FOR OFFICIAL USE

G

KU	PS

Total Marks

0300/401

NATIONAL QUALIFICATIONS 2003

MONDAY 26 MAY
9.00 AM – 10.30 AM

BIOLOGY
STANDARD GRADE
General Level

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Date of birth
Day Month Year

Scottish candidate number

Number of seat

1 All questions should be attempted.

2 The questions may be answered in any order but all answers are to be written in the spaces provided in this answer book, and must be written clearly and legibly in ink.

3 Rough work, if any should be necessary, as well as the fair copy, is to be written in this book. Additional spaces for answers and for rough work will be found at the end of the book. Rough work should be scored through when the fair copy has been written.

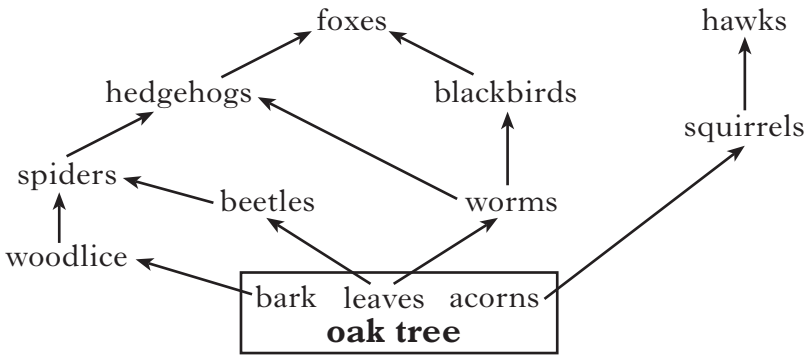
4 Before leaving the examination room you must give this book to the invigilator. If you do not, you may lose all the marks for this paper.

LIB 0300/401 6/3/27170

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

1. The diagram gives some information about a woodland in southern Scotland.



(*a*) What name is given to this type of diagram?

1

(*b*) Answer the following using information **from the diagram**.

(i) Name **one** producer and **one** consumer.

Producer Consumer

1

(ii) What do the arrows in the diagram represent?

1

(iii) Complete the food chain below.

oak leaves → → → → foxes

1

(iv) Name the part of the oak tree not involved in the food chains that include foxes.

1

(v) Which part of the oak tree provides energy for the greatest number of different species?

1

(*c*) Complete the table of words about the biosphere and their meanings.

Word	*Meaning*
habitat	
	all the animals or plants of a single species living in an area
	a particular area and all the animals and plants which live there

3

DO NOT WRITE IN THIS MARGIN

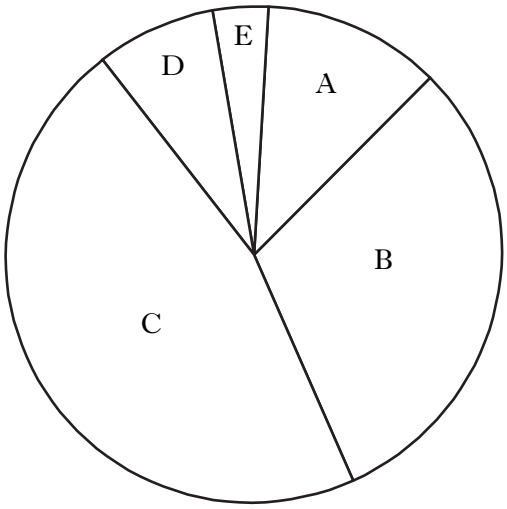
Marks	KU	PS

2. The table shows the mass of some of the main air pollutants produced in Britain in one year.

Pollutant	*Mass produced (tonnes per year)*
sulphur dioxide	4000
dust and grit	1500
carbon monoxide	6000
smoke	1000
others	500
TOTAL	

(*a*) Complete the table by entering the total mass of pollutants in the space provided. **1**

(*b*) The pie chart below shows the information from the table.



(i) Which letter represents the pollution due to dust and grit?

Letter _____ **1**

(ii) Identify the pollutants represented by segments C and D on the chart.

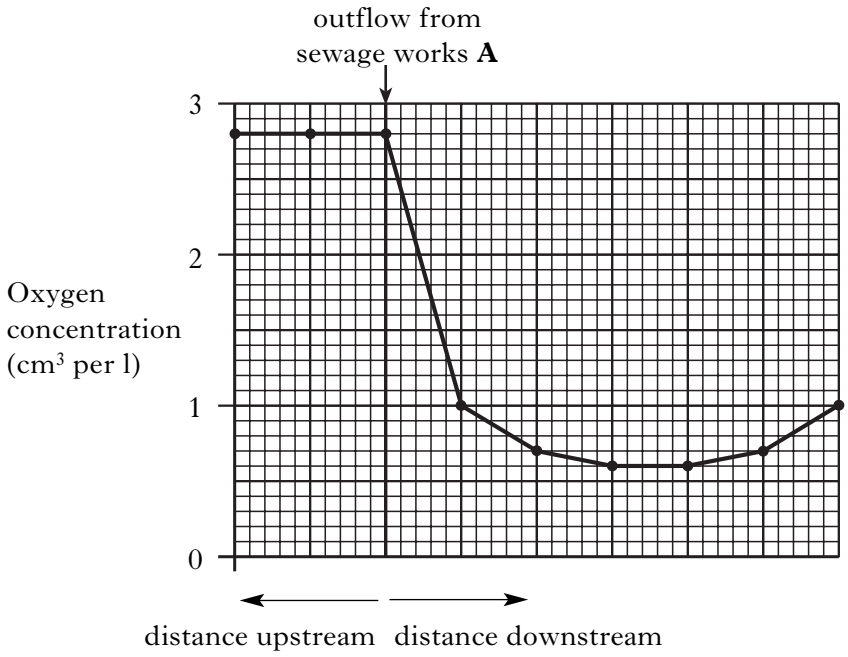
C _____ **1**

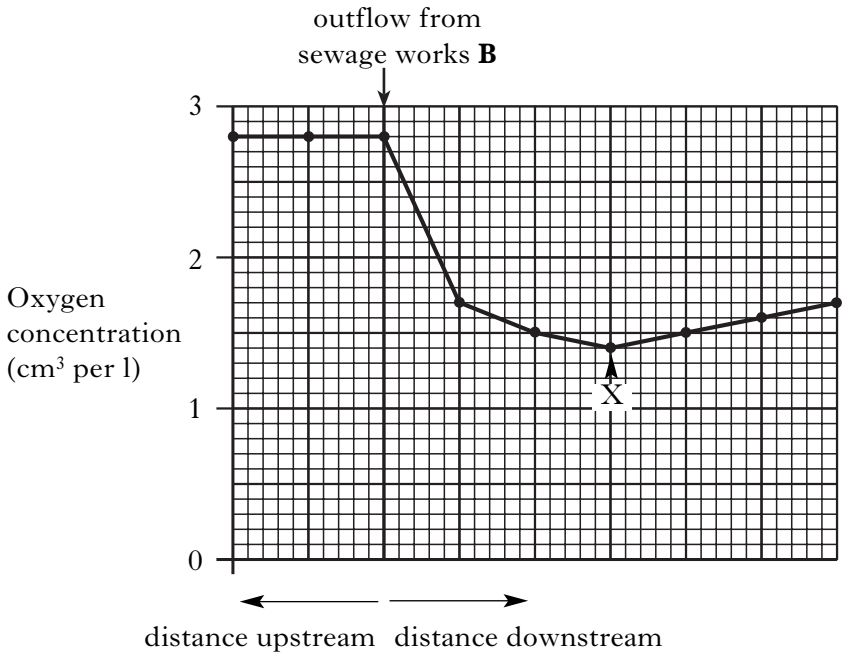
D _____ **1**

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

3. The graphs below show the oxygen concentrations upstream and downstream from the outflow pipes of two different sewage works, **A** and **B**. The two sewage works receive equal quantities of sewage and the two rivers are of equal size and speed.





