

FOR OFFICIAL USE



National
Qualifications
2018

Mark

X807/75/01

**Biology
Section 1 — Answer Grid
and Section 2**

TUESDAY, 15 MAY

1:00 PM – 3:30 PM



* X 8 0 7 7 5 0 1 *

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day

Month

Year

Scottish candidate number

Total marks — 100

SECTION 1 — 25 marks

Attempt ALL questions.

Instructions for the completion of Section 1 are given on *page 02*.

SECTION 2 — 75 marks

Attempt ALL questions.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers and rough work is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting. Any rough work must be written in this booklet. Score through your rough work when you have written your final copy.

Use **blue** or **black** ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.



* X 8 0 7 7 5 0 1 0 1 *

The questions for Section 1 are contained in the question paper X807/75/02.

Read these and record your answers on the answer grid on *page 03* opposite.

Use **blue** or **black** ink. Do NOT use gel pens or pencil.

1. The answer to each question is **either** A, B, C or D. Decide what your answer is, then fill in the appropriate bubble (see sample question below).
2. There is **only one correct** answer to each question.
3. Any rough working should be done on the additional space for answers and rough work at the end of this booklet.

Sample question

The thigh bone is called the

- A humerus
- B femur
- C tibia
- D fibula.

The correct answer is **B** — femur. The answer **B** bubble has been clearly filled in (see below).

A	B	C	D
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

Changing an answer

If you decide to change your answer, cancel your first answer by putting a cross through it (see below) and fill in the answer you want. The answer below has been changed to **D**.

A	B	C	D
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

If you then decide to change back to an answer you have already scored out, put a tick (✓) to the **right** of the answer you want, as shown below:

A	B	C	D	or	A	B	C	D
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>		<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>



SECTION 1 — Answer Grid



	A	B	C	D
1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



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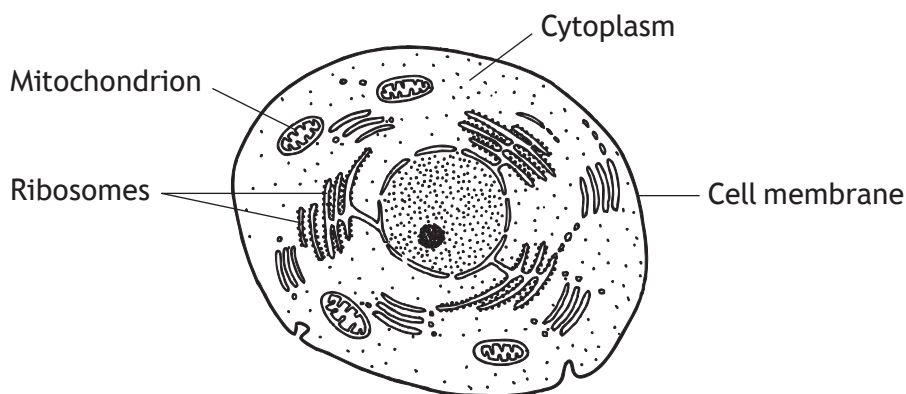
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* X 8 0 7 7 5 0 1 0 4 *

SECTION 2 — 75 marks
Attempt ALL questions

1. (a) The diagram shows a typical animal cell and some of its structures.



Choose **two** of the structures labelled and state their functions. 2

- 1 Structure _____
Function _____

- 2 Structure _____
Function _____

(b) The field of view of a light microscope measures 2 mm in diameter.
20 plant cells were counted in a line across the diameter.

