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Name: ()

Class: Sec 4A

Queenstown Secondary School



Preliminary Examination 2019 Secondary Four Express Biology 6093/01

2 September 2019
Monday

Time: 1130 – 1230h
Duration: 1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, class and index number on the Answer Sheet in the spaces provided.

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

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

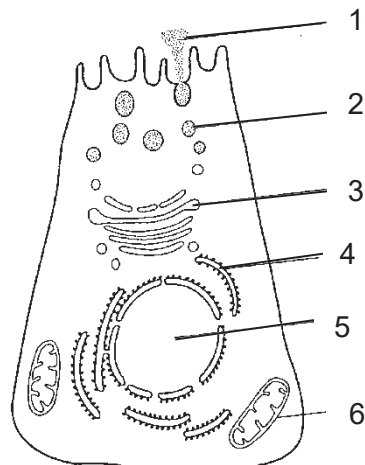
Read the instructions on the Answer Sheet very carefully.

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

Any rough working should be done in this booklet.

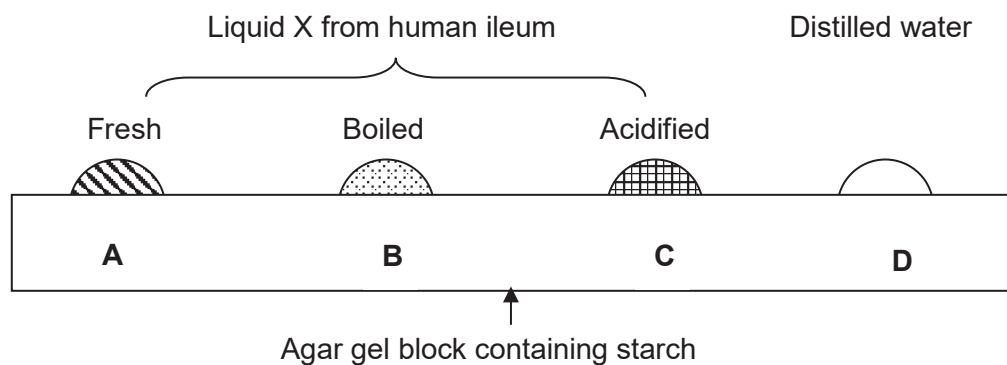
The use of an approved scientific calculator is expected, where appropriate.

- 1 The diagram below shows an animal cell.



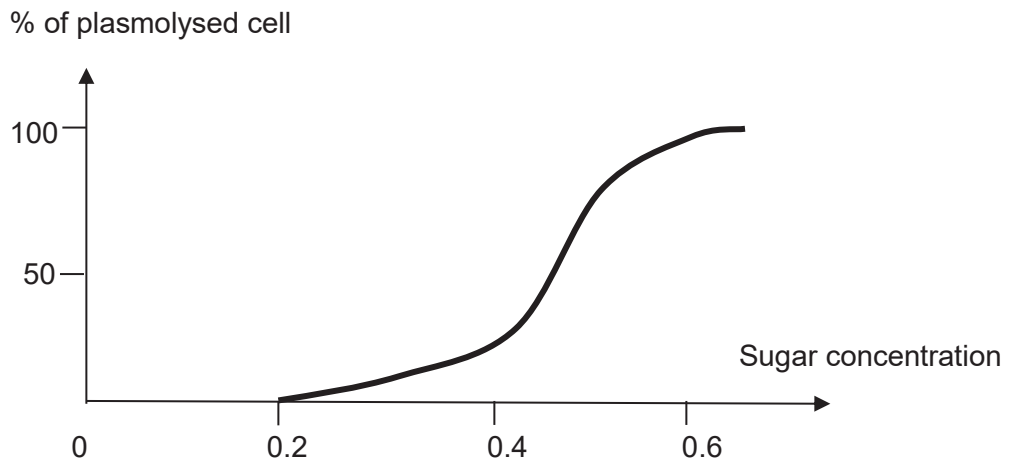
What is the functional relationship between the labelled structures?

- A 1 is synthesised by 4.
 - B 2 develops into 6.
 - C 3 contains products synthesised by 5.
 - D 4 controls the contents of 5.
- 2 The figure below shows an experiment in which four different liquids were added onto an agar gel plate on spots **A**, **B**, **C** and **D**.



The set was incubated at 37°C for 5 hours, after which the starch plate was washed with distilled water and iodine solution was added onto **A**, **B**, **C** and **D**. Which of the spots **A**, **B**, **C** and **D** will not turn blue-black?

- 3 The following graph illustrates the percentage of plasmolysed leaf cells at different concentrations of sugar solutions.



From the above results, it suggests that the leaf cells

- A are resistant to low sugar concentration.
 - B have cell saps of different concentrations.
 - C are of different sizes.
 - D are of different shapes.
- 4 The table below shows the results of an analysis of the cell sap from a marine plant and the surrounding seawater.

substance analysed	concentration of ions (arbitrary units)		
	sodium ions (Na^+)	potassium ions (K^+)	chloride ions (Cl^-)
cell sap	0.13	0.56	0.61
sea water	0.57	0.02	0.30

A student makes the following deductions that the cell

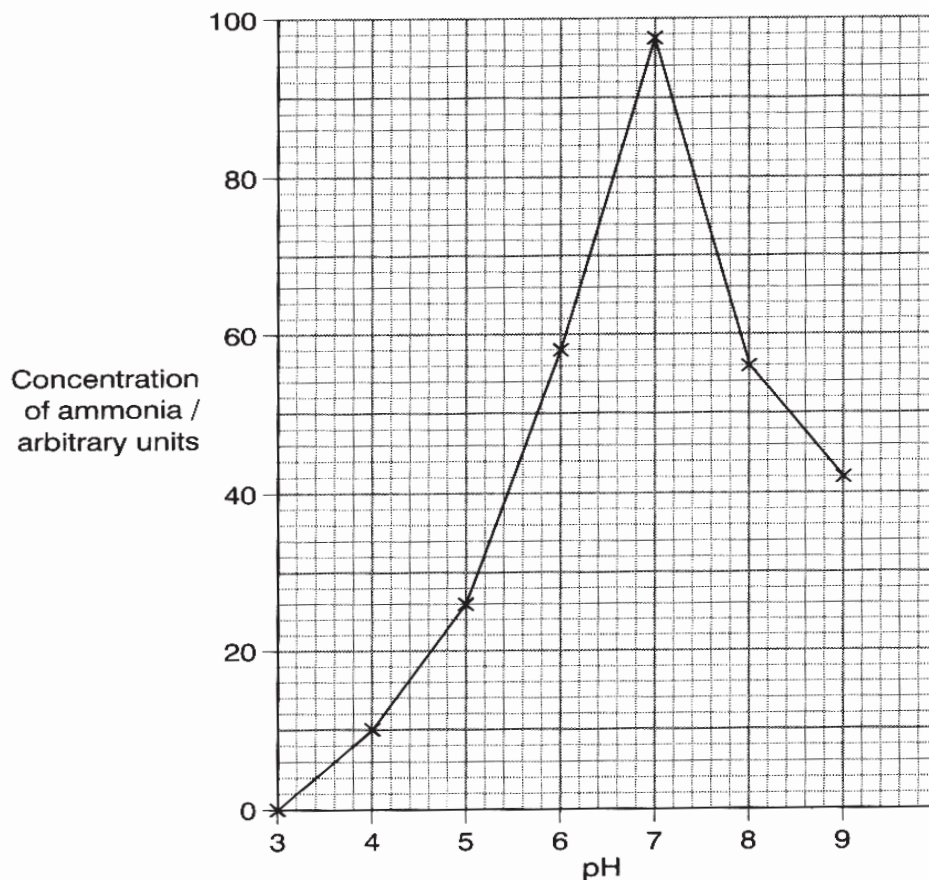
- I removes chloride ions by diffusion.
- II removes sodium ions by active transport.
- III accumulates sodium ions by active transport.
- IV accumulates potassium ions by active transport.

Which of the above statements are correct?

- A I, II and III
- B I, II and IV
- C I, III and IV
- D II, III and IV

- 5 Urease is an enzyme which catalyses the breakdown of urea to ammonia and carbon dioxide. An experiment was carried out at 30°C to investigate the effect of pH on the activity of urease. 10.0 cm³ of pH 3 buffer solution was mixed with 1 cm³ of urease solution. This mixture was then added to 10.0 cm³ of urea solution and the concentration of ammonia in the mixture was measured after 60 minutes. This procedure was repeated using buffer solutions of pH 4, 5, 6, 7, 8 and 9.

The results are shown in the graph below.



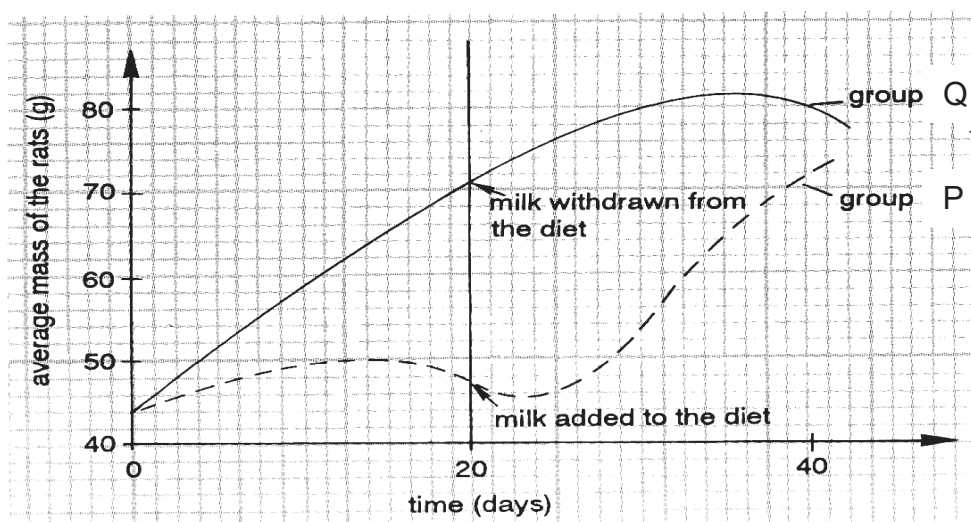
Which of the following statements are true about the activity of urease at different pH values?