(*a*) What is the oxygen concentration of the water upstream from sewage works **A**?

_____ cm³ per l **1**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

3. (continued)

(*b*) Calculate the percentage of oxygen lost from the water between the outflow of sewage works **B** and point **X**.

Space for Calculation

% **1**

(*c*) Complete the following sentence to describe the change in oxygen concentration which takes place downstream from both sewage works.

As the distance downstream from the sewage works increases, the oxygen concentration _____ and then _____. **1**

(*d*) Which sewage works is more efficient at removing waste material from the sewage?

Give a reason for your answer.

Sewage works _____ **1**

Reason

1

(*e*) Give **one** example of a disease that may be spread by untreated sewage.

1

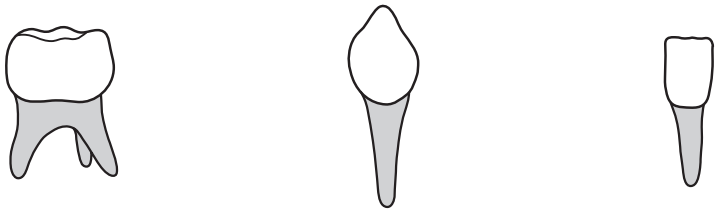
Extra Writing Space

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

4. The diagrams show three different types of human teeth.



A B C

(*a*) (i) Complete the following table by choosing **one** of the teeth, **A**, **B** or **C**, for each description.

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

Description of tooth	*Tooth*
Found at the very back of the jaw	
Known as an incisor	
Used for grinding and crushing food	

2

(ii) State **one** function of canine teeth in carnivores.

1

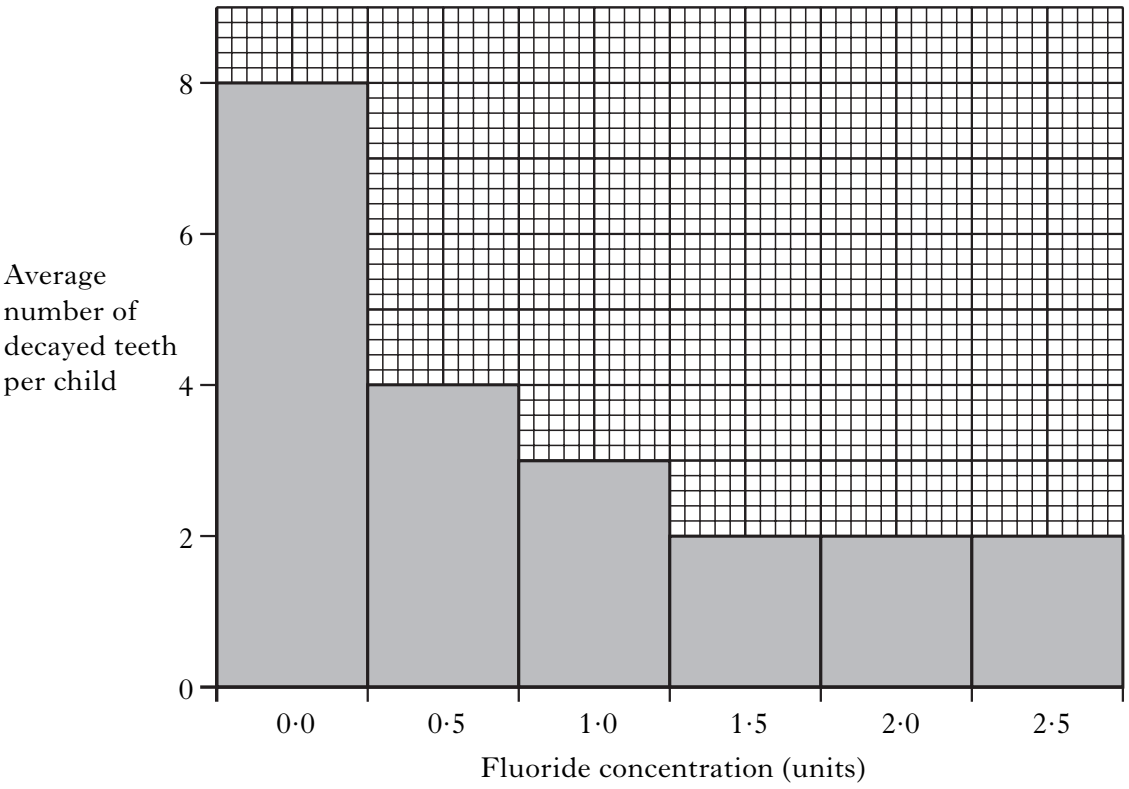
Extra Writing Space

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

4. (continued)

(*b*) Fluoride can be added to water supplies to help reduce tooth decay. The following bar graph shows the results of a study into the effect of some fluoride concentrations on the decay of children's teeth.



(i) What was the average number of decayed teeth per child when the fluoride concentration was 1 unit?

_____ decayed teeth per child **1**

(ii) On average, how many teeth per child were saved from decay by increasing the fluoride concentration from 0·0 to 0·5 units?

_____ teeth per child **1**

(iii) It may be concluded from the study that a fluoride concentration of 1·5 ppm is best.

Explain why this concentration would be better than each of the following.