1 mm = 1000 micrometres

Calculate the average size of a cell in micrometres. 1

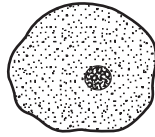
Space for calculation

_____ micrometres

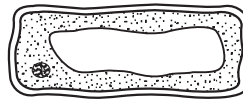


2. A student examined plant and animal cells using a microscope.

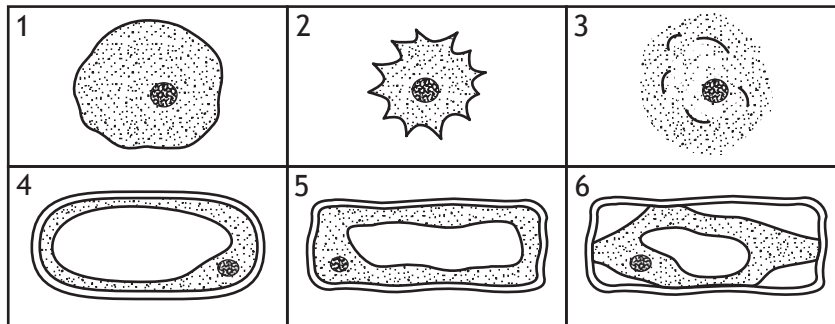
Animal cell



Plant cell



The animal and plant cells were placed in solutions of different salt concentrations. After several minutes a sample of cells was taken from each solution and examined. One cell from each solution is shown.



(a) Changes in the cells were due to osmosis.

Explain why osmosis is described as a passive process.

1

(b) Identify the animal cell shown which had been placed in a solution of higher salt concentration than its cell contents.

1

Cell number _____

(c) State the term used to describe the condition of cell 6.

1

(d) Cells 3 and 4 had been placed in solutions which were both of the same concentration.

Explain why the results observed were different.

2



* X 8 0 7 7 5 0 1 0 6 *

3. The diagram represents part of a DNA molecule.



(a) (i) Give the term which describes the shape of a DNA molecule as shown in the diagram. 1

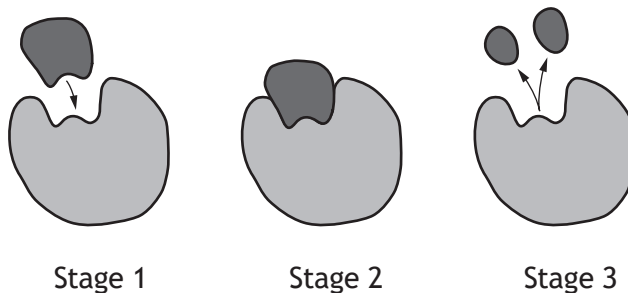
(ii) Describe the way in which the DNA strands are linked together. 1

(b) Name the organelle in animal cells which stores the DNA. 1

[Turn over



4. The diagrams represent stages in an enzyme-controlled reaction.



(a) Enzymes are involved in two types of reaction.
Identify the type of reaction shown in the diagrams above.

1

(b) Describe the events occurring in the enzyme reaction shown.

3



5. (a) The table shows information about two types of respiration in animal cells.

Tick the boxes in the table to indicate whether the statements apply to aerobic respiration, fermentation or both.

2

Statement	Type of respiration	
	Aerobic	Fermentation
Oxygen is required		
Pyruvate is formed		
Lactate is formed		
Carbon dioxide is formed		

- (b) ATP is an energy-rich molecule formed by respiration.

Name a cellular process which requires energy from ATP.

1

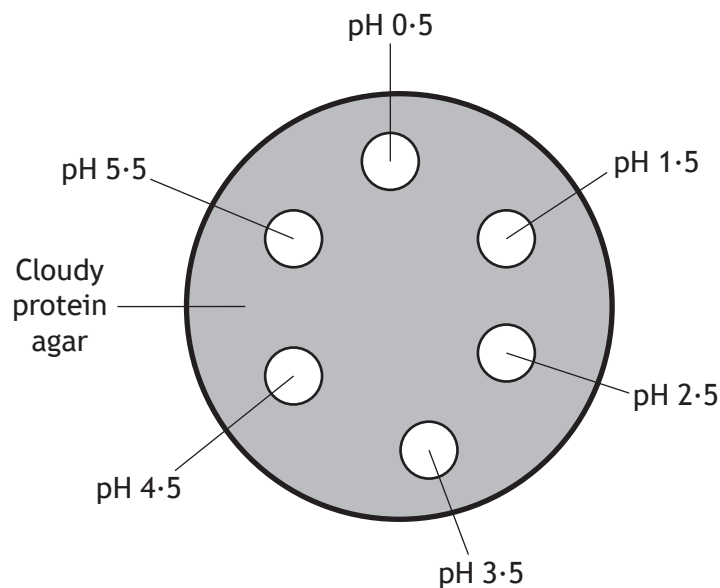
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* X 8 0 7 7 5 0 1 0 9 *

