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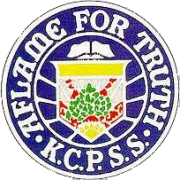
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KUO CHUAN PRESBYTERIAN SECONDARY SCHOOL
2024 PRELIMINARY EXAMINATION

Secondary 4 Express / 4 Normal Academic (SBB)

NAME

CLASS

REG. NO

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SCIENCE (CHEMISTRY/BIOLOGY)

5088 / 01

Paper 4 Biology

Paper 1: 1 hour

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.
 Write in dark blue or black pen on both sides of the paper.
 You may use an HB pencil for any diagrams, graphs or rough working.
 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.

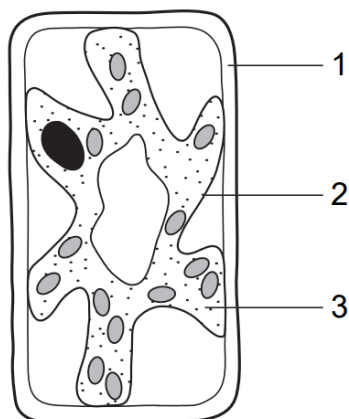
Write your answers in the spaces provided on the question paper.

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

.....
Parent's signature/ Date

FOR EXAMINER'S USE	
Total	

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



Which numbered structure(s) is / are partially permeable?

- A** 1 only
- B** 2 only
- C** 1 and 2 only
- D** 1 and 3 only
- 2** The table below shows the comparison between a red blood cell and a root hair cell.

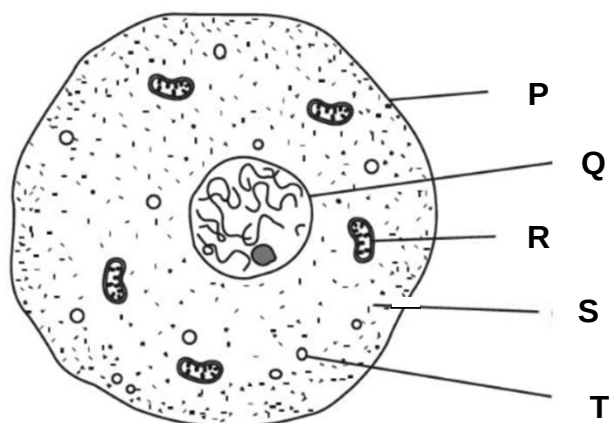
feature number	feature	red blood cell	root hair cell
1	transport oxygen	yes	yes
2	cytoplasm present	no	yes
3	large surface area to volume ratio	yes	yes
4	nucleus present	no	yes

Which comparisons are correct?

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

D 3 and 4 only

3 The diagram shows an animal cell.



Which labelled parts show a mitochondrion and a ribosome?

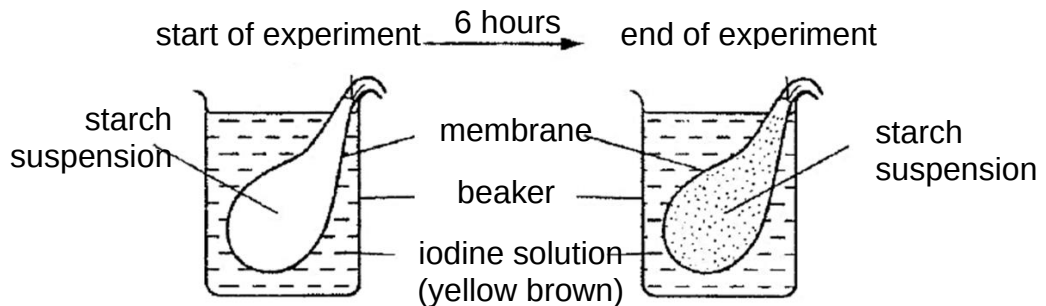
	mitochondrion	ribosome
A	R	P
B	R	S
C	I	P
D	I	S

4 The cell wall of a plant cell is removed using an enzyme.

What would happen if this cell were then placed in distilled water?

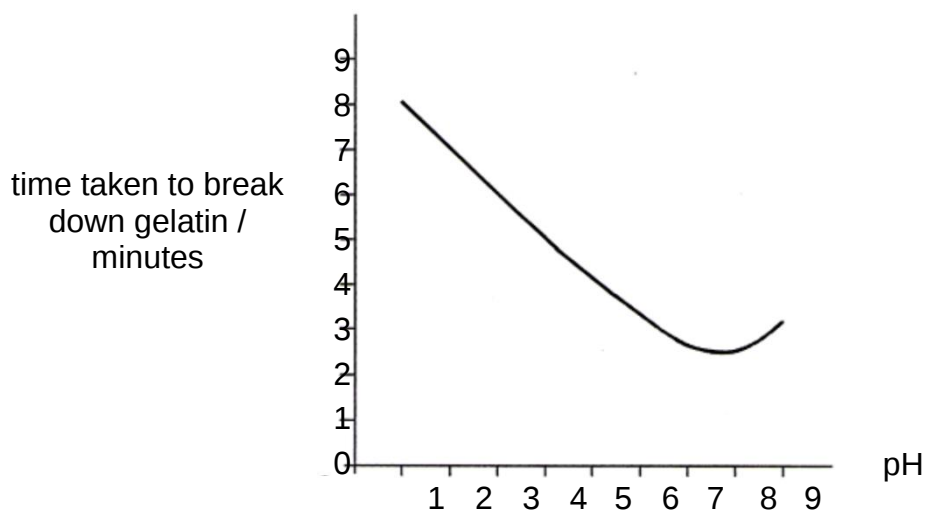
- A** It would take longer for the cell to become turgid.
- B** The cell would become plasmolysed.
- C** The cell would become smaller as water moves out.
- D** The cell would burst as water moves into it.

- 5 The diagram shows an experiment.



Why did the starch suspension change colour?

- A Iodine molecules have diffused in through the membrane.
 - B Iodine molecules have diffused out through the membrane.
 - C Starch molecules have diffused in through the membrane.
 - D Starch molecules have diffused out through the membrane.
- 6 The diagram shows the effect of different pH on the time taken for a protease to digest gelatin (a fibrous protein).



What can be concluded from the graph?

- A The enzyme is denatured at pH 9.
- B The enzyme is inactive at pH 2.
- C The lowest amount of substrate remaining would be at pH 7.5.

D The maximum amount of products formed will be at pH 1.

