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Class	Register Number	Name
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BARTLEY SECONDARY SCHOOL

O-LEVEL PRELIMINARY EXAMINATIONS

BIOLOGY

6093/01

Sec 4 Express

Paper 1 Multiple Choice

23 Sep 2019

1 hour

Candidates answer on the Multiple Choice Answer Sheet.

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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

Write in soft pencil on the Multiple Choice Answer Sheet.

You may use a soft pencil for any diagrams, graphs or rough working.

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

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

Choose the **one** you consider correct and record your choice in soft pencil on the separate Multiple Choice Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

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

At the end of the examination, submit the Multiple Choice Answer Sheet.

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

Set by: LMY

[Turn over

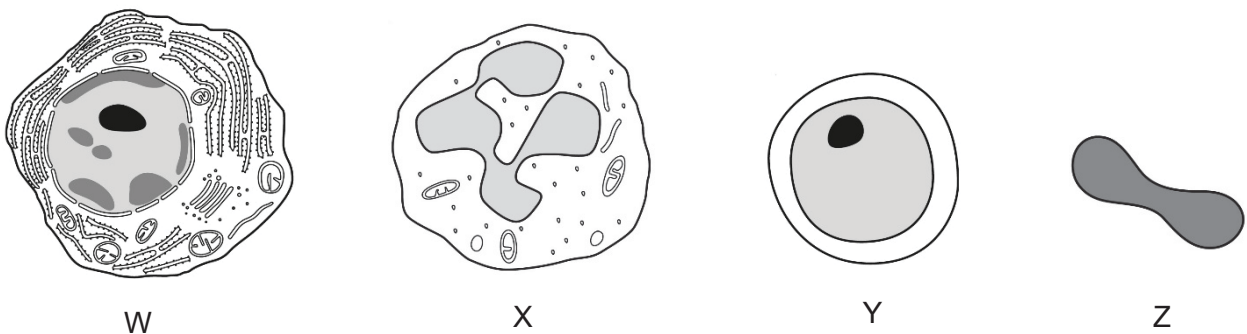
- 1 Specialised cells from the human gut produce lipases.

What are the most likely features of this cell?

- 1 It has less mitochondria than RER.
- 2 It has less RER than SER.
- 3 It has more Golgi bodies compared to a human cheek cell.
- 4 It requires a high supply of amino acids.

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

- 2 The diagram below shows four human cells W, X, Y and Z observed from electron micrographs.

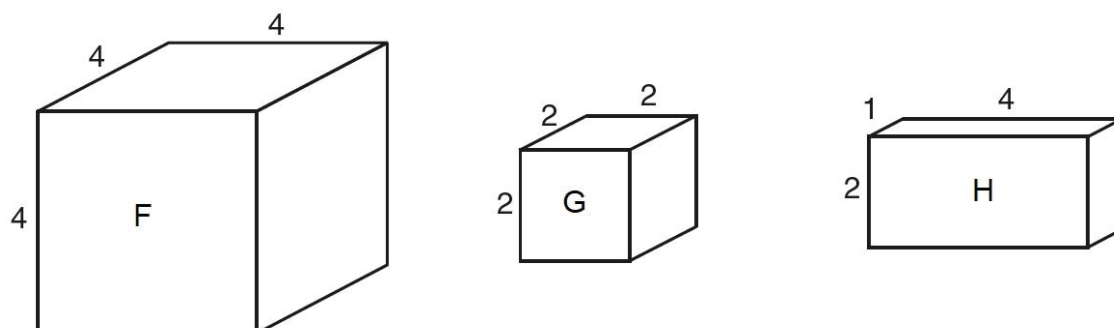


Which row matches the cells to their correct functions?

	carry oxygen	phagocytosis	produce antibodies	secrete enzymes
A	W	Y	X	Z
B	X	W	Z	Y
C	Y	Z	W	X
D	Z	X	Y	W

- 3** An experiment was carried out to investigate the effect of surface area to volume ratio on diffusion.

A block of agar containing sodium hydroxide solution and Universal Indicator solution was cut into three smaller blocks of different sizes, as shown in the diagrams below. All dimensions are in centimetres.

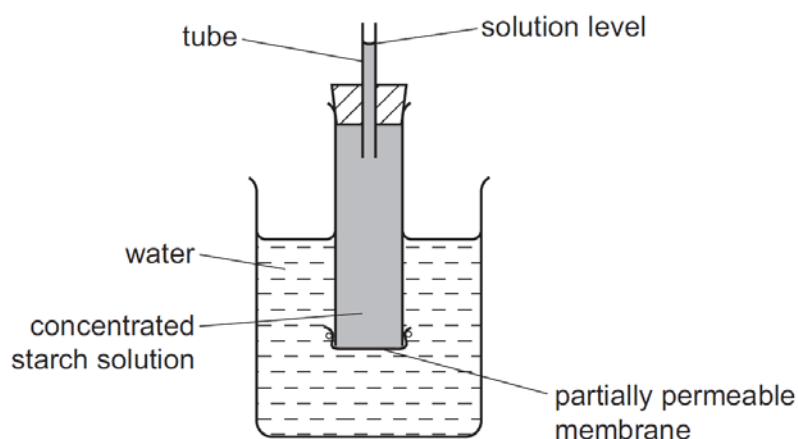


The blocks were placed in a solution of 0.1 mol / dm^3 hydrochloric acid. As the hydrochloric acid diffused into each block, a colour change was observed. The time taken for each block to change its colour completely was recorded.

Which statement is correct?

- A** Although H and G have equal volumes, it will take less time for G to change colour completely.
- B** H will take more time than G to change colour completely, as H has a larger surface area for each unit of volume.
- C** The length, width and breadth of F are double that of G. Compared to G, this halves the surface area to volume ratio and increases the time taken for F to change colour completely.
- D** The smaller the surface area of a block, the longer the time taken to change colour completely.

- 4 The diagram represents apparatus used to investigate osmosis.



Which molecules will move across the partially permeable membrane and which change will occur in the solution level?

	molecules	solution level
A	starch	fall
B	starch	rise
C	water	fall
D	water	rise

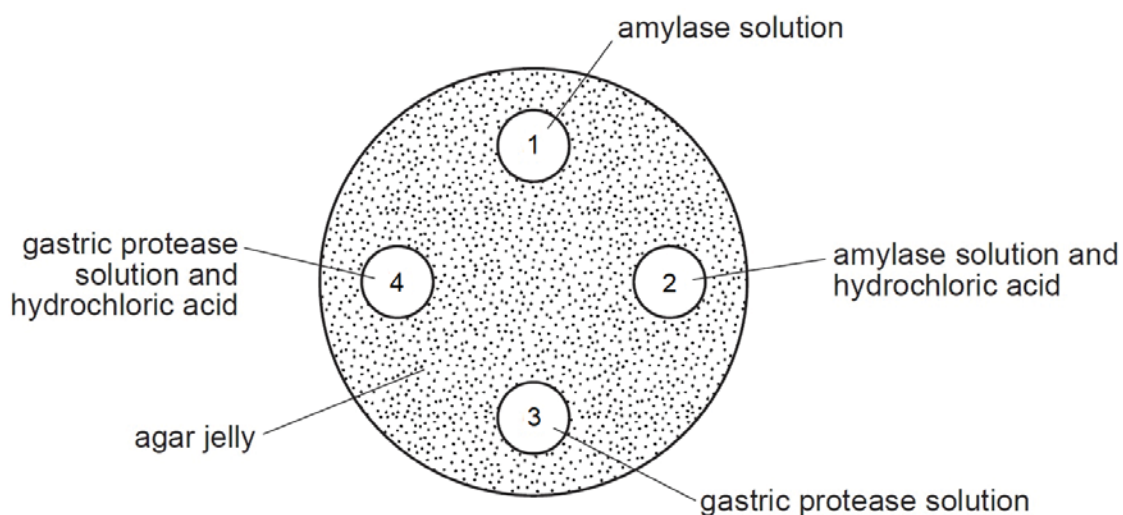
- 5 A mixture of glucose and amylase solution is tested with Benedict's solution, biuret solution and iodine solution.

Which colours are obtained?

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

- 6 A dish is filled with agar jelly containing starch. Four holes are cut in the jelly and each hole is filled as shown.

After 30 minutes, the wells are tested with iodine solution.



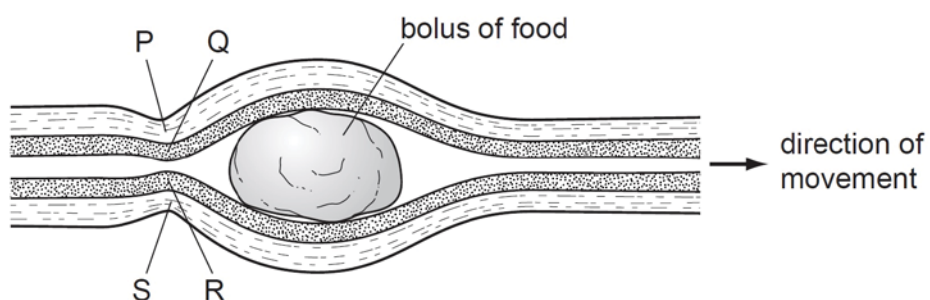
Which statement is correct?

