

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

ASSESSMENT AND QUALIFICATIONS ALLIANCE

General Certificate of Education

Advanced Subsidiary Examination

June 2010

BIOLOGY

Unit 2 The variety of living organisms

BIOL2

Tuesday 8 June 2010 9.00 am

For this paper you must have:

- a ruler with millimetre measurements.
- a calculator.

TIME ALLOWED

- 1 hour 45 minutes plus your additional time allowance

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Answer ALL questions.**
- **You must answer the questions in the spaces provided.**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**

INFORMATION

- **The maximum mark for this paper is 85**
- **The marks for questions are shown in brackets.**
- **Quality of Written Communication will be assessed in all answers.**
- **You will be marked on your ability to:**
 - **use good English**
 - **organise information clearly**
 - **use scientific terminology accurately.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

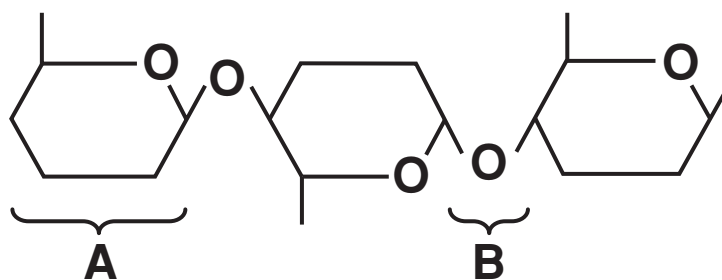
Answer ALL questions in the spaces provided.

- 1 (a) Give ONE feature of starch and explain how this feature enables it to act as a storage substance. [2 marks]**

Feature _____

Explanation _____

- 1 (b) The diagram shows part of a cellulose molecule.



- 1 (b)(i) Name part A.
[1 mark]

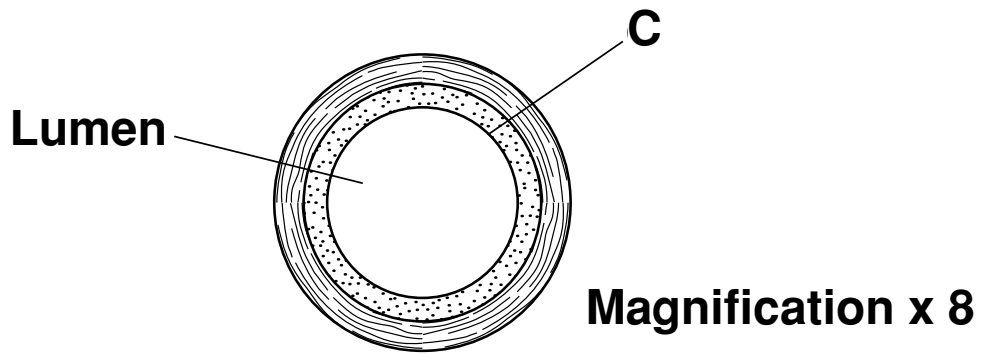
- 1 (b)(ii) Name bond B.
[1 mark]

[Turn over]

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TURN OVER FOR THE NEXT QUESTION

2 The diagram shows a cross-section of a blood vessel.



2 (a) Name layer C.
[1 mark]

- 2 (b) Calculate the actual diameter of the lumen of this blood vessel in millimetres. Show your working. [2 marks]

Answer _____ mm

[Turn over]