- I: A curve of similar shape should be obtained if the concentration of carbon dioxide is tracked in the experiment.
- II: A curve of similar shape should be obtained if the experiment is conducted at 60°C.
- III: This enzyme works best at pH 7.
- IV: The enzyme is denatured at pH 9.

- A** I and II **B** I, II and III **C** I, III and IV **D** I, II, III and IV

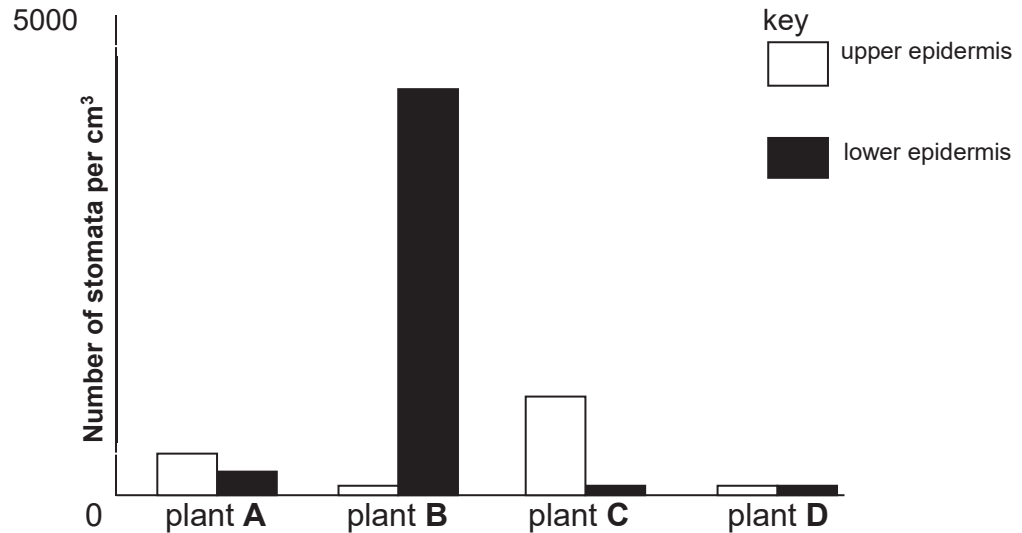
For questions 6 and 7, refer to the information and graph given below.

In this experiment, a group of rats (P) was fed on a basic diet (carbohydrates, lipids, proteins, minerals and water) and a second group of rats (Q) was given the basic diet plus milk initially. The results over 40 days were shown below.

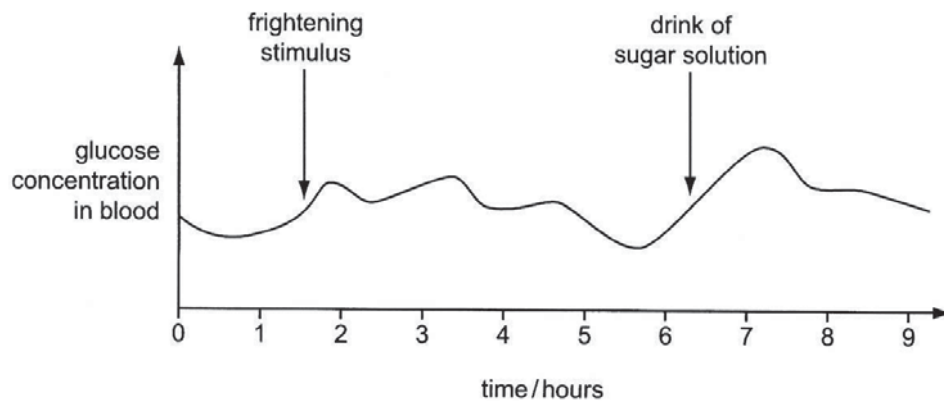


- 6 The diet given to groups P and Q was exchanged after the 20th day. What is the reason?
- A To prevent the death of the rats.
 - B To remove minerals stored in the rats.
 - C To prove that the results seen are due to the effect of milk.
 - D To investigate the interactions of different diets on the growth rate.
- 7 The rats in group P did not increase in mass immediately after milk was added to the diet because
- A milk took time to be digested and assimilated.
 - B the rat did not need the special constituents found in milk.
 - C it took time to produce the digestive enzymes.
 - D the rat did not have the right enzymes to catalyse the reaction.

- 8 The graph below shows the distribution of stomata on the upper and the lower epidermis of the leaves of four plants. Which of these plants would you find in a desert?



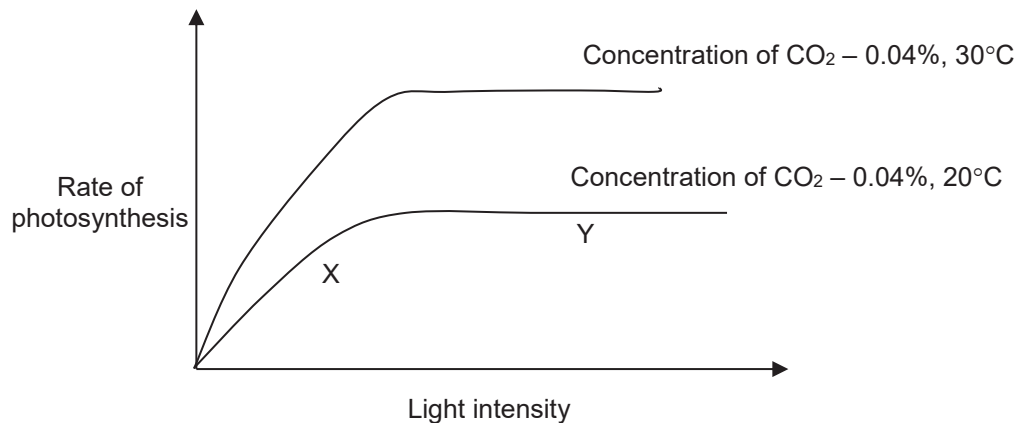
- 9 The graph shows the blood glucose concentration over a period of time.



Which statement is consistent with the blood glucose concentration at eight hours?

- A adrenaline secretion is high
- B insulin secretion is high
- C insulin secretion is low
- D the brain detects the low glucose concentration

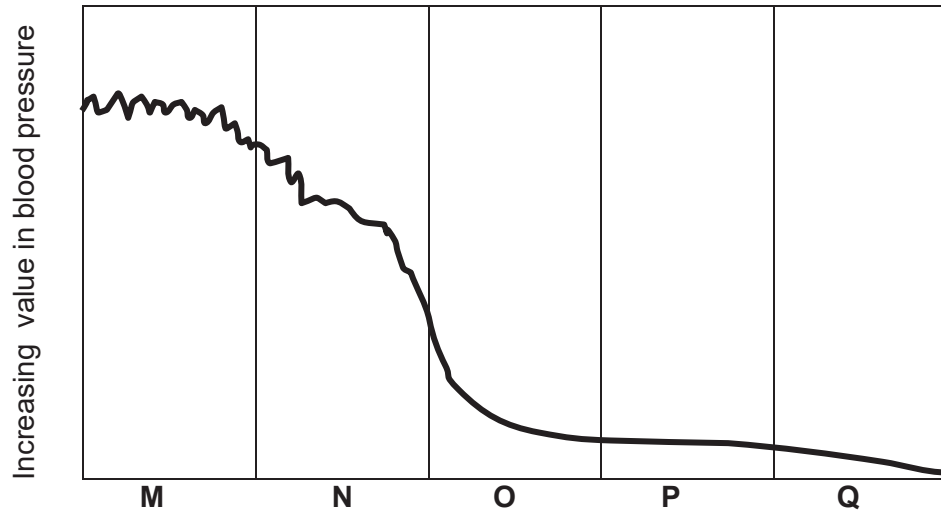
- 10 The graph below shows how the rate of photosynthesis in a plant varies with light intensity at 2 different carbon dioxide concentrations and temperatures as shown.



From the information of the graphs alone, which are the limiting factors at points X and Y?

	X	Y
A	light intensity	concentration of CO ₂
B	temperature	light intensity
C	light intensity	temperature
D	concentration of CO ₂	temperature

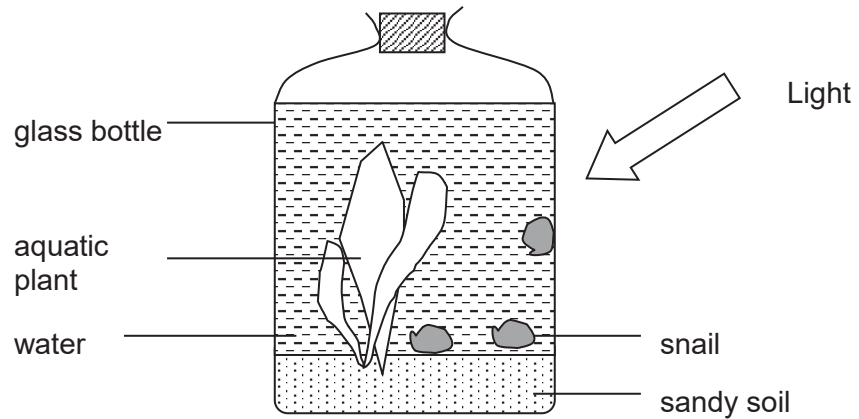
- 11 The graph below shows the variation in blood pressure of the five main types of blood vessels in the circulatory system of man.