7 Some processes that occur in the body are listed.

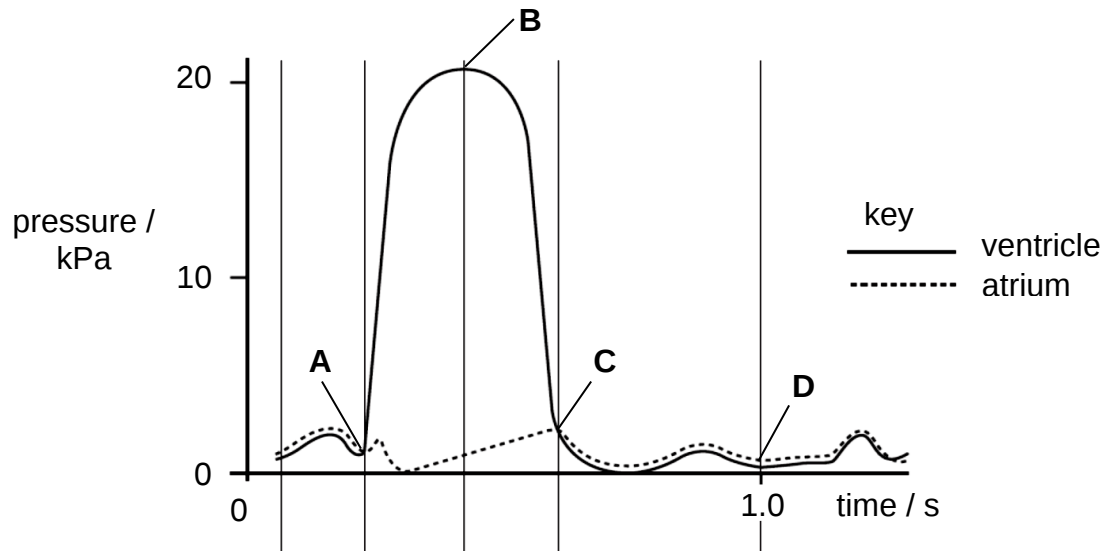
- | | |
|---|-----------------------------------|
| 1 | breakdown of excess amino acids |
| 2 | conversion of glycogen to glucose |
| 3 | digestion of fats |
| 4 | formation of bile |
| 5 | storage of starch |

Which processes occur in the liver?

- A** 1, 2 and 4 only
- B** 1 and 3 only
- C** 2, 4 and 5 only
- D** 4 and 5 only
- 8** Which blood vessel carries the greatest concentration of glucose and amino acids after a meal?
- A** aorta
- B** hepatic portal vein
- C** pulmonary artery
- D** renal artery

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

At which time does the bicuspid valve start to open?



- 10 Which substance in cigarette smoke increases heart rate?

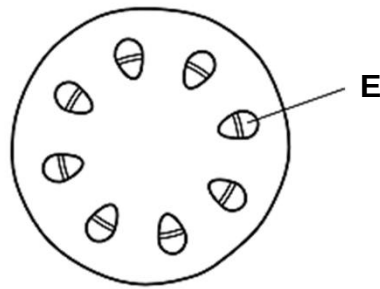
- A carbon monoxide
- B nicotine
- C smoke particles
- D tar

- 11 Which of the following statements are correct?

- 1 Avoid touching eyes, nose and mouth to reduce transmission of pneumococcal disease.
- 2 One of the signs of pneumococcal disease is a fever.
- 3 One of the symptoms of influenza is sore throat.
- 4 Some antibiotics can kill viruses.

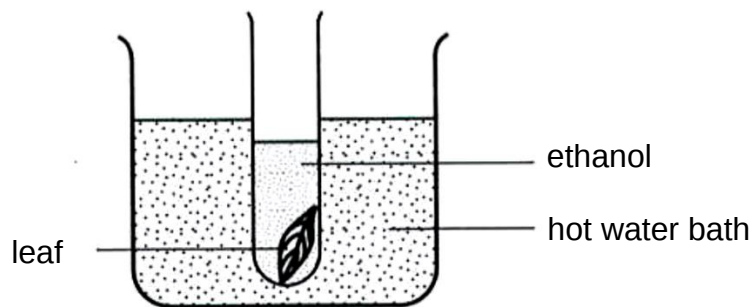
- A 1 and 2 only
- B 2 and 3 only
- C 3 and 4 only
- D 1, 2 and 3 only

- 12** The diagram shows a section through a plant stem.



Which process is responsible for moving substances in region **E**?

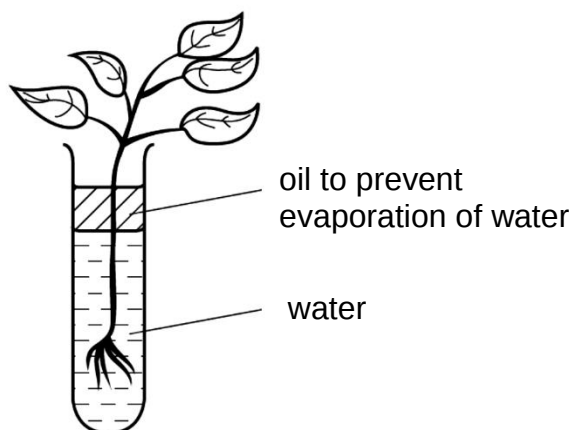
- A** diffusion
 - B** osmosis
 - C** translocation
 - D** transpiration
- 13** The diagram below shows an experiment to test for the presence of starch in a leaf.



What is the purpose of the procedure shown in the diagram?

- A** breakdown the cell wall of the leaf
- B** soften the leaf for iodine test
- C** stain the leaf for viewing under microscope
- D** remove chlorophyll in the leaf

14 Five similar plants are placed in test-tubes as shown.



Some of the plants have their leaves coated with grease to reduce transpiration. Each plant is weighed in its test-tube at the start of the experiment and again two days later. The results are shown in the table below.

	mass / g				
	plant 1	plant 2	plant 3	plant 4	plant 5
start of experiment	105	121	107	111	119
after two days	103	97	84	110	93

Which plants had their leaves coated with grease?

