

FOR OFFICIAL USE

--	--	--	--	--	--

C

KU	PS

Total Marks

0300/402

NATIONAL
QUALIFICATIONS
2008

TUESDAY, 27 MAY
10.50 AM – 12.20 PM

BIOLOGY
STANDARD GRADE
Credit 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

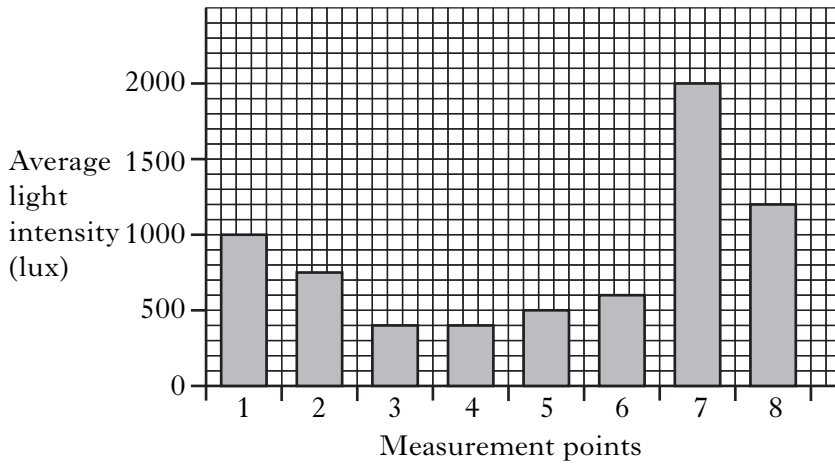
- 1 All questions should be attempted.
- 2 The questions may be answered in any order but all answers are to be written in the spaces provided in this answer book, and must be written clearly and legibly in ink.
- 3 Rough work, if any should be necessary, as well as the fair copy, is to be written in 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.



1. (continued)

(b) An investigation was carried out into the effect of light intensity on the distribution of a plant species. At eight different measurement points in a garden, the average light intensity was measured and the percentage ground cover of the plant was recorded.

The results are shown below.



Measurement points	Ground cover of the plant (%)
1	85
2	65
3	20
4	20
5	30
6	35
7	100
8	90

DO NOT WRITE IN THIS MARGIN

- (i) 1 What is the light intensity in the garden where the ground cover of the plant was 100%?
 _____ lux
- 2 What was the percentage ground cover of the plant when the light intensity was 750 lux?
 _____ %
- (ii) What is the relationship between light intensity and percentage ground cover of the plant?

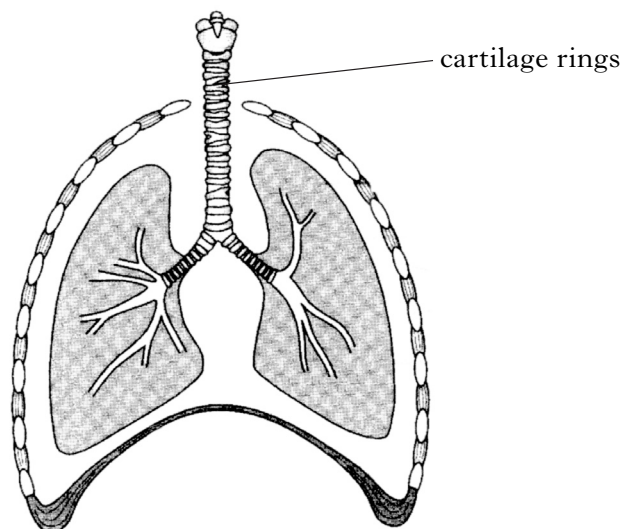
- (c) Explain how light intensity affects the distribution of the plants in the garden.

Marks	KU	PS
1		
1		
1		
1		

Marks

KU	PS
1	
1	
1	
1	
1	
1	

4. (a) The diagram shows part of the human breathing system.



Describe the function of the cartilage rings.

- (b) (i) Name the sticky substance that traps inhaled dust particles.

- (ii) Explain how the trapped particles are removed from the breathing system.

- (c) As blood passes through capillary networks in the lungs, oxygen and carbon dioxide are exchanged between the blood and the air sacs.

- (i) Describe **one** feature of a capillary network which allows efficient gas exchange.

- (ii) Name the structures in blood that contain haemoglobin.

