FOR OFFICIAL USE

G

KU	PS

Total Marks

0300/401

NATIONAL QUALIFICATIONS 2010

THURSDAY, 27 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.

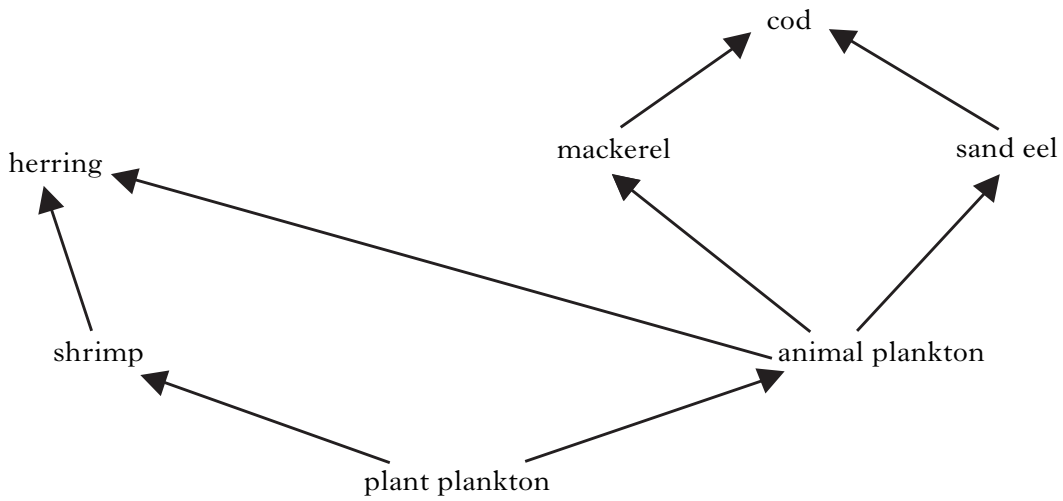
3 Rough work, if any should be necessary, as well as the fair copy, is to be written in this book. Additional spaces for answers and for rough work will be found at the end of the book. Rough work should be scored through when the fair copy has been written.

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.

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

1. (*a*) The following diagram shows part of a food web from the North Sea.



Use the food web to answer the following questions.

(i) Name the producer. _____ **1**

(ii) Give a complete food chain consisting of **three** organisms from the food web.

_____ → _____ → _____ **1**

(iii) Name **two** animals from the food web which are competing for the same food.

_____ and _____ **1**

(*b*) What term is used to describe all organisms which are not producers?

_____ **1**

(*c*) (i) The herring from the North Sea are an example of a population. What is meant by the term "population"?

_____

_____ **1**

(ii) State a factor which can affect the size of a population.

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

2. (*a*) A quadrat was used to sample four species of plants growing in a field. The abundance of each plant species was measured by counting **the number of squares** of the quadrat which contained that species.

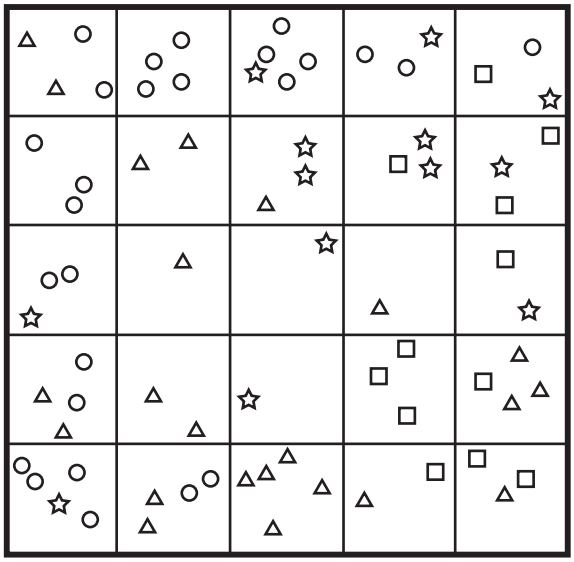
The diagram below shows the species found in one throw of the quadrat.

○ Daisy

△ Dandelion

□ Plantain

☆ Buttercup



(i) Complete the following table to show the abundance of the four plant species found in the quadrat.

One result has been completed for you.

Plant species	*Abundance*
Daisy	10
Dandelion	
Plantain	
Buttercup	

1

(ii) Give an example of a different sampling technique and name an organism it could be used for.

Technique _____

Organism _____ **2**

(*b*) Give an example of an abiotic factor and describe a method of measuring it.

Abiotic factor _____

How to measure it _____

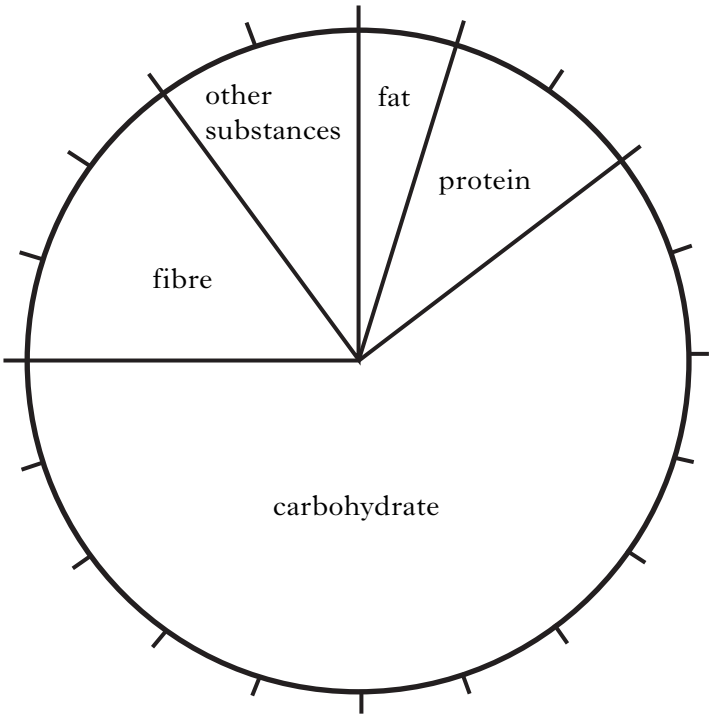
_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

3. Oatmeal and wheatmeal are two cereal products.

(*a*) The pie chart below gives information about components found in oatmeal.