6. An investigation was carried out into the effect of pH on the activity of the enzyme pepsin.

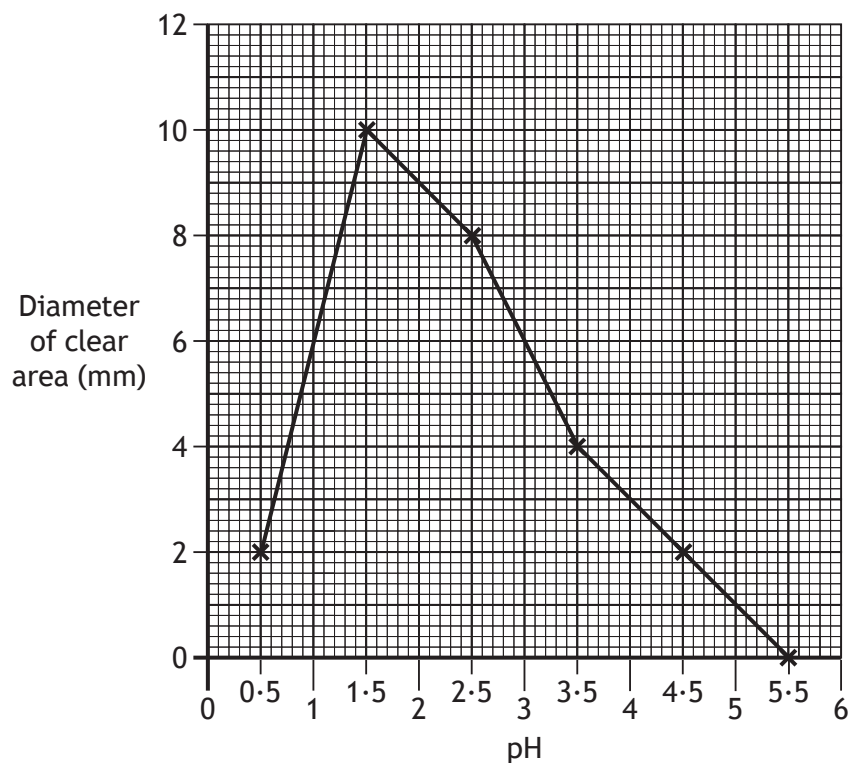
A Petri dish was filled with cloudy protein agar. Six holes were made in the agar and each was filled with pepsin solution at the pH values shown.



When the protein is broken down, cloudy agar becomes clear.

The dish was examined after 24 hours and the diameter of the clear area around each hole was measured. The larger the clear area, the more active the enzyme.

The results are shown in the graph.



* X 8 0 7 7 5 0 1 1 0 *

6. (continued)

- (a) (i) Identify the optimum pH for pepsin in this experiment.

1

pH _____

- (ii) Calculate how many times more active the enzyme is at pH 2.5 than at pH 4.5.

1

Space for calculation

_____ times

- (b) State two variables which should be controlled to make this experiment valid.