- A All wells will be surrounded by an area of blue-black stain except well 1.
 B Wells 1 and 4 will have the largest area with yellow stain.
 C Well 2 will have a larger area with blue-black stain than well 3.
 D Well 4 will have a larger area with yellow stain than well 3.
- 7 What are the advantages of chewing food at the start of digestion?

	increasing surface area	lubricating food	making food soluble
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✗	✓

key
 ✓ = yes
 ✗ = no

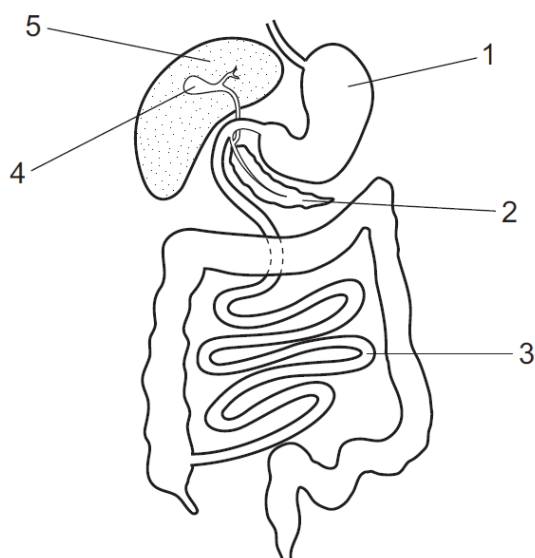
- 8 The diagram shows a bolus of food moving along the oesophagus.



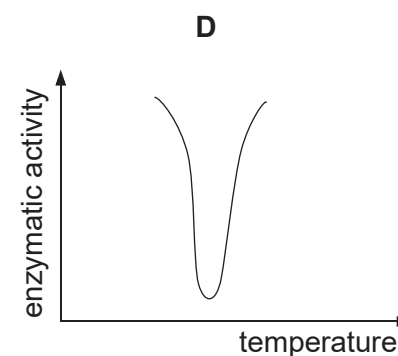
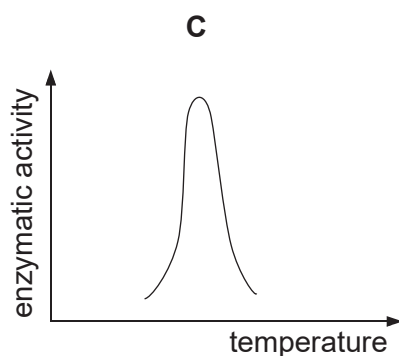
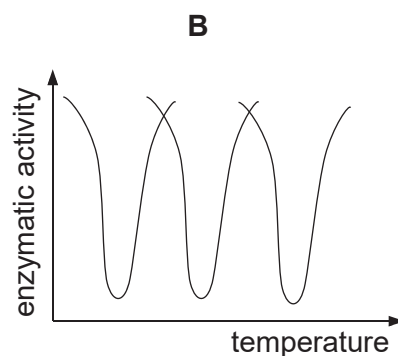
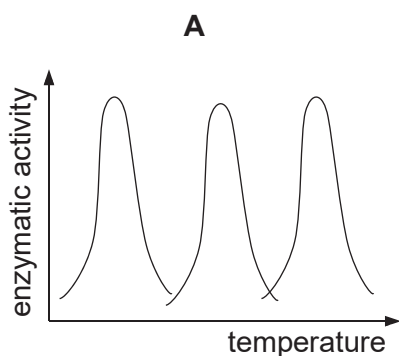
Which row describes the condition of the muscles at P, Q, R and S?

	P	Q	R	S
A	contracted	relaxed	contracted	relaxed
B	contracted	relaxed	relaxed	contracted
C	relaxed	contracted	contracted	relaxed
D	relaxed	contracted	relaxed	contracted

The figure below shows the human digestive system. Study the diagram carefully and answer questions 9 and 10.



- 9 Which graph shows the effect of temperature on the rate of enzymatic activity of the enzymes found in parts 1, 2 and 3?



- 10 Which row matches the functions to the correct structures?

	activate pepsin	produce alkaline secretions	produce bile
A	1	2	5
B	2	3	4
C	3	1	3
D	5	4	2

- 11 Which features apply to both sieve tube elements and xylem vessel elements?

- 1 no cytoplasm
- 2 no end walls
- 3 no nucleus

A 1, 2 and 3

B 1 and 3 only

C 2 only

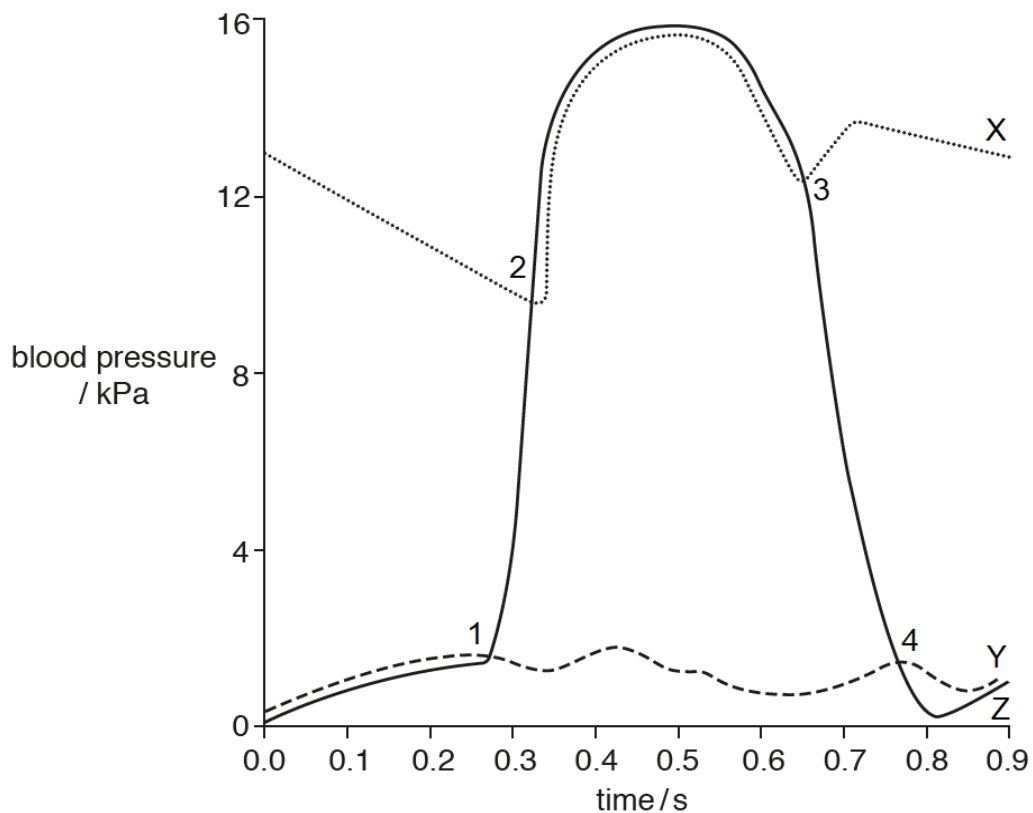
D 3 only

- 12** In which combination of environmental conditions are the stomata of a plant most likely to close?

	atmospheric humidity	soil water potential	wind speed
A	high	low	high
B	high	low	low
C	low	high	high
D	low	low	high

Use the graph below to answer Questions 13 and 14.

The graph shows the pressure changes that occur in the left side of the human heart during the cardiac cycle. Labels 1 to 4 indicate the points at which a valve opens or shuts.



13 Which structures are represented by the pressure curves X, Y and Z ?

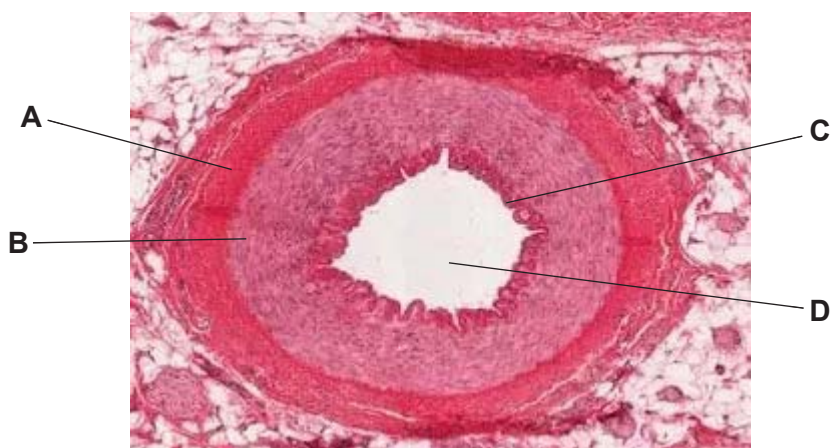
	X	Y	Z
A	aorta	vena cava	left atrium
B	aorta	left atrium	left ventricle
C	left atrium	vena cava	left ventricle
D	left ventricle	left atrium	aorta

14 Which set of labels is correct?

	valves close	valves open	bicuspid valve closes	bicuspid valve opens	semi-lunar valve opens
A	1 and 3	2 and 4	-	-	-
B	1 and 4	2 and 3	-	-	-
C	-	-	1	-	3
D	-	-	3	2	-

15 The photograph shows a cross-section of an artery.

Which labelled part would be of the same thickness in a vein?