Wheatmeal contains less fibre and more protein than oatmeal.

The proportions of all the other components are the same.

(i) Use **all** information provided to complete the following table.

	Component (%)				
	Protein	*Carbohydrate*	*Fat*	*Fibre*	*Other substances*
Oatmeal			5		10
Wheatmeal	15			10	10

2

(ii) Calculate the mass of protein present in an 80 g portion of wheatmeal.

Space for calculation

_____ g **1**

(*b*) Animals need food for growth and repair.

Give **one** other reason why animals need food.

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

3. (continued)

(*c*) Animals produce several proteins which break down food into products which have small particles.

The small particles can then be absorbed into the bloodstream.

(i) What name is given to the proteins which cause the breakdown of food?

_____ **1**

(ii) What is the name of this breakdown process?

_____ **1**

(iii) In what part of the alimentary canal are the products of food breakdown absorbed into the bloodstream?

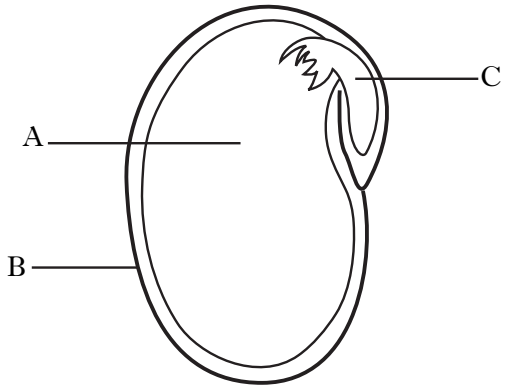
_____ **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

4. (*a*) The diagram below shows the structure of a seed.

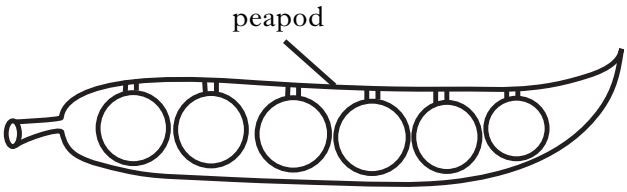


Complete the table with the names and functions of the parts labelled on the diagram.

Letter	*Name*	*Function*
A		provides energy for growth
B	seed coat	
C		

2

(*b*) A peapod is the fruit of the pea plant.



Underline **one** word in each bracket to complete the following sentences correctly.

A fruit contains {seeds / ovules} formed from fertilised {ovules / pollen}.

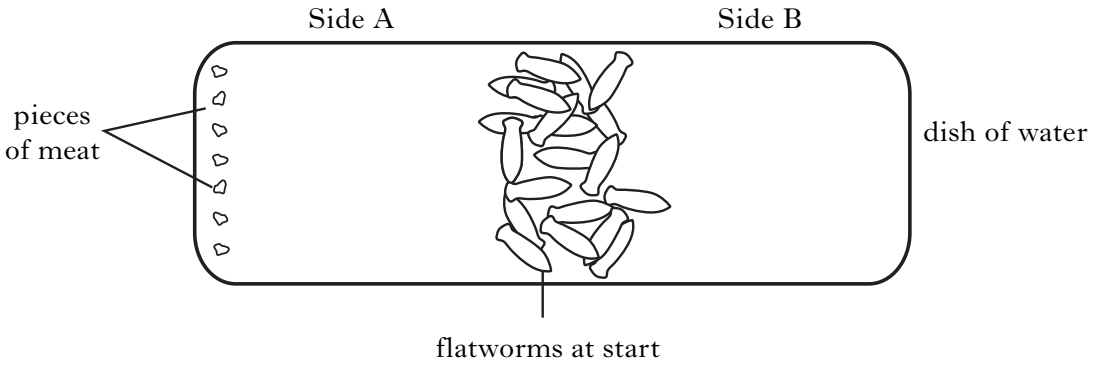
The outer layer of the fruit is formed from the {ovary / stigma}. **2**

DO NOT WRITE IN THIS MARGIN

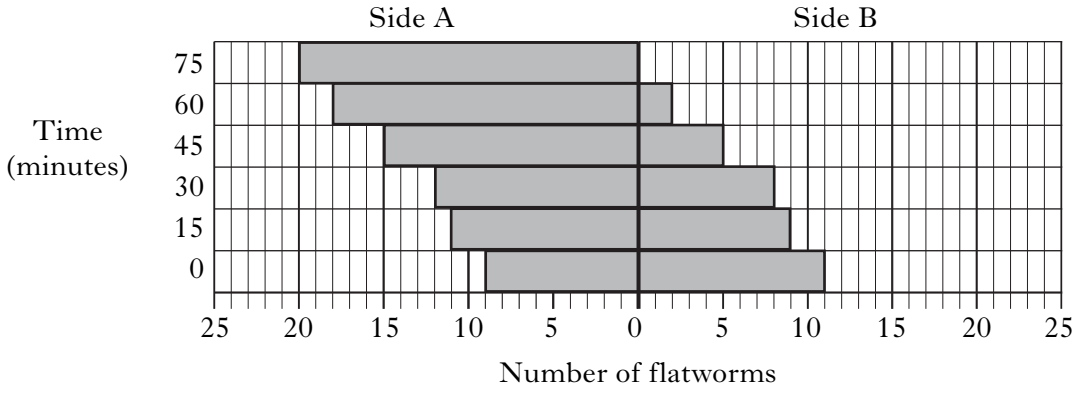
Marks	KU	PS

5. The response of flatworms to food was investigated. Twenty flatworms were placed in the centre of a dish of water with pieces of meat at one end.

