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Human Biology

Unit: 4HB0

Paper: 01

Wednesday 11 January 2017 – Afternoon

Time: 2 hours

Paper Reference

4HB0/01

You must have:

Ruler

Calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 120.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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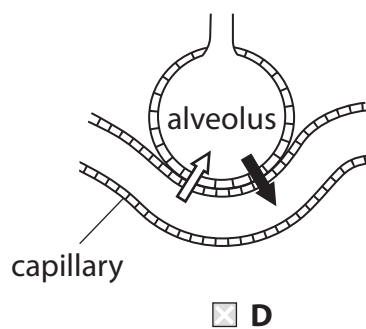
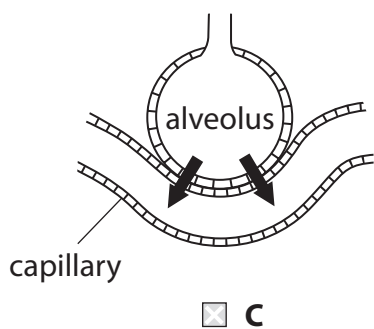
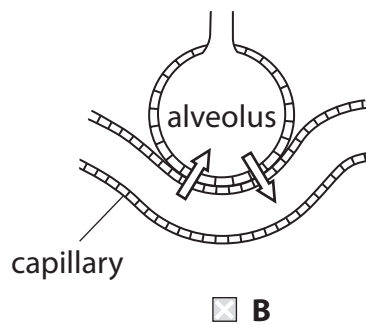
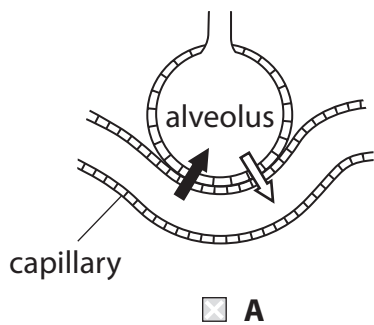
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Answer ALL questions.


1 For each of the questions (a) to (j), choose an answer **A**, **B**, **C** or **D** and put a cross in the box . Mark only one answer for each question. If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .


(a) Which diagram shows the correct process of gaseous exchange in the lungs?

(1)



Key

 Oxygen

 Carbon dioxide

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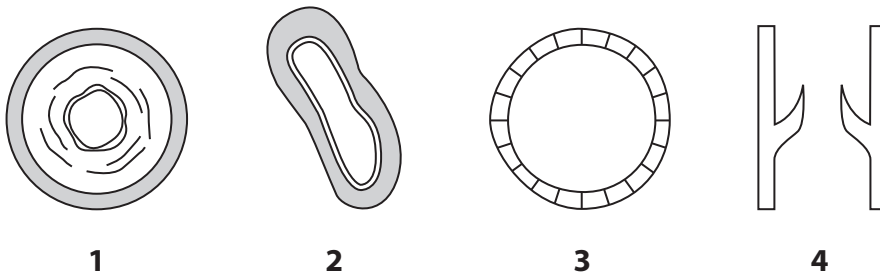
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(b) The diagram shows three types of blood vessel.

Not to scale



Which row of the table correctly identifies these vessels?

(1)

| | 1 | 2 | 3 | 4 |
|----------------------------|-----------|-----------|-----------|-----------|
| <input type="checkbox"/> A | artery | vein | capillary | vein |
| <input type="checkbox"/> B | capillary | artery | artery | vein |
| <input type="checkbox"/> C | artery | vein | vein | capillary |
| <input type="checkbox"/> D | vein | capillary | capillary | artery |

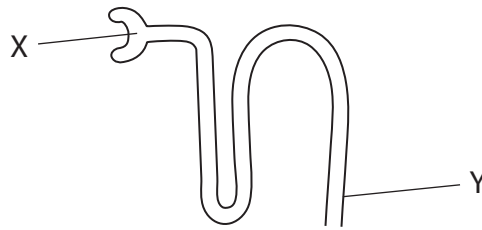
(c) How do cilia prevent pathogens entering the human body?

(1)

- A they provide a covering of protective tissue
- B they produce secretions toxic to pathogens
- C they move mucus to the throat
- D they increase blood circulation to the infected area



(d) The diagram shows a kidney tubule.



