogen level is increasing; thickness of uterine lining is also increasing;	1
		From day 13 to 22, progesterone rapidly increases; thickness of uterine lining is maintained;	1
		From day 23 to 28, both hormones decreases when no fertilization takes place; uterine lining starts to break down and decrease in thickness	1
		Correct days from graph	1
	b	Describe: <ul style="list-style-type: none"> uterus lining thickness maintains at thickest ; progesterone remains high ; Explain: <ul style="list-style-type: none"> uterus lining remains thick for <u>embryo implantation</u> and <u>growth</u> ; 	1 1 1

	c	<p>Transmission:</p> <p>Through semen when it comes into contact with mucous membrane in the vagina;</p> <p>Through fluid in the vagina when it comes into contact with mucous membrane of urethra;</p> <p>When blood from an infected person gets into the bloodstream of an uninfected person</p> <p>Prevention:</p> <ul style="list-style-type: none"> - Keep to one sex partner - Abstinence - Males should wear condoms - Do not abuse drugs/ share needles - Do not share instruments that can break the skin and contaminate blood - Go to reliable operators if require acupuncture, ear piercing or tattooing. 	2
			1
9	a	<p>Numerous alveoli; to provide a large surface area for gaseous exchange;</p> <p>The wall of the alveolus is one cell thick; this provides short diffusion distance for gases, ensuring a higher rate of diffusion;</p> <p>Thin film of moisture covers the inner wall of the alveolus; This allows oxygen to dissolve in it;</p> <p>Wall of alveoli are richly supplied with blood capillaries; the flow of blood maintains the concentration gradient of gases;</p> <p style="text-align: right;"><i>Any 3 points</i></p>	6
	b	<p>The partition walls between alveoli has broken down in the alveolus with emphysema;</p> <p>compared to the healthy alveolus due to persistent violent coughing.</p>	1
			1
	c	<p>Emphysema is not caused by a pathogen.</p> <p>Emphysema cannot be spread from one person to another.</p>	1
			1





**BEATTY SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024
SECONDARY FOUR EXPRESS**

CANDIDATE
NAME

CLASS

REGISTER
NUMBER

SCIENCE (CHEMISTRY, BIOLOGY)

5088/01

Paper 1

Multiple Choice

28 August 2024

Setters:

Ms Ling Pei Ling

Mdm Siti Zubaidah

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, class and register number on the Multiple Choice 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.

A copy of the Data Sheet is printed on page **14**.

A copy of the Periodic Table is printed on page **15**.

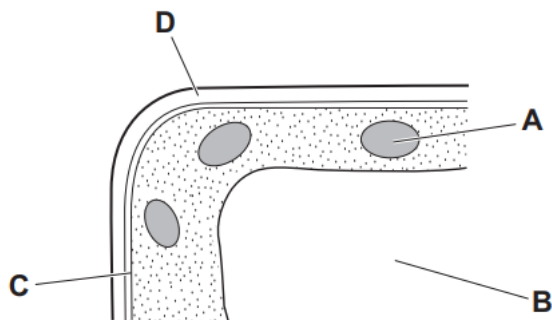
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **15** printed pages and **1** blank pages.

[Turn over

21 The diagram shows part of a plant cell.

Which labelled part controls the substances entering and leaving the cell?



22 Below are several statements on osmosis.

- Water particles move down a water potential gradient.
- Energy is required in osmosis.
- Osmosis can happen with or without a partially permeable membrane.
- An increase in surface area to volume ratio will increase rate of osmosis.
- Movement of water up the xylem is an example of osmosis.

How many of these statements is/are true?

A 1

B 2

C 3

D 4

23 Samples of glucose, maltase and sucrose were tested with Benedict's solution.

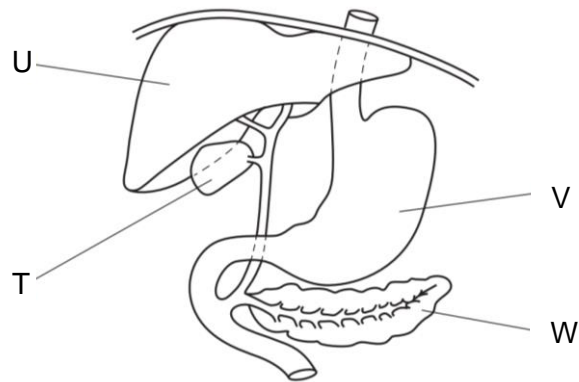
Which row shows the correct observation for each of the sample?

	glucose	maltase	sucrose
A	blue	blue	brick-red
B	brick-red	blue	blue
C	brick-red	blue	brick-red
D	brick-red	brick-red	blue

24 What are the substrates and products of pancreatic amylase and pancreatic protease, respectively?

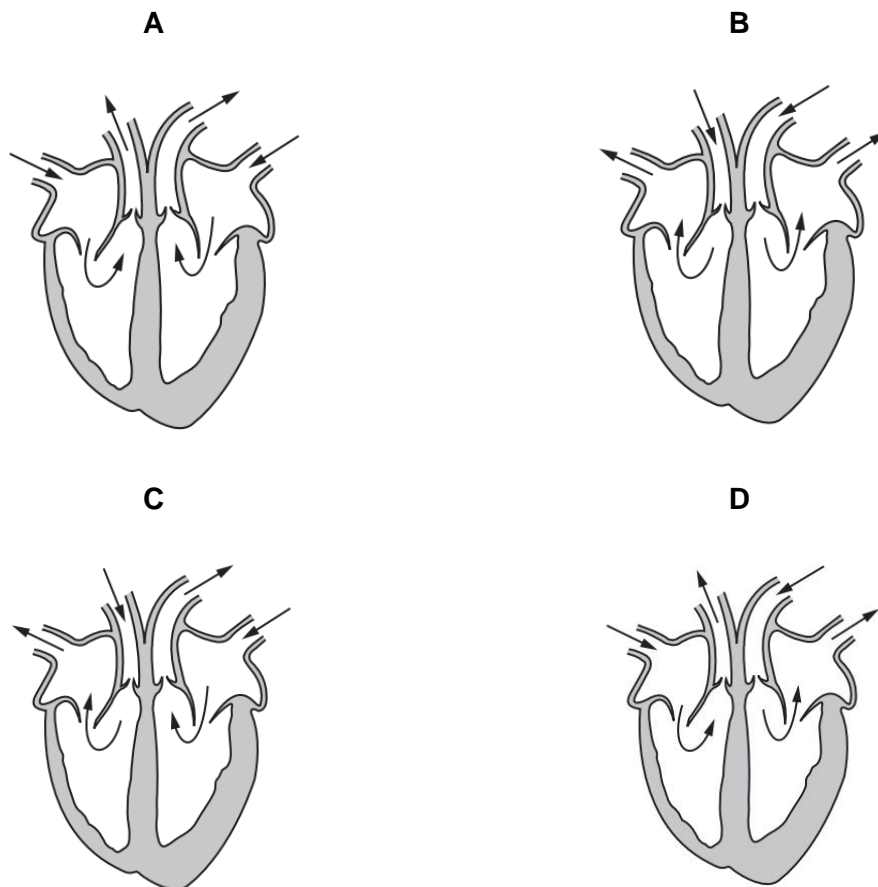
	pancreatic amylase		pancreatic protease	
	substrate	product	substrate	product
A	maltose	glucose	polypeptide	amino acid
B	starch	glucose	protein	polypeptide
C	starch	maltose	polypeptide	amino acid
D	starch	maltose	protein	polypeptide

- 25 The diagram shows part of the alimentary canal and associated organs.



Which structures are involved in the digestion of fats?

- A T, U and W
 - B T and V
 - C U and W
 - D V and W
- 26 Which diagram shows the correct direction of the flow of blood through the heart?



- 27 Which row correctly identifies the organ(s) that receive(s) blood from both an artery and a vein?

	kidney	liver	lungs
A	✓	x	✓
B	x	✓	x
C	x	✓	✓
D	✓	✓	✓

✓ = yes

x = no

- 28 Emphysema is a condition that arise because of long-term violent coughing. A person with emphysema has difficulties breathing.

Why does emphysema cause difficulty in breathing?

- A** alveoli become less elastic
 - B** over production of mucus in the bronchi
 - C** surface area becomes larger
 - D** trachea collapsed
- 29 Which row correctly shows the reactant(s) and product(s) of anaerobic respiration in muscles?

	reactant(s)	product(s)
A	glucose	lactic acid
B	glucose	lactic acid, carbon dioxide, water
C	glucose, oxygen	lactic acid
D	glucose, oxygen	lactic acid, carbon dioxide, water

- 30 Which of these diseases is caused by a pathogen?

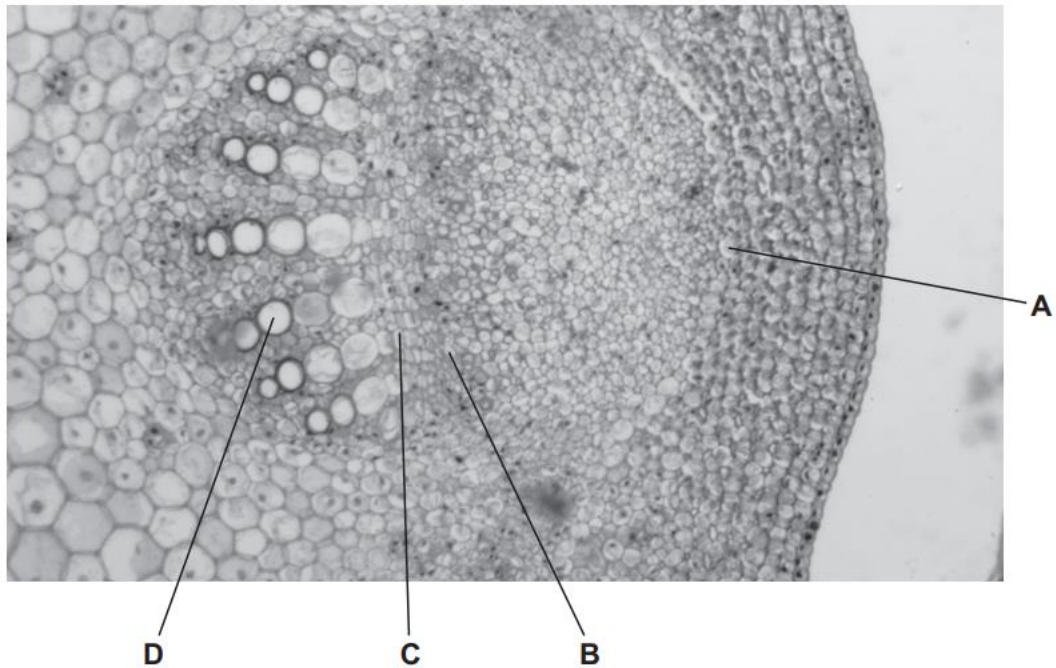
- A** liver cancer
- B** pneumococcal
- C** sickle-cell anaemia
- D** type 1 diabetes

- 31 Which of these will result in the development of antibiotic-resistant bacteria?

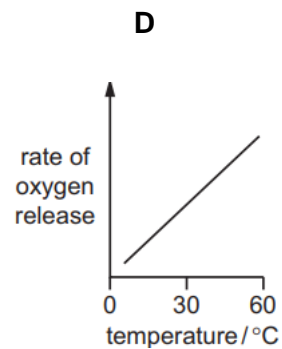
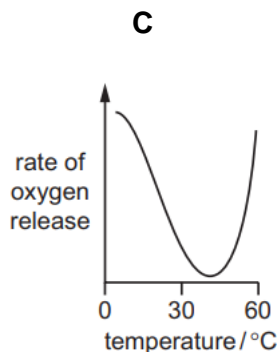
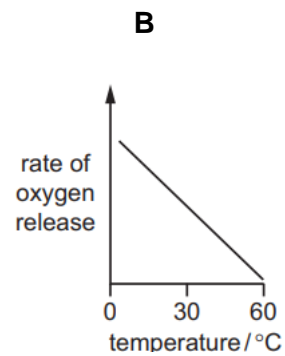
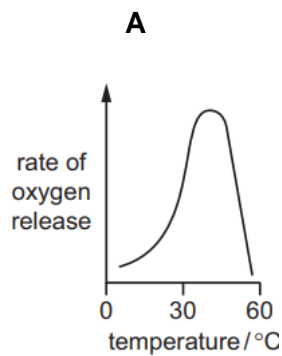
- A** not completing dose of antibiotics
- B** skipping booster vaccinations
- C** taking antibiotics before food
- D** taking antibiotics for an infection

- 32 The diagram shows the transverse section of a stem.

Which part will be stained when the stem is placed in a solution of red dye after a day?

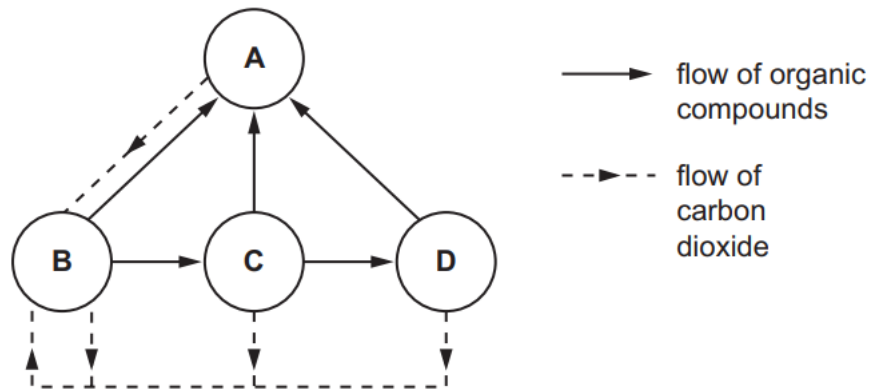


- 33 Which graph correctly shows the effect of temperature on the rate of oxygen released by an aquatic plant when placed under strong light?

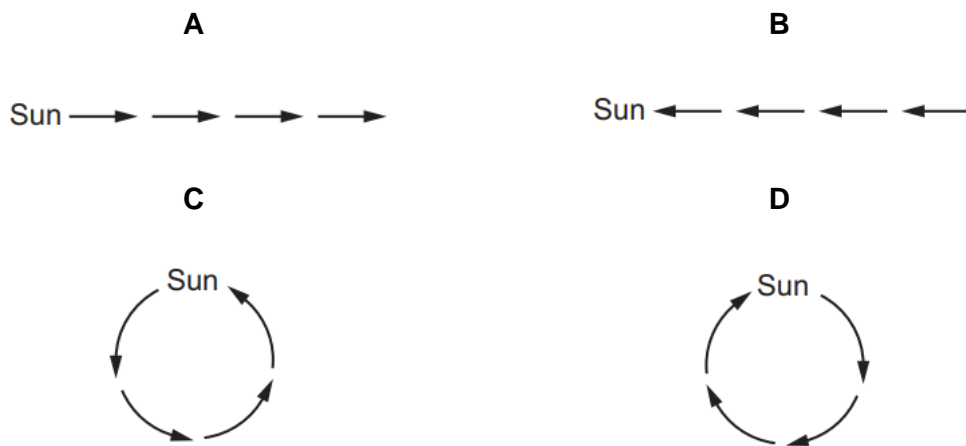


- 34** The diagram shows the flow of substances in an ecosystem. The circles represent the different trophic levels.

Which circle represents the producers?



- 35** Which diagram correctly shows the flow of energy within the ecosystem?



- 36** A polypeptide is made up of 240 amino acids.

How many bases are there in the gene that will be used to code for the polypeptide?

- A** 80
B 240
C 720
D 1440

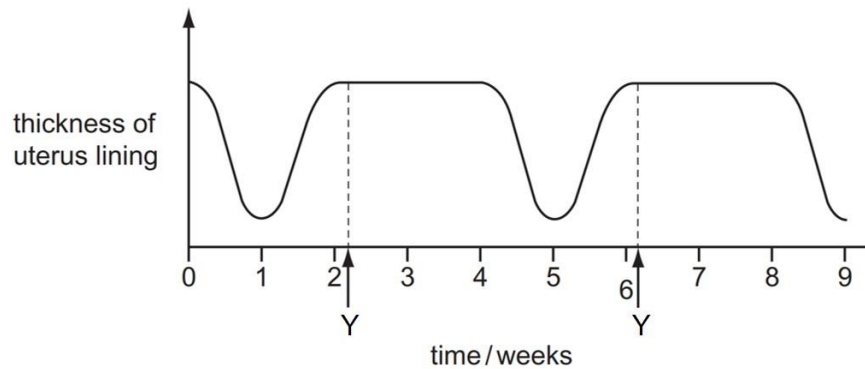
37 A student wrote several statements about DNA but made some mistakes.

- There are 23 pairs of chromosomes in a haploid cell.
- DNA is a double-stranded molecule made of nucleotides.
- A chromosome is a highly condensed DNA.
- DNA can contain many types of genes.
- In a pair of homologous chromosomes, the alleles can be identical.

How many of these statements is/are correct?

- A 1
B 2
C 3
D 4

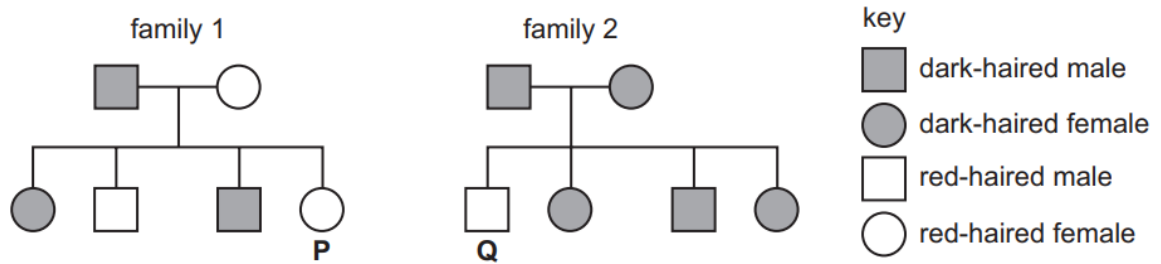
38 The graph shows changes in the thickness of the uterus lining of a woman.



Which statement best describes the event happening at Y?

- A implantation of embryo
B growth and repair of uterine lining
C release of mature egg from ovary
D uterine lining breaks down

- 39 The diagram shows the pattern of inheritance of dark haired and red haired in two families.



If individuals **P** and **Q** have children together, what is the percentage of having a child with dark-hair?

- A 0%
 - B 25%
 - C 75%
 - D 100%
- 40 Which of these phenotypes will show discontinuous variation?
- A foot size
 - B presence of dimples
 - C skin colour
 - D weight



**BEATTY SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024
SECONDARY FOUR EXPRESS**

CANDIDATE
NAME

CLASS

REGISTER
NUMBER

SCIENCE (CHEMISTRY, BIOLOGY)

Paper 4
Setter:

Biology
Mdm Siti Zubaidah

5088/04

**23 August 2024
1 hour 15 minutes**

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer only **one** question.

Write your answers in the spaces provided on the question paper.

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

For Examiner's Use	
A	55
B.....	10
Total	65

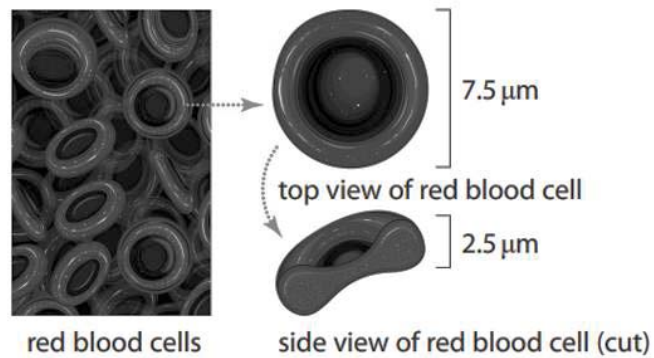
This document consists of 16 printed pages and 0 blank page.

[Turn over

Section A

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

- 1 Figure 1.1 below shows the structure and actual size of a red blood cell (not drawn to scale).



(Source: © N.Vinoth Narasingam/Shutterstock)

Fig. 1.1

- (a) Given that the top view of red blood cell is viewed at a magnification of 400x, calculate its image size.

Give your answer in mm. (1 mm = 1000 μm)

image size = mm [1]

- (b) Describe the structural adaptation of red blood cell, as seen in Fig. 1.1, allowing it to carry out its function effectively.

..... [2]

- (c) Red blood cells are usually stored in 5.0% glucose and 0.9% salt solution, in blood transfusion cases.

Explain why red blood cells **cannot** be stored in pure water.

..... [2]

2 Pineapple juice contains a protease known as bromelain.

A student investigates the effect of pH on the action of bromelain by carrying out the following method:

- place solid gelatine protein into five different test tubes up to a height of 5 cm;
- mix 5 cm³ of pineapple juice and 1 cm³ buffer solution of different pH (pH 3, 5, 7, 9 and 11) respectively;
- leave tubes for one hour in a water bath set to 37 °C;
- measure height of the solid gelatine and use it to calculate the volume of gelatine that has been digested.

Fig. 2.1 shows part of the student's method.

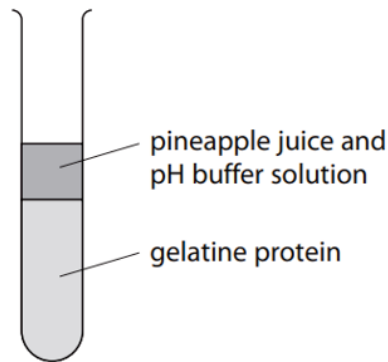


Fig. 2.1

- (a) Suggest one way the student can obtain a more reliable result.

..... [1]

- (b) Table 2.1 shows the results of the investigation.

Table 2.1

pH	volume of gelatine digested/ cm ³
3	0.32
5	0.98
7	0.51
9	0.33
11	0.01

- (i) From the results, state a possible optimum pH for the bromelain.

..... [1]

(ii) Explain your answer.

.....
 [2]

(c) Pineapple juice is often used to tenderise meat.

Suggest why it is advisable to use fresh pineapple juice instead of canned pineapple juice which has been treated to high temperatures to kill

.....
 [1]

3 (a) Stomata play an important role in photosynthesis.

Describe how stomata are involved in this process.

.....
 [2]

(b) Fig. 3.1 shows the number of stomata per mm^2 present on the lower surfaces of leaves of plants grown in soil of different water content.

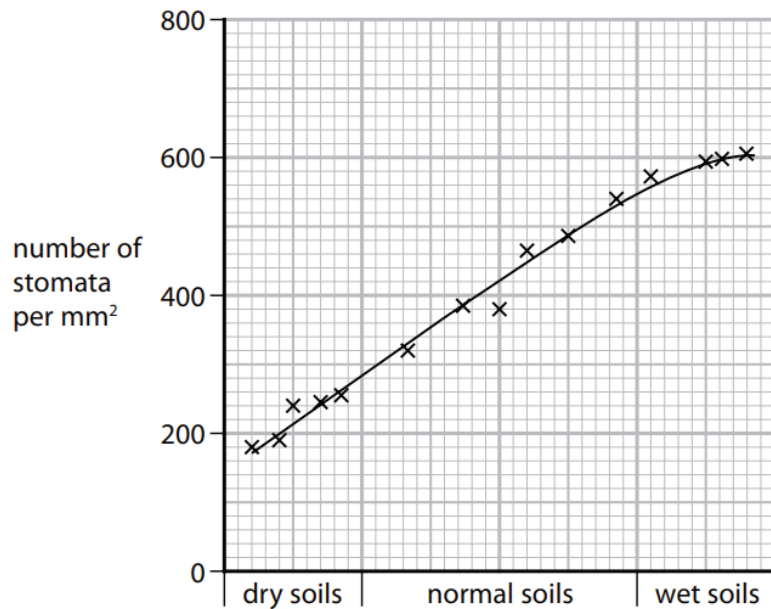


Fig. 3.1

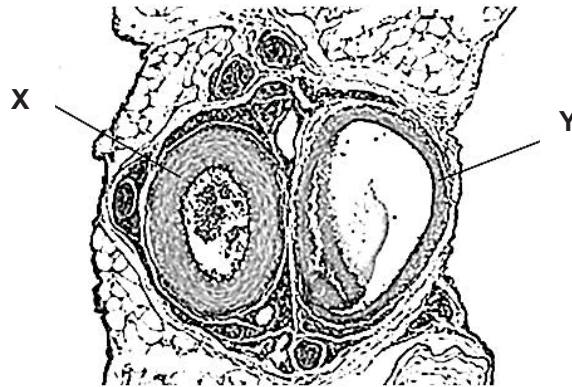
Describe the relationship between the number of stomata per mm² and the soil of

..... [1]

- (c) Explain the difference in the number of stomata per mm² between plants grown in dry soils and plants grown in wet soils

..... [3]

- 4 Fig. 4.1 shows a cross-section of two different blood vessels, **X** and **Y**, in the pancreas.



(Source: © The University of Kansas Medical Center)

Fig. 4.1

- (a) Determine, with a reason, the blood vessel that transports blood at high pressure.

..... [1]

- (b) State a structural difference between **X** and **Y** that is **not** seen in Fig. 4.1.

..... [1]

- (c) It was found that there is a higher level of a chemical substance in **Y** an hour after a meal rich in carbohydrates.

Identify **Y** and explain the increase in the level of **Y**.

.....
 [3]

- (d) Coronary arteries supply blood to the heart muscles.

Table 4.1 shows the blood flow in the coronary arteries in two different persons.

Table 4.1

person	blood flow through the coronary arteries in cm ³ per minute
A	250
B	155

.....

 [3]

- 5 Fig. 5.1 shows a strand of a DNA molecule showing part of a gene that is responsible in the production of haemoglobin.

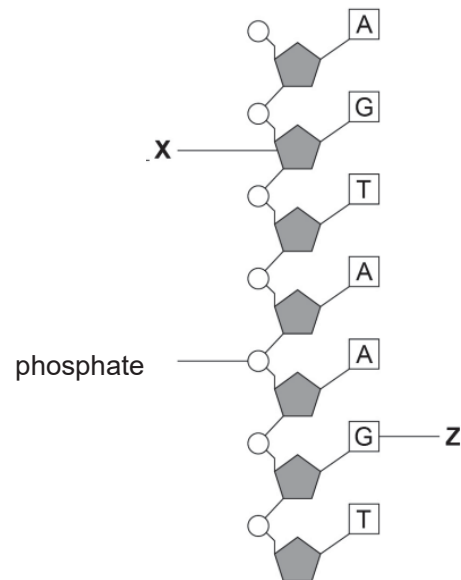


Fig. 5.1

- (a) Identify **X** and **Z**.

X:...

Z:...

[2]

- (b) Haemoglobin protein is made up of four different polypeptides. There are two processes involved in its production.

Complete Table 5.1 to identify the processes and product obtained at end of each process.

Table 5.1

process 1	
product	
process 2	
product	

[2]

(c) A mutation in **Z** (refer to Fig. 5.1) resulted in the production of a dysfunctional haemoglobin.

(i) State the type of mutation that took place.

..... [1]

(ii) Explain how the mutation resulted in the production of a dysfunctional haemoglobin.

..... [2]

(iii) Suggest how this mutation can affect the person.

.....

..... [1]

- 6 (a) Oestrogen and progesterone are hormones involved in the menstrual cycle in females.

Using oestrogen as an example, define *hormone*.

.....
 [3]

- (b) Fig. 6.1 shows the concentration of the hormones oestrogen and progesterone in the blood of women of different ages.

Table 6.1 shows the likelihood of getting pregnant across the different age groups.

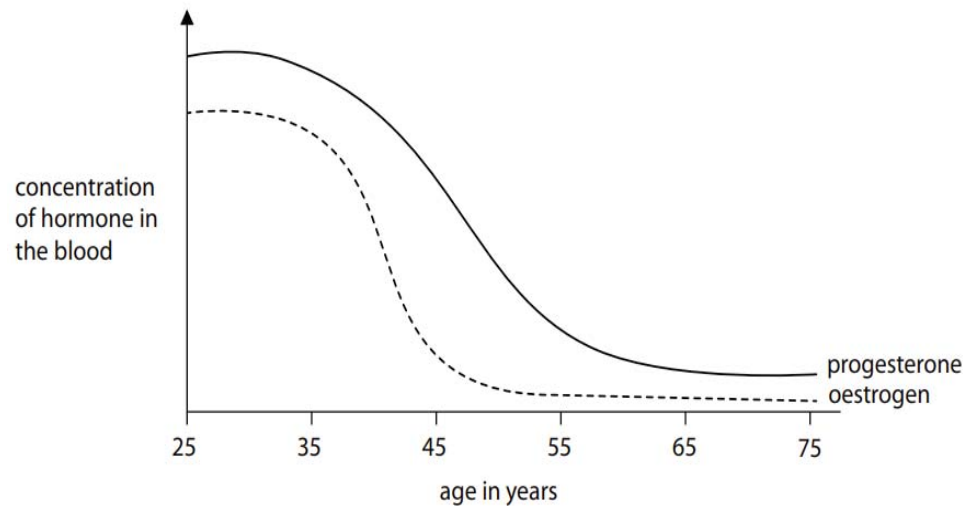


Fig. 6.1

Table 6.1

age groups	likelihood of getting pregnant / %
25-28	78
30-34	63
35-39	52
40-44	36
45-49	5
above 50	0

- (i) Describe the relationship between the concentration of hormones and the likelihood of getting pregnant.

.....
 [1]

- (ii) Using your knowledge of the functions of both hormones, explain why women, above 50 years old, have zero chance of getting pregnant.

..... [3]

- 7 Measles is a disease caused by a virus. Fig. 7.1 shows the number of cases of measles each year and the percentage of five year-olds vaccinated between 1950 and 2016 in the United Kingdom.

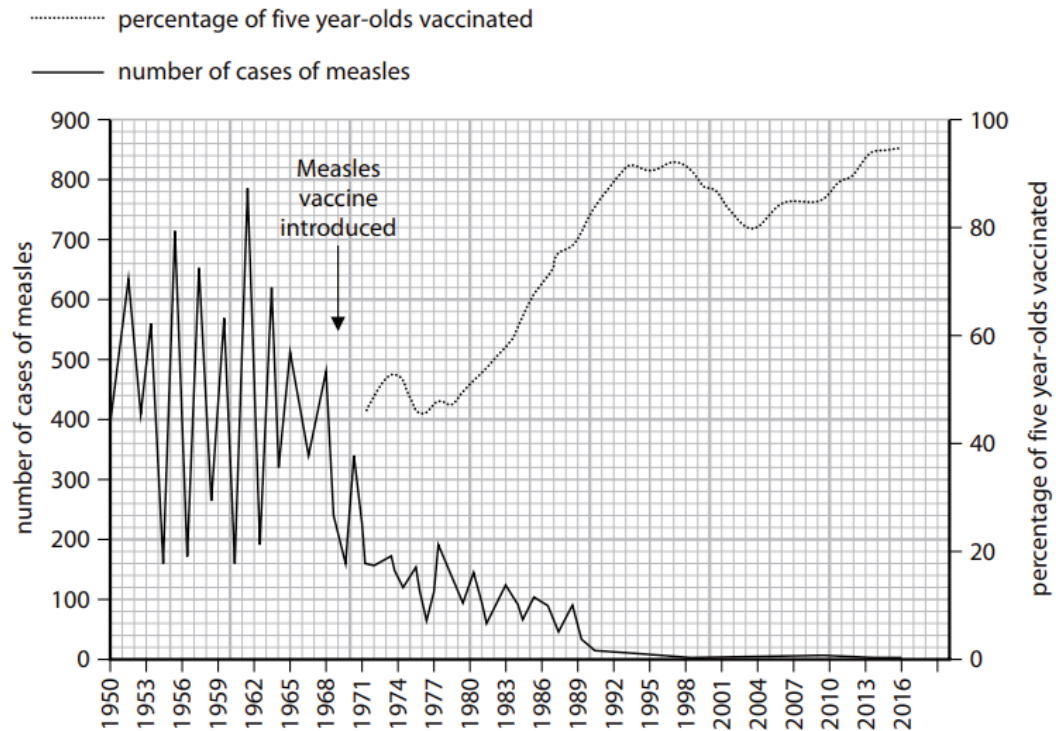


Fig. 7.1

- (a) Explain why measles is an infectious disease.

..... [1]

- (b) With reference to Fig. 7.1, describe the relationship between the number of cases of measles and percentage of five year-olds vaccinated.

.....

.....

..... [2]

- (c) Using your knowledge on how vaccines work, explain the relationship described in (b).

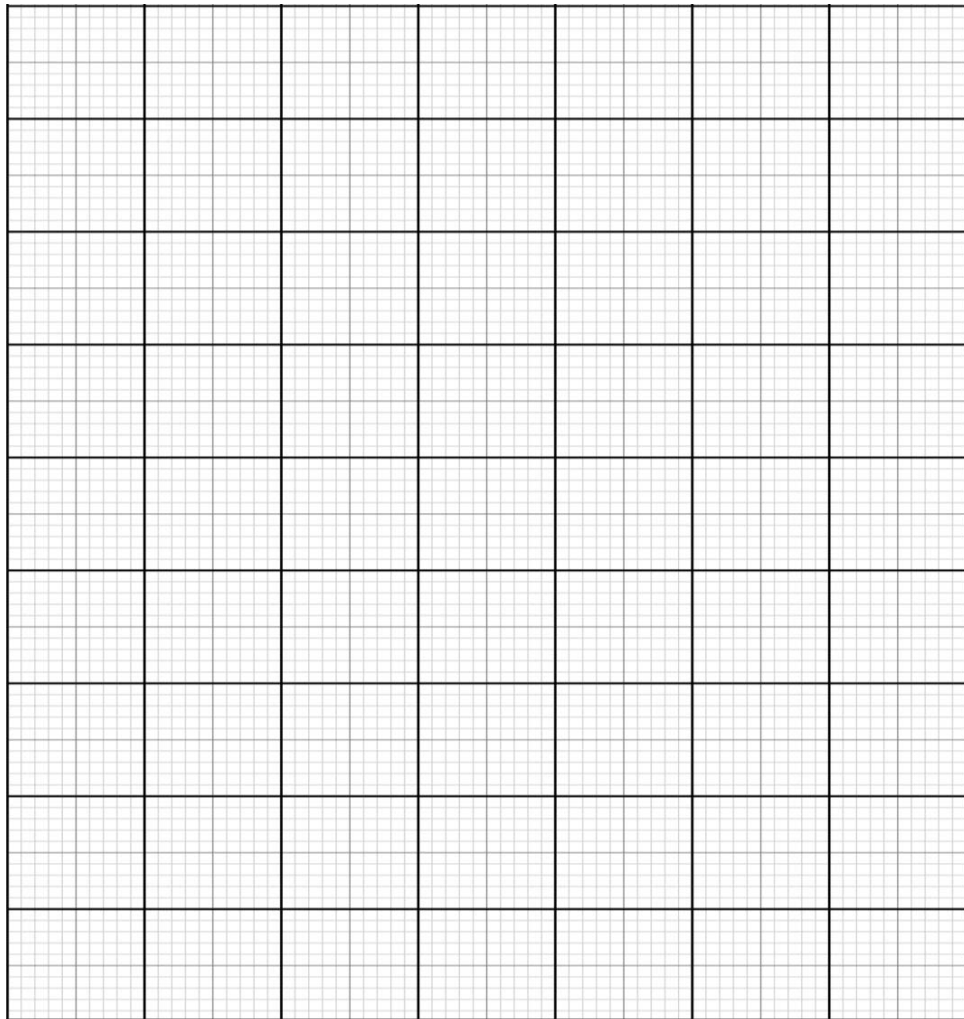
..... [3]

- 8 Table 8.1 shows the area of rainforest on the Earth from 1990 to 2015.

Table 8.1

year	area of rainforest/ km ²
1990	40850
1995	40500
2000	40120
2005	40020
2010	40008
2015	40000

- (a) Plot the data in the grid provided below.



[3]

- (b) Calculate the greatest percentage change in the area of rainforest per km² over a five year period.

[1]

- (c) Suggest a reason for the decrease in the area of rainforest on Earth over the years.

.....
 [1]

- (d) Rainforests are important carbon sinks.

Explain how the decrease in area of rainforest will lead to global warming.
 In your answer, include the definition of carbon sinks.

.....

 [3]

- (e) Rainforests are also habitats to many species of plants and animals.
 Fig. 8.1 shows some of the species living in the rainforest connected in a food web.

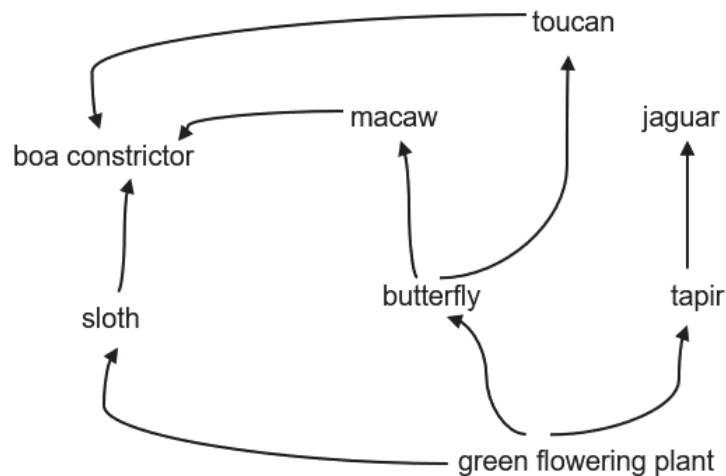


Fig. 8.1

- (i) State the number of secondary consumers present in the food web.

4

[1]

- (ii) The longest food chain in the Fig. 8.1 shows four trophic levels.

Explain why a fifth trophic level does **not** usually exist.

.....
..... [1]

Section B

Answer only **one** question in this section.

Write your answers in the spaces provided.

- 9** Muscular dystrophy (MD) is a type of genetic disease that results in progressive weakness of the muscles over time. Over time, a person with MD may lose ability to carry out movement. The disease will affect the quality and lifespan of the affected individual.

The disease is inherited by a recessive allele.

- (a)** A man and his pregnant wife, both carriers, are advised to do a genetic screening for MD on their fetus.

Explain, with a genetic diagram, to show why this screening may be useful. You may use 'D' or 'd' to represent the alleles.

..... [5]

- (b)** It is found that in some patients with MD, the number of a functional organelle in muscle cells is lower than normal.

Identify the organelle and explain how a lack of this organelle may result in MD.

..... [5]

- 10 (a)** Cancer of the small intestine is when the cells of the intestinal lining grow uncontrollably. One of the common signs of this disease is unexplained weight loss.

Describe the functions of the small intestine and explain how cancer of the small intestine can result in weight loss.

..... [4]

- (b) (i)** To support the nutritional requirements in patients with cancer of the small intestine, doctors will begin a procedure where a specially formulated mixture is supplied directly to the bloodstream of these patients.

Suggest, with reasons, the components that make up the mixture.

..... [4]

- (ii)** Such procedure, when carried over long-term, can result in liver disease.

Describe two functions of the liver.

.....

 [2]







BEATTY SECONDARY SCHOOL - SCIENCE DEPARTMENT
MARKING SCHEME

Name of Setter(s): Mdm Siti Zubaidah

Title of Prelim 2024

Assessment:

Subject: Science Biology

Level: Secondary 4E

Paper 1 MCQ (20 Marks)									
21	22	23	24	25	26	27	28	29	30
C	B	B	D	A	A	B	C	A	B
31	32	33	34	35	36	37	38	39	40
A	D	A	B	A	C	D	C	A	B



**BEATTY SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024
SECONDARY FOUR EXPRESS**

CANDIDATE
NAME

CLASS

REGISTER
NUMBER

SCIENCE (CHEMISTRY, BIOLOGY)

5088/04

Paper 4

Biology

23 August 2024

Setter:

Mdm Siti Zubaidah

1 hour 15 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer only **one** question.

Write your answers in the spaces provided on the question paper.

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

For Examiner's Use	
A	55
B.....	10
Total	65

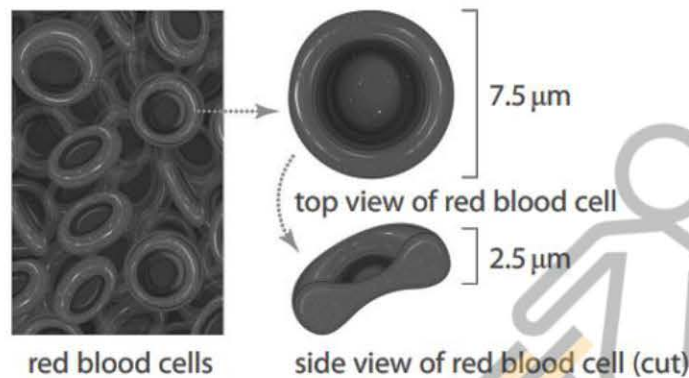
This document consists of 16 printed pages and 0 blank page.

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Section A

Answer all the questions in the spaces provided.

- 1 Figure 1.1 below shows the structure and actual size of a red blood cell (not drawn to scale).



(Source: © N.Vinoth Narasingam/Shutterstock)

Fig. 1.1

- (a) Given that the top view of red blood cell is viewed at a magnification of 400x, calculate its image size.

Give your answer in mm. (1 mm = 1000 μm)

$$\text{Image size} = 400 \times 7.5 = 3000 \mu\text{m}$$

$$3000 / 1000 = 3 \text{ mm};$$

image size = mm [1]

- (b) Describe the structural adaptation of red blood cell, as seen in Fig. 1.1, allowing it to carry out its function effectively.

Biconcave structure;

Increase surface area to volume ratio to increase rate of diffusion of oxygen;

[2]

- (c) Red blood cells are usually stored in 5.0% glucose and 0.9% salt solution, in blood transfusion cases.

Explain why red blood cells cannot be stored in pure water.

The water potential in red blood cell is lower than pure water;

Water enters cells by osmosis and will cause the cells to burst/undergo lysis;

[2]

2 Pineapple juice contains a protease known as bromelain.

A student investigates the effect of pH on the action of bromelain by carrying out the following method:

- place solid gelatine protein into five different test tubes up to a height of 5 cm;
- mix 5 cm³ of pineapple juice and 1 cm³ buffer solution of different pH (pH 3, 5, 7, 9 and 11) respectively;
- leave tubes for one hour in a water bath set to 37 °C;
- measure height of the solid gelatine and use it to calculate the volume of gelatine that has been digested.

Fig. 2.1 shows part of the student's method.

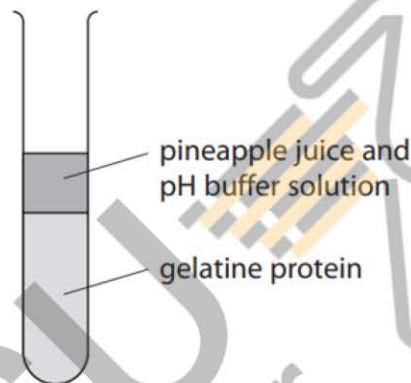


Fig. 2.1

- (a) Suggest one way the student can obtain a more reliable result.

Repeat the experiment a few times and take its average height

[1]

- (b) Table 2.1 shows the results of the investigation.

Table 2.1

pH	volume of gelatine digested/ cm ³
3	0.32
5	0.98
7	0.51
9	0.33
11	0.01

- (i) From the results, state a possible optimum pH for the bromelain.

pH 5

[1]

- (ii) Explain your answer.

The volume of gelatine digested is the highest at pH 5;

This shows that enzyme bromelain is most active/ has the highest rate of activity at the pH; [2]

- (c) Pineapple juice is often used to tenderise meat.

Suggest why it is advisable to use fresh pineapple juice instead of canned pineapple juice which has been treated to high temperatures to kill microbes.

During canning, high heat may have denatured the enzyme in the pineapple juice hence the enzymes will not be able to digest gelatine.