- (iii) Explain the function of haemoglobin in the transport of oxygen.

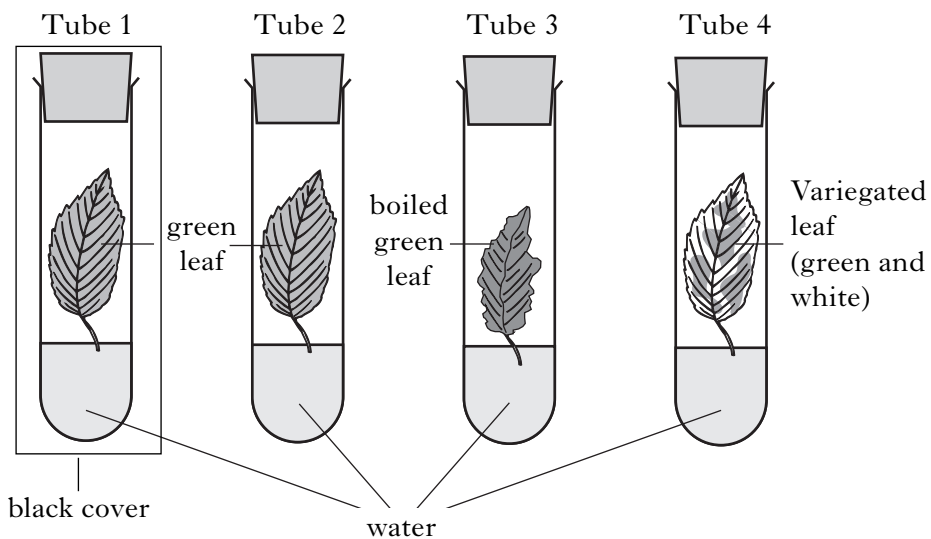
Marks

KU	PS
----	----

5. (continued)

(c) Leaves were placed in tubes as shown below.

The tubes were left in bright light.



For each of the tubes, tick (✓) the appropriate box in the table to indicate which processes will take place in the leaves.

<i>Process</i> <i>Tube</i>	<i>Only</i> <i>photosynthesis</i>	<i>Only</i> <i>respiration</i>	<i>Both</i>	<i>Neither</i>
1				
2				
3				
4				

2

[Turn over

6. (a) (continued)

- (ii) Calculate the simple whole number ratios of patients waiting for a transplant to the number of kidney transplants carried out for 1996 and for 2005.

Space for calculation.

1996 _____ : _____

2005 _____ : _____
 patients waiting for a transplant transplants carried out

- (iii) The following statements refer to the data in the graph.

Tick (✓) the box(es) of the correct statement(s).

The number of patients waiting for a transplant increased every year.

The number of transplants carried out decreased every year.

The difference between the number of patients waiting for a transplant and the number of transplants carried out increased every year.

- (b) Give **one** advantage and **one** disadvantage of treating kidney failure by transplant compared to treatment using a dialysis (kidney) machine.