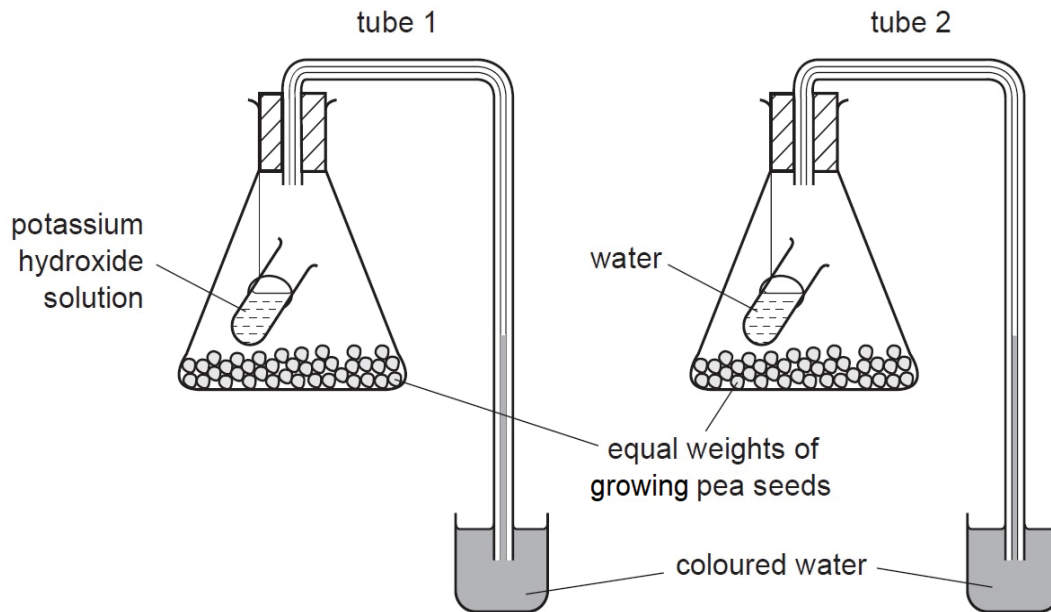


Source: <https://qph.fs.quoracdn.net/main-qimg-edb2174af10d54f34d9d4089951bdcd4.webp>
last accessed August 2019

16 In a muscle, which two substances show net movement from the tissue fluid into the plasma?

- A** carbon dioxide and glucose
- B** carbon dioxide and lactic acid
- C** glucose and oxygen
- D** lactic acid and oxygen

17 An experiment is set up as shown.



After four hours, the coloured water will

- A** be higher in tube 1 than in tube 2.
- B** be higher in tube 2 than in tube 1.
- C** have gone down by the same amount in both tubes.
- D** have gone up by the same amount in both tubes.

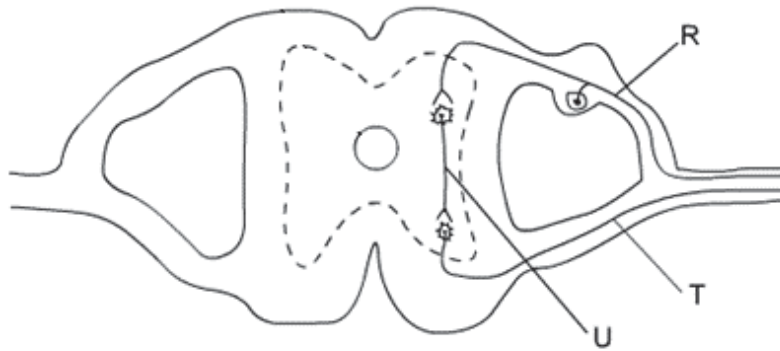
18 In the human breathing system, which features maintain the carbon dioxide gradient between the alveoli and the outside air?

- 1 blood continually pumped to the alveoli
- 2 breathing in and out
- 3 moist alveolar surfaces
- 4 thin alveolar walls

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

- 19** Why is glucose found in the urine of diabetics?
- A** increased uptake and use of glucose by the body cells
 - B** not enough glucose in the blood is converted to glycogen
 - C** stored fats in the body are being oxidised
 - D** too little glucose is absorbed by the Loop of Henle
- 20** Where does most reabsorption of water occur in the kidney in humans?
- A** collecting ducts
 - B** distal convoluted tubules
 - C** loops of Henle
 - D** proximal convoluted tubules
- 21** Which process is not a result of negative feedback?
- A** A decrease in the surrounding temperature leads to a decrease in blood flow through the skin surface.
 - B** A decrease in the surrounding temperature leads to a decrease in respiration rate.
 - C** A decrease in the surrounding temperature leads to a decrease in sweating.
 - D** A decrease in the surrounding temperature leads to shivering.

22 The diagram below shows a transverse section of the spinal cord with spinal nerves.



Nerve impulses in neurones can travel in the following directions.

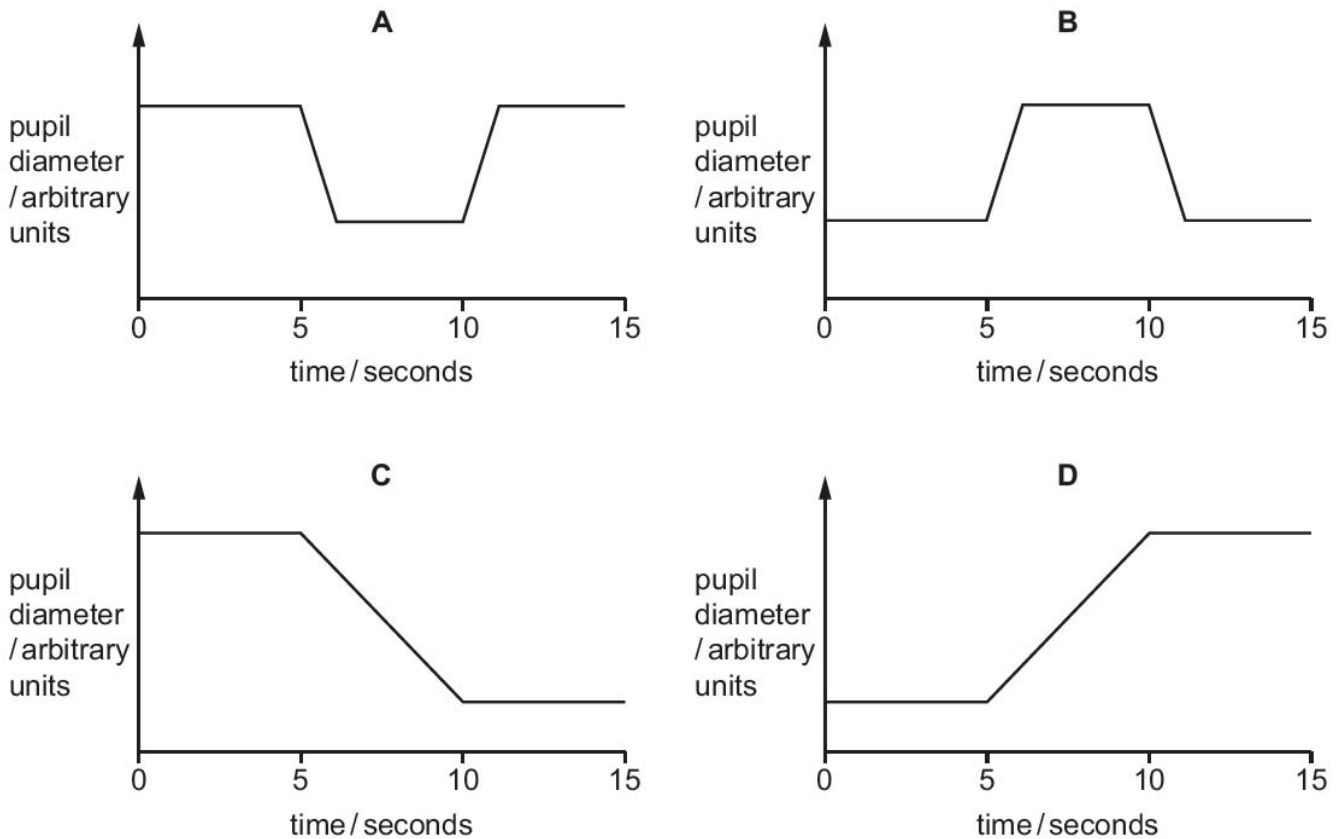
- 1 away from the central nervous system
- 2 towards the central nervous system
- 3 within the central nervous system

In which direction do impulses in neurones R, T and U travel?

	R	T	U
A	1	2	3
B	1	3	2
C	2	3	1
D	2	1	3

- 23** A person is sitting in a darkened room. After five seconds, a light is turned on. Five seconds after that, the light is turned off again.