Fresh pineapple juice contains active enzymes that can digest gelatine. [1]

- 3 (a) Stomata play an important role in photosynthesis.

Describe how stomata are involved in this process.

Stomata opens to allow entry of carbon dioxide which is a raw material needed for photosynthesis;

Stomata also allows oxygen gas produced at end of photosynthesis to exit; [2]

- (b) Fig. 3.1 shows the number of stomata per mm^2 present on the lower surfaces of leaves of plants grown in soil of different water content.

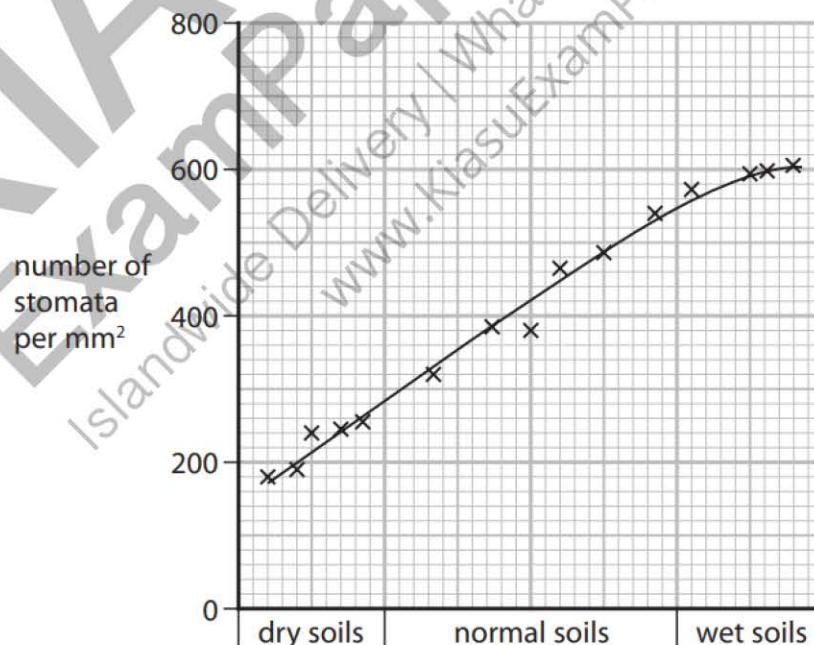


Fig. 3.1

Describe the relationship between the number of stomata per mm^2 and the soil of different water content.

As the water content of the soil increases from dry to wet, the number of stomata increases from 180 per mm^2 to about 600 per mm^2 .

[1]

- (c) Explain the difference in the number of stomata per mm^2 between plants grown in dry soils and plants grown in wet soils.

Difference: Lesser stomata in dry soils than in wet soils; [no need for values]

In dry soils, there is less water absorbed by roots into plants hence there is lesser stomata to reduce rate of transpiration;

thus preventing excessive loss of water/ wilting;

In wet soils, rate of water absorption of water is constantly high. The higher number of stomata allows a higher rate of transpiration to take place.

[3]

- 4 Fig. 4.1 shows a cross-section of two different blood vessels, X and Y, in the pancreas.



(Source: © The University of Kansas Medical Center)

Fig. 4.1

- (a) Determine, with a reason, the blood vessel that transports blood at high pressure.
X as there is a thicker (muscular) wall/ smaller lumen as compared to Y.

[1]

- (b) State a structural difference between X and Y that is not seen in Fig. 4.1.
Y has valves but X does not.

[1]

- (c) It was found that there is a higher level of a chemical substance in Y an hour after a meal rich in carbohydrates.

Identify Y and explain the increase in the level of Y.

Chemical substance is insulin/ Y is vein;

Carbohydrates are digested into glucose and absorbed into bloodstream;

Blood glucose levels increase above normal causing pancreas to release insulin

To stimulate liver cells to convert excess glucose to glycogen, lowering blood glucose to normal level;

[3]

- (d) Coronary arteries supply blood to the heart muscles.

Table 4.1 shows the blood flow in the coronary arteries in two different persons.

Table 4.1

person	blood flow through the coronary arteries in cm^3 per minute
A	250
B	155

Suggest and explain which person will have a higher risk of having a heart attack.

Person B as rate of blood flow is slower in B than A;

Heart muscles will not receive enough oxygen and glucose for respiration;
(R: no oxygen and no glucose) (A: nutrients instead of glucose)

Heart muscles will die thus leading to heart attack;

[3]

- 5 Fig. 5.1 shows a strand of a DNA molecule showing part of a gene that is responsible in the production of haemoglobin.

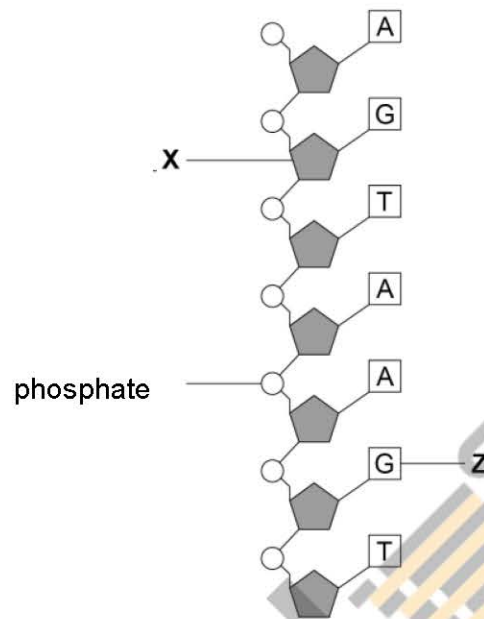


Fig. 5.1

- (a) Identify X and Z.

X: X: deoxyribose sugar;

Z: Z: Guanine;

[2]

- (b) Haemoglobin protein is made up of four different polypeptides. There are two processes involved in its production.

Complete Table 5.1 to identify the processes and product obtained at end of each process.

Table 5.1

process 1	<u>transcription</u>
product	<u>messenger RNA</u>
process 2	<u>translation</u>
product	<u>polypeptide</u>

[2]

- (c) A mutation in Z (refer to Fig. 5.1) resulted in the production of a dysfunctional haemoglobin.

(i) State the type of mutation that took place.

gene mutation

[1]

(ii) Explain how the mutation resulted in the production of a dysfunctional haemoglobin.

A change in the base resulted in a change in the codon that codes for a different amino acid;

As the amino acid changes, the polypeptide produced will be different resulting in the dysfunctional haemoglobin;

[2]

(iii) Suggest how this mutation can affect the person.

Person will feel breathless/ easily tired;

[1]

- 6 (a) Oestrogen and progesterone are hormones involved in the menstrual cycle in females.

Using oestrogen as an example, define *hormone*.

Oestrogen is released in minute quantities by the ovary, which is an endocrine gland into the bloodstream;

It is then transported to the target organs such as the uterus where it helps to repair the growth of uterine lining;

It is then broken down in the liver;

[3]

- (b) Fig. 6.1 shows the concentration of the hormones oestrogen and progesterone in the blood of women of different ages.

Table 6.1 shows the likelihood of getting pregnant across the different age groups.

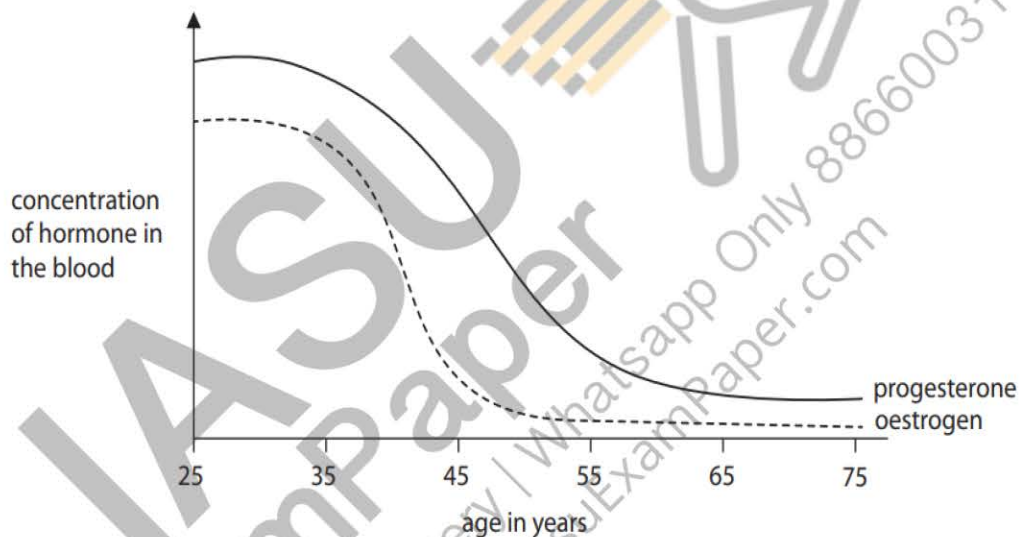


Fig. 6.1

Table 6.1

age groups	likelihood of getting pregnant / %
25-28	78
30-34	63
35-39	52
40-44	36
45-49	5
above 50	0

- (i) Describe the relationship between the concentration of hormones and the likelihood of getting pregnant.

As the concentration of hormones decrease, the likelihood of getting pregnant decreases.

[1]

- (ii) Using your knowledge of the functions of both hormones, explain why women, above 50 years old, have zero chance of getting pregnant.

Low levels of oestrogen does not stimulate ovulation, no mature egg is released hence there is no fertilisation;

Low levels of progesterone and oestrogen do not maintain the thickness of the uterine lining/ uterine lining not well supplied with blood vessels;

If there is successful fertilisation, the embryo cannot be implanted hence there can be no pregnancy;

[3]

- 7 Measles is a disease caused by a virus. Fig. 7.1 shows the number of cases of measles each year and the percentage of five year-olds vaccinated between 1950 and 2016 in the United Kingdom.

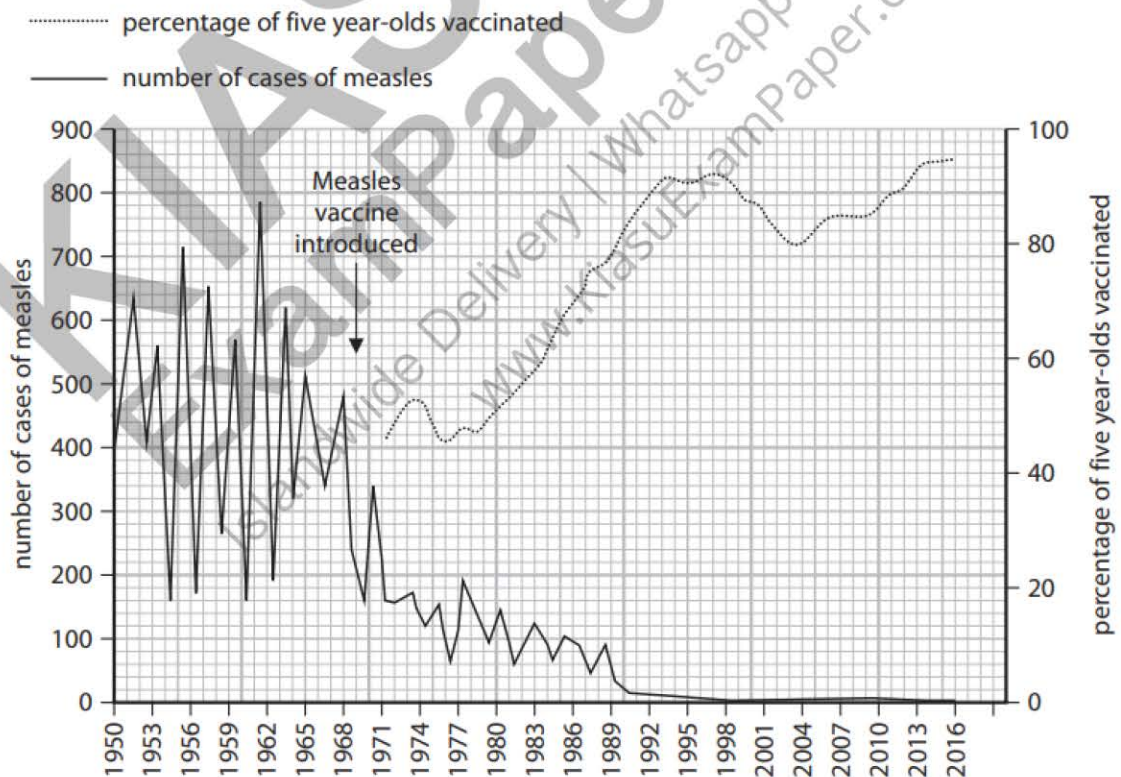


Fig. 7.1

- (a) Explain why measles is an infectious disease.

Measles is caused by virus that can be easily spread from one person to another;

[1]

- (b) With reference to Fig. 7.1, describe the relationship between the number of cases of measles and percentage of five year-olds vaccinated.

As the percentage of five year-olds vaccinated increase from 42% to 86%, the number of cases of measles decrease from 160 to 0.

[2]

- (c) Using your knowledge on how vaccines work, explain the relationship described in (b).

Vaccine contains an agent that resembles the virus that cause measles

Vaccines stimulate white blood cells to produce antibodies to destroy the agent;

These white blood cells remain in the bloodstream and will recognise the virus that cause measles;

Virus will not be able to spread easily as these viruses are destroyed;

[3]

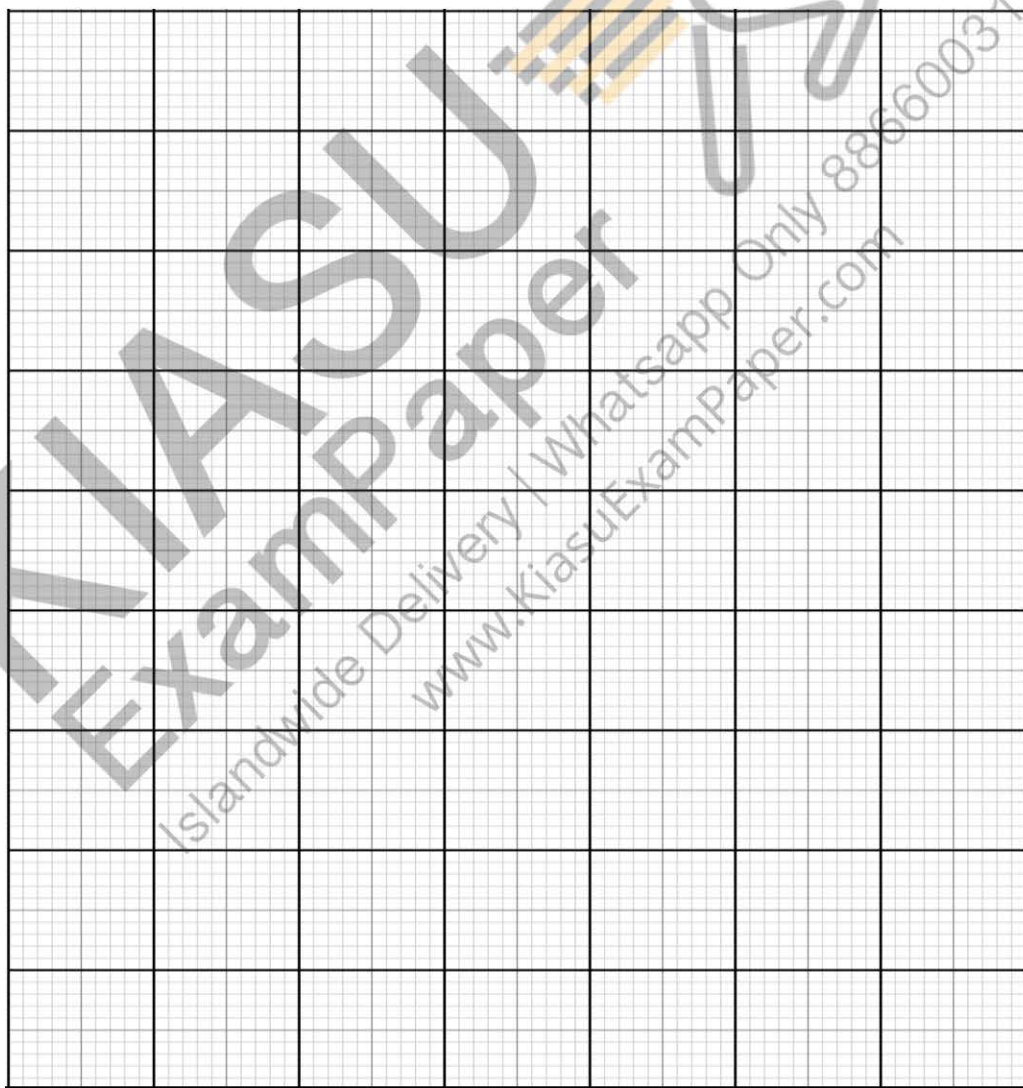
Thus lowering the number of cases

- 8 Table 8.1 shows the area of rainforest on the Earth from 1990 to 2015.

Table 8.1

year	area of rainforest/ km ²
1990	40850
1995	40500
2000	40120
2005	40020
2010	40008
2015	40000

- (a) Plot the data in the grid provided below.



[3]

- (b) Calculate the greatest percentage change in the area of rainforest per km² over a five year period.

$$40500 - 40120 = 380$$

$$380/40500 \times 100\% = 0.94\%$$

[1]

- (c) Suggest a reason for the decrease in the area of rainforest on Earth over the years.

.....To make land for roads/ buildings.....

[1]

- (d) Rainforests are important carbon sinks.

Explain how the decrease in area of rainforest will lead to global warming.
In your answer, include the definition of carbon sinks.

Carbon sink is an area that stores carbon from the atmosphere for a long period of time. It stores more carbon than it releases.

When rainforest is destroyed more carbon dioxide released into the air/ carbon dioxide cannot be removed by plants;

Carbon dioxide is a greenhouse gas that traps heat leading to global warming;

[3]

- (e) Rainforests are also habitats to many species of plants and animals.
Fig. 8.1 shows some of the species living in the rainforest connected in a food web.

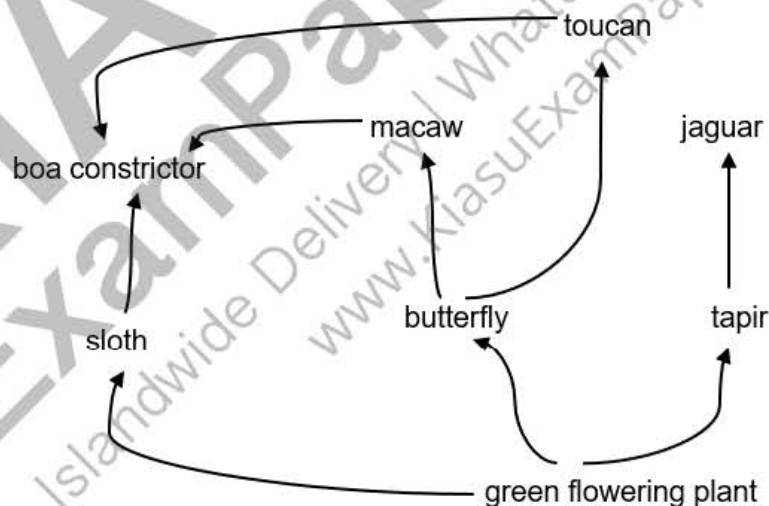


Fig. 8.1

- (i) State the number of secondary consumers present in the food web.

4

[1]

- (ii) The longest food chain in the Fig. 8.1 shows four trophic levels.

Explain why a fifth trophic level does **not** usually exist.

As 90% of energy is lost between each trophic level, lesser energy is available to the next trophic level/ only 10% of energy that gets transferred.

There will not be sufficient energy to support the organism in the fifth trophic level; [1]

Section B

Answer only **one** question in this section.

Write your answers in the spaces provided.

- 9 Muscular dystrophy (MD) is a type of genetic disease that results in progressive weakness of the muscles over time. Over time, a person with MD may lose ability to carry out movement. The disease will affect the quality and lifespan of the affected individual.

The disease is inherited by a recessive allele.

- (a) A man and his pregnant wife, both carriers, are advised to do a genetic screening for MD on their fetus.

Explain, with a genetic diagram, to show why this screening may be useful. You may use 'D' or 'd' to represent the alleles.

Parental phenotype Father carrier x Mother carrier
 Parental genotype Dd x Dd
 Gametes D d D d
 Offspring genotype DD Dd Dd dd
 Offspring phenotype ; Not affected carrier carrier affected ;

There is a 25% chance/ 0.25 probability that the fetus may be affected with MD.;

The screening will allow the both the man and his wife to be mentally prepared/ make informed choices or decisions. ; (any sensible ans)

[5]

- (b) It is found that in some patients with MD, the number of a functional organelle in muscle cells is lower than normal.

Identify the organelle and explain how a lack of this organelle may result in MD.

Mitochondrion; (a: plural)

Mitochondria is the site of aerobic respiration;

Glucose is oxidized to release energy;

Lesser mitochondria, lower rate of aerobic respiration, lesser energy released;

Muscle cells cannot contract or relax causing it to be weak;

[5]

- 10 (a)** Cancer of the small intestine is when the cells of the intestinal lining grow uncontrollably. One of the common signs of this disease is unexplained weight loss.

Describe the functions of the small intestine and explain how cancer of the small intestine can result in weight loss.

... Digestion of carbohydrates, proteins and fats is completed in the small intestine;
 ... Digested food is absorbed into blood stream;
 ... Cancer may affect the release of intestinal enzymes which affects the digestion process hence the food molecules may be too large to be absorbed into blood stream;
 ... Cancerous cells may affect absorption of the digested food thus lesser digested food available for assimilation;
 ... (any 1)
 ... Body may utilise glucose and fat storage to provide energy resulting in weight loss;
 [4]

- (b) (i)** To support the nutritional requirements in patients with cancer of the small intestine, doctors will begin a procedure where a specially formulated mixture is supplied directly to the bloodstream of these patients.

Suggest, with reasons, the components that make up the mixture.

... Mixture contains glucose and fats to provide energy for short and long term use;
 ... Contains amino acids to synthesise proteins and repair worn out cells;
 ... Contains water to allow blood to flow smoothly;
 ... And to maintain the water potential in blood;
 [4]

- (ii)** Such procedure, when carried over long-term, can result in liver disease.

Describe two functions of the liver.

.....

 [2]





Geylang Methodist School (Secondary) Preliminary Examination 2024

SCIENCE (CHEMISTRY, BIOLOGY)

5088/01

Paper 1 Multiple Choice

Sec 4 Express

1 hour

Additional Materials: Multiple Choice Answer Sheet

15 August 2024

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.

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 work should be done in this booklet.

A copy of the Data Sheet is printed on page 17.

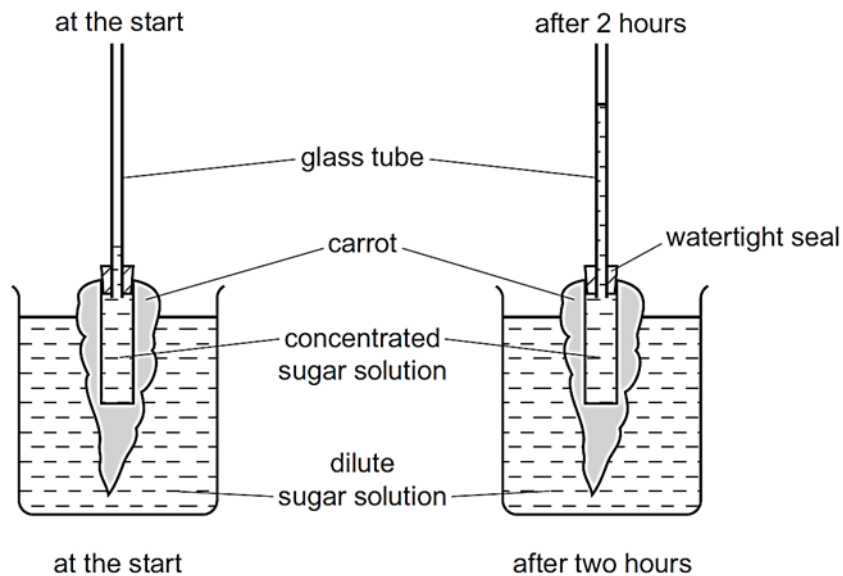
A copy of the Periodic Table is printed on page 18.

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

This document consists of **17** printed pages and **1** blank page.

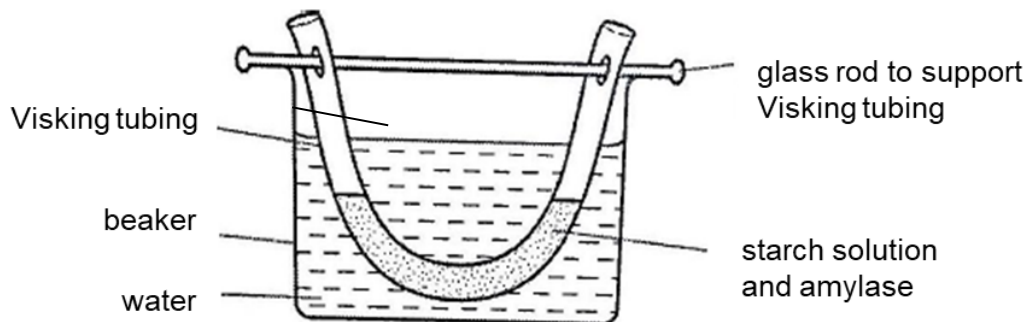
[Turn over

- 21** The diagram shows the movement of a concentrated sugar solution up a glass tube. The glass tube is connected to a hollowed-out carrot.



Why does the sugar solution in the glass tube rise?

- A** Sugar molecules moved across the carrot tissue into the beaker.
B Sugar molecules moved across the carrot tissue into the glass tube.
C Water molecules moved across the carrot tissue into the beaker.
D Water molecules moved across the carrot tissue into the glass tube.
- 22** An experiment was carried out to investigate digestion and absorption in the alimentary canal. The diagram shows the apparatus used. The Visking tubing is partially permeable.



After one hour, samples of water in the beaker are tested with Benedict's solution and iodine solution respectively.

Which row shows the correct results?

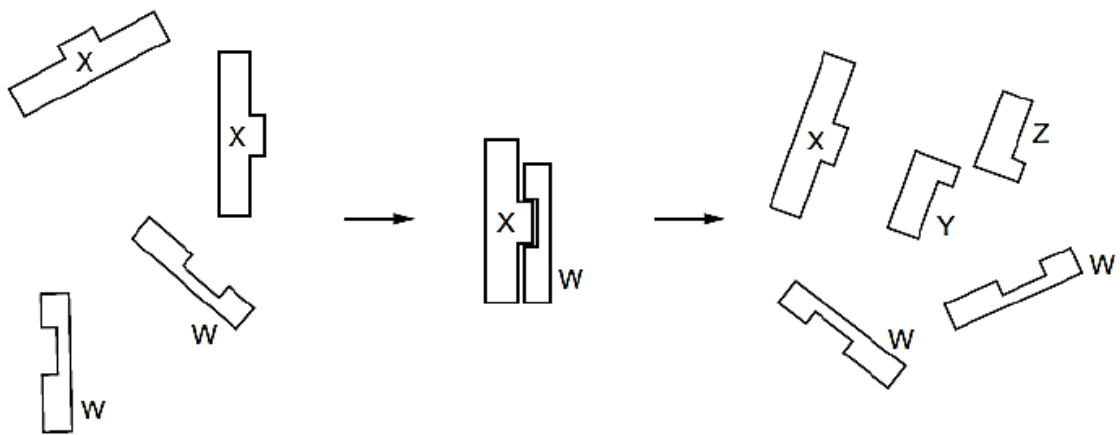
	Benedict's solution	iodine solution
A	blue	blue-black
B	blue	yellowish-brown
C	brick red precipitate formed	blue-black
D	brick red precipitate formed	yellowish-brown

- 23** A student tested four samples of food, **A**, **B**, **C** and **D**, for the presence of nutrients. One of the food samples, egg white, was found to test positive for protein but tested negative for fats.

Which of the food samples, shown in the results below is egg white?

	observation	
	biuret test	emulsion test
A	blue	clear
B	blue	milky emulsion
C	purple	clear
D	purple	milky emulsion

- 24** The diagram illustrates the 'lock and key' hypothesis of enzyme action.



Which of the following shows the enzyme, product and substrate?

	enzyme	product	substrate
A	W	X	Y and Z
B	W	Y and Z	X
C	X	W	Y and Z
D	X	Y and Z	W

- 25 The diagram represents the digestion of a type of nutrient S.



Which of the following shows the correct identity of S, T and U?

	S	T	U
A	maltose	maltase	glucose
B	polypeptide	protease	amino acid
C	protein	protease	polypeptide
D	starch	amylase	maltose

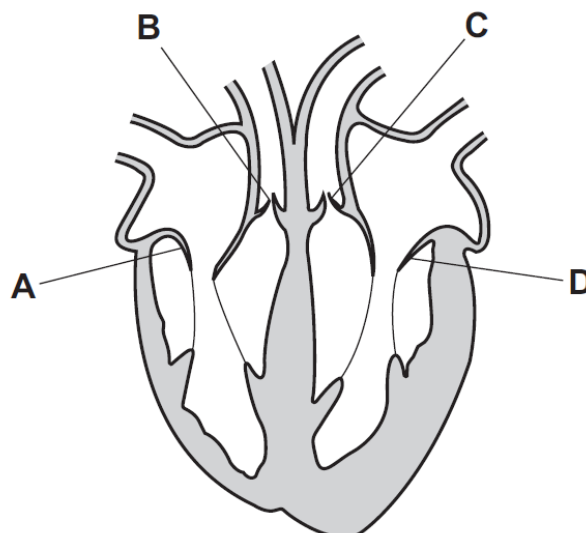
- 26 Which of the following comparisons about the blood contents in the hepatic vein and hepatic portal vein after a meal is/are correct?

	hepatic vein	hepatic portal vein
1	more oxygen	less oxygen
2	more urea	less urea
3	less carbon dioxide	more carbon dioxide
4	less waste products	more waste products
5	less glucose	more glucose

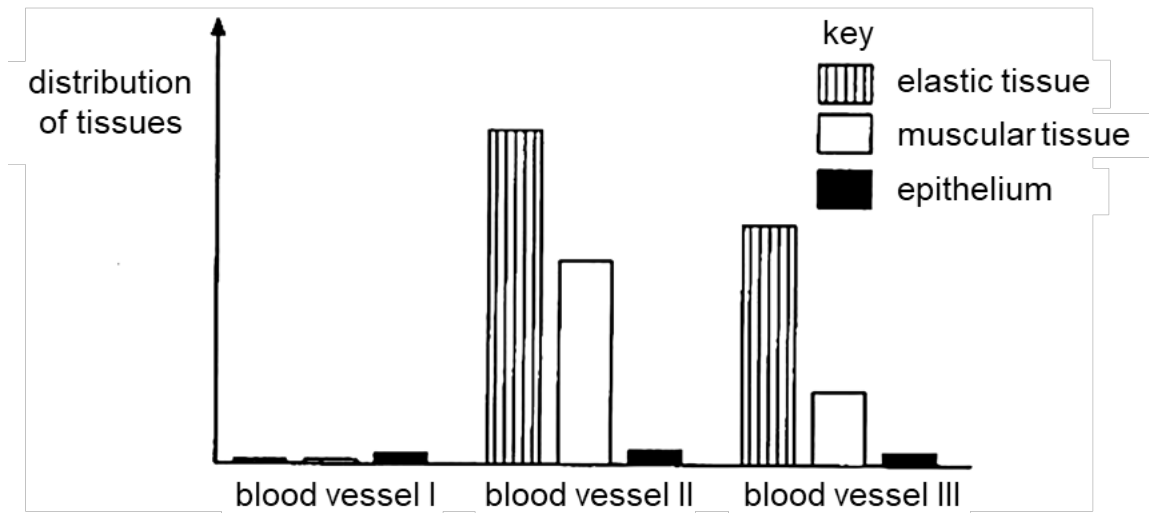
- A 1 and 5
 B 2 and 5
 C 2 and 4
 D 1, 3 and 4

- 27 The diagram shows a section through the heart.

During ventricular contraction, which valve must be closed to ensure that blood will flow to all body parts?



- 28 The bar chart shows the distribution of tissues in three main types of blood vessels in the human body.



Which row correctly identifies blood vessels I, II, III?

	blood vessel I	blood vessel II	blood vessel III
A	artery	vein	capillary
B	artery	capillary	vein
C	capillary	vein	artery
D	capillary	artery	vein

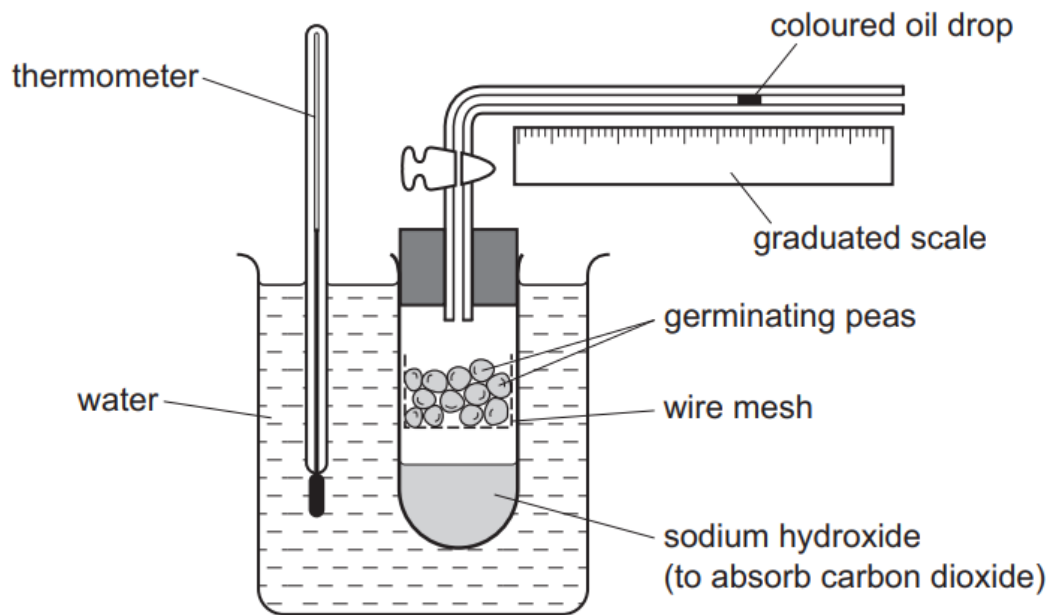
- 29 Which of the following lifestyle habits is most strongly associated with an increased risk of coronary heart disease?

- A adequate sleep
- B balanced diet
- C regular exercise
- D smoking

- 30 Which row is correct for anaerobic respiration of glucose in human muscle?

	carbon dioxide produced	lactic acid produced	water produced	energy yield
A	✓	✓	X	low
B	✓	X	✓	high
C	X	✓	X	low
D	X	X	✓	high

- 31 The diagram shows apparatus used to investigate respiration.



Which change will be seen and what is the explanation?

	change	explanation
A	oil drop moves right	peas release carbon dioxide
B	oil drop does not move	oxygen is used up as fast as carbon dioxide is released
C	oil drop does not move	carbon dioxide is absorbed
D	oil drop moves left	oxygen is used up by the peas

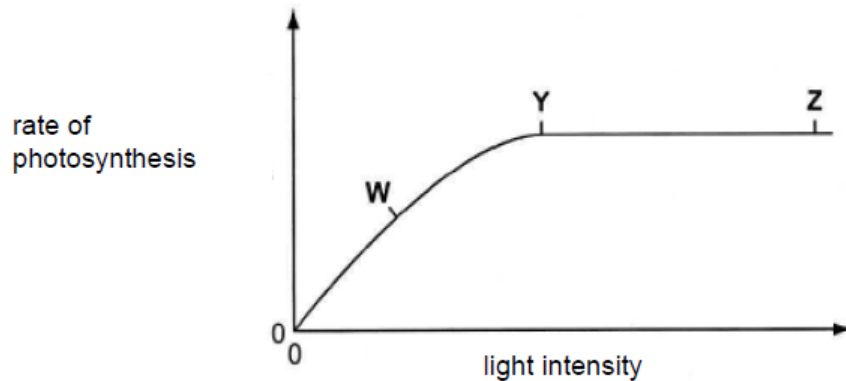
- 32 Which is an effective treatment for pneumococcal disease?

- A** antibiotics
- B** anti-viral drugs
- C** quarantine
- D** vaccine

- 33** An investigation was carried out on the effect of light intensity on the rate of photosynthesis.

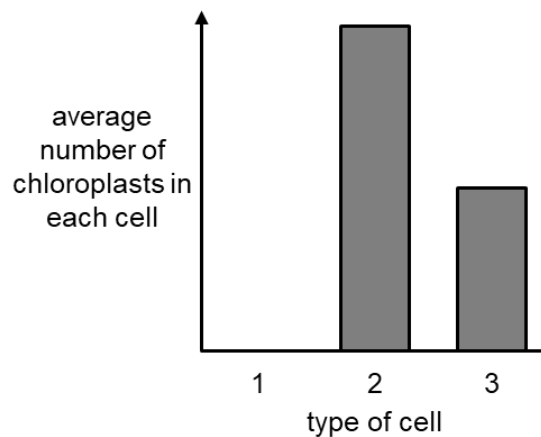
Throughout the experiment, all other factors affecting photosynthesis were kept constant.

The results are shown on the graph.



What do these results show?

- A** Light does not limit the rate of photosynthesis.
B Light limits the rate of photosynthesis at point **W**.
C Light limits the rate of photosynthesis at point **Y**.
D Light limits the rate of photosynthesis at point **Z**.
- 34** The bar chart shows the average number of chloroplasts in each of three different types of leaf cell.

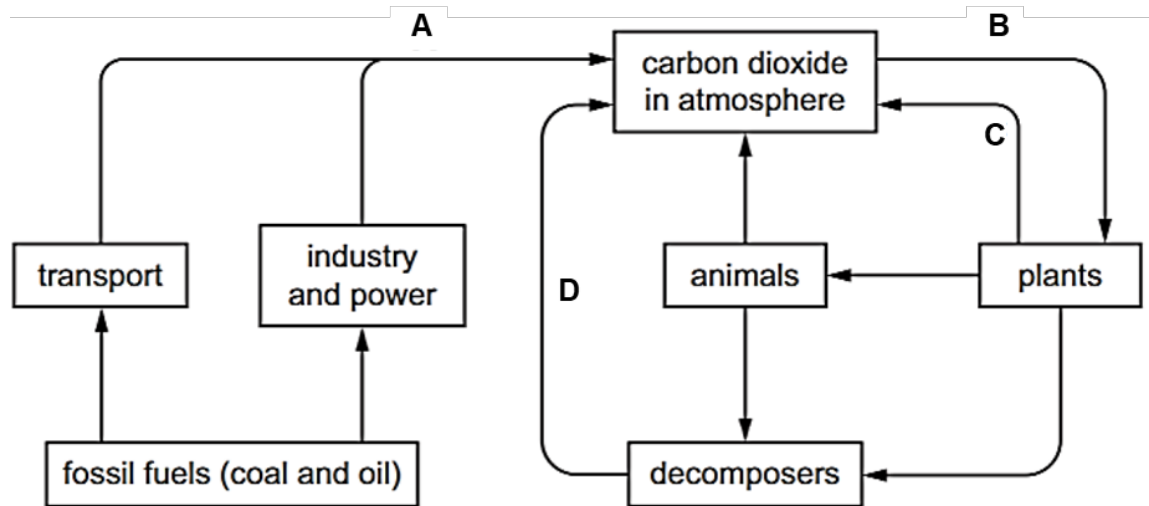


What are three types of cells?

	1	2	3
A	epidermal cell	palisade mesophyll cell	spongy mesophyll cell
B	palisade mesophyll cell	spongy mesophyll cell	epidermal cell
C	spongy mesophyll cell	epidermal cell	palisade mesophyll cell
D	spongy mesophyll cell	palisade mesophyll cell	epidermal cell

- 35 The diagram shows part of the carbon cycle.

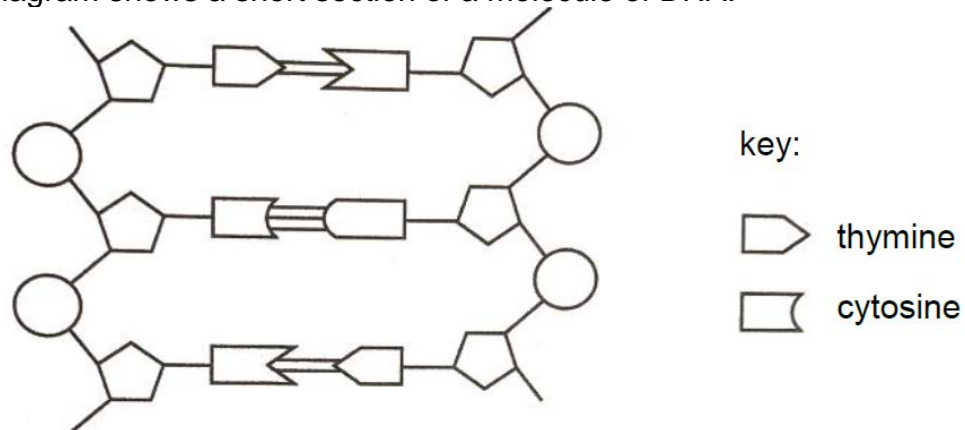
Which process represents photosynthesis?







- 36 What is one major consequence of deforestation on the global climate?

- A decreased atmospheric carbon dioxide
- B increased atmospheric oxygen
- C increased greenhouse gas emissions
- D increased rainfall

- 37 The diagram shows a short section of a molecule of DNA.



Which row identifies the shapes used in this diagram?

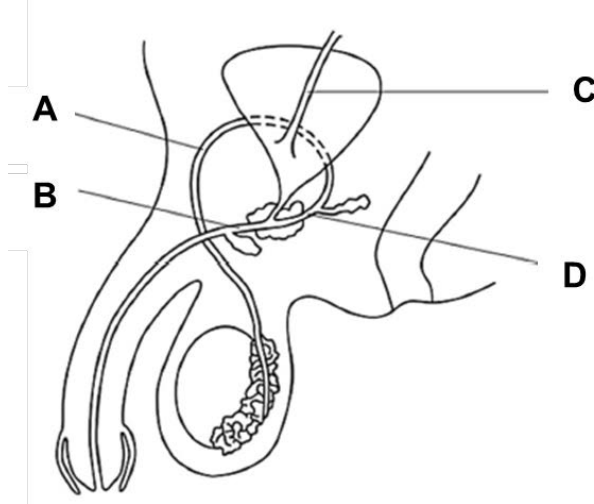
	shape			
				
A	phosphate	sugar	adenine	guanine
B	phosphate	sugar	guanine	adenine
C	sugar	phosphate	adenine	guanine
D	sugar	phosphate	guanine	adenine

- 38 A gene is a unique sequence of ____ (i) ____ that directs the ____ (ii) ____ .

	(i)	(ii)
A	amino acids	functions of a specific protein
B	nucleotides	synthesis of a specific polypeptide
C	DNA	synthesis of new DNA strands
D	chromatin	function of a nucleotide

- 39 The diagram shows the reproductive system of a human male.

Which tube carries both sperms and urine?



- 40 How do condoms reduce the risk of HIV infection?
- A** They prevent semen from coming into contact with the vagina wall.
 - B** They prevent sperm from entering the vagina.
 - C** They prevent the formation of seminal fluid.
 - D** They prevent virus particles crossing the placenta.

End-of-Paper



Geylang Methodist School (Secondary) Preliminary Examination 2024

Candidate
Name

Class

Index Number

SCIENCE (CHEMISTRY, BIOLOGY)

5088/04

Paper 4 Biology

Sec 4 Express

Candidates answer on the Question Paper.

