

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education  
November 2006



**SCIENCE: DOUBLE AWARD A (MODULAR)**  
**BIOLOGY A (MODULAR)**  
**Humans as Organisms (Module 01)**

**346001**

Thursday 23 November 2006 Morning Session

**For this paper you must have:**

- a black ball-point pen
- an objective test answer sheet

You may use a calculator.

Time allowed: 30 minutes

**Instructions**

- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Humans as Organisms' printed on it.
- Attempt **one Tier only**, either the Foundation Tier **or** the Higher Tier.
- Make sure that you use the correct side of the separate answer sheet; the Foundation Tier is printed on one side and the Higher Tier on the other.
- Answer **all** the questions for the Tier you are attempting.
- Record your answers on the separate answer sheet only.
- Do all rough work in this book, **not** on your answer sheet.

**Instructions for recording answers**

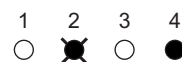
- Use a **black ball-point pen**.

- For each answer **completely fill in the circle** as shown:

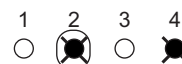


- Do **not** extend beyond the circles.

- If you want to change your answer, **you must** cross out your original answer, as shown:



- If you change your mind about an answer you have crossed out and now want to choose it, draw a ring around the cross as shown:



**Information**

- The maximum mark for this paper is 36.

**Advice**

- Do **not** choose more responses than you are asked to. You will lose marks if you do.
- Make sure that you hand in both your answer sheet and this question paper at the end of the test.
- If you start to answer on the wrong side of the answer sheet by mistake, make sure that you cross out **completely** the work that is not to be marked.

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You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.  
The Higher Tier starts on page 18 of this booklet.

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**FOUNDATION TIER**

**SECTION A**

Questions **ONE** to **FIVE**.

In these questions match words in the list with the numbers.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

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**QUESTION ONE**

The diagrams show a liver cell, a virus, a bacterium and a sperm cell. (The diagrams are not to scale.)

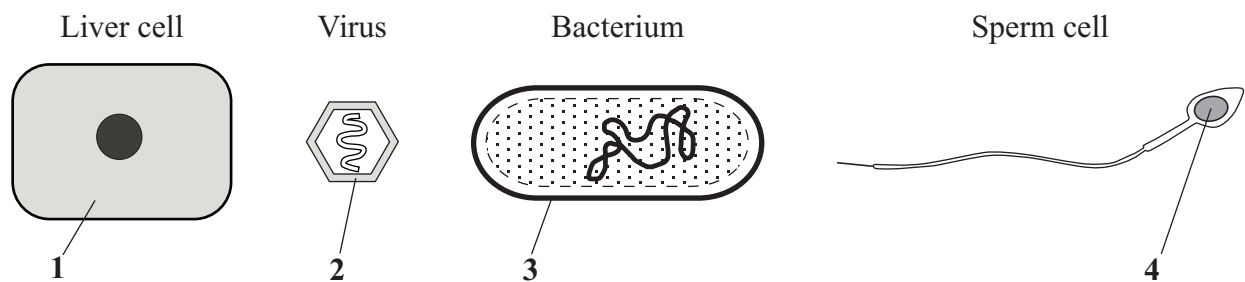
Match words from the list with the labels **1–4** on the diagrams.

**cell wall**

**cytoplasm**

**nucleus**

**protein coat**



**QUESTION TWO**

The heart is an organ which pumps blood.

Match words from the list with the numbers **1–4** in the sentences.

**atria**

**muscles**

**valves**

**ventricles**

Blood enters the heart through chambers called ... **1** ... .

The blood is kept flowing through the heart in the correct direction by ... **2** ... .

The walls of the heart contain mainly ... **3** ... .

Blood is pumped out of the heart by chambers called ... **4** ... .

**Turn over for the next question**

**Turn over ►**

**QUESTION THREE**

The diagram shows some of the structures in the thorax.