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

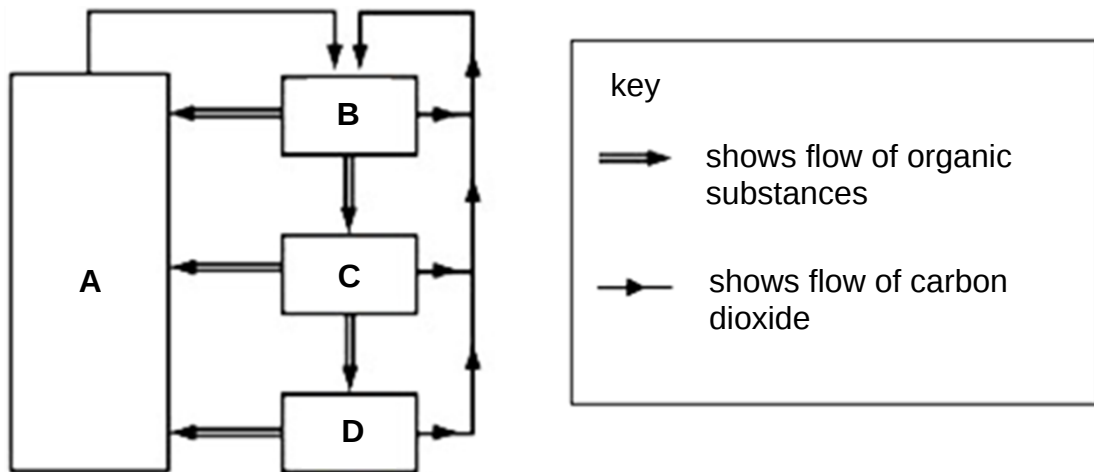
- 15** Mealybugs are small insects that can feed on crops such as mango and coffee. They damage the crops and reduce the yield and profits for farmers. Lacewing insects and ladybird beetles both eat mealybugs.

Which row shows the positions of some of the organisms in this food chain?

	producer	herbivore	carnivore
A	coffee	mealybug	lacewing
B	lacewing	mealybug	coffee
C	mango	ladybird	mealybug
D	mealybug	ladybird	mango

- 16** The diagram represents the flow of substances within a balanced ecosystem. The boxes represent the various trophic levels.

Which box represents herbivores?



17 Which statements below correctly describe the functions carried out only by mRNA?

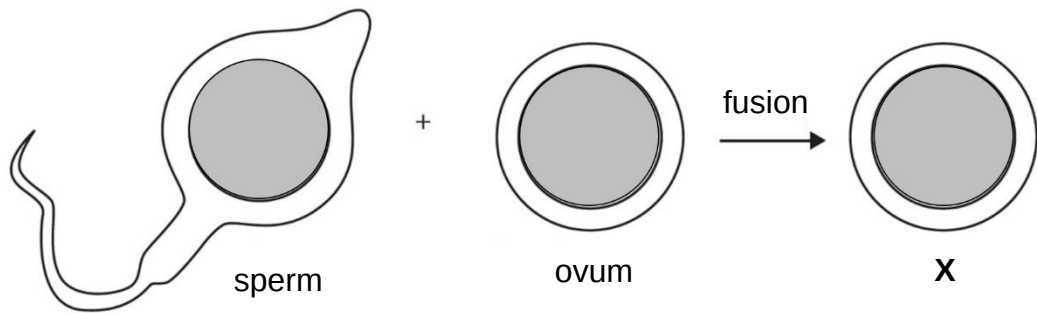
- 1 carry a genetic code sequence out of the nucleus
- 2 carry a genetic code sequence to a ribosome
- 3 carry an amino acid to a ribosome

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

18 Which pair of sex cells will develop into a baby with Down's syndrome?

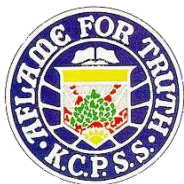
	number of chromosomes in egg	number of chromosomes in sperm
A	23	23
B	24	23
C	24	24
D	47	47

19 Fertilisation and early development in humans are shown.



Identify X?

- A baby
 - B embryo
 - C nucleus
 - D zygote
- 20 Which factor is **least** likely to increase the rate of mutation?
- A exposure to UV radiation
 - B exposure to X-ray radiation
 - C inhaling carbon dioxide
 - D smoking tobacco



KUO CHUAN PRESBYTERIAN SECONDARY SCHOOL

2024 PRELIMINARY EXAMINATION

Secondary 4 Express / 4 Normal Academic (SBB)

NAME

CLASS

REG. NO

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SCIENCE (CHEMISTRY/BIOLOGY)

5088 / 04

Paper 4 Biology

Paper 4: 1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

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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.

.....
Parent's signature/ Date

FOR EXAMINER'S USE	
Section A	
Section B	
Total	

This document consists of **21** printed pages, including the cover page.

Section A

Answer **all** questions.

Write your answer in the spaces provided.

- 1** Fig. 1.1 represents an enzyme and substrate involved in a reaction which takes place in the mouth.

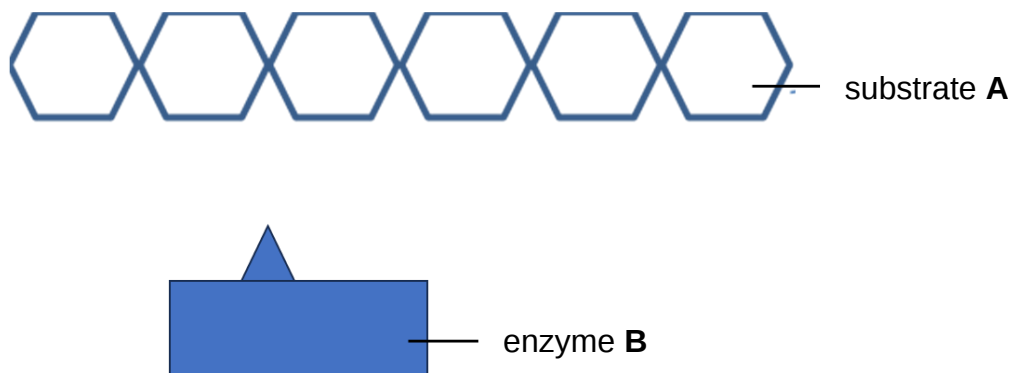


Fig. 1.1

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

A

B [1]

- (b)** In the space below, draw the enzyme-substrate complex and the final products formed during the reaction.

Label your drawing.

enzyme-substrate complex	final product

[2]

- (c) A student carried out the Benedicts' test on a solution of substrate **A** and a solution consisting of the final products drawn in **(b)**.

Predict the observation for the two solutions.

solution of the substrate **A**

solution of final products in **(b)**

[1]

[Total: 4]

- 2 Fig. 2.1 represents what the human alimentary canal would look like if it was removed from a person and straightened out.

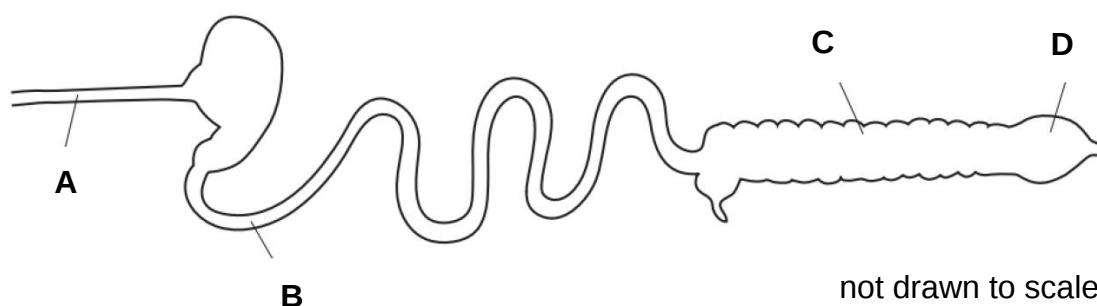


Fig. 2.1

- (a) (i) Identify parts **A** to **D**.

