



**YISHUN SECONDARY SCHOOL**  
*We Seek, We Strive, We Soar*  
**PRELIMINARY EXAMINATION**

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Name : \_\_\_\_\_ Reg. No : \_\_\_\_\_ Class: \_\_\_\_\_

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**SEC 4 EXPRESS**

**Date: 17 September 2020**

**BIOLOGY (6093/01)**

**PAPER 1**

**Duration: 1 hour**

**MAX MARKS: 40**

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**READ THESE INSTRUCTIONS FIRST:**

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

Do not use staples, paper clips, highlighters, glue or correction fluid.  
Write your name and register number on the question paper and OTAS.

Answer **all** questions. Shade your answers on the **OTAS** provided with a **2B** pencil.

**INFORMATION FOR CANDIDATES**

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

The total marks for Paper 1 is 40.

You may use a calculator.

Answer in complete sentences.

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This document consists of **23** printed pages including the cover page

**[Turn Over**



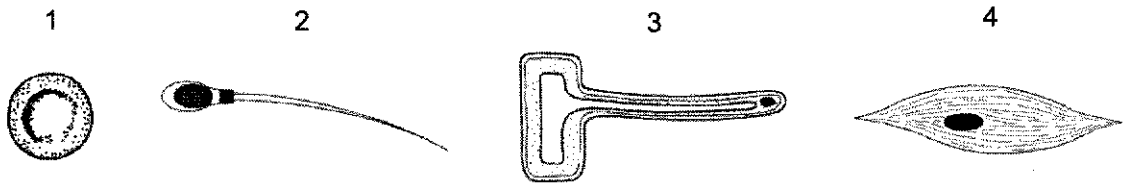
40 marks

Answer all questions in this section.

- 1 Which structures are found in an ovum present in an ovule?

	cell membrane	cell wall	nucleus
<b>A</b>	present	absent	absent
<b>B</b>	present	absent	present
<b>C</b>	present	present	present
<b>D</b>	absent	present	present

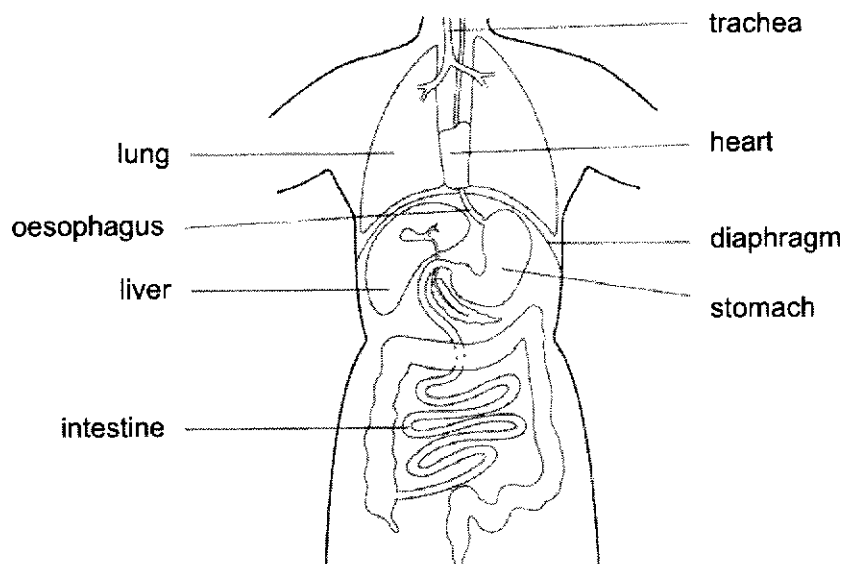
- 2 The diagrams show four different cells (not drawn to scale).



Which cells provide a large surface area to volume ratio for absorption?

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

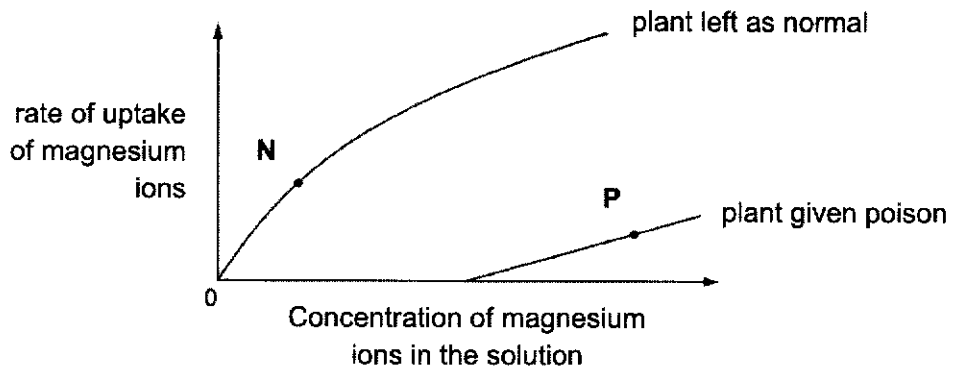
- 3 The diagram shows some of the main organs in the human body.



Which group of organs belongs to the same organ system?

- A diaphragm, oesophagus, trachea
- B heart, liver, lungs
- C heart, stomach, trachea
- D oesophagus, intestine, stomach

- 4 An experiment measured the rate at which plants take up magnesium ions from solution. One plant was given a poison that stops respiration. Another plant was left as normal. The graph shows the results.

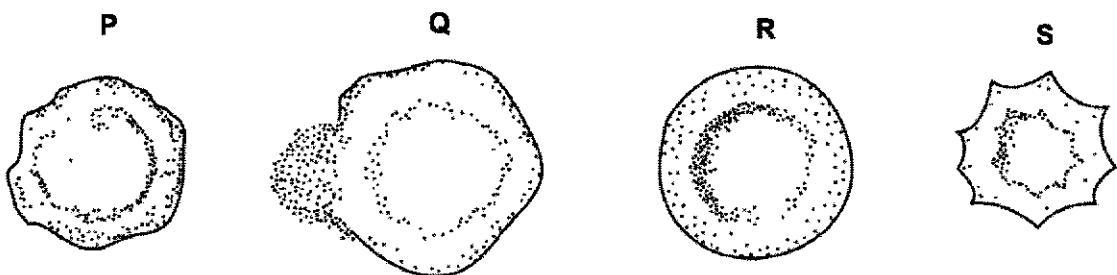


How are the magnesium ions being absorbed by the plants at points N and P?

	point N	point P
A	active transport	active transport
B	active transport	diffusion
C	diffusion	active transport
D	diffusion	diffusion

- 5 Four red blood cells were each placed into four different salt solutions P, Q, R and S.

The diagrams show the appearance of the red blood cells after 30 minutes.

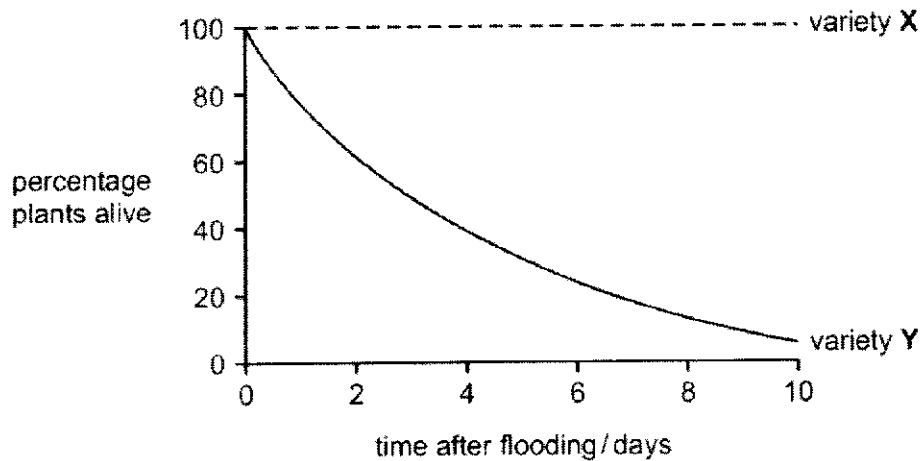


Which solution will cause a **plant cell** to become turgid after placing in it for 30 minutes?

- A P
- B Q
- C R
- D S

- 6 A concentrated salt solution accidentally flooded a field of young rice plants.

The graph shows the effect on two different varieties of rice plants in the field.



What causes the effect shown by the graph?

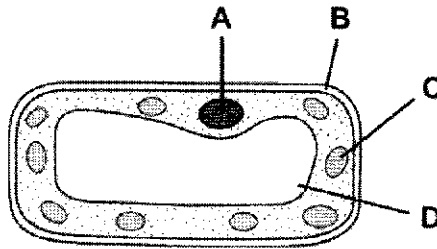
- A Water enters the root cells of X.  
 B Water enters the root cells of Y.  
 C Water leaves the root cells of X.  
 D Water leaves the root cells of Y.
- 7 Cellulose, glycogen, protein and starch are all large molecules made from smaller basic units.

Which basic units form these molecules?

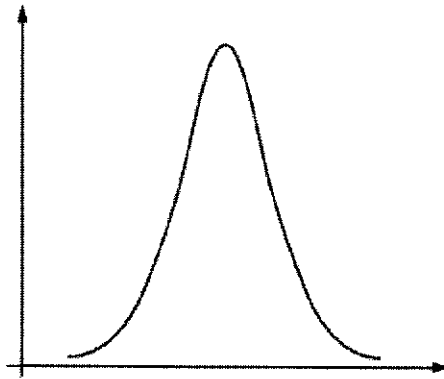
	cellulose	glycogen	protein	starch
<b>A</b>	amino acids	amino acids	maltose	fatty acids
<b>B</b>	fatty acids	fatty acids	glucose	maltose
<b>C</b>	glucose	glucose	amino acids	glucose
<b>D</b>	maltose	maltose	fatty acids	amino acids

- 8 The diagram shows a plant cell.

Which part will stain blue-black with iodine solution?



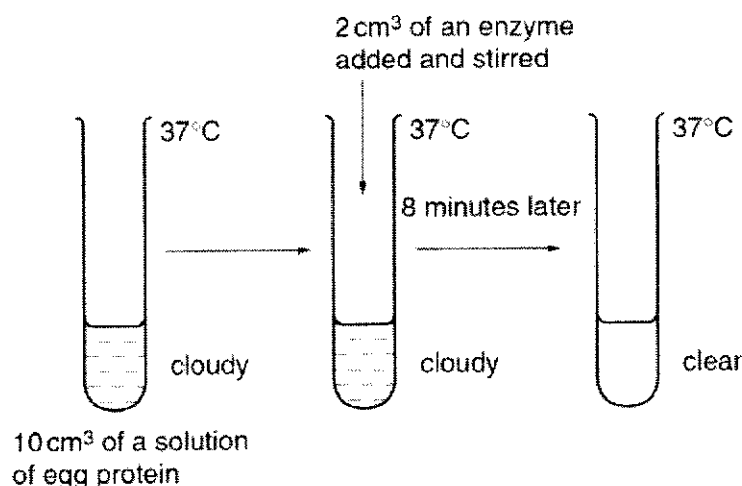
- 9 The graph shows the results of an investigation into enzyme activity.