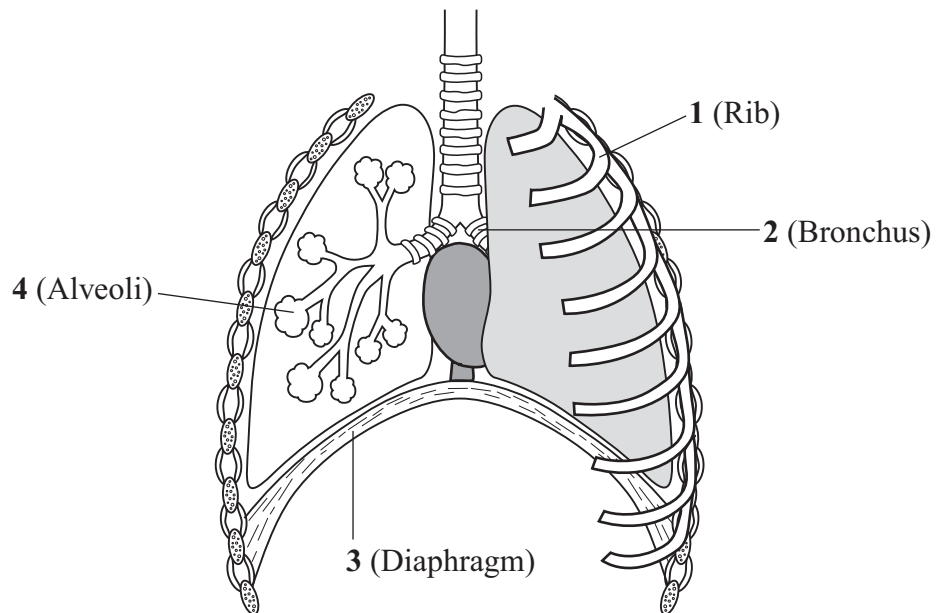
Match words from the list with the numbers 1–4 on the diagram.

**divides into many branches**

**protects the lungs**

**rises when we breathe out**

**where oxygen and carbon dioxide are exchanged**



**QUESTION FOUR**

The diagram shows some parts of the blood.

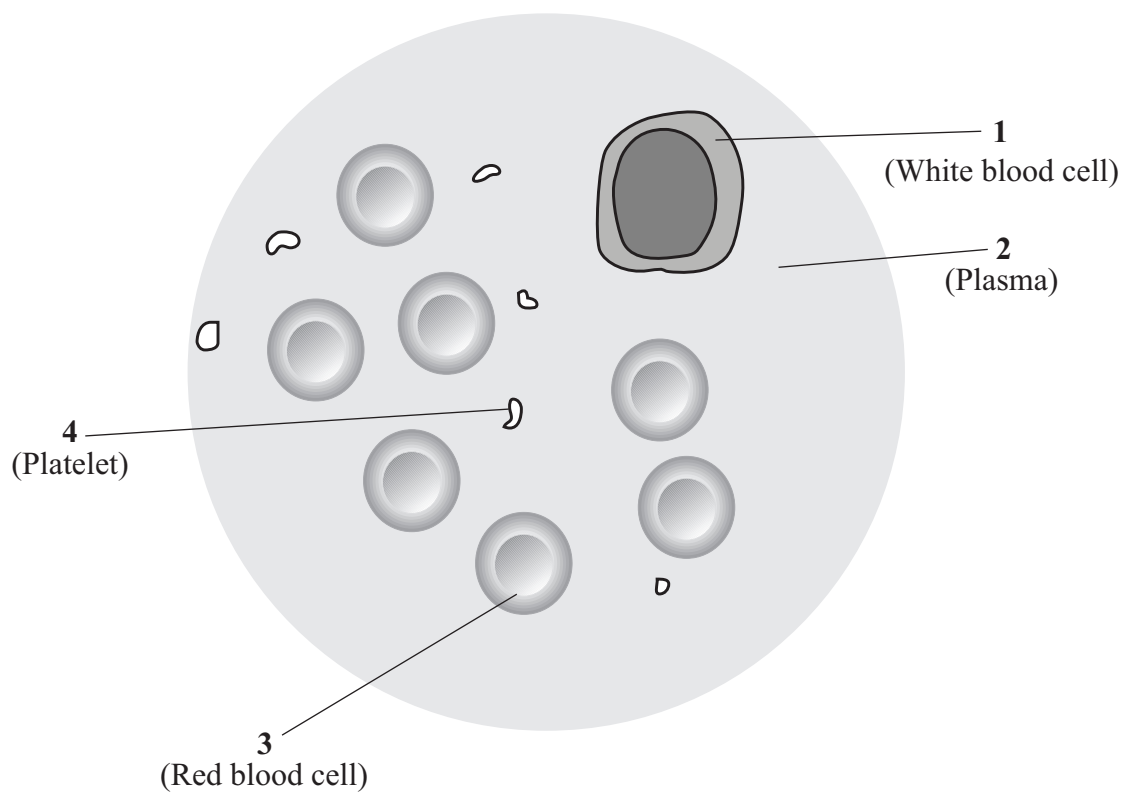
Match words, **J**, **K**, **L** and **M**, from the list with the labels **1–4** on the diagram.