2

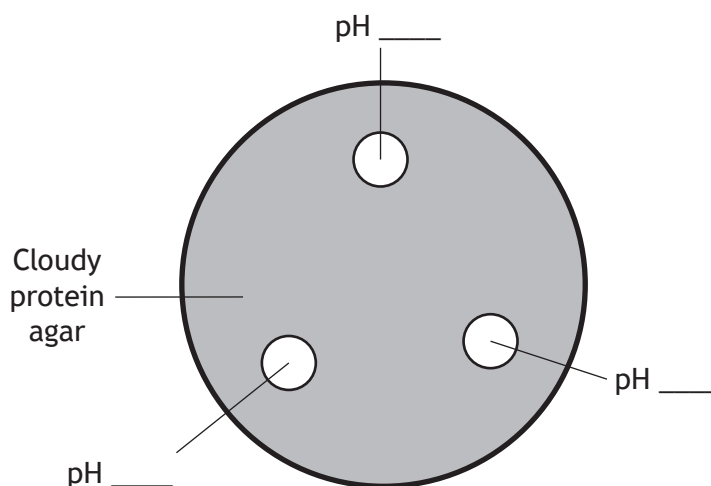
1 _____

2 _____

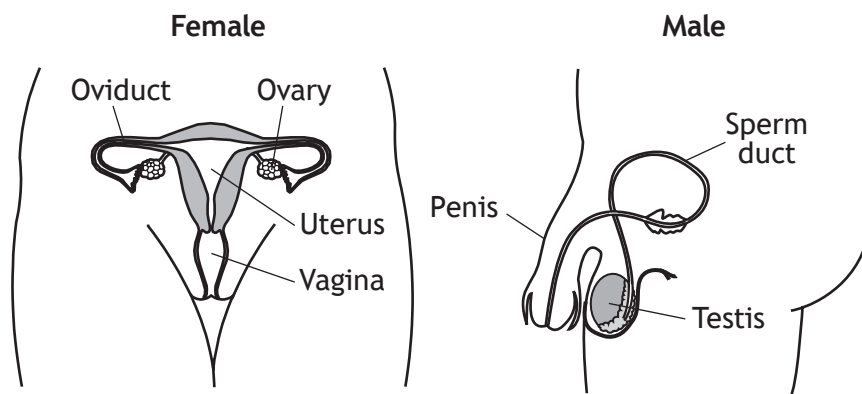
- (c) As a follow-up to this investigation, students were asked to design an experiment using the same apparatus to identify a more exact optimum pH value.

Complete the diagram below to show the pH values the students could use.

1



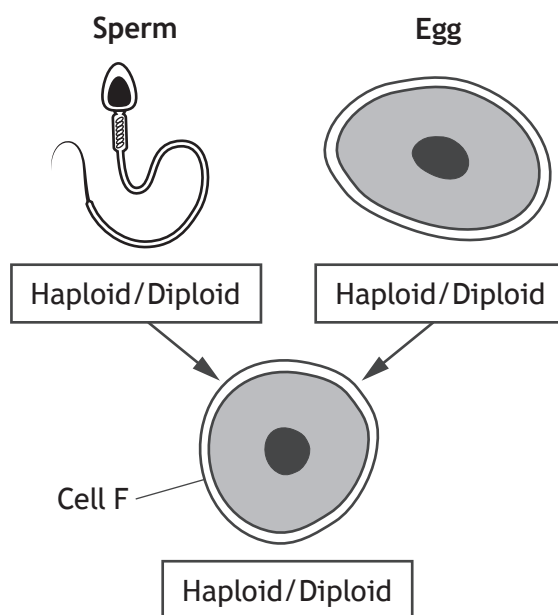
8. The diagrams show the human reproductive system in females and males.



(a) From the diagrams, identify **one** site of gamete production.

1

(b) The diagram represents the process of fertilisation.



(i) In the diagram, circle one term in each box to show the chromosome complement for each cell.

1

(ii) Name cell F which is produced when the sperm fertilises the egg.

1

[Turn over



9.

Adapted from the Herald, Friday 4 March 2016

Coffee and Multiple Sclerosis

Multiple sclerosis (MS) is a condition which affects the central nervous system and can cause problems with vision and balance as well as numbness in the skin. Scotland has one of the highest incidences of MS in the world, with a mixture of genetic and environmental factors thought to be the cause.

Research suggests that drinking a lot of coffee every day could potentially cut the risk of developing MS.

Experts found that consuming more than 900 ml daily may offer up to 30% reduced risk.

Researchers compared the results of studies from two different countries.

One study in Sweden involved 1,620 adults with MS and a comparison group of 2,788 people without MS. A second study in the USA involved 1,159 people with MS and 1,172 people without MS.

The results showed the risk of MS was consistently higher among people who drank fewer cups of coffee every day in both studies, even after taking into account other factors of influence.

- (a) Identify the factors thought to be the cause of the high incidence of MS in Scotland. 1

- (b) In the table below, present the information from the passage, to give details of the two studies and the people involved. 2

(An additional table, if required, can be found on page 28.)