Advantage _____

Disadvantage _____

Marks

KU	PS
1	
1	
1	

[Turn over

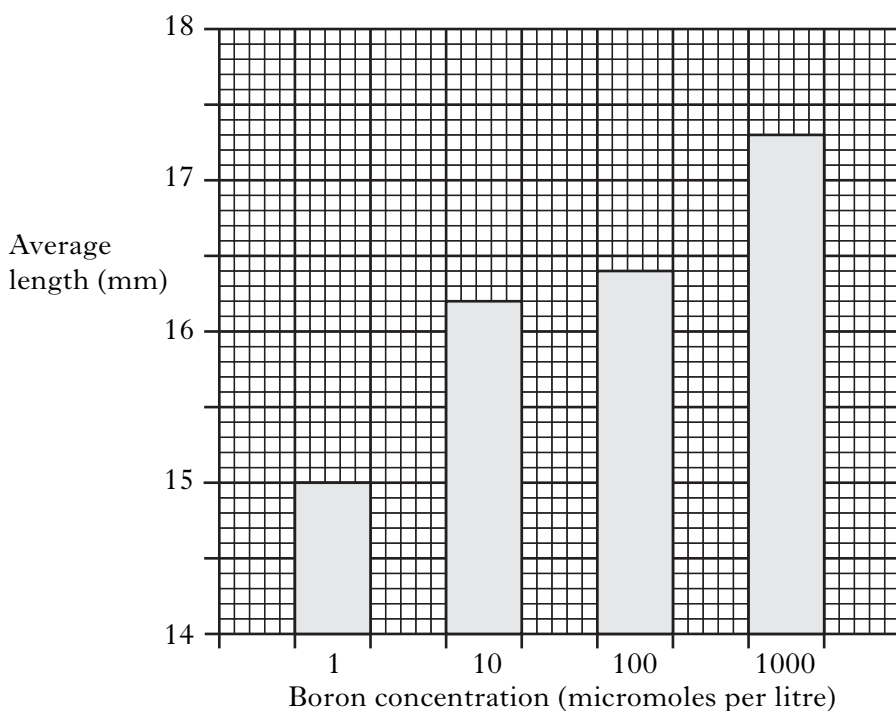
Marks

KU	PS
----	----

7. An investigation was carried out into the effect of the mineral boron on the growth of young trout.

Immediately after fertilisation, trout eggs were placed in distilled water containing different concentrates of boron.

After hatching, young trout survive on food from their yolk sac for a maximum of four weeks. The graph below shows the average lengths of the young trout three weeks after hatching.



- (a) Describe the relationship between boron concentration and the length of the young trout.

1

- (b) Calculate the percentage change in the average fish length when the boron concentration is increased from 1 micromole per litre to 10 micromoles per litre.

Space for calculation.

_____ %

1

<i>Marks</i>	KU	PS
1		
1		

7. (continued)

(c) Distilled water is the purest form of water available. Give a reason for using distilled water in this investigation.

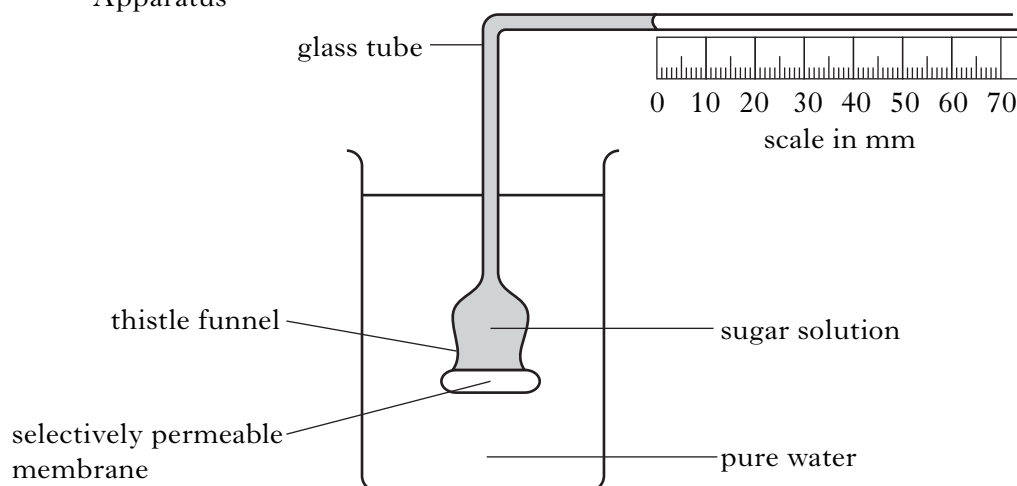
(d) Explain why the results would not be valid if the fish were measured more than four weeks after hatching.

[Turn over

8. An investigation was carried out into the effect of water concentration on the rate of osmosis.

Details of the apparatus, method used and results are given below.

Apparatus



Method

- 1 A thistle funnel containing 50 cm^3 of 0.5% sugar solution was covered with selectively permeable membrane.
- 2 The funnel was placed in a beaker of pure water.
- 3 The scale was positioned with the sugar solution at zero on the scale.
- 4 The position of the sugar solution was recorded after 30 minutes.
- 5 The procedure was repeated using 1.0%, 2.0% and 3.0% sugar solutions.

Results

<i>Concentration of sugar solution (%)</i>	<i>Distance moved by sugar solution in 30 minutes (mm)</i>
0.5	4.5
1.0	9.0
2.0	18.0
3.0	27.0

<i>Marks</i>	KU	PS
2		
1		
1		
1		

8. (continued)

(a) Identify **two** variables not already mentioned that should be kept constant when setting up the investigation.