Which of the following correctly identifies the blood vessels labelled M to Q?

	M	N	O	P	Q
A	arterioles	arteries	veins	venules	capillaries
B	arteries	arterioles	capillaries	veins	venules
C	veins	venules	capillaries	arterioles	arteries
D	arteries	arterioles	capillaries	venules	veins

- 12 The following diagram shows an aquarium placed in a bright room with temperature of about 30°C.



Which of the following factors is most important for the survival of the organisms in the aquarium?

- A the amount of carbon dioxide in the water
- B the amount of light in the room
- C the amount of oxygen in the water
- D the temperature of the water

- 13** The table below shows the changes in the dry weight of substances found in seeds before and after germination in a dark covered container.

Parts of seed	Dry weight of seeds /g	Dry weight of seedlings formed after germination in darkness /g
Fats	86.2	32.2
Sugars	7.3	19.0
Cellulose	5.4	14.6
Simple proteins	21.6	11.2
Others	24.9	49.1
Total dry weight	145.4	126.1

Why is there a greater mass of cellulose in the seedlings compared to the seeds?

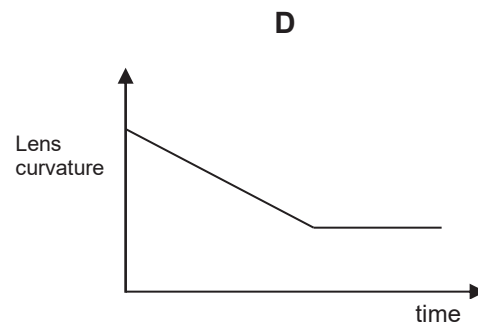
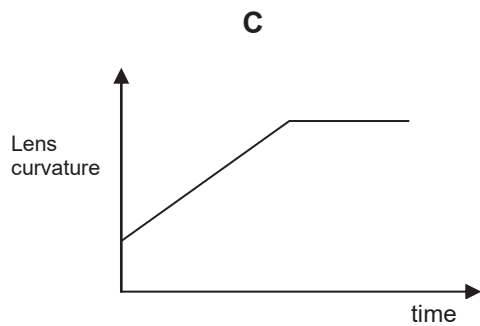
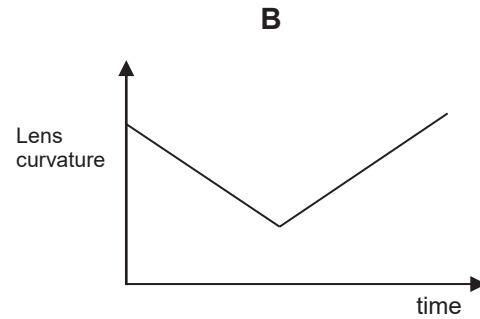
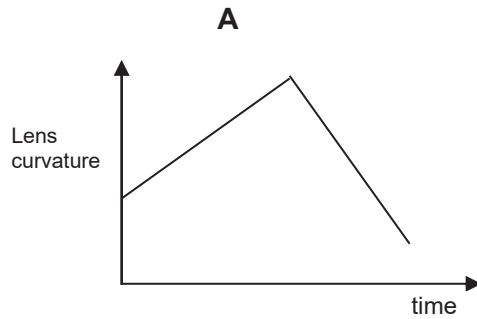
- A** Cellulose and fats are used up during respiration.
- B** Cellulose is formed as the number of cells increased.
- C** Cellulose is translocated from the seeds to the seedlings.
- D** Cellulose is formed as a storage substance in the seedling.

- 14** Which of the following are **not** the characteristics of nervous impulses?

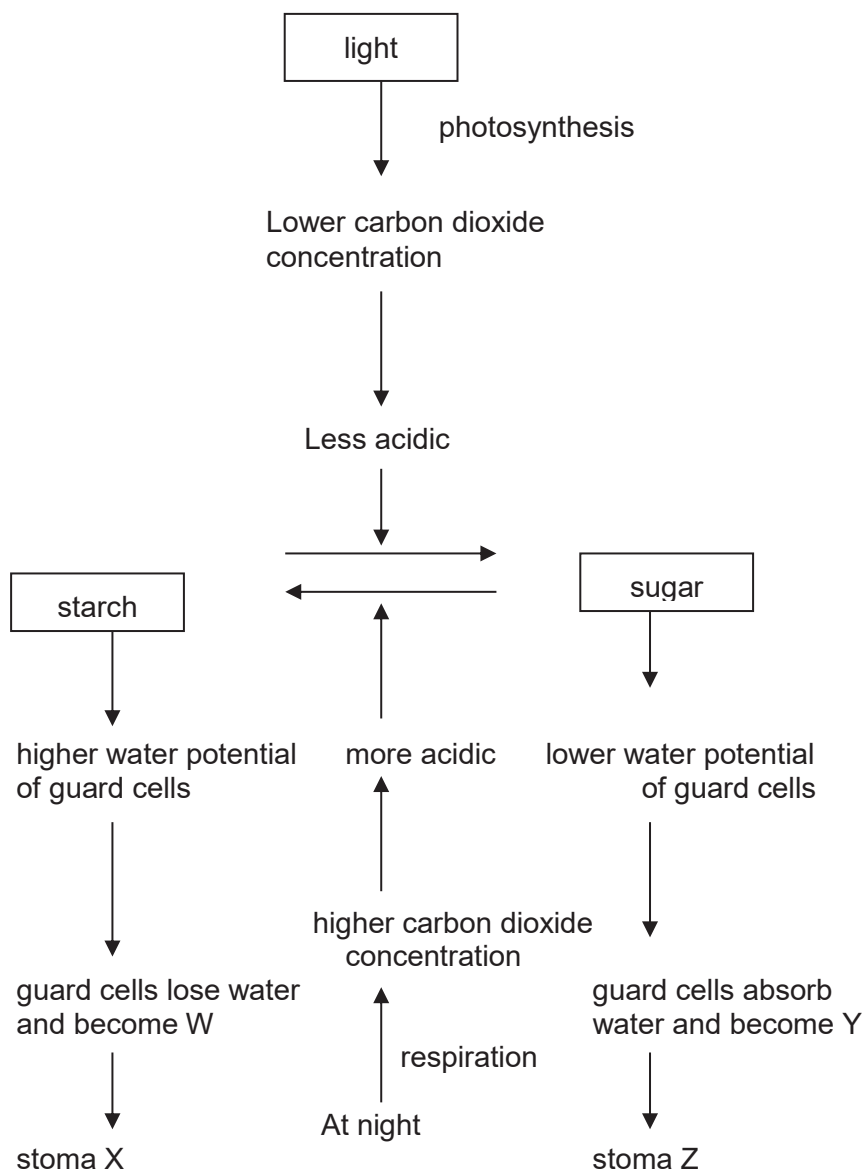
- I It can be transmitted in reverse directions.
- II Transmission along a nerve fibre are both electrical and chemical in nature.
- III The initiation of impulses always starts from the brain.

- A** I and II **B** II and III **C** I and III **D** I, II and III

- 15 A boy was watching a ladybird which was flying towards him and then landed on his nose. Which of the following graphs shows the change in curvature of the lens of his eyes?



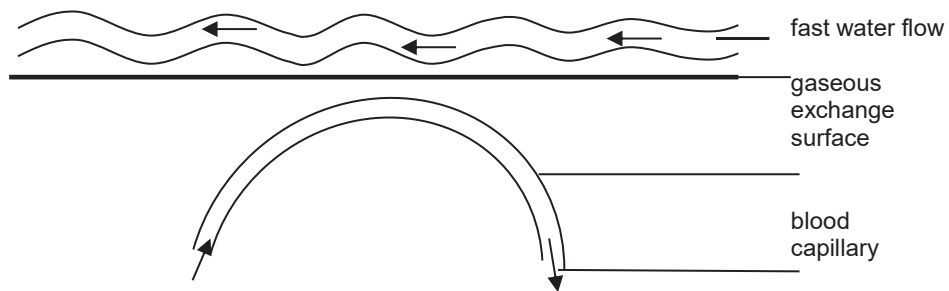
- 16 The mechanism of how stomata opens and closes is shown below.



Which of the following correctly represents W, X, Y and Z?

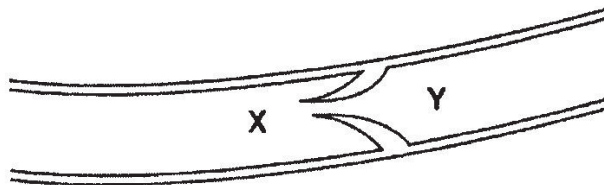
	W	X	Y	Z
A	flaccid	opens	turgid	closes
B	flaccid	closes	turgid	opens
C	turgid	closes	flaccid	opens
D	turgid	opens	flaccid	closes

- 17 The diagram represents the gaseous exchange surface of a fish.