How should the vertical axis and horizontal axis of the graph be labelled?

	vertical axis	horizontal axis
<b>A</b>	time	temperature
<b>B</b>	time	pH
<b>C</b>	1 / time	temperature
<b>D</b>	1 / time	pH

- 10 The diagram shows an experiment using an enzyme.



The suspension might have become clear more quickly if

- A more egg protein had been used.  
 B the mixture had not been stirred.  
 C the pH of the mixture had been changed.  
 D the temperature had been raised to 75 °C.
- 11 Two samples of a human enzyme were used in an experiment.

Before they were used:

- Sample X was heated to 80 °C and then cooled to 37 °C.
- Sample Y was cooled to 0 °C and then heated to 37 °C.

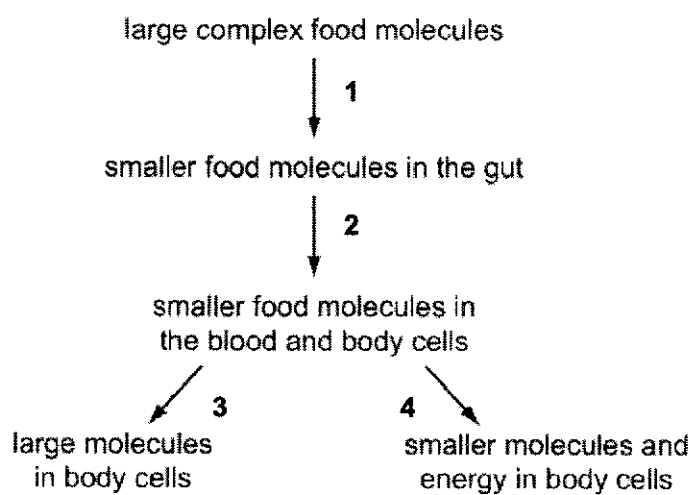
How will this affect their activity?

- A Sample X and Sample Y are no longer active.  
 B Sample X and Sample Y are equally active.  
 C Sample X will be more active than Sample Y.  
 D Sample Y will be more active than Sample X.
- 12 Which substances are stored in the body of a healthy person?

	substance		
	starch	fat	protein
A	yes	yes	no
B	yes	no	yes
C	no	yes	no
D	no	no	yes



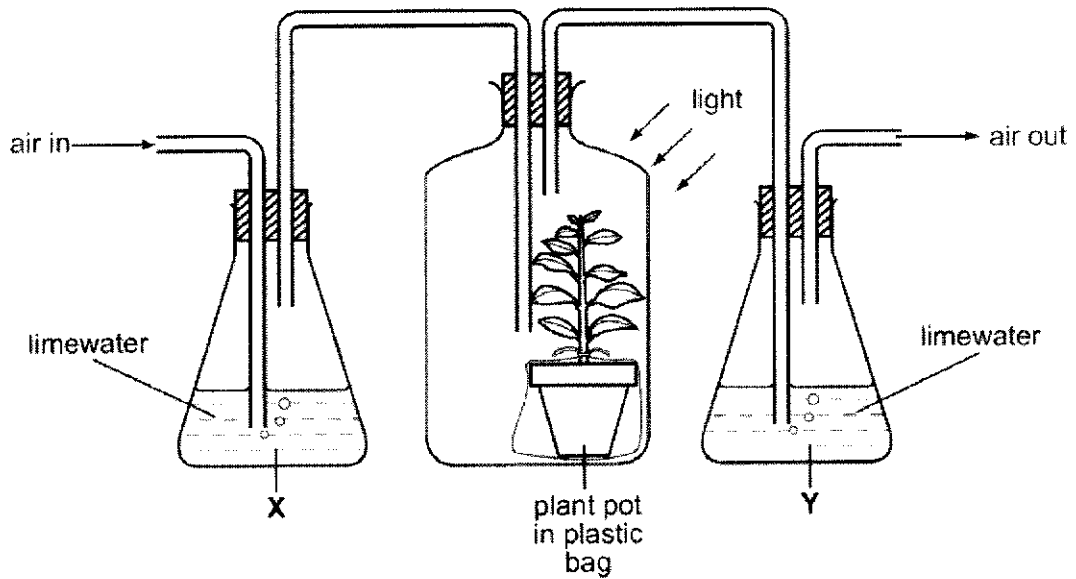
- 13 The flow diagram shows what happens to food in humans.



Which row identifies absorption, assimilation and digestion?

	absorption	assimilation	digestion
<b>A</b>	1	1 and 2	2
<b>B</b>	2	3 and 4	1
<b>C</b>	2	1 and 3	4
<b>D</b>	1	2 and 4	3

- 14 The apparatus shown in the diagram is used to investigate the effect of a green plant on carbon dioxide in the air.



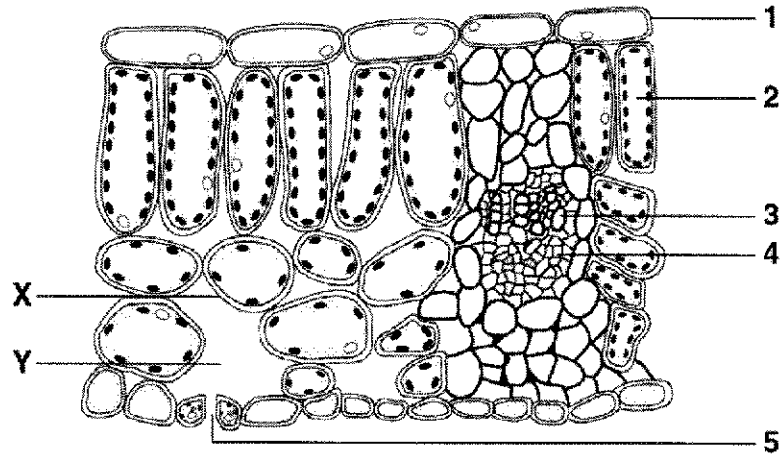
A white precipitate forms if carbon dioxide is bubbled through limewater.

What happens to the limewater in **X** and **Y**?

	<b>X</b>	<b>Y</b>
<b>A</b>	white precipitate forms	no white precipitate forms
<b>B</b>	white precipitate forms	white precipitate forms
<b>C</b>	no white precipitate forms	white precipitate forms
<b>D</b>	no white precipitate forms	no white precipitate forms

The diagram below shows a section through a leaf.

Use the diagram to answer questions 15 and 16.



15 What takes place in the structures indicated?

	transport water to the cells of the leaf	allow carbon dioxide to enter the leaf	absorb sunlight for photosynthesis
<b>A</b>	4	1	5
<b>B</b>	3	5	2
<b>C</b>	2	3	1
<b>D</b>	4	5	1

16 The leaf is losing water to the atmosphere.

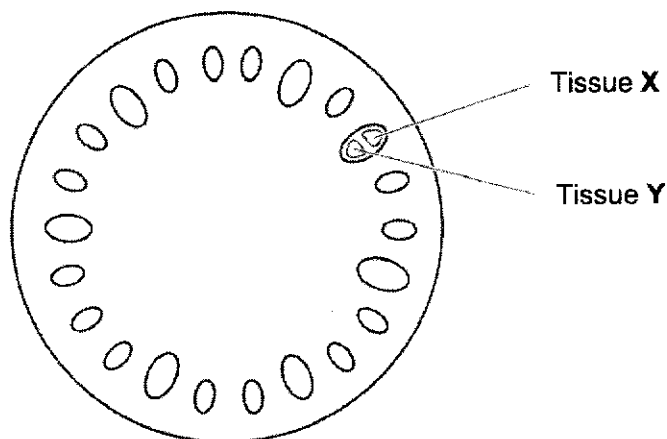
What process is occurring at X and Y respectively?

	X	Y
<b>A</b>	evaporation	diffusion
<b>B</b>	diffusion	evaporation
<b>C</b>	diffusion	transpiration
<b>D</b>	transpiration	diffusion

- 17 The table shows four substances and the parts of the plant to which they are transported.

	substance	part of plant
1	amino acids	flower buds
2	nitrate ions	leaf cells
3	sucrose	root cells
4	water	guard cells

The diagram shows a cross-section through a plant stem.



Which row correctly identifies the examples of translocation and the tissue which the substances are transported in?

	examples of translocation	tissue which the substances are transported in
<b>A</b>	1 and 2	<b>Y</b>
<b>B</b>	1 and 3	<b>X</b>
<b>C</b>	2 and 4	<b>Y</b>
<b>D</b>	2 and 3	<b>X</b>

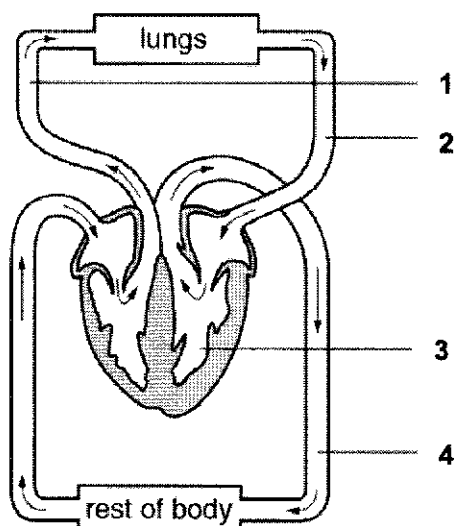
- 18 The table shows the rates of water uptake and transpiration of a pot of plant under the sun over six hours.

time	1100	1300	1500	1700
rate of water uptake / cm <sup>3</sup> per hour	16	17	12	16
rate of transpiration / cm <sup>3</sup> per hour	16	19	16	7

What conclusion can be drawn from the table?

- A** The plant is wilted at 1100.
- B** Humidity is the lowest at 1300.
- C** The plant is wilted at 1500.
- D** Humidity is the highest at 1700.

- 19 The diagram shows part of the human circulatory system.



Which row is correct?

	contains highest oxygen concentration	has the highest pressure during atrial systole
<b>A</b>	1	3
<b>B</b>	2	3
<b>C</b>	2	4
<b>D</b>	1	4

- 20 Which row shows the functions of the parts of the blood?

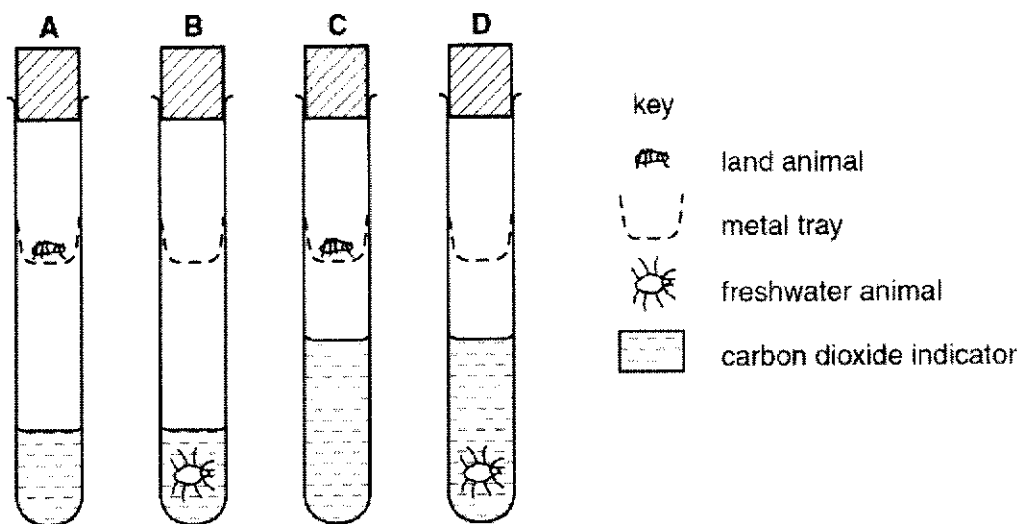
	red blood cells	white blood cells	platelets
<b>A</b>	antibody production	clotting	oxygen transport
<b>B</b>	clotting	oxygen transport	antibody production
<b>C</b>	oxygen transport	antibody production	clotting
<b>D</b>	oxygen transport	clotting	antibody production

- 21 Which air sample has just been breathed out?

