

FOR OFFICIAL USE

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KU PS

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Total Marks

0300/401

NATIONAL MONDAY, 9 MAY
 QUALIFICATIONS 9.00 AM – 10.30 AM
 2011

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

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Scottish candidate number

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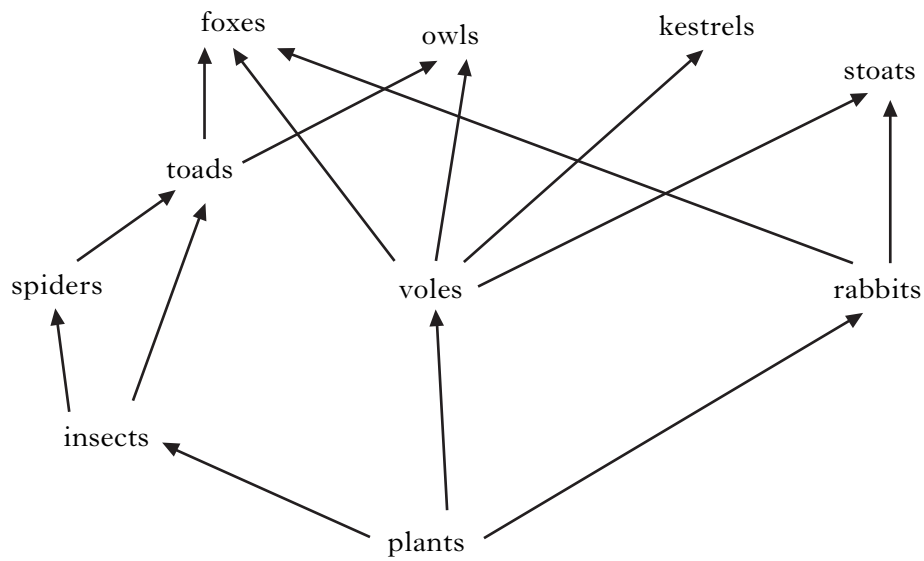
Number of seat

- 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.



Marks

1. (a) The diagram shows part of a food web in an ecosystem.



Use information from the diagram to answer the following questions.

(i) What do the arrows represent?

1

(ii) Which organisms are the producers?

1

(iii) Name **two** animals that are not eaten by other organisms.

1 _____ 2 _____

1

(iv) Show a complete food chain from the diagram using the spaces below.

plants → _____ → _____ → toads → _____

1

(b) Name **one** way in which energy can be lost from a food web.

1

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1. (continued)

(c) The grid contains some terms related to the biosphere.

A community	B competition	C ecosystem	D food supply
E habitat	F light intensity	G population	H predation

Use letters from the grid to identify the correct term for each of the following:

- (i) an example of an abiotic factor;
- (ii) the interaction between organisms which use the same resources;
- (iii) all the organisms living in a particular area.

3

[Turn over

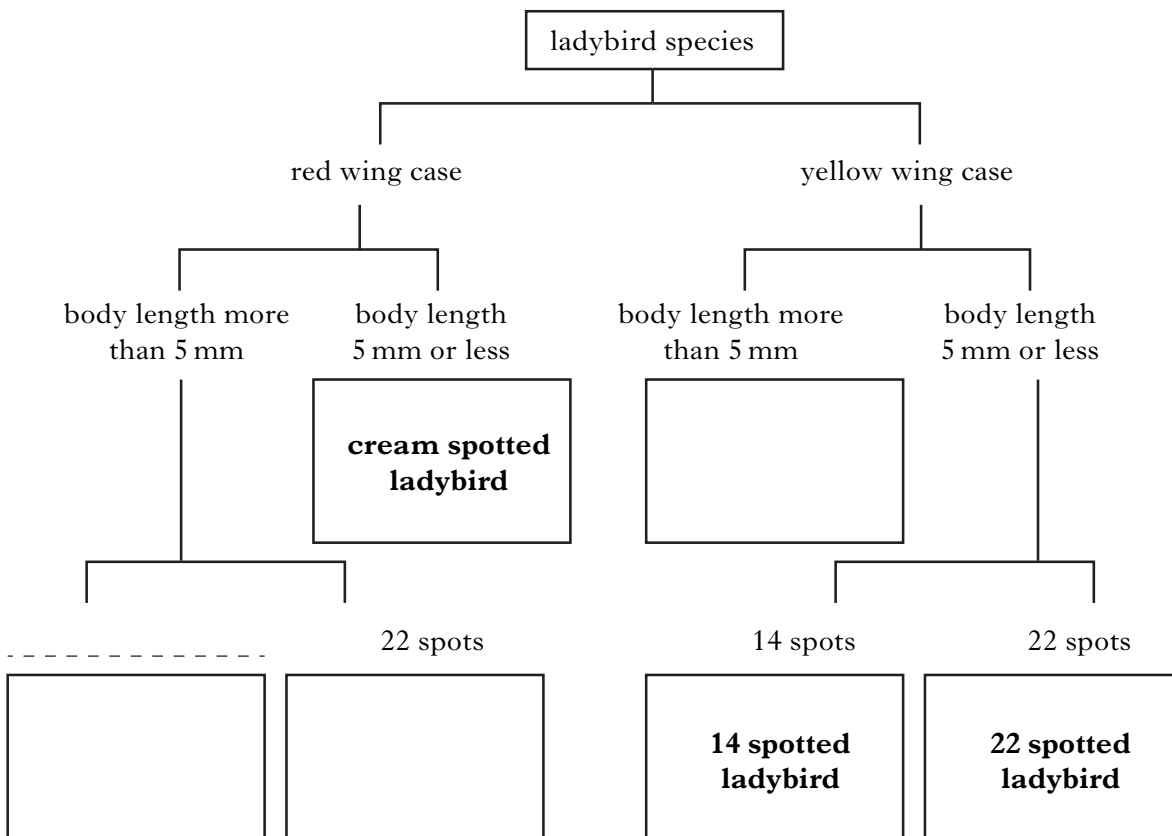
Marks

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2. The table below shows some of the characteristics of six ladybird species which live in this country.