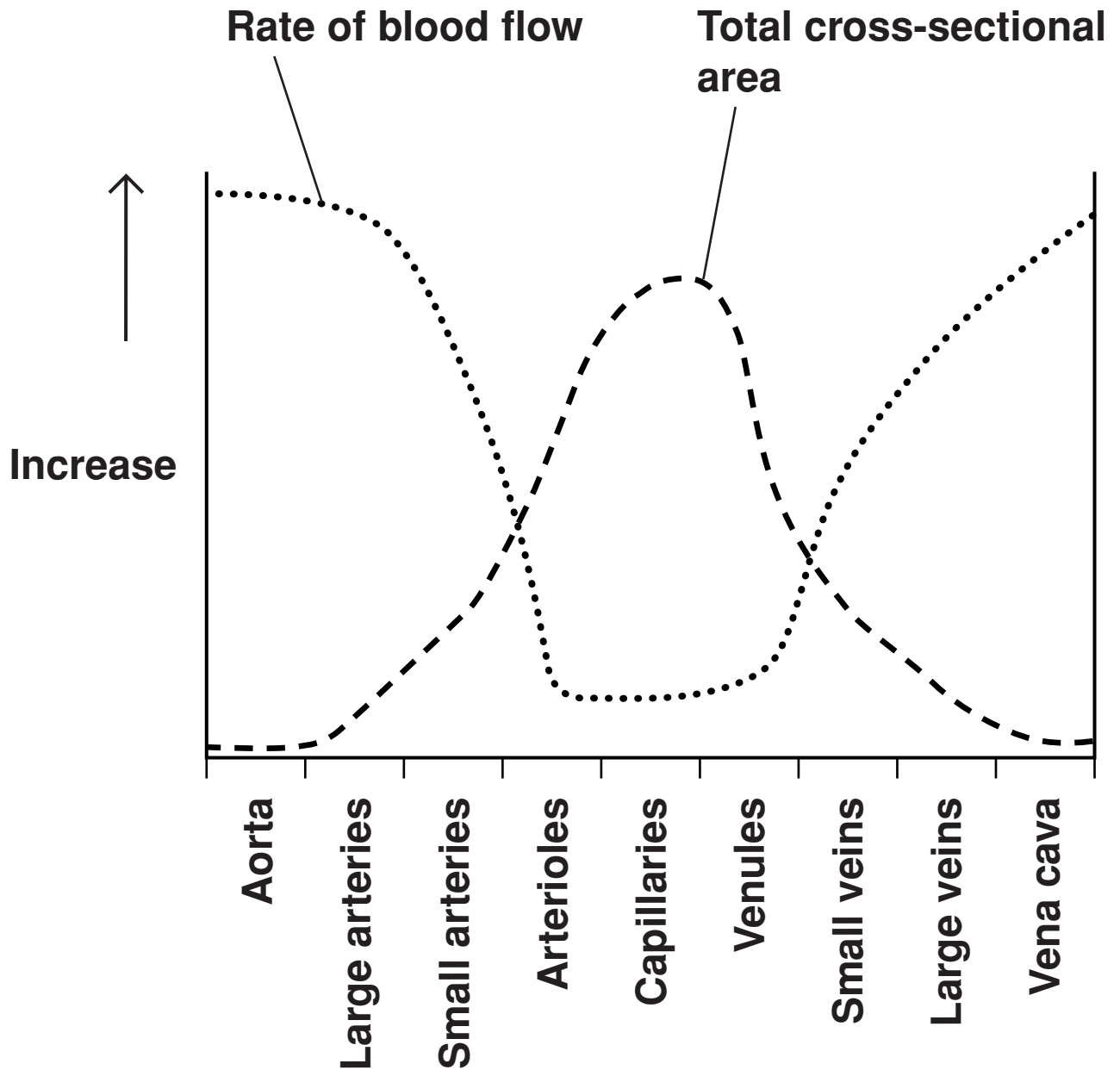
2 (c) The aorta has many elastic fibres in its wall. An arteriole has many muscle fibres in its wall.

2 (c) (i) Explain the importance of elastic fibres in the wall of the aorta. [2 marks]

2 (c) (ii) Explain the importance of muscle fibres in the wall of an arteriole. [2 marks]

[Turn over]

- 2 (d) The graph shows the rate of blood flow in different blood vessels. It also shows the total cross-sectional area of these blood vessels.



2 (d)(i) The rate of blood flow decreases from the aorta to the capillaries. Use information from the graph to explain why. [1 mark]

2 (d)(ii) Efficient exchange of substances in the capillaries is linked to the rate of blood flow. Explain how. [1 mark]

[Turn over]

- 3 (a) What name is used for the non-coding sections of a gene? [1 mark]
-

FIGURE 1 shows a DNA base sequence. It also shows the effect of two mutations on this base sequence. Figure 2 shows DNA triplets that code for different amino acids.

FIGURE 1

Original DNA base sequence	A	T	T	G	G	C	G	T	G	T	C	T
Amino acid sequence												
Mutation 1 DNA base sequence	A	T	T	G	G	A	G	T	G	T	C	T
Mutation 2 DNA base sequence	A	T	T	G	G	C	C	T	G	T	C	T

FIGURE 2

DNA triplets	Amino acid
GGT, GGC, GGA, GGG	Gly
GTT, GTA, GTG, GTC	Val
ATC, ATT, ATA	Ile
TCC, TCT, TCA, TCG	Ser
CTC, CTT, CTA, CTG	Leu

- 3 (b) Complete FIGURE 1 to show the sequence of amino acids coded for by the original DNA base sequence. [1 mark]**

[Turn over]

3 (c) Some gene mutations affect the amino acid sequence. Some mutations do not. Use the information from FIGURE 1 and FIGURE 2 to explain

3 (c) (i) whether mutation 1 affects the amino acid sequence [2 marks]

3 (c) (ii) how mutation 2 could lead to the formation of a non-functional enzyme. [3 marks]