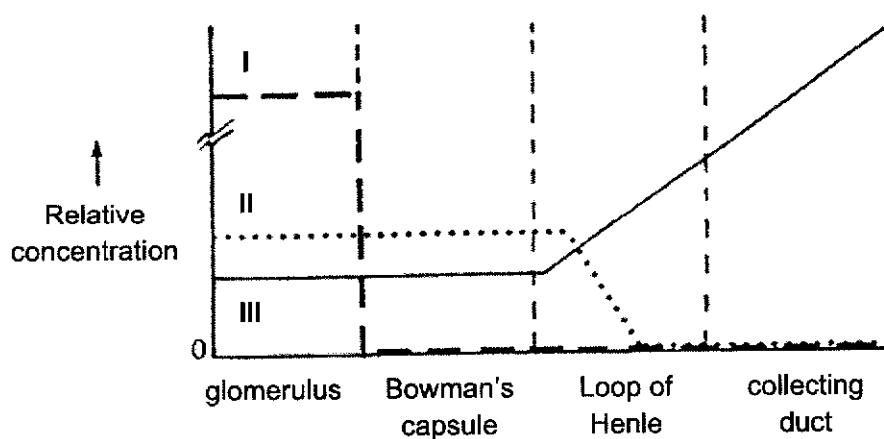
air sample	percentage of oxygen	percentage of carbon dioxide	percentage humidity
<b>A</b>	16	4.04	90
<b>B</b>	21	0.04	20
<b>C</b>	4	0.40	80
<b>D</b>	20	4.00	50

- 22 The diagram shows an experiment to find out the rate of respiration of small land animals and freshwater animals. The carbon dioxide indicator will change colour when the concentration of dissolved carbon dioxide changes. All the tubes were kept at the same temperature and all animals were equally active.

In which tube would the indicator be the first to change colour?



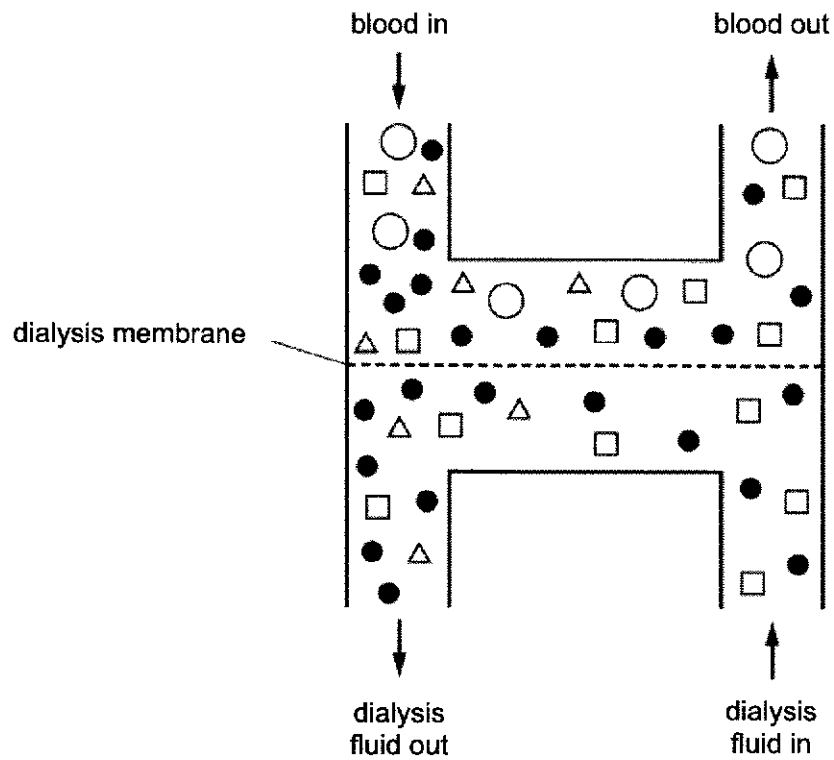
- 23 The figure shows the relative concentrations of glucose, protein and urea in the fluids taken from various parts of a mammalian kidney.



Which row correctly identifies substances represented by graphs I, II and III?

	I	II	III
A	protein	glucose	urea
B	glucose	protein	urea
C	protein	urea	glucose
D	glucose	urea	protein

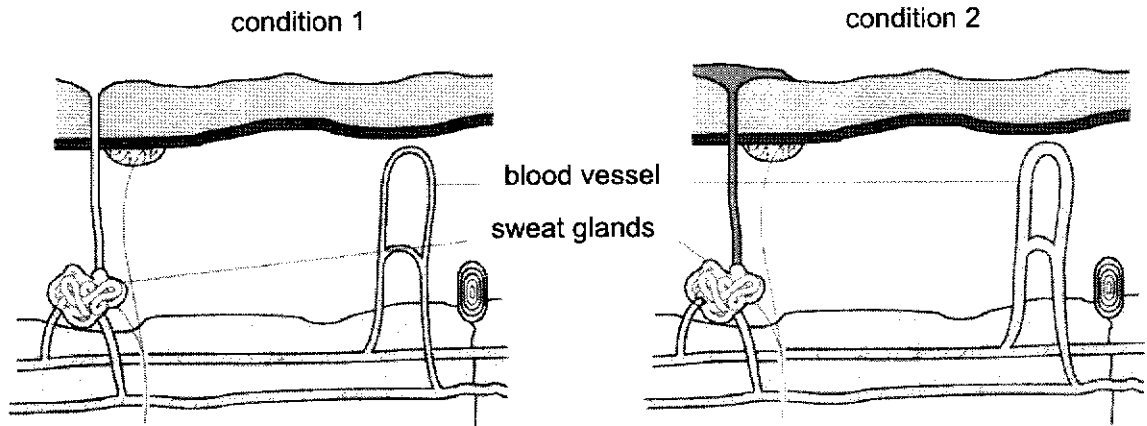
- 24 The diagram shows how a kidney dialysis machine works. Each shape represents a molecule found in blood or dialysis fluid.



Which shape represents urea?

- A ○  
 B ●  
 C □  
 D △

25 The diagram shows structures within human skin under two different external conditions.



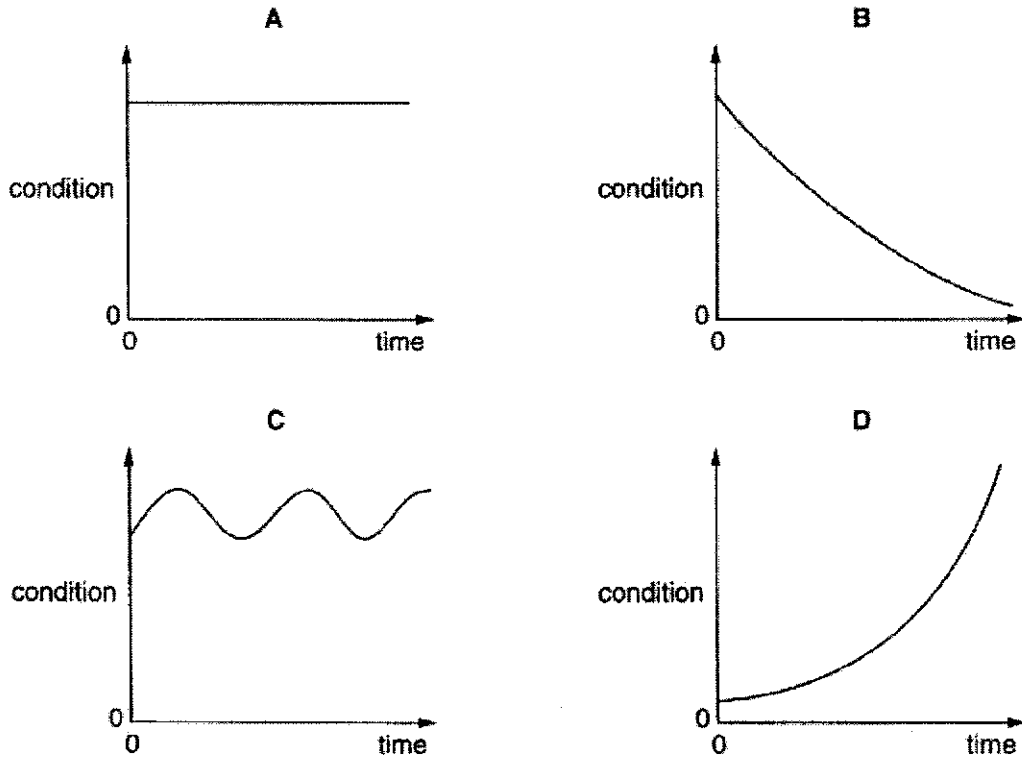
What are the external conditions 1 and 2?

	condition 1	condition 2
<b>A</b>	cool	hot
<b>B</b>	cool	cool
<b>C</b>	hot	cool
<b>D</b>	hot	hot



26 The graphs show how four different conditions in the body may change with time.

In which graph is the condition being controlled by negative feedback?