1 _____

2 _____

(b) Explain the movement of the sugar solution in terms of water concentrations.

(c) From the results, predict the distance moved by a 3.5% sugar solution in 30 minutes and justify your prediction.

Prediction _____ mm

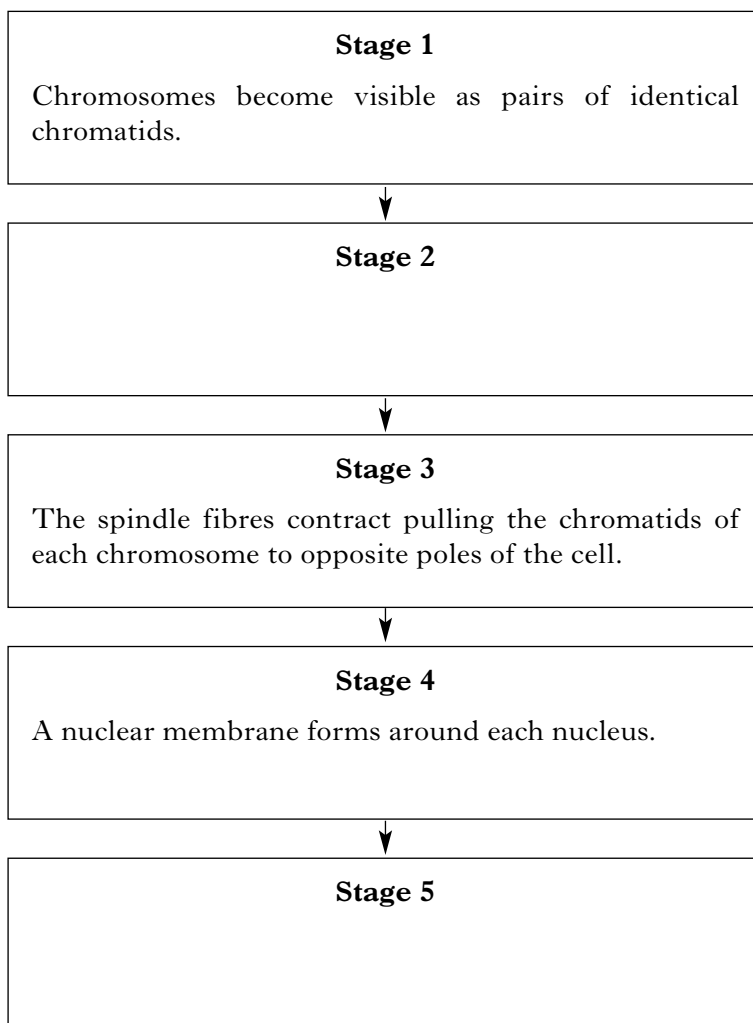
Justification _____

[Turn over

Marks

9. (a) The diagram below contains some of the stages of cell division by mitosis.

Describe **Stages 2** and **5** in the spaces provided.



- (b) Mitosis ensures that all daughter cells in a multicellular organism have the same number and type of chromosomes.

Explain why this is necessary.

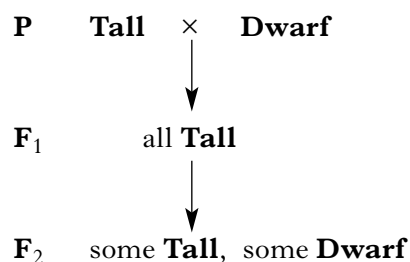
	KU	PS
1		
1		
1		

Marks

KU	PS

11. (continued)

(b) The diagram shows a cross between tall and dwarf pea plants.



(i) What would be the predicted ratio of **Tall** to **Dwarf** plants in the **F₂** generation?

_____ : _____
Tall **Dwarf**

1

(ii) The observed ratio of **Tall : Dwarf** plants was different from the expected ratio.

Give an explanation for this difference.

1

(iii) Identify the true-breeding plants from the above cross.

Tick (✓) the box(es) of the correct plant(s).

Tall P

Dwarf P

Tall F₁

1

[Turn over

12. (continued)

Marks

KU	PS

- (c) Predict the volume of gas which would be collected in one hour if the investigation was repeated at 60°C. Give an explanation for your answer.