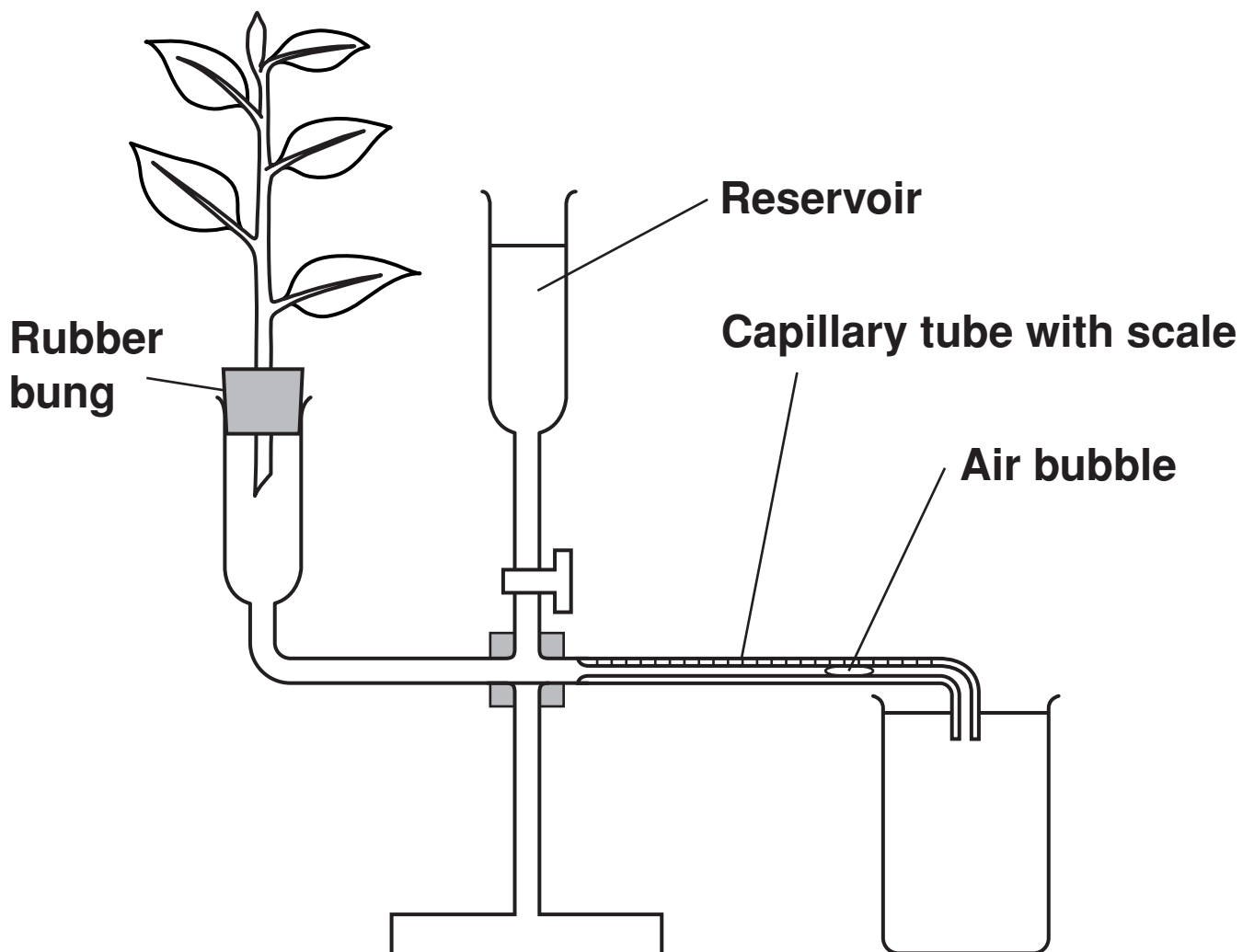
3 (d) Gene mutations occur spontaneously.

3 (d)(i) During which part of the cell cycle are gene mutations most likely to occur? [1 mark]

3 (d)(ii) Suggest an explanation for your answer. [1 mark]

[Turn over]

- 4 A student investigated the rate of transpiration from a leafy shoot. She used a potometer to measure the rate of water uptake by the shoot. The diagram shows the potometer used by the student.



4 (a) Give ONE environmental factor that the student should have kept constant during this investigation. [1 mark]

4 (b) The student cut the shoot and put it into the potometer under water. Explain why. [1 mark]

4 (c) The student wanted to calculate the rate of water uptake by the shoot in cm^3 per minute. What measurements did she need to make? [2 marks]

[Turn over]

4 (d) The student assumed that water uptake was equivalent to the rate of transpiration. Give TWO reasons why this might NOT be a valid assumption. [2 marks]

1. _____

2. _____

4 (e) The student measured the rate of water uptake three times.

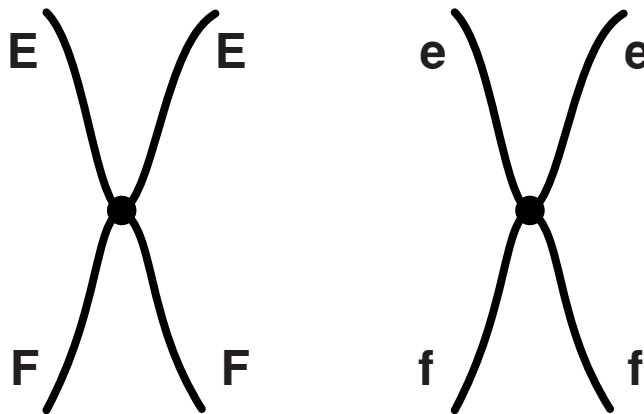
4 (e) (i) Suggest how the reservoir allows repeat measurements to be made. [1 mark]

4 (e) (ii) Suggest why she made repeat measurements. [1 mark]

[Turn over]

- 5 **FIGURE 3** shows a pair of chromosomes at the start of meiosis. The letters represent alleles.