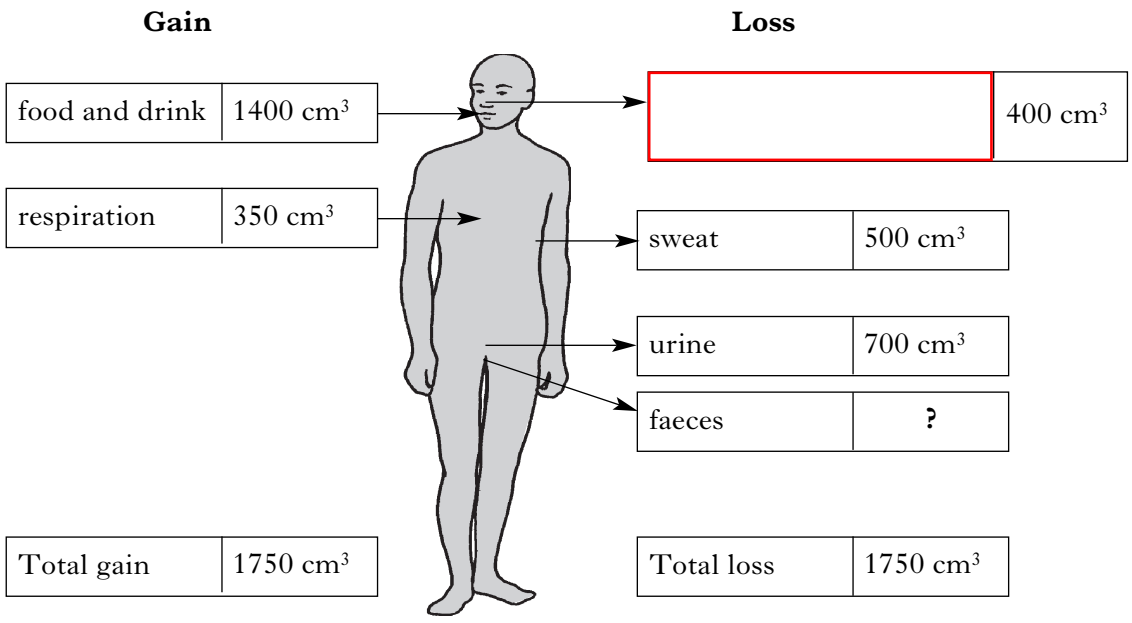
1 _____ **1**

2 _____ **1**

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

5. (*a*) The following diagram shows the main methods of water gain and loss for the human body.



(i) Complete the empty box to name the missing method of water loss. **1**

(ii) Calculate the volume of water lost in faeces.

Space for Calculation

cm^3 **1**

(iii) What percentage of the water gained comes from respiration?

Space for Calculation

% **1**

(*b*) Which organs are directly responsible for regulating the water content of the blood? **1**

(*c*) Name the poisonous waste substance that is removed in the urine together with water and salts. **1**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

5. (continued)

(*d*) The table shows the volumes of juices released into the digestive system each day.

Digestive juice	*Volume* (cm^3)
saliva	1500
gastric juice	2500
bile	500
pancreatic juice	700
intestinal juice	3000

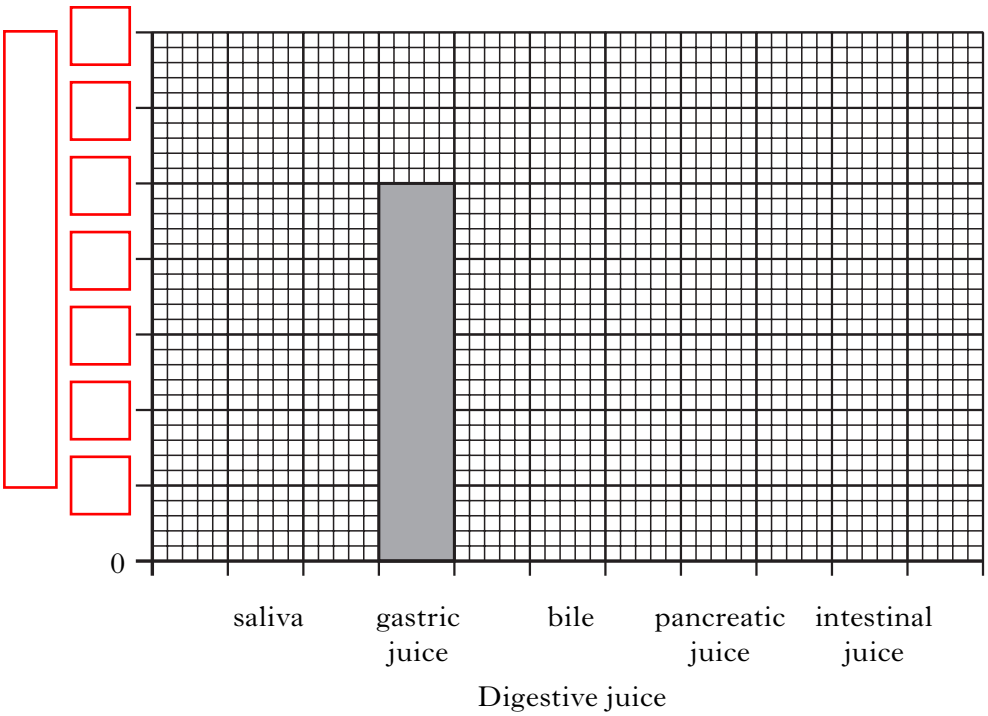
Use the table to complete the **bar chart** below by:

(i) labelling the vertical axis **1**

(ii) adding the scale to the vertical axis **1**

(iii) completing the bars **1**

(Additional graph paper, if required, will be found on page 27.)



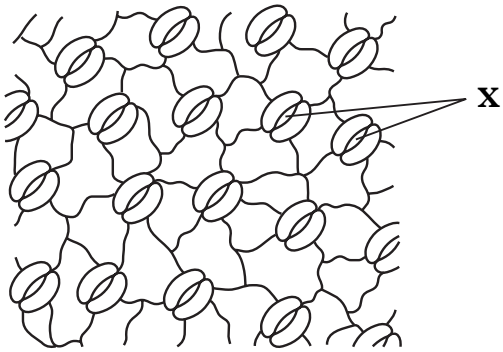
(*e*) Which part of the digestive system reabsorbs most of the water from the juices?

1

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

6. The diagram shows the lower surface of a leaf.



(*a*) (i) Name the pores labelled **X** on the diagram.

1

(ii) Which gas, needed for photosynthesis, is taken in through these pores?

1

(iii) The pores are able to open and close. Which substance, important for the growth of the plant, is conserved when the pores are closed?

1

(*b*) During photosynthesis green plants produce glucose. This can be changed to an insoluble carbohydrate for storage. What is the name of this storage carbohydrate?

1

(*c*) Name the green substance needed for photosynthesis.