**J** carries carbon dioxide from the organs to the lungs

**K** carries oxygen to the organs from the lungs

**L** helps blood to clot

**M** produces antitoxins



**Turn over for the next question**

**Turn over ►**

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**QUESTION FIVE**

The table is about some of the substances that are released into the digestive system.

Match words from the list with the numbers **1–4** in the table.

**amylase**

**bile**

**lipase**

**protease**

<b>Substance</b>	<b>Information</b>
<b>1</b>	breaks down fats into tiny droplets
<b>2</b>	digests fats
<b>3</b>	may work best in acid conditions
<b>4</b>	produced in the salivary glands

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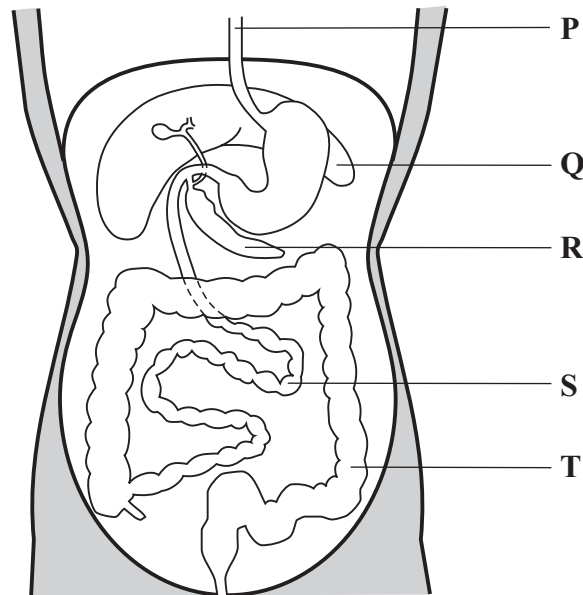
**SECTION B**Questions **SIX** and **SEVEN**.In these questions choose the best **two** answers.Do **not** choose more than two.Mark your choices on the answer sheet.

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**QUESTION SIX**

The digestive system has a number of different organs with different functions.

The diagram shows some of the parts of the digestive system.

In which **two** parts does absorption take place?**P****Q****R****S****T****Turn over ►**

**QUESTION SEVEN**

Houseflies carry bacteria on their feet. The flies are attracted to faeces and human food. Each year, thousands of people in Britain get food poisoning caused by eating food containing such bacteria.

Which **two** of the following actions are most likely to give protection against infection caused by the bacteria carried by houseflies?

**drinking only fresh tap water**

**eating only fresh food**

**keeping all cuts and grazes covered**

**keeping cooked food covered**

**wrapping dirty nappies in plastic bags**



**Turn over for the next question**

**Turn over ►**

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**SECTION C**

Questions **EIGHT** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

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**QUESTION EIGHT**

The table shows the volume of blood flowing through different parts of the body at rest and during exercise.

Part of body	Volume of blood flowing in cm <sup>3</sup> per minute			
	At rest	Light exercise	Moderate exercise	Vigorous exercise
<b>Brain</b>	750	750	750	750
<b>Digestive system</b>	1 400	1 100	700	300
<b>Heart muscle</b>	250	350	600	1 000
<b>Kidneys</b>	1 100	900	600	250
<b>Muscles attached to skeleton</b>	1 200	4 500	13 000	22 000
<b>Skin</b>	500	1 500	1 150	600
<b>Rest of body</b>	600	400	400	600
<b>Total</b>	5 800	9 500		