The composition of the filtrate changes as it passes along the tubule.

Which row of the table describes the changes taking place between X and Y?

(1)

| | Glucose concentration | Protein concentration |
|----------------------------|-----------------------|-----------------------|
| <input type="checkbox"/> A | decreases | increases |
| <input type="checkbox"/> B | no change | decreases |
| <input type="checkbox"/> C | increases | no change |
| <input type="checkbox"/> D | decreases | no change |

(e) Water is treated to make it safe to drink.

Which water treatment process results in the killing of pathogens?

(1)

- A chlorination
- B filtration
- C fluoridation
- D precipitation



(f) The table gives four diseases and the type of organism that causes each disease.

Which disease can be treated by an antibiotic?

(1)

| | Disease | Type of organism |
|----------------------------|--------------|------------------|
| <input type="checkbox"/> A | influenza | virus |
| <input type="checkbox"/> B | malaria | protozoan |
| <input type="checkbox"/> C | thrush | fungus |
| <input type="checkbox"/> D | tuberculosis | bacterium |

(g) DNA consists of four nitrogen-containing bases.

They are adenine (A), guanine (G), cytosine (C) and thymine (T).

Which of these is the correct pairing of the bases in DNA?

(1)

- A C – A and T – G
- B G – C and T – A
- C G – T and A – C
- D T – C and G – A

(h) The presence of a skin pigmentation known as freckles is controlled by a dominant allele.

A child's father has no freckles and its mother is heterozygous for the condition.

What is the probability that the child will have freckles?

(1)

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



- (i) Four cubes of equal size, from the same potato, are each placed into sugar solutions, A, B, C and D. Each sugar solution has a different concentration.

The cubes are weighed at the start and one hour after being placed in their sugar solution.

The table shows the results.

| Solution | Mass at start in g | Mass after 1 hour in g |
|----------|--------------------|------------------------|
| A | 49.5 | 50.1 |
| B | 49.5 | 46.2 |
| C | 49.5 | 60.1 |
| D | 49.5 | 43.4 |

Which sugar solution has the lowest concentration?

(1)

- A**
- B**
- C**
- D**

- (j) Some cells contain a large number of different enzymes.

What is the reason for this large number of different enzymes?

(1)

- A** they have different optimum temperatures
- B** they have a different optimum pH
- C** they are affected by different substrate concentrations
- D** they are each specific to one type of reaction

(Total for Question 1 = 10 marks)



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2 This passage is about breathing.

Complete the passage by writing a suitable word in each blank space.

(7)

During inhalation (breathing in) the muscles contract and pull the ribs upwards and At the same time the contracts and becomes flattened.

Both of these processes increase the of the thoracic cavity and decrease the

This causes air from the atmosphere to be into the and then into the lungs.

(Total for Question 2 = 7 marks)

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3 The box lists substances needed for a balanced diet.

| | | | | |
|-----------|---------|---------|-----------|-----------|
| starch | lipids | protein | vitamin A | vitamin C |
| vitamin D | calcium | iron | fibre | water |

The table gives the function of some substances.

Complete the table by matching the substances in the box to their correct function.

Each substance may be used once, more than once or not at all.

(8)

| Function of substance | Name of substance |
|---|-------------------|
| stored under the skin and around some organs | |
| used to strengthen tooth enamel | |
| broken down into amino acids during digestion | |
| assists peristalsis | |
| used for the formation of visual purple in the retina | |
| used in the formation of haemoglobin | |
| a medium in which chemical reactions occur in a cell | |
| needed for growth of tissues | |

(Total for Question 3 = 8 marks)

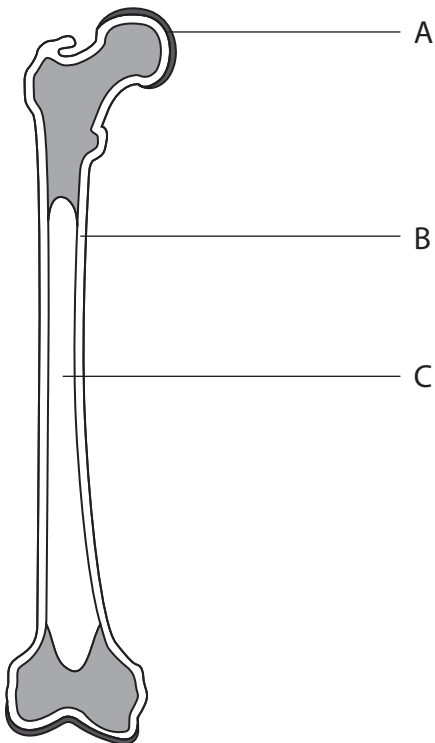
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4 The diagram shows a section through a long bone.