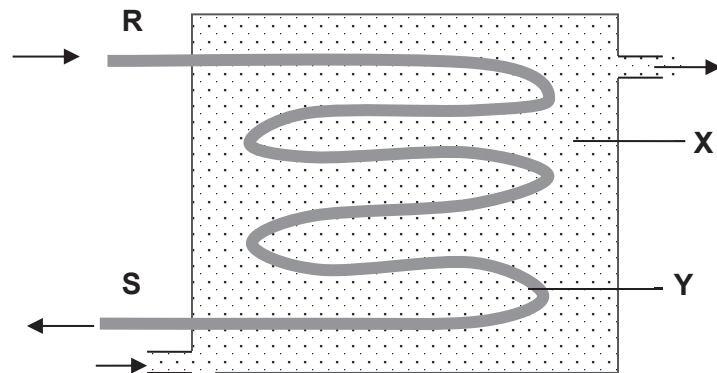
	amount of oxygen dissolved in water	amount of oxygen dissolved in blood plasma	rate of blood flow
A	small	large	fast
B	small	large	slow
C	large	small	fast
D	large	small	slow

- 18 The diagram shows a valve in a section through a blood vessel. Which statement is correct?



- A** Blood flows from X to Y, opening the valve.
- B** The elastic wall causes the valve to close between heartbeats.
- C** Muscles in the wall contract and close the valve, preventing backflow.
- D** The valve is forced open when the blood pressure at Y is greater than at X.

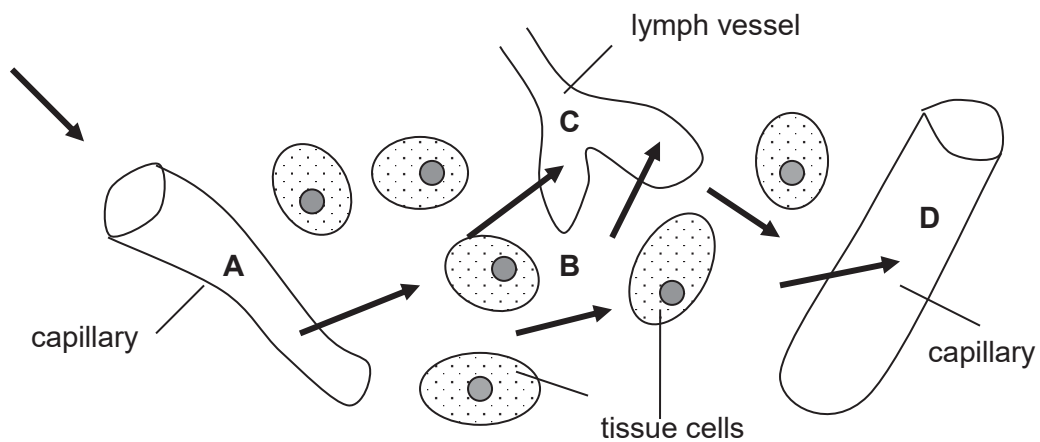
- 19 The diagram below represents a dialysis machine.



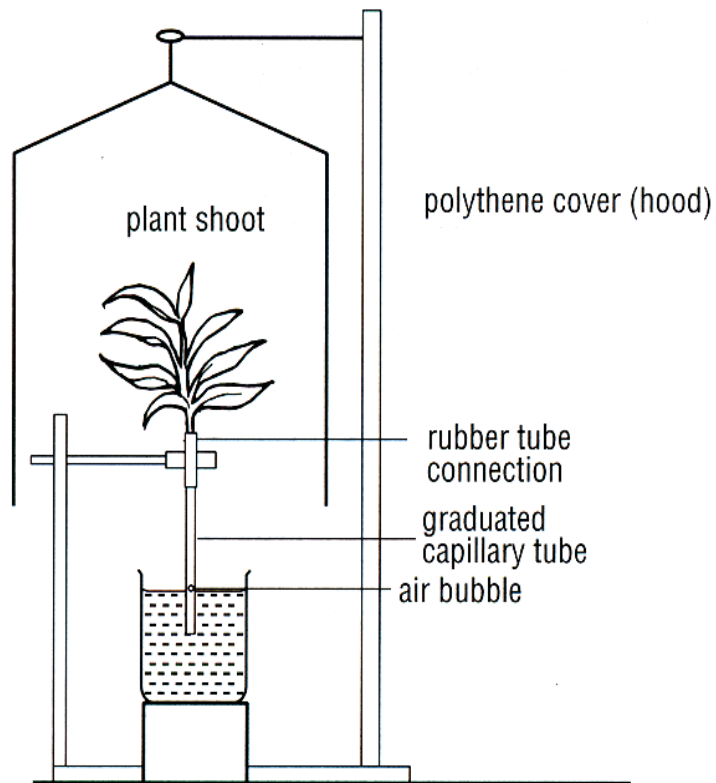
What are X and Y, and to which parts of the patient are R and S connected?

	X	Y	R	S
A	dialysis fluid	lymph	artery	vein
B	lymph	dialysis fluid	vein	artery
C	dialysis fluid	blood	artery	vein
D	blood	dialysis fluid	vein	artery

- 20 The diagram below shows part of a tissue. The arrows show movement of fluids. At which point is the pressure highest?



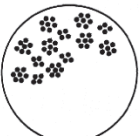
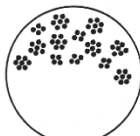
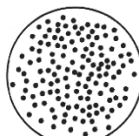
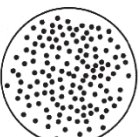
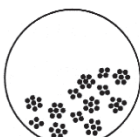
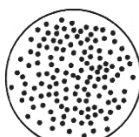
- 21 An experiment was set up as shown in the diagram below.



What is likely to happen to the air bubble during the experiment?

- A Falls slightly due to no wind and no light.
- B Rises slightly due to low humidity and no wind.
- C Remains the same due to low humidity and no light.
- D Remains the same due to high humidity and no wind.

For questions **22** and **23**, refer to the results of blood group testing of three people, John, Jacob and Jennifer, shown below.

Blood of person	X	Y	Z
Serum from blood of group A	 clumps	 clumps	 no clumping
Serum from blood of group B	 no clumping	 clumps	 no clumping

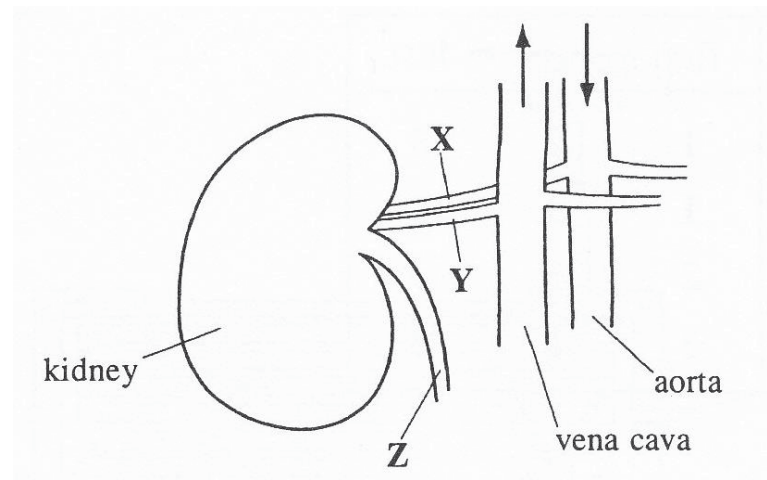
22 To which blood group does each belong?

	John	Jacob	Jennifer
A	A	B	AB
B	B	AB	O
C	AB	A	B
D	O	AB	A

23 What causes the red blood cells of John to clump when his blood is mixed with serum from group A?

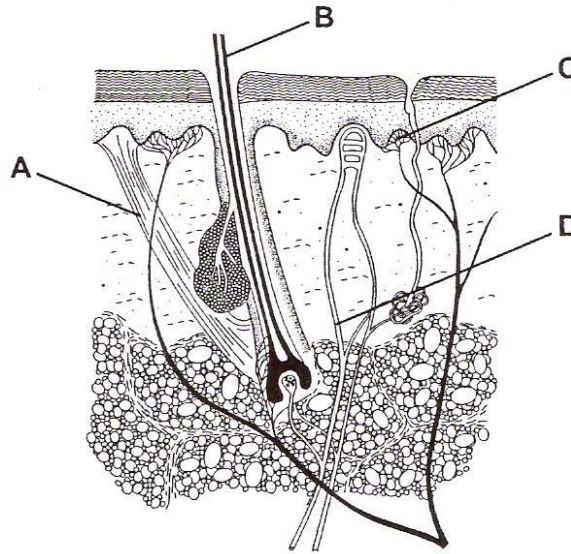
- A** Antibody a in the serum reacts with antigen A on the red blood cells.
- B** Antibody a in the serum reacts with antigen B on the red blood cells.
- C** Antibody b in the serum reacts with antigen B on the red blood cells.
- D** Antibody b in the serum reacts with antigen A on the red blood cells.

- 24** Long term kidney failure can be treated by introducing sterile dialysis fluid into the abdominal cavity. The fluid is drained and replaced regularly using a tube inserted surgically through the abdominal wall. Why does this method work well?
- A** It is because osmoregulation and excretion are achieved by diffusion between the blood in the abdominal capillaries and the dialysis fluid.
- B** It is because osmoregulation and excretion are achieved by the active transport of ions, water and urea between the abdominal capillaries and the dialysis fluid.
- C** It is because the fluid is in direct contact with the kidneys and urea so that excess ions can pass into it without being filtered by the glomeruli.
- D** It is because the fluid is in direct contact with the liver and the large intestine so that waste and excess ions can pass into it from these organs.
- 25** The diagram shows the structures associated with a human kidney. What are the relative concentrations of urea in X, Y and Z?