A

B

C

D

[2]

- (ii) Diarrhoea is a condition where a patient has watery stools.

State which part, **A – D**, is likely to be affected in this condition.

..... [1]

- (b) Fig 2.2 shows a person's blood glucose concentration before and after a meal containing carbohydrates is eaten.

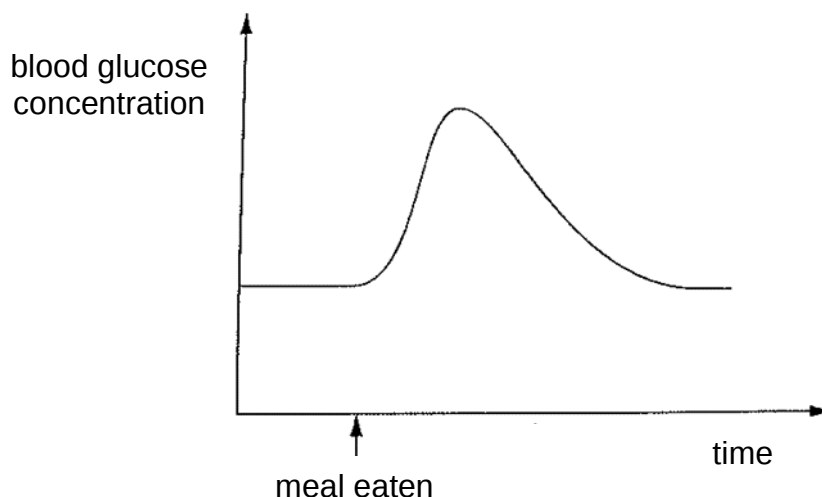


Fig. 2.2

- (i) State **one** function of insulin.

.....
 [1]

- (ii) A person suffering from type 1 diabetes is unable to make insulin. This person normally receives an injection of insulin before a meal.

With reference to Fig. 2.2, predict the shape of the graph if this person did not receive an insulin injection.

.....
 [1]

[Total: 5]

- 3** Fig. 3.1 shows an angiogram of a heart before treatment for coronary heart disease. An angiogram is an image of the blood flow through the blood vessels on the surface of the heart.

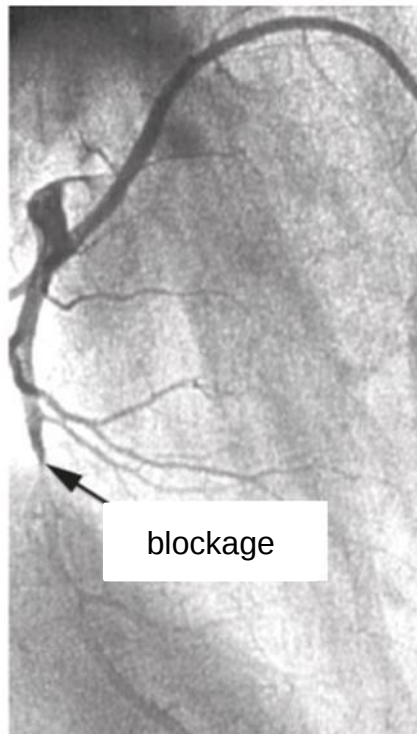


Fig. 3.1

The arrow on Fig. 3.1 shows the position of a blockage in a blood vessel due to a blood clot.

- (a)** State the name of the blocked blood vessel.

..... [1]

- (b)** State one factor, other than diet, that can increase a person's risk of developing coronary heart disease.

..... [1]

(c) Suggest and explain how this blockage in Fig. 3.1 may affect the heart.

.....

.....

.....

.....

.....

.....

.....

.....

[4]

[Total: 6]

- 4 (a) Fig. 4.1 shows a setup with a number of respiring maggots placed in a large test tube. The apparatus was left for 20 minutes and then a drop of coloured liquid was introduced into the capillary tube as shown.

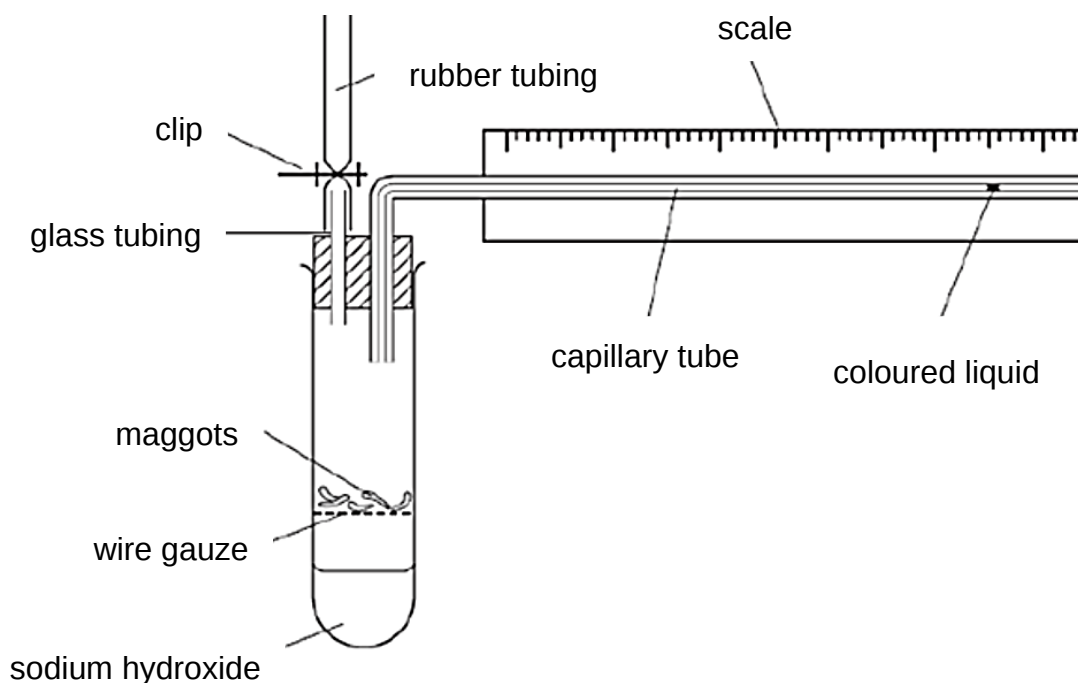


Fig. 4.1

- (i) What is the function of sodium hydroxide in the setup?