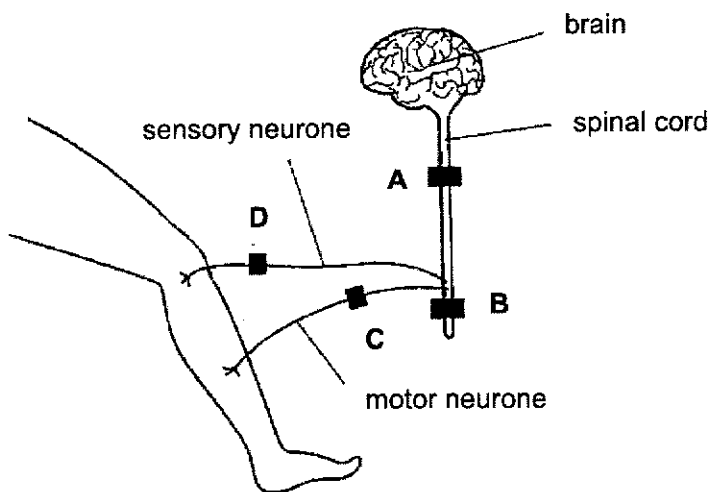
27 Which row is characteristics of all neurones?

	carry information within the brain	stimulate muscles or glands	transmit electrical impulses
<b>A</b>	yes	yes	no
<b>B</b>	yes	no	yes
<b>C</b>	no	yes	no
<b>D</b>	no	no	yes

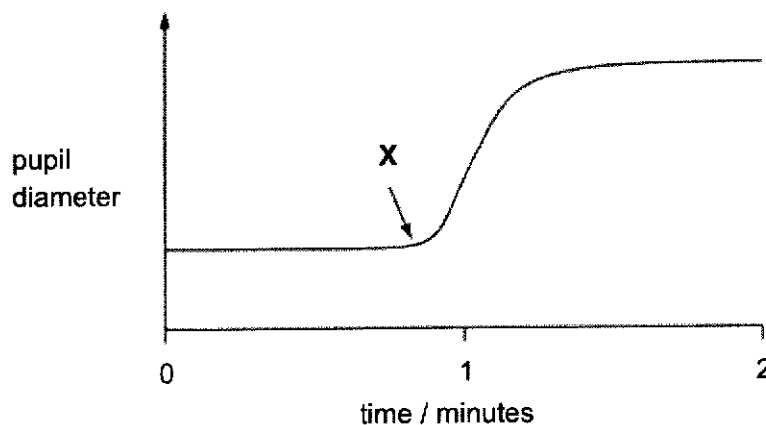
28 This diagram of the nervous system shows four places, **A**, **B**, **C** and **D**, where a local anaesthetic block can be applied. The block prevents nerve impulses travelling along neurones.

A man had an anaesthetic block applied at one of the sites shown, **A**, **B**, **C** or **D**. He cannot feel a pinprick on his leg but can move his leg when he wants to.

Where is his anaesthetic block, **A**, **B**, **C** or **D**?



29 The graph shows how the diameter of the pupil of a person's eye changed during the course of two minutes.

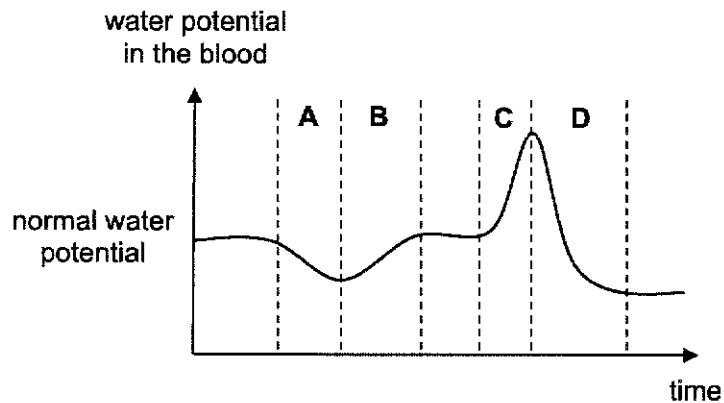


What happens to the light intensity after **X** and which muscles begin to contract?

	light intensity	iris muscles contracting
<b>A</b>	decreases	circular
<b>B</b>	decreases	radial
<b>C</b>	increases	circular
<b>D</b>	increases	radial

- 30 The graph shows the changes in the water potential in the blood of a person over a period of time.

During which period is the hypothalamus stimulated to secrete less antidiuretic hormone?



- 31 Which is correct for sexual reproduction in flowering plants?

	number of plants involved	number of gametes
A	always 1	more female than male
B	always 1	more male than female
C	1 or 2	more female than male
D	1 or 2	more male than female

- 32 The following four processes occur during reproduction in a plant.

- 1 The male nucleus fuses with the female nucleus.
- 2 The male nucleus is released from the pollen tube.
- 3 The male nucleus travels down the pollen tube.
- 4 The pollen grain grows a pollen tube.

In which order do these processes occur after pollination?

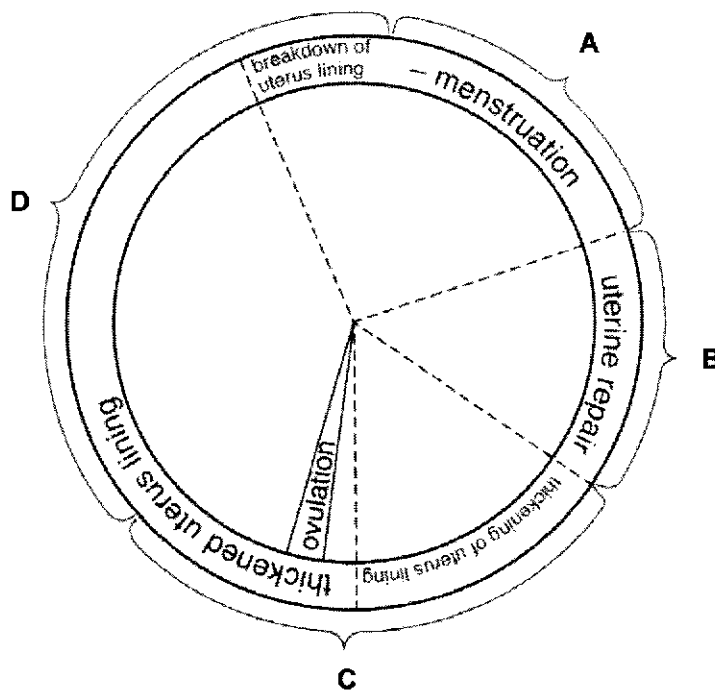
	first	→		last
A	3	4	1	2
B	4	3	2	1
C	3	4	2	1
D	4	3	1	2

33 Which sex chromosomes in the egg and the sperm will produce a male child?

	sex chromosome in egg	sex chromosome in sperm
<b>A</b>	X	X
<b>B</b>	X	Y
<b>C</b>	Y	X
<b>D</b>	Y	Y

34 The diagram shows stages of a menstrual cycle.

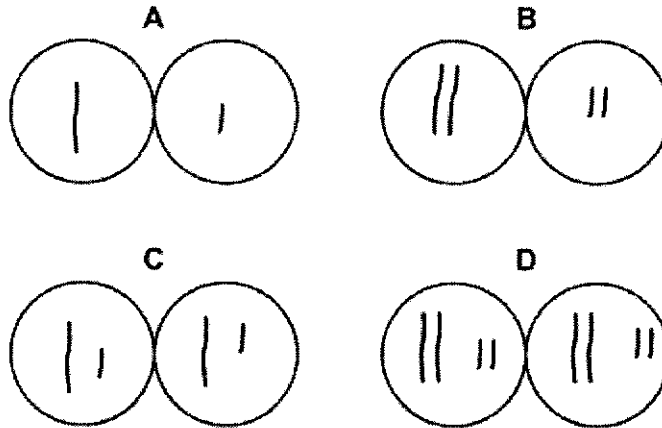
During which stage is a woman most fertile?



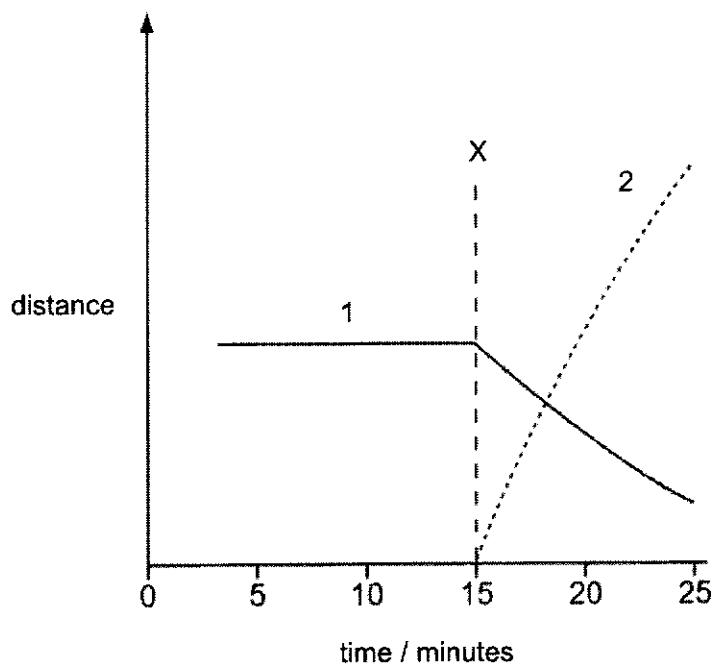
- 35 The nucleus of a cell contains two pairs of chromosomes.



Which two nuclei are produced after mitosis?



36 The graph shows measurements taken during one cycle of meiosis.



Which row correctly identifies the stage beginning at X and the measurements shown by curves 1 and 2?

	stage beginning at X	distance between centromeres of chromosomes and poles of spindle	distance between centromeres of sister chromatids
<b>A</b>	anaphase I	2	1
<b>B</b>	anaphase II	1	2
<b>C</b>	metaphase I	2	1
<b>D</b>	metaphase II	1	2

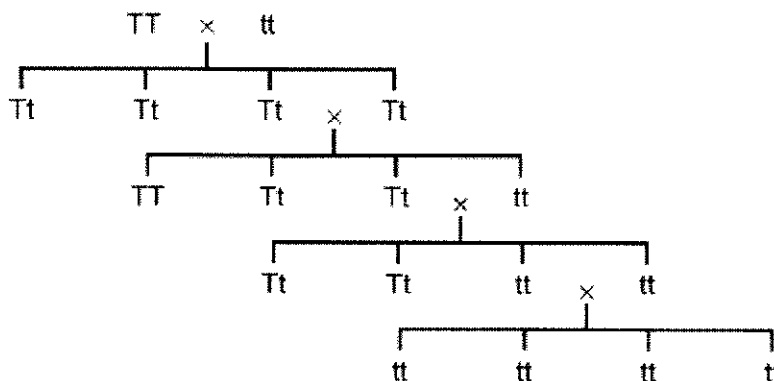
- 37 A female fruit fly with short wings mates with a male with long wings. All the offspring are long-winged.

Two of these offspring mate with each other.

What percentage of their offspring will have long wings?

- A 25 %
- B 50 %
- C 75 %
- D 100 %

- 38 The genetic diagram shows a breeding experiment that starts with crossing a tall plant with a short plant.

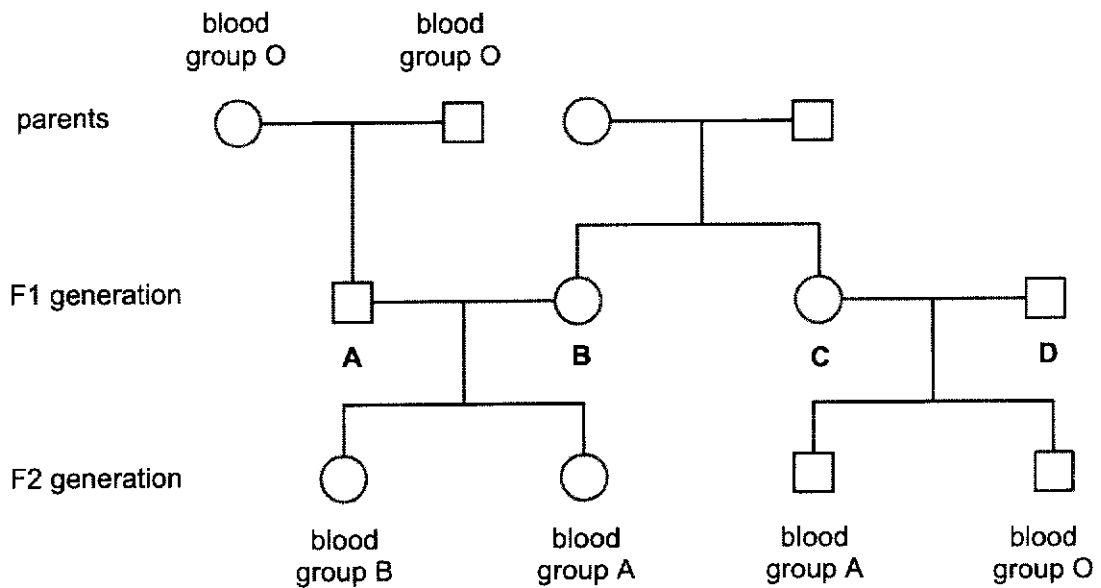


Which cross gives 1:1 phenotypic and genotypic ratios?