1 hour 15 minutes

No Additional Materials are required.

7 August 2024

READ THESE INSTRUCTIONS FIRST

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

You may use an HB pencil for any diagrams or graphs.

Write in dark blue or black pen.

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

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

You may lose marks if you do not show your working or if you do not use appropriate units.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer **one** question.

Write your answers in the spaces provided on the question paper.

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

For Markers' Use	
Section A	55
Section B	10
TOTAL	65

This question paper consists of **18** printed pages and **2** blank pages.

[Turn over

Section A

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

- 1 Fig. 1.1. shows some muscle cells.

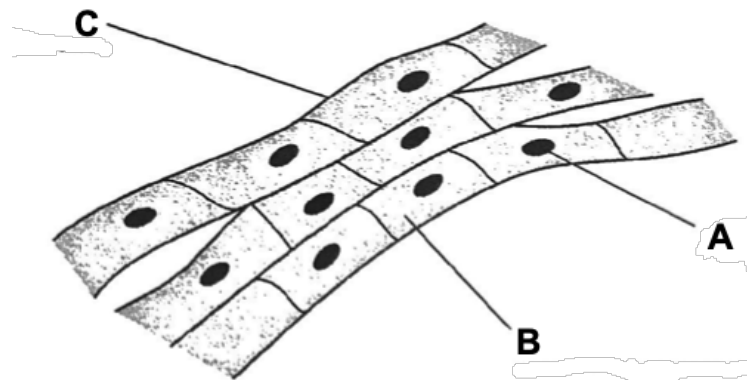


Fig. 1.1

- (a) Name structures **A** and **B**.

A **B** [2]

- (b) State the function of structure **C**.

.....
 [1]

- (c) Compare and contrast the structure of a muscle cell and a root hair cell.

.....

 [2]

- (d) Name **one** organelle in a muscle cell not shown in Fig. 1.1 and explain how this organelle helps the muscle cell in carrying out muscular contractions.

.....

 [2]

[Total: 7]

- 2 Lactose is found in cows' milk. Some people do not have the enzyme to digest lactose.

Fig 2.1 shows a flow diagram for the production of lactose-free milk.

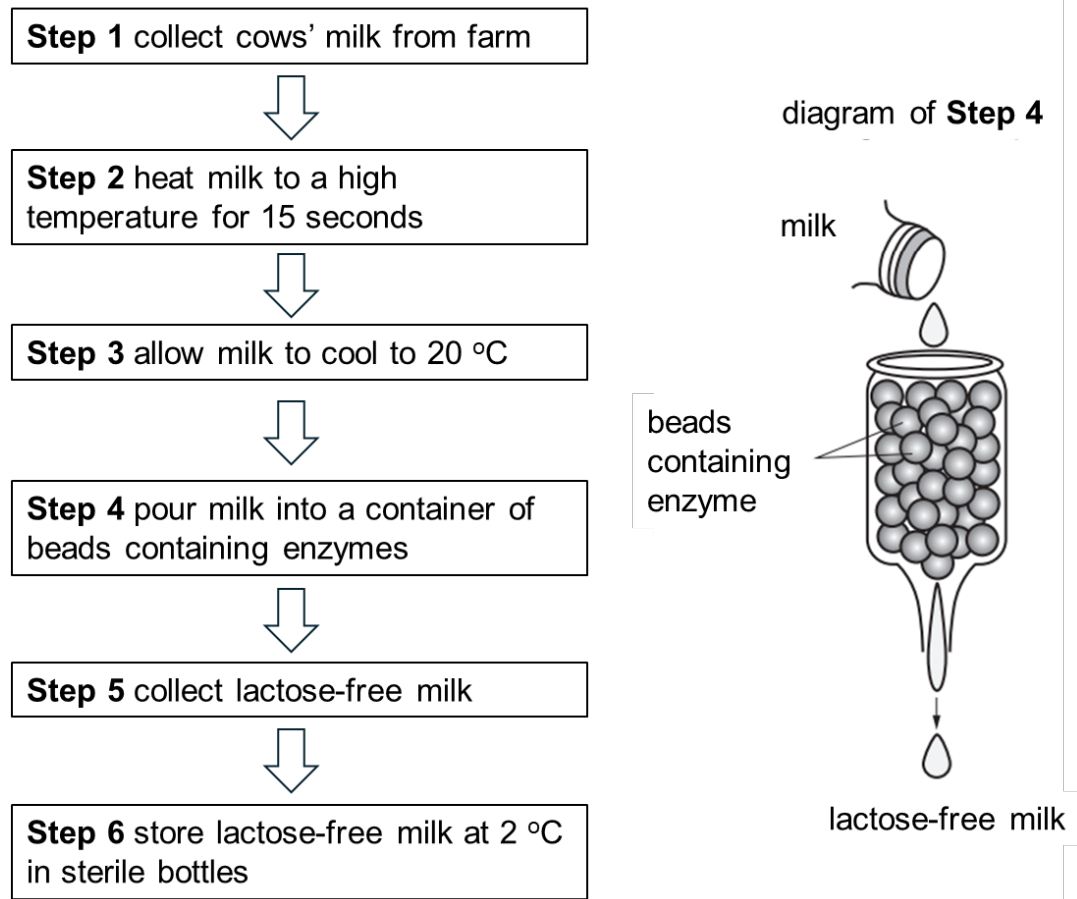


Fig 2.1

- (a) Explain how heating the milk in **step 2** in Fig. 2.1 ensures the hygienic preparation of lactose-free milk.

.....

[1]

- (b) Explain why the milk must be cooled in **step 3** before it makes contact with the enzymes.

.....

[2]

- (c) Suggest the name of the enzyme used to make lactose-free milk in **step 4**.

.....
[1]

- (d) State **one** characteristic of enzymes which is not shown in Fig. 2.1.

.....
.....
[1]

[Total: 5]

- 3 (a) Fig. 3.1 is a diagram of the digestive system.

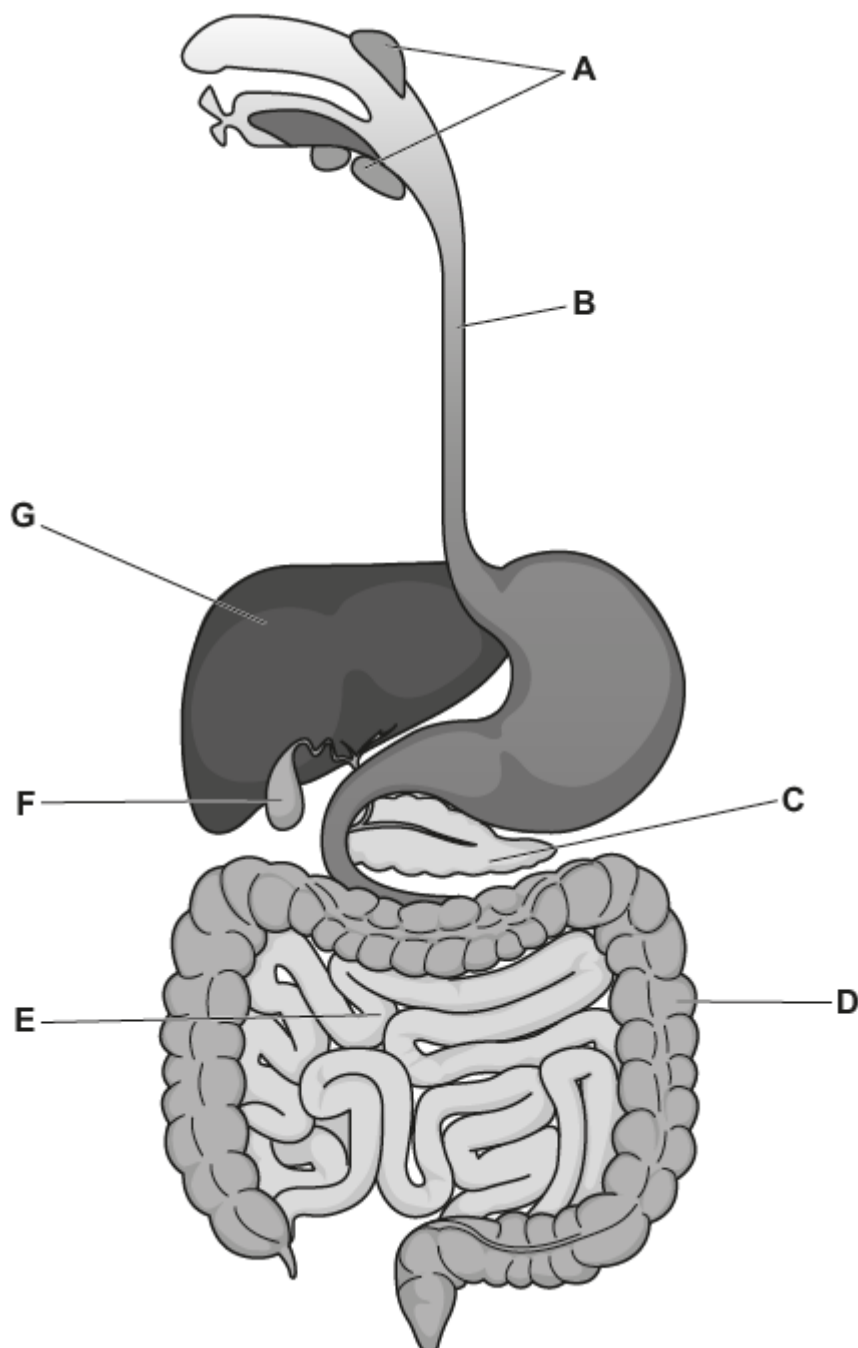


Fig. 3.1

- (i) State the letter from Fig. 3.1 that represents:
- | | |
|------------------------------------|-------|
| where salivary amylase is produced | |
| where insulin is produced | |
| where bile is produced | |
| where protease acts | |

[2]

- (ii) State **one** function of the hydrochloric acid in the stomach.

.....
.....
[1]

- (b) Glucose is one of the products of digestion.

Describe the formation of glucose from starch in the human digestive system, naming the enzymes involved.

.....
.....
.....
.....
.....
.....
.....
.....
.....
[3]

- (c) Explain why a person suffering from type 2 diabetes mellitus is advised to eat food that contains less starch.

.....
.....
.....
.....
.....
[2]

[Total: 8]

- 4 Fig. 4.1 shows an alveolus and a nearby capillary in a human lung.

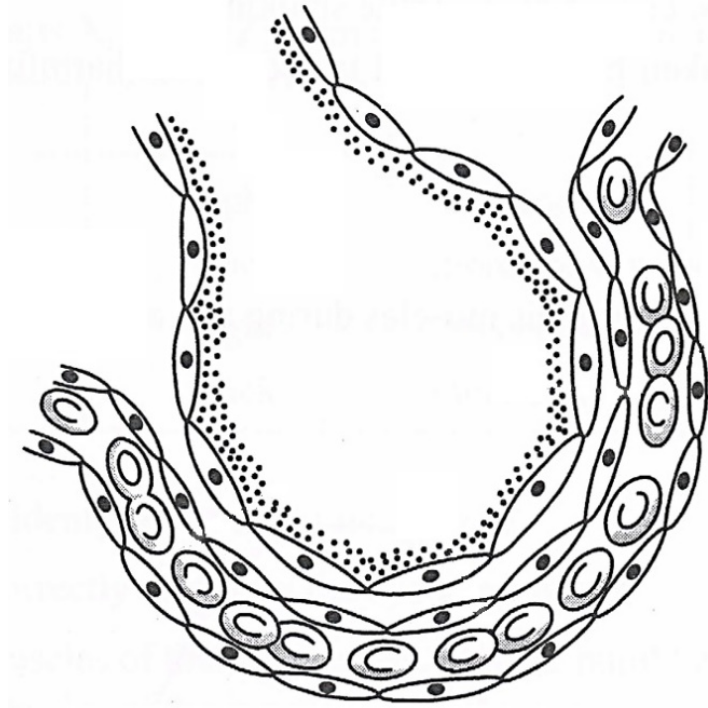


Fig. 4.1

- (a) On Fig. 4.1, draw arrows to indicate the flow of oxygen and carbon dioxide between the alveolus and the capillary.

Label your arrows clearly.

[2]

- (b) Describe and explain an adaptation of the alveolus that enables it to carry out its function efficiently.

.....

.....

.....

.....

.....

[2]

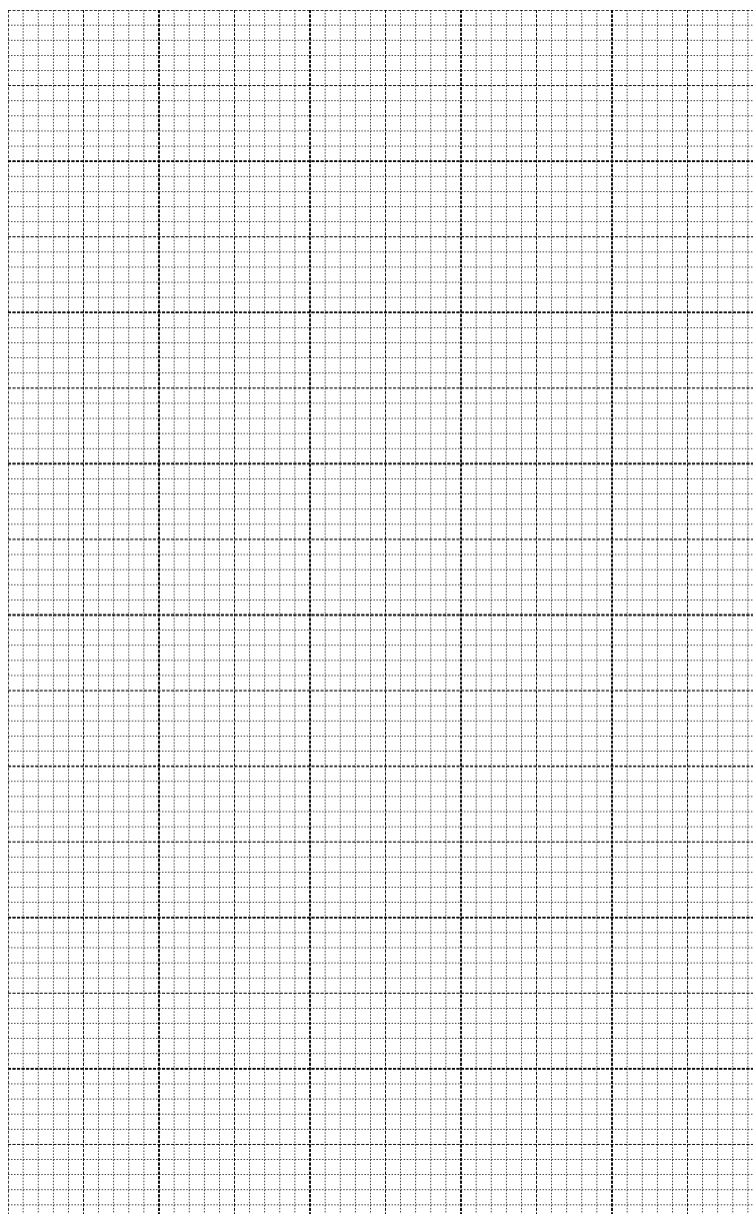
[Total: 4]

- 5 Table 5.1 shows data collected from an experiment carried out to investigate how varying the diameter of the stomata and the wind speed can affect the rate of transpiration from a leaf of a plant at a constant temperature of 27 °C.

Table 5.1

diameter of stomata / μm	rate of transpiration / g per m^2 per hour	
	in still air	in wind
0	0	0
4	1.0	3.6
8	1.8	5.8
12	2.3	6.9
16	2.5	7.5
20	2.5	7.6

- (a) Plot a graph of the rate of transpiration against the diameter of stomata in still air and in the presence of wind on the grid below. [4]



- (b) Use your graph to predict the rate of transpiration in still air when the stomata have a width of 10 μm .

..... g per m^2 per hour [1]

- (c) Using the information from the graph, describe the relationship between the width of stomata and the rate of transpiration in still air.

.....
.....
..... [2]

- (d) Describe and explain why the rate of transpiration in wind differs from the rate in still air.

.....
.....
.....
.....
.....
..... [3]

- (e) Name **one other** factor that will affect the rate of transpiration from the leaf of a plant.

..... [1]

[Total: 11]

6 Fig. 6.1 shows a pyramid of numbers for a food chain.

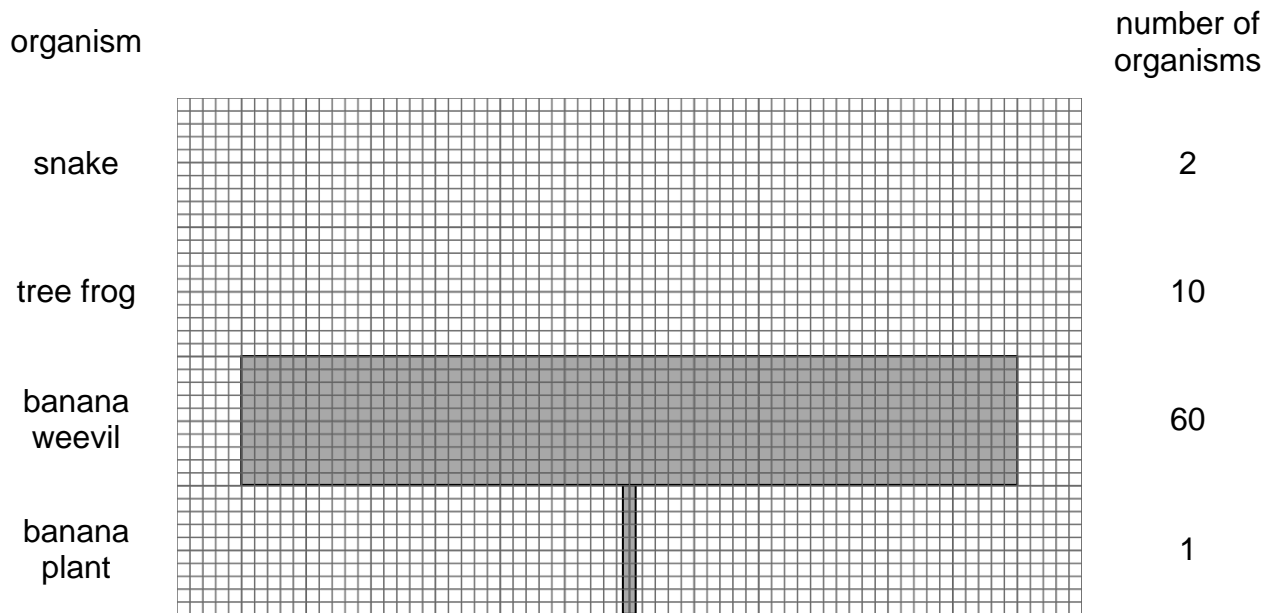


Fig. 6.1

- (a) Use the information in Fig. 6.1 to complete the pyramid of numbers. [1]
- (b) Write the food chain for the pyramid of numbers shown in Fig. 6.1
 [1]
- (c) Identify the number of trophic levels in Fig. 6.1.
 [1]
- (d) Sketch the pyramid of biomass for the food chain in (b).

[1]

[Total: 4]

- 7 Fig. 7.1 shows the female reproductive system in humans.

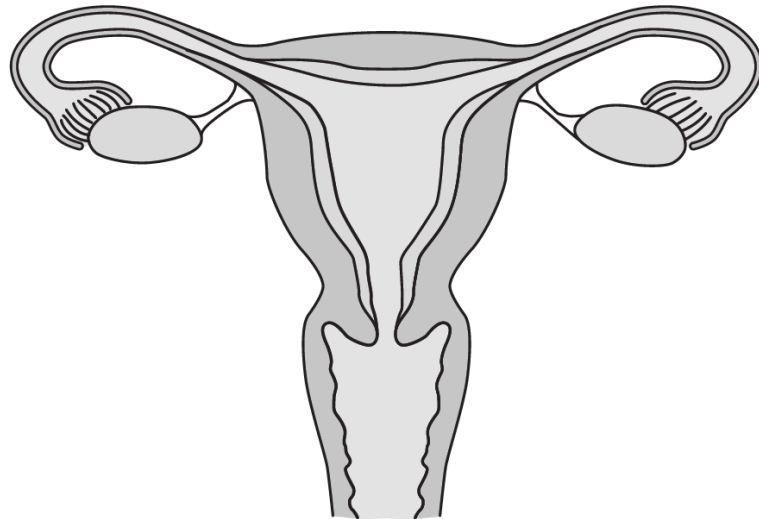


Fig. 7.1

- (a) On Fig. 7.1,
- (i) Draw a line and label it with the letter 'F' to show where fertilisation occurs. [1]
 - (ii) Draw a line and label it with the letter 'Z' to show where implantation of the embryo is at. [1]
- (b) Fig. 7.2 shows the changes in the thickness of the uterus lining during a menstrual cycle.

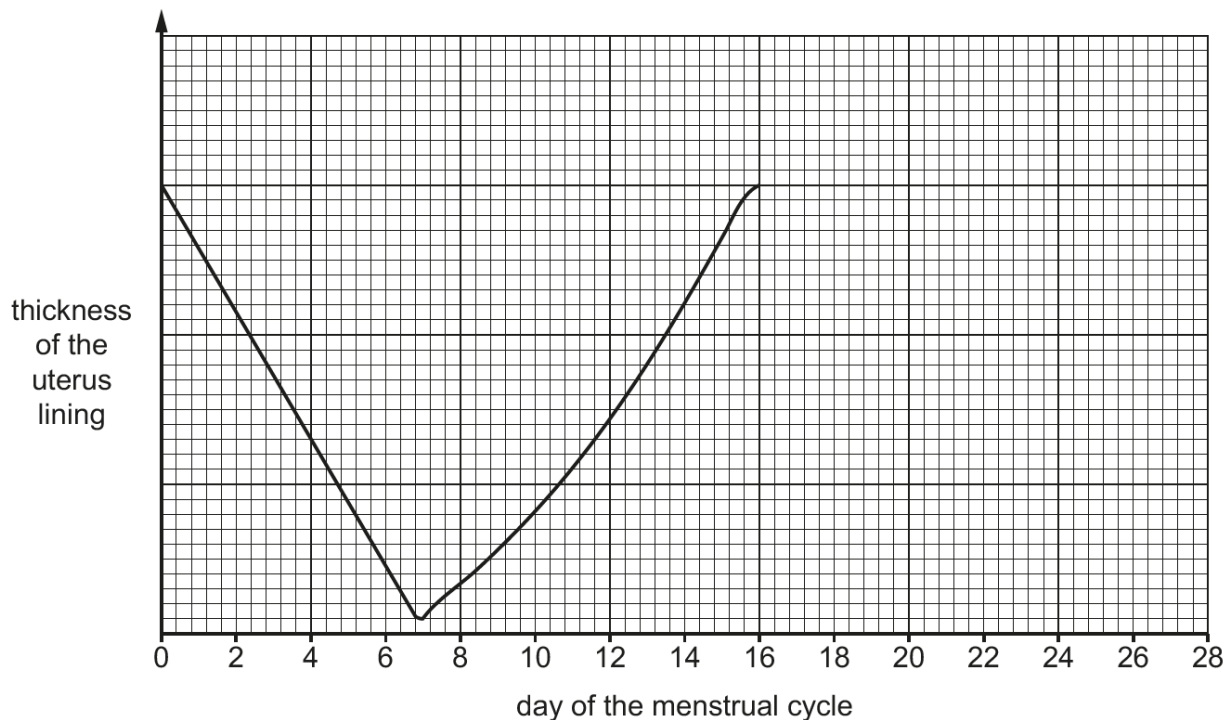


Fig. 7.2

- (i) With reference to Fig. 7.2, state the number of days during which the uterus lining is shed.

.....
[1]

- (ii) Complete the graph in Fig. 7.2 to show the thickness of the uterus lining between day 16 and 28. [1]

- (iii) Explain your answer in (b)(ii) with reference to a named hormone.

.....
.....
.....
.....
[2]

[Total: 6]

- 8** Sickle cell anaemia is a condition where haemoglobin molecules have lowered oxygen-binding capacity (sickle cell haemoglobin).

The allele for normal haemoglobin production is dominant and is represented by **H**.

The allele for sickle cell haemoglobin production is recessive and is represented by **h**.

- (a)** State the type of mutation that results in sickle cell anaemia.

.....
[1]

- (b)** Suggest why an individual who has sickle cell anaemia should not exercise vigorously.

.....
.....
.....
.....
.....
[2]

- (c)** Two individuals with the genotypes Hh and hh would like to start a family.

- (i)** Complete the Punnett square to show the parental gametes and the possible genotypes of the offspring.

		parental gametes	
parental gametes			

[2]

- (ii)** Using your answer to (c)(i), state the percentage of the offspring having sickle cell anaemia.

.....
[1]

- (iii) The two individuals have four children. None of them has sickle cell anaemia.

Suggest a reason why.

.....

[1]

- (d) In 2014, a study was carried out in Uganda to investigate the relationship between having the sickle cell allele and being affected by malaria.

People who get malaria are typically sick with high fevers, shaking chills and flu-like illness. It can be fatal.

Table 8.1 shows the percentage of three different groups of individuals (normal, carriers of sickle cell allele and those with sickle cell anaemia) having malaria.

Table 8.1

	genotype	percentage of individuals / %	
		malaria	no malaria
normal	HH	78	22
carriers of sickle cell allele	Hh	51	49
sickle cell anaemia	hh	33	67

With reference to Table 8.1, describe the relationship between having the sickle cell allele and being affected with malaria.

.....

[2]

- (e) The type of variation shown by the sickle cell anaemia is discontinuous.

State another example of discontinuous variation in humans.

.....

[1]

[Total: 10]

End of Section A

Section B

Answer **one** question from this section.

9 Red blood cells are specialised cells that transport oxygen.

- (a)** Some students investigated the effect of immersing red blood cells in different concentrations of salt solution.

They measured the diameters of samples of red blood cells and calculated the mean.

They then immersed each red blood cell sample in a different concentration of salt solution.

After two minutes they measured and calculated the mean of the samples again.

Table 9.1 shows the results.

Table 9.1

percentage concentration of the salt solution	mean initial diameter of the red blood cells / μm	mean diameter of the red blood cells after two minutes / μm
0.4	7.5	cells burst
0.8	7.5	8.2
0.9	7.5	7.5
1.8	7.5	6.0

- (i)** Name the process that causes the change in the red blood cells.

..... [1]

- (ii)** Calculate the percentage increase in the mean diameter of red blood cells that were immersed in the 0.8% salt solution.

Give your answer to **two** significant figures.

..... % [1]

- (iii) Explain the results for the red blood cells that were immersed in the 1.8% salt solution.

.....

.....

.....

.....

[2]

- (iv) State why there was no change in the mean diameter of the red blood cells immersed in the 0.9% salt solution.

.....

.....

[1]

- (v) Describe and explain the difference in results if the red blood cells were replaced with plant cells in the 0.4% salt solution.

.....

.....

.....

.....

.....

.....

[3]

- (b) Describe and explain **two** ways that the red blood cell is adapted for its function.

.....

.....

.....

.....

.....

.....

[2]

[Total: 10]

- 10 (a)** Table 10.1 shows the components of blood of a healthy person and an infected person.

Table 10.1

blood component	percentage in blood / %	
	healthy person	infected person
blood plasma	55	55
red blood cells	43	40
white blood cells	1	3
platelets	1	1

With reference to Table 10.1, describe the difference in the white blood cells in a healthy person and an infected person.

.....

.....

.....

[2]

- (b)** Describe the functions of the two types of white blood cells.

.....

.....

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.....

.....

[3]

- (c) Sepsis is a life-threatening condition that happens when the body's immune system has an extreme response to an infection, causing organ dysfunction. Bacterial infections are one of the most common causes of sepsis. A person can die from septic shock when the bacteria count becomes too high.

Describe and explain how antibiotics can be used to treat sepsis.

.....

.....

.....

.....

.....

.....

[3]

- (d) Suggest **two** methods to reduce the spread of infectious diseases.

.....

.....

.....

.....

[2]

[Total: 10]

End of Paper

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Geylang Methodist School (Secondary)

Preliminary Examination 2024

Secondary 4E Science (Biology) Answer Scheme**Paper 1**

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

Geylang Methodist School (Secondary)

Preliminary Examination 2024

Secondary 4E5N Science (Biology) Answer Scheme

Paper 3 Section A (55 marks)

Question	Marking Point	Marks
1 (a)	A – nucleus	1
	B – cytoplasm	1
(b)	Regulates/controls the movement of substances entering and leaving the cell Reject <u>allow</u>	1
(c)	[Similarity] Both muscle cell and root hair cell have nucleus/cytoplasm/cell membrane/numerous mitochondria/do not have chloroplast.	1
	[Difference] Root hair cell has cell wall/long and narrow protrusion while muscle cell does not have a cell wall/have a regular shape. OR Root hair cell has few large central vacuoles while muscle cell has many small temporary vacuoles.	1
(d)	Muscle cell has numerous <u>mitochondria</u> ;	1
	Mitochondria is the site of aerobic respiration to release energy for muscular contraction. Reject: produce	1
		3
2 (a)	Heating the milk ensures that any harmful microorganisms found in the milk will be killed off / ensures that the milk will be sterilised .	1
(b)	The milk must be cooled off to prevent the denaturation of the enzymes in the beads	1
	As high temperatures from step 2 will result in the enzymes denaturing and not being able to catalyse the reaction.	1
(c)	Lactase	1
(d)	Enzymes are required in minute amounts / enzymes are sensitive to pH	1
		5
3 (a) (i)	A	0-1 ✓ – 0M
	C	2-3 ✓ – 1M
	G	4 ✓ – 2M
	E	
(ii)	Kill bacteria / Provide acidic environment for protease to act on / Denature the salivary amylase /	Any 1

- (b) In the mouth, salivary amylase digests/breaks down starch to maltose. 1
- In the duodenum/small intestine, (pancreatic) amylase digests/breaks down starch to maltose. 1
- In the duodenum/small intestine, (maltase) digests/breaks down maltose to glucose. 1
- (c) Pancreas does not produce/secrete sufficient insulin. OR 1
- Liver and muscle cells do not respond well to insulin. 1
- When less starch is eaten, less glucose will be formed/will enter the bloodstream, so blood glucose concentration will not increase sharply/suddenly. 1

8

4 (a)

2



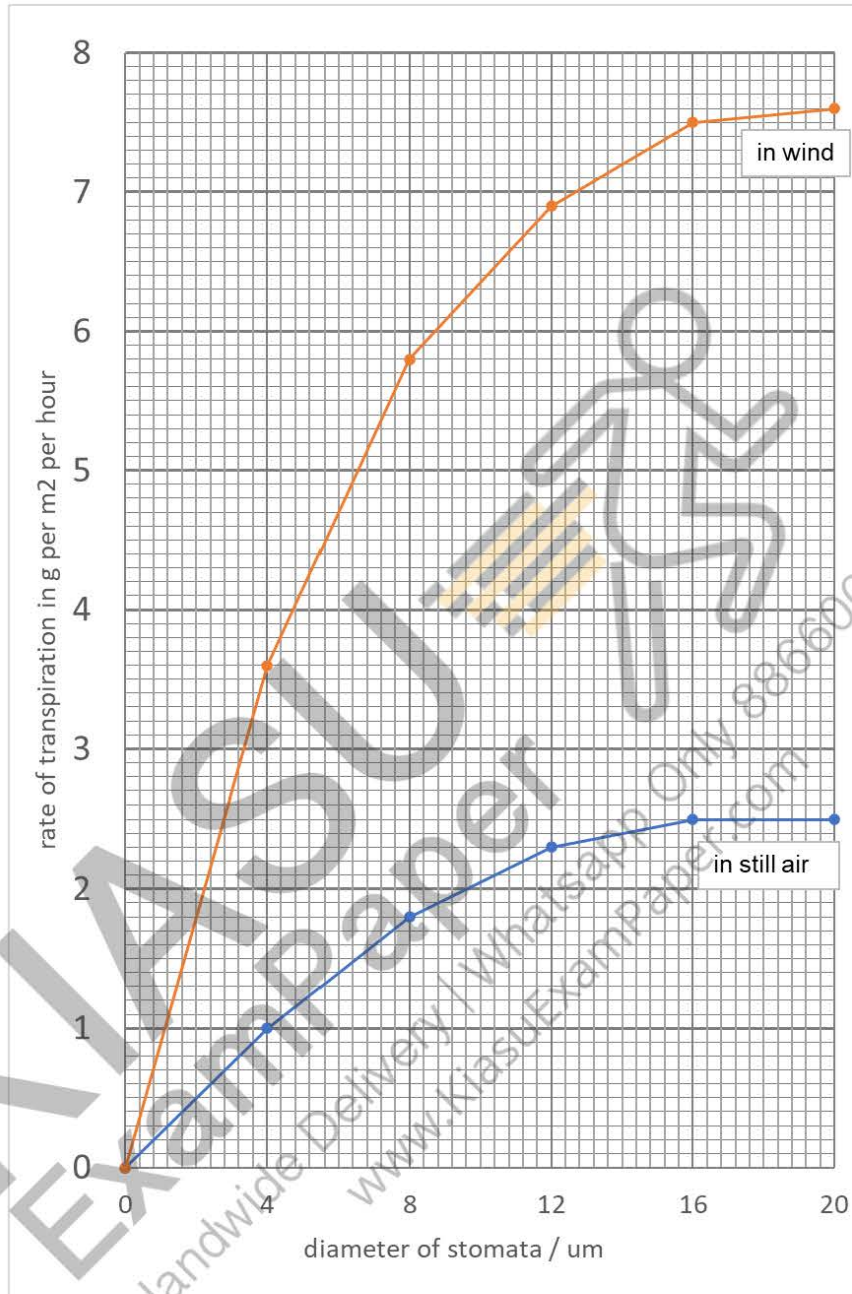
- Arrow of oxygen to end in the red blood cell
 - Arrow of carbon dioxide to start from plasma (space between RBC)
- (b)
- The inner alveolar surface is **coated with a thin film of moisture**; to **allow oxygen to dissolve before diffusing across the wall**;
 - The alveolar **walls** are **one-cell thick**; to have shorter diffusion distance for **faster rate of diffusion**.;
 - The alveolar walls are **well-supplied with blood capillaries**; to **maintain steep concentration gradient of gases**.;

Any set
of 2

Total: 4

5 (a)

4



Assign and label of axes – 1

Appropriate scale of axes – 1

Accurate plotting of points – 1

Curve line or point to point + label line – 1

(b) 2.1 (read from graph) to 1 dp 1

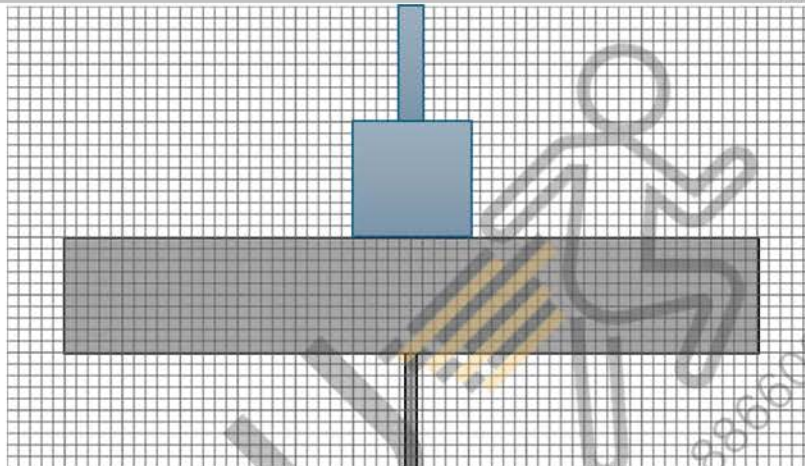
(c) As the diameter of stomata increase (from 0 to 16 μm), the rate of transpiration in still air increase (from 0 to 2.5g per m^2 per hour) 1and remains constant (at 2.5g until 20 μm). 1

Max 1 mark if no data quoted.

- (d) The rate of transpiration in wind is higher than the rate of transpiration in still air for the same diameter of stomata
Water vapour released from the leaf via transpiration accumulates outside the stomata and the wind blows away the water vapour.
This maintains steep concentration gradient of water vapour between leaf and atmosphere.
- (e) Light intensity/ temperature/ humidity

Total: 11

6 (a)

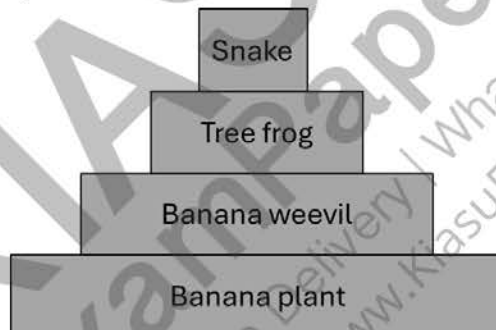


Bars should centralise (allow one small square off)

- (b) Banana plant → (banana) weevil → (tree) frog → snake

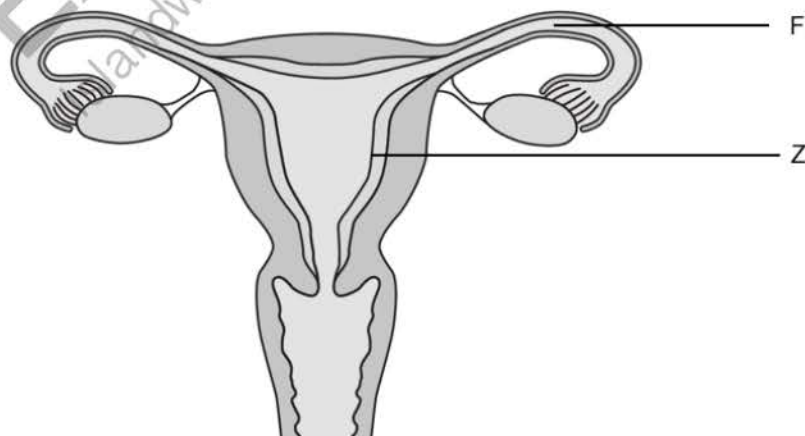
(c) 4

(d)



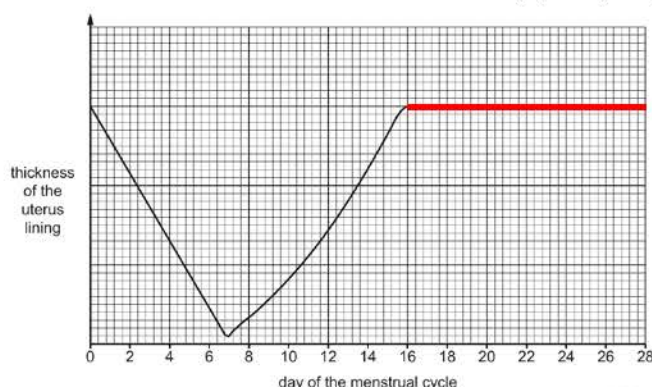
Total: 4

7 (a)



- (b) (i) 7 days

(ii)



1

Accept slight increase

(iii)

Progesterone

1

Stimulates further thickening / maintains thickness of uterus lining, ensuring it is thick and supplied with blood capillaries

1

Total: 6

8

(a)

Gene mutation





1

(b)

- There is insufficient oxygen delivered to respiring cells.
- The rate of respiration is lowered.
- Insufficient energy is released / need to meet the energy demand (for contraction and relaxation of muscles).
- This leads to fainting / death.

Any 2 points

(c) (i)

		parental gametes	
			
parental gametes		Hh Normal / carrier	Hh Normal / carrier
		hh Sickle-cell anaemia	hh Sickle-cell anaemia

2

One mark for the drawing of gametes (no marks deducted for not circling gametes)

One mark for the genotypes of offspring

(ii)

50%

1

(iii)

- Fertilisation is a random process / depends on chance and probabilities
- The sample size is too small.
- Each birth is an independent event

Any 1

(d)

- As the number of copies of the sickle cell allele a person has increases, the lower the percentage of the person having malaria.

1

•

1

The percentage of normal individuals having malaria is highest at 78%, followed by carriers of sickle cell allele at 51% and only / lowest for individuals with sickle cell anaemia at 39%.

(e)

blood group / eye colour / gender / ability to roll tongue

1

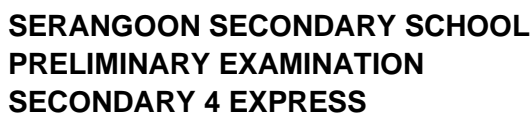
Total: 10

Section B (10 marks)

9	(a)	(i)	Osmosis	1
		(ii)	$(8.2 - 7.5) / 7.5 \times 100\%$ 9.3% (2sf)	1
		(iii)	The salt solution has lower water potential than the red blood cells.	1
			Water moves out of the cells causing the cells to shrink/ become smaller in diameter (size).	1
		(iv)	The salt solution has the <u>same water potential</u> as the red blood cell.	1
		(v)	The salt solution has higher water potential than the red blood cells	1
			The water moves into the cells causing the cells to expand.	1
			The red blood cell burst but the plant cells do not as the plant cells have the cell wall to prevent it from bursting.	1
	(b)		<ul style="list-style-type: none"> The red blood cell contains haemoglobin to transport oxygen from the lungs to all parts of the body. The red blood cell has no nucleus so that it can carry more haemoglobin and hence more oxygen. The red blood cell is circular biconcave in shape to increase the surface area to volume ratio of the cell to increase rate of diffusion of oxygen. The red blood cell is flexible which allows it to change shape and squeeze through the blood capillaries. 	Any 2
Total:				10

10	(a)	There is a higher percentage of white blood cells (at 3%) in an infected person than (only 1%) in a healthy person.	1
		values quoted	1
	(b)	Phagocytes and lymphocytes	1
		Phagocytes engulf and destroy foreign particles	1
		Lymphocytes <ul style="list-style-type: none"> • Produce antibodies that binds to and destroy foreign particles • Produce antibodies that neutralise toxins produced by bacteria • Produce antibodies that cause bacteria to clump together for easy ingestion by phagocytes 	Any 1
	(c)	Antibiotics are used to kill or inhibit growth of bacteria <ul style="list-style-type: none"> • Antibiotics work by weakening the bacterial cell wall allowing water to enter the bacterial cell and cause it to burst. • Inhibit function of enzymes in bacteria and prevent growth of bacteria • Prevent ribosomes from making proteins and enzymes, thereby killing the bacteria • Break up the cell membranes in the bacteria 	Any 3
	(d)	Vaccination <ul style="list-style-type: none"> • Cover mouth when coughing/sneezing • Social distancing • Washing hands with soap and water regularly • Avoid touching eyes, nose and mouth • Take complete course of antibiotics for bacterial infection. 	Any 2
Total:			10





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5088/01

28 August 2024
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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

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.

A copy of the Periodic Table is printed on page 18.

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

This document consists of **19** printed pages and **2** blank pages, including this **cover** page.

- 21** An amoeba is a unicellular organism. An amoeba had its nucleus removed by means of a fine glass tube but was not otherwise damaged. For several days, it continued to move and feed, but it did not reproduce.

Another amoeba with no parts of the cell removed, used as a control experiment, reproduced twice in that time.

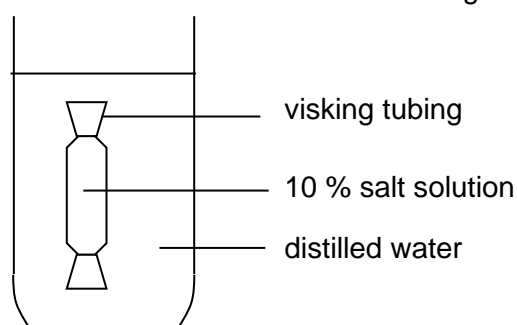
What can be concluded about the role of the nucleus in amoeba from this experiment?