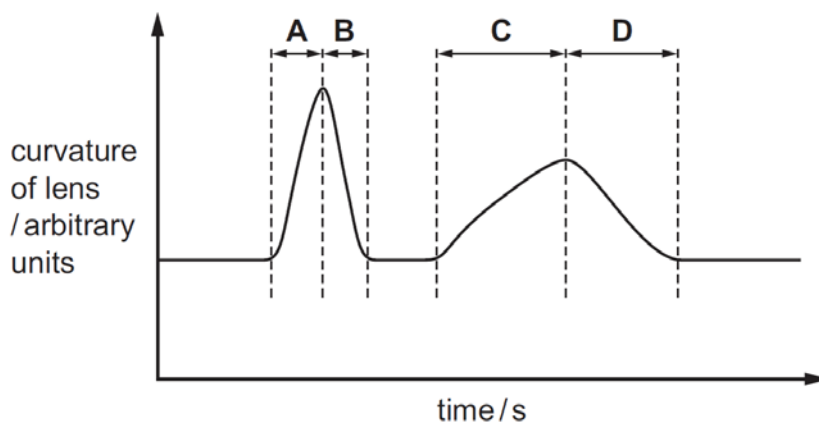
Which graph shows the changes in the diameters of the pupils?



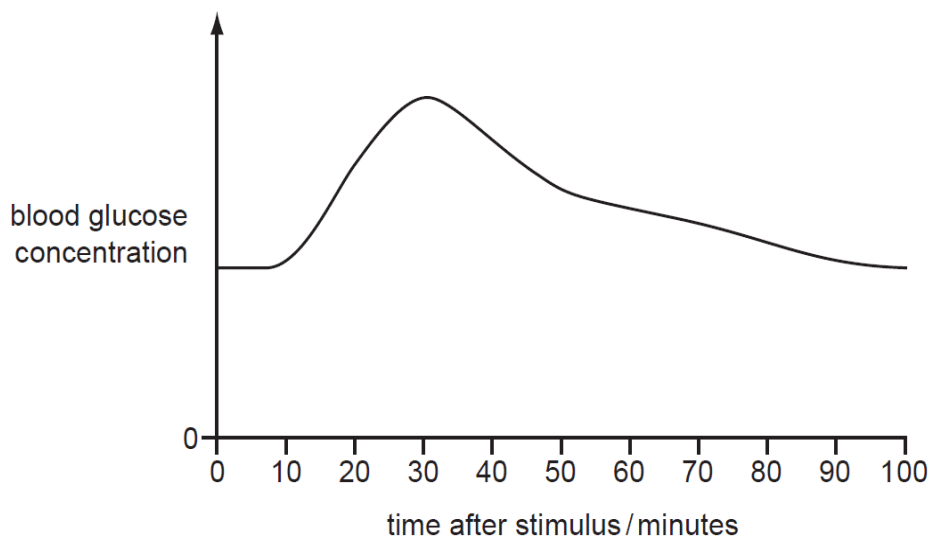
- 24** The diagram shows the curvature of the lens in a person's eye.

The shape of the lens changes as the person watches two motorbikes go past at different speeds.

During which period was a motorbike moving towards the person at the higher speed?



- 25** The graph shows changes in blood glucose concentration when a body responds to an external stimulus.



A student considers the following hormones.

- 1 adrenaline
- 2 glucagon
- 3 insulin

Which option shows the correct substance(s) responsible for the change in blood glucose concentration in the first 30 minutes?

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

- 26** Some plant species have evolved flowers suited to pollination by certain hawk moths, which are fluid-feeders. These moths have a high energy demand, feed at night and hover in front of the flowers while they feed.

Which flower characteristic is most likely to be possessed by a plant species that is pollinated by these hawk moths?

- A** brightly coloured petals and high pollen production
B flower parts shaped to resemble the female hawk moth
C production of odours during the day that mimic rotting flesh
D white petals with high nectar production

27 The first day of menstrual loss in a woman was 1 February.

Which statements are most likely true?

- 1 Ovulation will occur on 14 February.
- 2 Progesterone levels will spike on 12 February.
- 3 Menstrual loss will cease on 5 February.
- 4 Oestrogen levels will remain high on 28 February.

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

28 Which disease can be cured by antibiotics?

- A** HIV / AIDS
- B** diabetes
- C** emphysema
- D** syphilis

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

	number of chromatids	nuclear envelope present
A	46	no
B	46	yes
C	92	no
D	92	yes

30 Each of the following events takes place during mitosis.

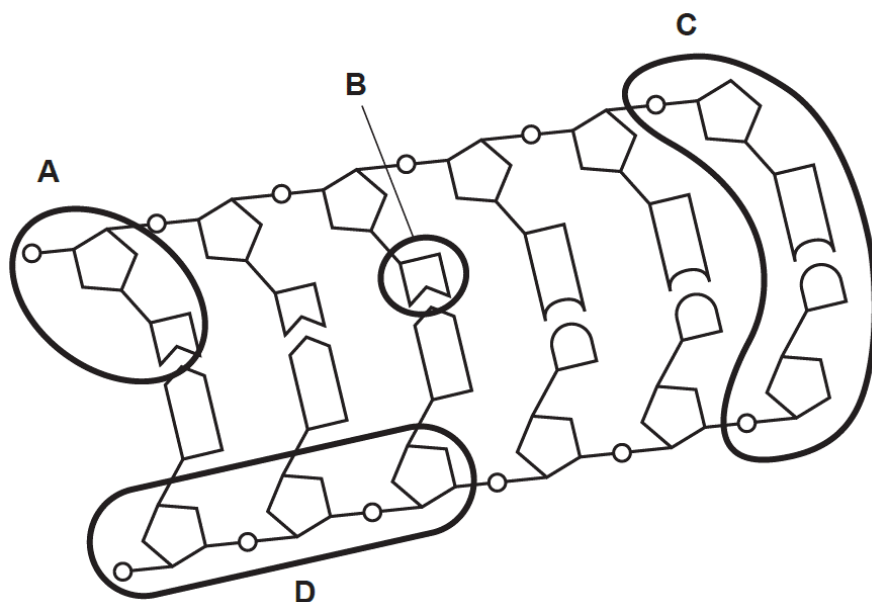
- 1 centromeres divide
- 2 chromatids move to opposite poles of the cell
- 3 chromosomes line up along the equator of the spindle
- 4 chromosomes uncoil
- 5 two chromatids are joined by a centromere

In which order do the events take place?

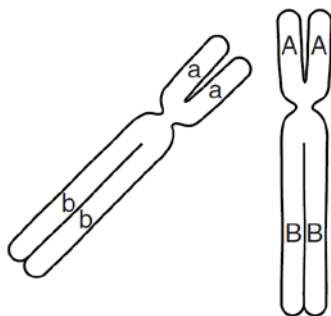
	first → last				
A	1	2	4	5	3
B	3	1	2	4	5
C	4	5	3	1	2
D	5	3	1	2	4

31 The figure shows part of a DNA molecule.

Which part is a nucleotide?



- 32 The diagram shows two homologous chromosomes in early prophase I of meiosis in a human cell. The position of two genes, **A/a** and **B/b**, on the homologous chromosomes are also shown.



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

	anaphase I	prophase II
A		
B		
C		
D		

33 The following statements describe the events that take place during DNA transcription.

Which statements are not correct?

- 1 adenine pairs with thymine
- 2 one DNA polynucleotide chain act as template
- 3 the original DNA molecule is changed after the process
- 4 uracil pairs with adenine

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

34 Which statements about genetic engineering to produce human insulin are correct?

- 1 The human insulin gene is cut out of human DNA.
- 2 The insulin gene is inserted into bacterial DNA.
- 3 The genetically engineered bacteria are cultured in large numbers.
- 4 These cultured bacteria are used in injections for diabetics.

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

35 A number of new plants are growing from pieces of a plant that have become detached and have rooted in soil.

Which statement is correct about these new plants when they mature?

- A** The fruit they produce will all ripen at the same time.
B They will all grow to the same size.
C They will all have the same colour flowers.
D They will all produce the same number of fruit.

36 Which statement is evidence that genes are copied and passed on to the next generation?

- A** Asexual reproduction produces genetically identical offspring.
B Different alleles of a gene can produce variation in phenotype.
C Each species of a plant or animal has a fixed number of chromosomes.
D Sexual reproduction produces genetically different offspring.

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

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

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

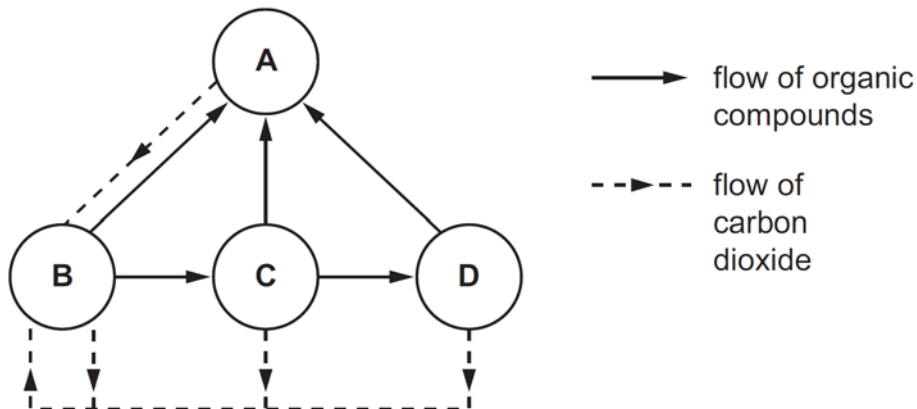
What ratio is expected in the F_2 generation and what ratio has been obtained?