- A  $Tt \times Tt$
- B  $TT \times tt$
- C  $Tt \times tt$
- D  $tt \times tt$

- 39 The diagram shows the blood groups of some members of a family.

Which member of the F1 generation must be heterozygous with the co-dominant alleles?



- 40 The table shows percentage concentrations of three bases in DNA from four different sources.

Which source is a species of mammal with a concentration of adenine of 31.0%?

source	cytosine	guanine	thymine
<b>A</b>	19.1	30.9	19.0
<b>B</b>	19.5	19.7	29.8
<b>C</b>	22.8	22.8	23.4
<b>D</b>	30.9	19.1	19.0





# YISHUN SECONDARY SCHOOL

*We Seek, We Strive, We Soar*

## PRELIMINARY EXAMINATION

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Name : \_\_\_\_\_ Reg. No : \_\_\_\_\_ Class: \_\_\_\_\_

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**SEC 4 EXPRESS**

**Date: 14 September 2020**

**BIOLOGY (6093/02)**

**PAPER 2**

**Duration: 1 hour 45 minutes**

**MAX MARKS: 80**

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**READ THESE INSTRUCTIONS FIRST:**

Write your register number and name on the question paper.

Write using dark blue or black pen.

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

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

**Section A**

Answer **all** questions

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

**Section B**

Answer **all** questions.

Write your answers to Section B in the spaces provided.

At the end of the examination, fasten any separate answer paper securely to the question paper.  
The intended number of marks is given in brackets [ ] at the end of each question or part question.

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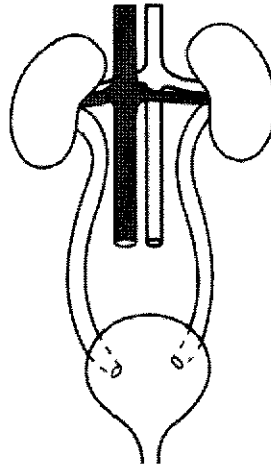
**This question paper consists of 21 printed pages including the cover page.**

[Turn Over]

**Paper 2**  
**Section A (50 marks)**

Answer all questions in the spaces provided on the question paper.

1 Fig. 1.1 shows structures that produce urine and excrete it from the body of a mammal.



**Fig. 1.1**

(a) On Fig. 1.1, label and name one organ. [1]

(b) Explain the difference between an organ and an organ system.

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[3]  
[Total: 4]

2 Fig. 2.1 shows an experiment to investigate the uptake of glucose by cells of the villi.

- Two leak-proof bags were set up.
- One bag was made from artificial partially permeable membrane (Visking tubing).
- The other bag was made from a piece of small intestine containing living cells, with its inner surface inside the bag.
- The bags were filled with equal volumes of a dilute glucose solution.
- The bags were suspended in the same glucose solution for two hours.
- After two hours, the volumes of the bags were measured and the contents were tested for the concentration of glucose.

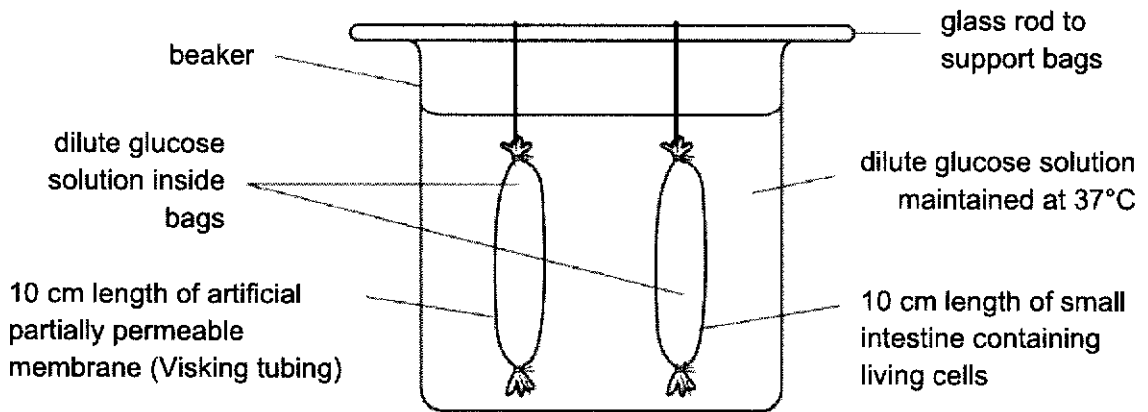


Fig. 2.1

Inside the bag made from small intestine, the volume and concentration of the glucose solution decreased. There were no changes to the volume and concentration in the Visking tubing bag.

(a) State and explain the process responsible for the decrease in the glucose concentration in the bag made from small intestine.

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[2]

(b) After two hours, there was less water in the bag made from small intestine.

The volume of water in the bag made from small intestine decreased but the volume in the bag made from Visking tubing did not change. Explain why.

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[3]  
[Total: 5]

3 Three enzymes, **P**, **Q** and **R**, were extracted from different regions of the alimentary canal of a mammal. The effect of pH on the activity of the enzymes was investigated at 40°C. The results are shown in Fig. 3.1.

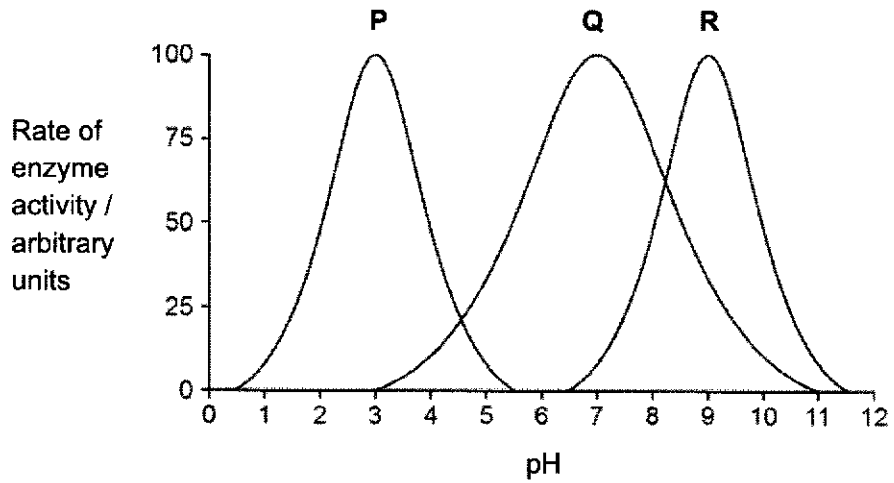


Fig. 3.1

(a) Explain why the investigation was carried out at 40°C.

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[2]

(b) Using information in Fig. 3.1, describe the effects of increasing pH on the rate of activity of enzyme **Q**.

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[3]

(c) Enzymes increase the rate of breakdown of different types of food substances in digestion.

Identify enzymes **P** and **R**.

**P:** .....

**R:** .....

[2]  
[Total: 7]

4 Fig. 4.1 shows the blood supply for the liver of a mammal.

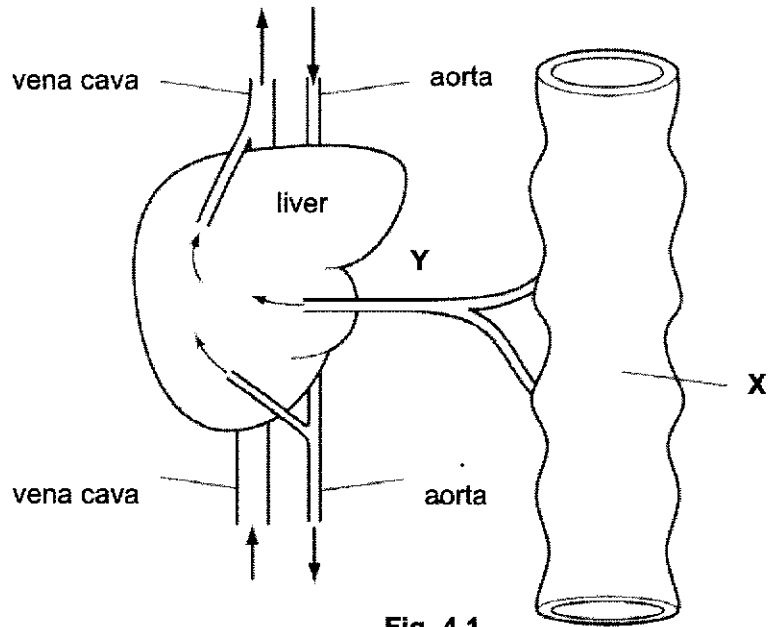


Fig. 4.1

(a) Blood from organ X is carried to the liver by blood vessel Y.

Name organ X and blood vessel Y.

organ X: .....

blood vessel Y: .....

[2]

Fig. 4.2 shows some liver cells as seen with a light microscope.

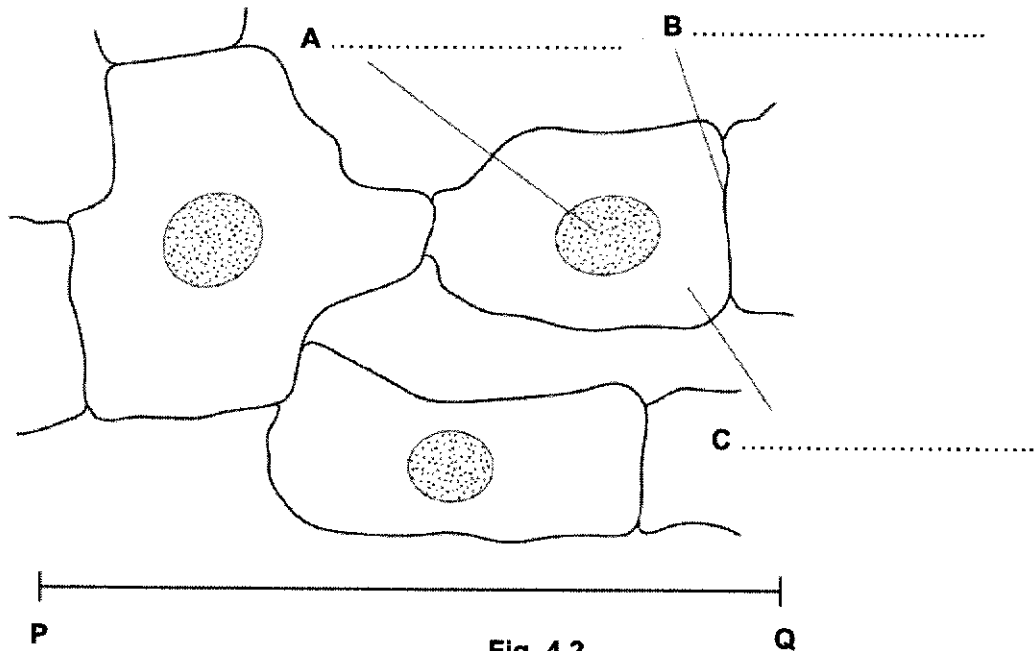


Fig. 4.2

(b) (i) On Fig. 4.2, label structures A, B and C.