- A** The nucleus is essential for life.
 - B** The nucleus is essential for cell division.
 - C** The nucleus controls the normal activity of the cell.
 - D** The nucleus is the only part of the cell to contain DNA.
- 22** Which feature(s) of a red blood cell correctly relate(s) to its function?

	absence of nucleus to maximise volume for haemoglobin	biconcave disc shape to squeeze through narrow blood capillaries	high surface area to volume ratio to increase rate of diffusion of carbon monoxide
A	✓	x	x
B	✓	✓	✓
C	x	x	✓
D	x	✓	x

key:
✓ correct
x incorrect

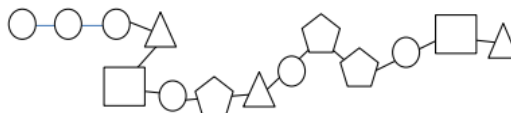
- 23** Some 10 % salt solution was added into a visking tubing. The tubing was then rinsed with distilled water and immersed into a beaker containing distilled water.



What is the percentage of salt in the visking tubing after 3 hours?

- A** 0 %
- B** 5 %
- C** 10 %
- D** 15 %

- 24 The diagram represents a large molecule.



Which row correctly identifies the large molecule and its component?

	large molecule	components			
		amino acid	fatty acid	glucose	glycerol
A	glycogen	x	x	✓	x
B	lipid	x	✓	x	✓
C	polypeptide	✓	x	x	x
D	starch	x	x	✓	✓

key:
 ✓ correct
 x incorrect

- 25 The table shows the observations of food tests on a sample that contains one or more nutrients.

test	initial colour	final colour
Benedict's test	blue	blue
biuret test	blue	purple
ethanol-emulsion test	colourless	white emulsion
iodine solution test	brown	brown

What are the nutrients present in the food sample?

- A** fat only
- B** fat and protein only
- C** protein and reducing sugar only
- D** starch, protein and reducing sugar

26 Four statements about the active site of a human enzyme are given.

- 1 The specificity of the enzyme depends on the shape of the active site.
- 2 The active site of the enzyme is the same shape as the substrate molecule.
- 3 The shape of the active site changes when the temperature falls to 10 °C and does not return to normal when the temperature returns to 37 °C.
- 4 The shape of the active site changes when the enzyme is heated to 75 °C and does not return to normal when the temperature returns to 37 °C.

Which statements are correct?

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

27 Which is an example of assimilation?

- A** large fat droplet becomes smaller fat droplet
- B** protein becomes amino acids
- C** excess glucose becomes glycogen
- D** glucose enters the bloodstream by diffusion

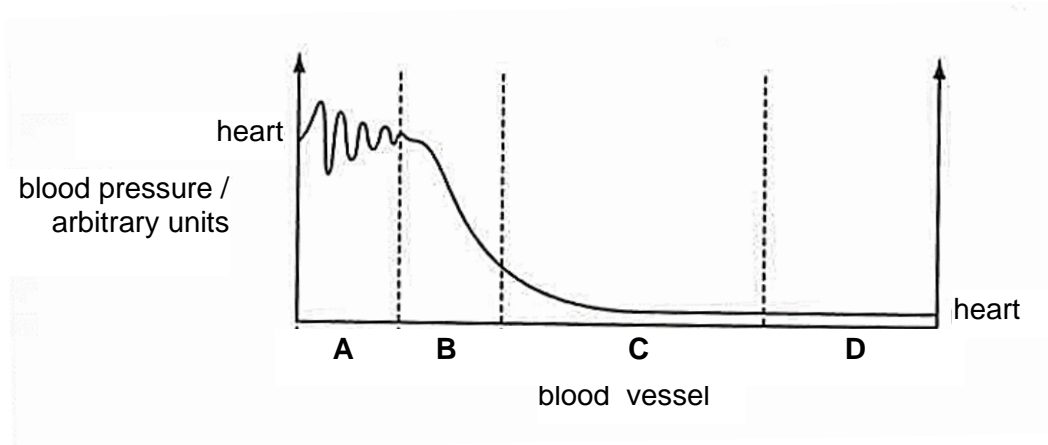
28 A person who has a diseased small intestine had about 30% of the small intestine near the large intestine removed.

What would be a likely consequence of this surgery?

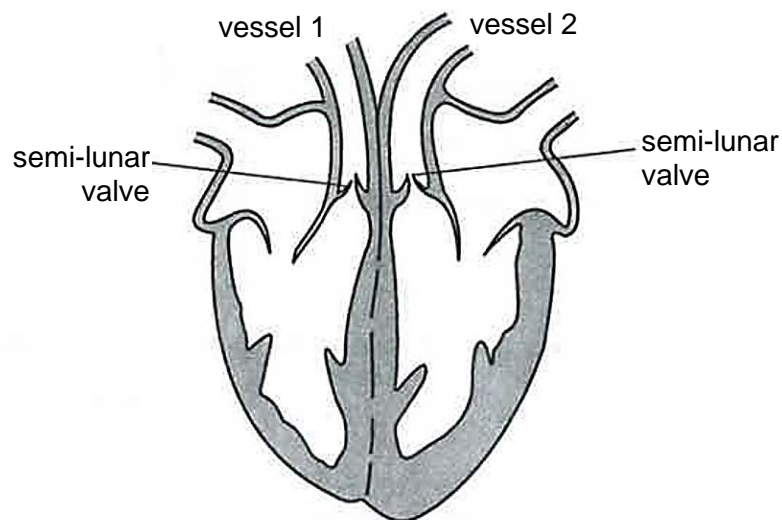
- A** He does not produce faeces.
- B** He is unable to digest fats.
- C** He loses his appetite.
- D** He loses weight.

- 29** The graph shows changes in blood pressure as blood flows through the blood vessels of the human circulatory system.

Which blood vessel has the thinnest wall?



- 30** The diagram shows a section through the human heart.



What happens as blood is pumped out of the heart?

	semi-lunar valves	blood passes to the stomach through vessel
A	close	1
B	close	2
C	open	1
D	open	2

- 31** In one year, smoking contributed to approximately 470 900 hospital admissions.

The table shows the causes of these admissions.

cause	number of admissions
cancer	160 300
circulatory disease	135 400
respiratory disease	137 200
digestive system disease	18 100
others	19 900

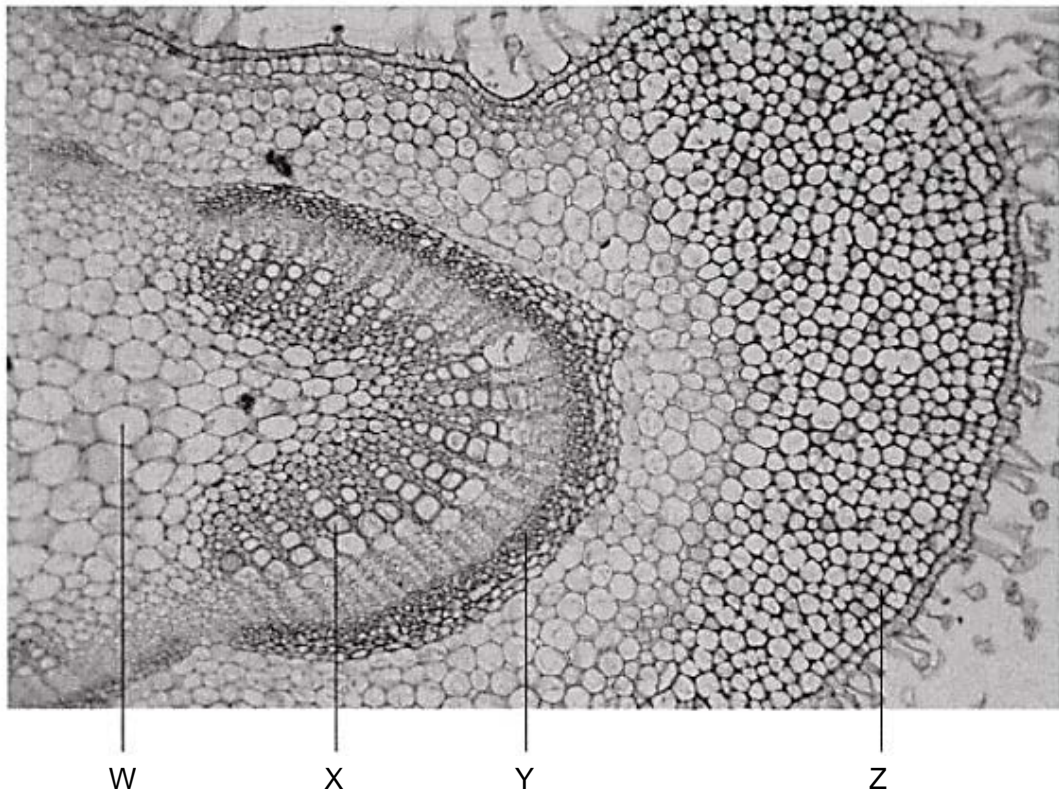
What percentage of admissions were related to emphysema?

- A** 4%
B 29%
C 35%
D 63%
- 32** Vaccines contain an agent that resembles a pathogen and prevent infectious diseases by stimulating J to quickly produce K when the pathogen invades.

Which row contains the correct words to fill the gaps J and K?

	J	K
A	red blood cells	antibiotics
B	red blood cells	antibodies
C	white blood cells	antibiotics
D	white blood cells	antibodies

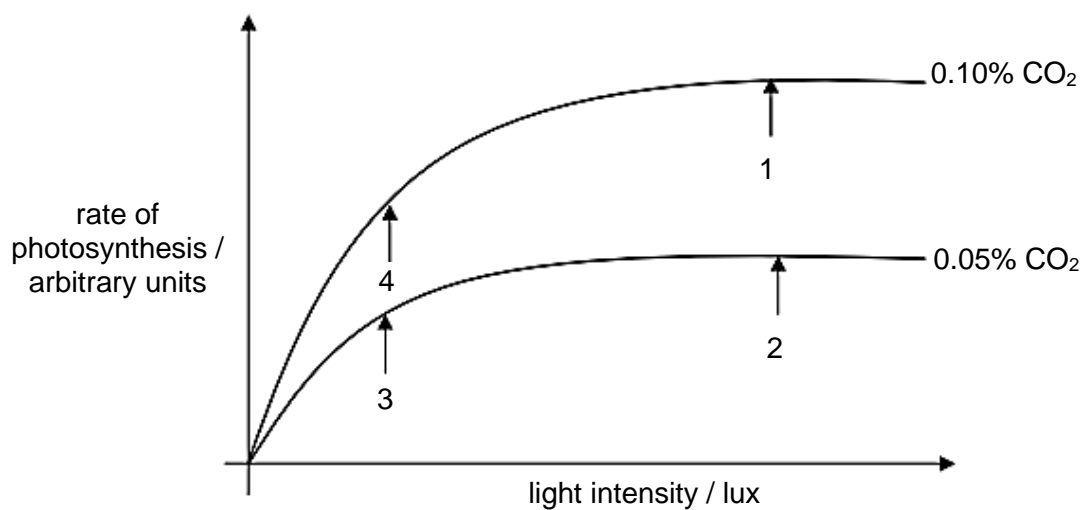
- 33 The photomicrograph shows part of a plant stem in transverse section.



Which tissue transports water and mineral salts and which tissue transports sucrose?

	water and mineral salts	sucrose
A	W	Z
B	X	Y
C	Y	X
D	Z	W

- 34** The graph shows the rate of photosynthesis of a plant, at two different carbon dioxide concentration and at varying light intensities. The temperature provided was optimum for the plant.



Which row correctly matches the points on the graph to the factors limiting the rate of photosynthesis?

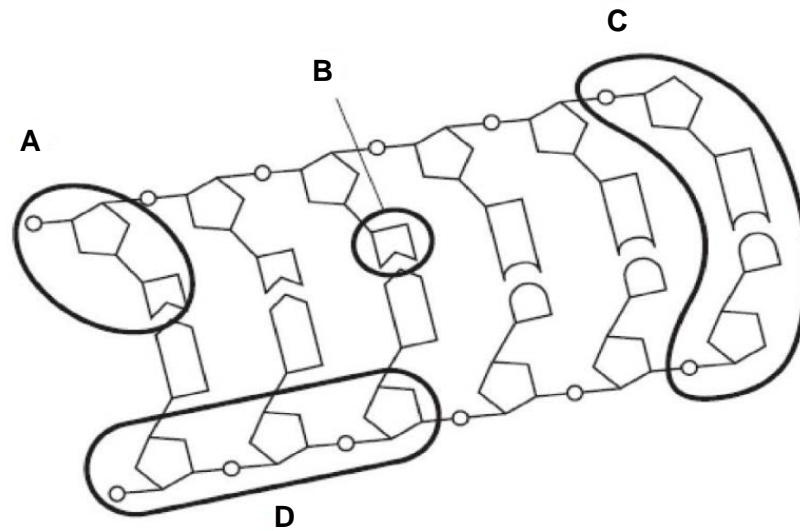
	light intensity	carbon dioxide concentration
A	1	2
B	3	4
C	1 and 2	3 and 4
D	3 and 4	1 and 2

- 35** Which statement involves the long-term storage of carbon in carbon sinks?

- A** decomposition of dead organisms
- B** fossil fuels under the ground
- C** passing down of carbon molecules from grass to the herbivores
- D** release of carbon dioxide gas to the environment via respiration

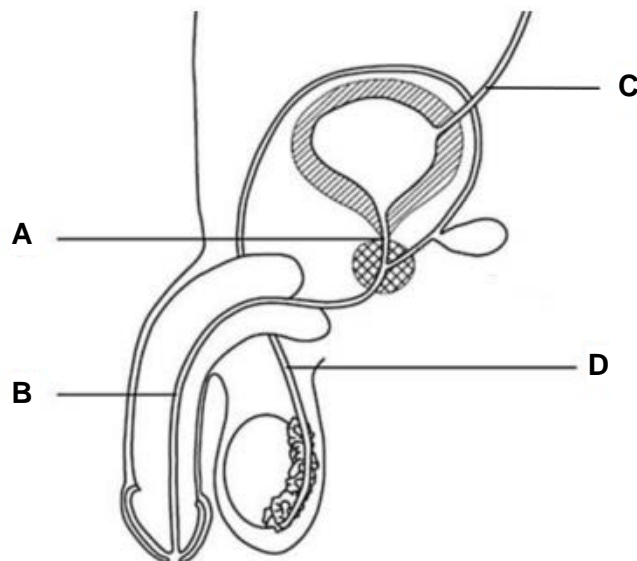
- 36** The diagram shows part of a DNA molecule.

Which part of the DNA molecule shows a nucleotide?

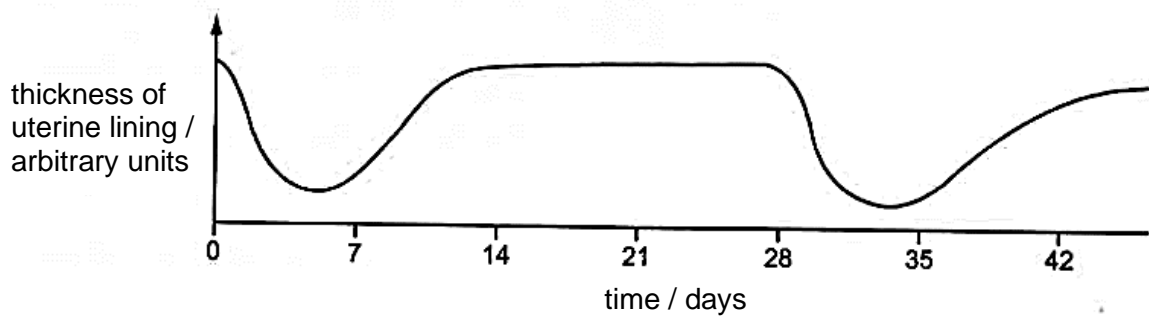


- 37** Vasectomy is a method of birth control which prevents sperm from being ejaculated. It involves the cutting and tying of a tube in the male reproductive system.

During this surgical procedure, which tube in the diagram is most likely to be cut and tied?

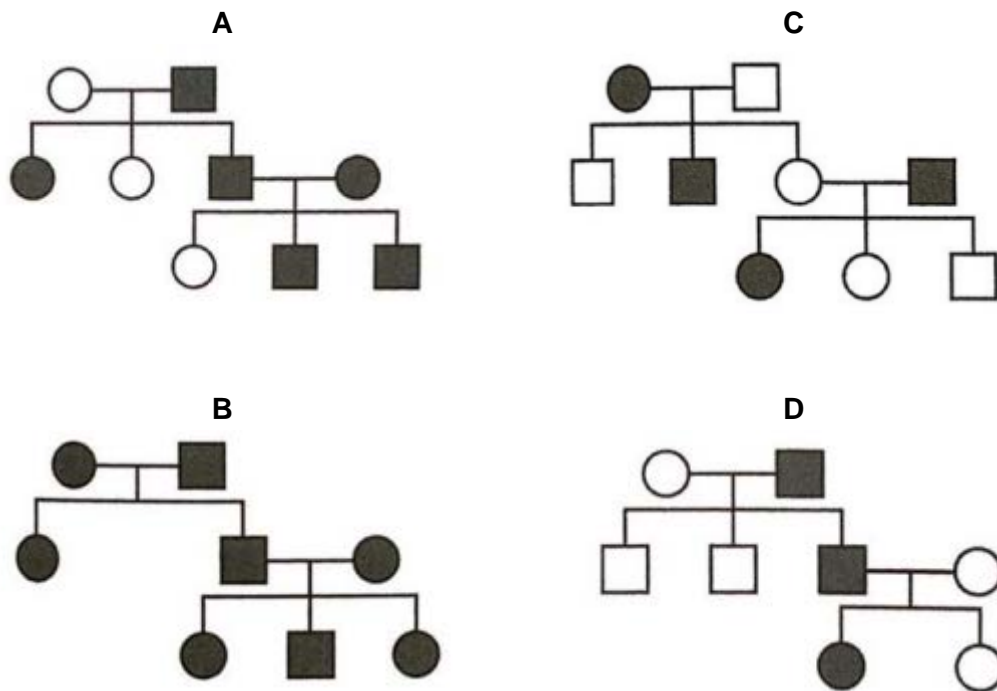


- 38 The diagram shows changes in the lining of the uterus for a woman with a regular menstrual cycle.

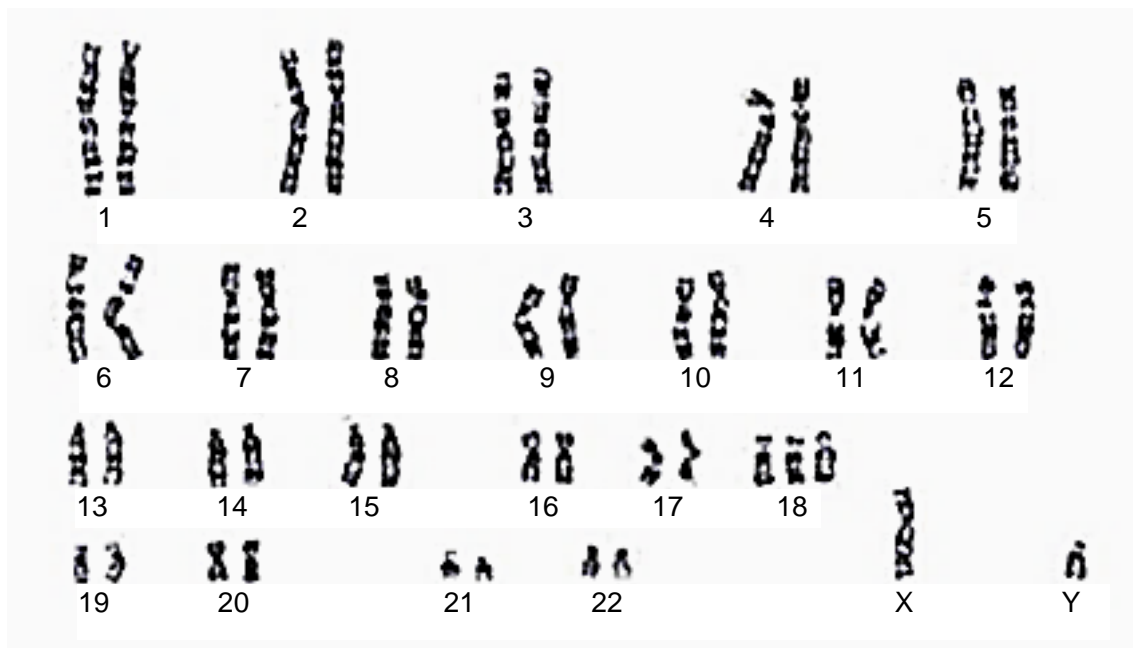


On which day is the level of progesterone likely to be the highest?

- A day 7
 - B day 14
 - C day 28
 - D day 35
- 39 The inheritance pattern of an abnormal condition in four families is shown.
- Which pedigree chart shows that the condition **cannot** be caused by a recessive allele?



- 40 The diagram shows the chromosomes taken from a particular individual's body cell.



Which fertilisation resulted in the above individual?

	chromosome in sperm	chromosome in ovum
A	22 + 1X	23 + 1Y
B	22 + 1Y	22 + 1X
C	23 + 1X	23 + 1Y
D	23 + 1Y	22 + 1X

End of Paper



**SERANGOON SECONDARY SCHOOL
PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS**

CANDIDATE
NAME

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CLASS

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INDEX
NUMBER

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SCIENCE BIOLOGY

Paper 4 (Section A)

5088/04

**26 August 2024
1 hour 15 minutes**

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

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

For Examiner's Use	
Section A	55

Section A

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

- 1 Fig. 1.1 shows a section of an alveolus and a capillary in the lung.



Fig. 1.1

- (a)** Describe and explain how the alveolus is adapted for the exchange of gases.

.....

.....

.....

.....

.....

..... [3]

- (b)** During vigorous exercise, lactic acid is produced in muscles.

- (i)** Write the word equation for anaerobic respiration.

..... [1]

- (ii)** Explain why lactic acid is produced only during vigorous activity.

.....

.....

.....

..... [2]

- (iii) Muscle damage can occur during vigorous exercise. This can cause an increase in amino acids in the blood.

Describe how the body metabolises excess amino acids

.....

.....

.....

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.....

.....

..... [3]

[Total: 9]

2 Blood clotting helps to prevent foreign particles from entering the bloodstream.

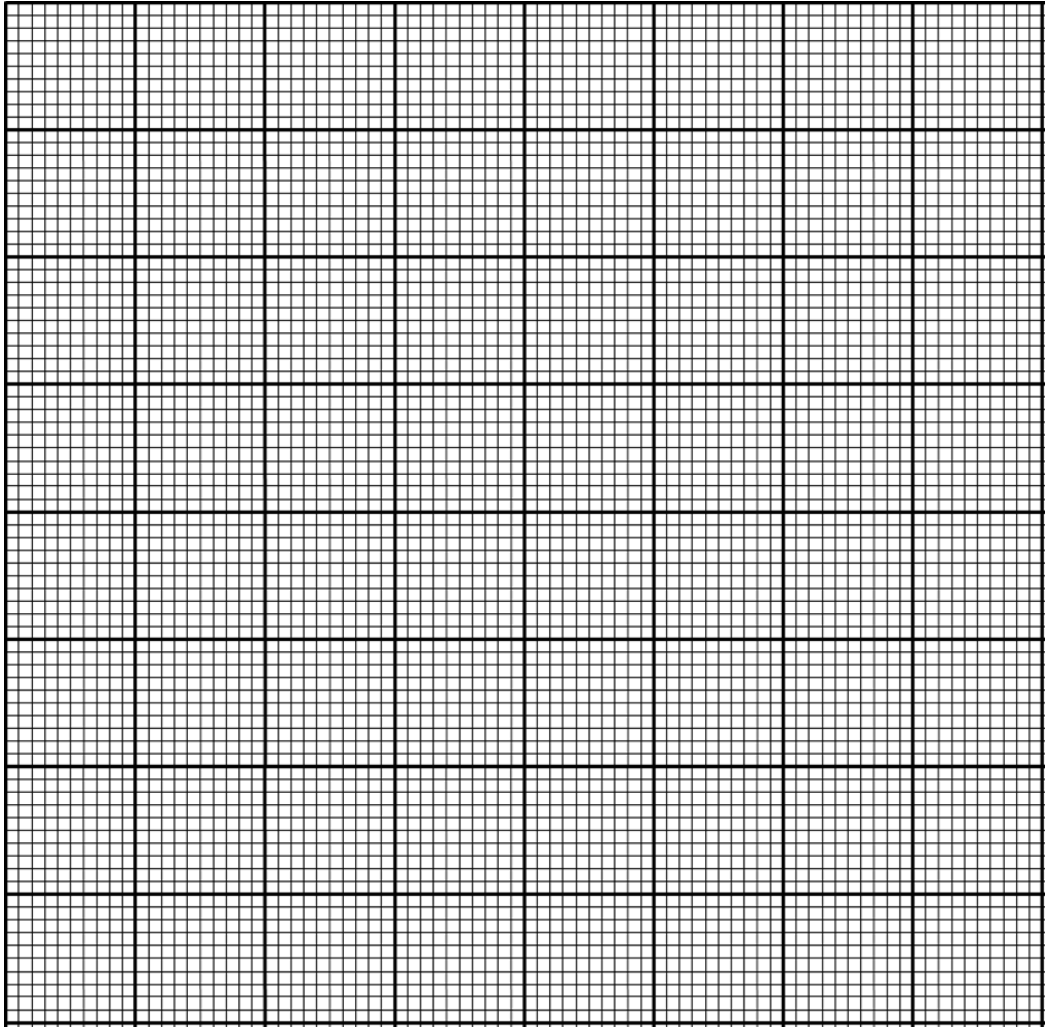
- (a)** The paragraph describes the process of blood clotting. Complete the blanks with appropriate words or phrases.

Blood clotting can occur when blood vessels are broken.
 are activated to cause a series of reactions. With the aid of enzymes,
 is converted to and a mesh
 is formed. This mesh helps to entangle to form a clot. The
 clot will then seal the wound. [2]

Blood clotting is enzyme-dependent. An experiment was conducted to investigate the effects of temperature on the clotting of human blood. The results are as shown.

temperature / °C	time taken for blood to clot / s
5	46
10	39
15	34
20	28
25	24
30	19
35	20
40	29

- (b)** Plot a graph to show the relationship between temperature and time taken for blood to clot.



[4]

- (c)** Explain what is shown in the graph in **(b)**.

.....

.....

.....

.....

.....

.....

.....

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..... [4]

[Total: 10]

- 3 Fig. 3.1 shows the number of cases of pneumococcal disease in children in a country between 1998 and 2008. A vaccine was introduced in the year 2000.

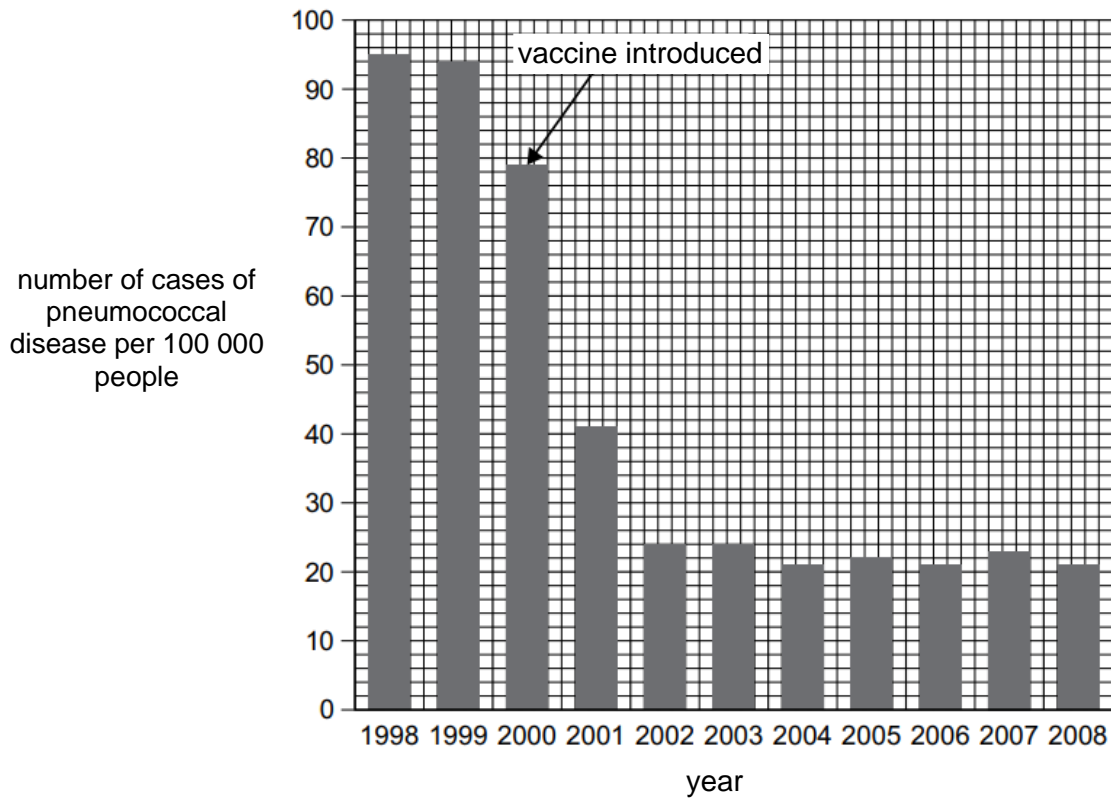


Fig. 3.1

- (a) (i) Calculate the percentage decrease in cases between 2000 and 2008. Give your answer to 1 decimal place.

.....% [2]

- (ii) Explain how the introduction of vaccines caused the percentage decrease in cases in (a)(i).

.....

.....

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.....

..... [3]

- (b) State the type of organism that causes pneumococcal disease and the treatment for the disease.

type of organism

treatment for pneumococcal disease [2]

- (c) Suggest **two** reasons why there are still cases of pneumococcal disease even after the introduction of the vaccine.

.....

.....

.....

..... [2]

[Total: 9]

- 4 Fig. 4.1 shows some guinea pigs, which are small mammals. In some countries they are produced for food and in others they are bred as pets.



Fig. 4.1

- (a) Guinea pigs can have either straight hair or curly hair. The alleles for straight hair is dominant while the allele for curly hair is recessive.

- (i) Define allele.

.....
 [1]

- (ii) Two straight-haired guinea pigs were bred and one of the offspring has curly hair.

Draw the genetic diagram to show how this is possible.

Use **T** and **t** to represent the alleles.

[4]

- (b) Fig. 4.2 shows a Baldwin guinea pig which has a genetic mutation.

Baldwin guinea pigs begin to lose their hair at two to five days of age and will be entirely hairless by about two months of age.



Fig. 4.2

- (i) Define mutation.

.....
 [1]

Fig. 4.3 shows how some nucleotides are deleted from a polynucleotide chain due to a genetic mutation, and the strand that result from it.

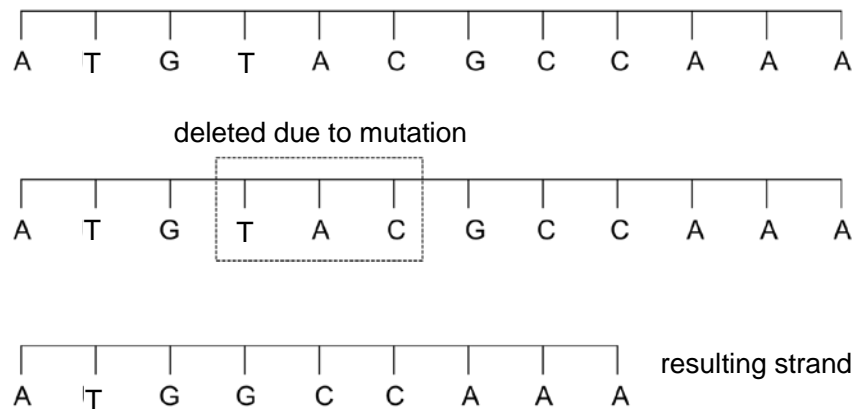


Fig. 4.3

- (ii) Name the site of protein synthesis in the cell.

..... [1]

- (iii) Suggest what will happen to the product made using the resulting mutated strand.

.....
 [1]

[Total: 8]

- 5 Fig. 5.1 shows a section of a green leaf.

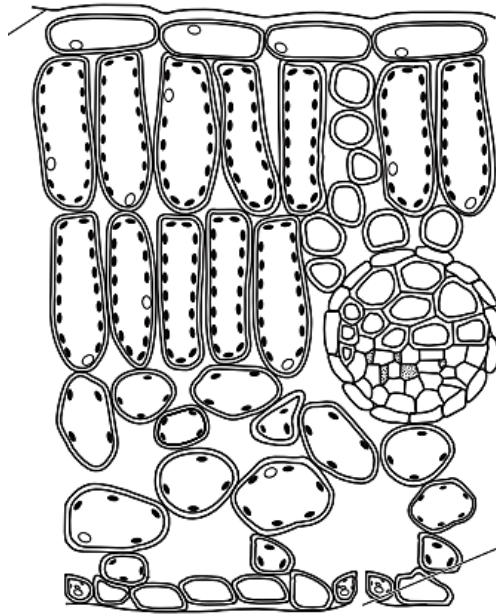


Fig. 5.1

- (a) On Fig. 5.1, label and name the following structures:

- (i) palisade mesophyll cell
- (ii) upper epidermal cell
- (iii) guard cell

[2]

- (b) On Fig. 5.1, draw arrows to show the path of carbon dioxide between the mesophyll tissue and atmospheric air on a bright sunny day. [1]

- (c) Describe two ways in which glucose made during photosynthesis is used by the plant itself.

.....

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..... [2]

- (d) With reference to Fig. 5.1, describe the process of movement of water and water vapour during transpiration.

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..... [4]

[Total: 9]

6 Fig. 6.1 shows the carbon cycle.

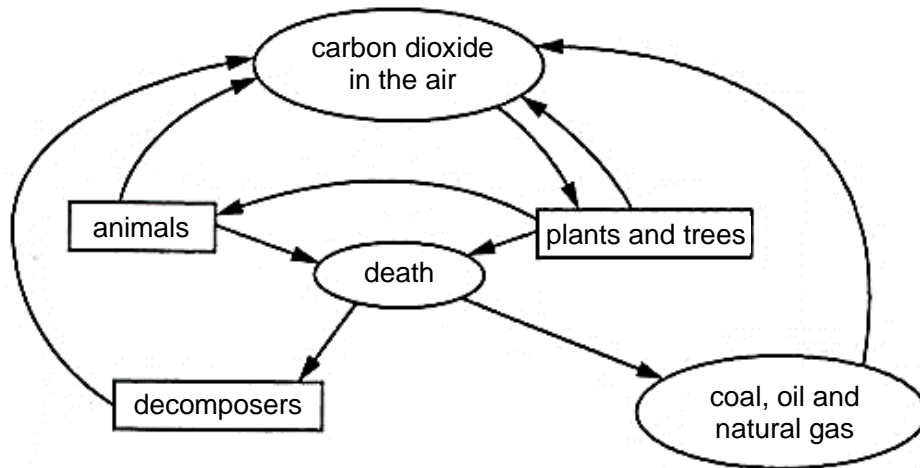


Fig. 6.1

- (a) Outline the role of photosynthesis in the carbon cycle and the transfer of energy in forest ecosystems **and** explain its importance.

carbon cycle

.....

energy transfer

.....

 [6]

- (b) Describe how **two** human activities have led to global warming.

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..... [4]

[Total: 10]

End of Section A



**SERANGOON SECONDARY SCHOOL
PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS**

CANDIDATE
NAME

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CLASS

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INDEX
NUMBER

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SCIENCE BIOLOGY

Paper 4 (Section B)

5088/04

**26 August 2024
1 hour 15 minutes**

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section B

Answer **one** question.

Write your answers in the spaces provided on the question paper.

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

For Examiner's Use	
Section B	10

This document consists of **5** printed pages and **0** blank pages, including this cover page.

Section B

Answer **one** question from this section.

- 7 Wetlands are important ecosystems. Researchers studied the feeding relationships between the organisms in an area of wetland on the coast of Texas.

Fig. 7.1 shows part of the food web that they studied.

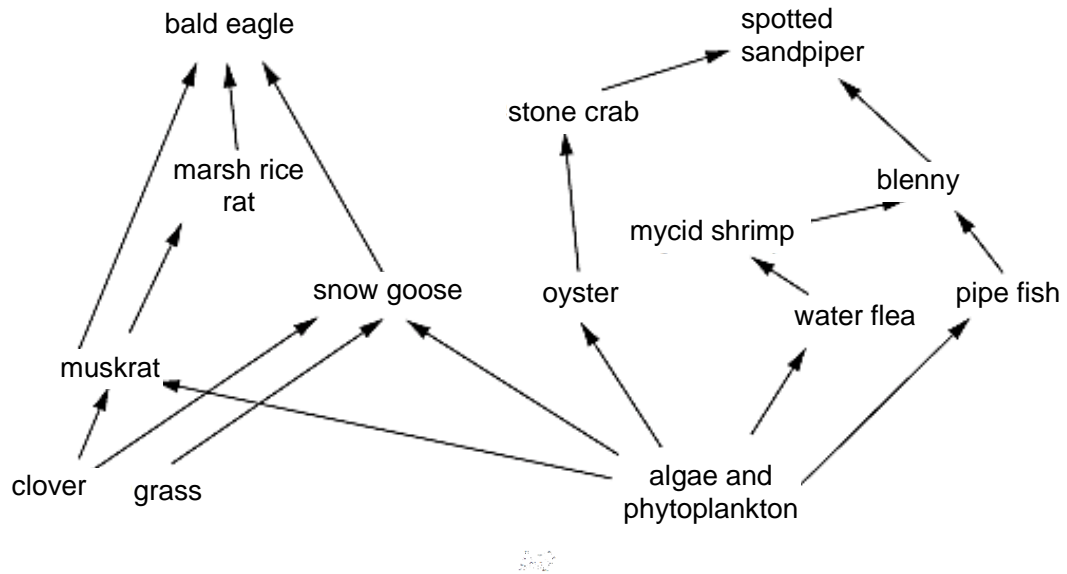


Fig. 7.1

- (a) Complete Table 7.1 by giving the name of **one** organism from the food web in Fig. 7.1 for each row.

Table 7.1

	name of one organism from Fig. 7.1
at trophic level 2	
a secondary consumer	
an animal that feeds at two trophic levels	

[3]

- (b)** A pyramid of numbers for the wetland ecosystem showed that there were very large numbers of organisms at the base of the pyramid and very few at the top.

Explain why.

.....

.....

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..... [3]

- (c)** Explain the advantages of presenting information about food webs as a pyramid of biomass and not as a pyramid of numbers.

.....

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..... [2]

- (d)** Some crop farmers use herbicides on their fields to kill weeds. An environmental researcher measured the concentration of herbicides and found at least 0.12 mg per kg of herbicides in the water samples.

Suggest how herbicides damage ecosystems in the wetland.

.....

.....

..... [2]

[Total: 10]

- 8 (a) A student measures the percentage gain or loss in the mass of onion pieces in different concentrations of sodium chloride solution.

Fig. 8.1 shows the results obtained by the student.

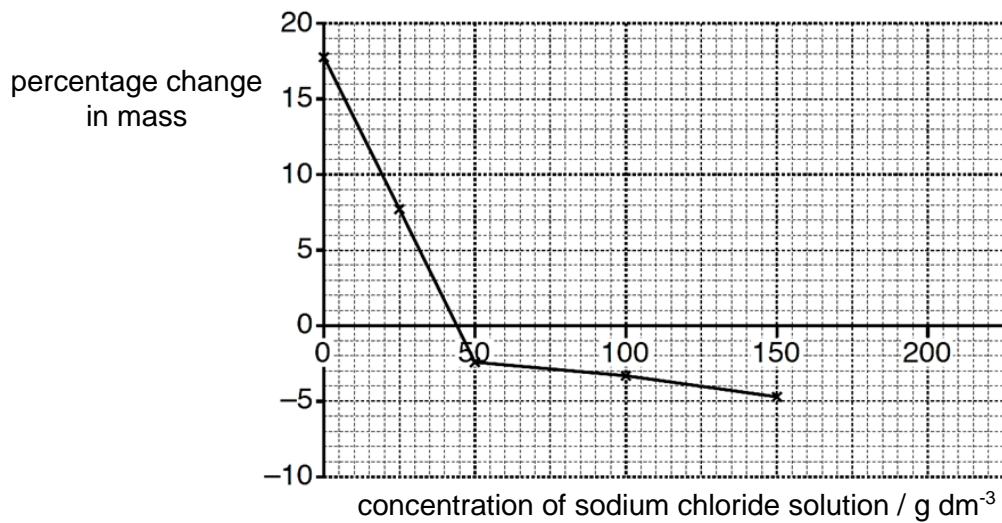


Fig. 8.1

- (i) Explain the trend shown by the graph in Fig. 8.1.

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..... [4]

- (ii) Use Fig. 8.1 to work out the concentration of sodium chloride in onion cell sap. Explain how you used the graph to work out this value.

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..... [2]

- (b) Fig. 8.2 shows the blood glucose concentrations of three different persons, D, E and F, over a 48-hour period.

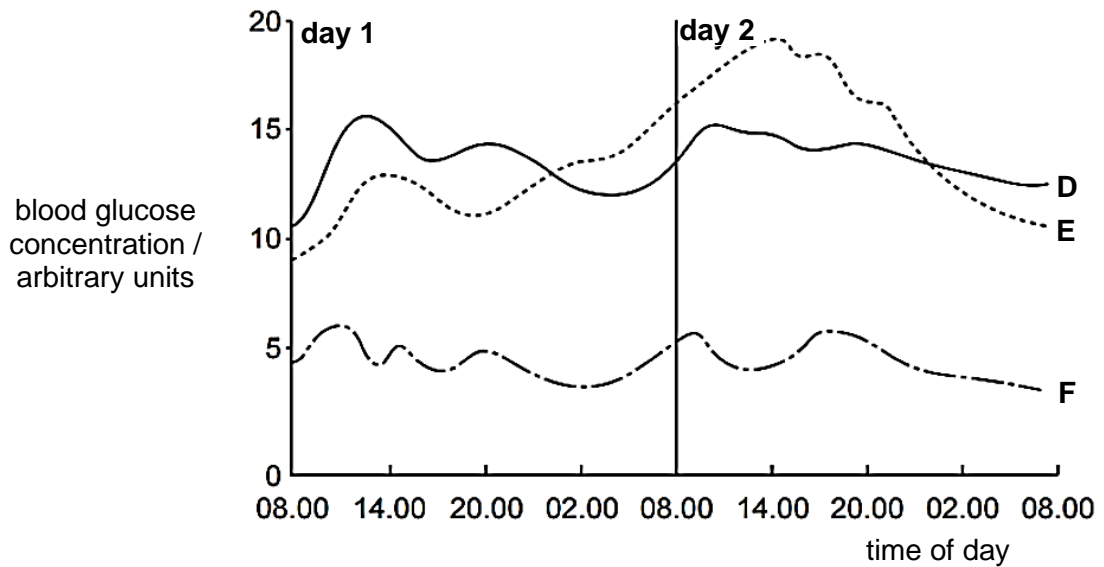


Fig. 8.2

Two of the persons are diabetic. The pancreas of one of these two persons produces small quantities of insulin. For the other person, the pancreas does not produce any insulin. The third person is not diabetic.

- (i) Using the information in Fig. 8.2, identify the person who does not have diabetes. Give reason for your answer.

.....

 [2]

- (ii) Using the information in Fig. 8.2, identify the person who does **not** produce insulin. Give reason for your answer.