<i>Country</i>		



9. (continued)

- (c) As part of the research described in the passage, groups of people with MS were compared to those without MS.

Give the term used to describe a comparison group in scientific research.

1

- (d) Decide whether this research would be described as reliable or not and tick the appropriate box.

Give a reason for your choice.

1

Reliable Not reliable

Reason _____

- (e) The researcher took 'other factors of influence' into consideration.

Suggest one of these factors.

1

[Turn over



* X 8 0 7 7 5 0 1 1 5 *

10. The following statements are about blood vessels.

1. Contain valves.
2. Have a narrow central channel.
3. Carry blood under low pressure.
4. Form networks at organs and tissues.
5. Carry blood from the heart to organs.

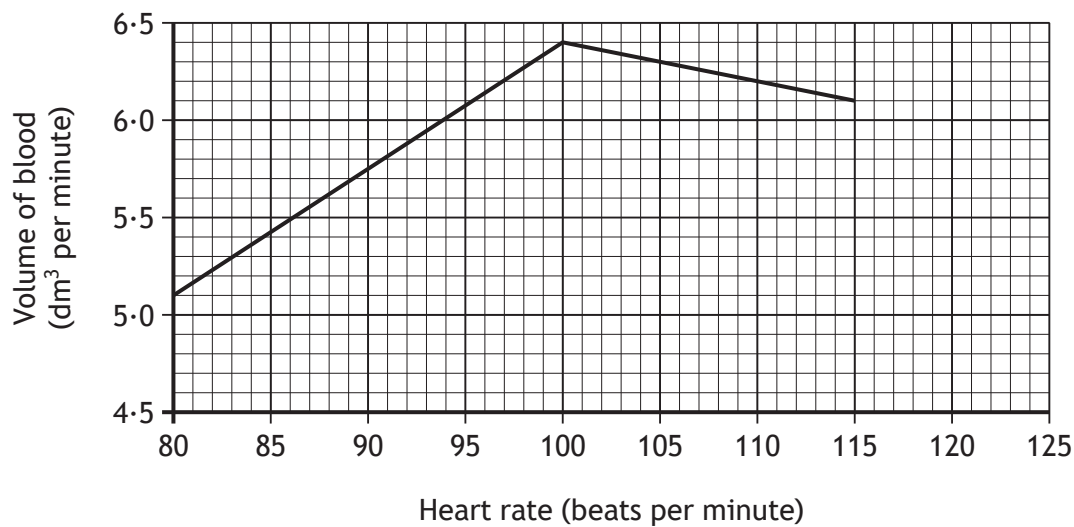
(a) Choose either arteries or veins and select two statements from the list above which describe that type of blood vessel.

2

Blood vessel _____

Statements _____ and _____

(b) The graph shows the effect of changes in heart rate on the volume of blood pumped by the left ventricle.



(i) Describe the relationship between heart rate and volume of blood pumped by the left ventricle.

2

(ii) Predict the volume of blood pumped by the left ventricle at 120 beats per minute.

1

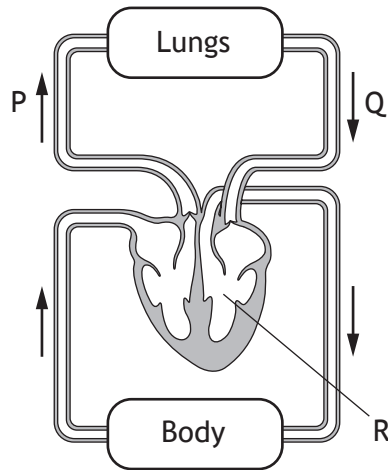
_____ dm³ per minute



10. (continued)

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(c) The diagram represents part of the circulatory system in humans.



(i) Describe the difference in oxygen concentration in the blood travelling through blood vessels P and Q.

1

(ii) Name the heart chamber labelled R.