FIGURE 3

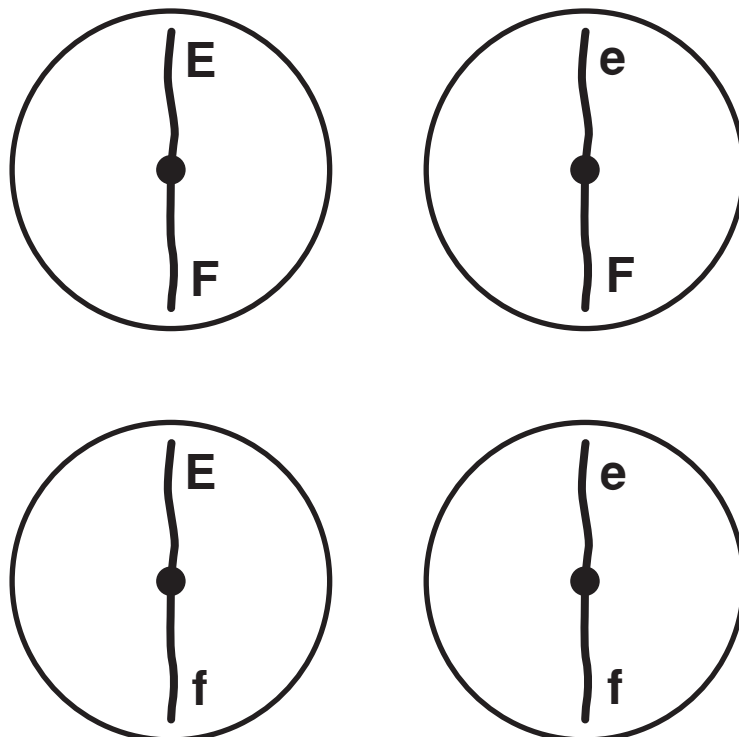


- 5 (a) **What is an allele? [1 mark]**

- 5 (b) Explain the appearance of one of the chromosomes in FIGURE 3. [2 marks]

- 5 (c) The cell containing this pair of chromosomes divided by meiosis. FIGURE 4 shows the distribution of chromosomes from this pair in four of the gametes produced.

FIGURE 4



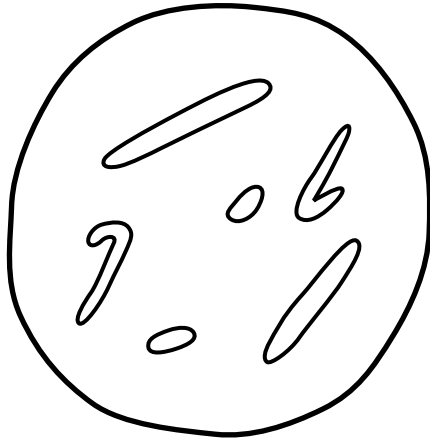
[Turn over]

5 (c) (i) Some of the gametes formed during meiosis have new combinations of alleles. Explain how the gametes with the combinations of alleles Ef and eF have been produced. [2 marks]

5 (c) (ii) Only a few gametes have the new combination of alleles Ef and eF. Most gametes have the combination of alleles EF and ef. Suggest why only a few gametes have the new combination of alleles, Ef and eF. [1 mark]

5 (d) FIGURE 5 shows a cell with six chromosomes.

FIGURE 5



5 (d)(i) This cell produces gametes by meiosis. Draw a diagram to show the chromosomes in one of the gametes. [2 marks]

[Turn over]

5 (d)(ii) How many different types of gametes could be produced from this cell as a result of different combinations of maternal and paternal chromosomes? [1 mark]

9

- 6 **Cytochrome c is a protein found in all eukaryotes. In humans it consists of 102 amino acids. Biologists have compared the amino acid sequence in some other species with that in humans. The table shows amino acids 9 to 13 in the amino acid sequences of cytochrome c from four species.**

	Amino acid in this position in cytochrome c				
Species	9	10	11	12	13
Human	Ile	Phe	Ile	Met	Lys
Chicken	Ile	Phe	Val	Gln	Lys
Dogfish	Val	Phe	Val	Gln	Lys
Chimpanzee	Ile	Phe	Ile	Met	Lys

[Turn over]

6 (a) What do the results suggest about the relationship between humans and the other three species? [2 marks]

6 (b) Suggest ONE advantage of using cytochrome c to determine relationships between species. [1 mark]