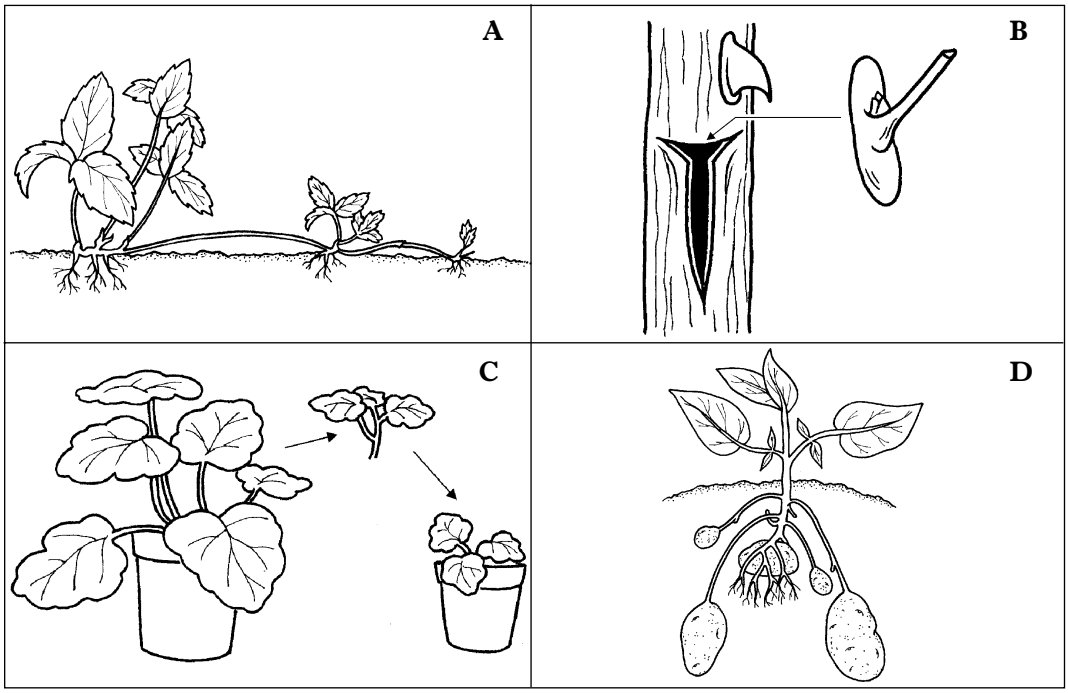
1

Extra Writing Space

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

7. The diagrams show some asexual methods of plant reproduction.



(*a*) Use the letters of the diagrams to identify the following.

(i) **Two** artificial methods of reproduction

letter ☐ and ☐ **1**

(ii) The diagram that shows reproduction by runners

letter ☐ **1**

(*b*) Name the methods of reproduction shown by diagrams **B** and **D**.

B ☐

D ☐ **1**

Extra Writing Space

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

8. Sweet pea seeds were planted in suitable conditions for germination and growth. Each week 20 seedlings were lifted. They were washed to clean off any soil and weighed. The results are shown in the table.

Age (weeks)	1	2	3	4	5	6	7
Total mass of 20 seedlings (g)	10	7	4	12	30	60	100

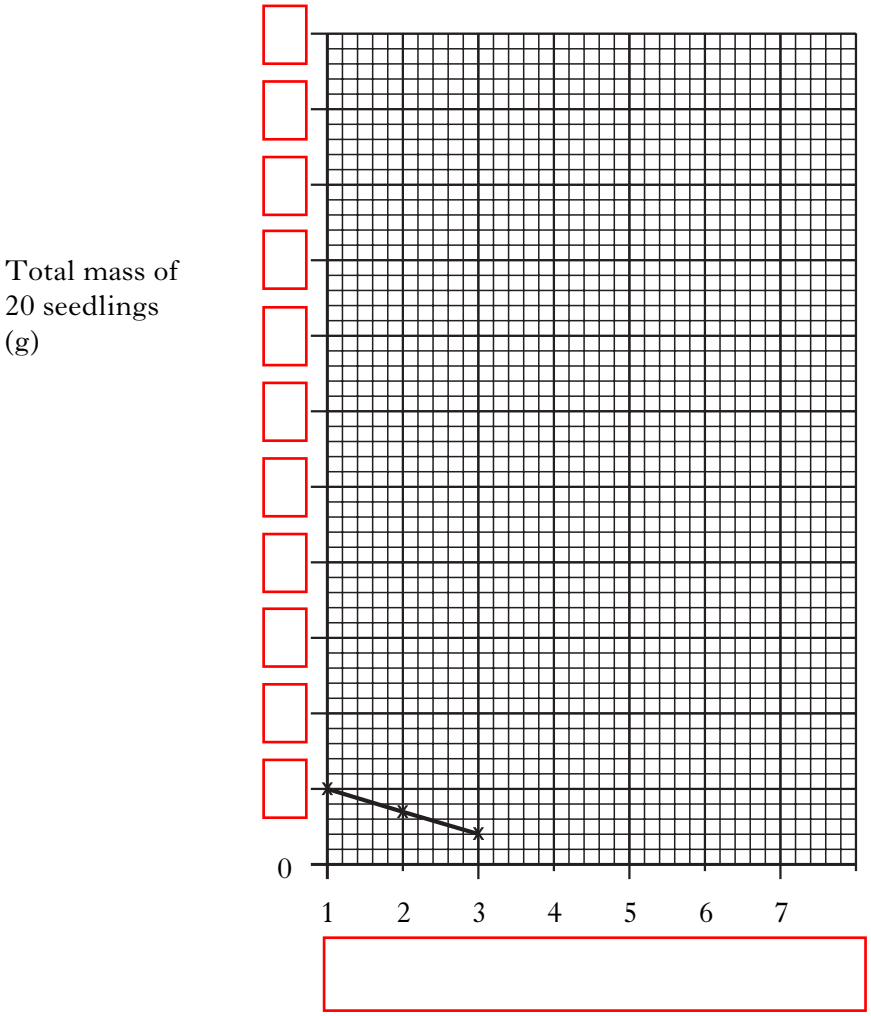
(*a*) Use the table to complete the **line graph** by:

(i) labelling the horizontal axis — **1**

(ii) adding a scale to the vertical axis — **1**

(iii) completing the graph — **1**

(Additional graph paper, if required, will be found on page 27.)



(*b*) (i) At what age did the seedlings have the lowest mass?

[ ] weeks — **1**

DO NOT WRITE IN THIS MARGIN

	Marks	KU	PS

8. (*b*) (continued)

(ii) Between which two weeks was there the greatest increase in mass?
Tick the correct box.

- [x] 2 – 3
- [ ] 3 – 4
- [ ] 5 – 6
- [ ] 6 – 7

1

(iii) Calculate the average mass of a single seedling at age seven weeks.

Space for Calculation

g

1

(*c*) (i) Name **two** factors that should be kept the same for all the seedlings during the investigation.

1

2

2

(ii) Weighing 20 seedlings each time reduced the error in weighing single small plants. Suggest **one** other reason for weighing 20 seedlings and calculating an average.

1

(iii) Removing soil from the seedlings reduced a source of error. Suggest **one** further step that should be taken before weighing the seedlings.

1

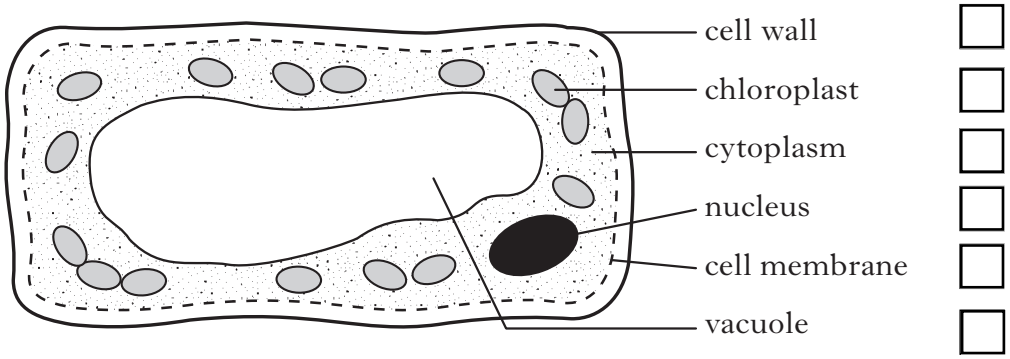
(*d*) Predict what difference there would be in the results if the investigation was repeated in the dark.