[1]

(ii) The actual distance of P-Q is 0.06 mm.

Calculate the magnification of Fig. 4.2. Show your working clearly.

Magnification = x ..... [1]

(c) Explain how liver cells help to regulate the concentration of glucose in the blood when blood glucose concentration is higher than normal.

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..... [3]

(d) Describe what happens to excess amino acids inside liver cells.

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..... [2]

[Total: 9]



- 5 The yields of tomatoes grown in open fields in India are very low compared with yields of tomatoes grown in glasshouses in Europe.  
 In a study, scientists in India grew tomato plants in glasshouses and in open fields nearby. The growth of the plants and the yields of tomatoes were recorded.

The results are shown in Table 5.1.

**Table 5.1**

	tomato plants grown in	
	glasshouses	open fields
mean final height of tomato plants / cm	84.1	69.0
mean number of leaves per tomato plant	123.0	82.0
mean fresh mass of tomato plants / g	988.3	491.7
mass of tomatoes per plant / g	2986.0	818.9
mean fresh mass of tomatoes / g	95.0	84.4

- (a) Suggest how the height of the plants and the number of leaves on each plant affects the yield of tomatoes.

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[4]

- (b) The scientists made sure that the only differences between the two groups of plants were the result of the protection provided by the glasshouses.

Suggest the factors that the scientists should have kept the same for the two groups of plants in this investigation.

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[2]

[Total: 6]

6 (a) Fig. 6.1 shows the total cross-sectional area of the blood vessels in the systemic circulation. It also shows the changes that occur in blood pressure and the speed (velocity) of blood in the different blood vessels.

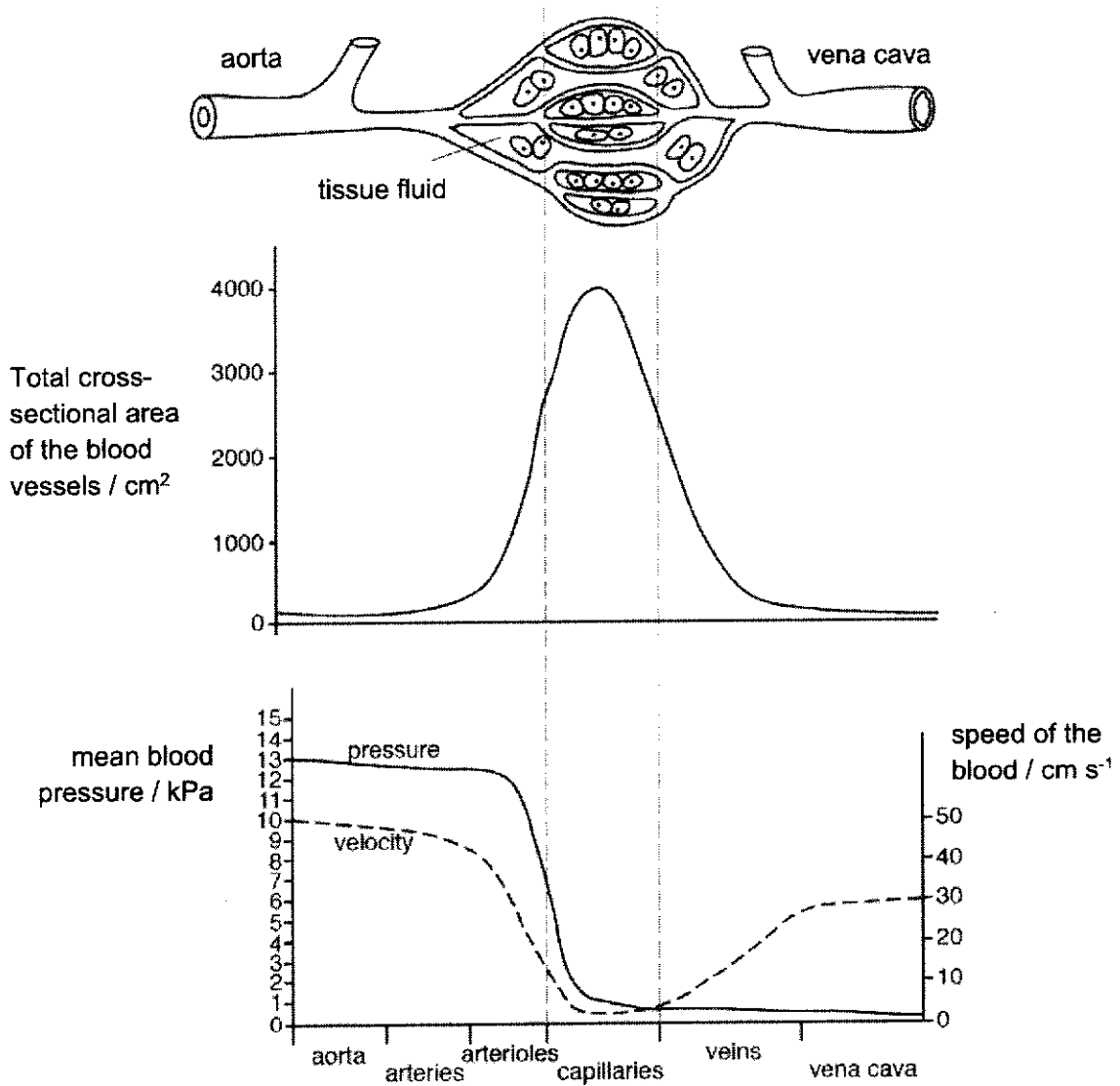


Fig. 6.1

(i) State the maximum speed of the blood in the aorta.

..... [1]

(ii) Describe how mean blood pressure and speed of blood change with cross-sectional area of blood vessels, as shown in Fig. 6.1.

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..... [3]

(iii) Besides blood pressure and speed of blood, state two other ways in which the blood in aorta is different from the blood in vena cava.

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..... [2]

(b) Humans have a double circulation.

Explain two advantages of humans having a double circulation.

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..... [2]

(c) State the roles of water in blood.

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

[Total: 10]

7 A healthy kidney controls the excretion of urea and other waste products of metabolism from the blood.

After kidney failure, there are two possible treatments: dialysis or a kidney transplant.

Fig. 7.1 shows how blood and dialysis fluid move through a dialysis machine.

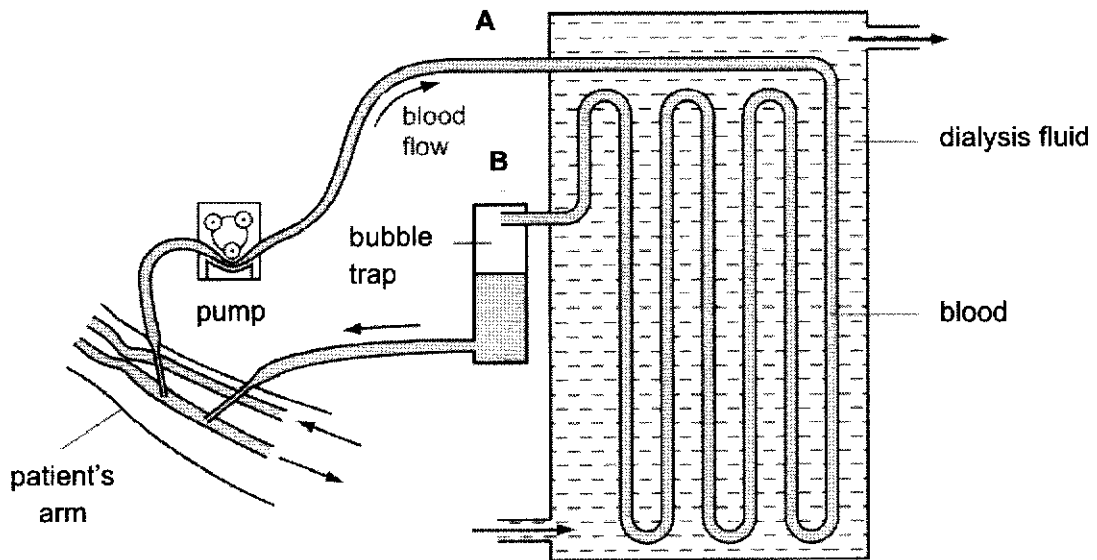


Fig. 7.1

(a) Describe the changes that occur to the blood as it flows through the dialysis machine from A to B.

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[2]

(b) Discuss the advantages of kidney transplants compared with dialysis.

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[3]

[Total: 5]

- 8 Fig. 8.1 shows a vertical section through the eye and the neurones involved in stimulating the muscles in the iris when the light intensity changes.

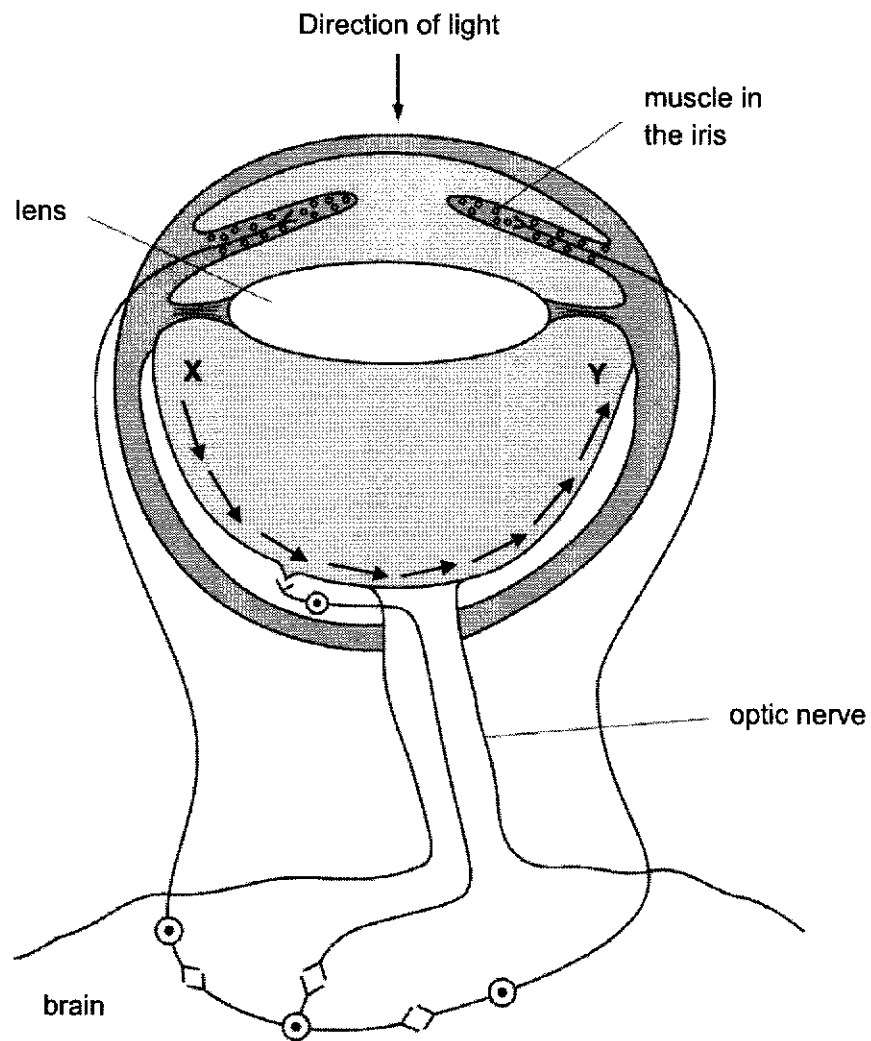


Fig. 8.1

- (a) On Fig. 8.1, draw an arrow on each of the four neurones to show the direction taken by the impulses when the light intensity changes.