(a) (i) Name structures A, B and C.

(3)

A

B

C

(ii) Describe the function of structure A.

(2)

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(b) The bone is placed into a container of hydrochloric acid for 10 hours.
The bone becomes soft and is easily bent after that time.

(i) State two safety precautions that should be taken whilst treating the bone in the way described.

(2)

1

2

(ii) Explain the changes to the bone that are observed after 10 hours.

(3)

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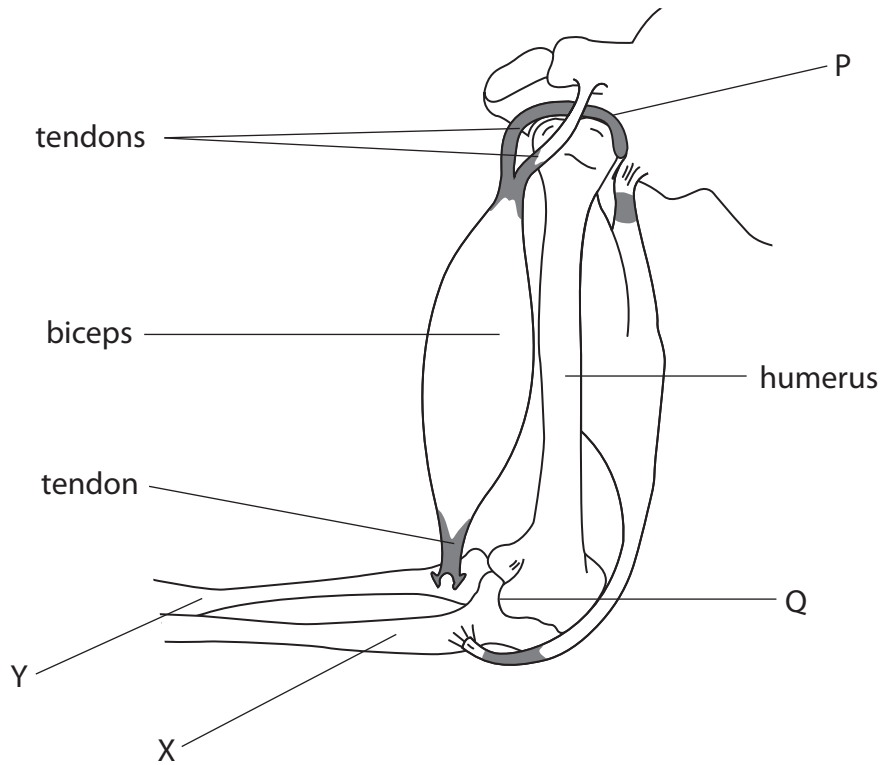
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(c) The diagram shows the bones and muscles used to raise and lower the forearm.



(i) State the names of bones X and Y. (2)

X

Y

(ii) Explain why the tendons from the lower end of the biceps are attached to bone Y and not the humerus. (2)

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(iii) Explain the changes that occur in the biceps muscle when the forearm is lowered (straightened).

(2)

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(iv) The two joints labelled P and Q are both synovial joints. State two other components of a synovial joint that are not shown in the diagram.

(2)

1

2

(d) Complete the table by giving two differences between muscles and tendons.