<i>Ladybird Species</i>	<i>Colour of wing case</i>	<i>Body length (mm)</i>	<i>Number of spots</i>
Eyed ladybird	red	7–8	22
7 spotted ladybird	red	6–7	7
Cream streaked ladybird	yellow	6–7	7
14 spotted ladybird	yellow	4–5	14
Cream spotted ladybird	red	4–5	14
22 spotted ladybird	yellow	3–4	22

- (a) Use the information in the table to complete the key below.



3

- (b) Which species of ladybird can be less than 4 mm in length?

1

2. (continued)

- (c) What characteristic could be used to distinguish a “cream streaked ladybird” from a “7 spotted ladybird”?

Marks

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1

- (d) A student found a ladybird with a red wing case and a body length of 7 mm. What specific feature of its appearance allowed it to be identified as an “Eyed ladybird”?

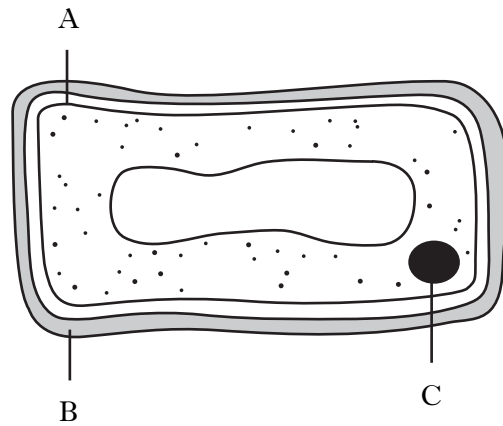
1

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3. (a) The diagram represents a section through a leaf cell.



Complete the table to show the name and function of the structures labelled.

<i>Letter</i>	<i>Name of structure</i>	<i>Function</i>
A	cell membrane	
B		gives shape and support
C	nucleus	

2

(b) Name a structure, present in plant cells, which is absent from animal cells.

1

(c) What name is given to chemicals which are used to make cell structures more visible under the microscope?

1

Marks

KU	PS

4. (a) Complete the table with the name of each type of tooth which is being described.

<i>Description</i>	<i>Tooth type</i>
Used by humans as cutting teeth when biting an apple	
Slide sideways in herbivores such as sheep for grinding grass	
Overlap in carnivores such as dogs for slicing meat	

2

- (b) Connect the parts of the alimentary canal in the two lists to show the direction in which the contents are moved.

The first two links, showing movement from the mouth to the oesophagus and the oesophagus to the stomach, have been done for you.

List 1

List 2

Moving from

Moving to

mouth

large intestine

large intestine

oesophagus

oesophagus

rectum

small intestine

small intestine

stomach

stomach

2

- (c) Give **two** ways in which the small intestine is adapted for its function.

1 _____

2 _____

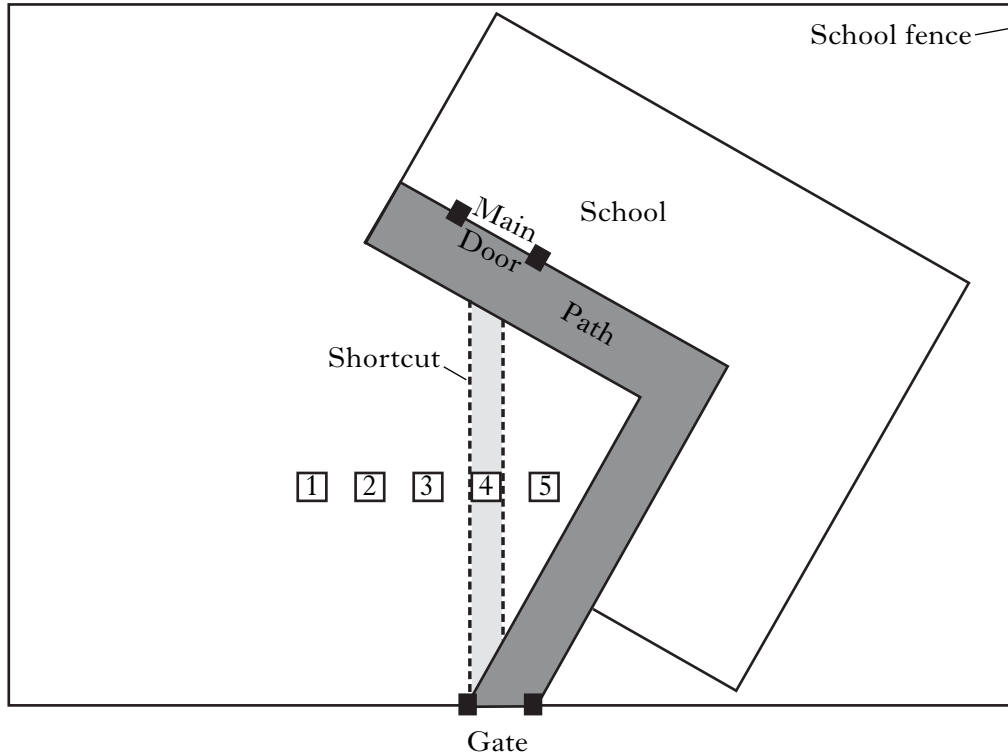
2

[Turn over

Marks

KU	PS
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5. A grass area is used as a shortcut by the pupils of a school.
- An investigation was carried out on the effect this has on the distribution of three types of plants.
- The diagram below shows the position of five quadrats.