The number of flatworms present in each side was recorded every 15 minutes.



The results are shown in the chart below.



(*a*) (i) Calculate the simple whole number ratio of flatworms on each side of the dish after 30 minutes.

Space for calculation

_____ : _____
Side A : Side B **1**

(ii) Calculate the percentage of flatworms on Side A at 60 minutes.

Space for calculation

_____ % **1**

(*b*) The hypothesis is that the flatworms responded only to the smell of the food. How could the design of the investigation be improved to test this?

_____

_____ **1**

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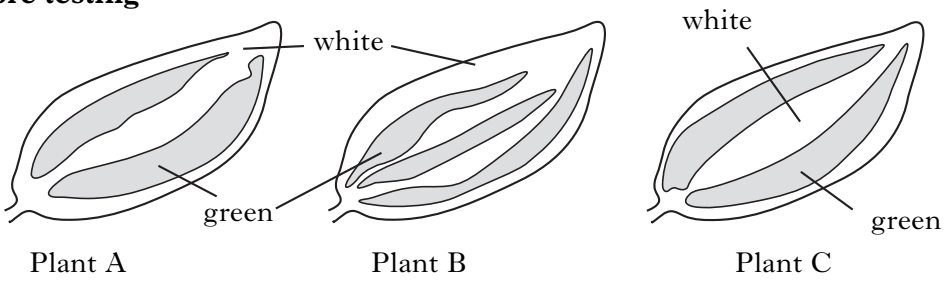
6. In an investigation into the factors needed for photosynthesis, three Wandering Sailor plants were destarched. The three plants were put into clear glass jars with lids. The jars were then placed in different conditions.

Plant	*Condition*
A	On a laboratory window sill
B	On a laboratory window sill with a chemical in the jar to remove carbon dioxide
C	In a dark cupboard

After 48 hours, a leaf from each plant was tested for starch. The test produces a blue-black colour when starch is present.

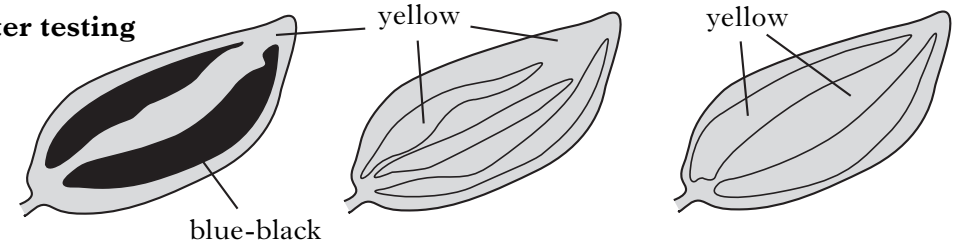
The following diagrams show the results.

Before testing



Plant A Plant B Plant C

After testing



Plant A Plant B Plant C

(*a*) Use these results to identify the **two** plants which show that light is needed for photosynthesis. Tick (✓) **two** boxes.

Plant A ☐ Plant B ☐ Plant C ☐ **1**

(*b*) Which plant showed that chlorophyll is needed for photosynthesis?

Plant _____ **1**

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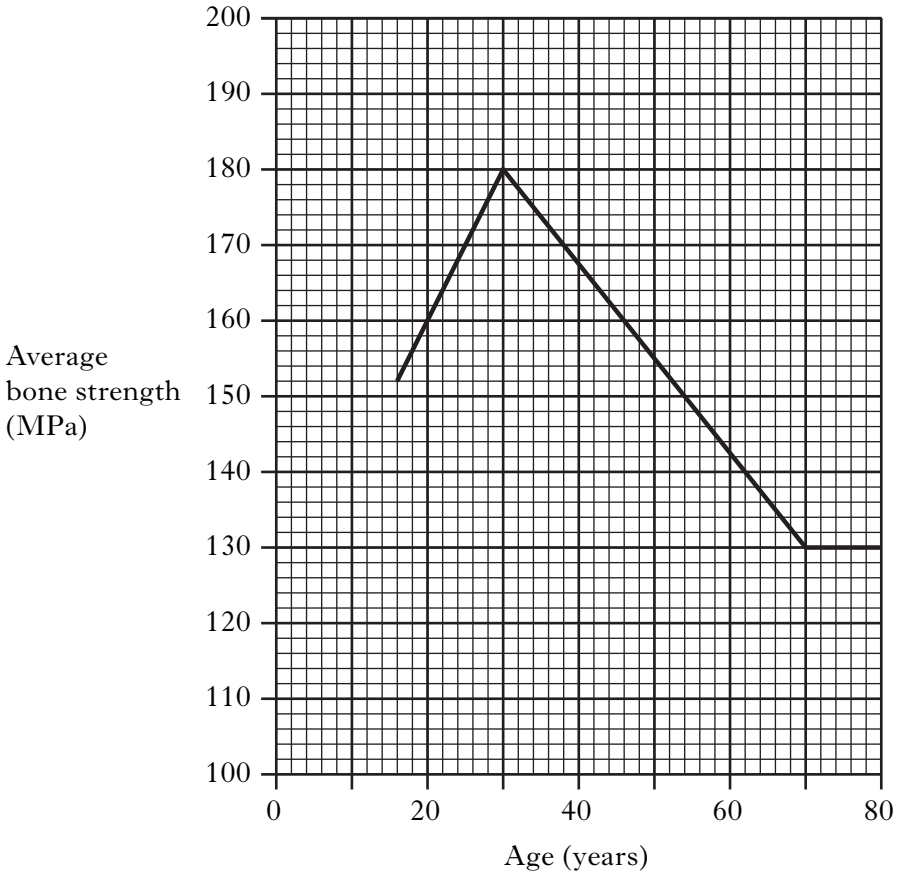
Marks | KU | PS

7. (*a*) The graph below shows the relationship between average bone strength and age in human females.