**8.1** Which part of the body has the greatest blood flow at rest?

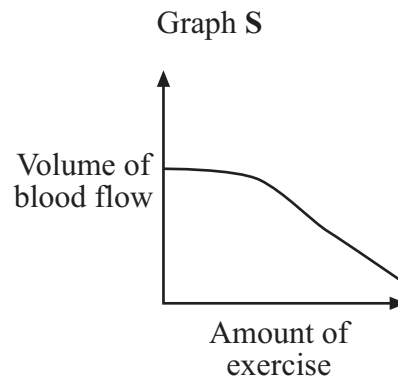
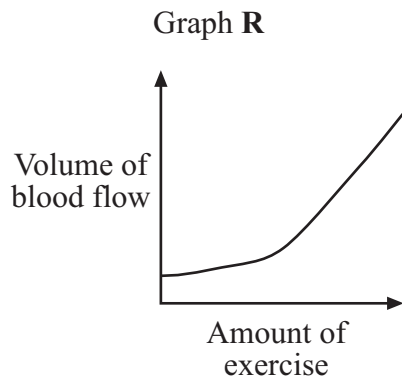
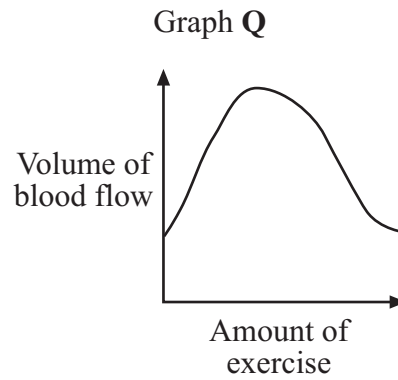
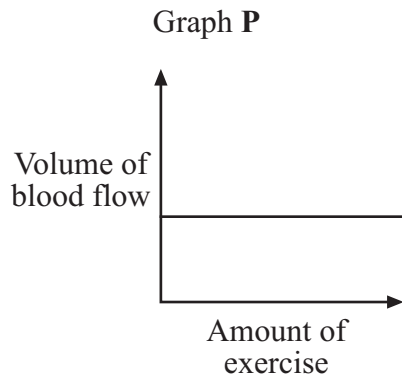
- A** The brain
- B** The digestive system
- C** The heart muscle
- D** The skin

- 8.2** In which part of the body does the blood flow decrease by 50 % between rest and moderate exercise?
- A** The digestive system
  - B** The heart muscle
  - C** The kidneys
  - D** The rest of the body
- 8.3** By how much does the total blood flow increase as the exercise changes from moderate to vigorous exercise?
- A** 830 cm<sup>3</sup> per minute
  - B** 8 300 cm<sup>3</sup> per minute
  - C** 10 260 cm<sup>3</sup> per minute
  - D** 16 000 cm<sup>3</sup> per minute

**Question 8 continues on the next page**

**Turn over ►**

8.4 The graphs, **P**, **Q**, **R** and **S**, show how the blood flow through different organs changes as the exercise increases.



Which graph shows the change in blood flow through the skin as the exercise increases?

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

**Turn over for the next question**

**Turn over ►**

**QUESTION NINE**

Respiration is the process during which energy is released. This energy comes from the food we have digested.

**9.1** The food substance which is used in respiration is . . .

- A** glucose.
- B** glycerol.
- C** lipase.
- D** starch.

**9.2** The gas released during aerobic respiration is . . .

- A** carbon dioxide.
- B** lactic acid.
- C** nitrogen.
- D** oxygen.

The table gives the body mass and rate of oxygen use of different mammals.

<b>Mammal</b>	<b>Body mass in kg</b>	<b>Rate of oxygen use per hour in mm<sup>3</sup> per g of body mass</b>
<b>Dog</b>	12	318
<b>Elephant</b>	3800	67
<b>Horse</b>	700	106
<b>Human</b>	70	202
<b>Mouse</b>	0.025	1580
<b>Rabbit</b>	2.2	466
<b>Rat</b>	1.2	872

**9.3** How much oxygen does a mouse use in one hour?

- A 39.5 mm<sup>3</sup>
- B 63.2 mm<sup>3</sup>
- C 2 370 mm<sup>3</sup>
- D 39 500 mm<sup>3</sup>

**9.4** Which of the following statements is supported by the data in the table?

- A The greater the mass of the mammal, the faster it breathes.
- B The greater the mass of the mammal, the more oxygen it uses per gram of body mass.
- C The smaller the mass of the mammal, the more active it is.
- D The smaller the mass of the mammal, the more oxygen it uses per gram of body mass.

**Turn over for the next question**

**Turn over ►**

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**QUESTION TEN**

People can be vaccinated against some diseases.

**10.1** When people are vaccinated, they are injected with . . .

- A** dead or weakened microbes.
- B** drugs to destroy the microbes.
- C** microbes to destroy toxins.
- D** white blood cells.

The table shows the concentration of antibodies in the blood of a person after a first and second injection of vaccine. The first injection was given at the start (0 weeks) and the second injection (booster dose) at a later time during the 12 weeks.

The person was immune when the antibody concentration exceeded 34 arbitrary units.

<b>Time in weeks</b>	<b>Antibody concentration in arbitrary units</b>
0	0
1	2
2	5
3	15
4	9
5	20
6	50
7	65
8	60
9	58
10	56
11	54
12	52



**10.2** It takes more than 2 weeks after the first injection for the concentration of antibodies to become higher than 5 arbitrary units.

This is because . . .

- A** it takes time for the white blood cells to produce the antibodies.
- B** microorganisms are increasing rapidly in the blood.
- C** platelets destroy antibodies.
- D** toxins are being produced to destroy poisons.