[1]

The retina contains light-sensitive cells known as rods and cones. The distribution of rods in the retina from point X to point Y, as shown on Fig. 8.2, was investigated.

Fig. 8.2 shows the distribution of rods in the retina from point X to point Y.

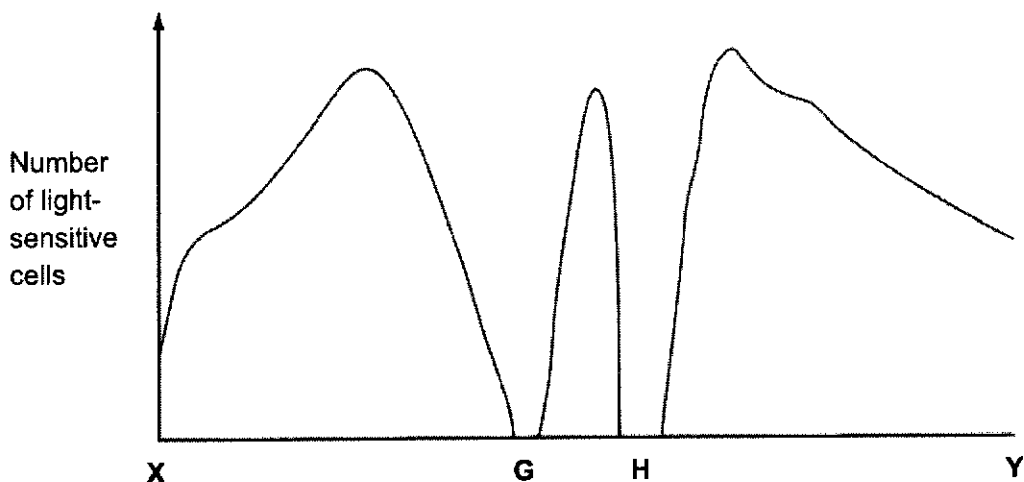


Fig. 8.2

(b) G and H, as shown on Fig. 8.2, are parts of the retina.

Using information from Fig 8.1 and Fig. 8.2, name G and H.

G: .....

H: .....

[1]

(c) Cones are light-sensitive cells which are responsible for clear colored vision.

Draw a line on Fig. 8.2 to show the distribution of cones in the retina.

[2]

[Total: 4]

~ End of Paper 2 Section A ~

**Section B (30 marks)**

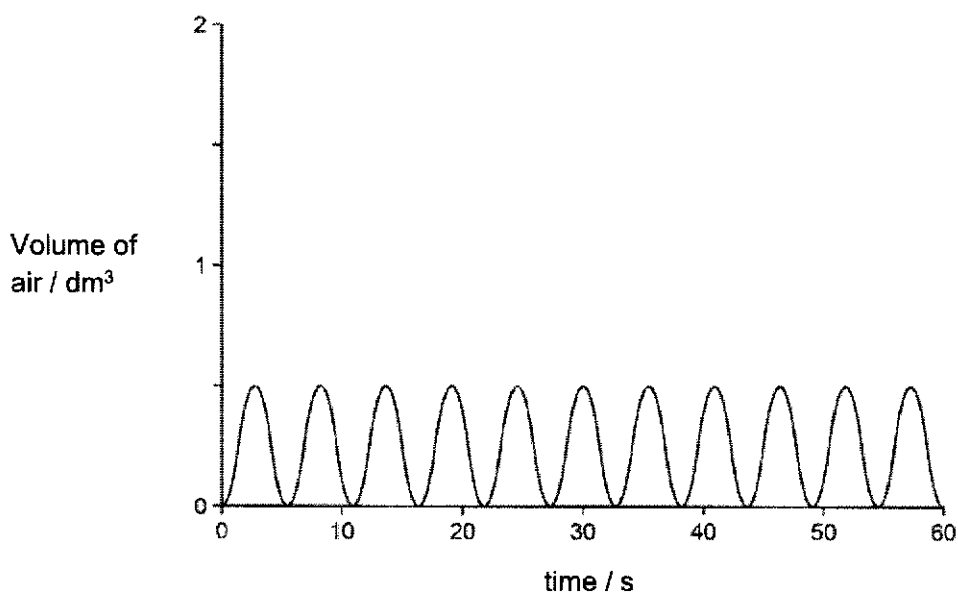
Answer **all** questions in this section.

Question 11 is in the form of an **Either/Or** question. Only one part should be answered.

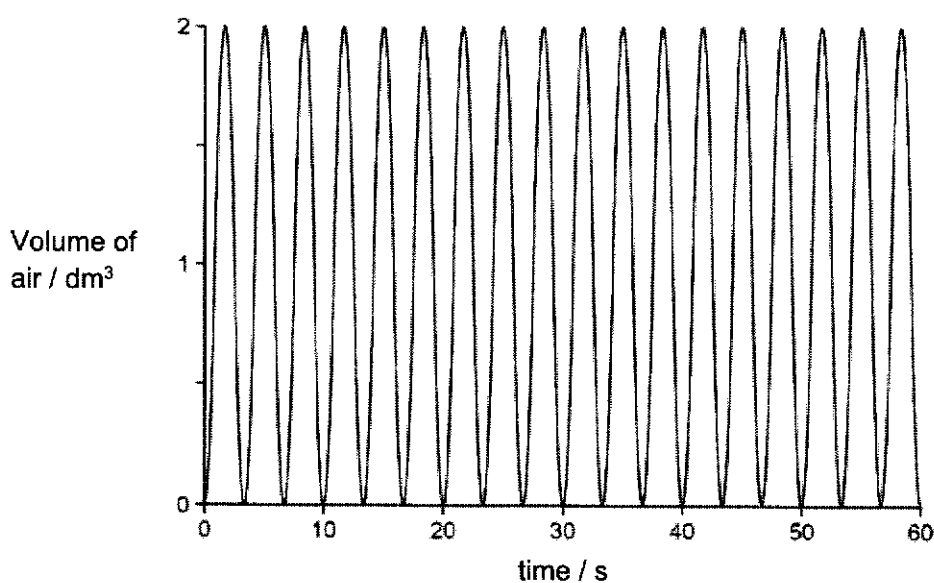
- 9 Some students investigated the breathing of a 16-year old male athlete.

Fig. 9.1 shows the pattern of his breathing for 60 seconds when resting.

Fig. 9.2 shows the pattern of his breathing while he took some exercise for 60 seconds.



**Fig. 9.1**



**Fig. 9.2**









Either

11 (a) Explain the importance of meiosis in the formation of gametes.

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[4]

Some plants like cactus and mammals like camels are adapted for life in desert where it can be very hot during the day and very cold at night.

(b) The stomata of some cacti open at night and close during the day.

Explain how this allows the cacti to survive in the desert, but limits their growth rate.

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[6]  
[Total: 10]







**Paper 1**

1. C	21. A
2. B	22. B
3. D	23. A
4. B	24. D
5. B	25. A
6. D	26. C
7. C	27. D
8. C	28. D
9. D	29. B
10. C	30. C
11. D	31. D
12. C	32. B
13. B	33. B
14. A	34. C
15. B	35. D
16. A	36. B
17. B	37. C
18. C	38. C
19. C	39. B
20. C	40. B

**Paper 2**

**Section A**

1a. kidney / (urinary) bladder / ureter / urethra / renal artery / renal vein ;

A either vertical vessel as aorta / vena cava

A any horizontal vessel as renal artery / renal vein

More than 1 label – all must be correct for award of mark

[any one, max 1m]

1b. an organ:

- composed of different / two or more / many tissues ;

- work together to carry out a function ;

an organ system:

- composed of different / two or more / many organs ;

- carrying different functions / working together to perform another function ;

[any three, max 3m]

2a. – active transport ;

- net movement + glucose molecules + out of the bag ;

Or

- respiration (by the cells) ;

- absorb glucose + within the bag + to release energy ; (reject produce energy)

(R diffusion)

[max 2m]

2b. – glucose concentration in small intestine bag decreased + no change in glucose concentration in Visking tubing ;

[max 1]

- higher water potential inside bag / ora ;

- net movement of water molecules + out of bag + by osmosis ;

Or

- no difference in water potential / no water potential gradient in Visking tubing ;

- no net movement of water molecules + out of bag + by osmosis ;

[max 2m]

3a. – constant variable + fair comparison ;



- (near) optimum temperature + most active / higher temperature + denatures / lower temperature + less active or inactive ;  
[max 2m]

3b. – from pH 3 to pH 7 + increase in activity ;  
- pH 7 + highest activity / most active ;  
- from pH 7 to pH 11 + decrease in activity ;  
- no activity + below pH 3 / above pH 11;

[any three, max 3m]

3c. **P:** pepsin ; (reject protease)

**R:** lipase / trypsin / pancreatic amylase / maltase / sucrose / erepsin / peptidase / lactase ;  
(reject protease / amylase)

4a. organ **X:** small intestine / ileum ;  
Blood vessel **Y:** hepatic portal vein ;

4bi. A: nucleus

B: cell membrane

C: cytoplasm

[all three correct – 1m]

4bii. Length of P-Q on Fig. 4.2 / 0.06 mm = correct calculated value ;

4c. – more insulin + secreted by islets of Langerhans cells / pancreas ;  
- more / AW glucose + absorbed from the blood ;  
- converted into glycogen ;  
- by liver / stored in liver ;  
[max 3m]

4d. – excess amino acids + deaminated ;  
- amino groups removed + form urea ;  
- rest of molecule / AW + converted into glucose ;  
[max 3m]

5a. – taller / more leaves + more yield ;  
[max 1m]

Taller:

- access to more light / better competition for light;  
[max 1m]

More leaves:

- increase + total surface area / number of chloroplasts (in a plant) ;
- increase + absorption of light ;

Or

- increase + number of stomata (in a plant);
  - increase + uptake of carbon dioxide ;
- [max 1m]