(i) Describe the changes in average bone strength after age 40.

_____

_____ **2**

(ii) At what age is average bone strength the greatest?

_____ years **1**

(iii) For how long does average bone strength remain above a value of 160 MPa?

Space for calculation

_____ years **1**

(*b*) Name the **two** main components of bone.

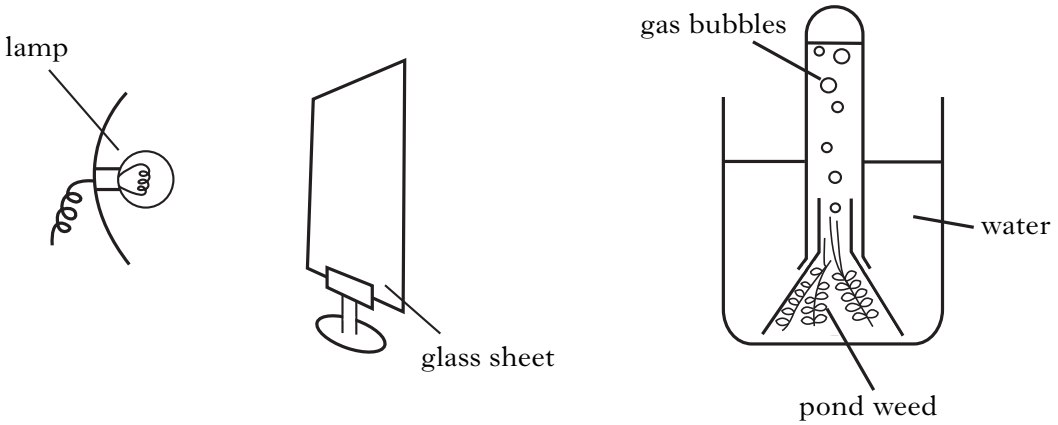
1 _____

2 _____ **1**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

8. (*a*) The investigation below was set up to show the effect of light intensity on the rate of photosynthesis in pond weed. The rate was measured by counting the number of gas bubbles released per minute.



(i) If the glass sheet was removed what factor, other than light intensity, might affect the rate of photosynthesis?

_____ **1**

(ii) Suggest a way in which the light intensity could be altered.

_____

_____ **1**

(iii) What raw material needed for photosynthesis is **not** shown in the diagram?

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

8. (*a*) (continued)

(iv) Six groups of pupils carried out the investigation. The averages of their results are shown in the table.

Light intensity (units)	2	4	6	8	10	12	14
Average rate of photosynthesis (bubbles/minute)	4	9	12	20	22	24	24

1 From the results, describe the effect of increasing light intensity on the rate of photosynthesis.

_____

_____ **2**

2 What is the advantage of having six groups carry out the investigation?

_____ **1**

(*b*) (i) Name the openings which allow gases to pass in or out of the leaves of land plants.

_____ **1**

(ii) Use words from the list to describe **one** of the transport systems in plants.

List leaves phloem roots sugar water xylem

Name of transport system _____

Material transported _____

Direction of transport

from _____ to _____ **2**

[Turn over

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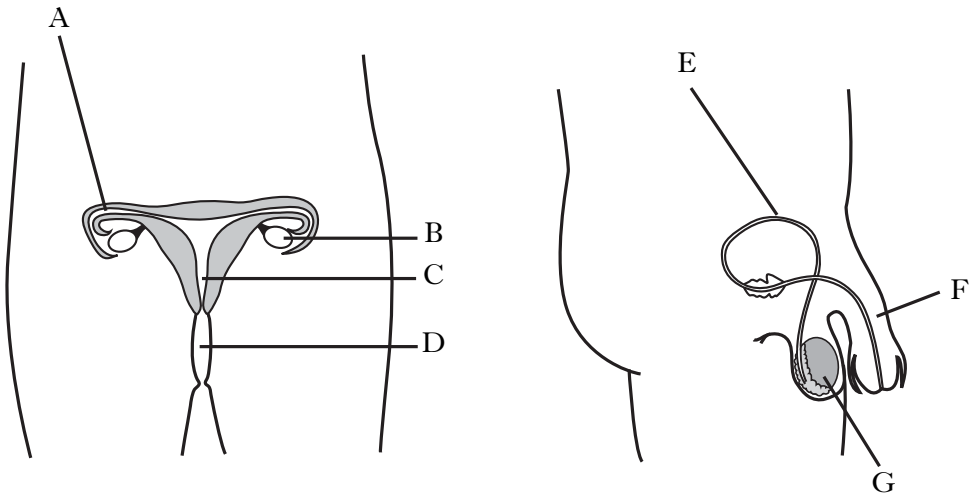
Marks | KU | PS

9. (*a*) The diagrams below represent parts of the human male and female reproductive systems.



Complete the table below by adding the correct letters, names and functions of the labelled structures.

Letter	*Name*	*Function*
A		site of fertilisation
F		deposits sperm
B	ovary	
G	testis	
	uterus	

3

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

9. (continued)

(*b*) Use words from the list to complete the following sentences.
Each word may be used **once**, **more than once** or **not at all**.

List water nucleus membrane placenta yolk amniotic

Fertilisation occurs when the _____ of a sperm cell fuses with the _____ of an egg cell. In mammals this happens inside the female body. In most fish, sperm are deposited in the surrounding _____ close to the eggs.