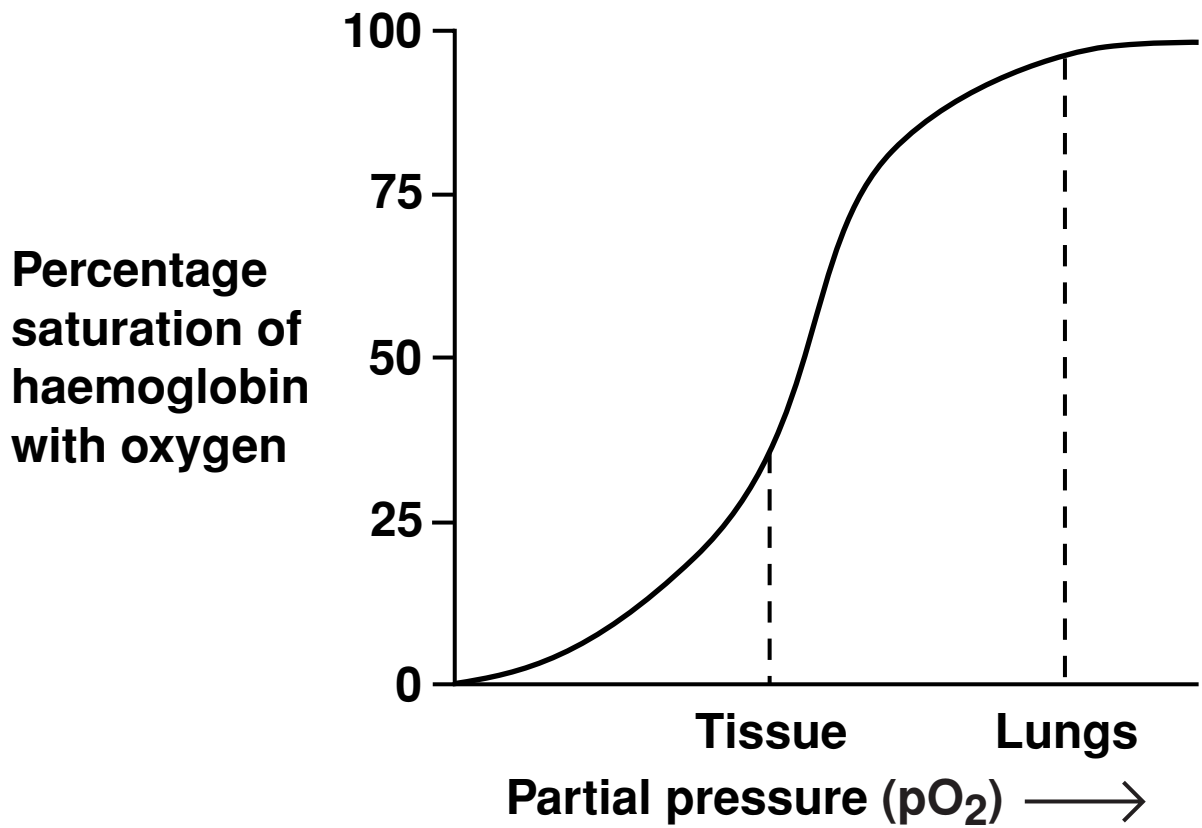
- 6 (c) Comparing the base sequence of a gene provides more information than comparing the amino acid sequence for which the gene codes. Explain why. [2 marks]**

[Turn over]

5

- 7 (a) **FIGURE 6** shows the oxygen dissociation curve for human haemoglobin.