- increase + rate of photosynthesis ;
- [max 1m]

5b. Same:

- species / type / AW ;
  - soil type ;
  - soil pH;
  - distance between plants / planting density ;
  - quantity of water supplied ;
  - type of / quantity of fertilisers ;
  - quantity / depth of soil ;
  - AVP ;
- (R temperature, humidity, wind speed / movement)
- [any two, max 2m]

6ai. 50 cm s<sup>-1</sup> ; (R without units)

- 6aii. – blood pressure decreases + as cross-sectional area increases (in capillaries) ;
- blood pressure decreases slightly / remains roughly constant / AW + as cross-sectional area decreases (in the veins) ;
  - speed of blood decreases + as cross-sectional area increases (in capillaries) ;
  - speed of blood increases + as cross-sectional area decreases (in veins / vena cava) ;

[any three, max 3m]

- 6aiii. – aorta + higher concentration of oxygen / AW ;
- aorta + lower concentration of carbon dioxide / AW ;
  - aorta + lower temperature ;
  - aorta + lower concentration of lactic acid / AW ;
- (Accept ORA for vena cava)

[any two, max 2m]

- 6b. – allows only deoxygenated blood + transported to the lungs ;
- allows only oxygenated blood + transported to the rest of the body ;
  - lower pressure blood + transported to the lungs ;

- higher pressure blood + transported to the rest of the body ;
- reference to increased efficiency of oxygen transport to body cells / AW ;
- reference to increased efficiency of exchange of gases / carbon dioxide / oxygen in the lungs / AW ;

[any two, max 2m]

- 6c. – transport dissolved substances / soluble proteins / fibrinogen / blood cells / platelets around the body ;
- transport digested nutrients / amino acids / glucose ; from small intestine / hepatic portal vein to the body cells ;
  - transport carbon dioxide + as bicarbonate ions ;

[any two, max 2m]

- 7a. – urea concentration + decreases ;
- salt concentration + decreases ;
  - water content + could be increases / decreases ;
  - glucose concentration + could be increases / decreases / stays the same ;
- [any two, max 2m]

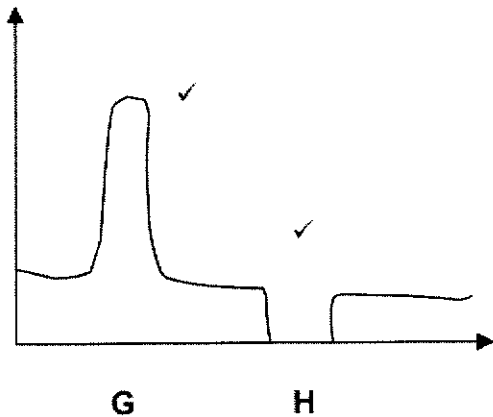
- 7b. – no need to go to clinic / hospital regularly ;
- increased freedom / better quality of life / AW / ORA ;
  - a disadvantage of dialysis: pain / tiring / discomfort / time-consuming / AW ;
  - can have wider diet / AW / ORA ;
  - reference to cost or economic benefit to health service / individual ;

8a. – arrows on each neurone + in correct direction (from retina to muscle in iris) ;

8b. **G**: yellow spot / fovea + **H**: blind spot ;

- 8c. – peak at G ;
- nothing at H ;

[Note: minus 1m if touch 0 other than H]



### Section B

9a. – breathing rate + faster ;

- depth of breathing + deeper ;
- faster muscular contractions ;
- rate of respiration + increased / faster / more / AW ;
- requires oxygen + faster / more / AW ;
- maintains oxygen concentration (in blood) ;
- removes carbon dioxide + faster / more / AW ;
- maintains carbon dioxide concentration (in blood) / pH of blood ;
- prevents / delays + anaerobic respiration ;
- prevents / delays + accumulation of lactic acid ;

[any five, max 5m]

9b. – pulse rate increases ;

- blood transported to muscles / lungs + faster / more / AW ;
- increased / faster / more / AW supply of oxygen + to muscles ;
- increased / faster / more / AW removal of carbon dioxide + from muscles ;
- increased / faster / more / AW removal of lactic acid + from muscles ;

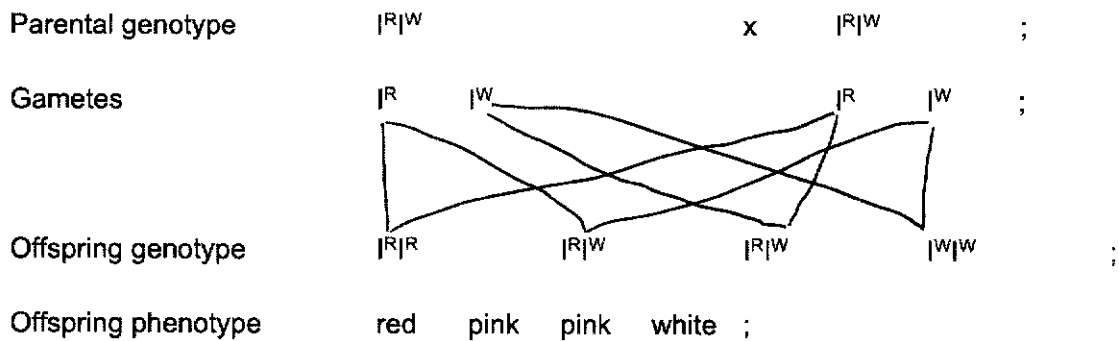
[at least one]

- concentration of blood glucose increases / delay from decreasing ;
- increased / faster / more / AW supply of glucose + to muscles ;
- increased / faster / more / AW + respiration in muscles ;

10a.

Cross 2:

Parental phenotype                  Pink Flower                                  x                  Pink Flower



10b. - Use restriction enzyme to isolate or cut out red pigment gene from Snapdragon DNA / AW ;

- Use same restriction enzyme + to cut plasmids from a bacterium / AW ;
- Mix red pigment gene + cut plasmids + (DNA) ligase / AW ;
- Mix recombinant plasmids with the bacteria + heat-shock or electric-shock / Insert recombinant plasmids into bacteria + using heat-shock or electric-shock / AW ;
- culture (transgenic) bacteria in fermenters / large scale ;
- burst open the cultured (transgenic) bacteria (to extract the red pigment) ;

11a.

- production of genetically different gametes ;
- independent assortment of (pairs of) homologous chromosomes + during prophase I ;
- crossing over (of sister chromatids of homologous chromosomes) + during metaphase I ;

- production of haploid gametes / gametes containing only 1 set of chromosomes ;
  - ensure formation of diploid zygote / maintains the diploid number for the species ;
- [any four, max 4m]

11b.

**Allowing to survive**

- no / little / less + water (vapour) loss + in the day ;
- by transpiration ;

- lower temperature / cooler + at night ;
- lower / slower / AW + loss of water (vapour) ;

[at least two, min 2m]

**Limits growth**

- no / little / less + absorption / diffusion of carbon dioxide + in the day ;
- carbon dioxide is needed / essential / raw material / AW for photosynthesis ;
- no / little / less + photosynthesis + in the day ;

- no photosynthesis at night ;
  - light is needed / essential / raw material / AW or no light for photosynthesis ;
  
  - no / little / less / lower + production of glucose ;
  - Glucose is needed / essential / raw material / AW for energy production / growth / ;
- [at least two, min 2m]

[max 6m]

### Paper 3

1a.

Time	Time / min	Temperature / °C	
		test-tube A	test-tube B
0800	0		
0802	2		
0804	4		
0806	6		
0808	8		
0810	10		

- Correct headings + correct units ;
- 6 temperature readings for **A** ;
- 6 temperature readings for **B** ;
- temperature readings recorded to an appropriate degree of precision / to 0.5°C ;

- 1b. – correct orientation + correct labels + units of axes ;
- suitable scale ; (linear scale, each graph covers at least half the grid area)
  - correct plotting for A + correct plotting for B ;
  - Best-fit graph ;

- 1ci. – Temperature of A decreased more than B / AW / ORA ;
- Steeper / Faster decrease in temperature in A / AW / ORA ;

- 1cii. – crowding of animals will retain heat better / lose heat slower / lose less heat / AW / ORA ;
- crowding of animals will have lower surface area to volume ratio (exposed to surrounding) / AW / ORA ; (Reject lower total surface area)

- 1ciii. – Repeat the experiment + calculate average / mean temperature ;
- more reliable results ;

- ensure same starting temperature ;
- fair / valid comparison ;

- measure + same volume of hot water to be added to each test-tube / reference to use of a measuring instrument e.g. measuring cylinder (volume), ruler (2cm from the top) ;
- fair / valid comparison ;

[any four, max 4m]

2a. Drawing:

- reasonably large (at least half the space provided) ;
  - clear + neat lines ;
  - shoots / buds drawn ;
- [any two, max 2m]

Labelling:

- bud / shoot / eye ;
- skin ;

2bi. – Teachers' value +/- 1cm ;

- 2bii. – effervescence / bubbling / AW ;
- chopped tissue rose / moved / AW ;
  - vigorous / rapid / AW reaction ;

2c. – Teachers' value +/- 1cm ;

- 2d. – chopped tissue has greater / higher / AW surface area to volume ratio / total surface area / exposed surface area / surface area ;
- chopped tissue has more cells + cut opened / burst / AW ;
  - more / higher concentration / AW enzymes (molecules) released ;
  - higher / AW rate of reaction / production of oxygen ;

[any two, max 2m]

2ei. – use boiled potato (instead of raw potato) / AW / ORA ;

or

- conduct at different pH ;

or

- conduct at different temperature ;

[any one, max 1m]

- same amount / AW of potato tissue ;
  - same quantity / concentration of Y ;
  - any other valid variables to be kept constant ;
- [any one, max 1m]

- measure + calculate + any (significant) difference in height / thickness / amount / rate of froth formed ;

2eii. Boiled potato:

- no effervescence / bubbling / AW ;
- enzymes denatured ;



or

conduct at different pH:

- varying thickness / amount / rate of froth formed (at different pH) ;
- enzymes have different activity at different pH / enzymes most active at optimum pH / enzymes denatured when not at optimum pH ;

or

conduct at different temperature:

- varying thickness / amount / rate of froth formed (at different temperature) ;
- enzymes have different activity at different temperatures / enzymes most active at optimum temperature / enzymes denatured when temperature higher than optimum temperature / enzymes inactive when temperature lower than optimum temperature ;

[any two, max 2m]

3a. – white precipitate formed in limewater ;

- volume of Visking tubing increased ;

3b. – Yeast + carried out anaerobic respiration ;

- carbon dioxide produced + diffuses out of Visking tubing ;
- limewater has higher water potential than the contents of Visking tube / ORA ;
- net movement of water molecules into Visking tube + osmosis / ORA ;

3c.

	Benedict's test	biuret test
Observation	- orange-red / orange / yellow precipitate formed	- remained blue / no violet colour observed
Conclusion	- Reducing sugar present  Observation + conclusion ;	- proteins absent  Observation + conclusion ;

3d. - Glucose molecules are small molecules / able to move across partially permeable membrane ;

[any two, max 2m]

- protein are large molecules / unable to move across partially permeable membrane ;

[1m]