The number of plants found in each quadrat is shown in the table below.

Quadrat number	Number of plants		
	Daisies	Plantains	Buttercups
1	30	23	18
2	10	22	8
3	8	20	9
4	3	23	1
5	65	21	24

- (a) Calculate the average number of buttercups found per quadrat.

Space for calculation

Marks

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1	
1	
1	

5. (continued)

- (b) Use information from the table to describe the effect of using the shortcut on the distribution of daisies and of plantains.

Daisies _____

Plantains _____

- (c) The investigation was repeated several times at different points across the shortcut. Give a reason for this.

[Turn over

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6. (a) Enzymes are described as “biological catalysts”.

What is the meaning of the term “catalyst”?

1

(b) Name the substance from which enzymes are made.

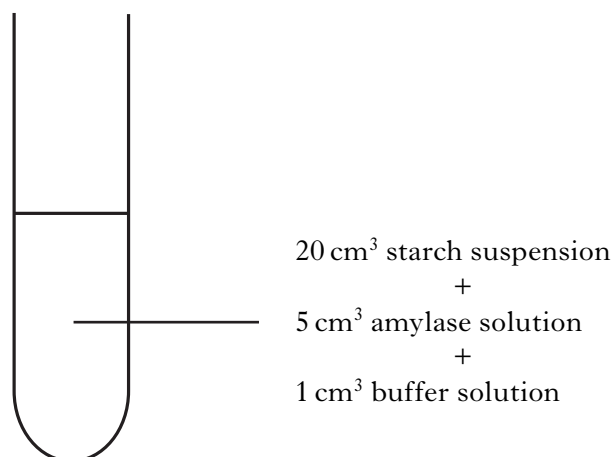
1

(c) Name an enzyme involved in a synthesis reaction.

1

(d) The enzyme amylase breaks down starch to maltose. An investigation was carried out to see how this reaction was affected by pH.

Nine test-tubes were set up with the contents as shown in the diagram. Each contained a different buffer solution which controlled the pH.



The contents of the tubes were monitored to see what percentage of starch had been converted to maltose in 20 minutes.

The results are shown in the table below.

<i>pH of solution</i>	<i>Percentage of starch converted to maltose</i>
3	0
4	10
5	64
6	100
7	46
8	24
9	6
10	0
11	0

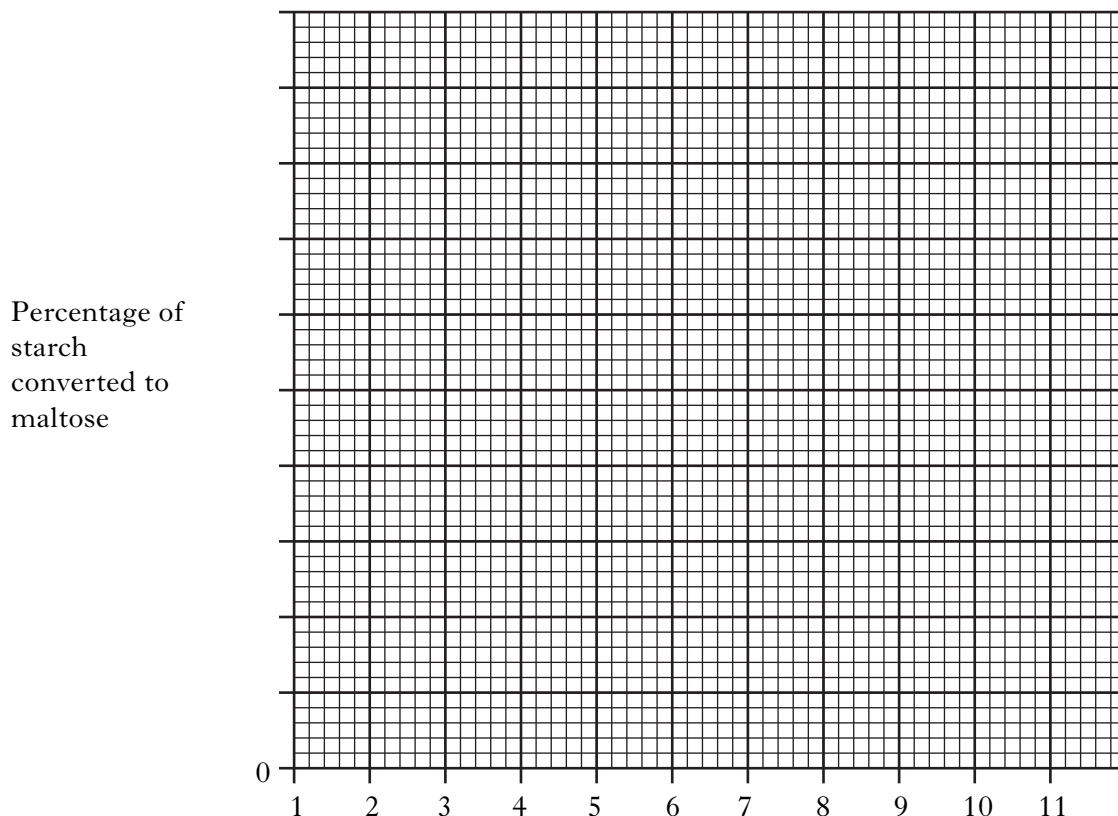
Marks	Marks	
	KU	PS
1		
1		
1		
1		
2		
1		

6. (d) (continued)

(i) On the graph paper below, complete a line graph of the results by:

- A labelling the horizontal axis;
- B adding an appropriate scale to the vertical axis;
- C plotting the graph.