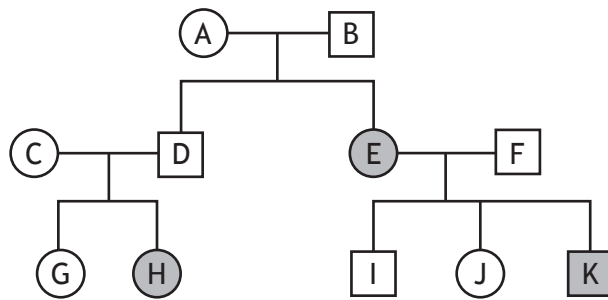
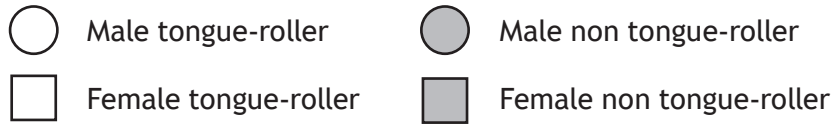
1

[Turn over



11. (a) Tongue-rolling is an inherited characteristic controlled by different forms of a gene. T (roller) represents the dominant form of the gene, and t (non-roller) represents the recessive form.

The family tree diagram shows a pattern of inheritance of the characteristic.



- (i) Use letters from the diagram to identify all the individuals in the F₂ generation. 1

- (ii) Give the genotypes of individuals E and F. 2

E _____ F _____

- (iii) Complete the Punnett square to show the gametes and expected genotypes of the offspring of E and F. 2

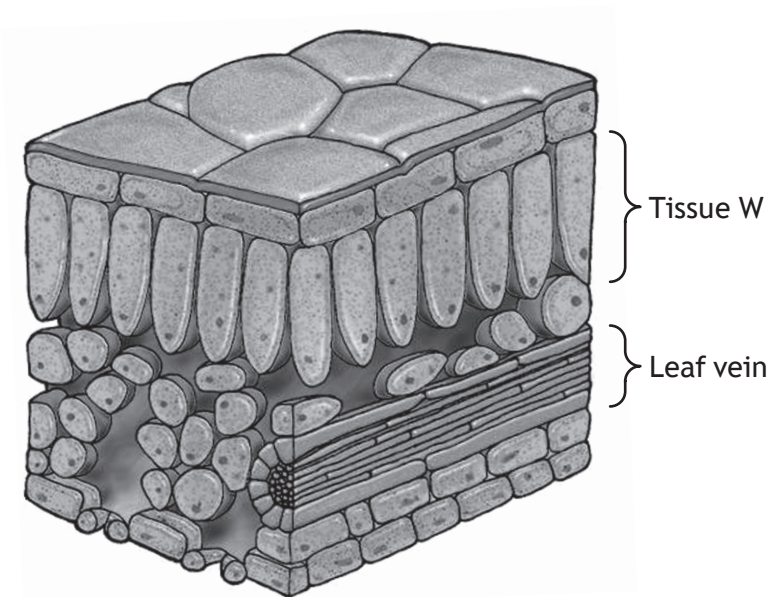
		<i>Genotype of gametes from F</i>	
<i>Genotype of gametes from E</i>			

- (b) State the type of variation shown by tongue-rolling. 1



* X 8 0 7 7 5 0 1 1 8 *

12. The diagram represents a section through a leaf.



(a) (i) Name tissue W. 1

(ii) The cells in tissue W have a greater number of chloroplasts than other leaf cells.

Suggest the advantage of these cells being located near the upper surface of the leaf. 1

(b) The leaf vein consists of xylem and phloem tissues.

Choose either xylem or phloem, by ticking one box, and describe one structural feature of that tissue. 1

Xylem Phloem

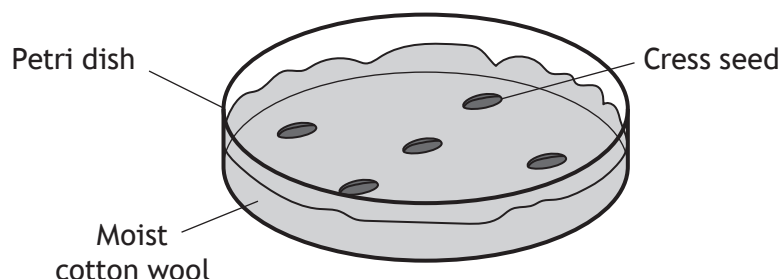
Feature of tissue _____

[Turn over



13. To investigate the effect of competition on the growth of cress seeds, five Petri dishes, labelled A–E, were set up and left for six days. Each dish contained a layer of moist cotton wool with different numbers of cress seeds sown evenly across its surface.