In mammals the fertilised egg develops inside a fluid-filled membrane called the _____ sac. **2**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

10. The average production of sperm cells by a bull throughout the year is shown in the table below.

Month	*Average sperm production* (millions/day)	*Month*	*Average sperm production* (millions/day)
January	14,000	July	10,500
February	13,500	August	10,000
March	13,000	September	10,500
April	12,500	October	11,500
May	12,000	November	12,000
June	11,000	December	14,500

(*a*) Describe the pattern of sperm production over one year.

_____

_____

_____ **2**

(*b*) From the results, suggest **one** environmental factor which affects sperm cell production.

_____ **1**

(*c*) In May, bulls produce a daily average of 8 cm^3 of fluid containing sperm cells. How many sperm cells would be contained in 1 cm^3 of this fluid?

Space for calculation

_____ million **1**

DO NOT WRITE IN THIS MARGIN

Marks	KU	PS

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

Bugs R Us

If we are not using our mouths to chew or swallow food, we are talking, drinking or brushing our teeth. Even so, some microbes do manage to hang on in there. Most of the time they do no harm but sometimes they can cause problems. The worst of these is a gum disease called peridontitis. This is the most widespread infectious disease in humans.

The disease begins when bacteria, which are normally harmless, are allowed to build up. They form a sticky layer of plaque at the junction of the teeth and gum. This provides ideal conditions for anaerobic bacteria to grow. These bacteria produce enzymes which can break down the surrounding gum tissue. This causes inflammation which can eventually weaken the jawbone in which the teeth are held. People over thirty are more likely to lose teeth through this type of gum disease than through the formation of cavities in the teeth.

Cavities are formed when particular bacteria in the plaque use sugary food in the mouth for energy. They do this without using oxygen, producing lactic acid as a waste product. This acid attacks the enamel of the tooth, resulting in cavities.

(*a*) Give **three** examples of activities from the passage which could make it difficult for bacteria to live in the mouth.

1 _____

2 _____

3 _____ **2**

(*b*) Where in the mouth would you expect to find high levels of anaerobic bacteria growing?

_____ **1**

(*c*) Which type of chemical attacks the gums in peridontitis?

_____ **1**

(*d*) Name **one** harmful condition mentioned in the passage, other than peridontitis, which results from the activity of bacteria.

_____ **1**

[Turn over

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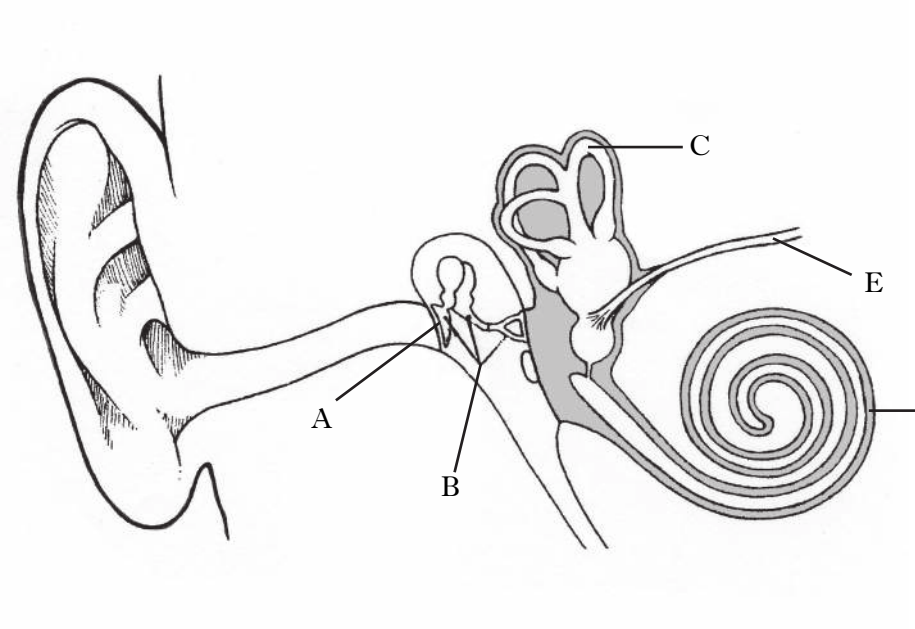
Marks | KU | PS

12. (*a*) The diagram below represents the human ear.



(i) Name the parts labelled A to D on the diagram.

A _____ B _____

C _____ D _____ **2**

(ii) Use the letters from the diagram to identify the parts with the following functions.

1 Carry vibrations across the middle ear. Letter _____

2 Converts vibrations into electrical impulses. Letter _____ **1**

(iii) Describe the function of the part labelled E on the diagram.

_____

_____ **1**

(*b*) What is the advantage of hearing with two ears rather than one?

_____

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

13. The table gives information about the distribution of lichens in and around a city. Atmospheric sulphur dioxide (SO_2) levels and the pH of rainwater were also recorded.

Distance from city centre (km)	*Number of lichen species per* km^2	*Atmospheric* SO_2 *concentration* ($\mu g/m^3$)	pH *of rainwater*
0 – 1·5	0	240	4·6
1·6 – 3·0	1	220	4·8
3·1 – 4·5	7	185	5·0
4·6 – 6·0	13	120	5·5

(*a*) Describe the relationship between each of the following by completing the sentences.

(i) *distance from the city centre and the number of lichen species per* km^2;

As the distance from the city centre increases, _____

_____ **1**

(ii) *distance from the city centre and atmospheric* SO_2 *concentration*;

As the distance from the city centre increases, _____

_____ **1**

(iii) *atmospheric* SO_2 *concentration and rainwater* pH.

As the atmospheric SO_2 concentrations increases, _____

_____ **1**

(*b*) From the information in the table, suggest a reason why there were no lichens found within 1·5 km of the city centre.