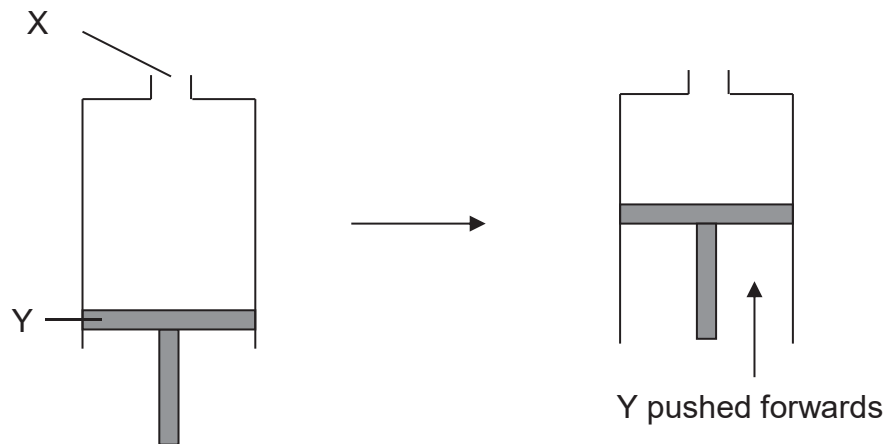


	X	Y	Z
A	high	low	high
B	high	low	low
C	low	high	high
D	low	high	low

- 26 A person walks into a very cold room. Shortly afterwards the hairs on their skin are raised. Which labelled structure is included in the first stage of this reflex?



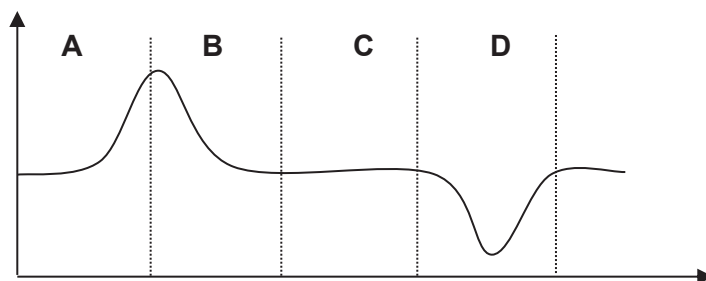
- 27 The following diagrams show models which demonstrate the actions of a set of muscles used during breathing.



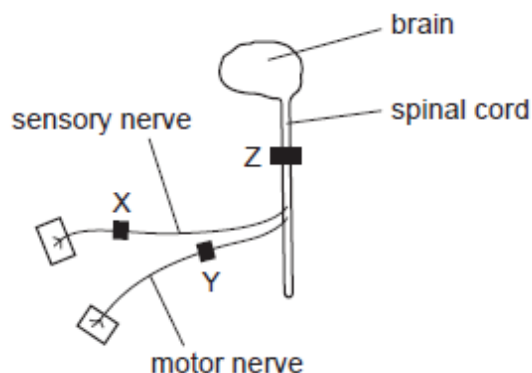
Which structures in the human thorax are represented by parts X and Y on the model and what process is exhibited as Y is pushed upwards?

	X	Y	process
A	bronchus	ribs	inhalation
B	bronchus	diaphragm	exhalation
C	trachea	ribs	inhalation
D	trachea	diaphragm	exhalation

- 28 The graph below shows changes in a person's internal body temperature over a period of time. During which period would the arterioles supplying blood to surface capillaries first become dilated?



- 29 The diagram shows part of the central nervous system where X, Y and Z indicate possible positions to apply an anesthetic block. The anaesthetics are not applied simultaneously at all locations.



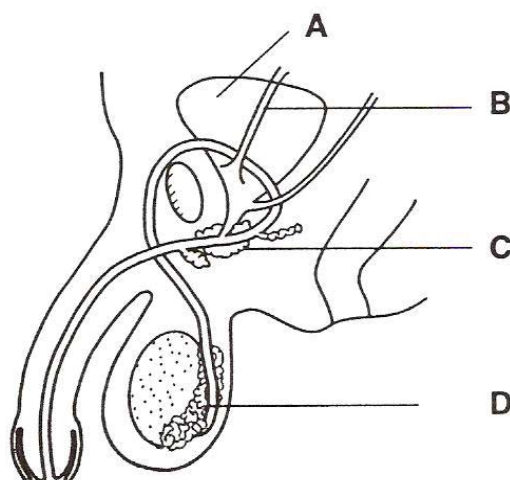
A person's hand is pricked by a pin.

Which of the following correctly describes the effects when an anesthetic block is applied at X and Y respectively?

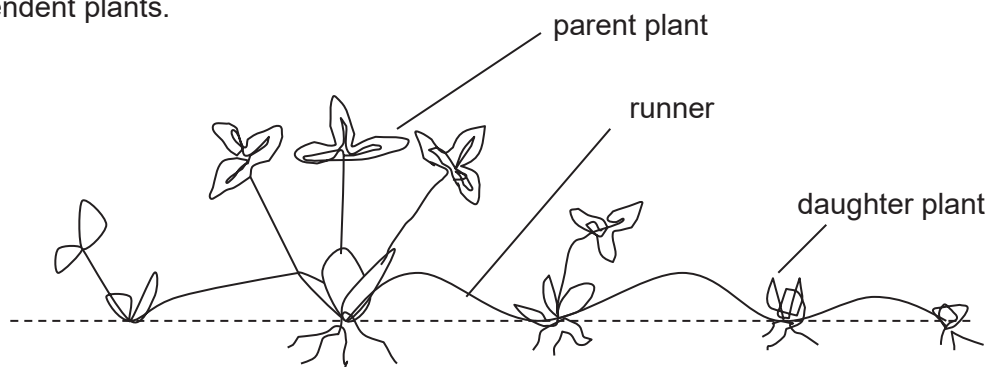
	X		Y	
	pain felt	arm moved	pain felt	arm moved
A	x	✓	✓	x
B	x	✓	x	✓
C	✓	x	✓	x
D	✓	x	x	✓

key: ✓ true x not true

- 30 The diagram shows the male reproductive system and part of the urinary system. Which labelled part stores passive sperms?



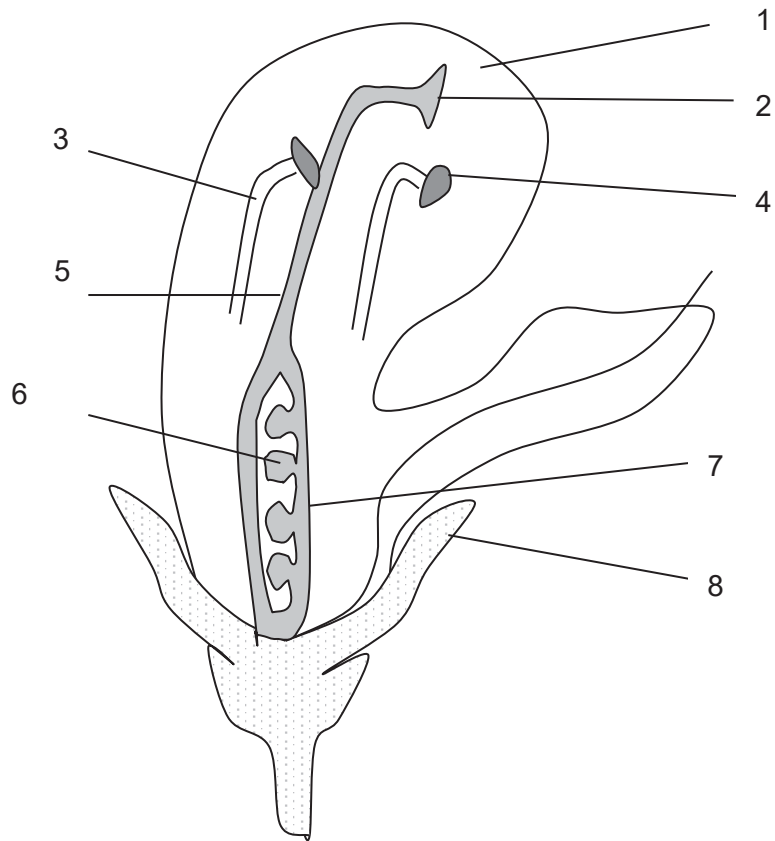
- 31 Some species of plant reproduce vegetatively by producing slender side-shoots called runners, which grow along the ground surface and roots at the nodes as shown in the diagram below. Eventually, the runner decays, leaving the rooted parts to develop as independent plants.



In which of the following ways may this method of reproduction have an advantage over reproduction by seed?

- A The offspring are identical to the parent and are able to survive well in the same environment as the parent plant.
- B Rapid growth of the runners will ensure a much wider range of dispersal.
- C There is no possibility of a mutation occurring to give offspring of a different genotype.
- D Those plants which compete with this species will have less chance of becoming established nearby.

- 32** The diagram below shows the structure of an insect-pollinated flower.



Which of the following is the adaptation of the above flower to bring about insect pollination?

- A** 5 is longer than 3.
- B** 1 is big and brightly coloured.
- C** 8 is small and green in colour.
- D** 3 is long and pendulous.