.....

 [2]

[Total: 10]

End of Section B





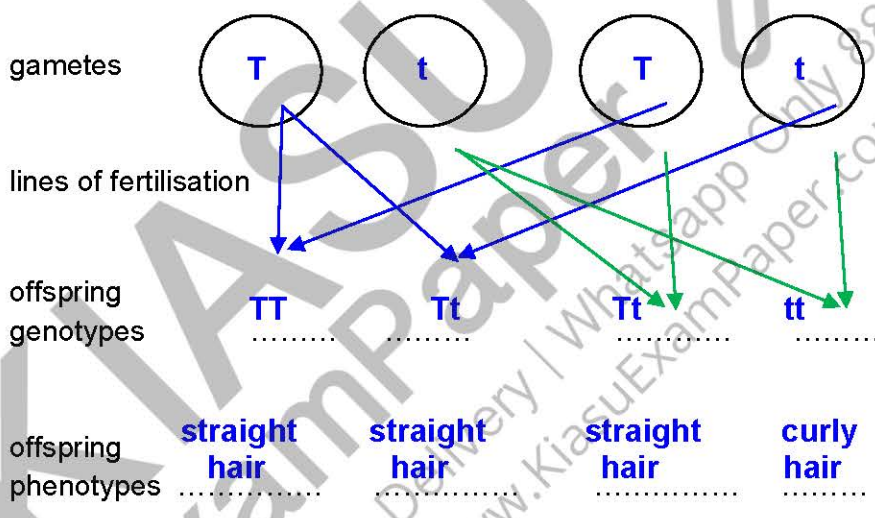
SSS 2024 4E Sc Bio Prelim P1 & P4 Answer Key

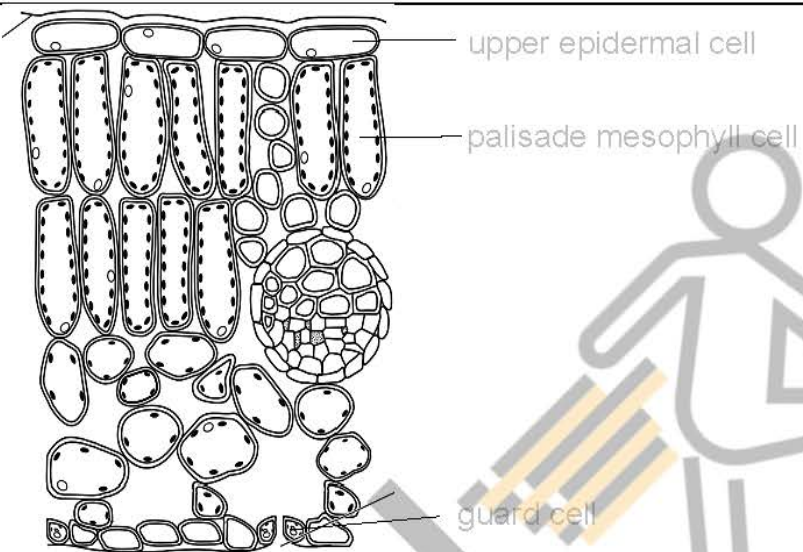
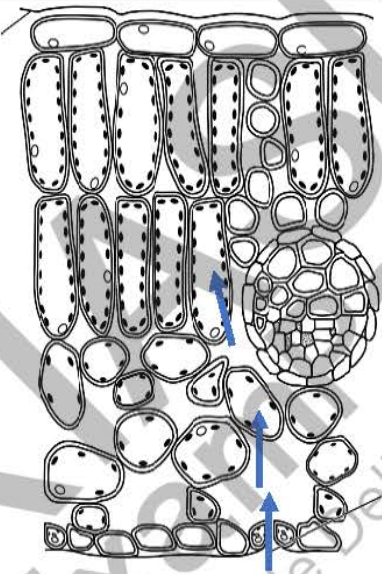
Paper 1

21	22	23	24	25	26	17	28	29	30
B	A	B	C	B	A	C	D	C	D
31	32	33	34	35	36	37	38	39	40
B	D	B	D	B	A	D	B	A	D

Paper 4

Q/no.	Answer	Mark
SECTION A		
1a	1. Alveolar wall is 1-cell thick / very thin + reduce diffusion distance; 2. Alveolar wall has a thin film of moisture + dissolve oxygen; 3. Alveolar wall has a rich network of capillaries + maintain steep concentration gradient	3
1b(i)	Glucose \longrightarrow lactic acid	1
1b(ii)	1. Increased energy demand for muscle contraction; 2. Insufficient oxygen for higher rate of aerobic respiration.	2
1b(iii)	Any 3 from: 1. Excess amino acids are transported to liver; 2. Deaminated to urea (and glucose); 3. Urea is transported to kidney to be removed in urine; 4. Excess glucose is converted to glycogen in liver for storage.	[Total: 9]
2a	every 2 correct – 1m platelets; fibrinogen; fibrin; blood cells	2
2b	correct axes with units; correct scale; correct plots; best-fit line;	4
2c	Any two cluster from: D: As temperature increases from 5 to 30 °C, time taken for blood to clot decreases from 46 to 19 s; E: because enzyme (for converting fibrinogen to fibrin) <u>gain kinetic energy</u> and become more active; D: As temperature increases from 40 to 40 °C, time taken for blood to clot increases from 19 to 29 s; E: because enzyme denatures + active site changes shape / no enzyme-substrate complex; D: The optimum temperature for blood clotting is 30 °C; E: because enzyme is most active.	[Total: 10]

Q/no.	Answer	Mark
3ai)	$79 - 21 = 58$; $(58/79) \times 100 = 73.4$	2
3aii)	(Cases decreases because) 1. Vaccine contains an agent that resembles a pathogen; 2. Which stimulate white blood cells to produce antibodies; 3. These antibodies kill pathogen that cause infectious diseases;	3
3b)	Bacteria; Antibiotics.	2
3c)	Any two from: 1. Not every child is vaccinated; 2. Not every child is suitable to take the vaccine; 3. There is a new strain of the pneumococcus bacteria; AVP	2 [Total: 9]
4ai	Alleles are different / alternative forms of the same gene. [1]	1
4aii	<p>genotype of parents Tt x Tt</p> <p>gametes</p>  <p>lines of fertilisation</p> <p>offspring genotypes TT Tt Tt tt</p> <p>offspring phenotypes straight hair straight hair straight hair curly hair</p> <p>correct lines of fertilisation + genotypes</p>	1 1 1 1
4bi	Mutation is the sudden random change in the sequence of a gene or in the chromosome number.	1
4bii	Ribosome	1
4biii	It will be shorter / will not be able to fold into a three-dimensional shape [1] A: other acceptable answers	1 [Total: 8]

Q/no.	Answer	Mark
5a	 <p>upper epidermal cell</p> <p>palisade mesophyll cell</p> <p>guard cell</p>	<p>2</p> <p>-1 mark for every incorrect label</p>
5b	 <p>1 arrow in through stomata <u>and</u> 1 arrow through intercellular air space</p>	<p>1</p>
5c	<p>Any 2 from:</p> <ol style="list-style-type: none"> 1. Used by leaf cells for respiration to release energy; 2. Excess glucose is converted to starch to be stored in leaves; 3. Excess glucose is converted to sucrose to be transported by phloem to other parts of the plant; 4. Converted to amino acids to make proteins to make new cells; 5. Converted to fats for storage purpose. 	<p>2</p>
5d	<p>Any 4 from:</p> <ol style="list-style-type: none"> 1. Thin film of moisture around mesophyll cells <u>evaporates to form water vapour in intercellular air spaces</u>; 2. Water vapour <u>diffuses</u> through <u>stomata</u> out of the leaf; 3. <u>Water moves out</u> from <u>mesophyll cells</u> to replenish the thin film of moisture; 4. <u>Water moves</u> from other cells <u>into mesophyll cells</u> by <u>osmosis</u>; 5. <u>Water</u> moves <u>out of xylem</u> to other cells by <u>osmosis</u>. 	<p>4</p> <p>[Total: 9]</p>

Q/no.	Answer	Mark
6a	<p>Carbon cycle - max 4 from:</p> <ul style="list-style-type: none"> • Photosynthesis converts <u>carbon dioxide</u> in the atmosphere to <u>carbon compounds</u>. (role) • Photosynthesis produces <u>food/nutrients/glucose/sugars</u> for <u>primary consumers</u> when they feed on plants. • Carbon compounds enable organisms to <u>grow/carry out activities</u>. • Carbon compounds/proteins help organisms to <u>build/repair tissues</u>. • Carbon compounds are used to <u>synthesise enzymes/hormones</u> to coordinate bodily functions. • Carbon compounds are <u>stored in trees/plants</u> which enable forests to be <u>carbon sinks</u>. <p>Energy transfer – max 3 from:</p> <ul style="list-style-type: none"> • Photosynthesis converts <u>light energy</u> to <u>chemical energy</u>. (role) • Transfer of chemical energy from one trophic level to the next during <u>feeding</u> makes the <u>energy available to all organisms</u>. • Transfer of chemical energy allows <u>different types of organisms to survive</u>. • Transfer of chemical energy to the <u>top consumers/predators</u> keeps the <u>population of other organisms in check</u> / helps to <u>maintain a stable ecosystem</u>. 	6
6b	<ol style="list-style-type: none"> 1. Deforestation + reduced carbon sink / reduced photosynthesis; 2. Burning of fossil fuel + release carbon dioxide into atmosphere; 3. Increased carbon dioxide concentration in atmosphere; <p>any one from:</p> <ol style="list-style-type: none"> 4. Carbon dioxide is a greenhouse gas; 5. Carbon dioxide traps heat. 	4 [Total: 10]

SECTION B		
7a	<ol style="list-style-type: none"> Trophic level 2: maskrat / snowgoose / oyster / water flea / pipe fish ; secondary consumer marsh rice rat / (stone) crab / mycid shrimp / blenny / (bald) eagle ; an animal that feeds at two trophic levels (bald) eagle / blenny / (spotted) sandpiper ; 	3
7b	<p>Any 3 from:</p> <ol style="list-style-type: none"> The size of organisms increases up the trophic level / Trophic level 1 are organisms that are smallest in size; Only 10% of energy is transferred from one trophic level to the next / <i>AVN</i> ; not enough energy, at the top of the pyramid / at higher trophic levels, to support a large number of organisms ; named example of energy loss e.g. heat / in respiration / in (named) metabolic processes / movement / excretion / urine / faeces not all organisms / parts of organisms (in one trophic level), are, eaten/ digested; <i>AVP</i> ; 	3
7c	<p>Pyramid of biomass:</p> <p>Any 2 from:</p> <ol style="list-style-type: none"> Takes into consideration the size and mass of organism / Reflects the amount of food/energy available; More accurate representation of energy flow through a food chain; Always upright pyramid unlike pyramid of numbers which may be inverted depending on size of organism 	2
7d	<p>Any cluster from:</p> <ol style="list-style-type: none"> kills water plants / algae / phytoplankton ; lack of, producers / food for herbivores ; bioaccumulation + killing top consumer (eagle and sandpiper) reduced biodiversity ; 	2 [Total: 10]
8ai	<p>Any 4 from:</p> <ol style="list-style-type: none"> As concentration of sodium chloride solution increases from 0 to 45, percentage change in mass of onion pieces decreases from 17.5 to 0; Because sodium chloride concentration gradient between onion cell sap and sodium chloride solution decreases; Net movement of water into onion cells by osmosis decreases; As concentration of sodium chloride solution increases from 45 to 150 gdm⁻³, Onion cell sap has higher water potential than sodium chloride solution; Net movement of water out of cells by osmosis. 	4
8aii	<ol style="list-style-type: none"> 0.45 gdm⁻³ No change in mass at this concentration + same water potential between onion cell sap and sodium chloride solution 	2

8bi	1. Person F; 2. No large fluctuation of blood glucose concentration over the 2 days; OR 3. Blood glucose concentration fluctuates between 3 to 6 arbitrary units.	2
8bii	1. Person E; 2. Large fluctuation of blood glucose concentration over the 2 days; OR 3. Blood glucose concentration fluctuates between 9 to 19 arbitrary units.	2 [Total: 10]



SCIENCE (BIOLOGY)

7

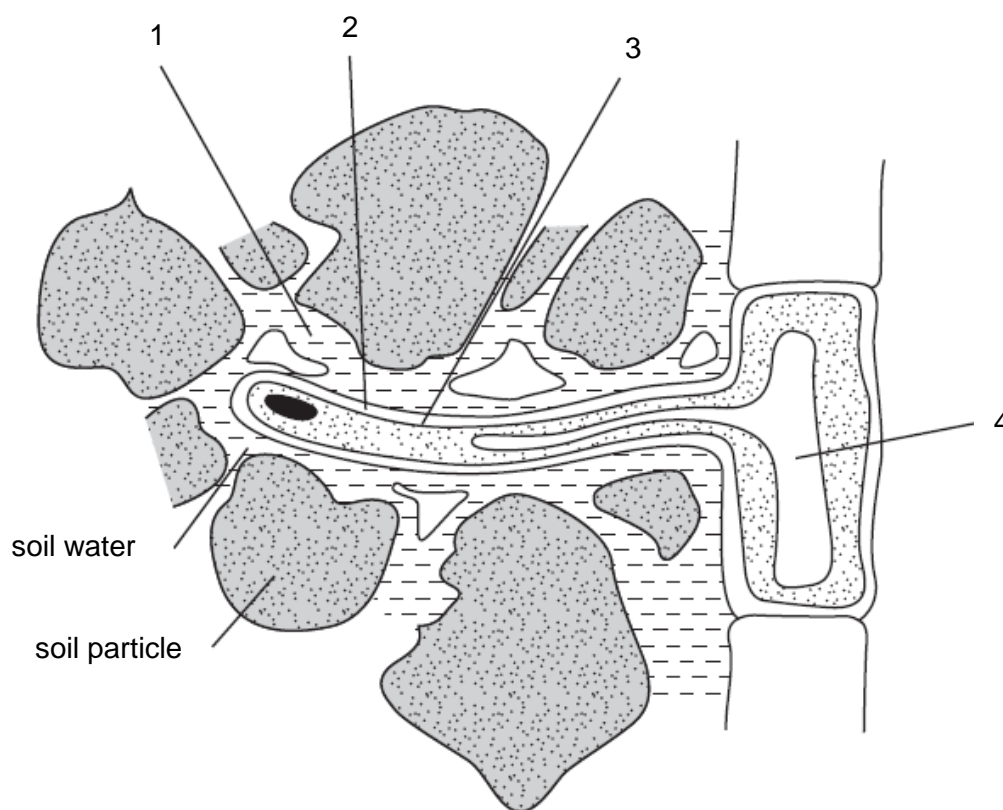
- 19** Which substance has a main constituent that contains only one carbon atom per molecule?
- A** bitumen
 - B** kerosene
 - C** naphtha
 - D** natural gas
- 20** Which statement about vegetable oil and margarine is correct?
- A** Both vegetable oil and margarine are liquids at room temperature.
 - B** Margarine has a higher melting point than vegetable oil.
 - C** Vegetable oil has fewer carbon-carbon double bonds than margarine.
 - D** Vegetable oil is made from margarine by hydrogenation.

21 A cell is being examined.

Which feature would enable you to identify it as a plant cell or an animal cell?

- A** The cell contains a single large sap vacuole space.
- B** The cell contains glucose and amino acids.
- C** The cell contains stored fat.
- D** The cell surface membrane is partially permeable.

22 The diagram shows a root hair cell and surrounding soil particles.

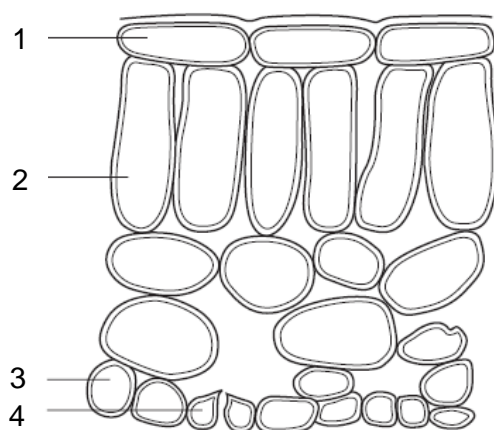


Osmosis occurs when solutions of different water potential are separated by a partially permeable membrane.

For root hair cell to absorb water, which of the following correctly identifies the regions and partially permeable membrane?

	higher water potential	partially permeable membrane	lower water potential
A	1	2	4
B	1	3	4
C	4	2	1
D	4	3	1

- 23** The diagram shows the arrangement of cells inside the leaf of a green plant. (No cell contents are shown.)



Which cells normally contain chloroplasts?

- A** 1 and 3
B 1 and 4
C 2 and 3
D 2 and 4
- 24** 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

- 25** The diagram shows the shape of a red blood cell.



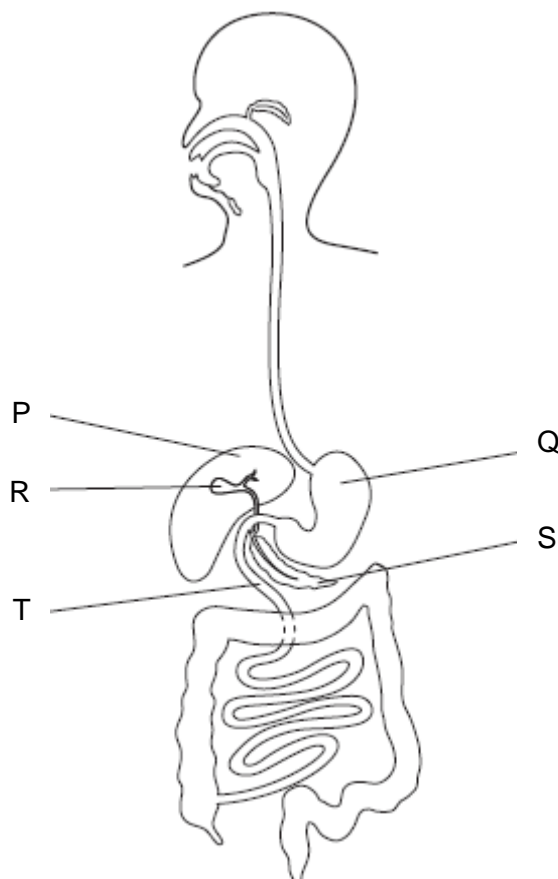
What is an advantage of this shape?

- A** allows it to carry more haemoglobin
B allows it to move more quickly in arteries
C increases its surface area for diffusion
D prevents it getting trapped in valves in veins

26 Which of the following happens to the excess amino acids in the blood?

- A** broken down to urine in the bladder
- B** broken down to urine in the liver
- C** broken down to urea in the bladder
- D** broken down to urea in the liver

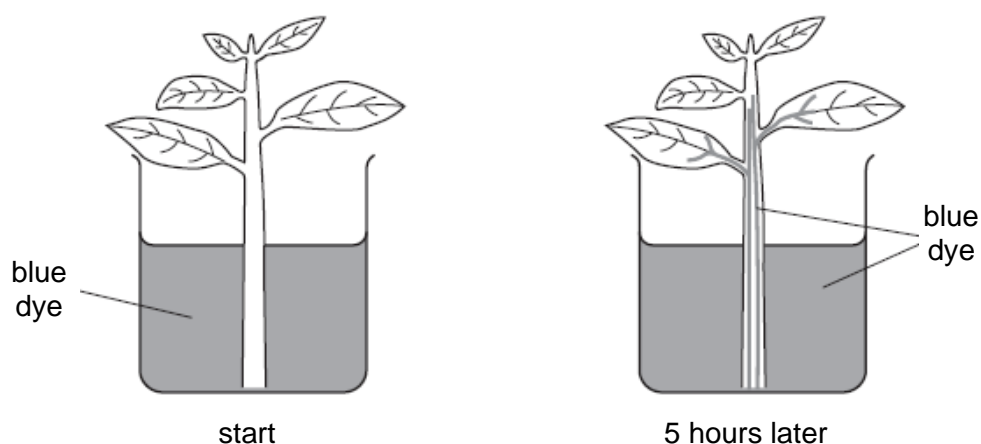
27 The diagram shows the human gut.



Where is bile made, where is it stored and where does it act?

	where it is made	where it is stored	where it acts
A	P	Q	R
B	P	R	T
C	Q	S	P
D	Q	T	S

- 28** Which of the following will likely result in a dangerously high level of blood glucose in a diabetic patient?
- A** caused by eating too much fat
 - B** reduced frequency of insulin injections
 - C** losing too much water by sweating
 - D** not producing enough glucagon
- 29** A piece of a plant with a transparent stem was placed in a beaker containing a blue dye and then examined 5 hours later.



Which statement explains the change in appearance?

- A** Blue dye diffuses through the cells of the plant.
 - B** Blue dye diffuses up the stem by osmosis.
 - C** Blue dye moves up through the phloem.
 - D** Blue dye moves up through the xylem.
- 30** Four similar leafy shoots are exposed to different conditions. The rates of water uptake and the rates of water loss are measured.

The results are shown in the table.

Which shoot is most likely to wilt?

	water uptake /mm ³ per min	water loss /mm ³ per min
A	5	2
B	5	5
C	10	8
D	10	12

- 31** A woman has fewer platelets than normal.

What would be the effect of this?

- A** Her blood contains high levels of urea.
- B** Her blood does not clot properly.
- C** Her body cells do not get enough oxygen.
- D** She cannot fight off infections.

- 32** Which is the correct route for blood flow in a human?

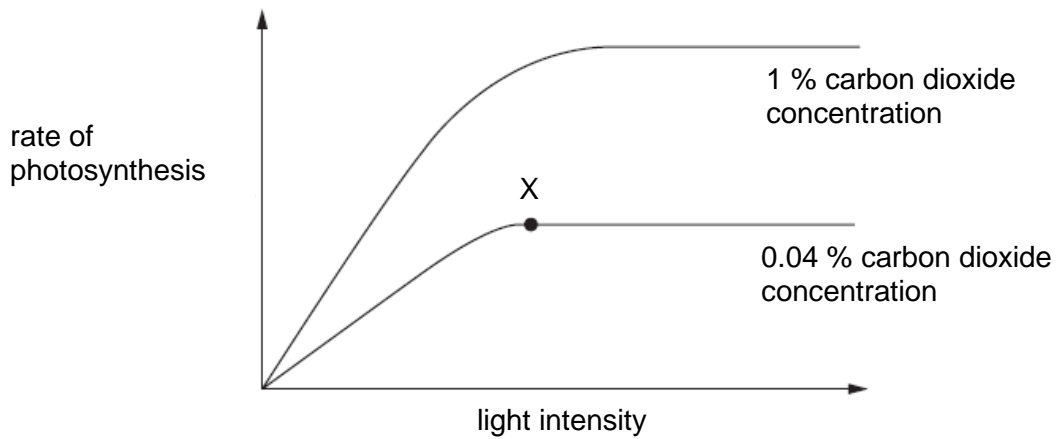
- A** left atrium → left ventricle → lungs → right ventricle → right atrium
- B** left atrium → left ventricle → right ventricle → right atrium →lungs
- C** right atrium → right ventricle → left ventricle → left atrium →lungs
- D** right atrium → right ventricle → lungs → left atrium →left ventricle

- 33** A boy looks at his mother standing next to him, then looks at an ice cream shop about 1 kilometer away.

Which of the following correctly describes the changes in the components of his eye in producing a focused image as he looks away from his mother to look at the ice cream shop?

- A** ciliary muscles contract → suspensory ligament become taut → lens become less convex
- B** ciliary muscles contract → suspensory ligament slacken → lens become more convex
- C** ciliary muscles relax → suspensory ligament become taut → lens become less convex
- D** ciliary muscles relax → suspensory ligament slacken → lens become more convex

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

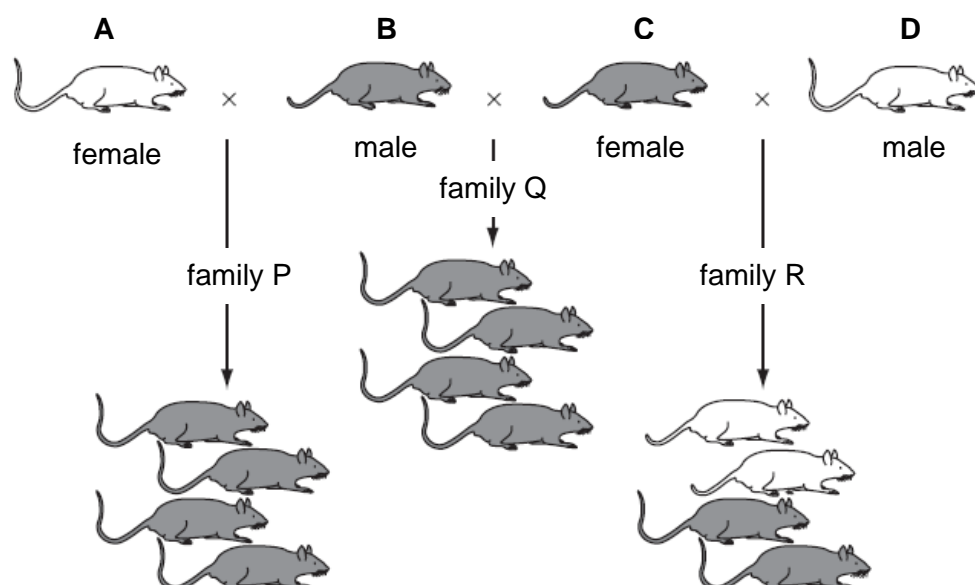


What is the limiting factor at X?

- A** carbon dioxide concentration
 - B** light intensity
 - C** temperature
 - D** humidity
- 35** Which human feature shows discontinuous variation?
- A** agility
 - B** body height
 - C** obesity
 - D** sickle cell anaemia

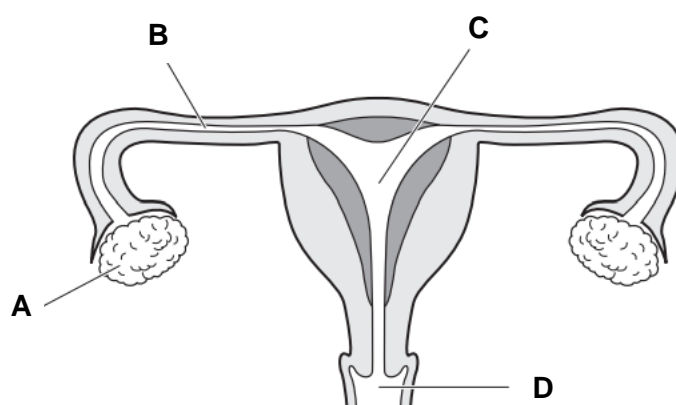
36 The diagram shows the inheritance of coat colour in mice.

Which mouse is heterozygous for coat colour?



37 The diagram shows the female reproductive system.

Where does fertilisation take place?



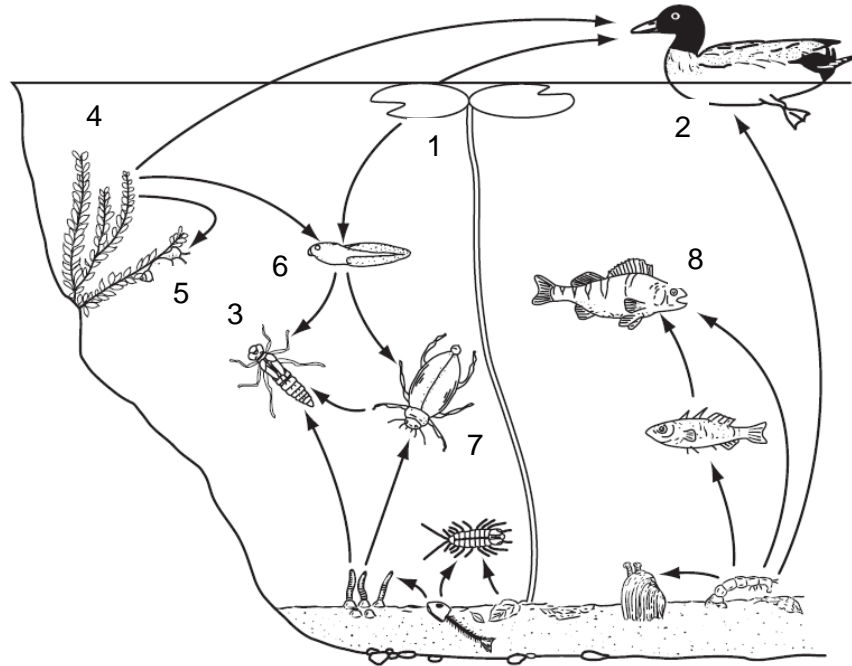
38 The table shows the amount of energy flowing into four trophic (feeding) levels in an ecosystem.

Which letter represents the producers?

trophic level	energy flowing in/ kJ per m ² per year
A	3
B	32
C	301
D	3000

39 The diagram shows a food web in a freshwater pond.

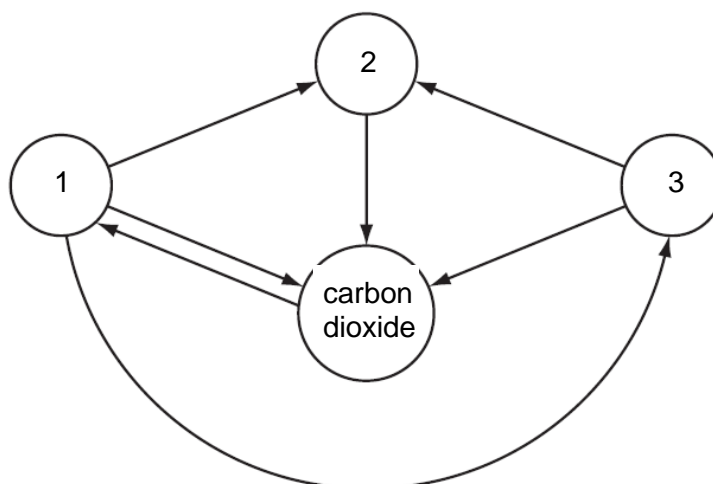
Which of the organisms is a producer, a herbivore or a carnivore?



Which of the organisms is a producer, a herbivore or a carnivore?

	producer	herbivore	carnivore
A	1	6	7
B	2	4	5
C	4	2	6
D	7	3	8

- 40** In the diagram, arrows represent the movement of carbon compounds in the carbon cycle. The circles represent carbon compounds in animals, decomposers, plants and in the air.



What is represented by each circle?

	1	2	3
A	animals	decomposers	plants
B	decomposers	animals	plants
C	decomposers	plants	animals
D	plants	decomposers	animals

THE END

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Name:	Index Number:	Class:
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YIO CHU KANG SECONDARY SCHOOL

O-LEVEL PRELIMINARY EXAMINATION 2024

SECONDARY FIVE NORMAL (ACADEMIC)



SCIENCE (BIOLOGY)

Paper 4

5078/04

1 hour 15 minutes

23 August 2024 (Friday)

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on the cover page.

Write in dark blue or black ink.

You may use a soft pencil for any diagrams or graphs. Do not use staples, paper clips, glue or correction fluid.

Section A

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

Section B

Answer any **two** questions in the spaces provided.

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

You are advised to spend no longer than one hour on Section A and no longer than 30 minutes on Section B. At the end of the examination, fasten all your work securely together.

For Examiner's use

Section A	/ 45
Section B	/ 20
Total	/ 65

Parent's / Guardian's signature

Setter: Ms Foo Ger Maine

This document consists of **17** printed pages and **3** blank pages.

Section A

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

- 1 DNA controls cell function by controlling the production of proteins.

These proteins determine the phenotype of an organism, including blood group in humans.

- (a) Describe the structure of a DNA molecule.

.....

.....

.....

.....[4]

- (b) One parent of a child has brown eyes, and the other parent has blue eyes.

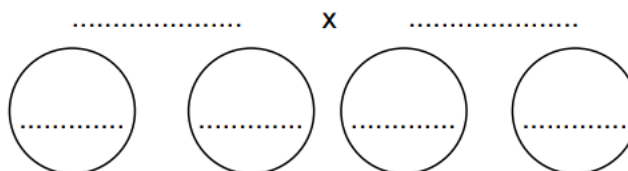
The child has blue eyes.

The parents decide to have another child.

- (i) Given that the allele for brown eyes (B) is dominant over the allele for blue eyes (b), complete the genetic diagram in Fig. 1.1 to show the possible eye colours for the second child of these parents.

genotype of parents

gametes



possible genotypes of child

possible eye colours of child

[4]

Fig. 1.1

- 1 (b) (ii) State the probability that the second child of these parents:

has the same sex as the first child

has the same eye colour as the first child

[2]

[Total: 10]

- 2 (a) Fig. 2.1 shows an open stoma on the lower surface of a leaf.

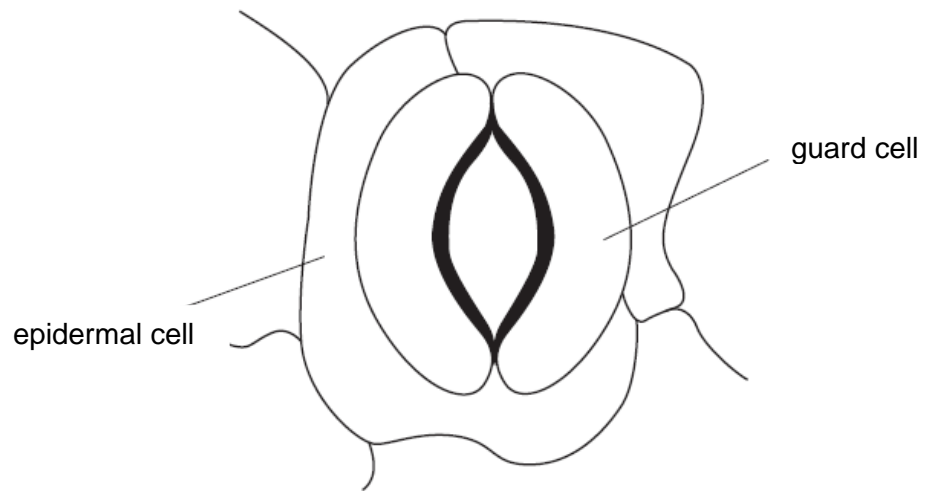


Fig. 2.1

- (i) The stoma can open and close. This involves the process of osmosis.

Explain how osmosis is involved in the opening of a stoma.

.....

.....

.....

.....[2]

- (ii) The opening of stomata is essential for photosynthesis.

Write the word equation for photosynthesis.

.....[1]

- (iii) Explain why the opening of stomata is essential for photosynthesis.

.....

.....[1]

- 2 (b) Fig. 2.2 shows how the concentration of sugars in the leaves and stem of a green plant change during a 24-hour period.

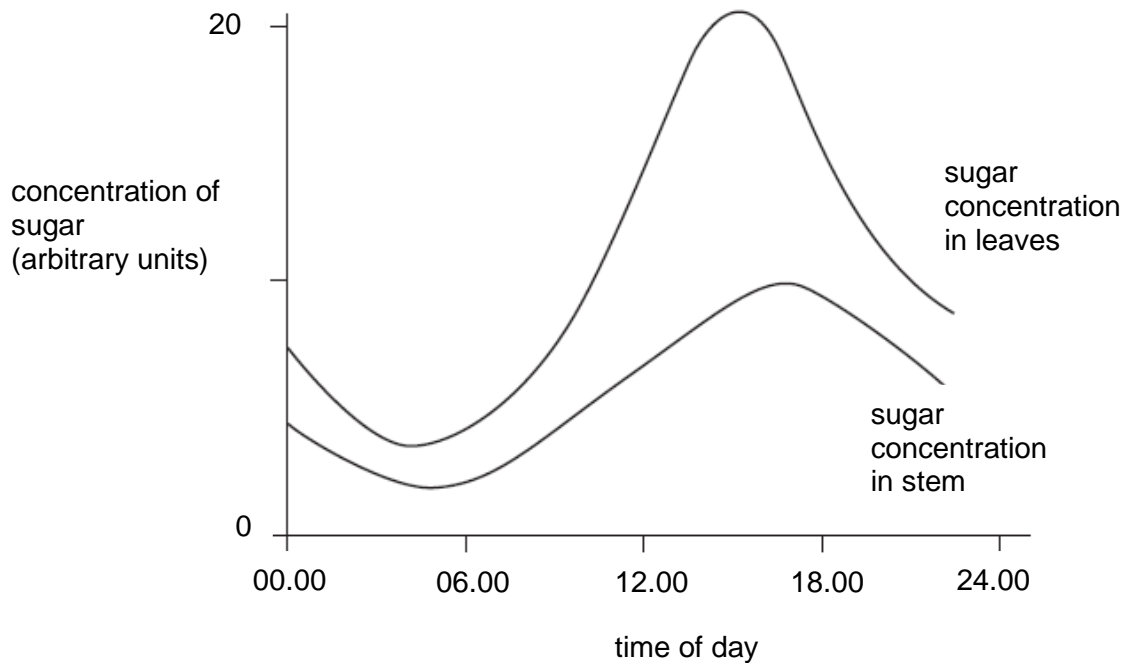


Fig. 2.2

In a green plant, sugar is made by the process of photosynthesis.

- (i) Use information from Fig. 2.2 to describe how the rate of photosynthesis in the leaves varies during this 24-hour period.

.....[1]

- (ii) Suggest an explanation for these changes in the rate of photosynthesis.

.....

.....[1]

- (iii) Sugar made in the leaves is transported down the stem to the roots.

How does the graph show that this statement is true?

.....

.....[1]

- (iv) Through which vessel in the stem is sugar transported?

.....[1]

[Total: 8]

- 3 A student investigated the effect of pH on the reaction between the enzyme amylase and starch.

Six test-tubes were set up, each containing the same volume of iodine solution.

Drops of acid were added to tubes **A**, **B** and **C** to produce a range of pH values.

Amylase was added to all test tubes.

Starch was added to all test-tubes.

All the test-tubes were kept at the same temperature.

The time taken for the mixture in each test tube to change from blue to colourless was recorded.

Fig. 3.1 shows the experimental set-up and the results.

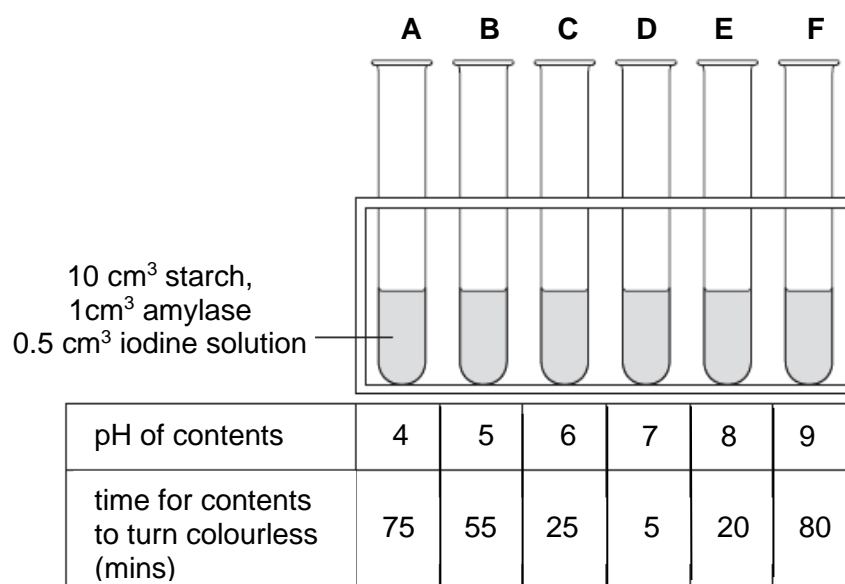
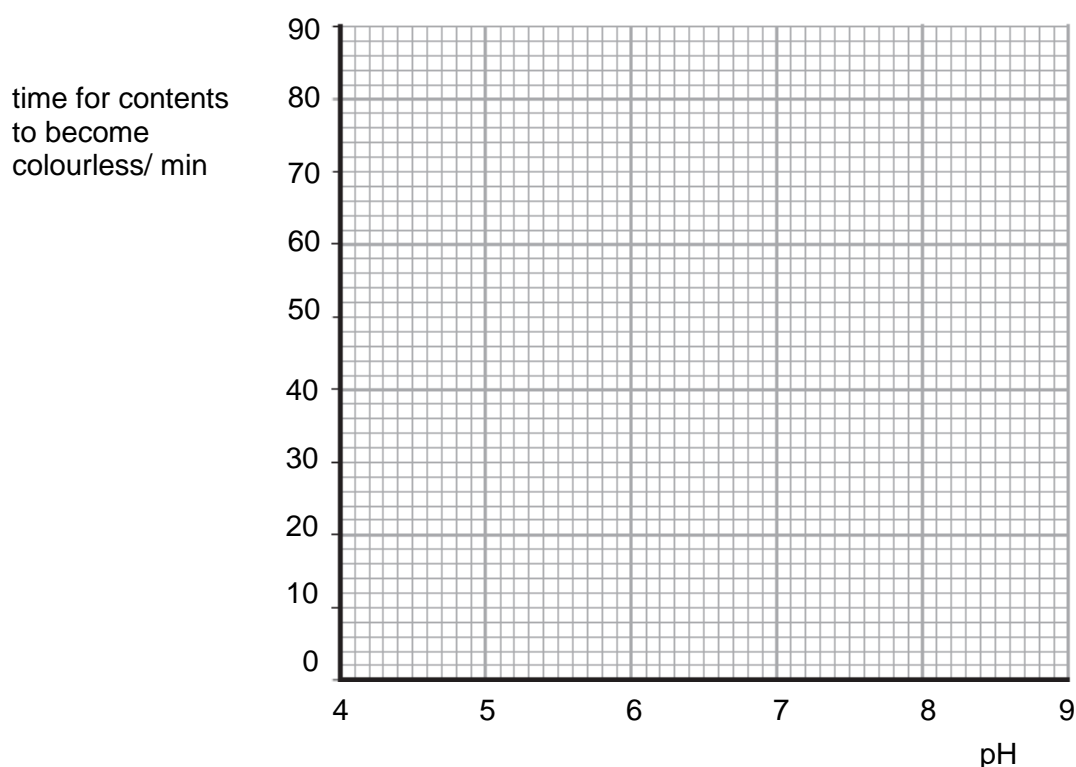


Fig. 3.1

- (a) (i) On the graph paper below, draw a line graph of the results.



[2]

- 3 (a) (ii) State the pH at which the enzyme was the most active.

.....[1]

- (iii) Explain why the mixture changed from blue to colourless.

.....
.....
.....
.....[2]

- (b) Name **two** parts of the human digestive system where amylase acts.

1

2

[2]

[Total: 7]

- 4 (a) Fig. 4.1 shows a section through the heart of an unborn baby, showing the hole in the wall between the left and right atria.