_____

_____ **1**

(*c*) Calculate the average decrease in atmospheric SO_2 concentration per kilometre over the 6 km from the city centre.

Space for calculation

_____ $\mu g/m^3/km$ **1**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

14. (*a*) The grid below refers to cell structures.

A cell	B cytoplasm	C cell wall
D nucleus	E chloroplast	F vacuole

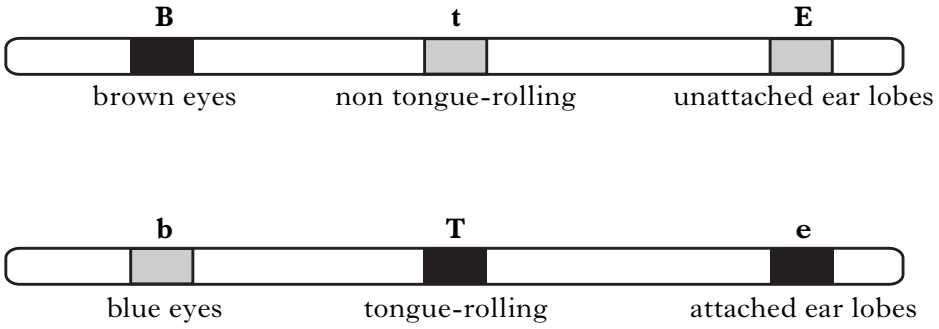
Choose letters from the grid to match the following statements.

(i) The basic unit of living organisms. _____ **1**

(ii) Contains chromosomes within a membrane. _____ **1**

(iii) Contains pigments for photosynthesis. _____ **1**

(*b*) The diagram below shows two chromosomes from a child. Genes for eye colour, tongue-rolling ability and type of ear lobes are found on the chromosomes. The forms of each gene are represented by letters. The capital letter represents the dominant form of the gene.



Complete the following sentence by underlining the correct option in each bracket.

The child will have { blue / brown } eyes, { will / will not } be able to roll their tongue and will have { attached / unattached } ear lobes. **2**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

14. (continued)

(*c*) (i) What sex will a child be if an **X** chromosome is inherited from one parent and a **Y** chromosome from the other?

_____ **1**

(ii) If the same parents have a second child, what are the chances that it will be the same sex as the first?

_____ **1**

(*d*) A cross between two true-breeding pea plants is shown below.

P Tall × Dwarf

$\mathbf{F_1}$ all Tall

(i) Identify the dominant characteristic and give a reason for your answer.

Dominant characteristic _____

Reason _____ **1**

(ii) Some of the tall plants produced from the cross were bred with each other to produce another generation of pea plants.

What symbol is used to identify this generation?

_____ **1**

(iii) The result of this final cross was that 240 tall plants were produced and 60 dwarf ones.

What is the simple whole number ratio of tall to dwarf plants in this cross?

Space for calculation

_____ : _____
Tall : Dwarf **1**

(*e*) How many complete sets of chromosomes are found in a pollen grain from a pea plant?

_____ **1**

(*f*) Suggest **one** feature of pea plants which could be improved by selective breeding.

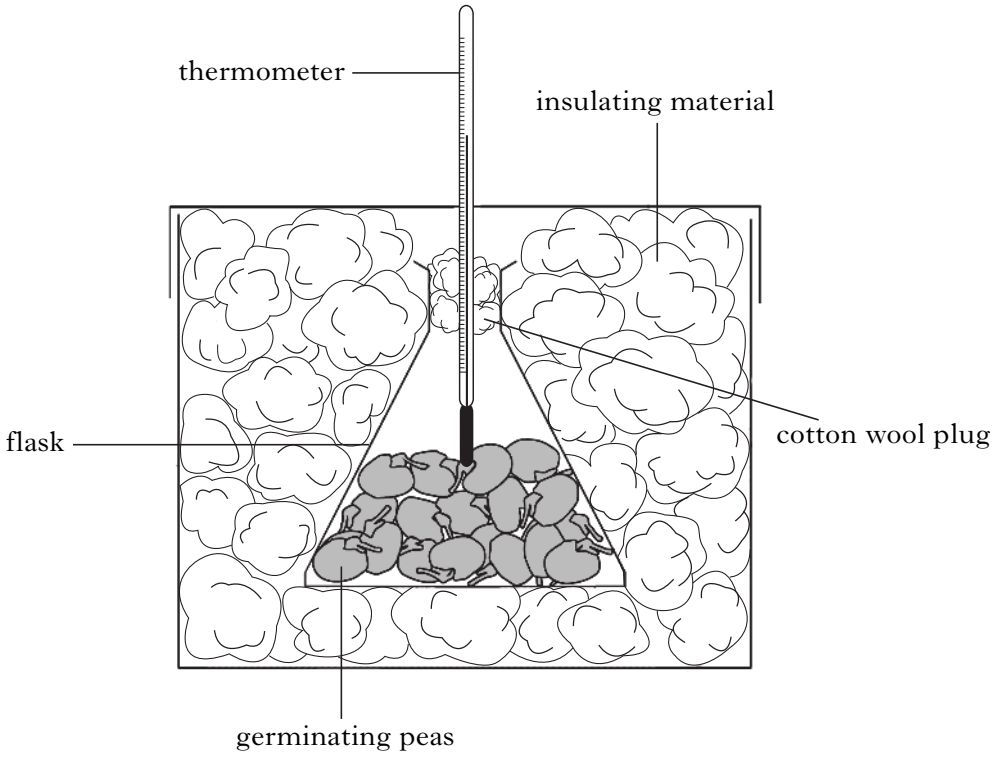
_____

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

15. The diagram below shows apparatus used to investigate heat production by germinating peas.



(*a*) (i) Which gas, needed by the germinating peas, will pass through the cotton wool plug?