FIGURE 6

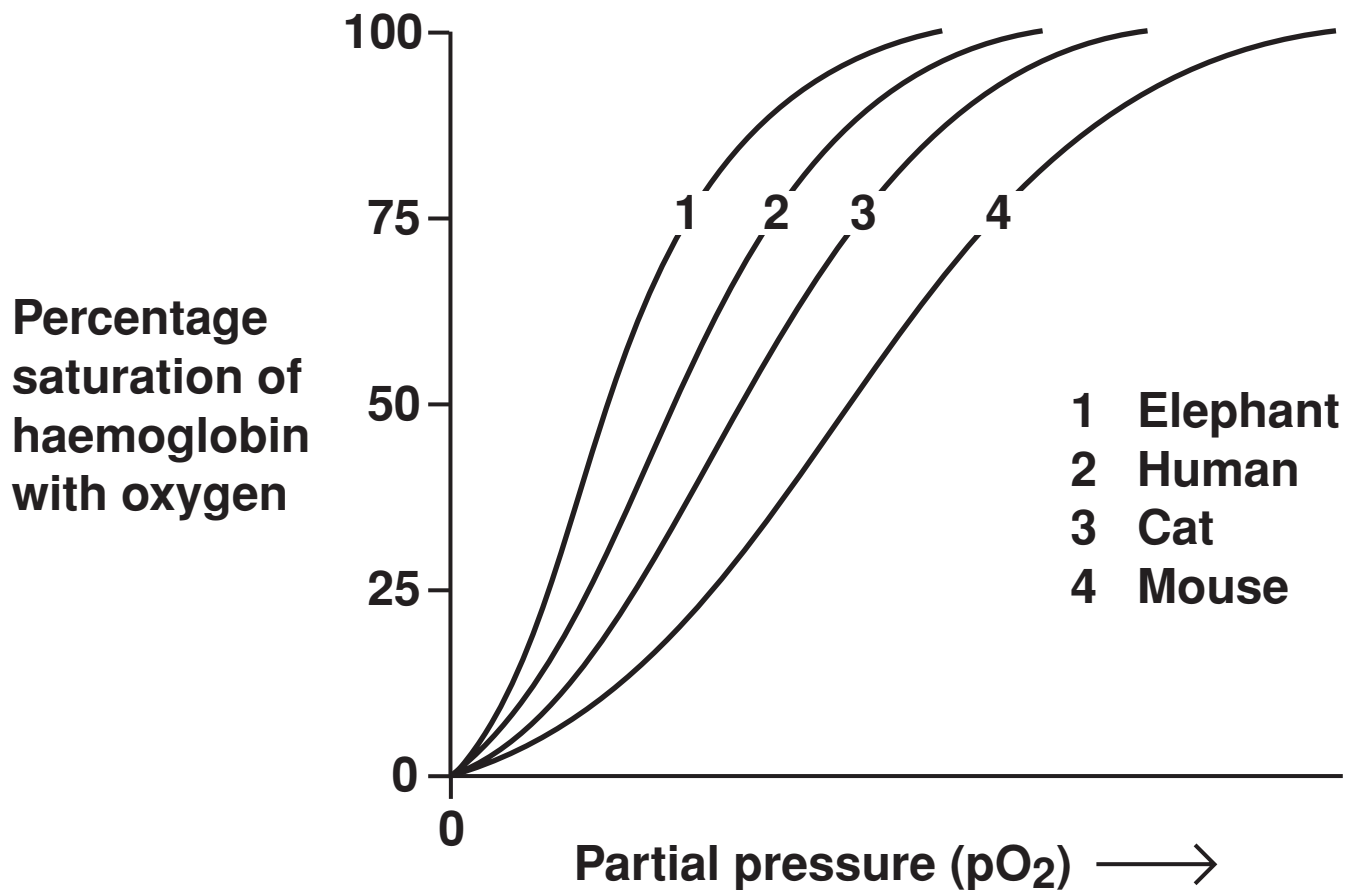


**Use FIGURE 6 to describe how haemoglobin loads and unloads oxygen in the body.
[3 marks]**

[Turn over]

7 (b) FIGURE 7 shows oxygen dissociation curves from mammals of different size.

FIGURE 7



7 (b)(i) Describe the relationship between the size of mammals and the oxygen dissociation curves of their haemoglobins. [1 mark]

8 (a) The number of patients infected with the bacterium MRSA has increased in some hospitals. Scientists have suggested ways to reduce the transmission of MRSA in hospitals. Suggest TWO ways to reduce the transmission of MRSA in hospitals. [2 marks]

1 _____

2 _____

8 (b) The minimum inhibitory concentration (MIC) is the lowest concentration of a substance that prevents the growth of a microorganism.

When antibiotics are prescribed for treating patients, higher doses than the MIC are recommended. Suggest TWO reasons why. [2 marks]

1 _____

2 _____

Scientists tested a new group of drugs for their effectiveness against four species of bacteria. The scientists used MICs to compare the effectiveness of four drugs. The results are shown in the table.

Drug	Minimum inhibitory concentration / $\mu\text{g cm}^{-3}$			
	Escherichia coli	Staphylococcus aureus	Enterococcus faecalis	Pseudomonas aeruginosa
P	0.39	0.049	0.049	3.13
Q	1.54	0.049	0.195	3.13
R	0.39	0.049	0.195	1.56
S	1.56	0.098	0.390	12.50

8 (c) Which of the four drugs is

8 (c) (i) most effective against *Enterococcus faecalis*?
[1 mark]

8 (c) (ii) least effective against all the species of bacteria used? [1 mark]

[Turn over]

8 (d) The effectiveness of these drugs was tested in double-blind trials using human volunteers. In a double-blind trial neither the volunteers nor the scientists know which treatment a particular volunteer is receiving.

8 (d)(i) Suggest TWO ways in which a double-blind trial improves reliability. [2 marks]

1 _____

2 _____

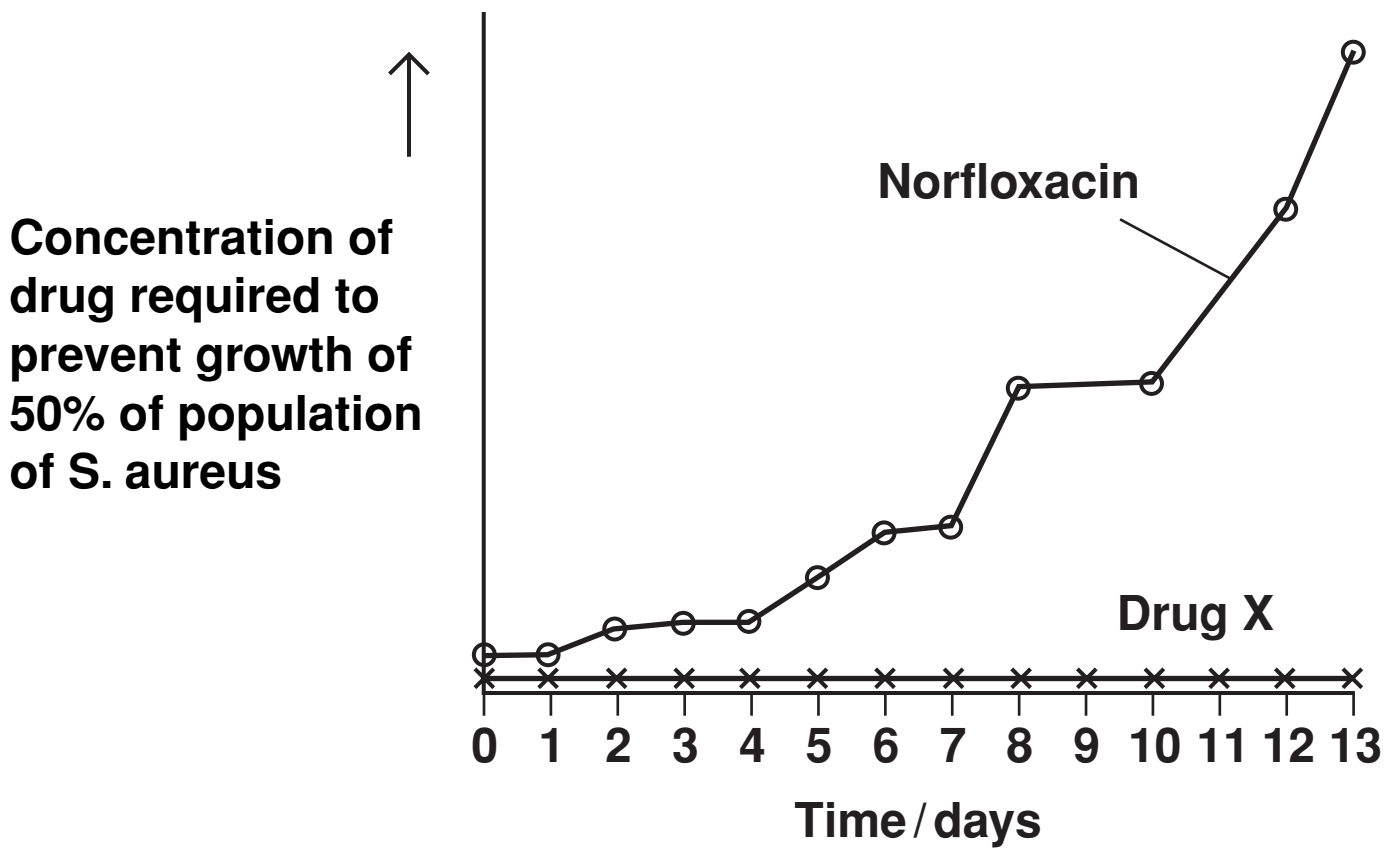
8 (d)(ii) Suggest TWO factors the scientists should have considered when selecting adult volunteers for this trial. [2 marks]