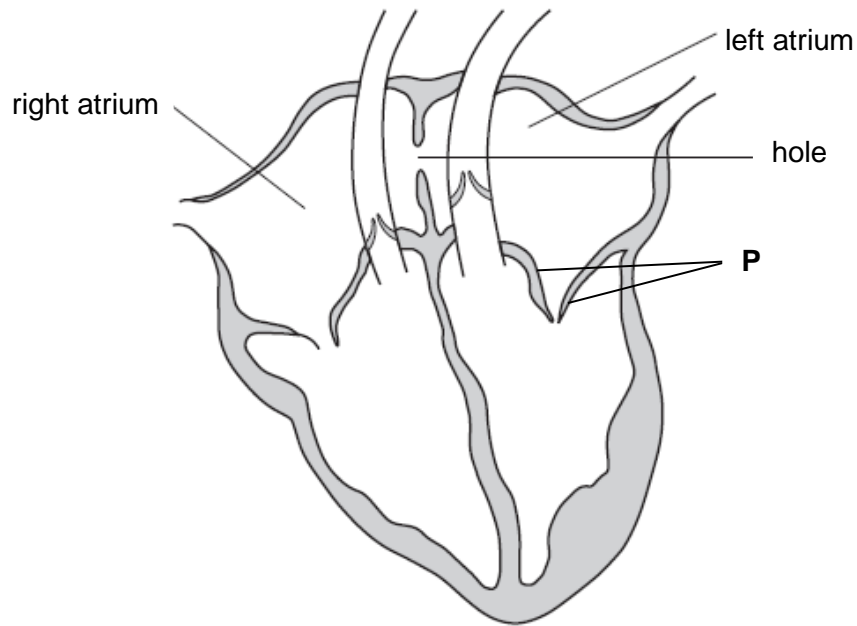


Fig. 4.1

- (i) On the diagram, draw a line to name **and** label the following:
- 1 the blood vessel that carries blood to the lungs
 - 2 the chamber which exerts the highest pressure when its walls contract [2]
- (ii) Explain how the presence of this hole will affect the flow of blood through the heart.
-
-[1]
- (iii) Shortly after birth, the hole in the wall between the atria seals itself. In some babies, this does not happen and the baby is said to have a 'hole in the heart'. This condition may be dangerous if not treated immediately. Explain why.
-
-
-
-[2]

- 4 (a) (iv) State the function of structure P.

.....
[1]

- (b) The graph shows the pulse rate and the output of blood from the left side of the heart before, during and after a period of exercise.

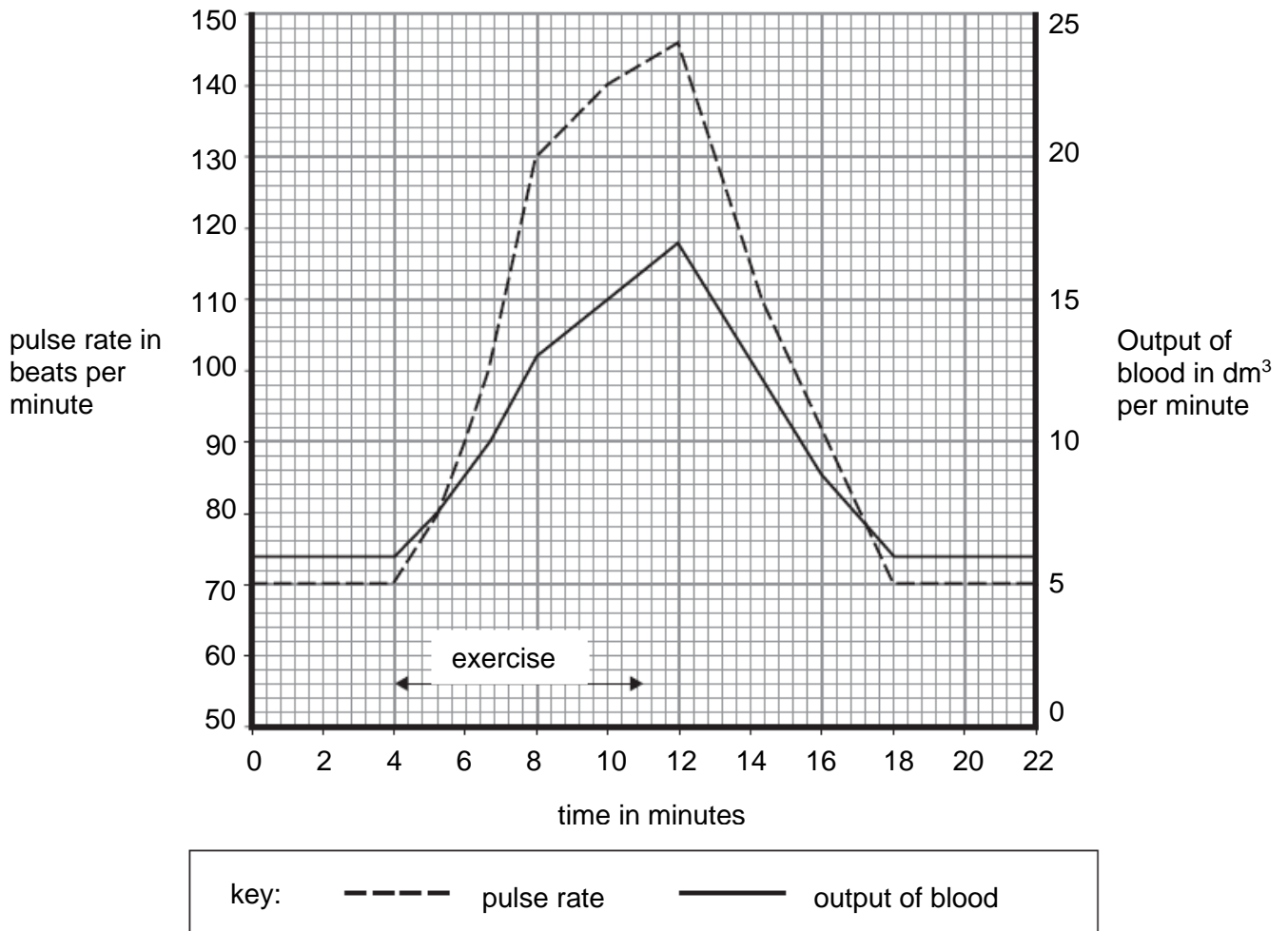


Fig. 4.2

- (i) What was the output of blood from the left side of the heart when the exercise ended?

..... dm^3 per minute [1]

- (ii) How does exercise affect the pulse rate and the output of blood?

.....[1]

[Total: 8]

- 5 A plant species lives in ponds.

Fig. 5.1 show the whole plant and a section through one of its leaves.

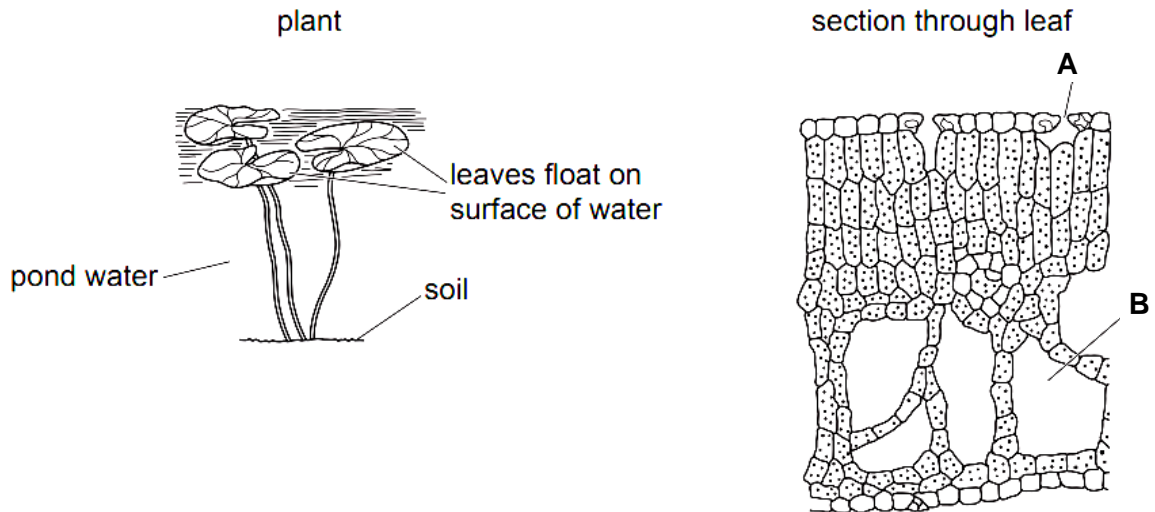


Fig. 5.1

- (a) The leaves are adapted to float on the surface of the water.

- (i) Suggest **one** advantage to the plant of the leaves floating on the surface of water.

.....
[1]

- (ii) Name the parts of the leaf labelled **A** and **B**.

A

B [1]

- (iii) With reference to parts **A** and **B**, describe and explain how the structure of the leaf is adapted to a pond environment.

.....

[2]

- (b) The plant is part of a food web in a pond.

State its trophic level.

.....[1]

[Total: 5]

- 6 A group of students examined a sample of leaf litter from an oak woodland. They weighed the leaves. They captured and identified all the animals that they could find in the leaf litter. They then divided the animals into two feeding types, those which feed on leaves and those which feed on small animals. They weighed each sample.

The results are shown in the table.

Sample	Mass in grams
Leaves	600
Animals feeding on leaves	80
Animals feeding on small animals	20

- (a) Complete the pyramid of biomass for these results in Fig. 6.1.

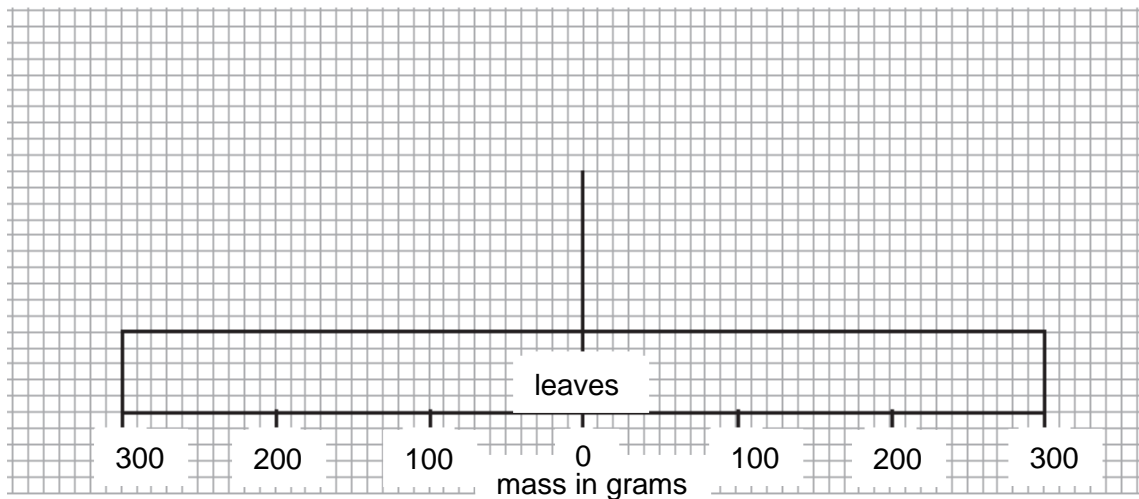


Fig. 6.1

[2]

- (b) What fraction of biomass in the leaf litter is transferred to the animals which feed on it?

.....

[1]

- (c) (i) Much of the biomass transferred to the small animals is used in respiration.

Why does respiration make the biomass decrease?

.....

.....[1]

- (ii) State **one** way in which the animals might use the energy released in respiration.

.....[1]

- 6 (c) (iii) State **two** reasons why the biomass in the leaves might not be transferred to the animals.

.....

.....

.....[2]

[Total: 7]

Section B

Answer **two out of three** questions from this section.

Write your answers in the space provided.

- 7 (a) The diagrams show sections of the lung, showing the alveoli. The two sections are drawn to the same scale.

The section of diseased lung is from a smoker with the disease emphysema.

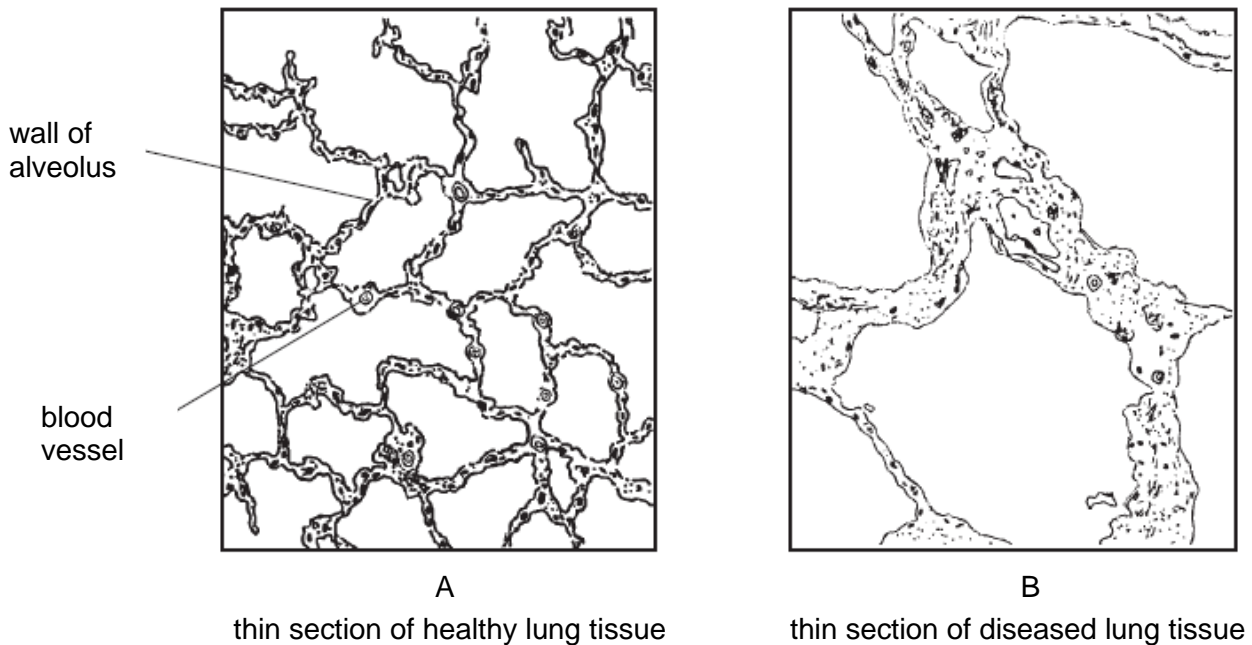


Fig. 7.1

- (i) Describe how gaseous exchange takes place in the alveoli.

.....

.....

.....

.....[3]

- (ii) Use the information in the diagram to explain how smoking damages the lung.

.....

.....

.....

.....[3]

7 (b) (i) State **three** differences between aerobic and anaerobic respiration in humans.

.....

.....

.....

.....[3]

(ii) Describe the circumstances under which anaerobic respiration may occur in human muscle tissue.

.....[1]

[Total: 10]

8 Fig. 8.1 shows the main events during a menstrual cycle.

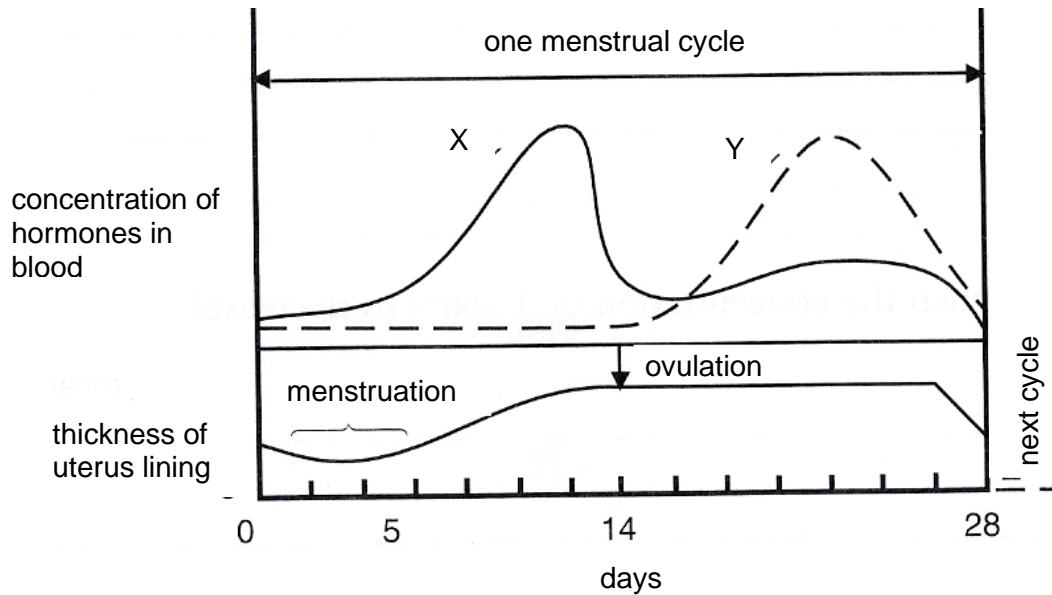


Fig. 8.1

(a) Name hormones **X** and **Y**.

X:

Y:

[2]

(b) What effect does **X** have on the uterus during this period?

.....[1]

(c) Describe what takes place in the ovary when the concentration of **X** starts to decrease.

.....[1]

(d) State **one** effect that **Y** have on the uterus during this period.

.....[1]

(e) Describe what happens when the concentration of **Y** drops to a very low level.

.....[2]

- 8 (f) (i) Fig. 8.2 represents four genes on part of the chromosome pair 11 from the body cell of a woman.

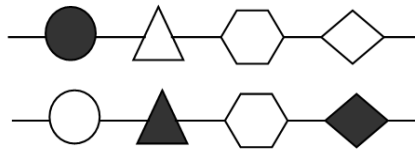


Fig. 8.2

In the space below, draw these genes as they might appear in one of her ova (gametes).

[1]

- (ii) Fig. 8.3 shows the same section of one of the chromosomes in another cell of the same person in which the structure of one of the genes has changed.

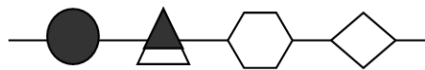


Fig. 8.3

State the name given to such a change in a gene **and** suggest a possible cause of such changes in genes.

.....
[2]

[Total: 10]

- 9 (a) Fig. 9.1 shows the state of the muscle of the iris and the size of the pupil at normal room light condition.

With reference to Fig. 9.1, complete Fig. 9.2 to show the action of the muscles of the iris and the size of the pupil in **dim** light condition. Label your drawing.

normal light condition

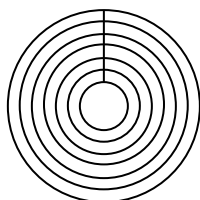


Fig. 9.1

dim light condition

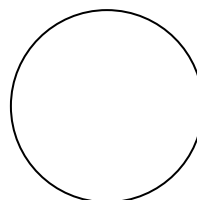


Fig. 9.2

[3]

- (b)** Define the term *hormone*.

.....[2]

- (c)** Describe the sequence of events that results in a reflex action when a person touches a hot object.

.....[5]

[Total: 10]





Sec 5N Prelim Exam Sc(Bio) 2024
Mark Scheme

No	Answer	No	Answer
21	A	31	B
22	B	32	D
23	D	33	C
24	C	34	A
25	C	35	D
26	D	36	C
27	B	37	B
28	B	38	D
29	D	39	A
30	D	40	D

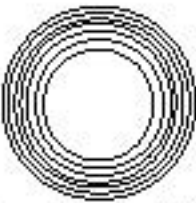
No.	Answer	Marks	Marker's Comments																								
1a	two strands ; double helix ; nucleotides ; A + T + G + C ; base + pairs ; bonds between bases ; bases always pair up the same way (complimentary base pairing) Any 4 points	4																									
1bi	<table><tr><td>genotype of parents</td><td colspan="2">Bb</td><td colspan="2">bb</td></tr><tr><td>gametes</td><td>B</td><td>b</td><td>b</td><td>b</td></tr><tr><td>possible genotypes of child</td><td>Bb</td><td>Bb</td><td>bb</td><td>bb</td></tr><tr><td>possible eye colours of child</td><td>brown</td><td>brown</td><td>blue</td><td>blue</td></tr></table>	genotype of parents	Bb		bb		gametes	B	b	b	b	possible genotypes of child	Bb	Bb	bb	bb	possible eye colours of child	brown	brown	blue	blue	<table><tr><td>1</td></tr><tr><td>1</td></tr><tr><td>1</td></tr><tr><td>1</td></tr></table>	1	1	1	1	
genotype of parents	Bb		bb																								
gametes	B	b	b	b																							
possible genotypes of child	Bb	Bb	bb	bb																							
possible eye colours of child	brown	brown	blue	blue																							
1																											
1																											
1																											
1																											
1bii	(same sex) 50% / half / 0.5 / 1 in 2 / 1:1 ; (same eye colour) 25% / quarter / 0.25 / 1 in 4 / 1:3	2																									
Total		10m																									
2ai	when water potential is cell sap in guard cells is lower than the neighbouring cells/ epidermal cells; water molecules enters guard cells by osmosis , making them swell and open the stomata;	<table><tr><td>1</td></tr><tr><td>1</td></tr></table>	1	1																							
1																											
1																											
aii	$\text{carbon dioxide} + \text{water} \xrightarrow[\text{(chlorophyll)}]{\text{(light energy)}} \text{glucose} + \text{oxygen}$	1																									
aiii	allows the diffusion/ entry of carbon dioxide for photosynthesis to take place;	1																									
bi	low at night/ minimum at about 05.00; high in day/ maximum at about 14.00	1																									

bii	photosynthesis requires energy from sunlight and therefore occurs during the day and not at night; <u>OR</u> photosynthesis requires energy from sunlight and therefore is most rapid when light intensity is strongest/ light is brightest	1	
biii	sugar concentration in stem increases after that in leaves;	1	
biv	In phloem;	1	
Total		8m	
3ai	correct plots; best fit curve/ smooth curve; [allow acceptable line of best fit that starts at first point and finishes at sixth point]	1 1	
a ii	optimum pH 7- pH 7.2	1	
aiii	amylase breaks down/ digests starch; sugar/ maltose produced; Starch reacts with iodine to form a blue-black coloration; sugar/ maltose and iodine solution is colourless;	1 1	
b	mouth; small intestine/ duodenum; reject: ileum	1 1	
Total		7m	
4ai	(1) pulmonary artery; (2) left ventricle;	1 1	
a ii	any <u>1</u> from: (some) blood passes directly from right atrium to left atrium/ between atria <u>Or</u> allows blood from both atria to mix <u>Or</u> (some) blood does not enter ventricle(s) <u>Or</u> (some) blood does not enter pulmonary artery	1	
aiii	any <u>2</u> from: (some) blood bypasses the lungs; less oxygen is carried in the red blood cells; less oxygen is transported to the cells/ tissues; reduced respiration so that less energy is released; pressure is reduced when the atria contract;	2	

aiv	prevent backflow of blood from ventricle to atrium; accept: keeps blood going in the right direction	1	
bi	16 dm^3 accept: ± 0.5	1	
bii	increases both pulse rate and output of blood	1	
Total		8m	

No.	Answer	Marks	Marker's Comments
	Total	10m	
5ai	More light energy /carbon dioxide from air absorbed for photosynthesis	1	
aii	A = stoma ; B = intercellular air spaces	1	
aiii	any three from: stomata + on upper surface /W ; gaseous exchange / air enters / air leaves ; carbon dioxide + for photosynthesis ; large + air spaces ; air space + leaf buoyancy / float / less dense	3	
b	producer / first trophic level	1	
	Total	6m	
6a	correct plotting; (even width on both sides) correct order; minimum 1 label	1 1	
b	$\frac{2}{15}$ or $\frac{80}{600}$	1	
ci	any 1 reason from: <ul style="list-style-type: none"> glucose is used up carbon dioxide is lost water is lost 	1	
cii	any 1 from: <ul style="list-style-type: none"> for muscular activity/ muscle contraction/ movement heat energy is used to maintain body temperature/ keeping the body warm to synthesise large molecules/ proteins/ enzymes 	1	
ciiii	some leaves are not eaten; some parts of the leaves cannot be digested and are lost as faeces/ waste	1 1	
	Total	7	

No.	Answer	Marks	Marker's Comments										
7ai	higher concentration of oxygen in the alveolar space than in the blood capillary;	1											
	oxygen first dissolves in the film of moisture that lines the inside wall of alveoli;	1											
	then diffuses through the single-celled alveolar wall; / and the capillary wall into the blood plasma;	1											
	carbon dioxide diffuses out of the blood capillary into the alveolar space;	1											
	Any 3 points												
aii	smoking causes excessive production of phlegm; persistent coughing to expel the phlegm;	1											
	causes some of the adjoining alveolar walls to break down; or alveolar space becomes enlarged;	1											
	with reduced surface area: volume ratio for gaseous exchange;	1											
bi	Compare the processes of aerobic and anaerobic respiration in humans. Any 3 from: <table><tr><th>aerobic</th><th>anaerobic</th></tr><tr><td>Requires oxygen</td><td>Does not require oxygen</td></tr><tr><td>Large amount of energy released</td><td>Small amount of energy released</td></tr><tr><td>Occurs in all living cells of the body</td><td>Occurs only in muscle cells</td></tr><tr><td>Products are carbon dioxide and water</td><td>Product is lactic acid</td></tr></table>	aerobic	anaerobic	Requires oxygen	Does not require oxygen	Large amount of energy released	Small amount of energy released	Occurs in all living cells of the body	Occurs only in muscle cells	Products are carbon dioxide and water	Product is lactic acid	3	
aerobic	anaerobic												
Requires oxygen	Does not require oxygen												
Large amount of energy released	Small amount of energy released												
Occurs in all living cells of the body	Occurs only in muscle cells												
Products are carbon dioxide and water	Product is lactic acid												
bii	when the demand for oxygen exceeds the supply of oxygen; (during sustained + vigorous muscular activity)	1											
Total		10m											
8a	X: oestrogen Y: progesterone	2											
b	Repairs and thickens the uterine lining	1											
c	A mature egg is released into the oviduct	1											
d	Y maintains the thickness of the uterine lining and causes vascularization/ blood vessels to be laid down	2											

e	The uterine lining will break down and menstruation will take place	2	
f	ovum: any one row of genes	1	
g	genetic mutation; induced by radiation/ chemicals	2	
9a	 <p>1m – large pupil; 1m – contracted labelled radial muscles 1m – relaxed labelled circular muscles</p>	1 1 1	No. of circular and radial muscles should be the same.
b	A hormone is a chemical substance produced in minute quantities by an endocrine gland; Transported by bloodstream to target organs	1 1	
c	<p>Any 5 (1m each):</p> <ol style="list-style-type: none"> 1. increased temperature on the object stimulates receptors in skin 2. nerve impulses produced 3. nerve impulses transmitted along the sensory neurone to the spinal cord 4. in the spinal cord; nerve impulses are transmitted from the sensory to the relay neurone across a synapse 5. nerve impulses are transmitted from the relay neurone to the motor neurone across a synapse 6. motor neurone transmits the impulses from the spinal cord to the effector, which is the muscle of the arm 7. bicep muscles contract and causes hand to withdraw suddenly 	5 1m per point	Accept muscles of the arm if students did not write biceps





YISHUN SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2024

SECONDARY 4 EXPRESS

CANDIDATE
NAME

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CLASS

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INDEX
NUMBER

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SCIENCE (CHEMISTRY, BIOLOGY)

Paper 1 Multiple Choice

5088/01

28 August 2024

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, class 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** or **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.

A copy of the Data Sheet is printed on page 19.

A copy of the Periodic Table is printed on page 20.

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

This document consists of **20** printed pages.

- 1 Which piece of apparatus would be most suitable to measure accurately 25.60 cm^3 of acid?
- A beaker
B burette
C measuring cylinder
D pipette
- 2 Four bottled drinks were analysed using paper chromatography to determine if they contained banned food colourings.

drinks				banned colourings	
A	B	C	D	I	II

Which drinks contain **both** the banned food colourings?

- A drink A and B
B drink A and C
C drink B and D
D drink C and D

- 3 The results of three tests on a solution of compound X are shown.

test	result
aqueous sodium hydroxide added	white precipitate formed, soluble in excess
aqueous ammonia added	white precipitate formed, soluble in excess
aluminium and aqueous sodium hydroxide added, then warmed	colourless gas, which turns damp red litmus paper blue

What is X?

- A aluminium carbonate
 B calcium nitrate
 C zinc carbonate
 D zinc nitrate
- 4 In which substance do the particles vibrate about fixed positions at room temperature?

	melting point / °C	boiling point / °C
A	120	445
B	0	100
C	- 57	18
D	- 114	- 80

- 5 A cation Y^{2+} has 18 electrons and a nucleon number of 41.
 How many protons and neutrons are there in the nucleus of an atom of Y?

	protons	neutrons
A	16	25
B	18	23
C	20	21
D	20	41

- 6 The table shows the number of neutrons and protons in unknown atoms P, Q, R and S.

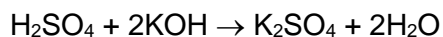
atom	number of neutrons	number of protons
P	8	8
Q	8	10
R	10	8
S	10	10

Which particles are isotopes of the same element?

- A** P and Q
B P and S
C Q and S
D R and S
- 7 Two elements react to form a compound with the chemical formula XY_2 .
 This compound is able to conduct electricity when dissolved in water.
 Which pair is most likely to be elements X and Y?

	X	Y
A	barium	fluorine
B	carbon	oxygen
C	oxygen	nitrogen
D	sodium	sulfur

- 8 The equation for the reaction between dilute sulfuric acid and aqueous potassium hydroxide is shown.

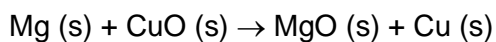


What is the volume of 0.250 mol/dm^3 sulfuric acid that is required to neutralise 20.00 cm^3 of 0.100 mol/dm^3 aqueous potassium hydroxide?

- A 4 cm^3
B 8 cm^3
C 16 cm^3
D 25 cm^3
- 9 Dilute sulfuric acid reacts with copper(II) oxide and with copper(II) carbonate.
In what way are these two reactions similar?

- A An acid is neutralised by an alkali.
B A gas is produced.
C The pH of the resulting mixture will increase beyond 7.
D Water is a product.

- 10 Magnesium metal (Mg) reacts with copper(II) oxide (CuO) according to the following equation.



Which statement is correct?

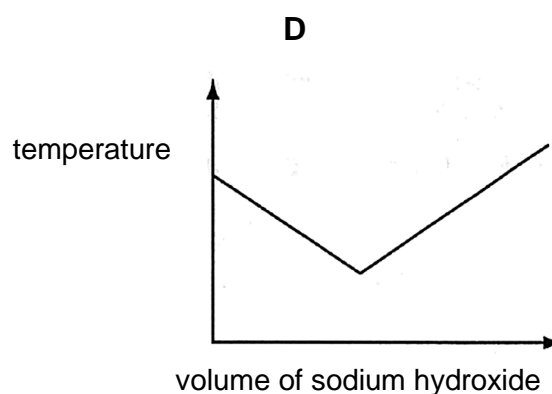
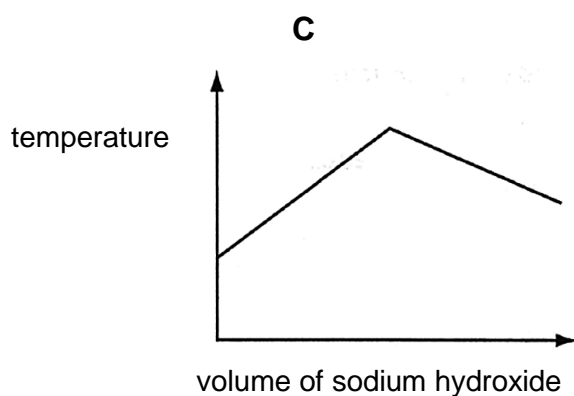
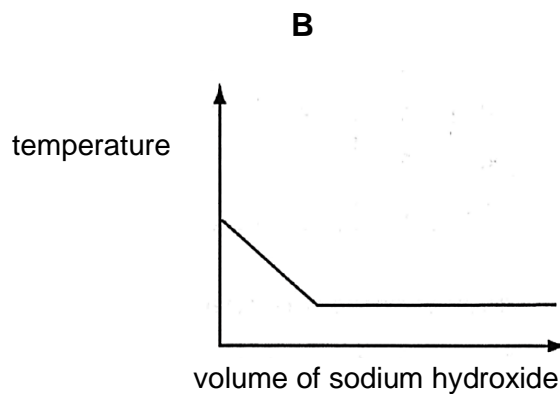
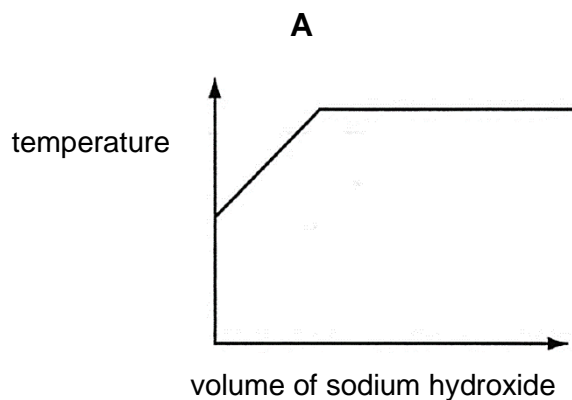
- A CuO is oxidised.
B Mg is reduced.
C CuO is the reducing agent.
D Mg is the reducing agent.

- 11 Aqueous sodium hydroxide and dilute hydrochloric acid are reacted together.

The reaction is exothermic.

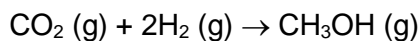
Both the sodium hydroxide and the hydrochloric acid are initially at room temperature.

Which graph shows how the temperature changes when aqueous sodium hydroxide is added to the hydrochloric acid until the alkali is present in excess?



- 12 Methanol is manufactured by reacting carbon monoxide with hydrogen.

The equation for the reaction is shown.



Which changes in pressure and temperature increase the rate of reaction?

	pressure	temperature
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

13 Which statement about the elements in the Periodic Table is correct?

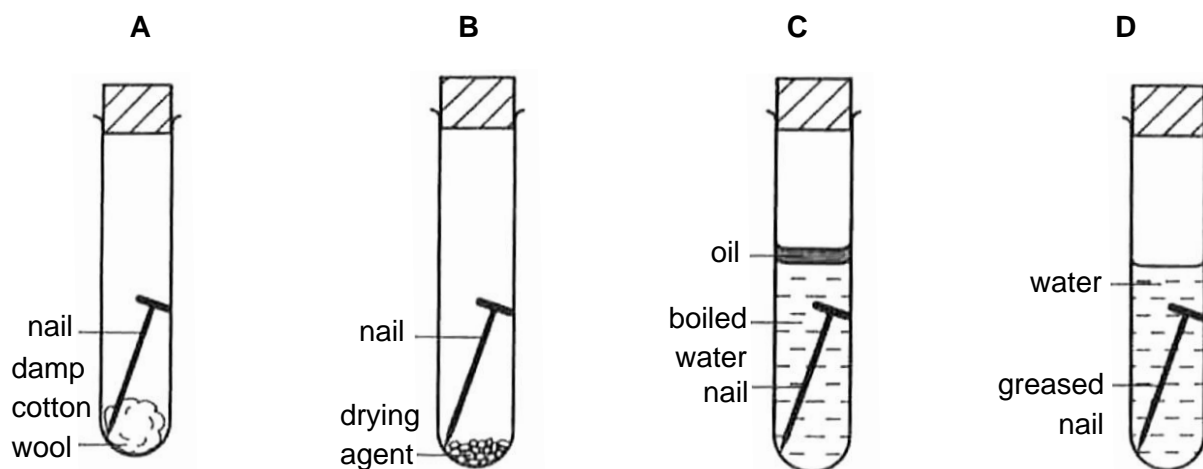
- A Elements are arranged in order of their nucleon number.
- B Elements are arranged in order of their proton number.
- C The period number is related to the number of electrons in the outer shell.
- D The reactivity of Group 1 elements decreases down the group.

14 Chlorine is an element in Group 17 of the Periodic Table.

Which row describes the properties of chlorine?

	colour	state at room temperature	reaction with aqueous potassium bromide
A	yellow-green	gas	turns red-brown
B	yellow-green	gas	turns colourless
C	red-brown	liquid	turns colourless
D	red-brown	liquid	turns yellow-green

15 In which setup will the iron nail rust most quickly?



[Turn over

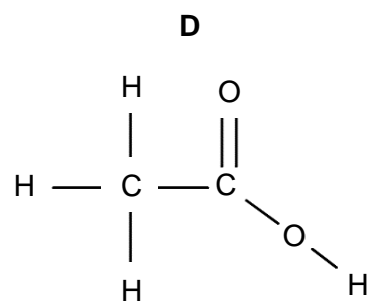
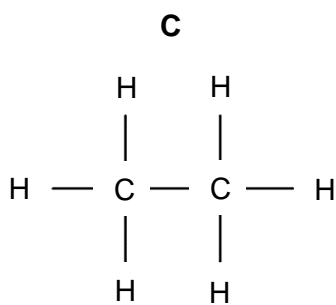
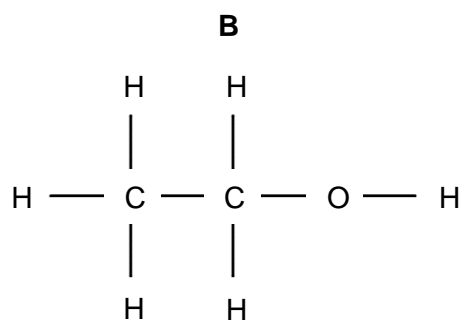
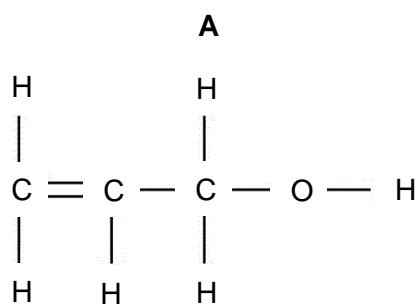
16 Which is the main source of biofuel?

- A crude oil
- B natural gas
- C plastic
- D sugarcane

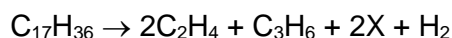
17 The results of two tests on compound Z are shown.

test	observation
add aqueous bromine	remains red-brown
add acidified potassium manganate(VII)	turns colourless

What is the structure of compound Z?



- 18** A hydrocarbon, $C_{17}H_{36}$, is decomposed during the process of cracking to produce ethene, propene, another hydrocarbon, X, and hydrogen.
The equation for the reaction is shown.



Which row describes X?

	formula of X	X belongs to the homologous series
A	$C_{10}H_{20}$	alkene
B	$C_{10}H_{20}$	alkane
C	C_5H_{10}	alkene
D	C_5H_{10}	alkane

- 19** Four statements about the recycling of plastics are listed.

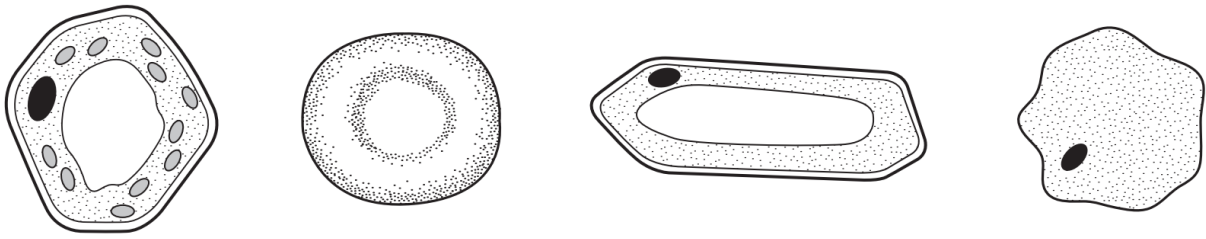
- 1 Recycling plastic can help to conserve limited resource.
- 2 Plastic made by recycling is less pure than plastic made from polymerisation.
- 3 More energy is needed to recycle plastic than making plastic from polymerisation.
- 4 Recycling plastic helps to reduce damage to the environment when plastic is burnt.

Which statements give valid reasons in favour of recycling plastics?

- A** 1 and 3
B 1 and 4
C 2 and 3
D 1, 3 and 4
- 20** Which atmospheric pollutant is responsible for damage to buildings?

- A** carbon monoxide
B ozone
C nitrogen dioxide
D methane

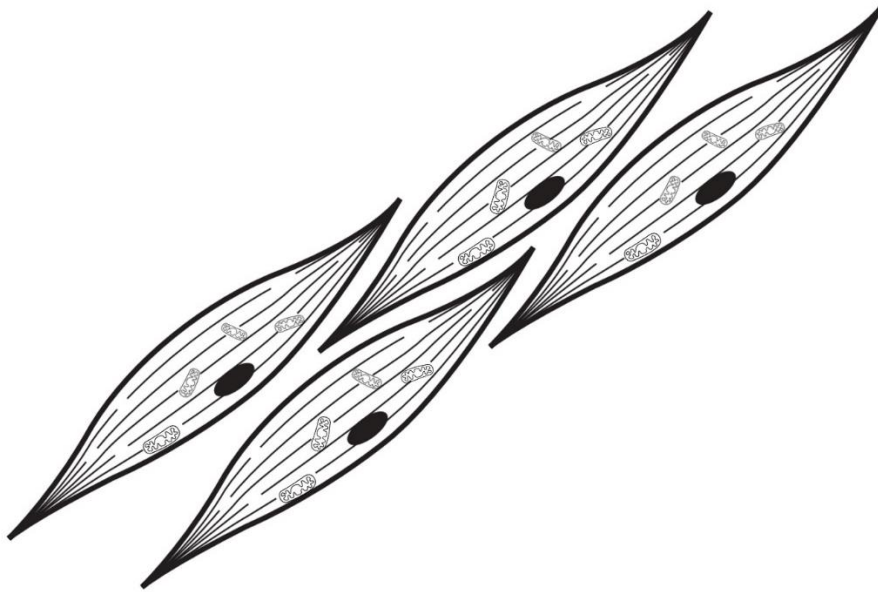
21 The diagram shows different types of cells.



Which structure do all these cells have?

- A nucleus
- B cell wall
- C cell membrane
- D chloroplast

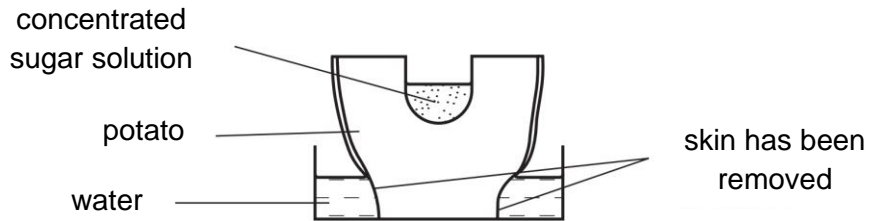
22 The diagram shows some specialised animal cells.



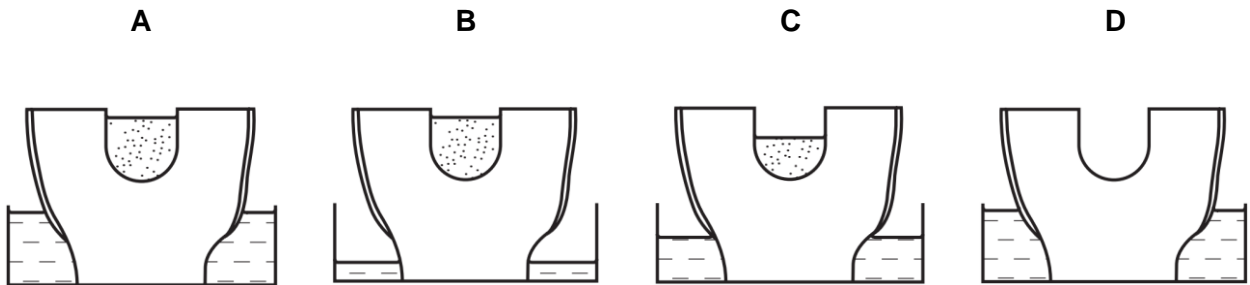
Which statement is correct about the structural adaptation of these cells?

- A They contain many mitochondria to release more energy.
- B They lack nuclei to carry more oxygen to other body cells.
- C They are elongated to increase surface area to volume ratio.
- D They are flexible to squeeze through narrow blood capillaries.