Dish A is shown in the diagram.



The results are shown in the table.

<i>Dish</i>	<i>Number of seeds sown</i>	<i>Number of seedlings surviving after six days</i>	<i>Percentage of seedlings surviving after six days</i>
A	5	5	100
B	10	10	100
C	20		95
D	40	34	85
E	80	60	75

- (a) (i) Complete the table by calculating the number of seedlings surviving in Dish C. 1

Space for calculation

- (ii) Describe the relationship between the number of seeds sown and the percentage of seedlings surviving after six days. 1



13. (a) (continued)

- (iii) Explain why the type of competition shown in this investigation is described as being intraspecific.

1

- (b) The diagram represents positions of organisms in a food chain.

Tick one of the boxes to show the position cross would occupy in the food chain.

1



- (c) Name one resource, other than water, for which plants may be in competition.

1

[Turn over



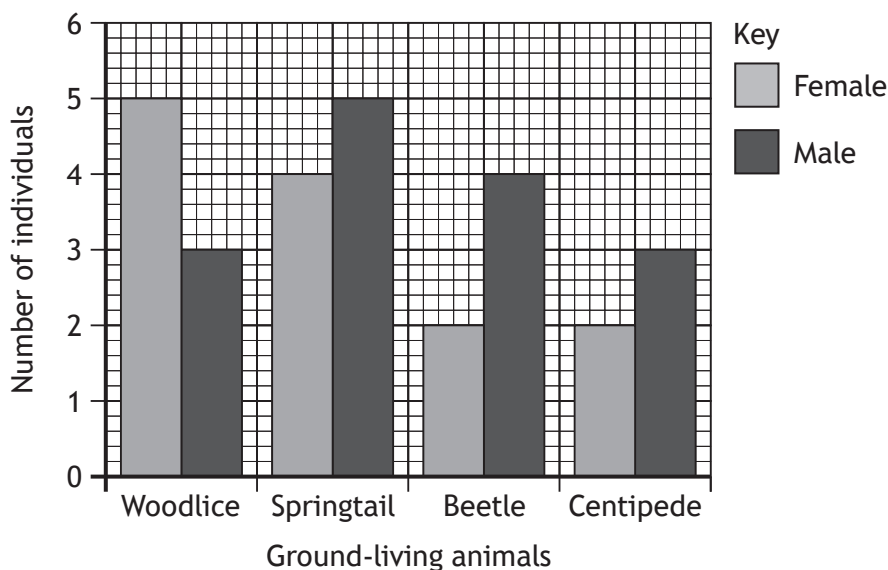
* X 8 0 7 7 5 0 1 2 1 *

14. Sampling techniques can be used to estimate the abundance of plants and animals.

(a) In an investigation into ground-living animals in a woodland, a group of students collected and counted the animals they found.

(i) Name a sampling technique which could be used to collect the ground-living animals. 1

(ii) The students sorted the animals into male and female, counted them and recorded the results in a bar graph.



1 Identify the animal which had the greatest overall abundance. 1

2 The students concluded that males were always more abundant than females.

Identify the animal for which this is **not** true. 1

(iii) It was decided that the samples were not fully representative of the area.

Suggest how the investigation could be improved. 1



14. (continued)

(b) The distribution of organisms may be affected by abiotic factors.

The table shows the results of a study into the effect of soil moisture levels on the distribution of three species of plant.

Sample site	Soil moisture (units)	Number of plants		
		Species E	Species F	Species G
1	20.2	11	15	12
2	23.4	13	14	11
3	22.1	12	16	10
4	24.5	15	17	15
5	26.6	18	13	12
6	28.4	19	15	14

(i) State which species has its distribution most affected by the soil moisture levels. 1

Species _____

(ii) Calculate the average number of plants per sample site for species F. 1

Space for calculation

_____ plants

[Turn over



15. A student set up an investigation into the effect of temperature on the rate of photosynthesis in a green plant, by measuring the volume of oxygen released in one hour.