1

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

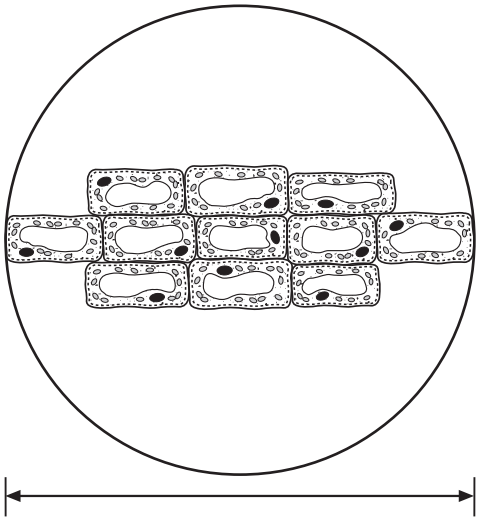
9. The diagram shows some of the structures found in a typical plant cell.



(*a*) Tick the boxes to show the structures that are also found in a typical animal cell. **2**

(*b*) Why are cells often stained before being viewed under a microscope? **1**

(*c*) The diagram shows some plant cells as they appear when viewed under a microscope.



Calculate the average length of the cells.

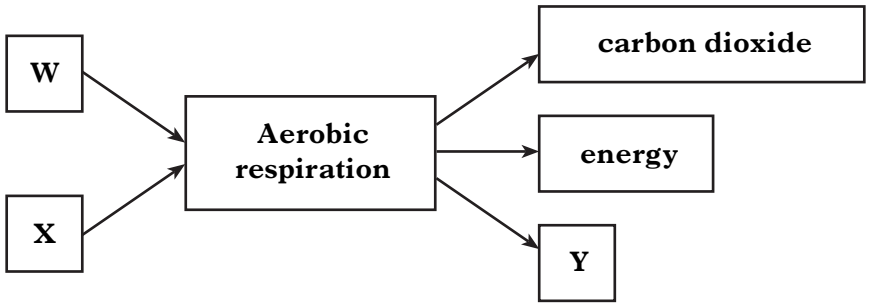
Space for Calculation

micrometres **1**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

10. The diagram represents aerobic respiration in a cell.



(*a*) Name the substances **W**, **X** and **Y**.

W

X

Y

2

(*b*) What is the source of the substance which is used in respiration and which leads to the formation of carbon dioxide?

1

(*c*) The energy released during respiration can be used for chemical reactions.

Give **two** other ways in which a cell may use this energy.

1

2

1

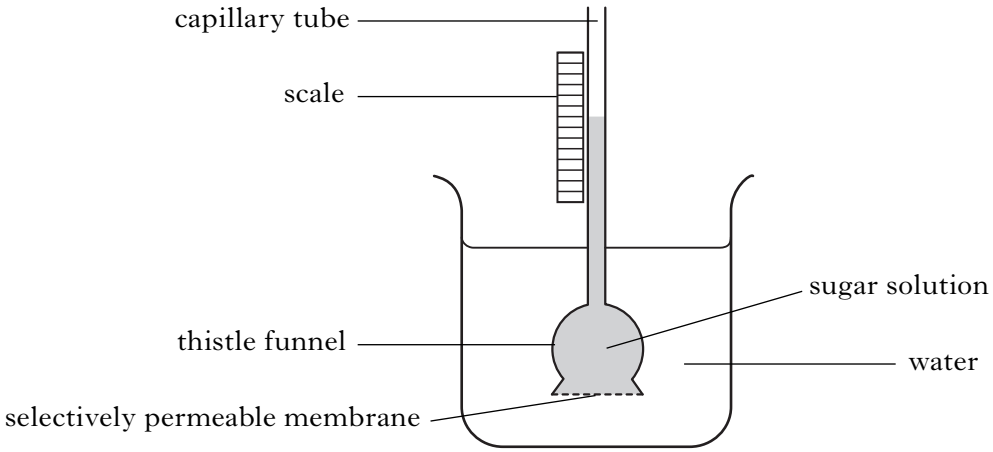
Extra Writing Space

[Turn over

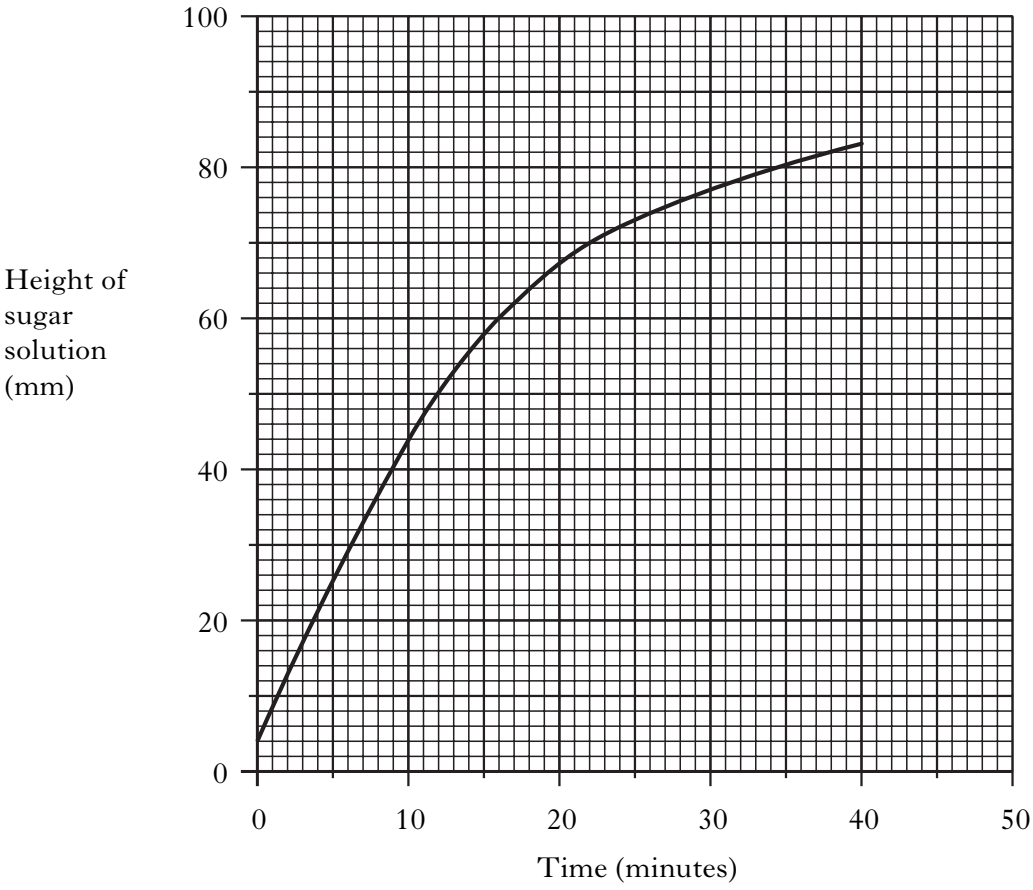
DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

11. The apparatus below was used to demonstrate diffusion.



The height of the sugar solution in the capillary tube was measured at regular intervals. The results are shown in the graph.