(2)

| Muscles | Tendons |
|---------|---------|
| 1 | |
| 2 | |

(Total for Question 4 = 20 marks)

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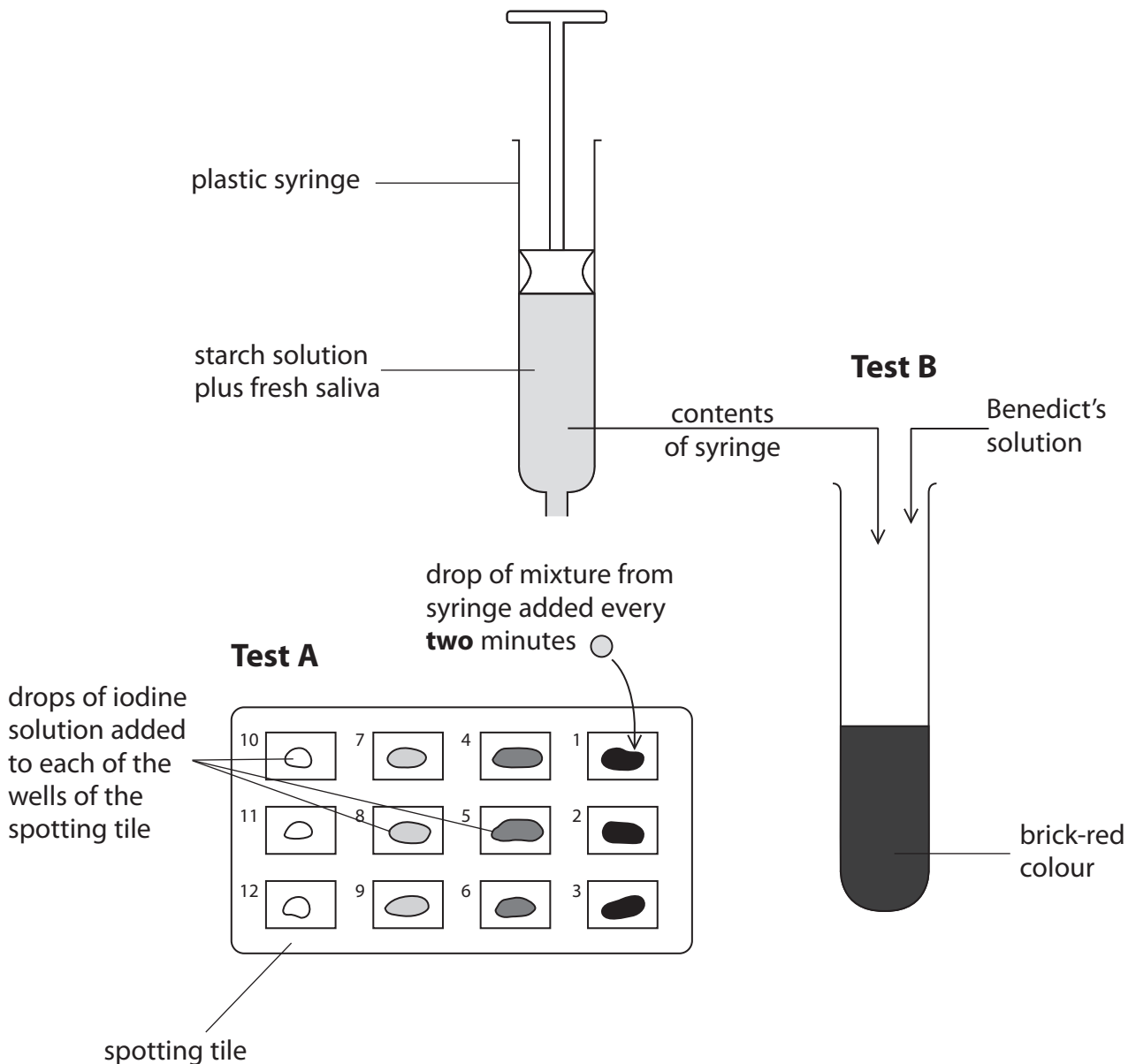
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5 An investigation is carried out to test the effect of saliva on starch.

- Starch solution is mixed with saliva in a syringe.
- Test A is then carried out using drops of iodine solution in wells on a spotting tile. Drops of the starch solution and saliva mixture are added to a new well in the spotting tile every two minutes.
- After 30 minutes the Benedict's test, test B, is carried out on the remaining contents of the syringe.

The results of both test A and test B are shown in the diagram.



(a) (i) Which part of the human body is represented by the syringe?