Prediction _____ cm³

1

Explanation _____

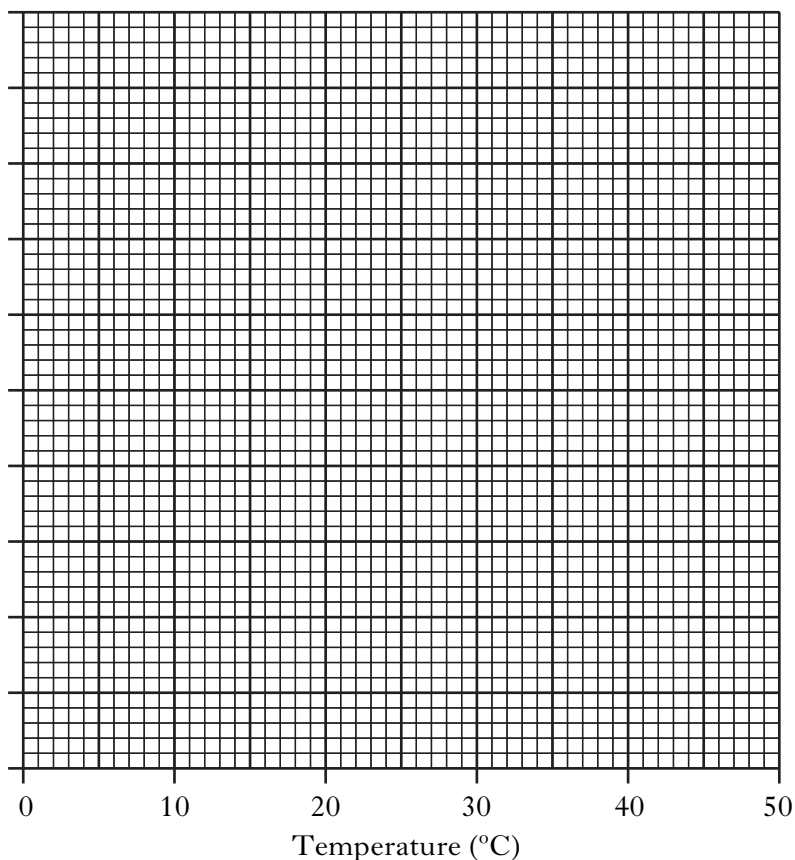
1

- (d) Describe the control flasks that would be set up to show that the gas was produced due to activity of the yeast and to no other factor.

2

- (e) Use the results to complete a line graph to show the volumes of gas produced in one hour over the range of temperatures.

(An additional grid, if needed, will be found on page 27.)



2

[Turn over

Marks

KU	PS
1	
1	

13. Read the following passage and answer the questions based on it.

Adapted from *GM Organisms* by John Pickrell, www.newscientist.com

Genetic modification (GM) of crops began with the discovery that the soil bacterium *Agrobacterium* could be used to transfer useful genes from unrelated species into plants. The Bt gene is one of the most commonly inserted. It produces a pesticide toxin that is harmless to humans but is capable of killing insect pests. Many new crop types have been produced. Most of these are modified to be pest, disease or weedkiller resistant, and include wheat, maize, oilseed rape, potatoes, peanuts, tomatoes, peas, sweet peppers, lettuce and onions.

Supporters argue that drought resistant or salt resistant varieties can flourish in poor conditions. Insect-repelling crops protect the environment by minimising pesticide use. Golden rice with extra vitamin A or protein-enhanced potatoes can improve nutrition.

Critics fear that GM foods could have unforeseen effects. Toxic proteins might be produced or antibiotic-resistance genes may be transferred to human gut bacteria. Modified crops could become weedkiller resistant “superweeds”. Modified crops could also accidentally breed with wild plants or other crops. This could be serious if, for example, the crops which had been modified to produce medicines bred with food crops.

Investigations have shown that accidental gene transfer does occur. One study showed that modified pollen from GM plants was carried by the wind for tens of kilometres. Another study proved that genes have spread from the USA to Mexico.

(a) What role does the bacterium *Agrobacterium* play in the genetic modification of crops?

1

(b) Crops can be genetically modified to make them resistant to pests, diseases and weedkillers. Give another example of genetic modification that has been applied to potatoes.

1

Marks

KU	PS
1	
1	
1	
	1

14. (a) (continued)

- (iii) Calculate the decrease in glucose concentration over the 60 hour period.

Space for calculation.