(*a*) (i) What was the height of the sugar solution in the capillary tube after 10 minutes?

_____ mm

1

DO NOT WRITE IN THIS MARGIN

	Marks	KU	PS

11. (*a*) (continued)

(ii) How long did it take for the sugar solution to rise from 60 mm to 70 mm?

☐ minutes **1**

(*b*) What caused the change in height of the sugar solution in the capillary tube?

Tick the correct box.

Sugar molecules moved out of the funnel. ☐

Sugar molecules moved into the funnel. ☐

Water molecules moved out of the funnel. ☐

Water molecules moved into the funnel. ☐ **1**

(*c*) Predict the height of the sugar solution in the capillary tube after 50 minutes.

☐ mm **1**

Extra Writing Space

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

12. Read the passage below.

Adapted from *Dairy Microbiology* by the National Dairy Council.

Yoghurt is a fermented milk product that originated in the Middle East. In that part of the world it tends to be more acidic and thinner than the yoghurt that has been developed in Britain.

Yoghurt can be made from whole milk, skimmed milk, evaporated milk or dried milk. Usually a mixture of these is blended together. The milk used for yoghurt manufacture must be free of all traces of antibiotics. This is to ensure successful fermentation. The blended milk is heated to between 85 °C and 95 °C before being cooled to 32 °C. A starter culture containing bacteria is added and fermentation begins. After 12 hours, the lactic acid content reaches the desired level of between 0·8% and 1·8%.

The yoghurt is now stirred and then fruit may be added before the finished product is packaged and stored at 5 °C. The slower bacterial growth at this temperature gives the yoghurt a shelf life of approximately 10 days. After this time bacterial growth, although restricted, will increase the level of acidity to such an extent as to change the flavour and make it unacceptable to most people.

Answer the questions based on the passage.

(*a*) Give **two** differences between Middle Eastern yoghurt and British yoghurt.

1

2

1

(*b*) Other than whole milk, name **two** types of milk used for yoghurt manufacture.

1 2

1

(*c*) Explain why antibiotics in the milk could prevent successful fermentation.

1

(*d*) Name the acid produced during yoghurt production.

1

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

12. (continued)

(*e*) What stage in yoghurt production ensures that no unwanted bacteria are present?

1

(*f*) How does storage at 5 °C increase the shelf life of the yoghurt?

1

(*g*) What causes the flavour of the yoghurt to change after 10 days storage?

1

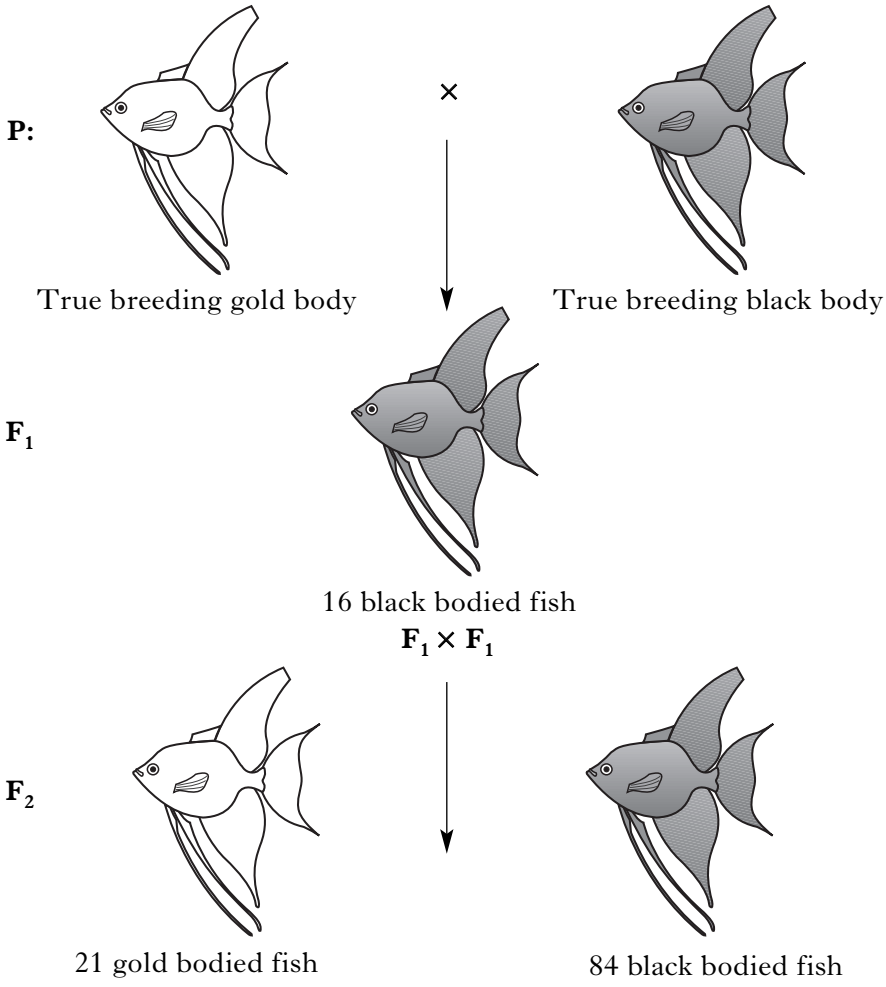
Extra Writing Space

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

13. The diagram below shows inheritance of body colour in angelfish.



(*a*) (i) What are the **two** phenotypes used in this cross?

1 _____ 2 _____ **1**

(ii) Which characteristic is dominant?

_____ **1**

(iii) Calculate the simple whole number ratio of **black** to **gold** bodied fish in the F_2 generation.

Space for Calculation

_____ : _____ **1**

black : gold

DO NOT WRITE IN THIS MARGIN

	Marks	KU	PS

13. (continued)

(*b*) Which **one** of the following statements is true?
Tick the correct box.

The parents have the same genotypes and phenotype. ☐

All the $\mathbf{F_1}$ generation have the same genotypes and phenotype. ☐

All the $\mathbf{F_2}$ generation have the same genotypes and phenotype. ☐ **1**

(*c*) What type of variation is shown by the body colour of the angelfish?

1

(*d*) Angelfish produce eggs and sperm for reproduction.
What general name is used for these sex cells?