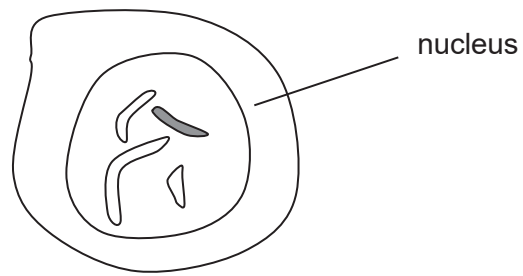
- 33 The table below shows the relative amounts of DNA found in different cells.

animal	sperm cell/arbitrary units	blood cell/arbitrary units
chicken	1.3	2.5
frog	3.7	7.3
human	3.3	7.3
trout	2.7	5.8

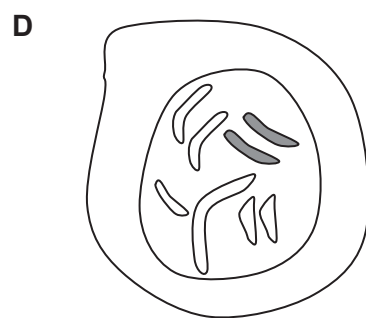
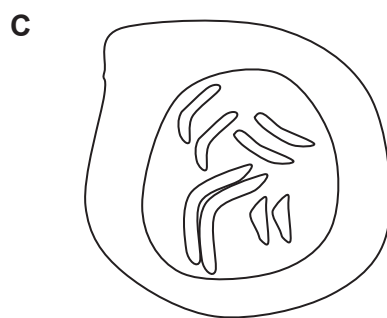
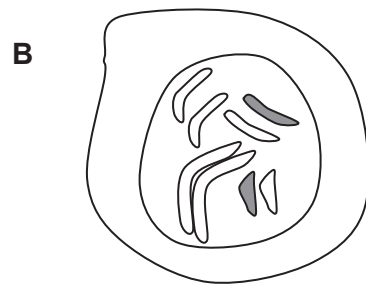
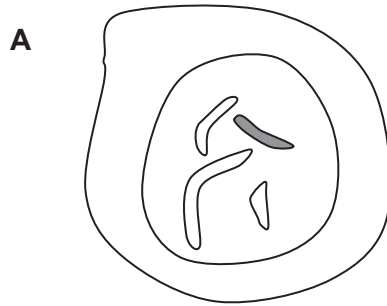
Which of these conclusions is **incorrect**?

- A The amount of DNA in each cell is in proportion to the size of the animal.
- B Not all animals have the same amount of DNA.
- C The sperm cells have roughly half the number of chromosomes found in blood cells.
- D The amount of DNA in the same type of cells varies from animal to animal.

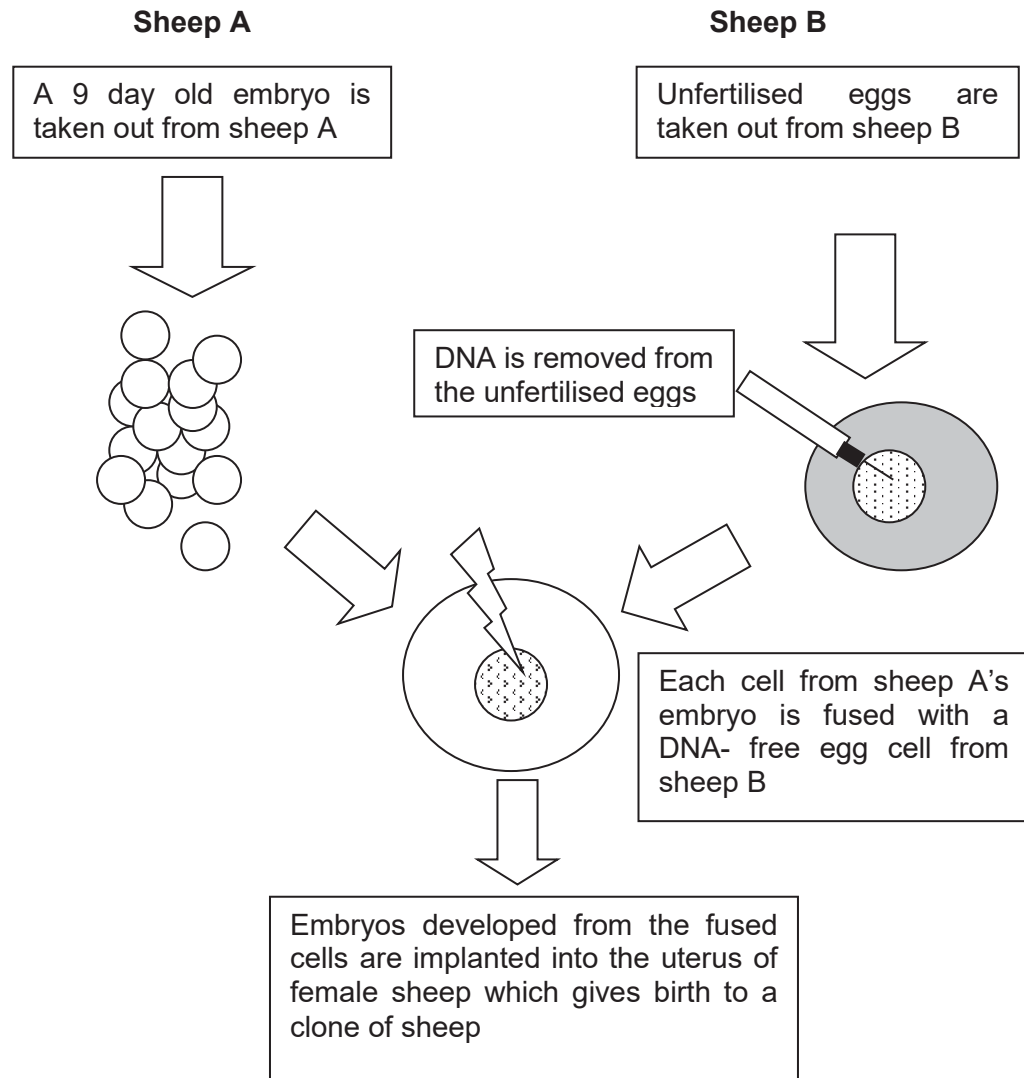
- 34 The diagram below shows the nucleus of a sex cell of an organism.



What would become of the nuclear contents after fertilisation?



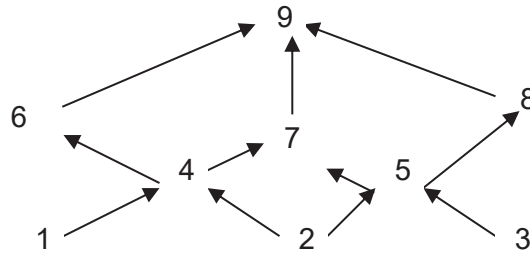
- 35 The diagram below outlines how a clone of sheep were produced from a mother sheep.



Which of the following statements states that the above process is asexual reproduction?

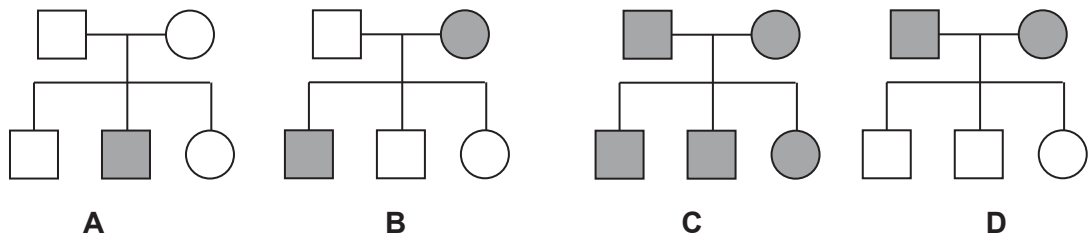
- A** No gametes are produced by sheep A.
- B** Sheep A and sheep B have not mated.
- C** The unfertilised egg obtained from sheep B contains haploid number of chromosomes.
- D** No fusion of gametes is involved in the production of the clone.

- 36 The diagram shows nine organisms forming a food web. Which of the organisms is a producer and which is a carnivore?

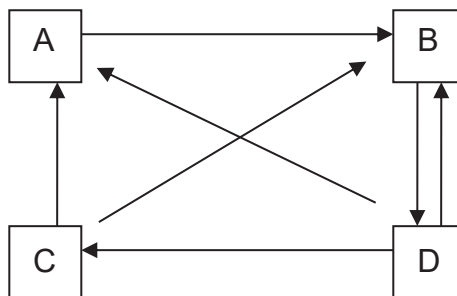


	producer	carnivore
A	1	4
B	2	6
C	5	8
D	7	9

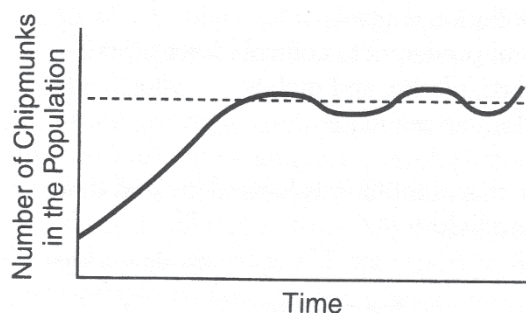
- 37 Which of the following pedigree diagrams may conclusively prove that the ability to roll the tongue (unshaded) is a dominant characteristic?



- 38 The diagram represents the cycling of carbon through the atmosphere, consumers, decomposers and producers in an ecosystem. Which box represents organisms whose growth rate would be increased by a rise in levels of atmospheric carbon dioxide?



- 39 A population of chipmunks migrated to an environment where they had little competition. Their population quickly increases but eventually stabilised as shown in the graph. Which statement best explains why the population stabilised?