(Additional graph paper, if required, can be found on *Page twenty-seven*).



(ii) Give **all** pH values used in this investigation at which the enzyme was found to be inactive.

pH values _____

(iii) Describe the effect of increasing pH, from pH 3 to pH 10, on the activity of amylase.

(iv) Name **one** factor, other than pH, which can affect the activity of an enzyme.

Marks

7. (a) Bone is made up of two main components. One of these, flexible protein fibres, is removed by roasting. A weighed piece of dry bone was roasted for 30 minutes and then reweighed. The results are shown below.

<i>Mass of bone before roasting</i> (g)	<i>Mass of bone after roasting</i> (g)
125	80

- (i) What percentage of the bone was made of protein fibres?

Space for calculation

_____ %

1

- (ii) How could the results of this investigation have been made more reliable?

1

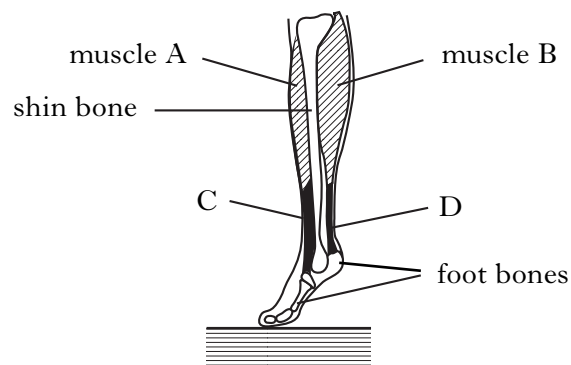
- (iii) In addition to protein fibres, what is the other main component of bone?

1

- (b) The skeleton supports the body and provides a framework for muscle attachment. Give **one** other function of the skeleton.

1

- (c) The following diagram represents the lower leg of a person on tiptoe.



- (i) Use a letter from the diagram to identify the structure which must contract to achieve this position.

Letter _____

1

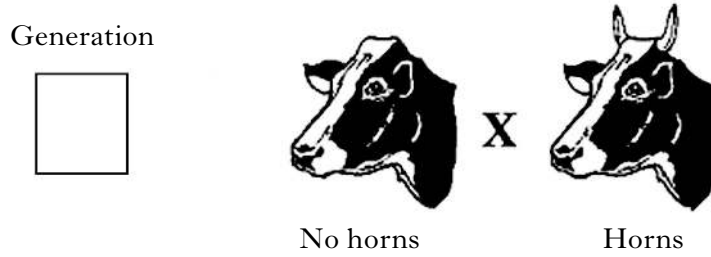
- (ii) What type of structure is represented by the letter C in this diagram?

1

Marks

KU	PS
1	
1	
1	
1	

8. (a) The presence or absence of horns in cattle is an inherited characteristic.



(None of the offspring had horns. They were allowed to interbreed.)



(i) Write the appropriate symbols in the boxes above to identify each of the generations.

(ii) Draw a circle round one animal in the diagram above, that fits the description “true-breeding”.

(iii) State whether “horns” or “no horns” is the recessive characteristic in cattle.

(b) A farm produced a total of 72 calves in one year, of which 18 had horns. Calculate the percentage of the calves which had horns.

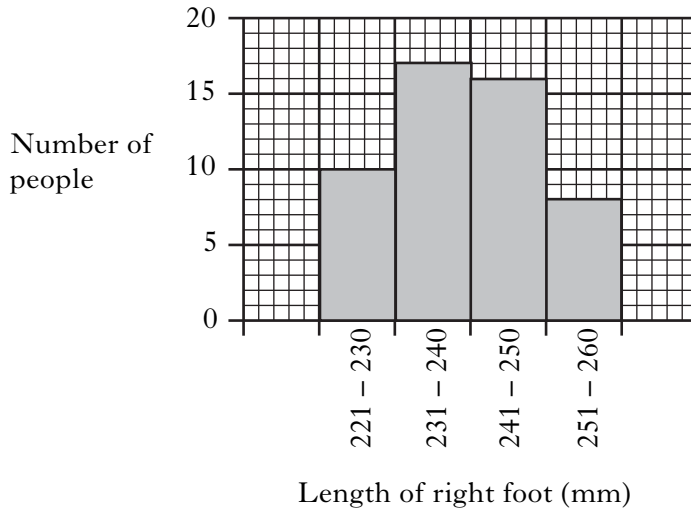
Space for calculation

_____ %

[Turn over

Marks	KU	PS
	2	
1		
1		

9. (a) The length of the right foot was measured in a number of people. The results are shown in the histogram below.



- (i) Complete the table using information from the histogram.

<i>Length of right foot (mm)</i>	<i>Number of people</i>
221 – 230	
231 – 240	
241 – 250	
251 – 260	

- (ii) What was the total number of people in the sample?