1 _____

2 _____

- 8 (e) Scientists investigated resistance of the bacterium, *S. aureus* to the antibiotic Norfloxacin. They grew the bacteria in a medium containing a low concentration of Norfloxacin. The concentration of Norfloxacin that they added killed some of the bacteria. It did not kill all of them. Every 24 hours, they removed a sample of the bacteria from the culture. They tested the sample to find the concentration of Norfloxacin that prevented the growth of 50 % of the bacteria in the sample.**
- The scientists then used the same method to investigate the resistance of *S. aureus* to a new drug, drug X. The results of both investigations are shown in the graph on the following page.**

[Turn over]



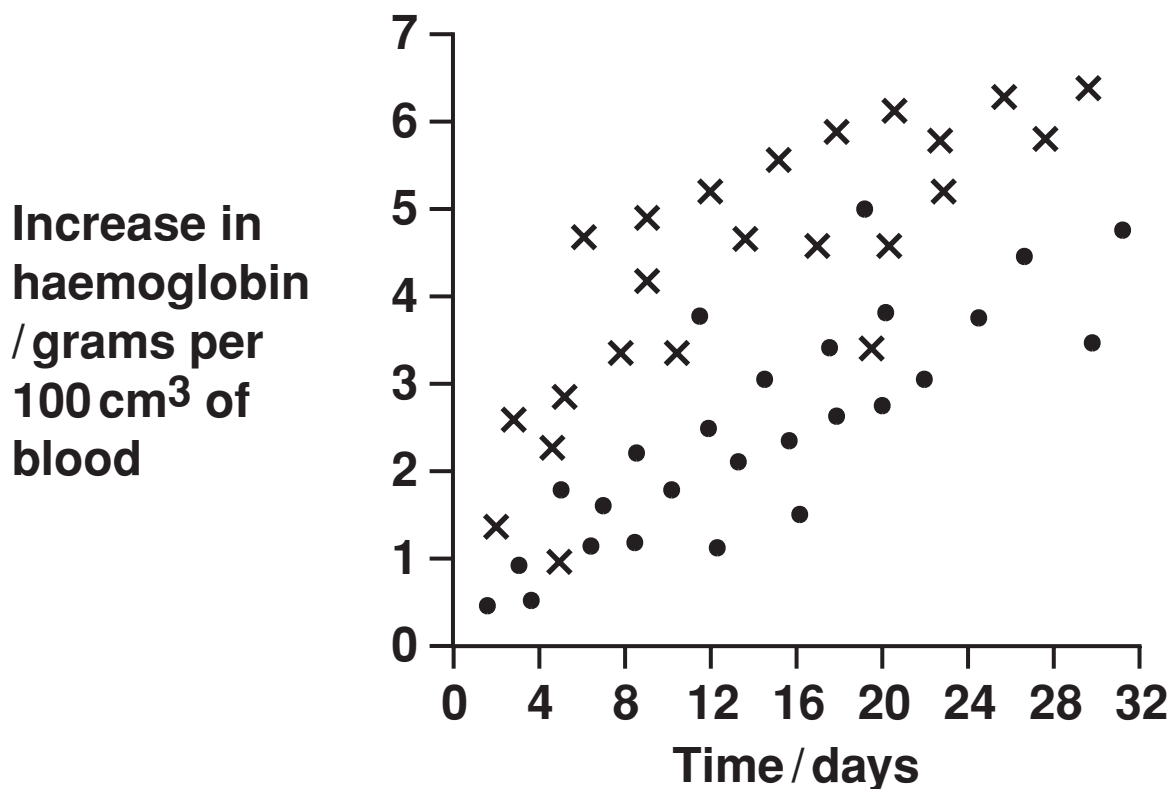
8 (e) (i) Describe the results obtained with Norfloxacin. [1 mark]

8 (e) (ii) Use your knowledge of resistance to explain the results obtained with Norfloxacin and drug X. [4 marks]

[Turn over]

- 9 (a) Haemoglobin contains iron. One type of anaemia is caused by a lack of iron. This type of anaemia can be treated by taking tablets containing iron. A number of patients were given a daily dose of 120 mg of iron. Figure 8 shows the effect of this treatment on the increase in the concentration of haemoglobin in their red blood cells.