(1)

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(ii) State the colour of the iodine solution when a drop of the mixture from the syringe is added to it after two minutes. (1)

(iii) State how long it takes for no colour change to be observed in the iodine. (1)

(iv) Explain why there is no colour change after the time you gave in your answer to (iii). (2)

(v) Suggest a suitable control experiment that could be carried out to support your explanation. (1)

(vi) Suggest why this experiment could be considered a health hazard in schools. (2)

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(b) (i) Describe what was done to the test tube in test B so that the contents turn brick-red. (2)

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(ii) Explain why the contents turn brick-red. (2)

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(c) The syringe is kept at 37°C during test A.

(i) Explain why this temperature is used. (2)

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(ii) In another investigation the syringe is kept at 5°C during test A. Explain how the results for test A and test B at this temperature would differ from the results at 37°C. (3)

Test A

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Test B

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(Total for Question 5 = 17 marks)



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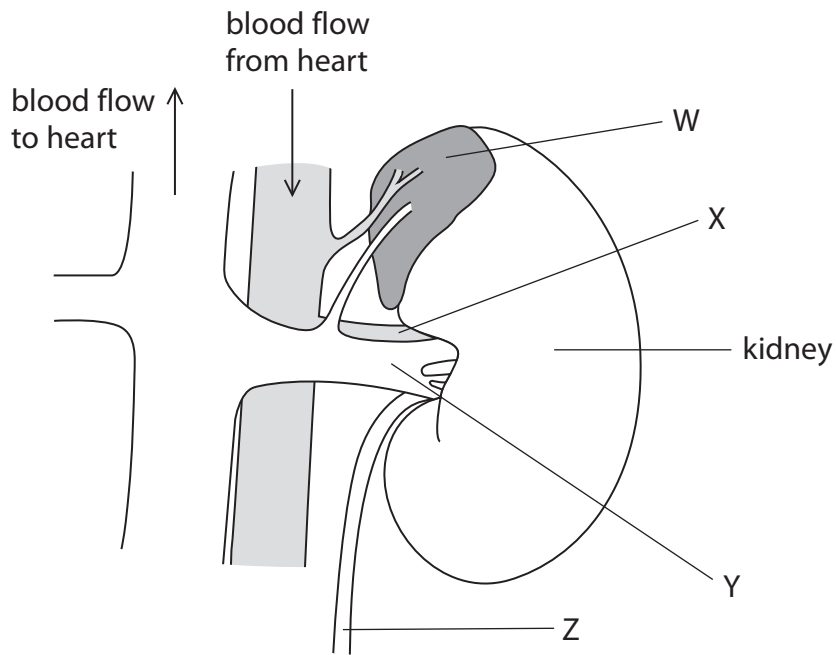
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6 The diagram shows a kidney and its blood vessels.



(a) The name of gland W is the

(1)

- A adrenal
- B pancreas
- C pituitary
- D thyroid

(b) Explain why gland W does not need a duct to carry away its secretions.

(2)

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(c) (i) Give the name of tube Z. (1)

(ii) One end of tube Z is attached to the kidney.
Give the name of the structure that is attached to the other end of tube Z. (1)

(d) Give the name of blood vessel Y. (1)

(e) State two differences between the composition of blood in blood vessel X and blood vessel Y. (2)

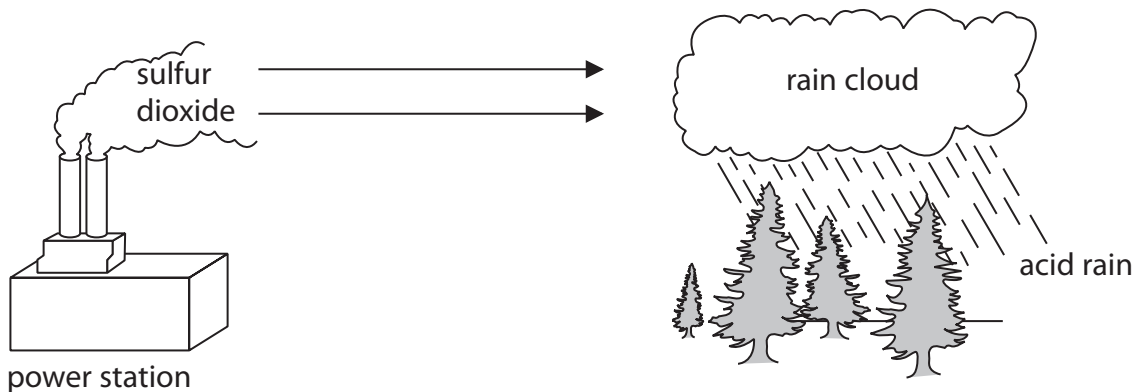
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(Total for Question 6 = 8 marks)



7 The diagram shows the formation of acid rain from sulfur dioxide.



(a) Describe how acid rain is formed from sulfur dioxide.