Space for calculation

- (iii) What is the maximum range of foot lengths which this sample represents?

From _____ to _____ mm

Marks

KU	PS

9. (continued)

- (b) Foot length in humans shows “continuous variation.” Give **one** example of a characteristic which shows discontinuous variation.

Discontinuous _____

1

- (c) The table below describes different groups of animals. Put a tick (✓) in the box(es) next to the description(s) which allow the animals in that group to be identified as being of the same species.

<i>Description</i>	
A group of animals with similar appearances which live in an isolated habitat.	
A group of animals which show variation and can breed to produce fertile offspring.	
A group of animals which look similar and which can mate with each other.	

1

[Turn over

Marks

KU	PS
1	
2	
1	
1	

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

Fight for your Life!

Adapted from *Biological Sciences Review*, September 2005

Every day there is a battle inside our bodies between invading micro-organisms and our immune system. Bacteria are present inside and out. Most are harmless but others are pathogens which cause disease. Infectious diseases are a major killer in developing countries. Vaccination programmes, public health improvements and increasing the availability of antibiotics are required to overcome them. However, there is a growing problem of resistance to antibiotics demonstrated by the "superbug" MRSA.

The first thing a micro-organism does is to find its way into a cell in the body. Cells of the immune system have to recognise that this has happened and make the appropriate response. The first cells on the scene are neutrophils. They engulf bacteria and kill them with enzymes. The next cells to arrive are macrophages which have a variety of specialised killing mechanisms. Dendritic cells are also involved. They are able to recognise pathogens and stimulate other immune cells to react. Fortunately, our immune system has a memory. This means that when we encounter a micro-organism for the second time, a much faster response is triggered that rapidly wipes out the pathogen. Our immune system is very powerful, giving us the best chance to win the battle with these invaders.

Sometimes this system breaks down and immune cells wrongly target and destroy our own body cells. This causes conditions such as rheumatoid arthritis and multiple sclerosis.

(a) What name is given to micro-organisms such as bacteria which cause disease?

1

(b) Give **three** actions which are needed by developing countries to overcome infectious diseases.

1 _____

2 _____

3 _____

2

(c) Why is MRSA a growing problem?

1

(d) Name **three** types of immune cells involved in a response to an attack by invading micro-organisms.

1 _____

2 _____

3 _____

1

Marks

KU	PS

10. (continued)

(e) Why is the response of the immune system faster the second time a type of micro-organism invades?

1

(f) What causes conditions such as rheumatoid arthritis?

1

[Turn over

Marks

KU	PS

11. (a) The heart is formed from four chambers. The upper chambers are the left atrium and the right atrium. The wall of the right atrium has an average thickness of 2 mm. The left atrium wall is on average 3 mm thick. The lower chamber on the left side, the left ventricle, has walls on average 18 mm thick, compared to 4.5 mm in the right ventricle.

(i) Use this information to complete the following table.

<i>Heart chamber</i>	<i>Average wall thickness (mm)</i>
	18

2

(ii) Express the ratio of the average wall thickness of the right ventricle to that of the left ventricle as a simple, whole number ratio.

Space for calculation

_____ : _____
right ventricle left ventricle

1

(b) Decide if each of the statements about the heart and surrounding blood vessels is **True** or **False** and tick (✓) the appropriate box.

If the statement is **False**, write the correct **term** in the **Correction** box to replace the term underlined.

Statement	True	False	Correction
Blood goes from the right atrium to the <u>left atrium</u>			
Blood from the <u>body</u> enters the right atrium			
The heart muscle obtains its blood supply from the <u>vena cava</u>			

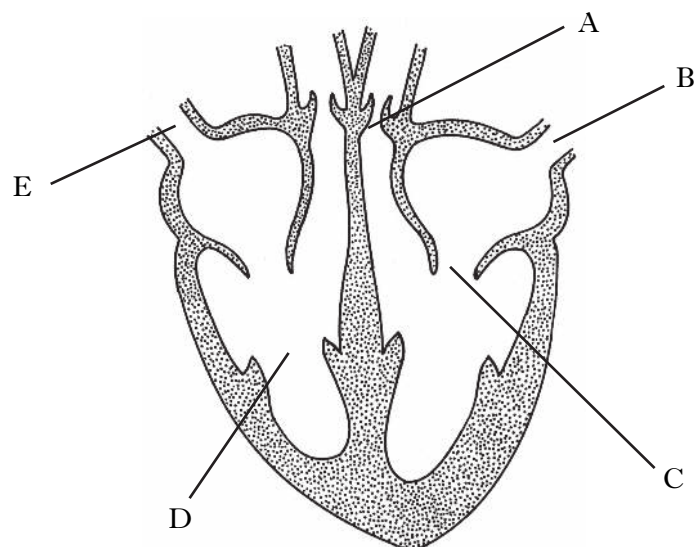
3

Marks

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1	
1	
1	

11. (continued)

(c) The diagram below represents a human heart.



(i) Select **two** letters which indicate where valves are found.

Letters _____ and _____

1

(ii) What is the function of valves in the circulatory system?

1

(d) Blood flows round the body in three different types of blood vessel. In which type of blood vessel can a pulse be easily detected?