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

- 38** The diagram shows the flow of substances within an ecosystem.

The circles represent trophic levels.

Which circle represents herbivores?



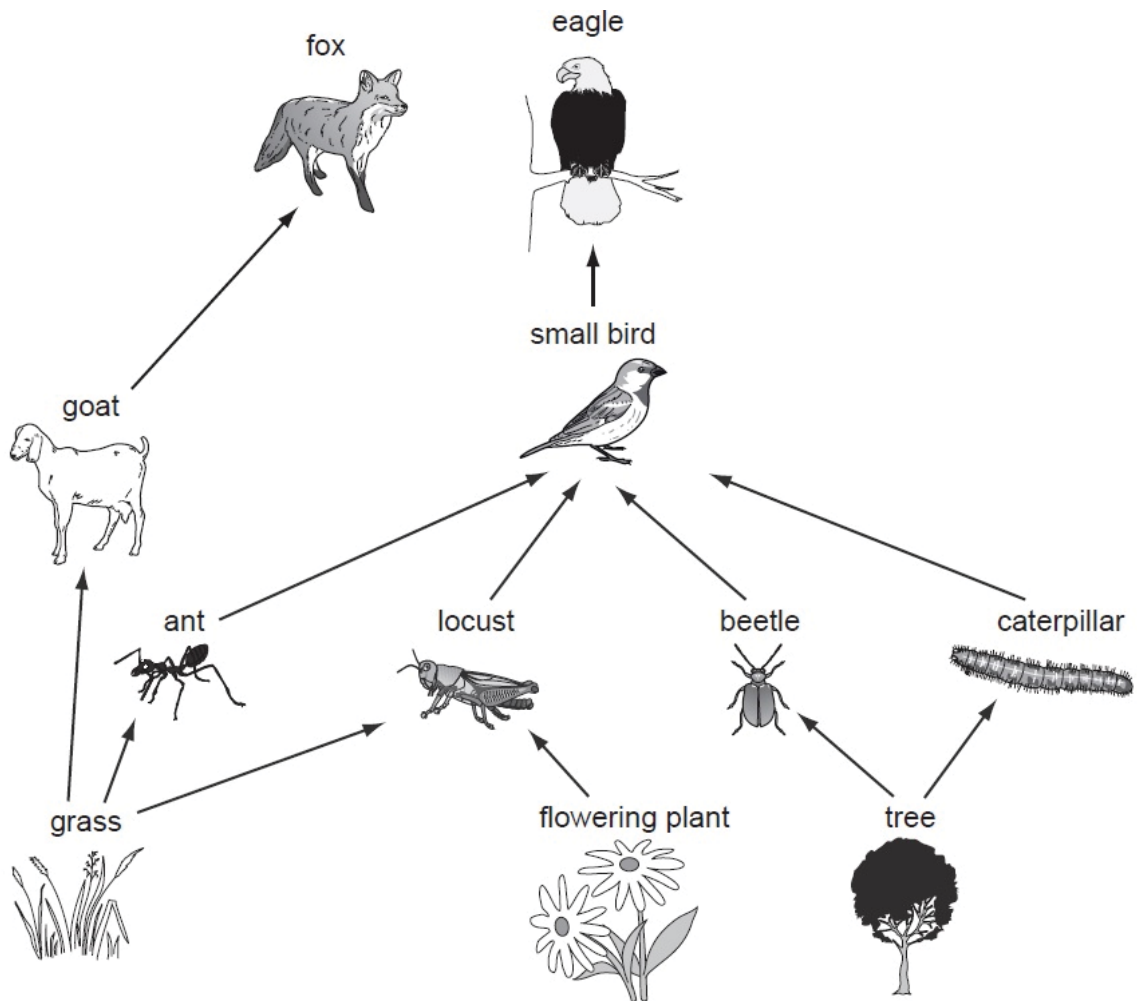
- 39** The diagram shows a food chain.

mahogany tree → caterpillar → songbird → hawk

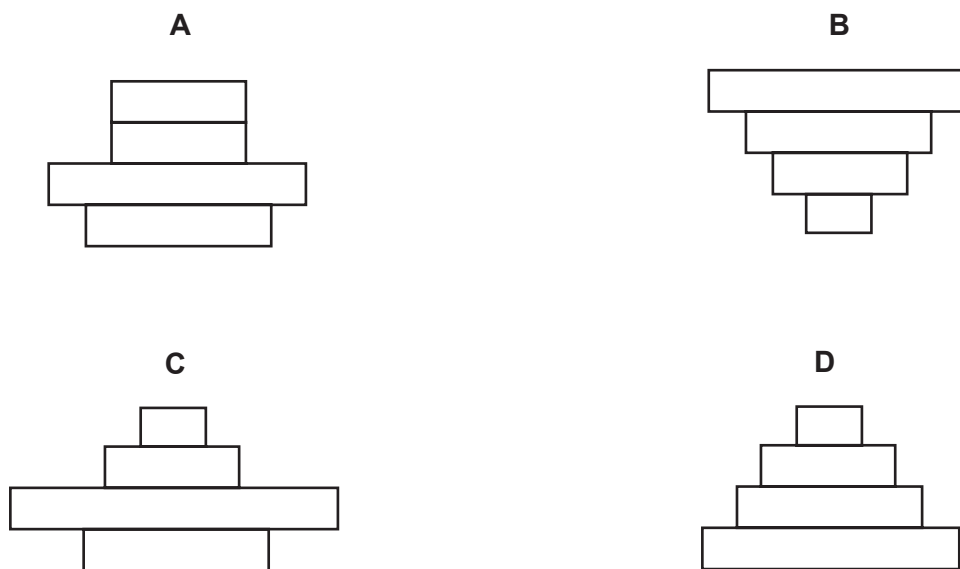
What is not recycled from the hawk to the mahogany tree?

- A** carbon dioxide
- B** energy
- C** nitrogen atoms
- D** water

40 The diagram shows part of a food web.



Which diagram shows the pyramid of biomass for this food web?



Class	Register Number	Name
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BARTLEY SECONDARY SCHOOL

O-LEVEL PRELIMINARY EXAMINATIONS

BIOLOGY

6093/02

Sec 4 Express

Paper 2

18 Sep 2019

1 hour 45 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs or rough working.

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

Section A

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

Section B

Answer all **three** questions, the last question is in the form either/or.

Answer all questions in the spaces provided.

At the end of the examination, fasten all your work securely together.

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

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

This document consists of **19** printed pages and **1** blank page.

Set by: LMY

[Turn over

Section A

Answer **all** questions.

Write your answers in the spaces provided.

- 1 Fig. 1.1 shows cells from a plant tissue which have been mounted on a slide with distilled water and viewed using a microscope.

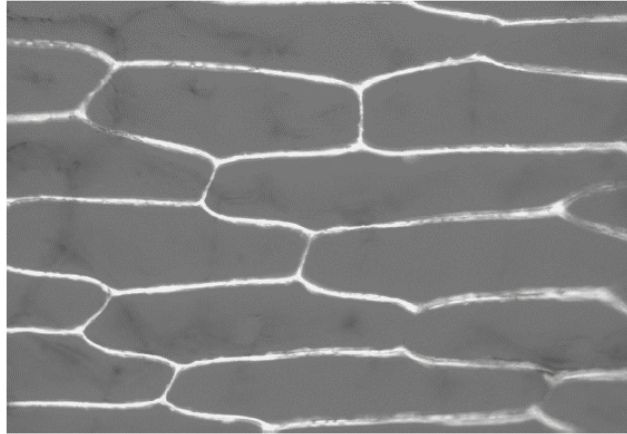


Fig. 1.1

Fig. 1.2 shows cells taken from the same plant tissue when mounted on a slide with concentrated salt solution.

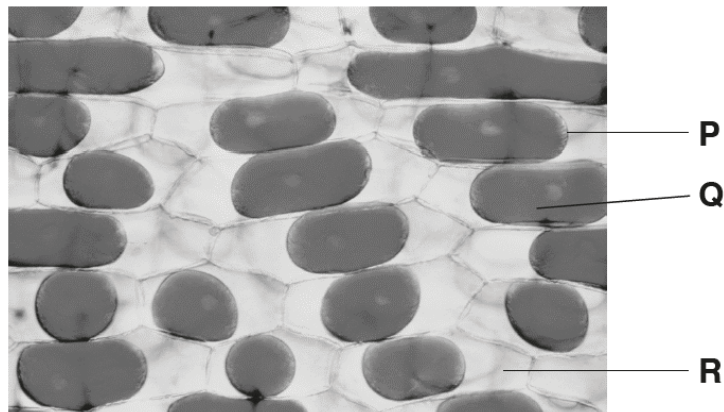


Fig. 1.2

(a) In Fig. 1.2,

- (i) identify structures **P** and **Q**.