(3)

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(b) Suggest a method to measure the acidity of rain.

(3)

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(c) Sulfur dioxide and acid rain have an effect on humans, trees and lakes.

(i) Describe two effects that sulfur dioxide has on humans.

(2)

1

2

(ii) Describe two effects that acid rain has on trees.

(2)

1

2

(iii) Describe two effects that acid rain has on lakes.

(2)

1

2

(Total for Question 7 = 12 marks)



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8 (a) (i) The table lists three types of cell found in human blood. It also lists some features of human blood cells.

Complete the table by placing a tick (✓) in the box if the feature is correct for the type of cell.

(3)

| Feature of cell | Red blood cell | Lymphocyte | Phagocyte |
|----------------------|----------------|------------|-----------|
| has a nucleus | | | |
| contains haemoglobin | | | |
| produces antibodies | | | |

(ii) State the function of each of the cells in the circulatory system.

(3)

red blood cell

lymphocyte

phagocyte

(iii) Explain how the structure of a red blood cell enables it to function efficiently.

(3)

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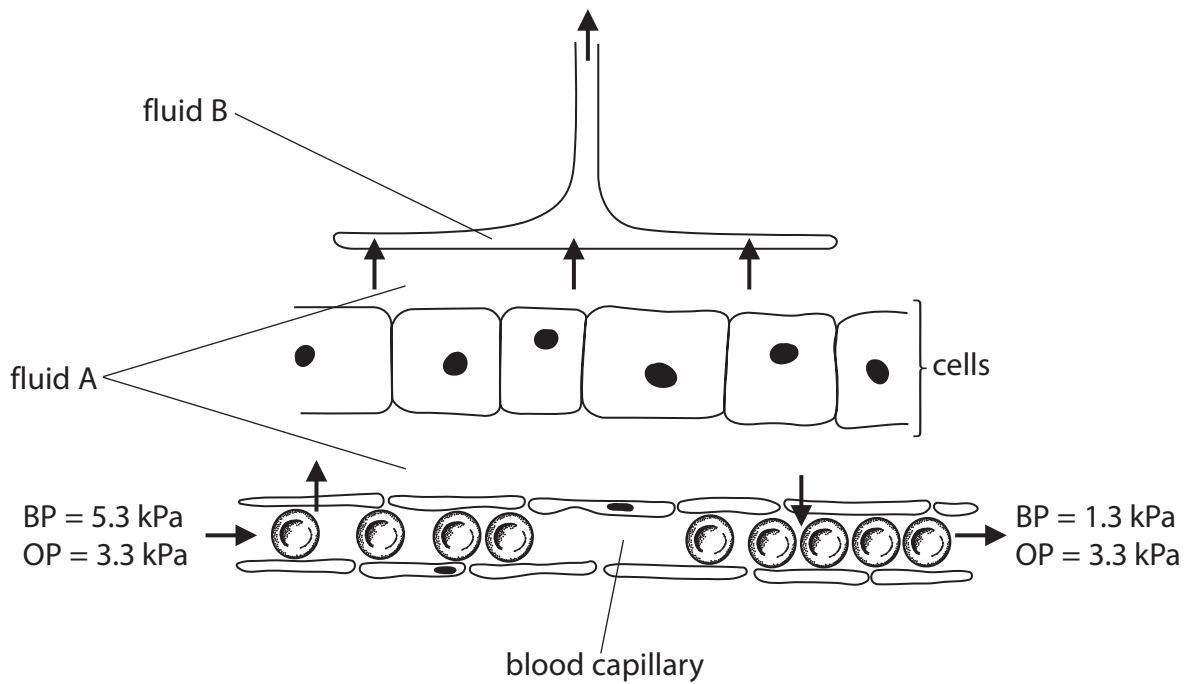
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(b) The diagram shows the movement of fluids between blood and surrounding cells.