_____ **1**

(ii) There was a 2 °C rise in temperature inside the flask after 24 hours. What biological process caused this increase?

_____ **1**

(iii) Why is it important that the flask is surrounded by insulating material?

_____ **1**

(*b*) Give **one** reason why living cells need energy.

_____ **1**

Marks | KU | PS

15. (continued)

(*c*) The results of the investigation are shown in the table below.

Time (days)	*Rise in temperature* (°C)
0	0·0
1	0·2
2	2·0
3	4·0
4	5·0
5	5·4
6	5·6
7	5·6

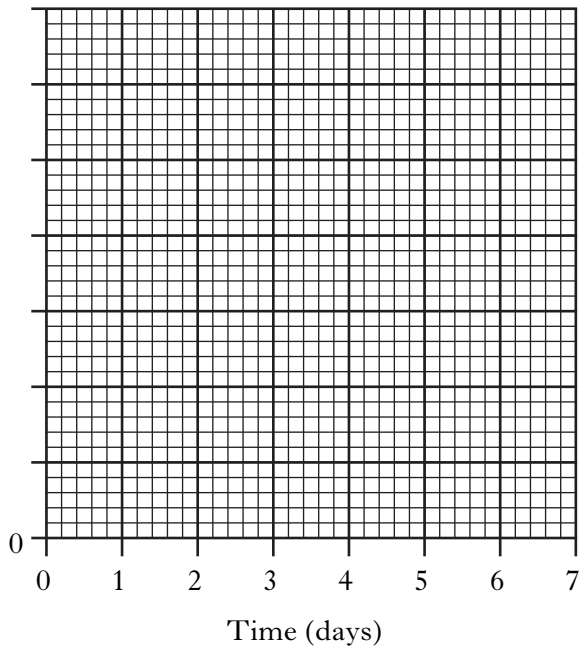
Use the results to complete the line graph by:

(i) completing the scale on the y axis; **1**

(ii) adding a label to the y axis; **1**

(iii) plotting the graph. **1**

(An additional grid, if required, will be found on *Page twenty-six*.)



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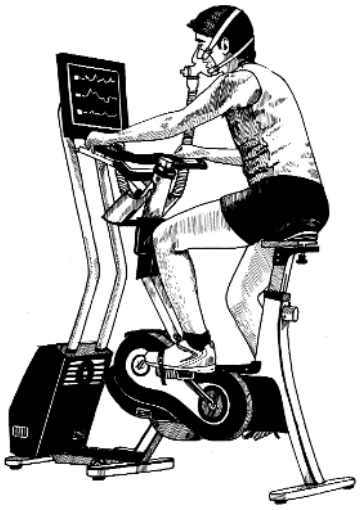
Marks | KU | PS

16. Fitness can be measured using an exercise bike as shown below.



An athlete exercised for eight minutes during which time his oxygen consumption, pulse rate and lactic acid concentration were monitored. The exercise level was increased every two minutes by tightening the brake on the wheel.

The results are shown in the table below.

Time from start (minutes)	*Oxygen consumption* (litres/minute)	*Pulse rate* (beats/minute)	*Lactic acid concentration* (mMol/litre)
2	2·00	120	1·25
4	2·25	129	2·50
6	2·50	147	5·00
8	2·75	168	10·00

(*a*) (i) What is the percentage increase in the pulse rate from 2 minutes to 8 minutes?

Space for calculation

_____ % **1**

(ii) What is the simple whole number ratio of the lactic acid concentration at 8 minutes to the concentration at 2 minutes?

Space for calculation

_____ : _____
8 minutes : 2 minutes **1**

DO NOT WRITE IN THIS MARGIN

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16. (*a*) (continued)

(iii) How much more oxygen does the athlete use up each time the lactic acid concentration doubles?

Space for calculation

_____ litres/minute **1**

(*b*) (i) Why would the athlete's pulse rate and breathing rate both rise as the level of exercise increased?

_____

_____ **1**

(ii) What term is used to describe the effect of a high concentration of lactic acid on muscles?

_____ **1**

(iii) Give **one** way in which the athlete's recovery time could be measured when he stopped exercising.

_____ **1**

(*c*) Six months later the athlete's fitness was measured again by doing identical exercise. This time his pulse peaked at 175 beats/minute and his lactic acid concentration reached 12 mMol/litre. Was he fitter or less fit than before?

Give a reason for your answer.

Fitter/less fit _____

Reason _____ **1**

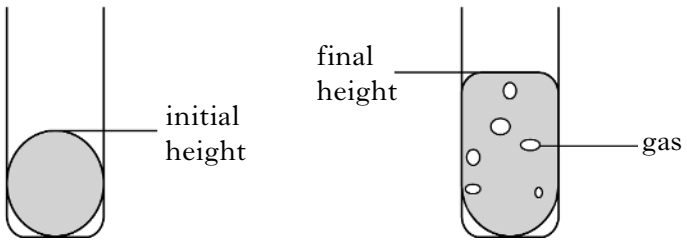
[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

KU	PS

17. Five groups of pupils carried out an investigation into flour types. Dough was made by mixing flour, sugar, water and yeast. It was then rolled into a ball which was put into a glass container and its height measured. After 24 hours the height of the dough was remeasured.



The table below shows the average results for the five groups.