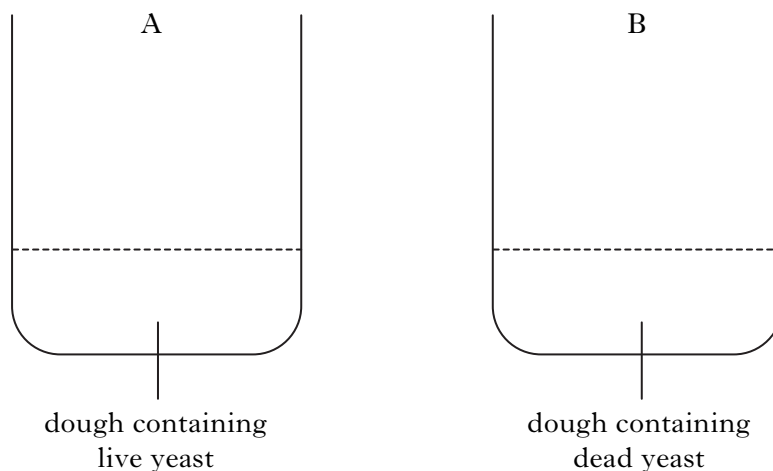
1

[Turn over

Marks

KU	PS

12. (a) During an investigation into the activity of yeast in bread making, a pupil divided a batch of dough into two equal portions. He added yeast to each portion before placing the dough into identical beakers as shown in the diagrams.



The volume of dough in each beaker was measured at the start and end of the investigation. The results are shown in the table below.

<i>Beaker</i>	<i>Volume of dough (cm³)</i>	
	<i>At start</i>	<i>At end</i>
A	100	250
B	100	100

- (i) How many times greater was the volume of dough in beaker A at the end compared to the start?

Space for calculation

_____ times greater

1

- (ii) The production of which substance caused the increase in the volume of the dough?

1

Marks

KU	PS

12. (a) (continued)

(iii) Give **two** factors, not already mentioned, which would need to be kept constant during this investigation.

1 _____

2 _____

2

(iv) What was the purpose of setting up control beaker B?

1

(b) What type of micro-organism is yeast?

1

(c) Give **one** use of yeast in a manufacturing process, other than the raising of dough.

1

(d) Bacteria are used to sour milk in the manufacturing of yoghurt.

Name the process carried out by the bacteria which causes the milk to sour.

1

[Turn over

13. (a) In an investigation into the effectiveness of different detergents, six pieces of cloth were washed. Each of the cloths had identical stains and all variables other than the detergent were kept the same. After washing, the percentage of the stain which had been removed was calculated.

Marks

KU	PS
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The results are shown in the table.

<i>Name of detergent</i>	<i>Type of detergent</i>	<i>Stain removed (%)</i>
Whizzo	Non-biological	50
Spotless	Non-biological	40
Purity	Biological	75
Cleano	Biological	80
Energise	Non-biological	65
Purgit	Biological	95

- (i) Use the information from the table to complete the bar chart showing the detergents and their percentage of stain removed by:

A adding a scale to the vertical axis;

1

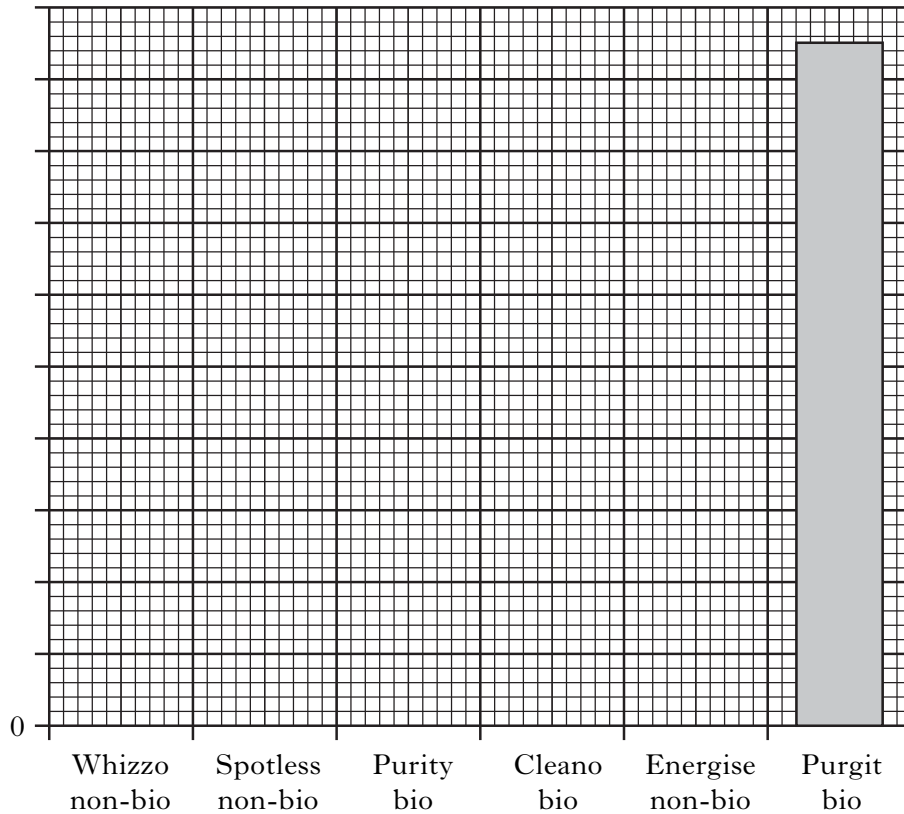
B adding a label to the vertical axis;

1

C completing the bars.

1

(Additional graph paper, if required, can be found on *Page twenty-eight*.)