..... [1]

- (ii) Explain why the drop of coloured liquid moved towards the boiling tube.

.....

..... [1]

- (b) Humans respire similarly to maggots, but a by-product called lactic acid may be present in the human muscle cells.

Table 4.1 shows the concentration of lactic acid and glycogen in a person's leg muscle. The measurements were made at rest and after vigorous exercise.

Table 4.1

	concentration in leg muscle / arbitrary units	
	at rest	after vigorous exercise
lactic acid	0.9	23.5
glycogen	75.0	22.0

- (i) Explain the decrease in glycogen concentration in the muscle after a vigorous exercise.

.....

.....

.....

..... [2]

- (ii) Explain the increase in lactic acid concentration in the muscle after a vigorous exercise.

.....

.....

.....

..... [2]

[Total: 6]

5 COVID-19 is an infectious disease.

Fig. 5.1 shows the number of new COVID-19 infections in a country between week 11 and week 26 of year 2020.

number of new
COVID-19 infections

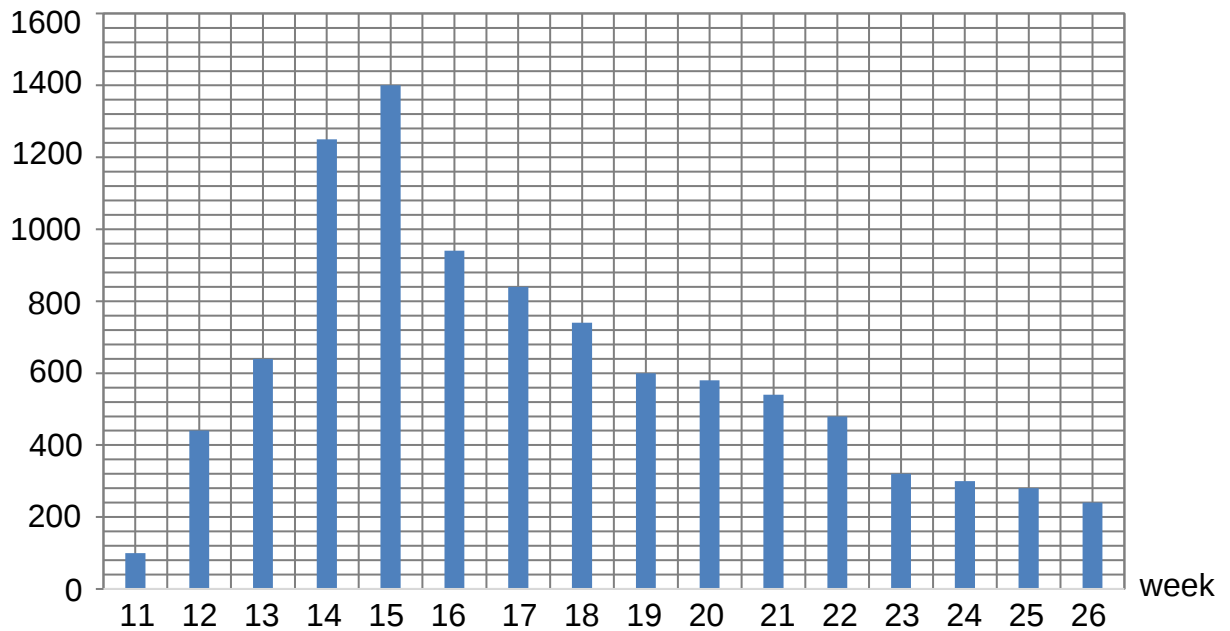


Fig. 5.1

- (a)** (i) Calculate the percentage change in cases between week 15 to week 26.
Show your working and give your answers to three significant figure.

..... % [2]

- (ii)** Vaccine for COVID-19 was introduced in week 15 of year 2020.
Explain how the introduction of vaccines caused the change in **(a)(i)**.

.....

.....

.....

.....

.....

..... [3]

- (b)** State the type of pathogen that causes COVID-19.

..... [1]

[Total: 6]

- 6 Fig 6.1 illustrates the effect of light intensity on the rate of photosynthesis of a species of aquatic plant, at combinations of two different temperatures and carbon dioxide concentrations.

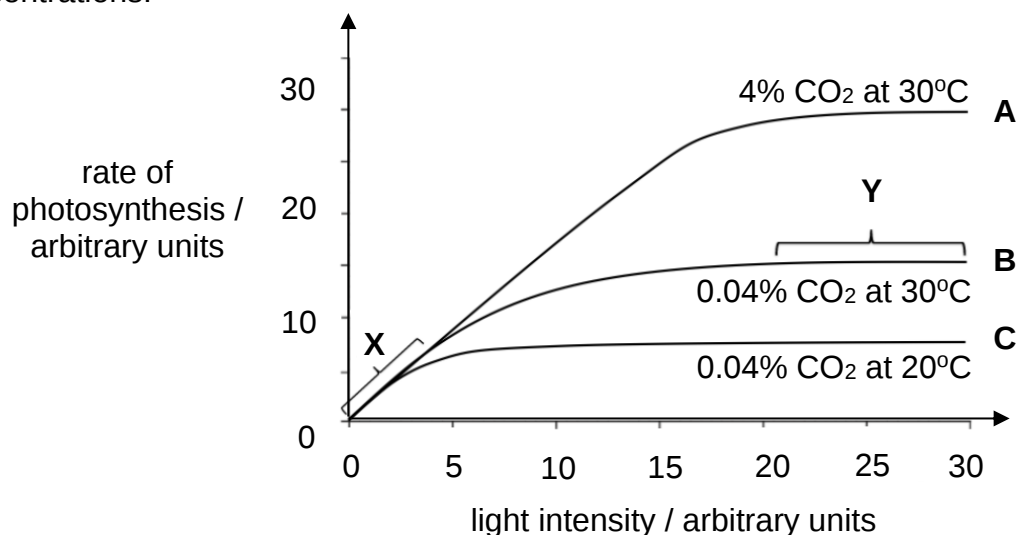


Fig. 6.1

- (a) Write the word equation for photosynthesis.

..... [2]

- (b) State the factor limiting the rate of photosynthesis in region X.

..... [1]

- (c) (i) Using Fig. 6.1, explain why the limiting factor stated in (b) is not the limiting factor in region Y.