1

Extra Writing Space

[Turn over

DO NOT WRITE IN THIS MARGIN

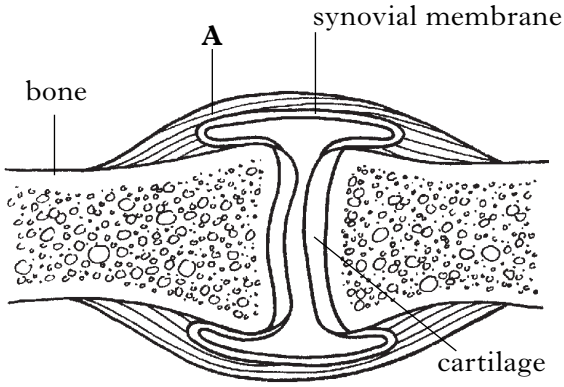
Marks	KU	PS

14. The skeleton provides protection for the soft organs of the body.

(*a*) Give **one** other function of the skeleton.

1

(*b*) The diagram shows the structure of a finger joint.



(i) Name the part labelled **A**.

1

(ii) What is the function of the cartilage in a joint?

1

(*c*) Complete the table below about two types of moveable joints.

Range of movement allowed by the joint	*Type of joint*	*Example*
One plane		
Many planes		

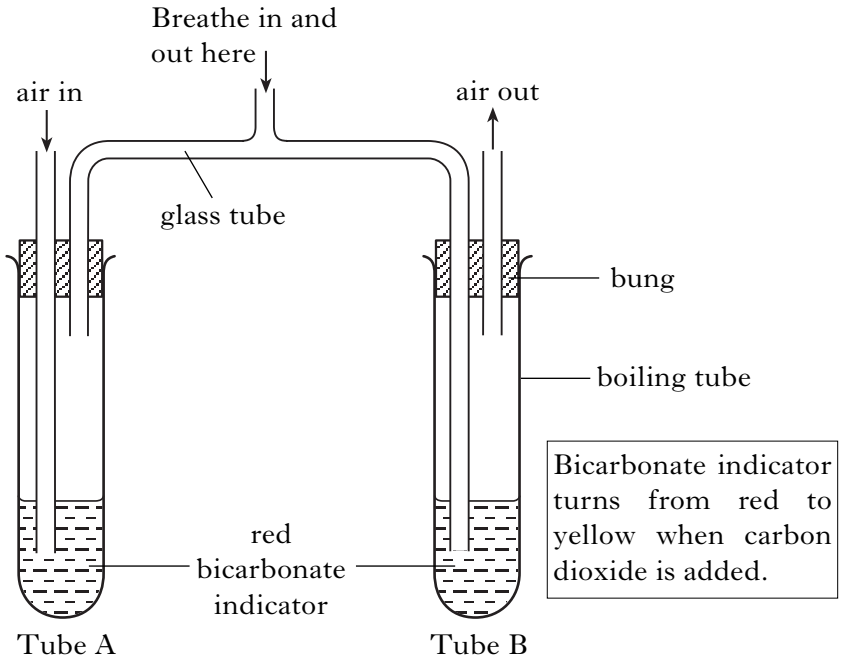
2

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

15. The diagram shows apparatus that a pupil used to investigate gas exchange.

Air that was breathed in passed through tube A. Air that was breathed out passed through tube B.



(*a*) (i) In which tube would the indicator change colour?

Tube [ ] **1**

(ii) The other tube acts as a control.

What is the purpose of a control in an experiment?

[ ] **1**

(*b*) The experiment was repeated several times using the same apparatus.

Name **two** variables that would have to be kept constant to make sure the results were valid.

1 [ ]

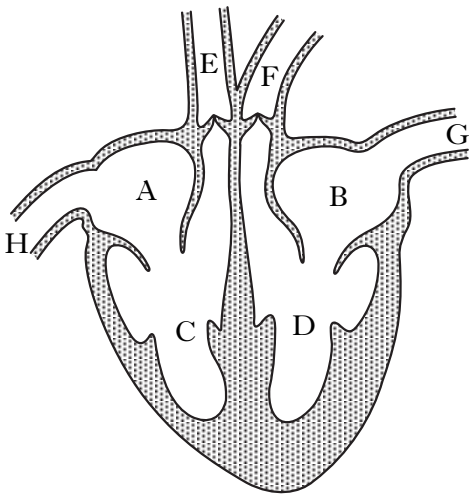
2 [ ] **2**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

16. The diagram shows the chambers and blood vessels in a heart.



(*a*) Complete the following table using the correct letter from the diagram for each description.

Description	*Letter*
The chamber that receives blood from the body.	
The artery that carries blood from the heart to the body.	
The chamber that pumps blood to the lungs.	
The vein that carries blood from the lungs to the heart.	

3

(*b*) The following sentences are about blood.
Underline **one** option in each bracket to make the sentences correct.

Oxygen is carried in the blood by { red blood cells / white blood cells / plasma }.

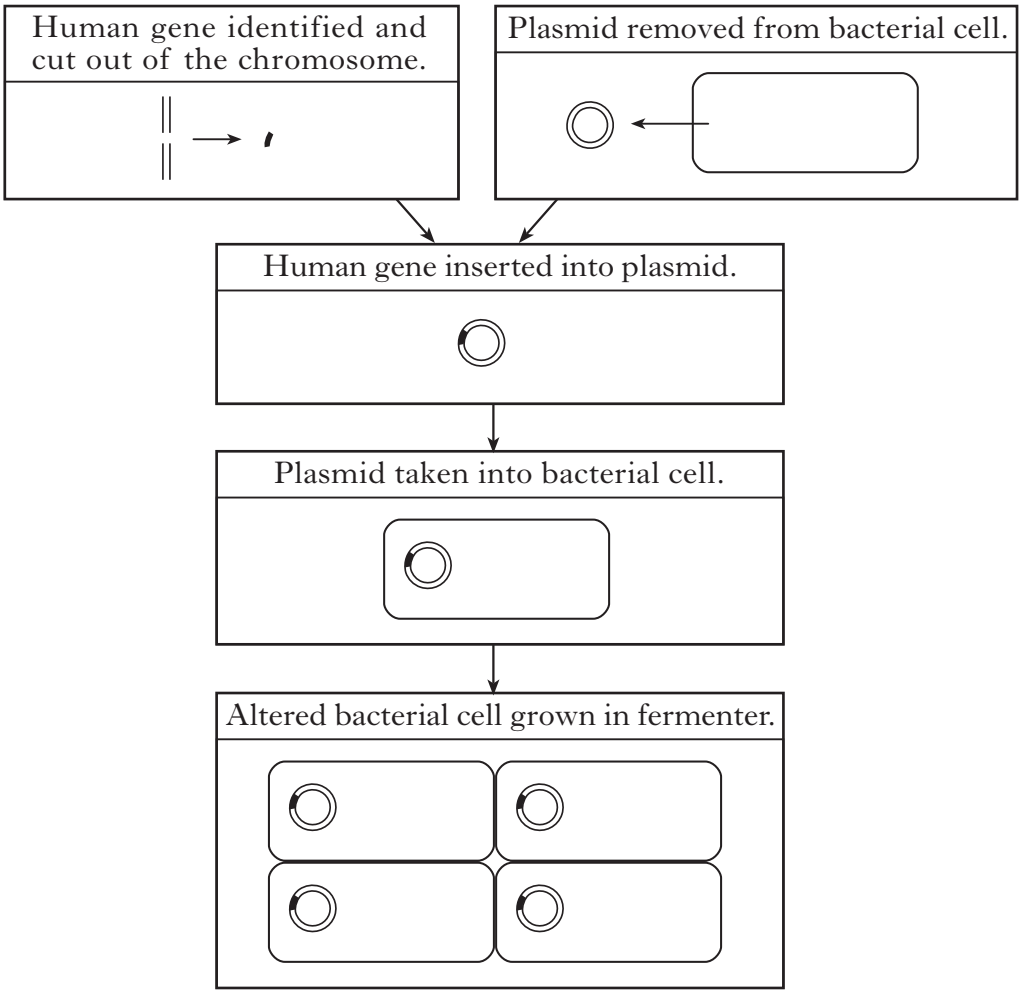
Digested food products such as glucose are carried by { red blood cells / white blood cells / plasma }.