**10.3** The most likely time when the second injection was given was . . .

- A** during week 2.
- B** during week 4.
- C** during week 7.
- D** during week 12.

**10.4** How many weeks after week 12 is it likely to take for the antibody concentration to reach the minimum level necessary for immunity? (Assume that the rate of fall of antibody concentration remains constant.)

- A** 6 weeks after week 12
- B** 9 weeks after week 12
- C** 17 weeks after week 12
- D** 21 weeks after week 12

**END OF TEST**

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You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.  
The Foundation Tier is earlier in this booklet.

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## HIGHER TIER

### SECTION A

Questions **ONE** and **TWO**.

In these questions match words in the list with the numbers.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

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### QUESTION ONE

The table is about some of the substances that are released into the digestive system.

Match words from the list with the numbers **1–4** in the table.

**amylase**

**bile**

**lipase**

**protease**

<b>Substance</b>	<b>Information</b>
<b>1</b>	breaks down fats into tiny droplets
<b>2</b>	digests fats
<b>3</b>	may work best in acid conditions
<b>4</b>	produced in the salivary glands

**QUESTION TWO**

Red blood cells transport most of the oxygen around the body.

Match words from the list with the numbers **1–4** in the sentences.

**haemoglobin**

**nucleus**

**oxygen**

**oxyhaemoglobin**

Red blood cells have no . . . **1** . . . .

They are packed with a pigment called . . . **2** . . . .

This pigment combines with . . . **3** . . . in the lungs to form . . . **4** . . . .

**Turn over for the next question**

**Turn over ►**

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**SECTION B**Questions **THREE** and **FOUR**.In these questions choose the best **two** answers.Do **not** choose more than two.Mark your choices on the answer sheet.

---

**QUESTION THREE**

Houseflies carry bacteria on their feet. The flies are attracted to faeces and human food. Each year, thousands of people in Britain get food poisoning caused by eating food containing such bacteria.

Which **two** of the following actions are most likely to give protection against infection caused by the bacteria carried by houseflies?

- drinking only fresh tap water**
- eating only fresh food**
- keeping all cuts and grazes covered**
- keeping cooked food covered**
- wrapping dirty nappies in plastic bags**

**QUESTION FOUR**

Mitochondria are found in living cells.

Which **two** are features of mitochondria?

- they are needed for diffusion**
- they are present in the cytoplasm**
- they contain a nucleus**
- they digest starch in the intestines**
- they release energy in respiration**

**Turn over for the next question**

**Turn over ►**

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**SECTION C**Questions **FIVE** to **TEN**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

---

**QUESTION FIVE**

The table shows the volume of blood flowing through different parts of the body at rest and during exercise.

Part of body	Volume of blood flowing in cm <sup>3</sup> per minute			
	At rest	Light exercise	Moderate exercise	Vigorous exercise
<b>Brain</b>	750	750	750	750
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<b>Heart muscle</b>	250	350	600	1 000
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<b>Muscles attached to skeleton</b>	1 200	4 500	13 000	22 000
<b>Skin</b>	500	1 500	1 150	600
<b>Rest of body</b>	600	400	400	600
<b>Total</b>	5 800	9 500		

**5.1** Which part of the body has the greatest blood flow at rest?

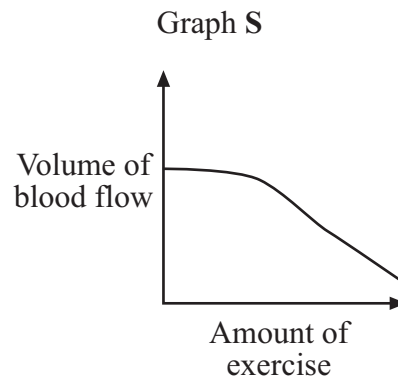
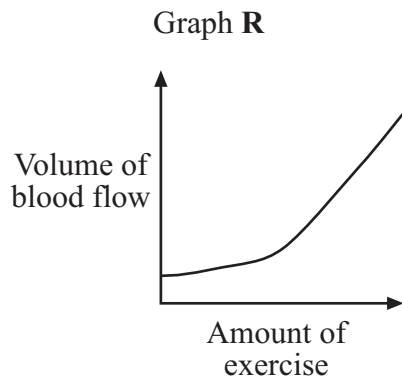
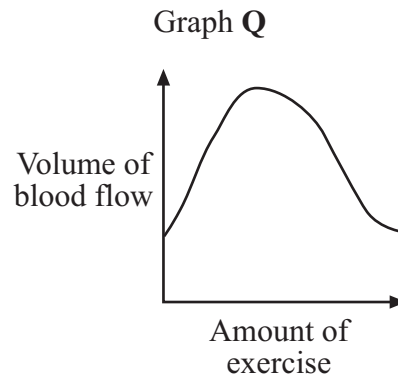
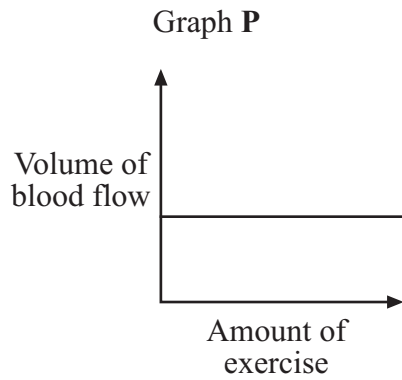
- A** The brain
- B** The digestive system
- C** The heart muscle
- D** The skin