(i) Name the fluids A and B.

(2)

Fluid A

Fluid B

(ii) Blood enters the capillary under pressure.

Explain how this blood pressure is produced.

(2)

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(iii) Suggest why there is a fall in blood pressure from one end of the capillary to the other.

(2)

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(iv) Fluid A moves out of the capillaries at one end but then moves back in at the other end.

Use the diagram to explain why this happens.

(2)

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(Total for Question 8 = 17 marks)

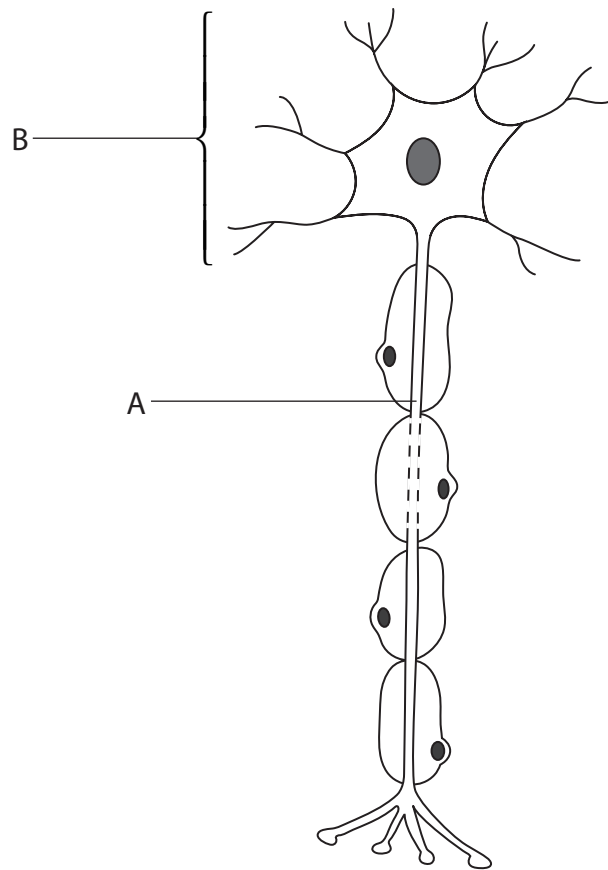
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9 (a) The diagram shows a motor neurone.



(i) Name parts A and B.

(2)

A

B

(ii) Draw an arrow on the diagram to show the direction in which a nerve impulse travels.

(1)

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(iii) Describe two ways in which a sensory neurone differs from the motor neurone shown in the diagram.

(2)

1

2

(b) Many reflex actions occur in the human body.

Complete the table to give the details of these human reflexes.

(4)

| Stimulus | Receptor | Effector | Response |
|---------------------------------|--|---------------|---------------|
| hit below the knee | stretch | thigh muscle | |
| change from dim to bright light | retina | | smaller pupil |
| | pain and temperature receptor in fingers | biceps muscle | |

(Total for Question 9 = 9 marks)

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10 Red-green colour blindness is a sex-linked recessive condition. People who are affected by it are unable to distinguish between red and green colours.

(a) Explain what is meant by the term **sex-linked**.

(2)

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.....

(b) The table shows the percentage of red-green colour blindness in males and females in different populations.

Equal numbers of males and females were tested.

| Population | Number of people tested | Colour blind males % | Colour blind females % |
|-----------------|-------------------------|----------------------|------------------------|
| Middle East | 350 | 10.00 | 1.00 |
| British | 16 200 | 6.60 | 0.40 |
| Pacific Islands | 5000 | 0.80 | 0.01 |

(i) Calculate the total number of Pacific Island males in the sample who are colour blind.

Show your working.

(2)

total number =

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(ii) Explain how the information in the table supports the fact that red-green colour blindness is a sex-linked condition.

(4)

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(c) Draw a genetic diagram to show how it is possible for a heterozygous mother and a father with normal vision to produce a boy who is colour blind.

Use B to represent the allele for normal vision and b to represent the allele for red-green colour blindness.

(4)

(Total for Question 10 = 12 marks)

TOTAL FOR PAPER = 120 MARKS

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