P

Q [2]

- (ii) state the contents of location **R**.

..... [1]

- (b) The concentrations of substances in structure **Q** are different from those in location **R**.

Explain how the properties of structure **P** result in differences in concentrations of substances in **Q** and **R**.

.....

.....

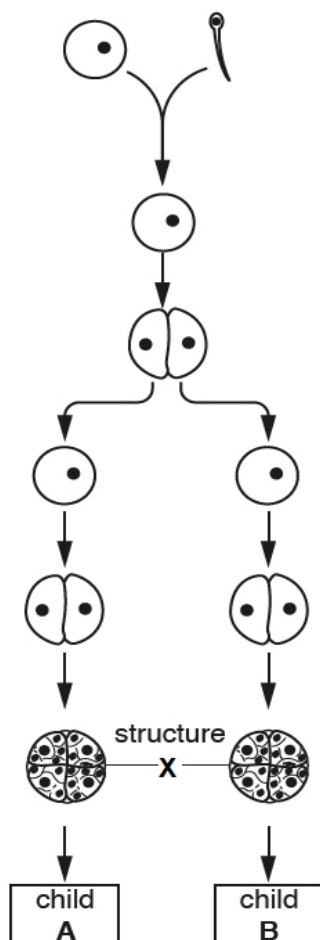
.....

.....

.....[3]

[Total:6]

2 The figure shows stages in the development of human twins.



(a) On the figure, label and name each of the following:

- a gamete,
- a zygote.

[2]

(b) Name the part of the female reproductive system that structure X enters.

.....[1]

(c) If the sex chromosome in the sperm is a Y chromosome, and in the ovum (egg) is an X chromosome, state the sex of child A and of child B. Explain your answer.

child A

child B

explanation

.....

.....

.....

.....

[3]

- (d) Explain how a woman's body prevents further ova (eggs) from being released until the end of her pregnancy.

.....

.....

.....

.....

.....[4]

[Total: 10]

- 3 The rate of carbon dioxide uptake at a range of carbon dioxide concentrations by two types of plants, X and Y, were compared at two temperatures using the apparatus shown in Fig. 3.1.

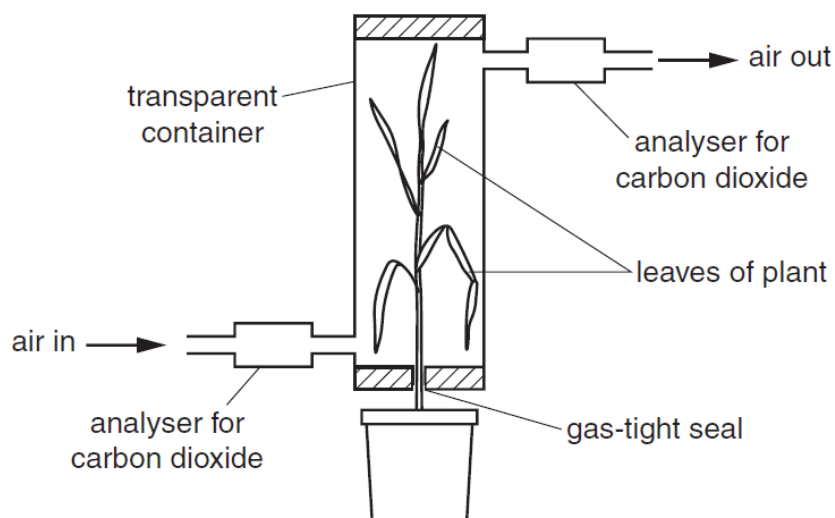


Fig. 3.1

The results of the experiment are presented in Fig. 3.2.

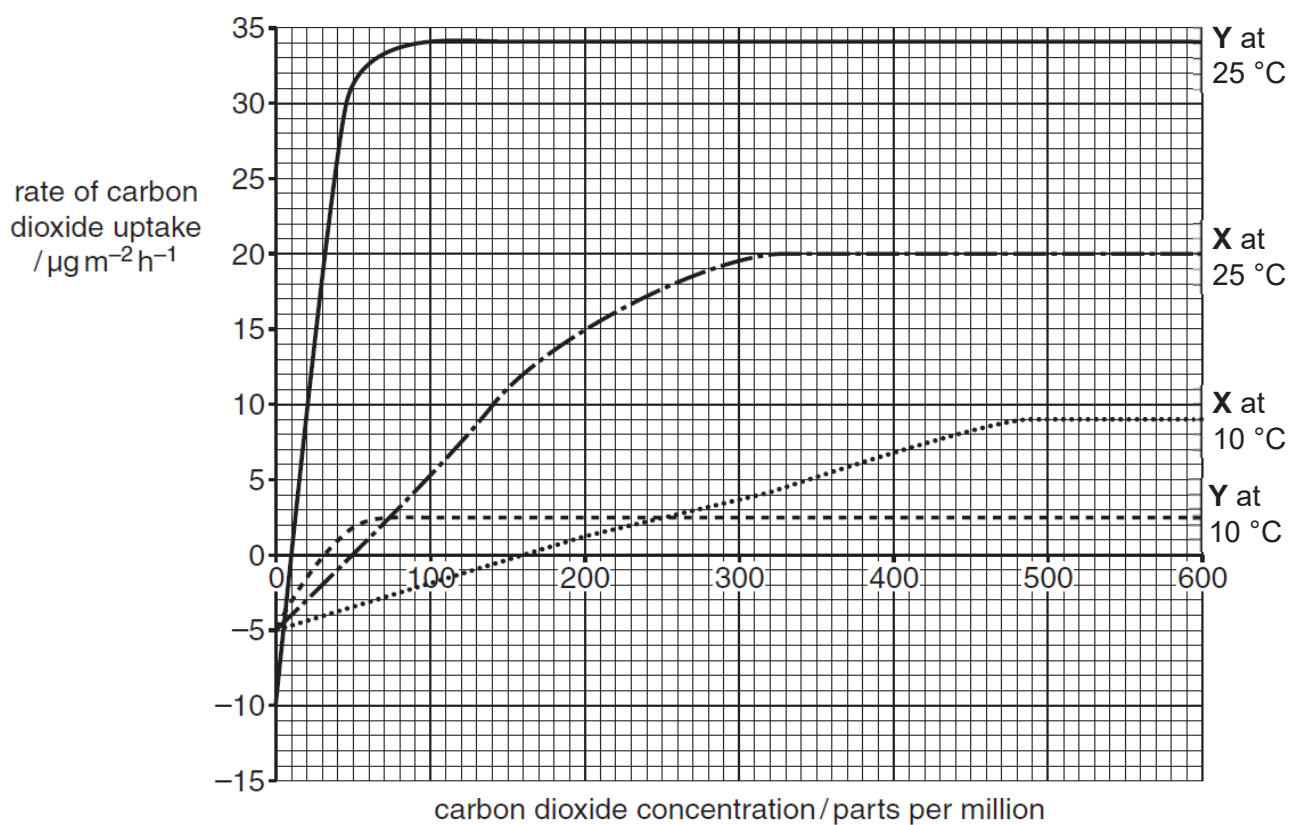


Fig. 3.2

(a) With reference to Fig. 3.2,

(i) give three conclusions for the results of the experiment.

- 1
-
-
- 2
-
-
- 3
-
-
- [3]

(ii) for plant Y at 25 °C, state

- the rate of carbon dioxide uptake at atmospheric carbon dioxide concentration.
Atmospheric carbon dioxide concentration is approximately 400 parts per million.
.....[1]
- the concentration of carbon dioxide at which the rates of photosynthesis and
respiration are the same.
.....[1]

(b) Both temperature and carbon dioxide concentrations can be limiting factors of photosynthesis.

With reference to the graph for plant X at 25 °C in Fig. 3.2, explain the term *limiting factor*.

.....

.....

.....

.....

.....[2]

[Total:7]

- 4 The rates of transpiration of plants of two species, **A** and **B**, were measured over a period of seven hours. The results are shown in Fig. 4.1.