2

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

17. The following diagram describes some of the stages involved in transferring a gene from a **human chromosome** into a bacterial cell.



(*a*) What name is given to this procedure?

1

(*b*) Give an example of a product that can be made by bacteria as a result of this procedure. State the use of this product.

Product

1

1

(*c*) What type of reproduction is involved during the growth of the bacteria in the fermenter?

1

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

18. The table gives information about some disease causing bacteria.

Name of bacteria	*Pattern of growth*		*Shape of cells*			*Disease*
	single cells	*clusters of cells*	*round*	*rod*	*spiral*	
B. cereus		✓		✓		food poisoning
B. burgdoferi	✓				✓	Lyme's disease
S. pneumonia		✓	✓			pneumonia
C. tetani	✓			✓		tetanus
S. aureus		✓	✓			skin abscesses
E. coli	✓			✓		food poisoning

(*a*) Which **two** diseases are caused by bacteria that grow as clusters of cells and are round in shape?

1 _____ 2 _____ **1**

(*b*) Give **three** pieces of information about *B. burgdoferi* bacteria.

1 _____

2 _____

3 _____ **1**

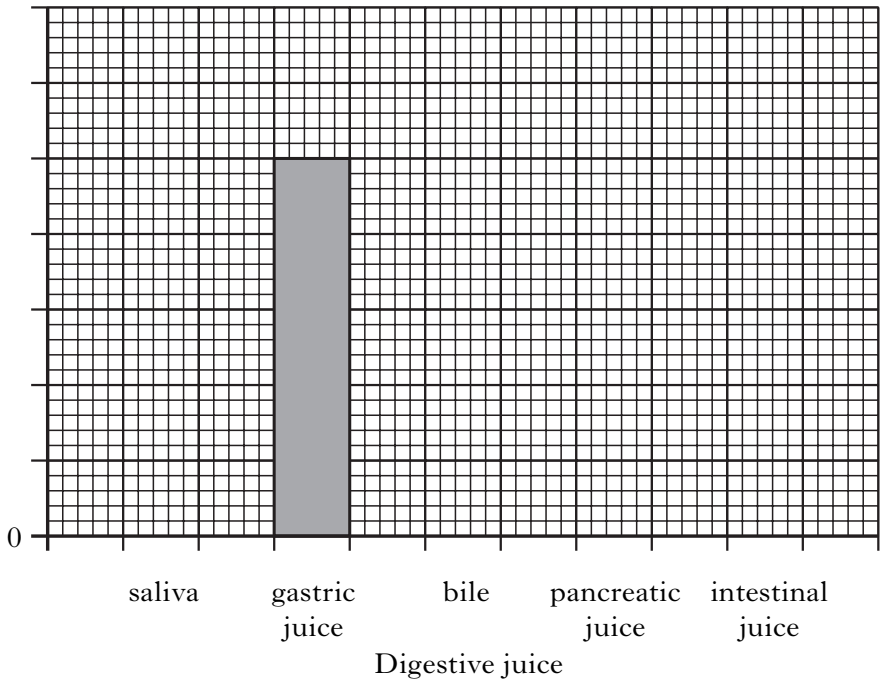
(*c*) A food sample caused food poisoning.
It was found to contain rod shaped bacteria that grew as single cells.
Name the bacteria.

_____ **1**

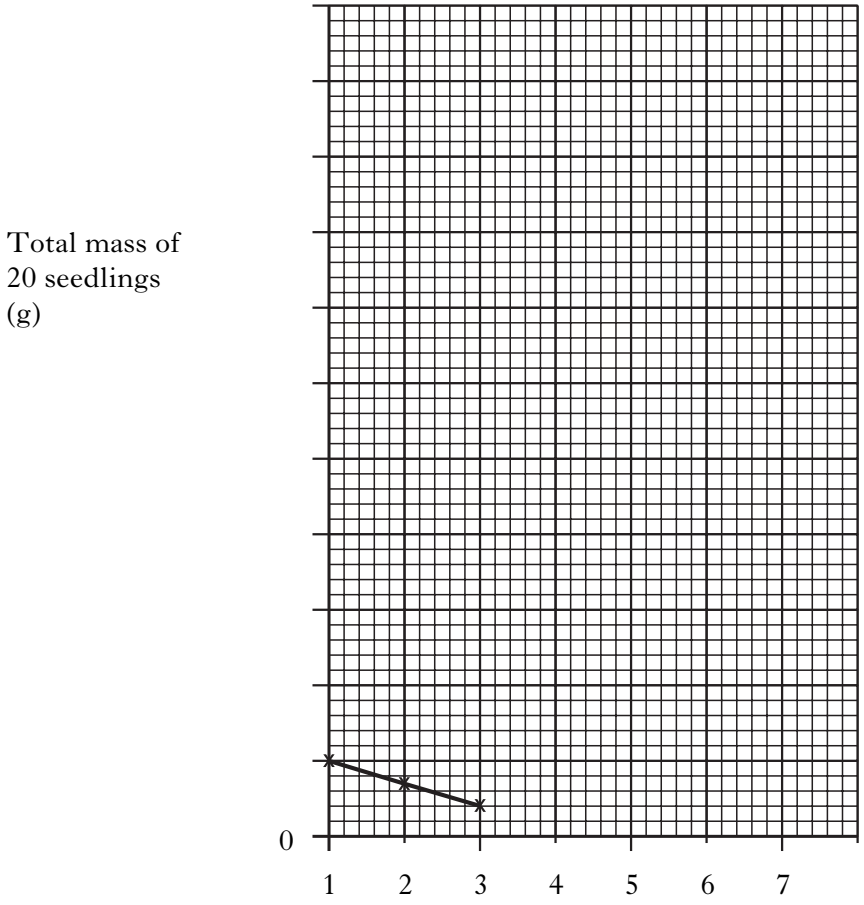
[*END OF QUESTION PAPER*]

SPACE FOR ANSWERS
AND FOR ROUGH WORKING

ADDITIONAL GRID FOR QUESTION 5(*d*)



ADDITIONAL GRID FOR QUESTION 8(*a*)



SPACE FOR ANSWERS
AND FOR ROUGH WORKING