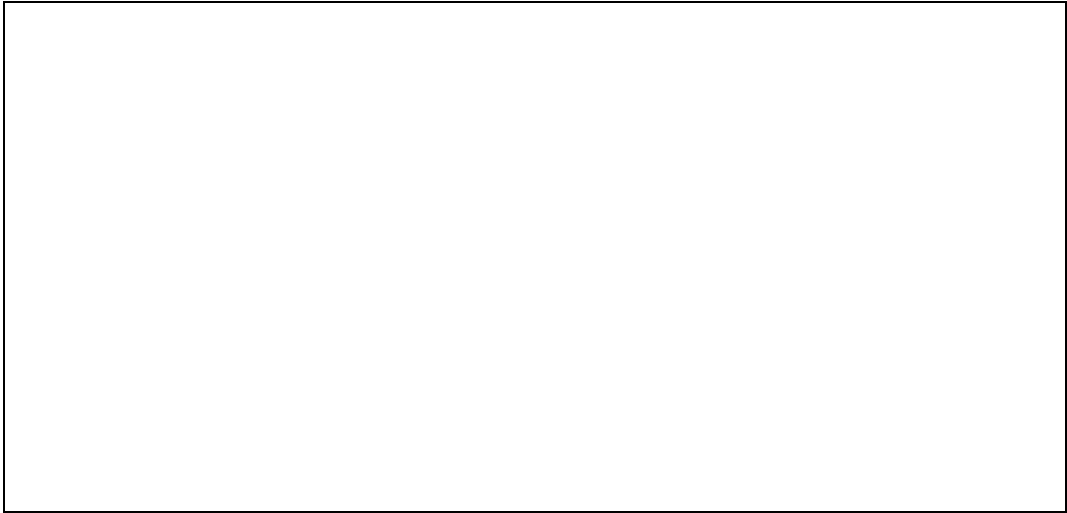
..... [1]

- (ii) Suggest **one** possible limiting factor in region Y.

..... [1]

[Total: 5]

- 7 (a) Draw the structure of one nucleotide of DNA. Label the components.



[2]

Table 7.1 shows the percentages of bases found in a particular virus.

Table 7.1

cytosine (C) / %	adenine (A) / %	thymine (T) / %	guanine (G) / %
21	21	29	29

- (b) Explain whether the genetic material found in the virus is DNA.

.....

.....

.....

.....

.....

.....

[3]

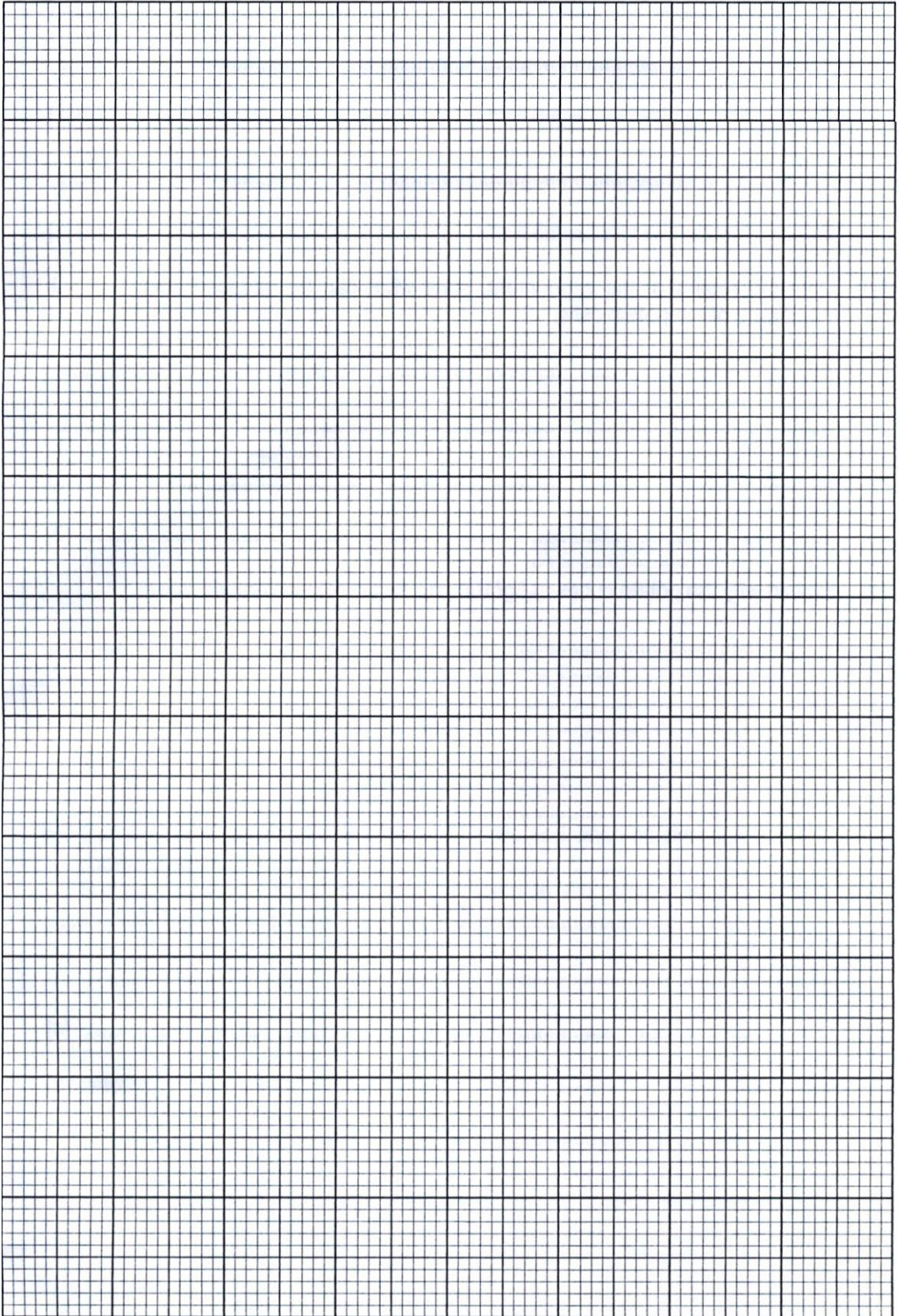
[Total: 5]

- 8 Table 8.1 shows the probability of a woman becoming pregnant during a menstrual cycle.

Table 8.1

day of menstrual cycle	probability of pregnancy / %
0	0
4	2
8	14
12	54
16	30
20	10
24	4
28	2

- (a) Plot these data on the grid provided.



[4]

- (b)** Describe and explain the change in probability of a woman getting pregnant between Day 16 to Day 28.

.....

.....

.....

..... [2]

- (c)** Explain how the concentration of progesterone would be like at day 28, if the woman is pregnant.

.....

.....

.....

..... [2]

[Total: 8]

- 9 Achondroplasia is a genetic bone growth disorder that leads to short-limbed dwarfism. It is caused by a mutation in the fibroblast growth factor receptor 3 gene. The allele causing achondroplasia is dominant.