- 5.2** In which part of the body does the blood flow decrease by 50 % between rest and moderate exercise?
- A** The digestive system
  - B** The heart muscle
  - C** The kidneys
  - D** The rest of the body
- 5.3** By how much does the total blood flow increase as the exercise changes from moderate to vigorous exercise?
- A** 830 cm<sup>3</sup> per minute
  - B** 8 300 cm<sup>3</sup> per minute
  - C** 10 260 cm<sup>3</sup> per minute
  - D** 16 000 cm<sup>3</sup> per minute

**Question 5 continues on the next page**

**Turn over ►**

5.4 The graphs, **P**, **Q**, **R** and **S**, show how the blood flow through different organs changes as the exercise increases.



Which graph shows the change in blood flow through the skin as the exercise increases?

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



**Turn over for the next question**

**Turn over ►**

**QUESTION SIX**

Respiration is the process during which energy is released. This energy comes from the food we have digested.

**6.1** The food substance which is used in respiration is . . .

- A glucose.
- B glycerol.
- C lipase.
- D starch.

**6.2** The gas released during aerobic respiration is . . .

- A carbon dioxide.
- B lactic acid.
- C nitrogen.
- D oxygen.

The table gives the body mass and rate of oxygen use of different mammals.

<b>Mammal</b>	<b>Body mass in kg</b>	<b>Rate of oxygen use per hour in mm<sup>3</sup> per g of body mass</b>
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**6.3** How much oxygen does a mouse use in one hour?

- A 39.5 mm<sup>3</sup>
- B 63.2 mm<sup>3</sup>
- C 2 370 mm<sup>3</sup>
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**6.4** Which of the following statements is supported by the data in the table?

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- B The greater the mass of the mammal, the more oxygen it uses per gram of body mass.
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- D The smaller the mass of the mammal, the more oxygen it uses per gram of body mass.

**Turn over for the next question**

**Turn over ►**

**QUESTION SEVEN**

People can be vaccinated against some diseases.

**7.1** When people are vaccinated, they are injected with . . .

- A** dead or weakened microbes.
- B** drugs to destroy the microbes.
- C** microbes to destroy toxins.
- D** white blood cells.

The table shows the concentration of antibodies in the blood of a person after a first and second injection of vaccine. The first injection was given at the start (0 weeks) and the second injection (booster dose) at a later time during the 12 weeks.

The person was immune when the antibody concentration exceeded 34 arbitrary units.

<b>Time in weeks</b>	<b>Antibody concentration in arbitrary units</b>
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7	65
8	60
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10	56
11	54
12	52

---

**7.2** It takes more than 2 weeks after the first injection for the concentration of antibodies to become higher than 5 arbitrary units.

This is because . . .

- A** it takes time for the white blood cells to produce the antibodies.
- B** microorganisms are increasing rapidly in the blood.
- C** platelets destroy antibodies.
- D** toxins are being produced to destroy poisons.

**7.3** The most likely time when the second injection was given was . . .

- A** during week 2.
- B** during week 4.
- C** during week 7.
- D** during week 12.

**7.4** How many weeks after week 12 is it likely to take for the antibody concentration to reach the minimum level necessary for immunity? (Assume that the rate of fall of antibody concentration remains constant.)