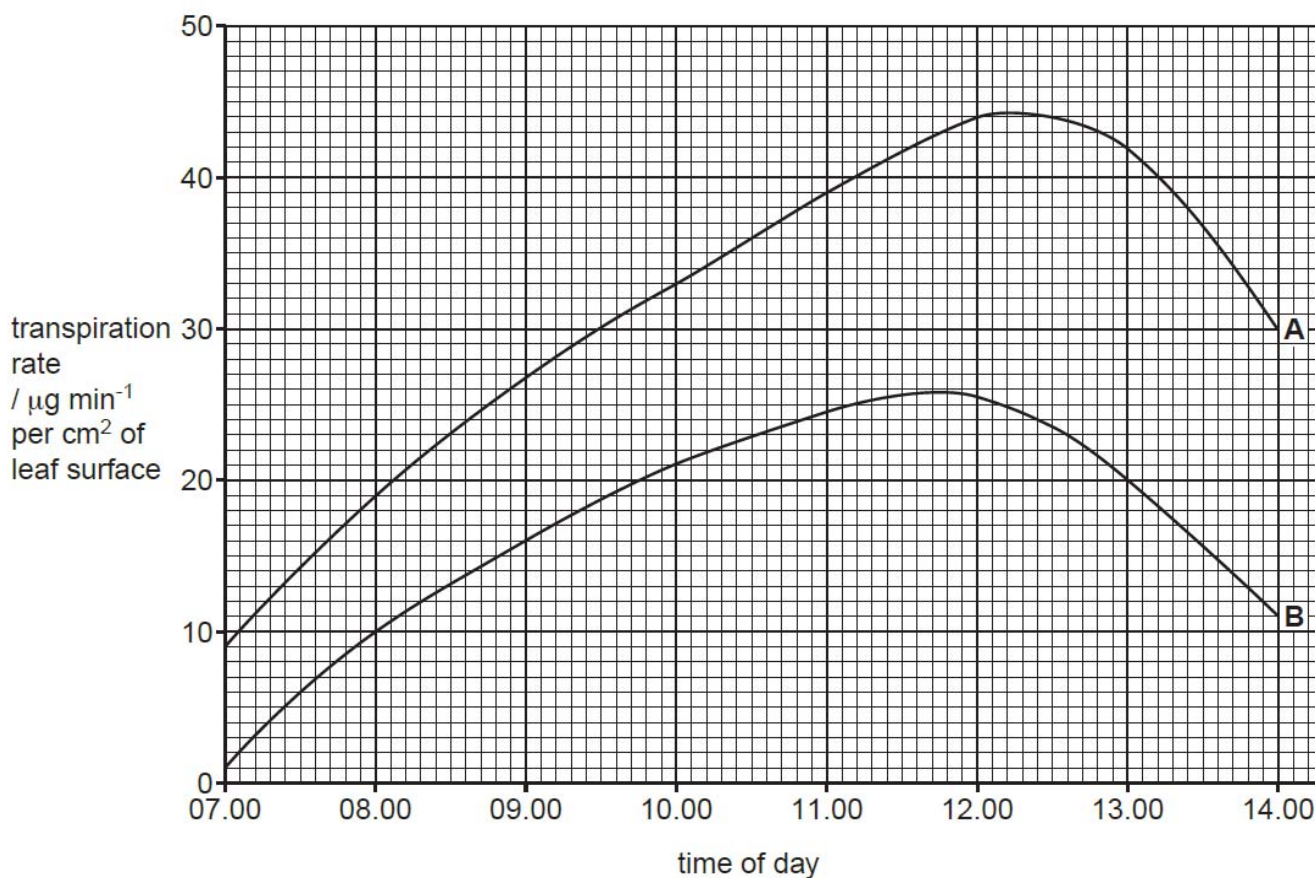


Fig. 4.1

Cacti are plants that grow in desert conditions. Fig. 4.2a shows a type of cactus. Fig. 4.2b shows the surface of the stem of the cactus seen using a microscope.

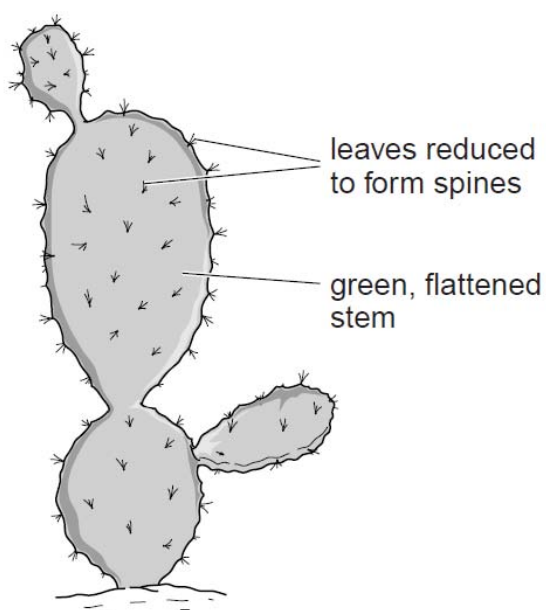


Fig. 4.2a

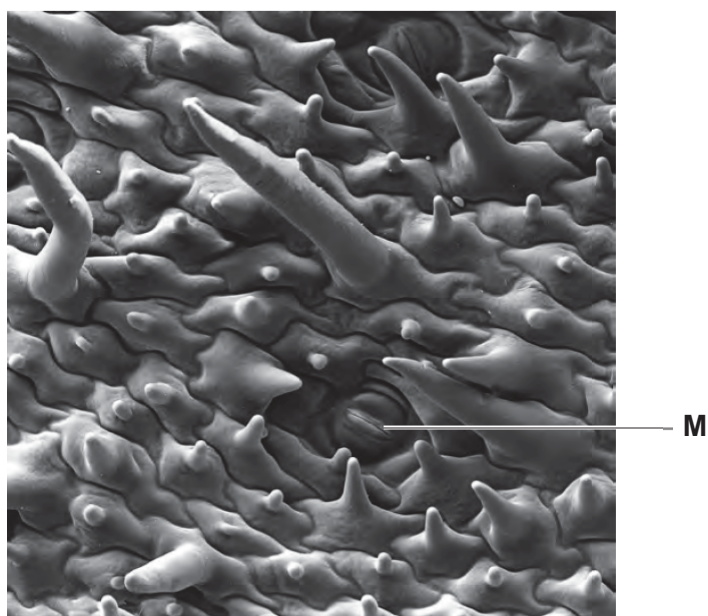


Fig. 4.2b

- (a) With reference to Fig. 4.1, calculate the maximum change in the rate of transpiration for plant **B**.

..... $\mu\text{g} / \text{min} / \text{cm}^2$ leaf surface [1]

- (b) State which plant, **A** or **B**, is likely cactus. Give a reason for your answer.

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

- (c) Suggest why it is advantageous for the cacti to have its leaves reduced to spines.

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

- (d) With reference to Fig. 4.2b,

- (i) name the part labelled **M**,

.....[1]

- (ii) suggest why there are many of these structures on the stems of a cactus.

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

[Total:8]

- 5 Fig. 5.1 shows the structures connected to the human kidney.

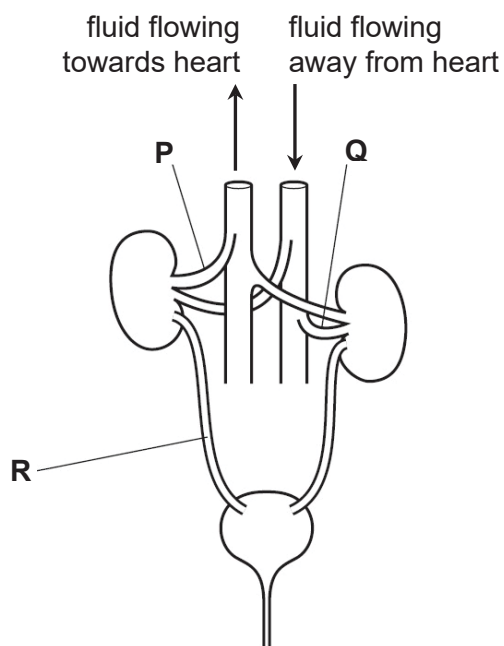


Fig 5.1

Fig. 5.2 shows the apparatus used by a student to compare the amount of urea in three samples of artificial body fluids. The three artificial body fluids are fluids obtained from structures **P**, **Q** and **R**.