Fig. 9.1 shows the inheritance of achondroplasia in a family.

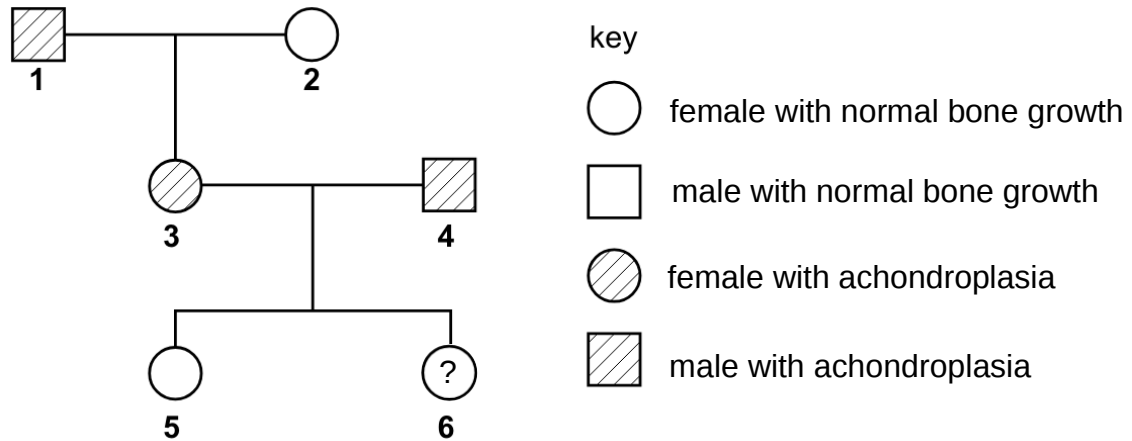


Fig. 9.1

- (a) (i) Explain the meaning of the terms *gene* and *mutation*.

gene

.....

mutation

..... [2]

- (ii) Name **one** other disease caused by a mutation in the structure of a gene.

..... [1]

- (b) Explain if the inheritance of Achondroplasia shows a continuous or discontinuous variation.

.....

.....

.....

..... [2]

(c) The symbols **A** and **a** represent the dominant and recessive alleles respectively.

(i) State the genotype of individual 2.

..... [1]

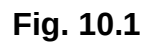
(ii) Complete the genetic diagram to explain the possible phenotypes of individual 6.

genotype of parents	.....	x	.....
gametes	.....	.....	.....
genotypes of children	.....	.....	.....
phenotypes of children	.....	.....	.....

[4]

[Total: 10]

10 Fig. 10.1 shows the internal structure of a leaf.



[5]

- (b) Explain how water passes from the surrounding soil water to the xylem vessels.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (c) State **one** factor that increases the rate of transpiration.

..... [1]

[Total: 10]

11 Below shows a food chain in a woodland.

oak tree → leaf beetle (insects) → blackbirds (birds) → parasitic worms

- (a)** For this food chain, draw labelled diagrams of a pyramid of numbers and a pyramid of biomass.

[5]

- (b) In the recent decades, the expansion of human activities such as agriculture, urban development, and infrastructure projects had led to significant land clearing across the globe. This practice often involves the removal of forests and other vegetation that act as crucial carbon sinks.

(i) State what is meant by the term *carbon sink*.

..... [1]

(ii) Suggest how removal of forests affect the carbon cycle and contribute to climate change.

.....
.....
.....
.....
.....
.....
.....
.....
..... [4]

[Total: 10]

End of Paper

KUO CHUAN PRESBYTERIAN SECONDARY SCHOOL

Sec 4 Express / Sec 4 Normal Academic (SBB)

Biology (5088)

Prelim Examination / 2024

Marking Scheme

Important Note:

1. Mark only answers clearly written in black or blue ink.

Section A – Multiple Choice Questions [20 marks] – Using OTAS

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

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

SECTION A [55 marks]

1	(a)	A: <u>starch</u> B: <u>(salivary) amylase</u> 2 correct for 1 mark.	1
	(b)	1. 1 mark for correct drawing of enzyme-substrate complex and maltose 2. 1 mark for correct labelling of enzyme-substrate complex, amylase and maltose.	2
	(c)	solution with substrate A: <u>remains blue</u> solution with final products: <u>brick-red / orange / yellow / green ppt</u> 2 correct for 1 mark.	1
		Total: 4	

2	(a)(i)	A: oesophagus B: small intestine C: large intestine D: rectum Any 2 – 1m	2
	(a)(ii)	B / C.	1
	(b) (i)	Any 1 point: 1. stimulates the conversion of excess glucose to glycogen in the liver / muscles 2. increased uptake of glucose by cells 3. increase permeability of cell membranes to glucose	1
	(b) (ii)	Blood glucose concentration will remain high for a longer period of time.	1
		Comments:	
		Total: 5	

3	(a)	coronary artery <i>[R: coronary heart artery]</i>	1
	(b)	Any one: high level of <u>stress</u> / <u>smoking</u> / <u>lack of exercise</u> / old age / <u>obesity</u> / genetics <i>Reject: diet high in cholesterol/saturated fats</i>	1
	(c)(i)	<u>1 point for 1m</u> 1. less oxygenated blood and <u>glucose</u> (nutrients) is pumped to heart muscles/tissues <i>[R: heart]</i> 2. less/no aerobic respiration/more anaerobic respiration	1 1 1

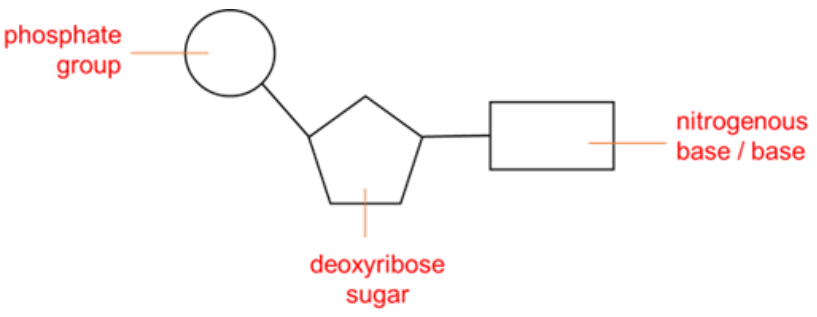
		3. less/no energy released [<i>R: produced</i>] 4. less/no contraction/pump of heart muscle to pump blood (out of aorta)/reduced pressure generated by heart muscle.	1
		Total: 6	