- A A predator species came to an area and occupied the same niche as the chipmunks.
- B An increase in the chipmunks population caused an increase in the producer population.
- C Interbreeding between members of the population increased the mutation rate.
- D The population size became limited due to factors such as availability of food.
- 40 Consider the food chain below :

Tree → caterpillar → birds → protozoa

Which of the following correctly illustrates the pyramid of biomass and pyramid of numbers?

	pyramid of biomass	pyramid of numbers
A		
B		
C		
D		

Name: ()

Class: Sec 4A

Queenstown Secondary School



Preliminary Examination 2019 Secondary Four Express Biology 6093/02

3 September 2019
Tuesday

Time: 1045 – 1230h
Duration: 1 hour 45 minutes

Additional Materials: Question Paper
Graph paper (1 sheet)

READ THESE INSTRUCTIONS FIRST

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

Section A

Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B

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

Electronic calculators may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.
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.

Examiner's Use	
Section A	/50
Section B	/30
Q8	
Q9	
Q10	
TOTAL	/80

Section A

Answer **all** questions.

Write your answers in the spaces provided.

- 1 An experiment was carried out with a plant over a period of three days to measure the rate of water uptake by the plant. The table below shows the rate of the uptake of water during the three days.

Day	Time (Hour)	Rate of Water Uptake (<i>ml</i> /hour)
Day 1	1200	10
	2400	4
Day 2	1200	16
	2400	4
Day 3	1200	9
	2400	4

- (a) Using the information obtained from the table above, account for the rate of water uptake at midnight each day.

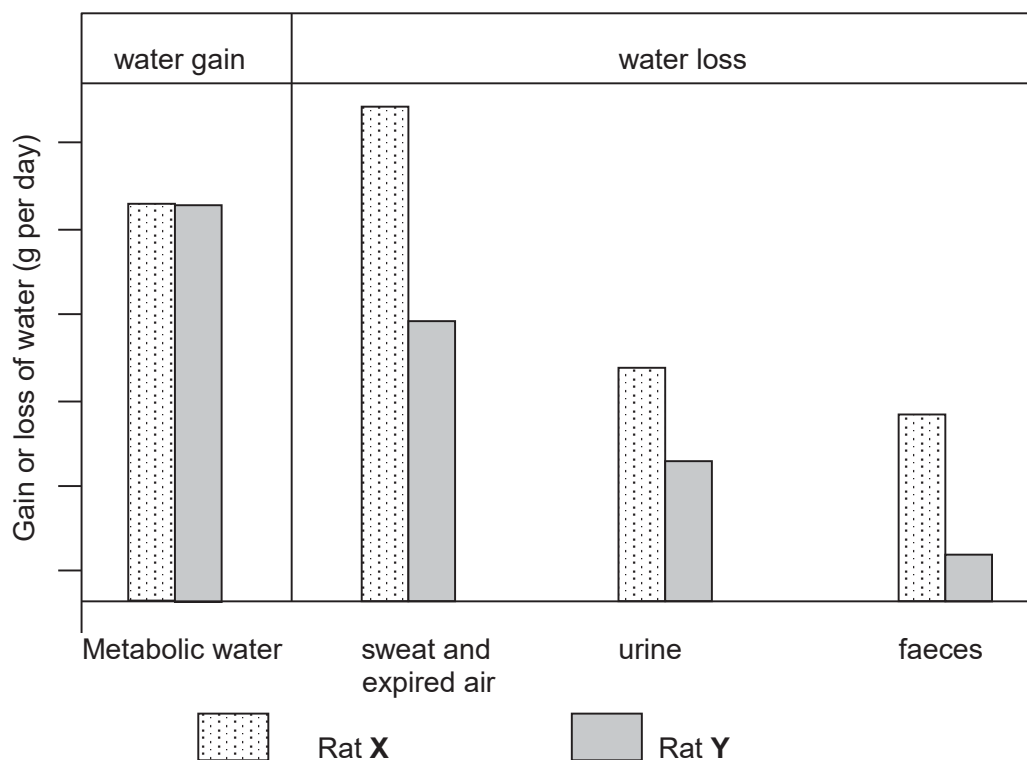
[2]

- (b) Suggest a reason for the difference in the rate of water uptake at 1200 on the three days.

[3]

[Total: 5]

- 2 Two rats **X** and **Y**, of equal weight but belonging to different species, were given the same amount of food. They were kept in the same environmental conditions inside the laboratory for three days. The average daily gain and loss of water by each rat is shown in the following chart:



- (a) State **two** environmental conditions that should be kept constant during the experimental period.

[2]

- (b) (i) Briefly describe **one** way by which the rats obtain metabolic water.

[1]

- (ii) What will be the result if the rats fail to maintain the water balance?

.....
 [1]

- (c) If rat **X** is forced to do vigorous exercise, what will be the change in the amount of water lost in each of the three waste products? Explain your suggestion.

.....

 [2]
 [Total: 6]

3 Fig. 3.1 shows a food chain and the energy flow through it.

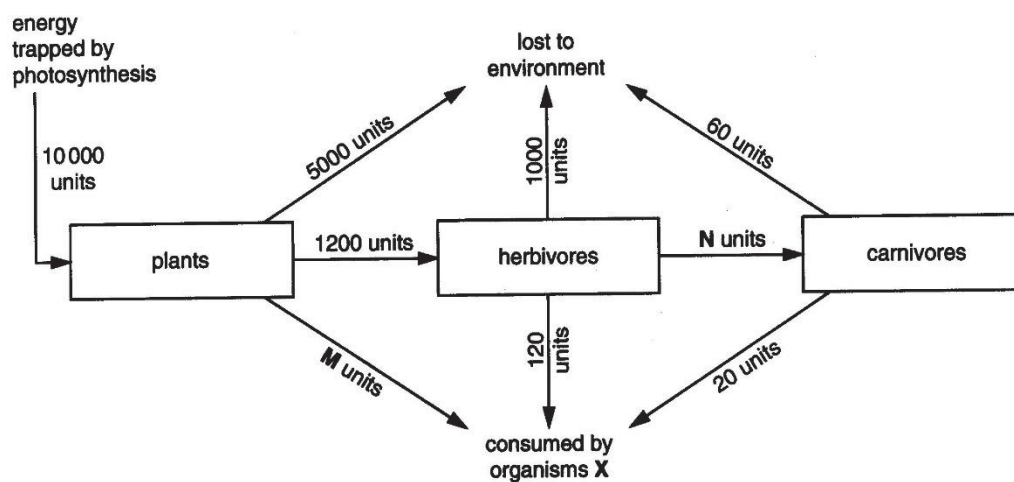


Fig. 3.1

- (a) Calculate the energy values **M** and **N**.

M: [1]

N: [1]

- (b) Which group of organisms might **X** belong to?

----- [1]

- (c) Suggest **two** processes that might account for the loss of energy from the organisms to the environment.

----- [2]

- (d) Suggest why the herbivores lose more energy to the environment than the plants.

----- [2]
[Total: 7]

- 4 Photomicrograph **X** shows the transverse section of the reproductive part of a plant. Photomicrograph **Y** shows a magnified image of the cells found in the reproductive structure.

Photomicrograph **X**Photomicrograph **Y****Fig 4.1**

- (a) Identify structures **X** and **Y**.

X: [1]

Y: [1]

- (b) (i) Name the type of cell division involved in the production of cells shown in photomicrograph **Y**.

..... [1]

- (ii) Explain the significance of the type of cell division you mentioned in (b) (i).

.....

 [3]

- (c) From the structure of **Y**, suggest how it is transferred from one reproductive structure to another. Give a reason for your answer.

----- [2]

- (d) Describe **one** similarity and difference between structure Y in plant and human.

similarity ----- [1]

difference ----- [1]

[Total: 9]

- 5 Fig. 5.1 below are two graphs showing potassium and bromide ion uptake in dandelion roots.

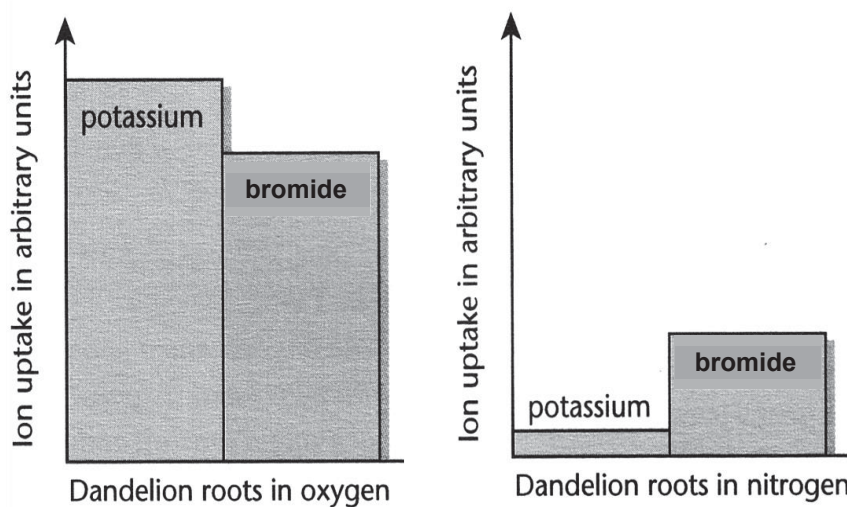


Fig. 5.1

- (a) State **two** processes in which the ions are taken up by the plants.

----- [2]

- (b) From the findings as shown in the graphs above, explain the difference in the absorption of the ions between the two processes.