_____ g/100 cm³

- (iv) If glucose continues to be used at the same rate as between 50 and 60 hours, predict how many more hours it would be before all the glucose would be used up.

Space for calculation.

_____ hours

- (v) During the first 10 hours of the process, energy was being used for functions other than the synthesis of the hormone.

Give **two** pieces of evidence from the graph to support this statement.

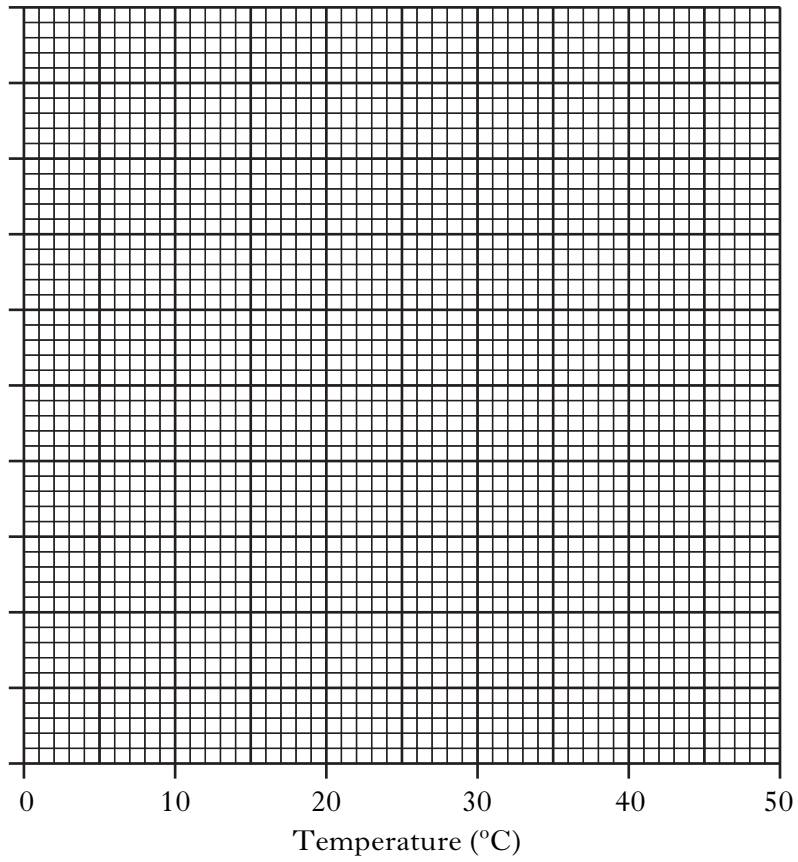
1 _____

2 _____

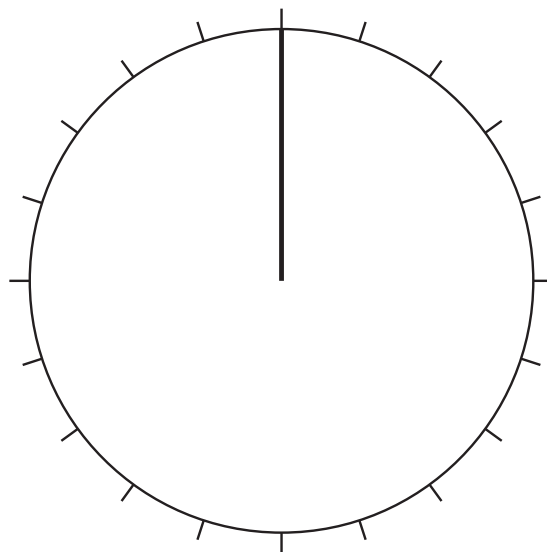
- (b) Glucose is a carbohydrate component of food. Which food component contains most energy per gram?

[Turn over for Question 15 on Page twenty-six

ADDITIONAL GRAPH PAPER FOR QUESTION 12(e)



ADDITIONAL PIE CHART FOR QUESTION 15(d)



SPACE FOR ANSWERS
AND FOR ROUGH WORKING

ACKNOWLEDGEMENTS

Question 11(a)—Photograph of a Child, Image no 39907132. Taken from www.pbase.com. Permission is being sought from Pbase.

Question 13—Extract adapted from *GM Organisms* by John Pickrell, taken from www.newscientist.com. Reproduced by kind permission of New Scientist.