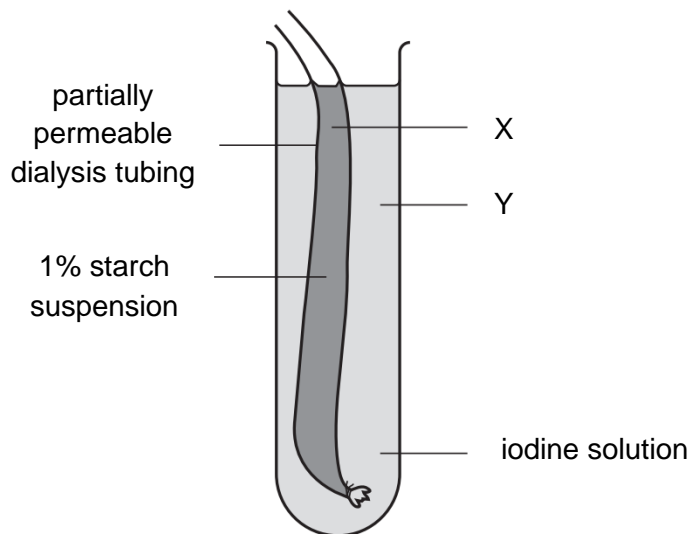
- 23** The diagram shows an experiment using an uncooked potato. The skin of the potato was removed as shown.



Which diagram shows the result of the experiment after 24 hours?



- 24** The diagram shows a partially permeable dialysis tubing filled with a starch suspension placed in a tube of iodine solution. Iodine is a small molecule.



What will the colour at X and Y be after an hour?

	X	Y
A	yellowish-brown	yellowish-brown
B	yellowish-brown	blue-black
C	blue-black	blue-black
D	blue-black	yellowish-brown

[Turn over

- 25 The table shows the results of food tests carried out on a fruit.

test	result
iodine	yellowish-brown
Benedict's	brick-red precipitate
ethanol emulsion	clear
biuret	violet

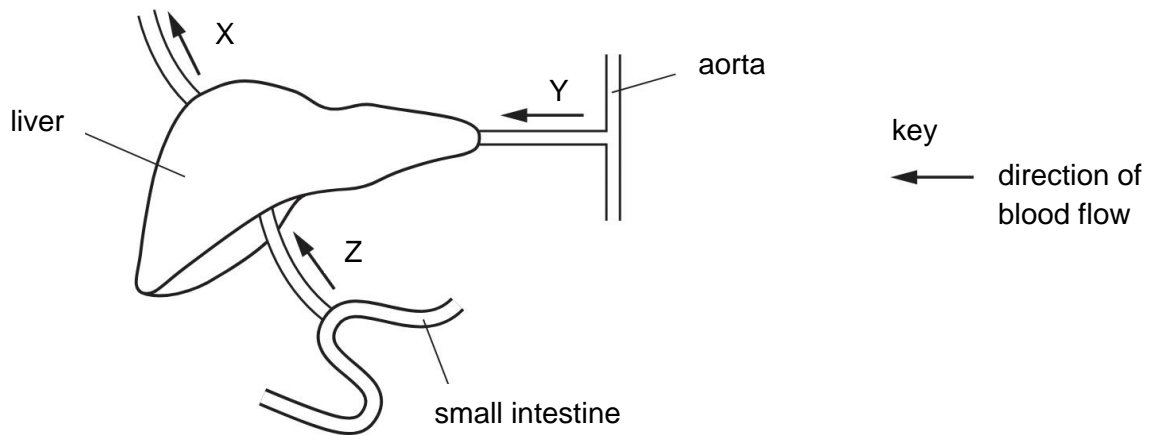
Which nutrients are present in the fruit?

- A fat and starch
 - B protein and starch
 - C reducing sugar and fat
 - D reducing sugar and protein
- 26 Protease breaks down proteins into amino acids.

Based on the 'lock and key' hypothesis, what is represented by the lock and the key?

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

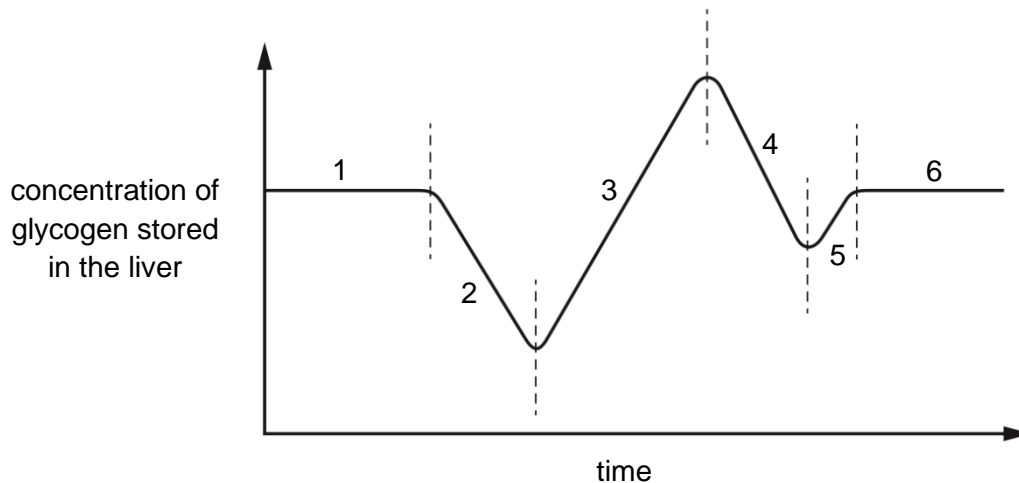
- 27 The diagram shows the blood vessels associated with the liver.



What are the blood vessels labelled X, Y and Z?

	X	Y	Z
A	hepatic artery	hepatic vein	hepatic portal vein
B	hepatic portal vein	hepatic artery	hepatic vein
C	hepatic vein	hepatic artery	hepatic portal vein
D	hepatic vein	hepatic portal vein	hepatic artery

- 28 The graph shows how the concentration of glycogen stored in the liver of a human changes over time.



During which periods is the concentration of **glucose** in the blood above average?

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

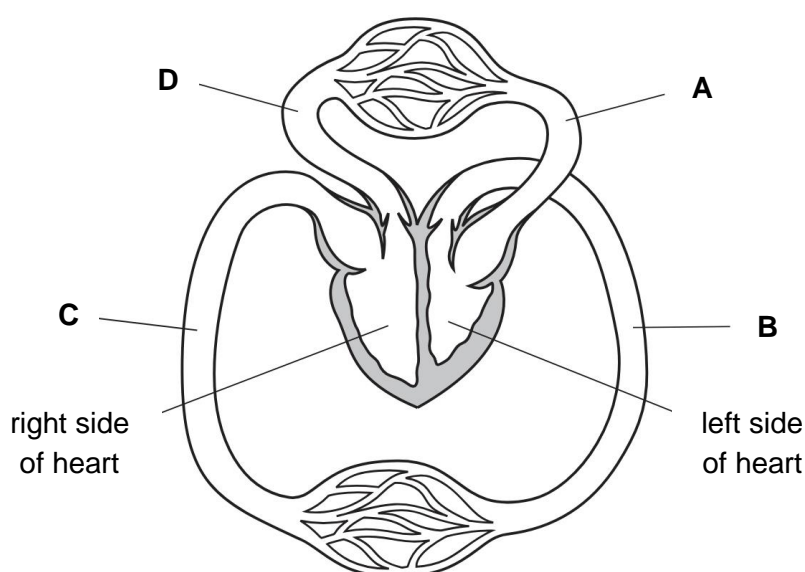
[Turn over

- 29 A hormone is a chemical substance produced in the body.

Which is **not** a property of a hormone?

- A It is broken down by the kidney.
 - B It is carried in the blood plasma.
 - C It is produced by an endocrine gland.
 - D It alters the activity of one or more target organs.
- 30 The diagram represents part of the human circulatory system.

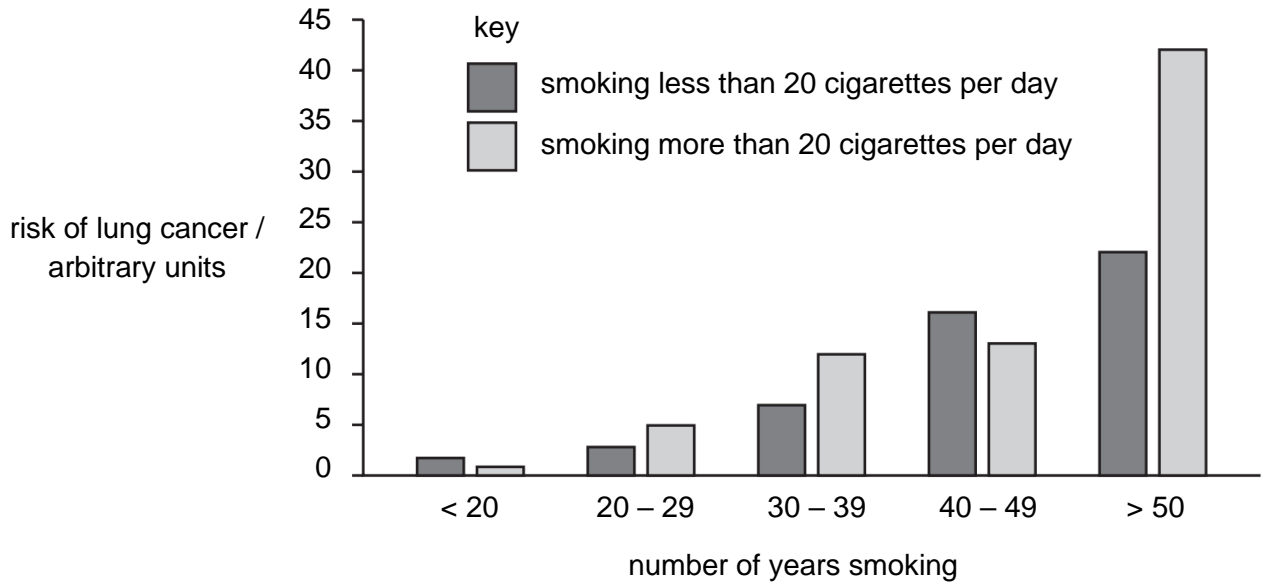
Where is the blood pressure highest?



- 31 Which route does an oxygen molecule take as it diffuses from the air in the lungs to haemoglobin in the blood?

	first —————→ last
A	wall of alveolus → thin film of moisture → red blood cell membrane → plasma
B	wall of alveolus → thin film of moisture → plasma → red blood cell membrane
C	thin film of moisture → wall of alveolus → red blood cell membrane → plasma
D	thin film of moisture → wall of alveolus → plasma → red blood cell membrane

- 32** The graph shows how smoking different numbers of cigarettes for different lengths of time affects the risk of lung cancer.



Which conclusions are supported by the data in the graph?

- 1 Smoking cigarettes for more years increases the risk of lung cancer.
- 2 Smoking more than 20 cigarettes per day for more than 50 years has the highest risk of lung cancer.
- 3 Smoking more than 20 cigarettes per day always increases the risk of lung cancer more than smoking less than 20 cigarettes per day.

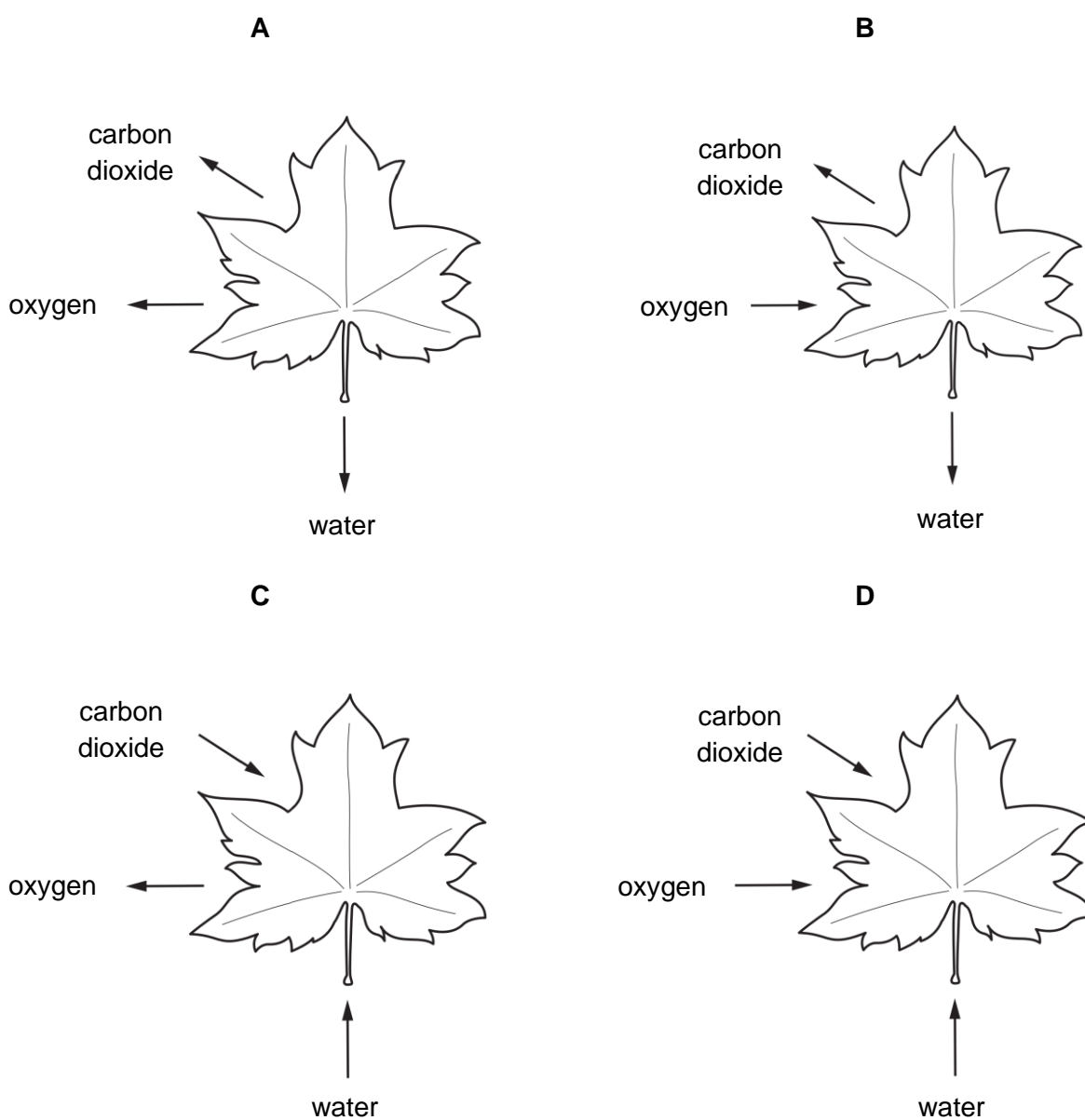
A 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

- 33** What is the pathogen, method of spread and method of control for influenza?

	pathogen	spread	control
A	bacteria	droplets	antibiotics
B	bacteria	insect bite	vaccination
C	virus	droplets	vaccination
D	virus	shared needles	isolate patients

[Turn over

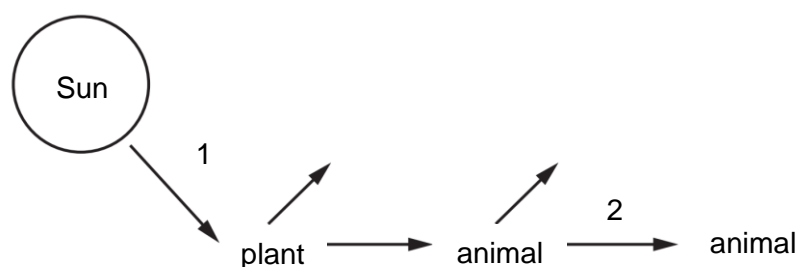
34 Which diagram shows substances going into and out of a leaf when glucose is being formed?



35 Which row shows the most likely number of chloroplasts in three types of cell in a leaf?

	vascular bundle cell	mesophyll	epidermis
A	17	6	0
B	0	17	0
C	0	6	17
D	6	0	17

- 36 The diagram shows energy flow from the Sun, through a food chain and into the environment.



What is the form of energy for each numbered arrow?

	stage 1	stage 2
A	light	chemical
B	light	kinetic
C	heat	chemical
D	heat	kinetic

- 37 Which row describes the genetic code in DNA?

	what forms the genetic code	what the DNA codes for
A	sequence of amino acids	sequence of bases
B	sequence of amino acids	sequence of proteins
C	sequence of bases	sequence of amino acids
D	sequence of bases	sequence of proteins

- 38 Which statement about chromosomes is correct?

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

[Turn over

- 39** A couple has three children. The table shows some of the children's characteristics.

child	sex	type of red blood cell	type of earlobe
1	male	sickle-cell	attached
2	female	normal	attached
3	male	normal	detached

What do the characteristics show?

- A** continuous variation only
B discontinuous variation only
C both continuous and discontinuous variation
D neither continuous nor discontinuous variation
- 40** Two fruit flies with normal wings mated with each other.

For every three offspring with normal wings, there is one with short wings.

What are the genotypes of the parents?

	female	male
A	Nn	Nn
B	Nn	NN
C	NN	Nn
D	Nn	nn

key

N = allele for normal wings

n = allele for short wings

Data Sheet**Colours of Some Common Metal Hydroxides**

aluminium hydroxide	white
calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
zinc hydroxide	white

The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
<div> <div>Key</div> <div>proton (atomic) number</div> <div>atomic symbol</div> <div>name</div> <div>relative atomic mass</div> </div>							<div>1</div> <div>H</div> <div>hydrogen</div> <div>1</div>										<div>2</div> <div>He</div> <div>helium</div> <div>4</div>
												<div>5</div> <div>B</div> <div>boron</div> <div>11</div>	<div>6</div> <div>C</div> <div>carbon</div> <div>12</div>	<div>7</div> <div>N</div> <div>nitrogen</div> <div>14</div>	<div>8</div> <div>O</div> <div>oxygen</div> <div>16</div>	<div>9</div> <div>F</div> <div>fluorine</div> <div>19</div>	<div>10</div> <div>Ne</div> <div>neon</div> <div>20</div>
												<div>13</div> <div>Al</div> <div>aluminium</div> <div>27</div>	<div>14</div> <div>Si</div> <div>silicon</div> <div>28</div>	<div>15</div> <div>P</div> <div>phosphorus</div> <div>31</div>	<div>16</div> <div>S</div> <div>sulfur</div> <div>32</div>	<div>17</div> <div>Cl</div> <div>chlorine</div> <div>35.5</div>	<div>18</div> <div>Ar</div> <div>argon</div> <div>40</div>
<div>3</div> <div>Li</div> <div>lithium</div> <div>7</div>	<div>4</div> <div>Be</div> <div>beryllium</div> <div>9</div>																
<div>11</div> <div>Na</div> <div>sodium</div> <div>23</div>	<div>12</div> <div>Mg</div> <div>magnesium</div> <div>24</div>	3	4	5	6	7	8	9	10	11	12						
<div>19</div> <div>K</div> <div>potassium</div> <div>39</div>	<div>20</div> <div>Ca</div> <div>calcium</div> <div>40</div>	<div>21</div> <div>Sc</div> <div>scandium</div> <div>45</div>	<div>22</div> <div>Ti</div> <div>titanium</div> <div>48</div>	<div>23</div> <div>V</div> <div>vanadium</div> <div>51</div>	<div>24</div> <div>Cr</div> <div>chromium</div> <div>52</div>	<div>25</div> <div>Mn</div> <div>manganese</div> <div>55</div>	<div>26</div> <div>Fe</div> <div>iron</div> <div>56</div>	<div>27</div> <div>Co</div> <div>cobalt</div> <div>59</div>	<div>28</div> <div>Ni</div> <div>nickel</div> <div>59</div>	<div>29</div> <div>Cu</div> <div>copper</div> <div>64</div>	<div>30</div> <div>Zn</div> <div>zinc</div> <div>65</div>	<div>31</div> <div>Ga</div> <div>gallium</div> <div>70</div>	<div>32</div> <div>Ge</div> <div>germanium</div> <div>73</div>	<div>33</div> <div>As</div> <div>arsenic</div> <div>75</div>	<div>34</div> <div>Se</div> <div>selenium</div> <div>79</div>	<div>35</div> <div>Br</div> <div>bromine</div> <div>80</div>	<div>36</div> <div>Kr</div> <div>krypton</div> <div>84</div>
<div>37</div> <div>Rb</div> <div>rubidium</div> <div>85</div>	<div>38</div> <div>Sr</div> <div>strontium</div> <div>88</div>	<div>39</div> <div>Y</div> <div>yttrium</div> <div>89</div>	<div>40</div> <div>Zr</div> <div>zirconium</div> <div>91</div>	<div>41</div> <div>Nb</div> <div>niobium</div> <div>93</div>	<div>42</div> <div>Mo</div> <div>molybdenum</div> <div>96</div>	<div>43</div> <div>Tc</div> <div>technetium</div> <div>—</div>	<div>44</div> <div>Ru</div> <div>ruthenium</div> <div>101</div>	<div>45</div> <div>Rh</div> <div>rhodium</div> <div>103</div>	<div>46</div> <div>Pd</div> <div>palladium</div> <div>106</div>	<div>47</div> <div>Ag</div> <div>silver</div> <div>108</div>	<div>48</div> <div>Cd</div> <div>cadmium</div> <div>112</div>	<div>49</div> <div>In</div> <div>indium</div> <div>115</div>	<div>50</div> <div>Sn</div> <div>tin</div> <div>119</div>	<div>51</div> <div>Sb</div> <div>antimony</div> <div>122</div>	<div>52</div> <div>Te</div> <div>tellurium</div> <div>128</div>	<div>53</div> <div>I</div> <div>iodine</div> <div>127</div>	<div>54</div> <div>Xe</div> <div>xenon</div> <div>131</div>
<div>55</div> <div>Cs</div> <div>caesium</div> <div>133</div>	<div>56</div> <div>Ba</div> <div>barium</div> <div>137</div>	57–71 lanthanoids	<div>72</div> <div>Hf</div> <div>hafnium</div> <div>178</div>	<div>73</div> <div>Ta</div> <div>tantalum</div> <div>181</div>	<div>74</div> <div>W</div> <div>tungsten</div> <div>184</div>	<div>75</div> <div>Re</div> <div>rhenium</div> <div>186</div>	<div>76</div> <div>Os</div> <div>osmium</div> <div>190</div>	<div>77</div> <div>Ir</div> <div>iridium</div> <div>192</div>	<div>78</div> <div>Pt</div> <div>platinum</div> <div>195</div>	<div>79</div> <div>Au</div> <div>gold</div> <div>197</div>	<div>80</div> <div>Hg</div> <div>mercury</div> <div>201</div>	<div>81</div> <div>Tl</div> <div>thallium</div> <div>204</div>	<div>82</div> <div>Pb</div> <div>lead</div> <div>207</div>	<div>83</div> <div>Bi</div> <div>bismuth</div> <div>209</div>	<div>84</div> <div>Po</div> <div>polonium</div> <div>—</div>	<div>85</div> <div>At</div> <div>astatine</div> <div>—</div>	<div>86</div> <div>Rn</div> <div>radon</div> <div>—</div>
<div>87</div> <div>Fr</div> <div>francium</div> <div>—</div>	<div>88</div> <div>Ra</div> <div>radium</div> <div>—</div>	89–103 actinoids	<div>104</div> <div>Rf</div> <div>rutherfordium</div> <div>—</div>	<div>105</div> <div>Db</div> <div>dubnium</div> <div>—</div>	<div>106</div> <div>Sg</div> <div>seaborgium</div> <div>—</div>	<div>107</div> <div>Bh</div> <div>bohrium</div> <div>—</div>	<div>108</div> <div>Hs</div> <div>hassium</div> <div>—</div>	<div>109</div> <div>Mt</div> <div>meitnerium</div> <div>—</div>	<div>110</div> <div>Ds</div> <div>darmstadtium</div> <div>—</div>	<div>111</div> <div>Rg</div> <div>roentgenium</div> <div>—</div>	<div>112</div> <div>Cn</div> <div>copernicium</div> <div>—</div>	<div>113</div> <div>Nh</div> <div>nihonium</div> <div>—</div>	<div>114</div> <div>Fl</div> <div>flerovium</div> <div>—</div>	<div>115</div> <div>Mc</div> <div>moscovium</div> <div>—</div>	<div>116</div> <div>Lv</div> <div>livermorium</div> <div>—</div>	<div>117</div> <div>Ts</div> <div>tennessine</div> <div>—</div>	<div>118</div> <div>Og</div> <div>oganesson</div> <div>—</div>

20

lanthanoids

57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

The Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$



YISHUN SECONDARY SCHOOL PRELIMINARY EXAMINATION 2024 SECONDARY 4 EXPRESS

CANDIDATE
NAME

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CLASS

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INDEX
NUMBER

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SCIENCE (CHEMISTRY, BIOLOGY)

5088/04

Paper 4 Biology

23 August 2024

1 hour 15 minutes

Candidates answer on Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A

Answer **all** questions.

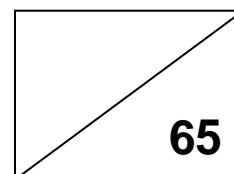
Write your answers in the spaces provided on the question paper.

Section B

Answer **one** question.

Write your answers in the spaces provided on the question paper.

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



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

[Turn over

Section A

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

- 1** Some students investigated the effect of immersing samples of red blood cells in different concentrations of salt solution. They measured the initial diameters of red blood cells and calculated the mean for each sample.

They then immersed each red blood cell sample in a different concentration of salt solution. After five minutes, they measured the diameters of red blood cells and calculated the mean again for each sample.

Table 1.1 shows the results.

Table 1.1

concentration of the salt solution / %	mean initial diameter of the red blood cells / μm	mean diameter of the red blood cells after five minutes / μm
0.0	7.5	cells burst
0.4	7.5	8.2
0.9	7.5	
1.8	7.5	6.0

- (a)** State why red blood cells burst when immersed in 0.0% salt solution but plant cells do not.

.....
 [1]

- (b)** Explain the results for the red blood cells that were immersed in the 1.8 % salt solution.

.....

 [3]

- (c) The concentration of the cytoplasm in red blood cells is the same as that of the 0.9% salt solution. Predict the mean diameter of the red blood cells after immersing them in the 0.9% salt solution for five minutes.

Complete Table 1.1 by writing your answer in the blank.

[1]

[Total: 5]

- 2 Fig 2.1. shows the action of enzymes on two different food substances in the small intestine.

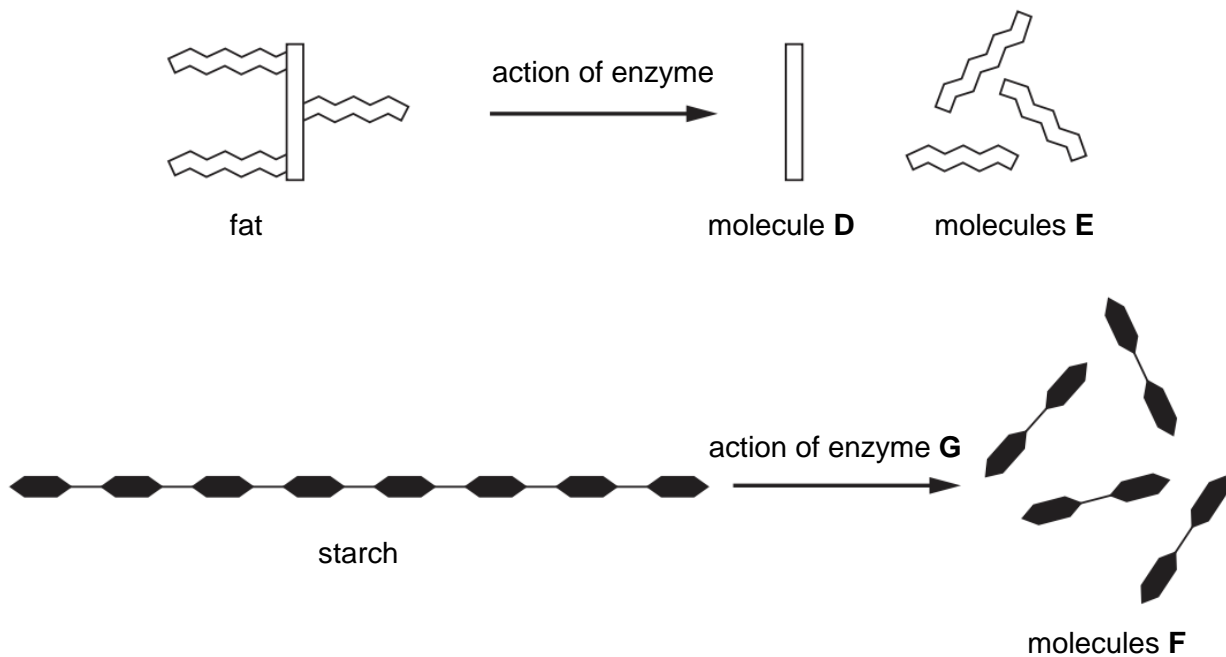


Fig. 2.1

- (a) (i) Identify the molecules shown in Fig. 2.1.

D

E

F

[2]

- (ii) Enzyme **G** also acts in another organ in the alimentary canal.

State the name of this organ.

..... [1]

(b) Fig. 2.2 shows some of the main regions of the alimentary canal in a person.

Cystic fibrosis is a genetic condition in humans that results in excessive production of mucus.

One effect of cystic fibrosis is that the bile and pancreatic duct becomes blocked with mucus.

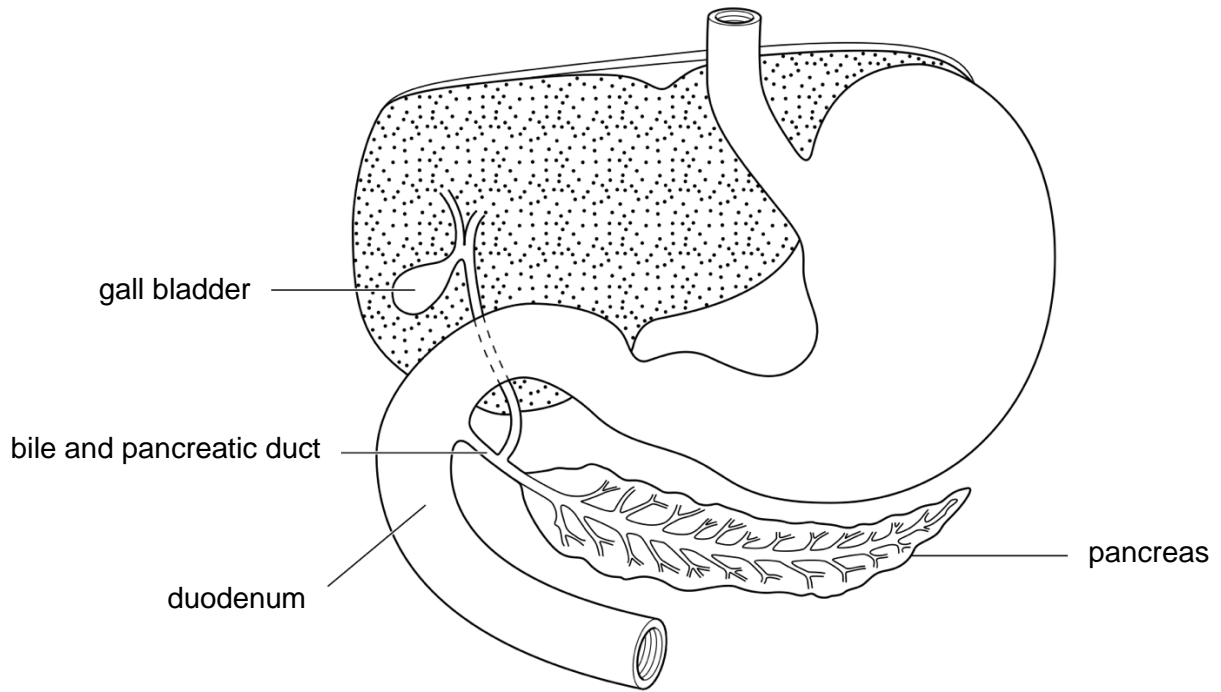


Fig. 2.2

Suggest why a person whose bile and pancreatic duct is blocked may find it difficult to gain weight despite having a balanced diet.

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 7]

[Turn over

- 3 Fig. 3.1 shows the events that follow fertilisation in structure X of a female.

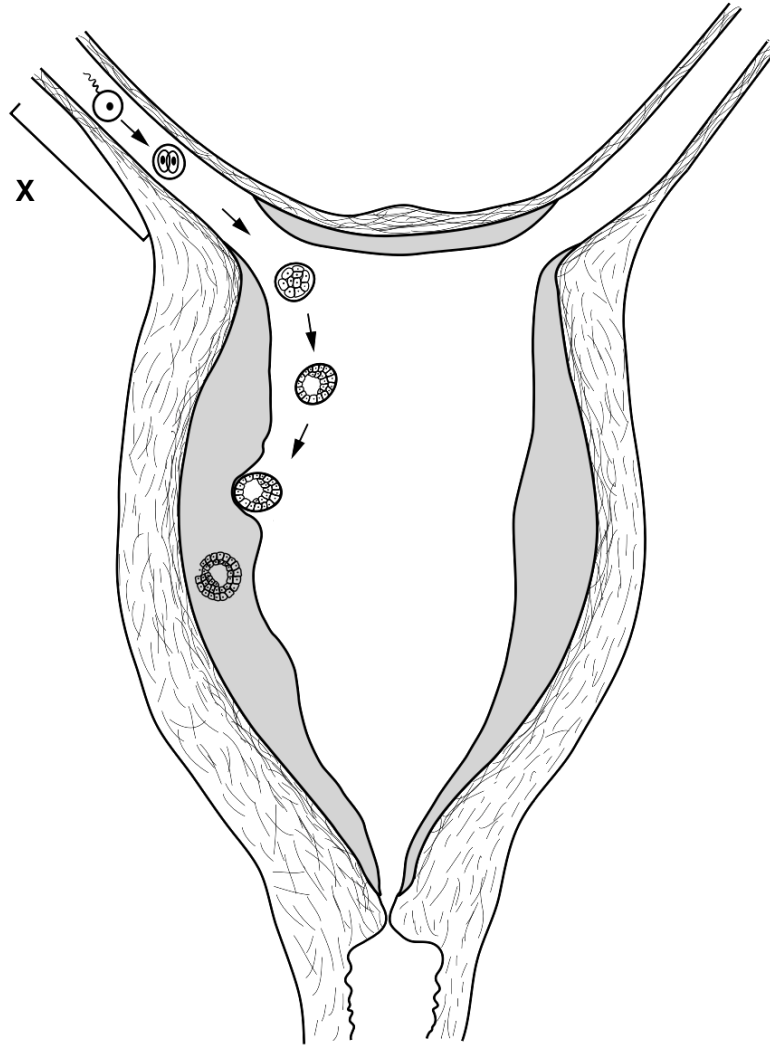


Fig. 3.1

- (a) State the name of structure X.

..... [1]

- (b) With reference to Fig. 3.1 only, describe the events that occur after fertilisation.

.....

.....

.....

..... [3]

- (c) The levels of progesterone in the female remains high after fertilisation.

Explain why.

.....

..... [1]

[Total: 5]

4 Respiration occurs in all living organisms.

- (a)** A student investigated aerobic respiration in an insect.

Fig. 4.1 shows the apparatus the student used.

The potassium hydroxide solution removed any carbon dioxide produced by the insect.

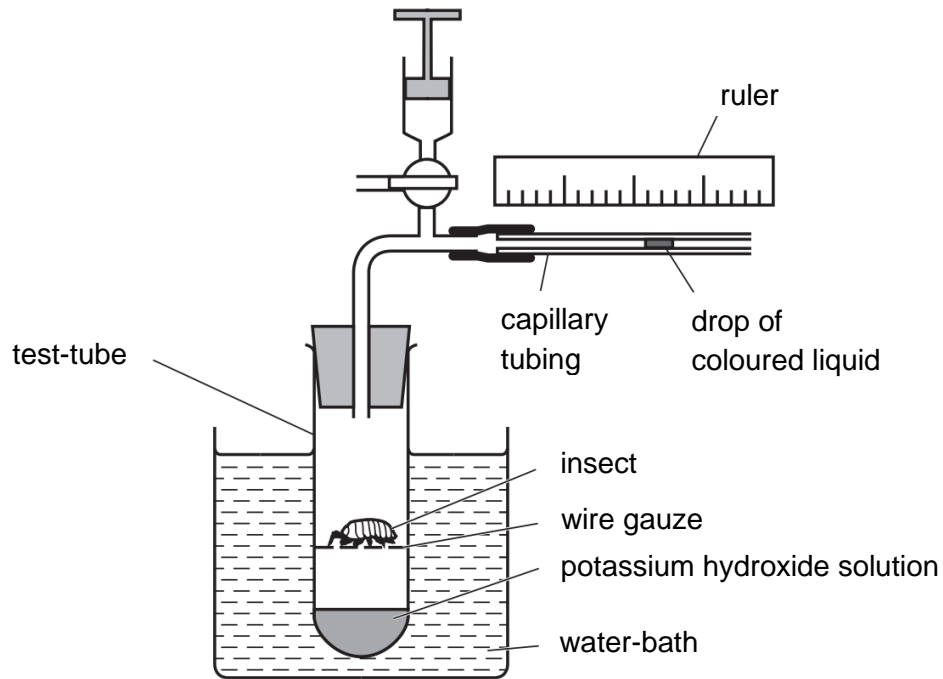


Fig. 4.1

- (i)** Carbon dioxide is produced during aerobic respiration.

State the name of the other product of aerobic respiration.

..... [1]

- (ii)** Predict and explain the direction of the movement of the coloured liquid in the capillary tubing.

.....
 [1]

- (iii) The coloured liquid moved 9 mm in 30 seconds.

Calculate the rate of movement of the coloured liquid.

Show your working.

..... mm per s [1]

- (b) Fig. 4.2 shows the percentage of energy provided by anaerobic respiration when athletes run in races of different distances.

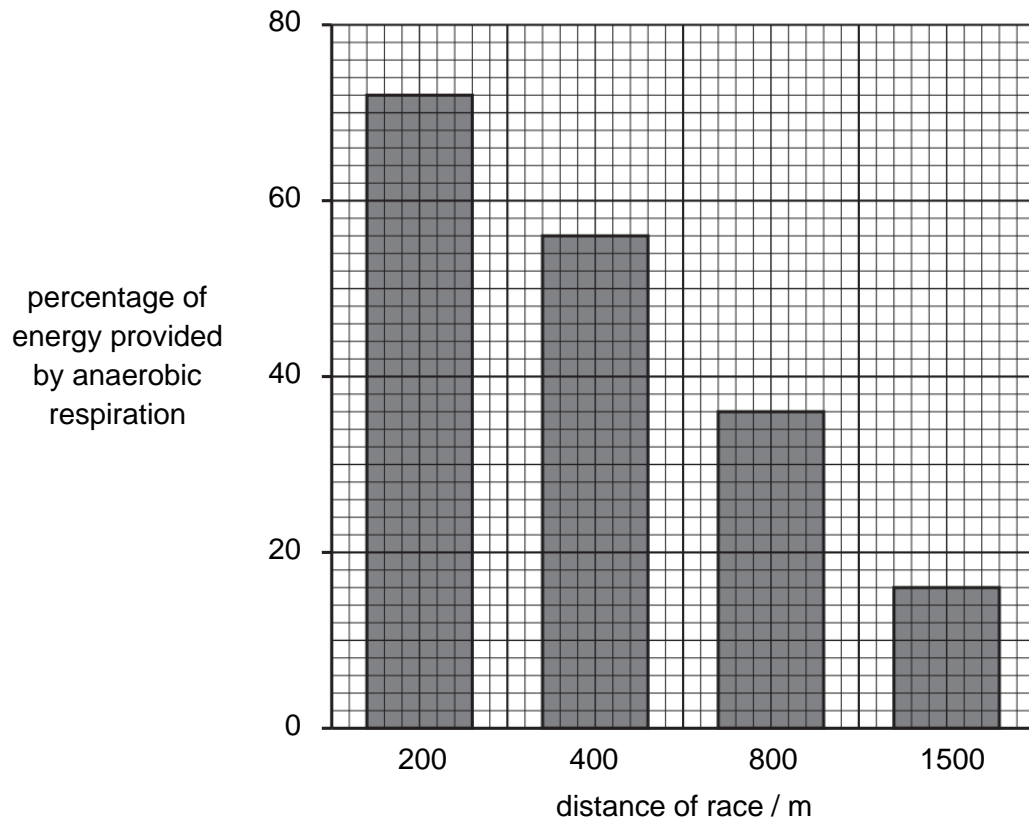


Fig. 4.2.

- (i) Describe the relationship shown in Fig. 4.2.

.....
 [1]

[Turn over

- (ii) Suggest an explanation for the relationship described in (b)(i).

.....

 [2]

- (iii) Explain why athletes are advised to take rapid, deep breathing after completing a vigorous exercise.

.....
 [1]

[Total: 7]

5 Antibiotics are used to control the spread of disease.

Fig. 5.1 shows the quantity of an antibiotic used in a hospital to treat a particular disease over an eleven-year period. It also shows the number of organisms responsible for this disease that survive the treatment.

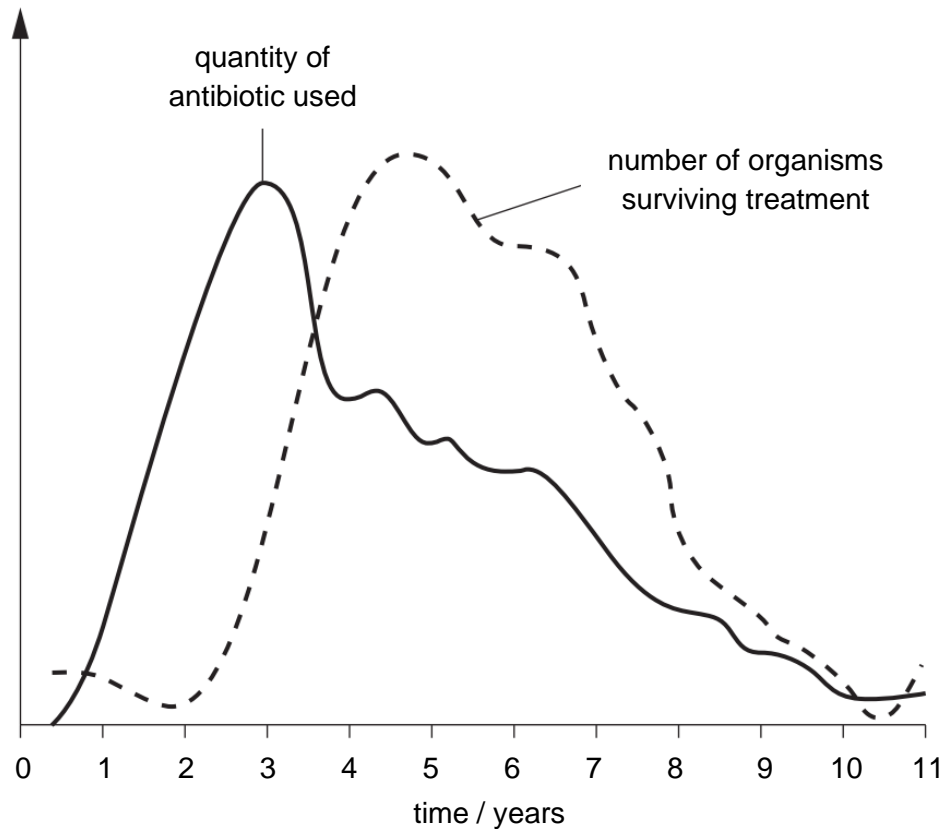


Fig. 5.1

- (a) Suggest a possible disease and name the type of organism likely to be responsible for the disease that was being treated.

disease

type of organism responsible [1]

- (b) (i) Describe the data shown in Fig. 5.1 between the third and fourth year of use of the antibiotic.