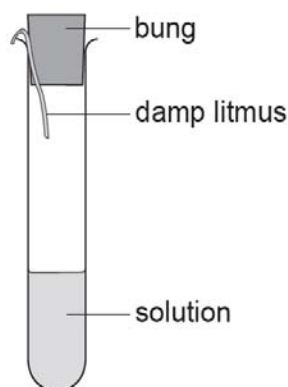


Fig. 5.2

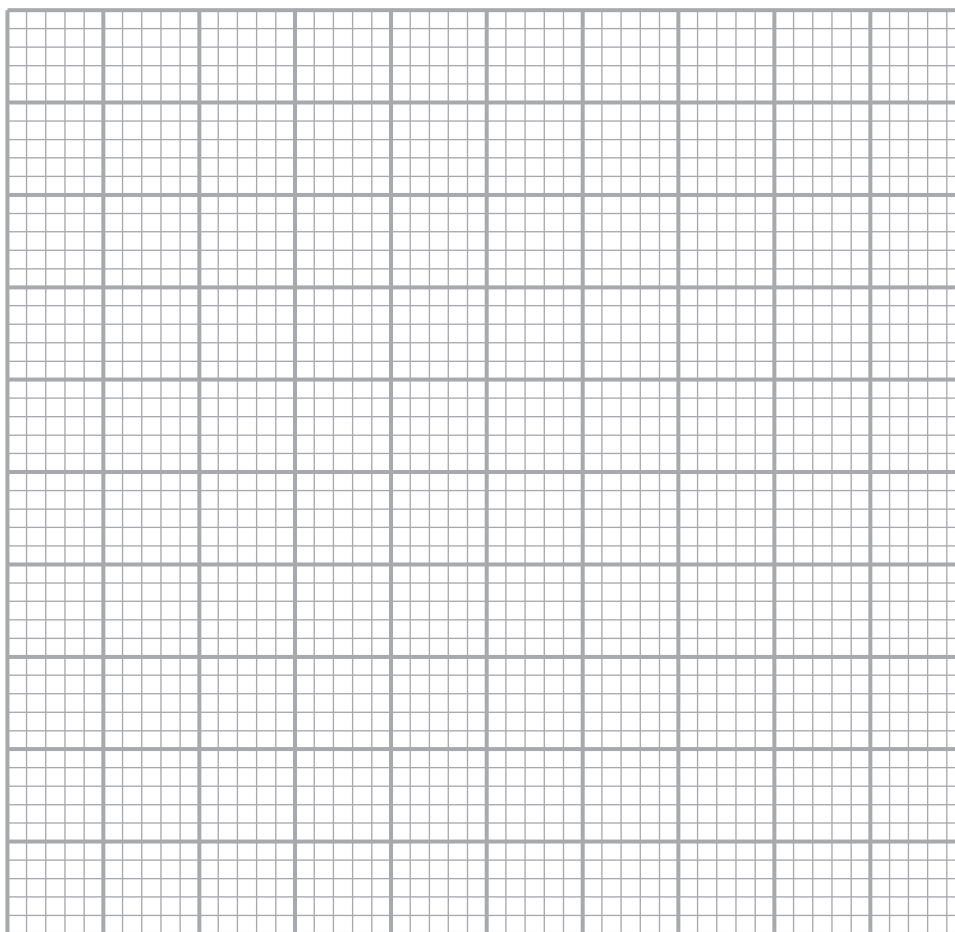
Urease is an enzyme that breaks down urea to produce ammonia. Ammonia turns red litmus paper blue.

The time taken for the litmus paper to begin to change colour is shown in Table 5.1.

Table 5.1

test tube	time taken for litmus to turn blue / min
T1	8
T2	20
T3	1

(a) Construct a bar chart to show the results of the investigation.



[2]

(b) (i) Using the letters **P**, **Q** and **R**, state the structure from which the artificial fluid is obtained for each test tube.

test tube	T1	T2	T3
structure			

[2]

(ii) Describe the function of structure **R**.

.....
[1]

(c) Explain the presence of urea in body fluid **Q**.

.....

[2]

[Total:7]

- 6 (a)** The table shows the mean distance that molecules must travel during gas exchange between air in the lungs and blood in the circulatory system in birds and mammals. This distance is known as the thickness of the blood-gas barrier.

animal	mean thickness of blood-gas barrier / μm
birds	0.2
mammals	0.5

- (i)** A gas that passes through the blood-gas barrier is carbon dioxide.

Explain why the movement of carbon dioxide across the blood-gas barrier is considered to be a form of excretion.

.....

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.....

.....[2]

- (ii)** Explain how the difference in thickness of the blood-gas barrier suggests that movement of a bird by flying requires more energy than movement by a mammal on land.

.....

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.....[3]

- (iii)** In mammals, lactic acid may accumulate in the muscle tissues.

Suggest how the presence of lactic acid indicates an oxygen debt even though the rate of oxygen absorption across the blood-gas barrier is at its maximum.

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.....

.....[3]

- (b) Describe how the relatively low blood pressure in the lungs is brought about by both the structure of the heart and the blood vessels in the lungs.

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.....[4]

[Total:12]

Section B

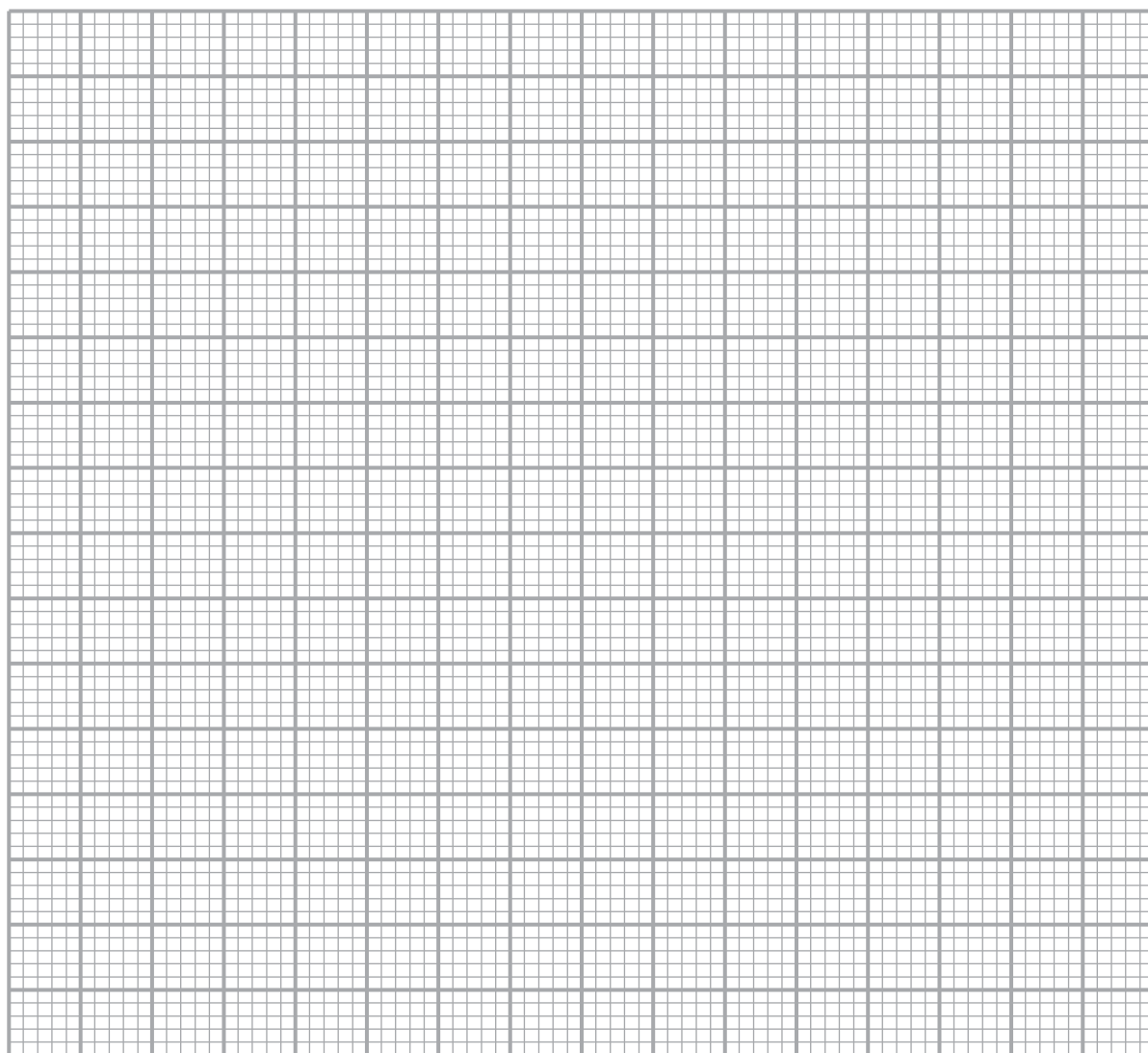
Answer **three** questions.

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

- 7** The table shows the concentration of glucose and insulin in blood plasma before and after a glucose drink. The time at which the glucose drink is taken is recorded as 0 minutes.

time / min	– 60	– 30	0	30	60	90	120	150	180	210	240	270	300
plasma glucose / mmol per dm ³	4.5	4.5	4.5	7.0	7.5	6.5	5.5	5.0	4.8	3.8	3.5	4.0	4.5
plasma insulin / pmol per dm ³	60	60	60	330	350	260		120	80	50	40	50	50

- (a) (i)** Plot a graph to show how plasma insulin changes with time.



[4]

- (ii) Calculate the rate of change in blood glucose from 60 minutes to 240 minutes after the glucose drink.

[2]

- (iii) Describe the relationship between the changes in blood glucose and the concentration of insulin in the blood plasma.

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

- (iv) Data for the plasma insulin at 120 minutes is missing.

Use your graph to estimate the plasma insulin at 120 minutes. Mark this point on your graph and rewrite the value here.

plasma insulin at 120 minutes = pmol per dm^3 [1]

- (b) Insulin must be excreted from the body after it has carried out its function.

Explain how this is done.

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

[Total: 11]

- 8 The figure shows bacteria growing on the surface of a dish containing nutrient jelly. Paper discs, such as **W** and **X**, were soaked in solutions of different antibiotics and placed on top of the growing bacteria. A clear area on the jelly indicates that bacteria in that area have been killed.



Source: https://en.wikipedia.org/wiki/Antimicrobial_resistance
last accessed August 2019

- (a) Use the information above, and your knowledge of the process of natural selection, to describe and explain the difference in appearance of the jelly surrounding discs **W** and **X**.

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.....[5]

- (b) With reference to the production of one named economically important plant or animal in your answer, describe how the process of artificial selection differs from that of natural selection.

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.....[4]

[Total:9]

-[6]

- [4]

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-[5]

- Describe how insulin is produced from DNA.

.....[5]

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