4	(a)(i)	To absorb carbon dioxide gas.	1
	(a)(ii)	Maggots <u>respire</u> , <u>taking in oxygen</u> , thus <u>volume of gas</u> within capillary tube <u>decreases</u> , causing the droplet to move towards the left.	1
		Comments:	
	(b)(i)	1. During vigorous exercise, <u>glycogen is converted to glucose</u> as 2. <u>glucose is needed to be oxidised via</u> respiration to release energy for the muscle cells.	1 1
		Comments:	
	(b)(ii)	1. As muscles did not get enough oxygen to release energy the body needs, <u>anaerobic respiration</u> has occurred. 2. As anaerobic respiration happen, <u>lactic acid, a by-product is produced and accumulated</u> . Hence, the increase in concentration is observed.	1 1
		Total: 6	

5	(a)(i)	Percentage change = (final – initial)/initial x 100% = (240-1400)/1400 x 100% = – 82.9% (3s.f.) Working – 1 mark, Final answer – 1 m (if didn't put (–), no 1m for final answer)	1 1
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	(a)(ii)	<u>Any 1 point 1m</u> 1. Vaccine contains an agent that resembles the pathogen. 2. Vaccines stimulates WBC to produce antibodies. 3. The white blood cells remain in the blood and can produce antibodies to bind to actual virus faster, hence the decrease in the spread rate.	1 1 1
		1.	
	(b)	Virus.	1
		1.	
		Total: 6	

6	(a)	Eqn: carbon dioxide + water → oxygen + glucose Conditions: light and chlorophyll (on arrow)	1 1
	(b)	Light intensity.	1
	(c)(i)	When limiting factor stated in (b) increases after 15 arbitrary units of light, rate of photosynthesis did not increase/ remains constant.	1
	(c)(ii)	carbon dioxide concentration Reject: Temperature/ water/ amount of photosynthetic pigment (chlorophyll)	1
		Total: 5	

7	(a)	 1 mark for correct drawing 1 mark for correct labelling	2
	(b)	1. <u>No</u>, it is not DNA. 2. ratios of <u>adenine to thymine</u> and <u>C:G</u> are <u>not in a 1:1 ratio</u>. 3. This indicates that there is <u>no complementary base-pairing</u>. Hence, it is not DNA.	1 1 1
		Total: 5	

8	(a)	1. [S] Appropriate <u>s</u> cale/reject odd scale – the scale used must allow the graph is occupy at least <u>half</u> of the graph paper	1
		2. [L] Best-fit <u>l</u> ine – use a sharp pencil to draw a smooth line. • This mark is deducted if a messy line is drawn. • Some students also plotted the points but did not draw the graph. • No extrapolation of the line beyond the points.	1
		3. [A] Correct <u>a</u> xes + units - [x-axis: day of menstrual cycle; y-axis: probability of pregnancy/%] – Please consult your teachers if you are not able to identify the X and the Y axis based on the question.	1
		[P] Correct plotting <u>p</u> oints – double-check your points to ensure that you get this easy mark.	1
	(b)	1. The probability of pregnancy decreases from Day 16 to Day 28 as it is the [Quote Date]	1
		2. Infertile period where the egg disintegrate after day 16.	1
		1.	
	(c)	1. progesterone level will remain high;	1
		2. to maintain the thickness of the uterine lining	1
		Total: 8	

9	(a) (i)	Gene is a <u>sequence of DNA nucleotides</u> that <u>controls the formation of a single polypeptide</u> .	1
		Mutation is a <u>change in the sequence of a gene</u> or <u>in the chromosome number</u> .	1
		1.	
	(a) (ii)	Any one: 1. Albinism 2. Sickle cell anaemia	1
	(b)	1. Discontinuous variation.	1
		2. There are <u>no intermediates</u> for the trait/ The <u>phenotypes</u> (traits) are <u>distinct (clear-cut)</u> / <u>not affected by environmental changes</u> (conditions) / controlled by <u>one gene</u> .	1
	(c) (i)	aa	1
	(c) (ii)	Genotype of parents: Aa x Aa	1
		Gametes: A, a, A, a (circle gametes)	1
		Genotypes of children: AA, Aa, Aa, aa	1
		Phenotypes of children: 3 achondroplasia, 1 normal bone growth <i>[R: female / male... as unable to determine from this cross]</i>	1
			Total: 10

10	(a)	1. A (cuticle): <u>transparent</u> to allow <u>light to pass through</u> / <u>waxy cuticle</u> to <u>prevent excessive water loss</u> 2. B (palisade mesophyll): <u>closely packed for maximum absorption of light</u> / highest number of / <u>numerous chloroplasts for maximum (more) absorption of light</u> 3. C (intracellular air spaces): <i>interconnected</i> for <u>rapid gaseous exchange</u> eg carbon dioxide for photosynthesis or oxygen for respiration 4. D (stoma): <i>found in epidermal layer</i> to <u>allow gaseous exchange</u> eg entry of carbon dioxide used in photosynthesis or oxygen for respiration 5. E (chloroplasts): <u>contain chlorophyll to trap (absorbs) light energy</u> for <u>photosynthesis</u> Reject: store or trap carbon dioxide For B and E: needs to state eg of uses of the gases at least once to get full 2 marks	1 1 1 1 1
	(b)	1. Water molecules move <u>from soil to the cell sap of the root hair cell</u> via <u>osmosis</u>. 2. down a water potential gradient. 3. Water molecules <u>move out of the cell sap of root hair cell</u> (down a water potential gradient) to the <u>surrounding cell sap of root cells</u> (via osmosis). 4. The water moves towards the xylem vessels and is <u>pulled up the xylem vessel via transpiration pull</u>.	1 1 1 1

	(c)	Any one: 1. Stronger wind / Higher air movement 2. Higher temperature 3. Higher light intensity / more light 4. Lower humidity	1
		Total: 10	

11	(a)	Pyramid of numbers: - Shape of pyramid - more leaf beetle than oak tree - Shape of pyramid - more parasitic worms than blackbirds - Correct sequence of labelling (lower trophic level at bottom) <pre> graph TD A[Parasitic worms] --- B[black birds] B --- C[leaf beetle] C --- D[oak tree] </pre> Pyramid of biomass: - Correct shape (upright pyramid) - Correct sequence of labelling (lower trophic level at bottom)	1 1 1 1 1
	(b)	Define carbon sink: - an area that stores carbon for a long period of time / stores more carbon than it releases Suggest how deforestation affects carbon cycle: - With less trees, less carbon dioxide is taken in from the environment for photosynthesis	1 1

		2. causing an increase in carbon dioxide concentration in the atmosphere.	1
		3. The cutting of trees can also lead to decomposition of dead trees releases more carbon dioxide into the atmosphere.	1
		4. Carbon dioxide is greenhouse gas and this will lead to global warming.	1
		Total: 10	