----- [2]

- (c) Potassium and bromide ions are absorbed into the plants by the roots. Explain briefly the adaptations of the root hairs in order to carry out its function.

----- [2]

- (d) Outline the route taken by the bromide ions as it travels from the roots to the leaves.

----- [3]

[Total: 9]

- 6 In humans, the inherited disease, Huntington's chorea, is caused by a dominant allele. Answer the questions with reference to the following pedigree:

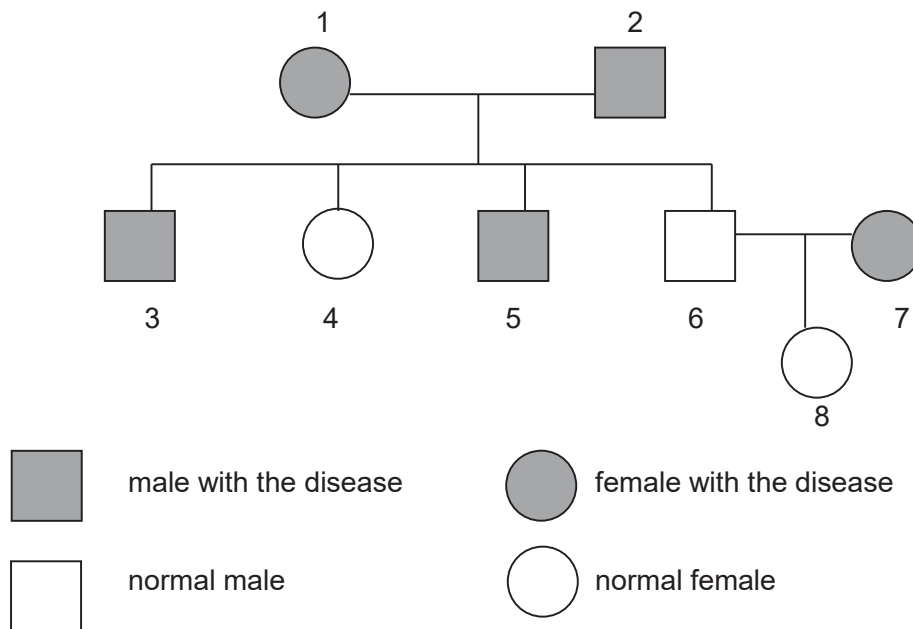


Fig. 6.1

- (a) From the information given in Fig. 6.1, deduce the genotypes of individuals **1** and **2**. Explain how you arrive at your answer.

individual 1: _____ [1]

individual 2: _____ [1]

explanation:

 _____ [1]

- (b) What is the chance of a second child of the couple **6** and **7** being normal?
Explain your answer with the help of a genetic diagram.

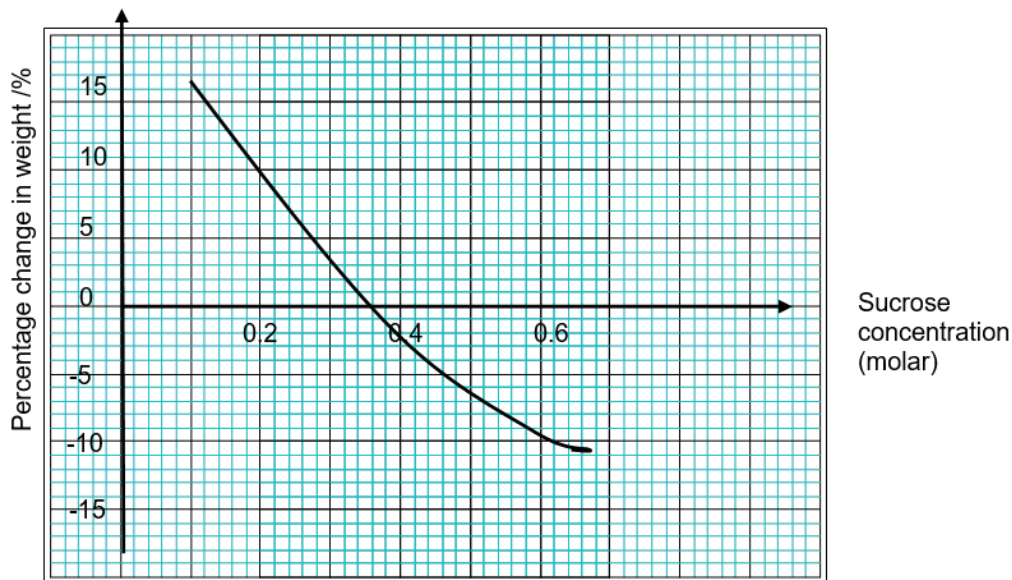
[5]

- (c) Suggest, if any, the possibility that individual **4** will have a child with the Huntington chorea if she is married to a normal man.

[2]

[Total: 10]

- 7 The following graph shows the result of an experiment where strips of potato of similar shape and size were immersed in sucrose solutions of different concentrations.



- (a) If the average initial mass of each potato strip is 3.2g, what is the average final mass of the potato strip that has been immersed in the 0.5M sucrose solution?

[2]

- (b) What is the water potential of the potato cell sap in terms of the concentration of the sucrose solution? Give a reason for your answer.

[2]

[Total: 4]

Section B

Answer **three** questions in this section.

Q10 is in the form of an ***Either / Or*** format. Only one part should be answered.

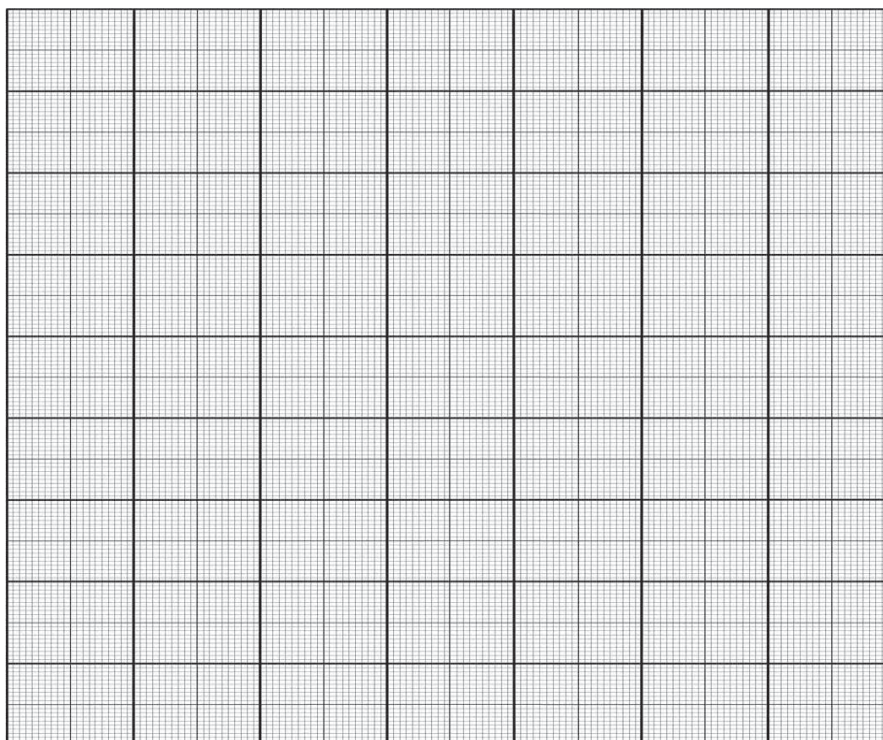
- 8** Two different types of haemoglobin were extracted from a pregnant woman. The percentage saturation of haemoglobin with oxygen is a measure of how readily the haemoglobin binds with oxygen.

Table 8.1 shows the percentage saturation of haemoglobin at different partial pressure of oxygen.

Table 8.1

Partial Pressure of oxygen / Kpa	0	2	4	6	8	10	12
% saturation of fetal haemoglobin	0	20	56	80	90	94	98
% saturation of normal haemoglobin	0	12	36	66	82	90	96

- (a)** Plot the percentage saturation of fetal and normal haemoglobin at different partial pressure of oxygen on the grid.



[4]

- (b) Using the graph above, describe and explain the trend shown by the fetal haemoglobin and normal haemoglobin at different pressures of oxygen.

[3]

- (c) Describe how the fetus obtains oxygen from the mother during the development of the fetus.

[3]

[Total: 10]

- 9 (a) The disease diabetes occurs commonly among obese people. One of the symptoms is the presence of glucose in the urine. Describe a test to check for the presence of glucose in the urine of diabetics.

[2]

- (b)** Diabetics are usually treated with daily insulin injections. Until recently, the insulin used to treat diabetics was extracted from animals. Nowadays, genetically engineered insulin is used widely for the treatment of diabetes.

- (i) Use your knowledge of the basic principles of genetic engineering to explain how genetically engineered insulin is produced.

[illegible]

[6]

- (ii) Suggest **two** advantages of using genetically engineered insulin to treat diabetes as compared to the insulin extracted from animals.

[2]

[Total: 10]

10 EITHER

- (a) Describe the main stages in the menstrual cycle of an unmarried female. Explain how hormones help in controlling this cycle.

[6]

- (b) "Upon successful fertilisation in a female mammal, the uterus plays a very important role in the development of the embryo till its birth." How true is this statement?

[4]

[Total: 10]

10 OR

- (a) In extremely cold conditions people may get frostbite. This causes the cells in the toes and fingers to die. Explain why this takes place even though thick gloves, socks and shoes are worn.

----- [5]

- (b) Explain why our body shiver in cold conditions and perspire in hot weather conditions.

----- [5]

[Total: 10]