Name and type of detergent

Marks	Marks	
	KU	PS
2		
1		
2		
1		

13. (a) (continued)

(ii) Give **two** conclusions which can be drawn from the results.

1 _____

2 _____

(b) Complete the following sentence by underlining the correct word in each bracket.

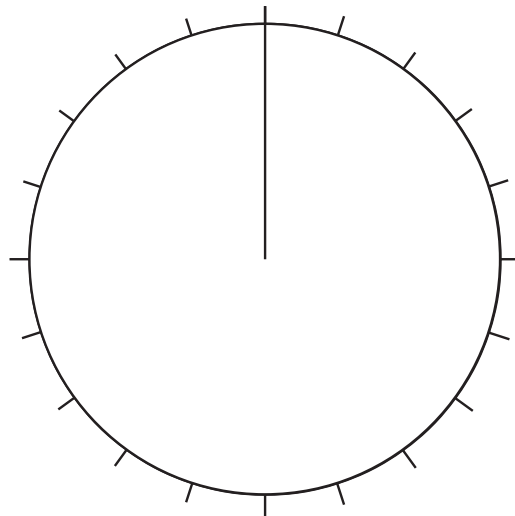
Biological detergents contain $\left\{ \begin{array}{l} \text{enzymes} \\ \text{genes} \end{array} \right\}$ produced by $\left\{ \begin{array}{l} \text{chromosomes} \\ \text{bacteria} \end{array} \right\}$.

(c) A manufacturer uses genetic engineering techniques to make a variety of products. The table below shows each product as a percentage of their total production in 2010.

<i>Product</i>	<i>Percentage of total production</i>
Antibiotics	30
Insulin	40
Detergents	20
Antifreeze	10

(i) Use the information in the table to complete the pie chart.

(An additional chart, if required, can be found on *Page twenty-eight*.)



(ii) What is transferred into bacterial cells during genetic engineering?

Marks

14. Salmon migrate from the sea into rivers to breed. The number of salmon coming into a river can be estimated by capturing them in a sampling trap. The number of salmon captured and the average flow rate of a river were recorded in July each year over a five year period. The results are shown in the table below.

<i>July values</i>	<i>Year</i>				
	2004	2005	2006	2007	2008
<i>Average flow rate of river</i> (cubic metres/second)	14	10	8	45	12
<i>Number of salmon captured</i>	16	6	2	36	12

- (a) (i) What evidence is there that a high flow rate is stimulating the salmon to come into the river?

1

- (ii) In 2007, the July capture represented 4% of the total capture for the year. How many salmon in total were captured that year?

Space for calculation

1

- (iii) If the average July flow rate of the river for a particular year had been 13 cubic metres/second, predict how many salmon would have been captured that July.

1

- (b) What name is given to the type of behaviour which occurs at regular intervals, for example, annual migration?

1

KU	PS

Marks

KU	PS

14. (continued)

- (c) (i) In salmon farming, eggs and sperm extracted from adult fish are mixed together in shallow trays.

What process in the life cycle of the fish will take place at this stage?

1

- (ii) What is the source of food for the young fish before they hatch?

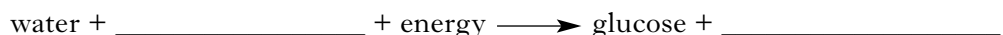
1

[Turn over for Question 15 on Page twenty-six

Marks		
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1		
1		
1		
1		
1		
1		
1		

15. (a) Photosynthesis is the process by which plants make food.

Complete the word equation for photosynthesis.



(b) Name the substance, found in a plant cell, which converts light energy to chemical energy.

(c) Instead of using the glucose produced straight away, it can be converted into a storage carbohydrate.

Name this carbohydrate.

(d) Glucose is transported to the roots of the plant from the leaves.

(i) Suggest a reason why the roots of the plant cannot make glucose.

(ii) Name the tissue which transports glucose.

(e) (i) Name the tissue which transports water through plants.

(ii) Name the structures in the leaf through which water vapour is lost.

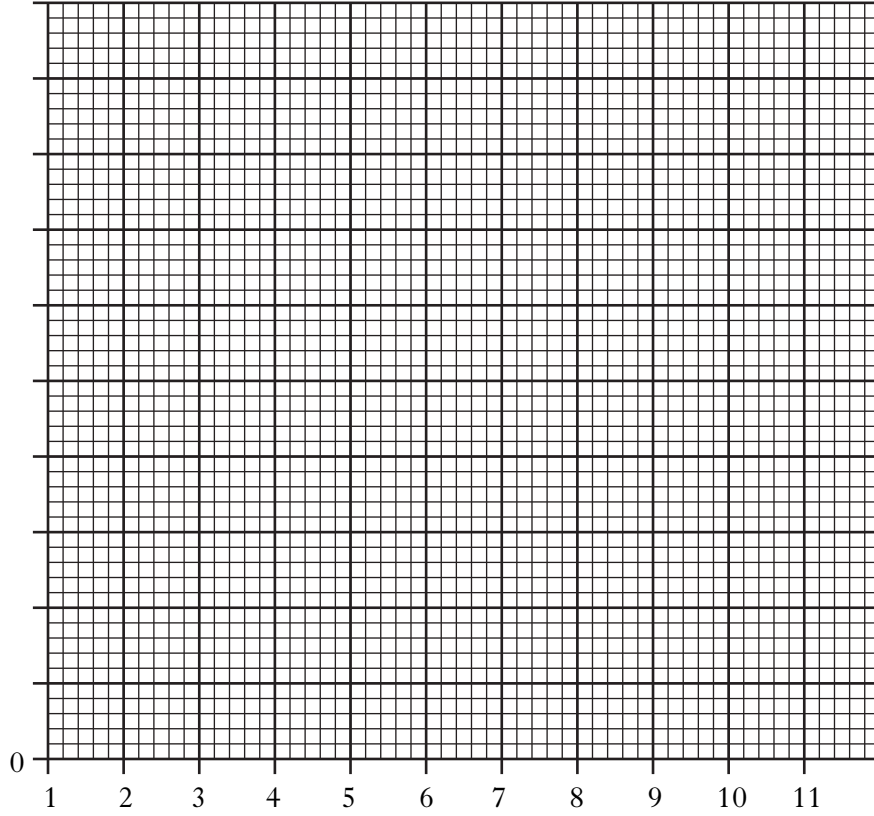
[END OF QUESTION PAPER]