.....

..... [1]

[Turn over

- (ii) Suggest why the overuse of antibiotics for treating minor infections can have dangerous consequences for people who are treated for very serious infections in the future.

.....

.....

.....

.....

..... [3]

- (c) Suggest a way that the disease might be treated after year 11.

..... [1]

[Total: 6]

- 6 (a) Define the term *transpiration*.

.....
 [2]

- (b) A student investigated the volume of water lost in one hour by different species of plants at different temperatures.

Fig. 6.1 shows the results.

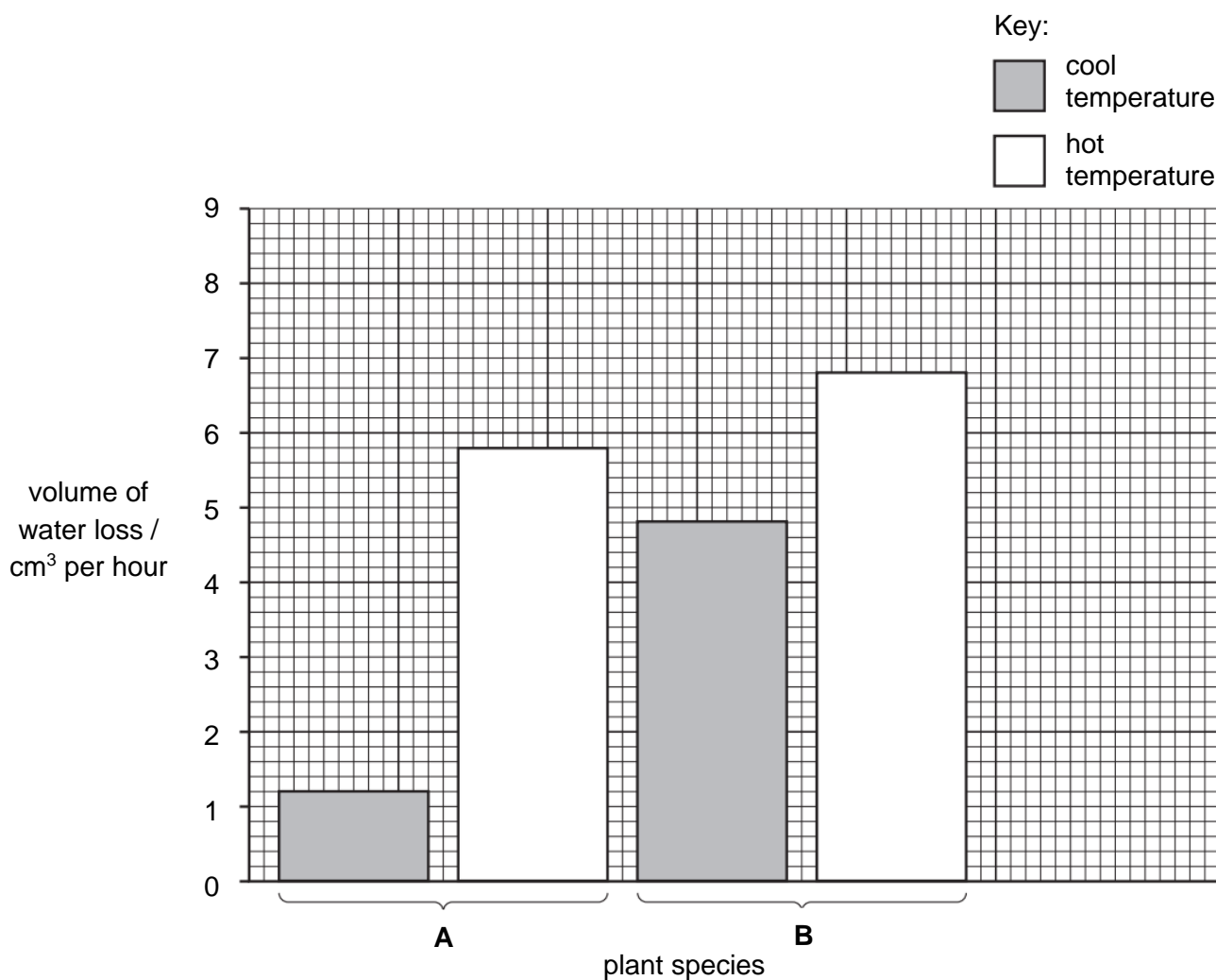


Fig. 6.1

[Turn over

- (i) With reference to Fig. 6.1, compare the volume of water loss in species **A** and species **B**.

.....

.....

.....

.....

.....

.....

..... [3]

- (ii) The investigation was repeated with increased humidity at a cool temperature.

Draw **one** additional bar **on Fig. 6.1**, for species **B** only, to show the expected result. [1]

- (c) State the name of the vessels that transport water through a plant.

..... [1]

[Total: 7]

- 7 PTC is a bitter tasting chemical that some humans can taste while others cannot. This is controlled by a single gene with a pair of alleles.

Fig. 7.1 shows the inheritance of the ability to taste PTC in a family.

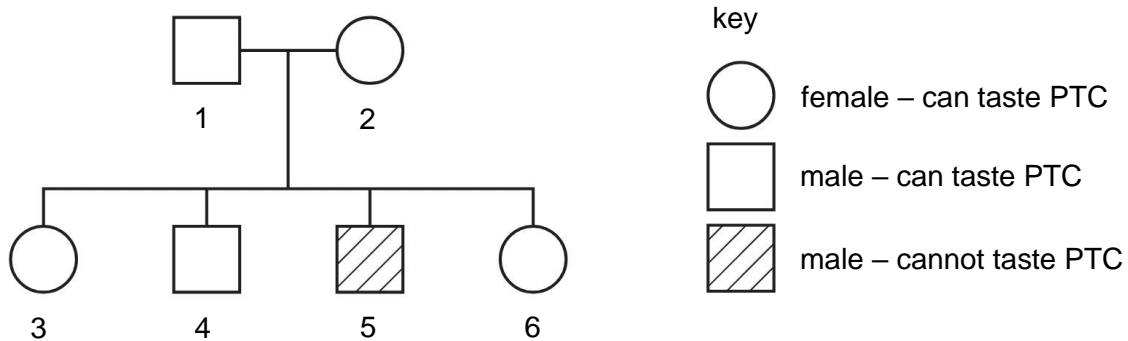


Fig. 7.1

- (a) (i) The allele for being able to taste PTC is dominant.

Using the symbols **T** for the dominant allele and **t** for the recessive allele, state the two possible genotypes for individuals who can taste PTC.

..... and [1]

- (ii) Which evidence, from Fig. 7.1, shows that the allele is dominant?

Explain your answer.

.....

.....

.....

.....

..... [3]

[Turn over

- (b) Fig. 7.2 represents four genes on a part of the sex chromosomes from a body cell of a woman.

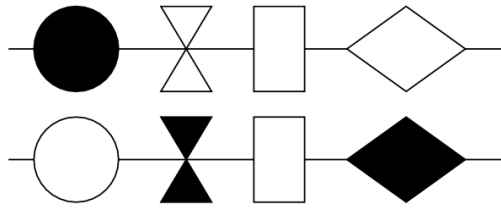


Fig. 7.2

- (i) In the space below, draw **one** allele shown in Fig. 7.2.

[1]

- (ii) In the space below, draw the genes in Fig. 7.2 as they would appear in one of her ova.

[1]

- (c) Fig. 7.3 shows the same section of an X chromosome in another cell of the same person in which the structure of one of the genes has changed.

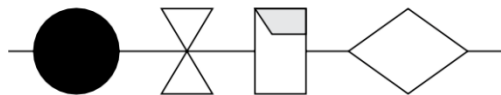


Fig. 7.3

- (i) State the name given to such a change in a gene.

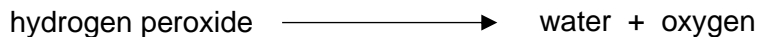
..... [1]

- (ii) Suggest a possible cause of such changes in genes.

..... [1]

[Total: 8]

- 8 Catalase is an enzyme which breaks down hydrogen peroxide into water and oxygen.



By using small pieces of filter paper soaked in a solution of catalase, it is possible to measure the rate of enzyme activity.

The pieces are placed in a solution of diluted hydrogen peroxide in a test-tube. The filter paper rises to the surface as oxygen bubbles are produced.

The time taken for these pieces of filter paper to rise to the surface indicates the rate of catalase activity.

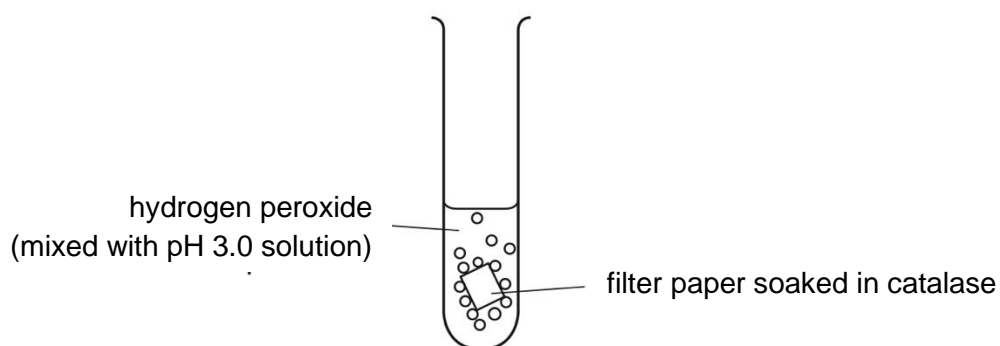


Fig. 8.1

An experiment was carried out to find out the effect of pH on the rate of catalase activity. Six test-tubes were set up, each containing hydrogen peroxide mixed with a different pH solution.

Fig. 8.1 shows the set-up for one of the test-tubes containing hydrogen peroxide mixed with pH 3.0 solution.

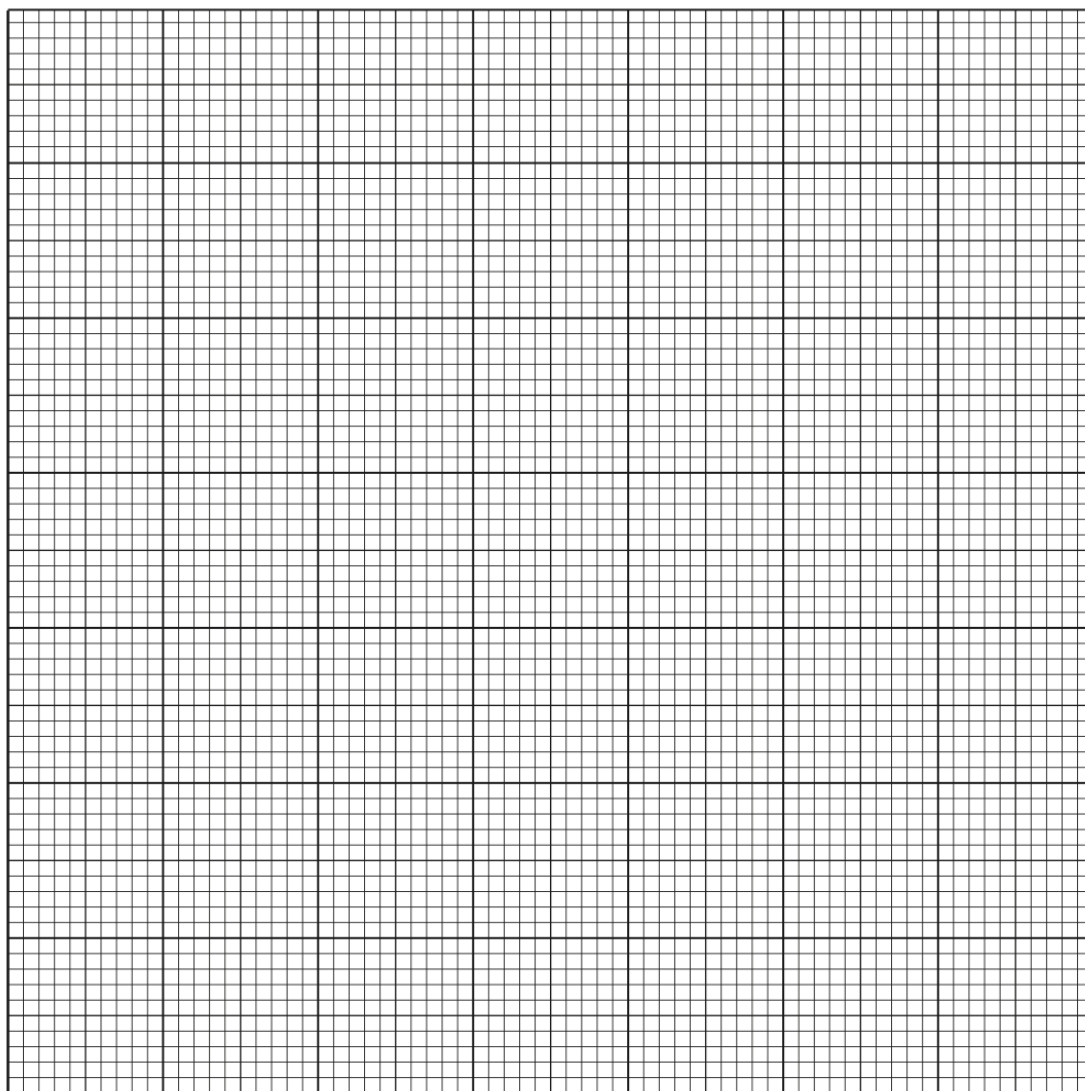
Table 8.1 shows the results obtained for the experiment as described.

Table 8.1

pH	time taken for filter paper to rise to the surface / s
3.0	62
4.0	45
5.0	35
6.0	25
7.0	20
8.0	50

[Turn over

- (a) (i) Use the data in Table 8.1 to draw a best fit line on the grid below.



[4]

- (ii) Based on the graph drawn in (a)(i), describe and explain the relationship between pH and the time taken for the filter paper to rise to the surface.

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.....

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..... [4]

- (b) State two variables which must be kept controlled in this experiment.

1

2 [2]

[Total: 10]

Section B

Answer **one** question from this section.

- 9 Fig. 9.1 shows an angiogram of a heart before and after treatment for coronary heart disease (CHD).

An angiogram is an image of the blood flow through the blood vessels of the heart.

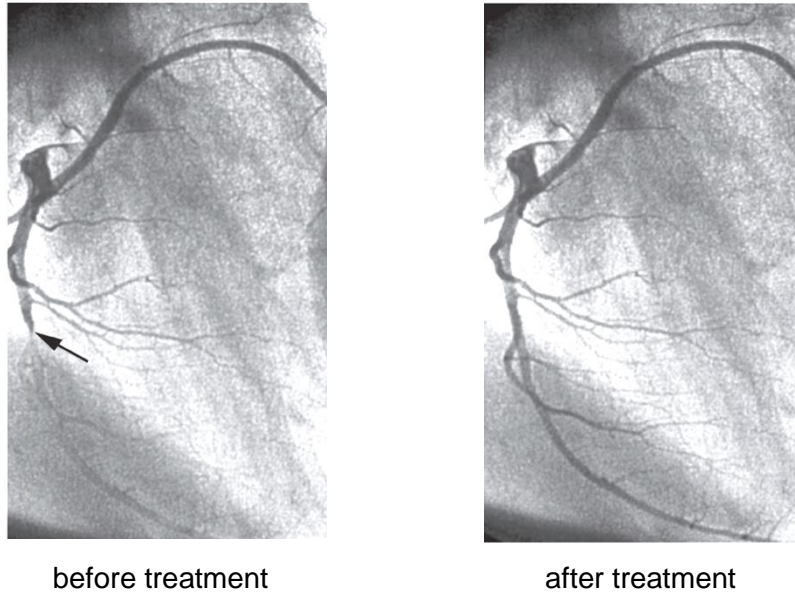


Fig. 9.1

- (a) The arrow on Fig. 9.1 shows the position of a blockage in a blood vessel.

- (i) State the name of the blocked blood vessel.

..... [1]

- (ii) Suggest and explain how a person might be affected by CHD.

.....

.....

.....

.....

..... [3]

- (b) Many health specialists think that the risk of CHD can be reduced by doing regular exercise.

A long-term study of a large group of women was used to test this hypothesis. The women were between 35 and 45 years old at the start of the study. Every two years the same group of women were asked how much they were exercising.

After 28 years, the researchers analysed their data:

- They calculated the average time spent exercising per week by each woman.
- They put the women into categories determined by how much exercise they had done.
- For each category, they calculated the number of women who died from CHD.

The results are shown in Fig. 9.2.

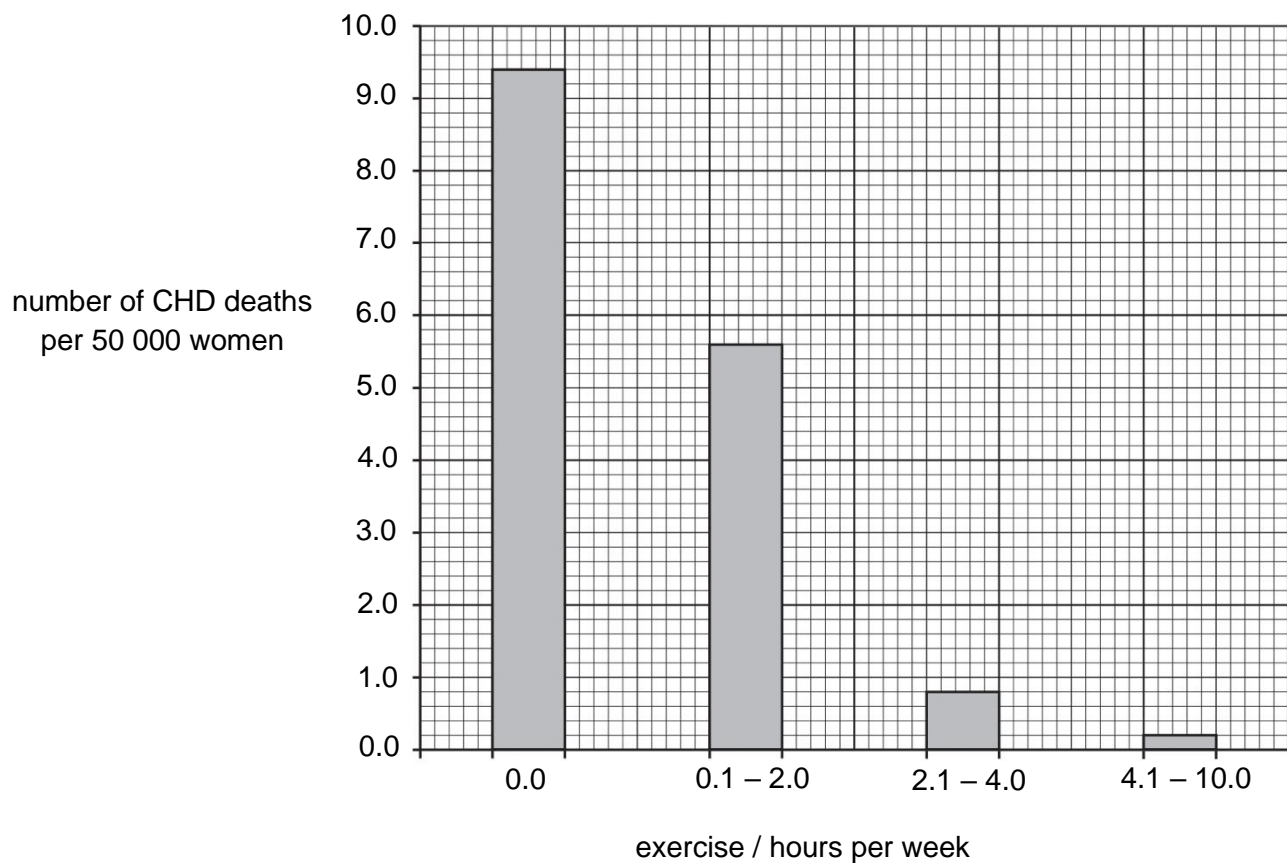


Fig. 9.2

[Turn over

Using the information about how the study was designed and the results in Fig. 9.2, suggest why it is **unfair** for the health specialists to use this study to encourage the **whole population** to exercise more.

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..... [6]

[Total: 10]

- 10** A species of caterpillar, the holly looper, feeds on the leaves of the holly plant.

Holly plants produce red berries that are eaten by a species of bird, the song thrush.

Song thrushes also eat caterpillars and are eaten by snakes.

- (a) (i)** Use the information above to construct a food web containing all the organisms.

[2]

- (ii)** Explain why there are only a few snakes although there are large numbers of holly looper and song thrush in this area.

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..... [4]

[Turn over

- (b) Explain how energy originally supplied by the Sun is eventually used to power the muscles in the snake as it moves.

.....

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.....

.....

.....

..... [4]

[Total: 10]

End of Paper

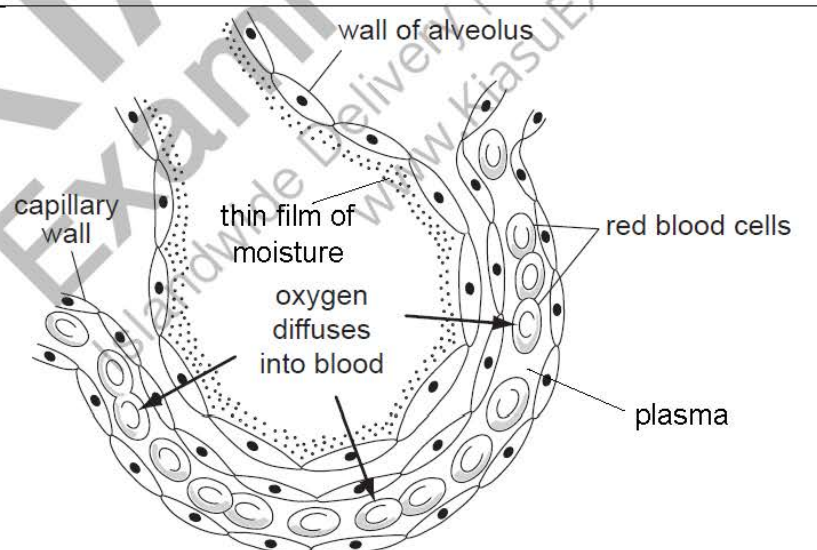




Answers to Paper 1

Qn	Answer	Explanation
1	B	Burette is the most accurate apparatus, able to measure up to 2 decimal places. Pipette can only measure a fixed volume of 25.0 cm ³ .
2	B	The drink must contain components that match both banned food colourings exactly.
3	D	Based on the first 2 cation tests, zinc ions are present. The anion test confirms that nitrate ions are present, hence X is zinc nitrate.
4	A	Particles vibrate about fixed positions in solid state. Room temperature is at 25 °C. For substance to be in the solid state, the melting point must be above 25 °C.
5	C	Since the cation has a charge of 2+, it has two more protons than electrons. Hence, number of protons is 20. This means that number of neutrons = 41 – 20 = 21.
6	C	Isotopes are atoms of the same element with the same number of protons and electrons but different number of neutrons.
7	A	This is an ionic compound as it can conduct electricity when dissolved in water. Hence X must be a metal while Y is a non-metal. Since the ratio of X:Y is 1:2, X forms X ²⁺ while Y forms Y ⁻ . X is from Group 2 while Y is from Group 17.
8	A	Mol of KOH = $0.1 \times 20 \div 1000 = 0.002$ mol $\begin{array}{l} \text{H}_2\text{SO}_4 : \text{KOH} \\ 1 : 2 \end{array}$ Mol of H ₂ SO ₄ = 0.001 mol Vol of H ₂ SO ₄ = $(0.001 \div 0.25) \times 1000 = 4$ cm ³
9	D	Option A is wrong as copper(II) carbonate and copper(II) oxide are not alkalis. Option B is wrong as reaction with copper(II) oxide does not produce a gas. Option C is wrong as reaction with copper(II) carbonate produces neutral products (pH = 7).
10	D	Option A is wrong as CuO is reduced (lose oxygen). Option B is wrong as Mg is oxidised (gain oxygen). Option C is wrong as CuO is the oxidising agent (itself is reduced).
11	C	As the reaction is exothermic, energy is released to the surroundings, causing temperature to rise. When the alkali is in excess, the reaction would have been completed and the temperature would decrease back to room temperature.
12	D	Temperature of a chemical reaction increases when temperature increases. Gas reactions go faster at higher pressure. The reactants are both gases at room temperature and pressure.
13	B	Elements in the periodic table are arranged in increasing proton number.

14	A	Chlorine is a yellow-green gas at room temperature. Chlorine displaces iodine from potassium iodide, forming a dark brown solution containing iodine.
15	A	Option B does not contain water (drying agent). Option C does not contain oxygen (boiled water). Option D has a rust prevention method (grease).
16	D	Biofuel is made from fermentation of sugarcane (glucose).
17	B	Since aqueous bromine remains red-brown, Z does not contain C=C. Since aqueous potassium manganate(VII) turns colourless, Z can be oxidised and hence contains a hydroxyl group (–OH).
18	C	To balance the number of atoms, 2X must contain 10 carbon atoms and 20 hydrogen atoms. Hence, each X contains 5 carbon atoms and 10 hydrogen atoms. This means that the formula of X is C_5H_{10} , which follows the alkene general formula of C_nH_{2n} .
19	B	Statement 2 is not true and statement 3 is not a reason in favour of recycling.
20	C	Only nitrogen dioxide is an acidic oxide, which dissolves in water to form acid rain that corrodes limestone/metal buildings.
21	C	Red blood cell (2 nd cell) lacks nucleus, cell wall and chloroplasts. The 3 rd cell is a plant cell but lacks chloroplasts. The 4 th cell is an animal cell and lacks cell wall and chloroplasts.
22	A	The specialised cells are muscle cells, whose key function is to contract and relax to bring about movement. Structural adaptations of the muscle cells include having many mitochondria to release more energy during aerobic respiration and having contractile protein fibre to bring about movement.
23	B	The water in the container has a higher water potential as compared to the potato cells, while the potato cells have a higher water potential than the concentrated sugar solution. As a result, there is a net movement of water molecules from the water into the potato cells, and a net movement of water molecules from the potato cells into the concentrated sugar solution by osmosis. Thus, the water level in the container falls while the solution level inside the cut potato rises.
24	D	Iodine molecules are small enough to diffuse into the Visking tubing while the starch molecules are too large to diffuse out. As a result, the iodine molecules turn blue-black when in contact with the starch molecules inside the Visking tubing.
25	D	A brick-red precipitate observed during Benedict's test means that a large amount of reducing sugar is present. A violet colour observed during biuret test means that protein is present. Therefore, option D is correct. Since there is no change in colour from yellowish-brown to blue-black for iodine test and no cloudy white emulsion produced during ethanol emulsion test, we can conclude that starch and fat molecules are absent respectively.
26	C	The lock is protease which is an enzyme that has an active site. The key is protein which is the substrate that binds to the active site. At the active site, protein is broken down into amino acids which are the products.

27	C	X (hepatic vein) transports blood from the liver towards the heart. Y (hepatic artery) transports blood away from the heart towards the liver. Z (hepatic portal vein) transports blood from the small intestine towards the liver.
28	D	When the concentration of glucose in the blood is above normal levels, the pancreas releases more insulin in the blood. Insulin stimulates liver cells to convert excess glucose into glycogen for storage, thereby increasing the glycogen concentration in the liver. This corresponds to periods 3 and 5.
29	A	A hormone is a chemical substance produced by an endocrine gland, carried by the blood, which alters the activity of one or more specific target organs, and is then destroyed by the liver and excreted by the kidneys.
30	B	<p>The order from highest to lowest blood pressure is $B > D > A > C$.</p> <p>B represents the aorta which transports blood away from the left ventricle in the heart to the rest of the body. The thick muscular wall of the left ventricle results in a large force of contraction. This generates high blood pressure in order to push blood out of the heart to reach distant parts of the body.</p> <p>D represents the pulmonary artery which transports blood away from the right ventricle in the heart to the lungs. The muscular wall of the right ventricle is thinner as compared to the left ventricle, resulting in a smaller force of contraction. This generates lower blood pressure to push blood out of the heart to reach the lungs which is at a shorter distance.</p> <p>A represents the pulmonary vein which transports blood from the lungs towards the heart. C represents the vena cava which transports blood from the rest of the body to the heart. Blood pressure is reduced as blood flows through the highly branched capillaries. There is a decrease in elastic tissue from the arteries to the veins, reducing the ability to maintain high blood pressure.</p>
31	D	 <p>The diagram illustrates the structure of an alveolus and the process of gas exchange. Labels include: wall of alveolus, capillary wall, thin film of moisture, oxygen diffuses into blood, red blood cells, and plasma. Arrows indicate the movement of oxygen molecules from the air in the lungs (inside alveolar cavity) into the red blood cells.</p> <p>The arrows in the diagram show the direction of movement of oxygen molecules from the air in the lungs (inside alveolar cavity) into the red blood cells.</p>

32	A	Statement 3 is not true. The bar showing <20 years and 40-49 years of smoking, shows an increased risk of lung cancer in people who smoked less than 20 cigarettes a day.															
33	C	Influenza is caused by a virus. It can be spread through droplets in the air. Vaccination serves as a mean to reduce the chance of contracting the virus.															
34	C	Glucose is being formed during photosynthesis. Carbon dioxide and water are required while oxygen is produced during photosynthesis.															
35	B	Vascular bundle cell (xylem or phloem) does not contain chloroplast. Upper and lower epidermis cells also do not have chloroplast (except for the guard cells). Most chloroplasts are found in the mesophyll (palisade and spongy) cells.															
36	A	Stage 1: Light energy from the sun is trapped by plants during photosynthesis. Stage 2: During photosynthesis, light energy is converted into chemical energy in plants. During feeding, this chemical energy is transferred along the trophic levels.															
37	C	DNA is used to carry the genetic code, which is a sequence of bases that codes for a specific sequence of amino acids. The amino acids chain up to form a polypeptide or protein.															
38	C	A chromosome is a coiled DNA molecule. A gene is a segment along a DNA molecule.															
39	B	Discontinuous variation involves distinct and clear-cut phenotypes unlike continuous variation which involves a range of phenotypes and no distinct categories.															
40	A	<p>The parents must be heterozygous. Each parent must carry a recessive allele, n, to pass down to the offspring with short wings. Each parent has normal wings and must therefore each carry a dominant allele, N, to express the dominant phenotype.</p> <p>The Punnett square for the cross of heterozygous parents is shown below.</p> <table><tr><td colspan="2"></td><th colspan="2">female</th></tr><tr><td colspan="2"></td><th>N</th><th>n</th></tr><tr><th rowspan="2">male</th><th>N</th><td>NN</td><td>Nn</td></tr><tr><th>n</th><td>Nn</td><td>nn</td></tr></table> <p>The result of the cross is 3 normal wings:1 short wing.</p>			female				N	n	male	N	NN	Nn	n	Nn	nn
		female															
		N	n														
male	N	NN	Nn														
	n	Nn	nn														

Yishun Secondary School

Mark Scheme

Sec 4E Preliminary Examination Science Biology (Paper 4)

Date of exam: 23 Aug 24


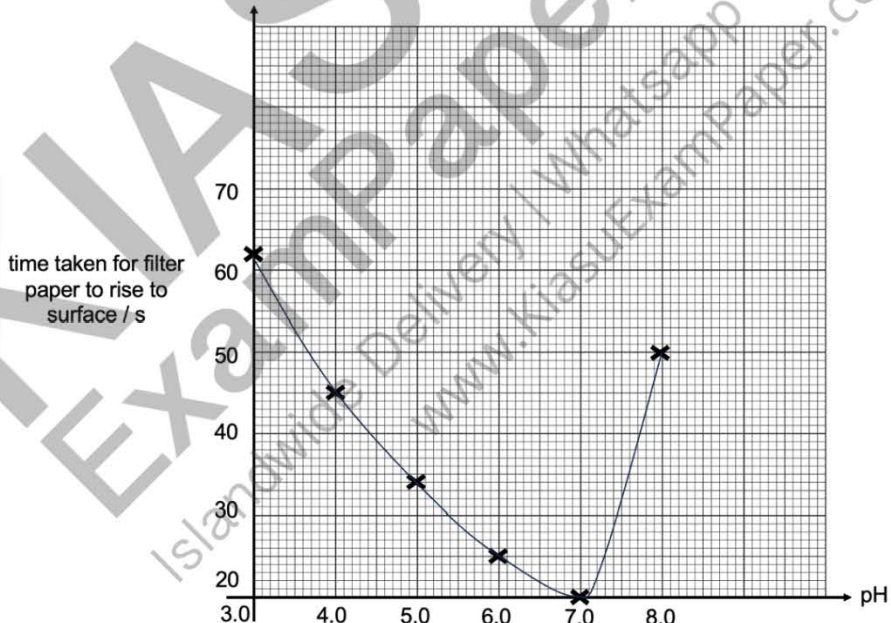
Setter: Ms Thiam Jia Hui and Mrs Leong Sin Yee

Answers to Section A

Qn no.	Key Answers	Remarks
1a	(red blood cells) do not have a (rigid) cell wall (while plant cells have a cell wall) / ORA ;	1
1b	<p><u>any three from:</u></p> <p>(salt) solution has a lower water potential than the (red blood) cells/ ORA;</p> <p>(diameter decreases because) of the net movement of water molecules out of the (red blood) cells ;</p> <p>by osmosis ;</p> <p>from higher water potential to lower water potential / down a water potential gradient ;</p>	max 3
1c	<p><u>7.5</u> ;</p> <p>(Reason: Since the water potential between the salt solution and the cytoplasm of red blood cells is the same, there will be no net movement of water molecules in and out of the cells. As such, the diameter of the red blood cells will remain the same.)</p>	1
2ai	<p>D: glycerol</p> <p>E: fatty acid(s)</p> <p>F: maltose</p>	<p>2m</p> <p>3 correct – 2m</p> <p>2 correct – 1m</p> <p>0 to 1 correct – 0m</p>
2aii	Mouth;	1m
2b	<p><u>Max 3m</u></p> <p>Less bile/ no bile released into duodenum ;</p> <p>Less physical digestion of fats/ less emulsification of fats;</p> <p>Less pancreatic juice/ enzymes/ ref. to any named enzyme in pancreatic juice released into duodenum ;</p> <p>Decreased rate of (chemical) digestion by enzymes;</p> <p>Ref. to food being less soluble/ bigger;</p>	Max 4m

	<p><u>Compulsory 1m:</u> Less absorption of end products of digestion/ digested food/ or ref. to any named digested food e.g. glucose/ amino acids/ fatty acids/ glycerol; Less assimilation into larger molecules/ ref. to example of assimilation;</p>	
3a	Oviduct/ fallopian tube;	1m
3b	<p>Zygote/ fertilised egg is transported/ moved/ swept to the uterus; Zygote/ fertilised egg divides (by mitosis) to form the embryo/ a ball of cells; which is implanted on the uterus lining/ wall of uterus;</p>	<p>Max 3m R zygote moves</p>
3c	<p>Maintain the thickness of the uterus lining (embryo implantation)/ ORA i.e. prevents the uterus lining from breaking down;</p>	<p>1m A prevents miscarriage</p>
4ai	<p><u>water</u> ; R: energy</p>	1
4aii	<p>(coloured liquid) move to the left / towards the insect / AW + volume of air inside test-tube decreases / less oxygen ;</p>	1
4aiii	<p>9 / 30 = <u>0.3</u> (mm per s) ;</p>	1
4bi	<p>the shorter the distance (of race), the greater the (percentage of) energy provided by anaerobic respiration;</p>	<p>1 ORA</p>
4bii	<p>more energy / higher demand of energy / (more) intense (burst) of energy + required by muscle (cells) (over shorter distance of race) / AW; due to a limit in our heartrate / breathing rate; oxygen cannot be supplied fast enough to the muscle (cells) (to meet the higher energy demand) / AW ;</p>	max 2
4biii	<p>to repay oxygen debt / remove lactic acid / AW ;</p>	1
5a	<p>pneumococcal + bacteria ; AVP; R spelling error / pneumococcus disease</p>	1
5bi	<p>quantity of antibiotic used decreases + number of organisms surviving treatment increases ;</p>	1

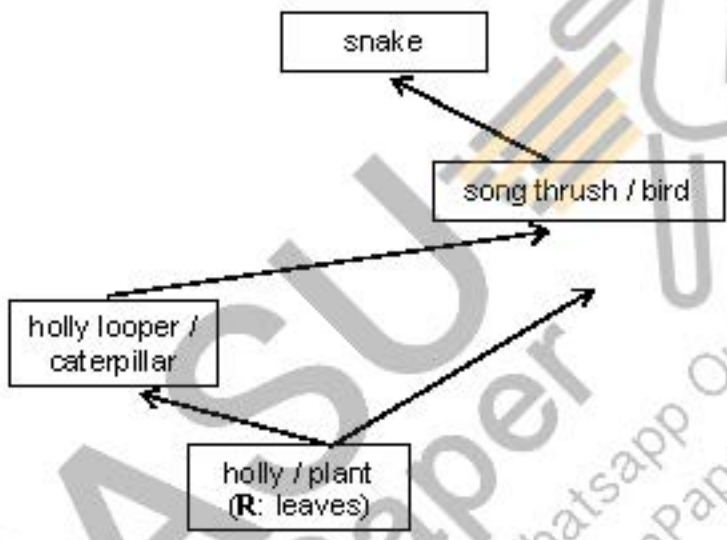
5bii	<p>bacteria that are (naturally) resistant (to antibiotic) survive ; reproduce / increase in number + pass on (resistance) gene / allele (to offspring) ; overuse / more antibiotic used (to treat minor infection), the (chance) of more resistant strains / bacteria types, will be present / AW ; ref. to overuse leading to (one strain of bacteria) resistance to several antibiotics ; (resulting in) antibiotic ineffective in a (serious) infection</p>	max 3
5c	<p>(development of) different / new antibiotic ;</p> <p>R vaccination (which is a prevention and not a treatment)</p>	1
6a	<p>loss of <u>water vapour</u> ; through aerial parts of the plant / (mainly) through stoma(ta) ;</p>	2
6bi	<p><u>similarity (min 1m)</u> ; both species lost <u>more</u> water in hot condition (than in cool) ;</p> <p><u>difference (min 1m)</u> ; species B lost <u>more</u> water than species A (in, either / both, conditions) ; the increase in water loss was <u>greater</u> in species A in hot condition (than in cool) ;</p> <p>[Compulsory 1m] quote / manipulate + comparison of data + with units ;</p>	<p>max 3</p> <p>ORA</p>
6bii	<p>one bar drawn with height that is <u>less than 4.8 cm³ per hour</u> ;</p> <p>BOD if width of bar is not 10 squares wide</p>	1
6c	<u>xylem</u> (vessel) ;	1
7ai	<u>II</u> and <u>It</u> ;	<p>1m</p> <p>Both genotypes must be correct</p>
7aii	<p><u>Evidence – 1m</u> Child 5 cannot taste PTC + parents can taste PTC ;</p> <p><u>Explanations – 2m</u> Parents (1 and 2) must be heterozygous/ have a dominant allele (for tasting PTC) ;</p>	3m

	<p>Allele for not tasting PTC must be present in both parents but not expressed (A not showing)/ allele for not tasting PTC must be present in each parent to pass down to Child 5/ Child 5 must have inherited the allele for not tasting PTC from each parent; -OR-</p> <p>(If allele for tasting PTC is recessive,) parents would be homozygous recessive/ parents can only pass down recessive alleles to children; All offspring would be able to taste PTC (which is not observed);</p>	
7bi	Drawing of any single shape (unshaded OR shaded except for rectangle);	1m
7bii	<p>Drawing of one chromosome shown + genes matching in shape, shade and sequence (A reversed);</p> 	1m
7ci	Mutation;	1m
7cii	Mutagen/ named mutagen e.g. X-ray/ UV rays/ tar/ LSD;	1m
8ai	 <p>Scale: no odd scale + graph occupies at least ½ of grid space; Line: best fit curve + no extrapolation; Axes: labelled correctly with units i.e. x-axis – pH, y-axis – time taken for filter paper to rise to surface/ s Plots: correct plots;</p>	4m

8a ii	<p>[D] At pH 7, the time taken for the filter paper to rise to the surface is the shortest;</p> <p>[E] pH 7 is the optimum pH for catalase/ enzyme is most active/ frequency of effective collisions is the highest;</p> <p>[D] As pH moves away from pH 7, time taken for the filter paper to rise to the surface is longer/ As pH increases from 3 to 7, time taken for the filter paper to rise to the surface is decreased + as pH increases from 7 to 8, time taken for the filter paper to rise to the surface is increased;</p> <p>[E] (As pH moves away from 7,) catalase is denatured/ active site of the catalase is lost/ active site is no longer complementary in shape to the substrate;</p>	4m
8b	<p><u>Any two:</u></p> <p>Temperature/ size of filter paper/ volume of hydrogen peroxide/ concentration of hydrogen peroxide/ volume of pH solution or buffer solution/ concentration of catalase/ type of filter paper,;</p>	2m

Answers to Section B

Qn no.	Key Answers	Remarks
9ai	Coronary artery;	1m
9aii	<p><u>Suggest – 1m:</u> The person can suffer from heart attack/ heart stops / angina A/V / cardiac arrest/ heart failure;</p> <p><u>Explain – max 2m:</u> This is due to less oxygen + glucose delivered to heart muscle (cells); Which leads to less (aerobic) respiration in heart muscle (cells); resulting in less energy released in heart muscle (cells); and death of heart muscle (cells)</p>	Max 3m
9b	<p><u>Design – min 2</u> Only women were included in the study/ORA; None younger than 35 (at the start of the study); Some women may have forgotten/ not answered correctly about how much exercise they did/ gave inaccurate responses/ A/V; Some women may have been successfully treated for CHD/ not died from the condition/ A/V; Other variables not considered e.g. pre-existing conditions/ medication / type of exercise/ length of exercise; Other risk factors were not considered/ named examples of other risk factors e.g. diet/ smoking/ genetics;;</p> <p><u>Results – min 2</u> Actual number of deaths per 50 000 women is small even for those that do not exercise; Data quote for 0.0 hours of exercise per week i.e. 9.4 CHD deaths per 50 000 women; Difference in number of deaths per 50 000 women between those who do not exercise/ exercised less compared to those who exercised/ exercised more is small; Data quoted/ data manipulated to compare 2 groups e.g. 9.2 CHD deaths difference per 50 000 women between women who had 0.0 hours of exercise and those who exercised 4.1 to 10.0 hours per week;</p>	<p>Max 6m</p> <p>Named risk factors – award max 2m</p>

10ai	<p>all organisms correct ; all directions of arrows correct ;</p>  <pre> graph TD A[snake] --> B[song thrush / bird] B --> C[holly looper / caterpillar] C --> D[holly / plant (R: leaves)] D --> B </pre>	2
10aii	<p>energy transferred along the trophic level decreases; ref. to 90% (of energy) lost / 10 % (of energy) transferred, from one (trophic) level to next; any two from: energy lost, to environment as heat during respiration / in uneaten body parts / in waste products during egestion / excretion ; ref. to idea of less energy to sustain same number of organisms ;</p>	max 4
10b	<p>plants / producers + photosynthesize; trap / absorb light <u>energy</u>; produce , glucose / sugar -or- convert / transfer (light energy) to chemical energy; ref. to idea of feeding / idea of (chemical) energy being passed along food chain; digestion / break down / absorption / assimilation, of food / named nutrients; respiration occurs to release energy (for contraction / for muscles);</p>	max 4