Figure 8



Key

x = children

• = adults

9 (a) (i) Give ONE difference in the response of adults and children to this treatment. [1 mark]

9 (a) (ii) You could use the graph to predict the effect of this treatment on the increase in haemoglobin content of an adult after 40 days. Explain how. [2 marks]

9 (a) (iii) Haemoglobin has a quaternary structure. Explain what is meant by a quaternary structure. [1 mark]

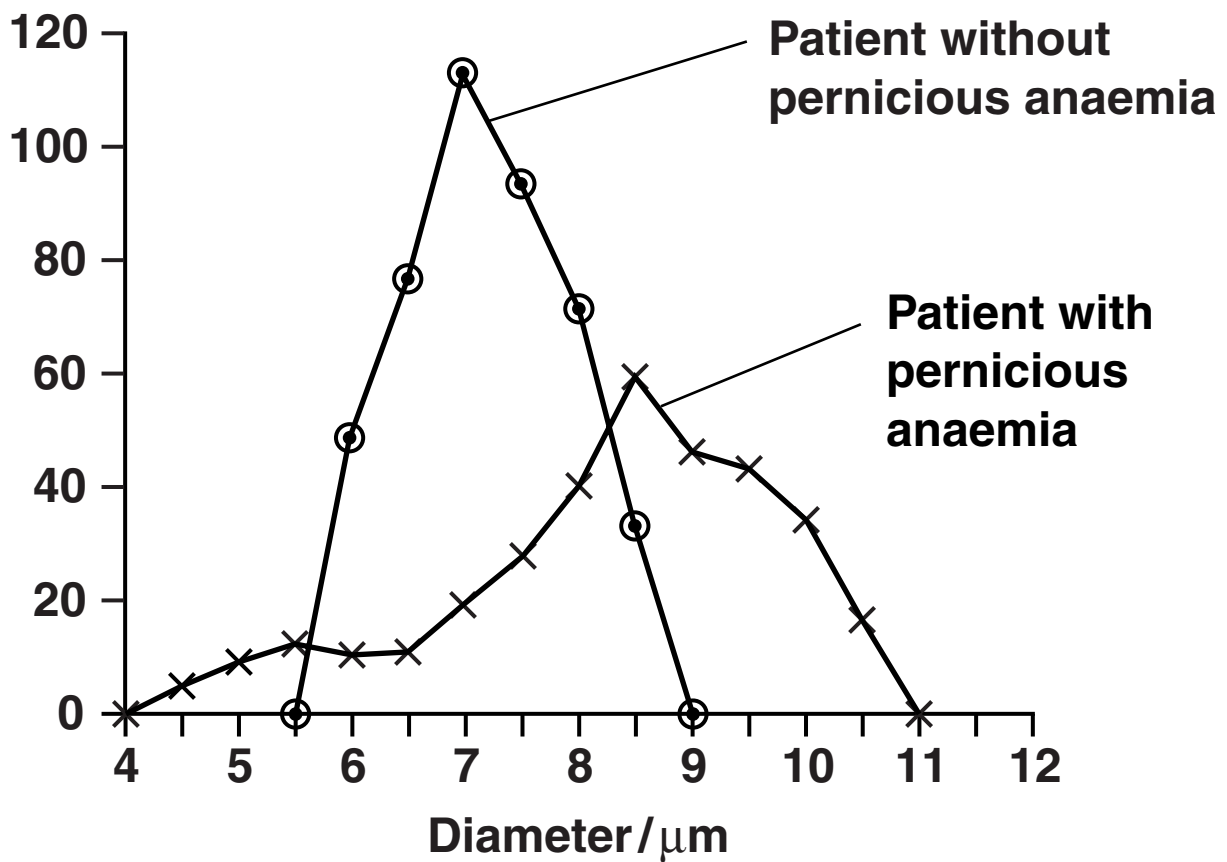
[Turn over]

- 9 (b) (i) Pernicious anaemia is another type of anaemia. One method of identifying pernicious anaemia is to measure the diameter of the red blood cells in a sample of blood that has been diluted with an isotonic salt solution. Explain why an isotonic salt solution is used to dilute the blood sample. [3 marks]**

- 9 (b)(ii) A technician compared the red blood cells in two blood samples of equal volume. One sample was from a patient with pernicious anaemia, the other was from a patient who did not have pernicious anaemia. FIGURE 9 shows some of the results she obtained.

FIGURE 9

Number of
red blood cells
per unit volume



[Turn over]

Describe TWO differences between the blood samples. [2 marks]

1 _____

2 _____

9 (c) Scientists' analysis of blood proteins has indicated a lack of genetic diversity in populations of some organisms. Describe the processes that lead to a reduction in the genetic diversity of populations of organisms. [6 marks]

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE

For Examiner's Use	
Examiner's Initials	
Question	Mark
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TOTAL	

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