SPACE FOR ANSWERS
AND FOR ROUGH WORKING

KU	PS

ADDITIONAL GRAPH PAPER FOR QUESTION 6(d)(i)

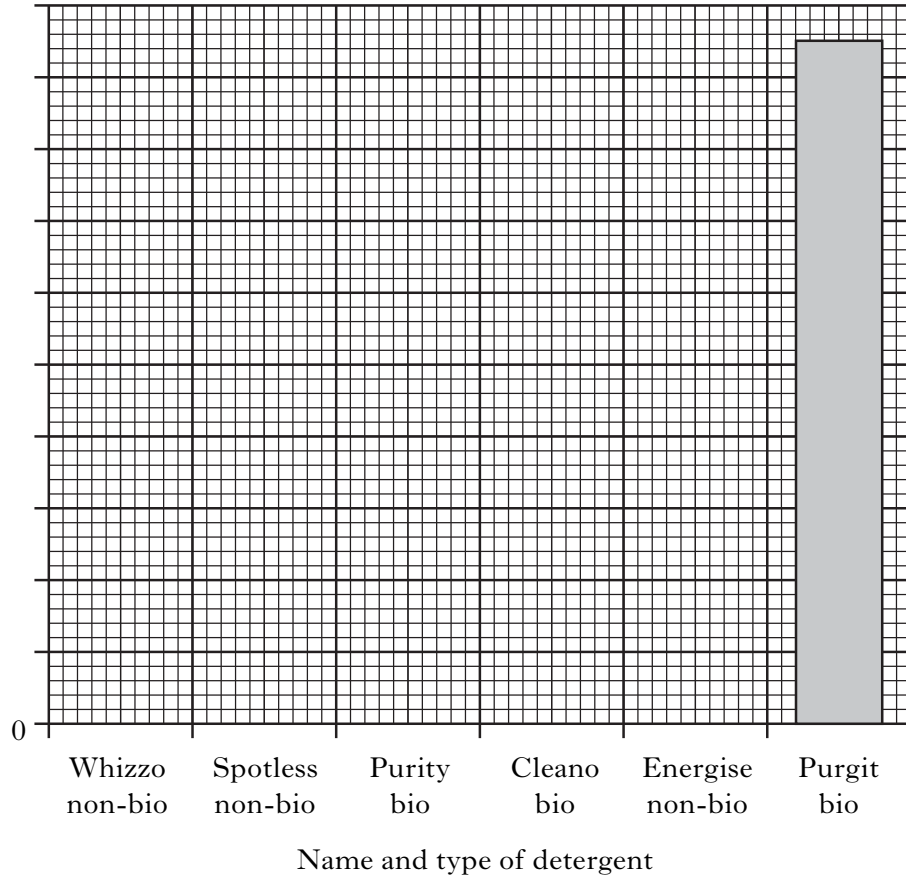
Percentage of
starch
converted to
maltose



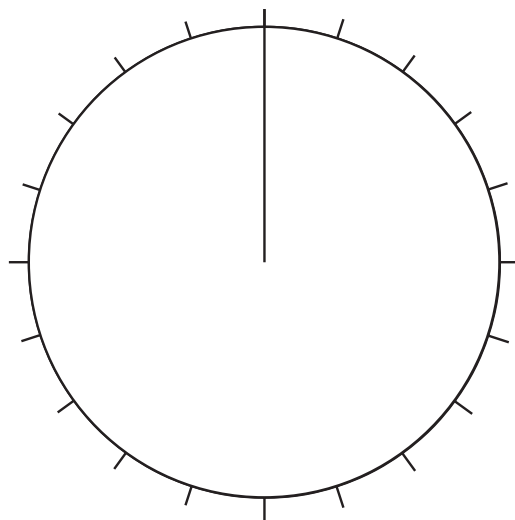
SPACE FOR ANSWERS
AND FOR ROUGH WORKING

KU	PS

ADDITIONAL GRAPH PAPER FOR QUESTION 13(a)(i)



ADDITIONAL CHART FOR QUESTION 13(c)(i)



SPACE FOR ANSWERS
AND FOR ROUGH WORKING

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SPACE FOR ANSWERS
AND FOR ROUGH WORKING

KU	PS

ACKNOWLEDGEMENTS

Question 10—Passage is adapted from "Fight for your life" by J McDermott and R Grencis, taken from *Biological Sciences Review, Volume 18, Number 1, September 2005*. Reproduced by kind permission of Philip Allan Updates.

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