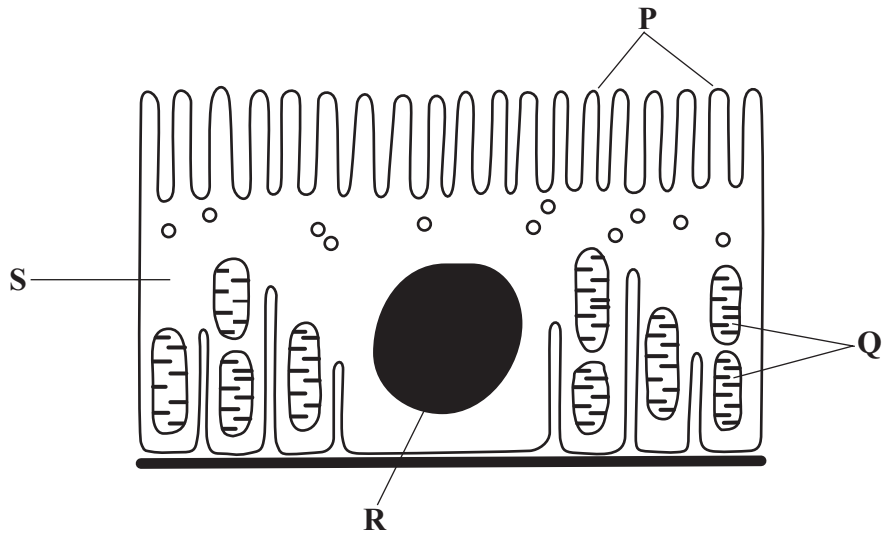
- A** 6 weeks after week 12
- B** 9 weeks after week 12
- C** 17 weeks after week 12
- D** 21 weeks after week 12

**Turn over for the next question**

**Turn over ►**

**QUESTION EIGHT**

The diagram shows a cell from the kidney. One function of this cell is to absorb ions from a low concentration to a high concentration.



**8.1** Which process is involved in absorbing ions from a low concentration to a high concentration?

- A Active transport
- B Diffusion
- C Digestion
- D Inhaling air

**8.2** In which part of the cell does aerobic respiration occur?

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

**8.3** Which part of the cell is adapted to increase the surface area for absorption?

**A P**

**B Q**

**C R**

**D S**

**8.4** Oxygen diffuses from . . .

**A Q to R.**

**B R to S.**

**C S to P.**

**D S to Q.**

**Turn over for the next question**

**Turn over ►**

**QUESTION NINE**

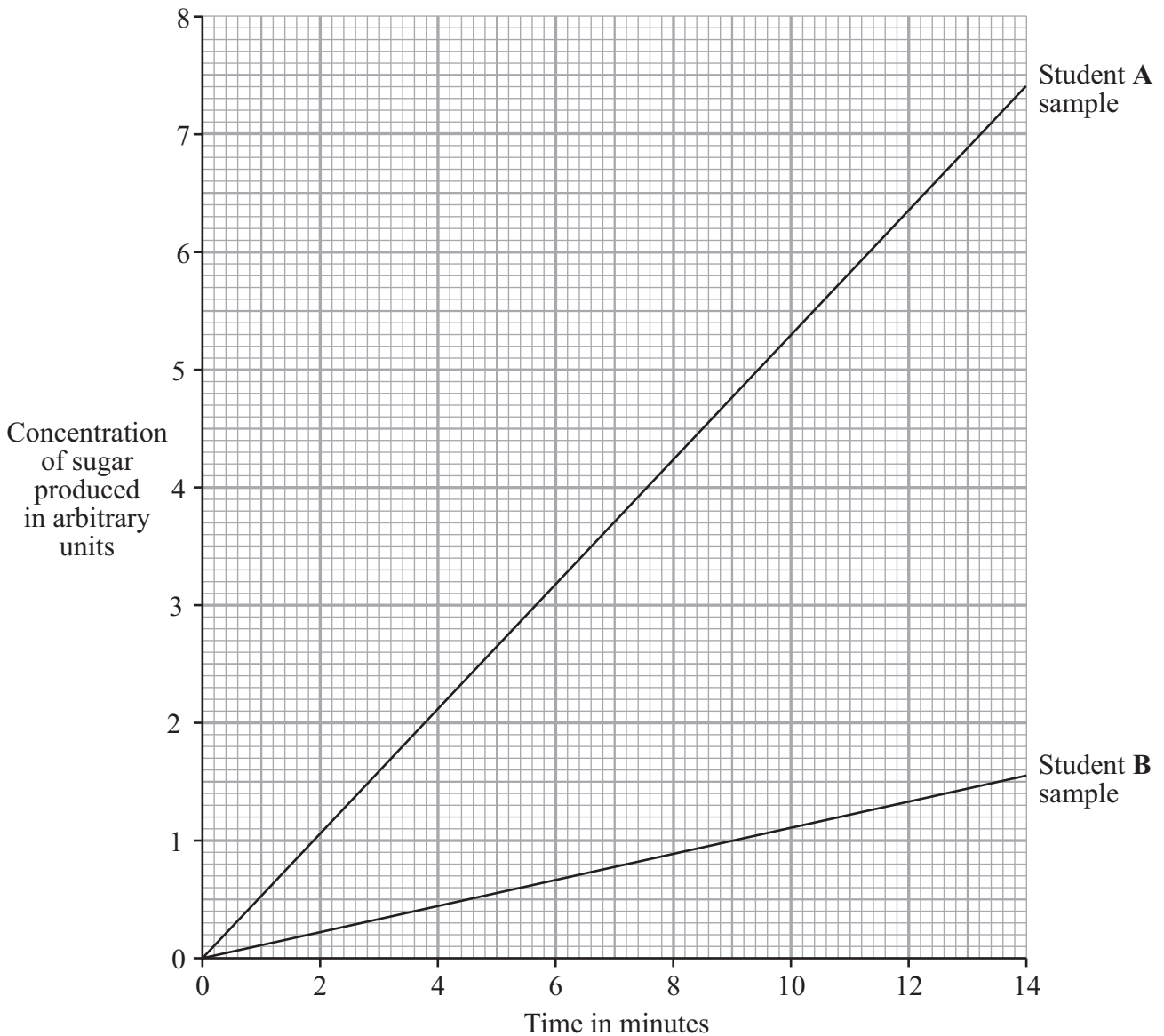
An investigation was carried out to compare the effectiveness of samples of saliva on the breakdown of starch. Saliva samples, of equal volume, were collected from Student **A** and Student **B**.