Type of flour	*Average increase in height of dough* (%)
stoneground	34
self raising	76
wholemeal	68
plain	42
organic	56

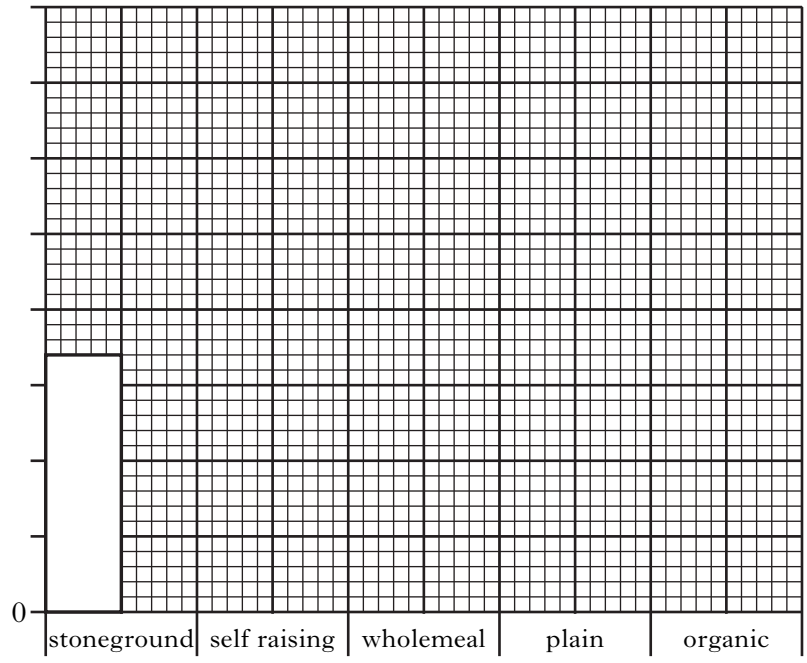
(*a*) Use the results to complete the bar chart by:

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

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

(iii) plotting the remaining bars. **1**

(An additional grid, if required, will be found on *Page twenty-six*.)



DO NOT WRITE IN THIS MARGIN

Marks | KU | PS

17. (continued)

(*b*) (i) What was the advantage of expressing the increase in height as a percentage, rather than in millimetres?

_____ **1**

(ii) One pupil recorded the initial height of his dough as 30 mm and the final height as 42 mm. What was the percentage increase in height of his sample?

Space for calculation

_____ % **1**

(*c*) (i) Name **two** factors which would have to be kept the same for each dough mixture to make the investigation valid.

1 _____

2 _____ **1**

(ii) Which ingredient of the dough mixture would provide most of the yeast's energy?

_____ **1**

(iii) Name the gas released by the yeast which made the dough rise.

_____ **1**

(*d*) (i) Name **one** product, other than bread, which is made using yeast.

_____ **1**

(ii) Give an example of a food which is made using bacteria.

_____ **1**

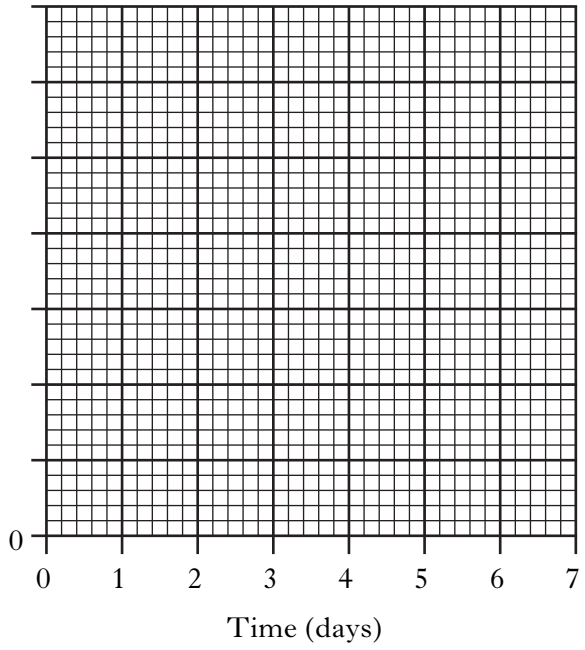
[*END OF QUESTION PAPER*]

DO NOT WRITE IN THIS MARGIN

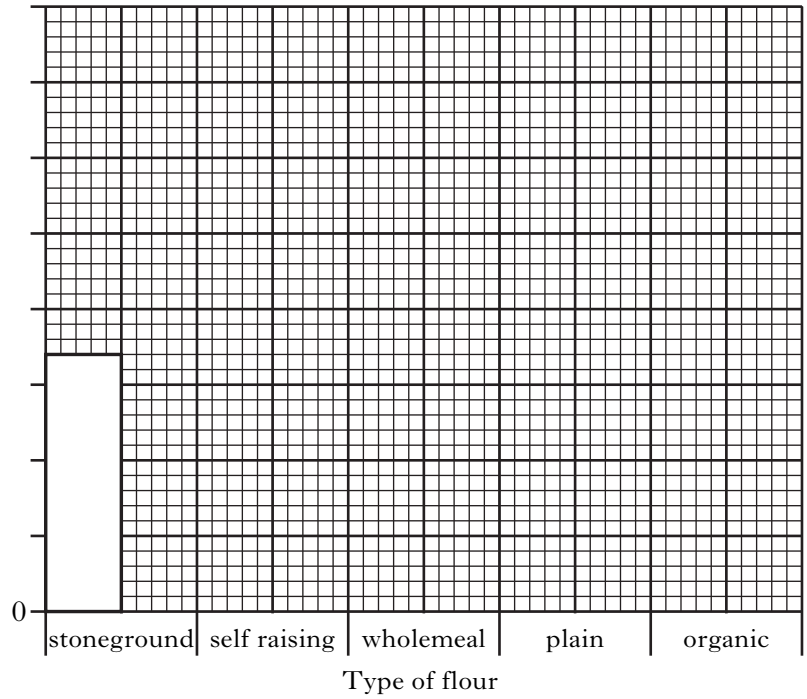
KU	PS

SPACE FOR ANSWERS
AND FOR ROUGH WORKING

ADDITIONAL GRID FOR QUESTION 15(*c*)



ADDITIONAL GRID FOR QUESTION 17(*a*)



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