The saliva samples and two tubes containing  $10\text{ cm}^3$  of starch solution were kept in a water bath at  $40^\circ\text{C}$  for 20 minutes.

Each saliva sample was then added to a tube containing starch solution and the mixtures were kept in the water bath.

The concentration of sugar produced was measured every two minutes for 14 minutes.

The results are shown in the graph.





- 
- 9.1** After 10 minutes the difference in the concentration of sugar between the two samples was . . .
- A** 4.2 arbitrary units.
  - B** 5.3 arbitrary units.
  - C** 5.9 arbitrary units.
  - D** 6.4 arbitrary units.
- 9.2** The rate of production of sugar by the saliva from Student **B** was . . .
- A** 0.11 arbitrary units per minute.
  - B** 0.53 arbitrary units per minute.
  - C** 1.89 arbitrary units per minute.
  - D** 52.80 arbitrary units per minute.
- 9.3** What is the most likely reason for the difference in the rate of sugar production between the two samples?
- A** Student **A**'s saliva contains a higher concentration of amylase than Student **B**'s saliva.
  - B** Student **A**'s sample had been kept at a warmer temperature.
  - C** Student **B**'s saliva used up the starch more rapidly.
  - D** The temperature of the water bath was too low for amylase to work effectively.
- 9.4** What change in conditions should be used to break down starch in an experiment like this if enzymes from the pancreas are used instead of saliva?
- A** Bile should be added.
  - B** The mixture should be made more acidic.
  - C** The mixture should be made more alkaline.
  - D** No change in conditions should be made.

**Turn over for the next question**

**Turn over ►**

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**QUESTION TEN**

It is more efficient to release energy using aerobic respiration than using anaerobic respiration. During a 100 metre sprint an athlete hardly has time to breathe. When sprinting, only about 10 % of the energy needed by the muscles comes from aerobic respiration. An oxygen debt builds up during sprinting.

**10.1** What is the most likely reason for the build up of an oxygen debt by the sprinter?

- A** Carbon dioxide is removed too quickly from the lungs.
- B** Muscles cannot use oxygen for respiration.
- C** The amount of oxygen needed cannot be carried to the muscles quickly enough.
- D** There are no mitochondria in muscle cells.

**10.2** Why is aerobic respiration considered to be more efficient than anaerobic respiration?

- A** Aerobic respiration does not produce carbon dioxide.
- B** Aerobic respiration releases more energy.
- C** Anaerobic respiration does not release any heat energy.
- D** Anaerobic respiration does not use glucose.

**10.3** The sprinter's body builds up an oxygen debt during the sprint.

Which of the following is formed as the oxygen debt builds up?

- A** Amino acids
- B** Glucose
- C** Hydrochloric acid
- D** Lactic acid

**10.4** Which of the following occurs as the oxygen debt is repaid?

- A** Amino acids combine with glycerol.
- B** Glucose is broken down into carbon dioxide and water.
- C** Hydrochloric acid is neutralised.
- D** Lactic acid is oxidised.

**END OF TEST**

**There are no questions printed on this page**