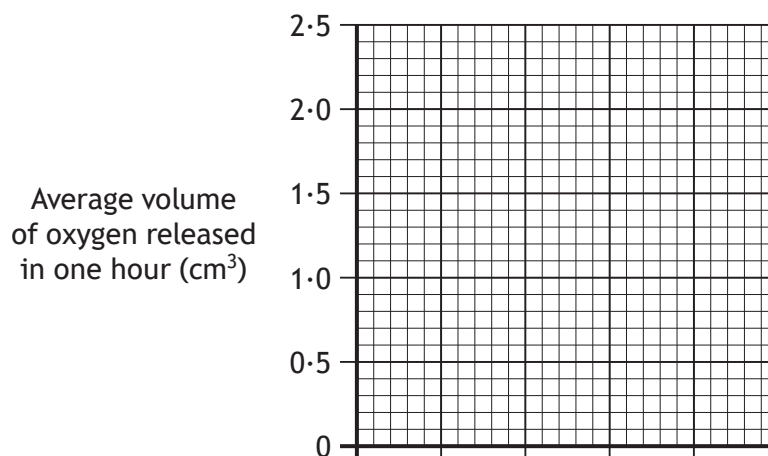
The results are shown in the table.

Temperature (°C)	Volume of oxygen released in one hour (cm ³)		
	Experiment 1	Experiment 2	Average
10	0.7	0.5	0.6
20	1.6	1.4	1.5
30	2.7	1.9	2.3
40	2.0	2.6	2.3
50	0.3	0.5	0.4

- (a) On the grid, plot a line graph to show the effect of temperature on the average volume of oxygen released in one hour.

2

(An additional grid, if required, can be found on page 28.)



- (b) Predict the average volume of oxygen released in one hour if the experiment was carried out at a temperature of 60 °C.

1

_____ cm³

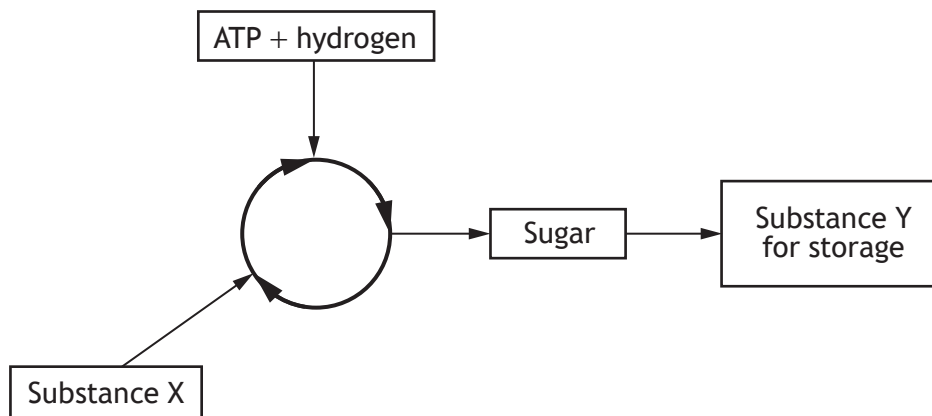


15. (continued)

(c) State one factor, other than temperature, which can limit the rate of photosynthesis.

1

(d) The diagram represents the second stage of photosynthesis.



Name substances X and Y.

2

X _____

Y _____

[Turn over



* X 8 0 7 7 5 0 1 2 5 *

16. A gardener treated the soil in the area where he planted vegetables with a chemical to increase the yield.

(a) (i) The chemical added to the soil by the gardener contained nitrates. Give the general name for this type of chemical. 1

(ii) Describe the use that plants make of nitrates. 1

(iii) When the vegetables were picked and weighed, the total yield was 42 kilograms. The previous year the total yield was 35 kilograms.

Calculate the percentage increase in yield. 1

Space for calculation

_____ %

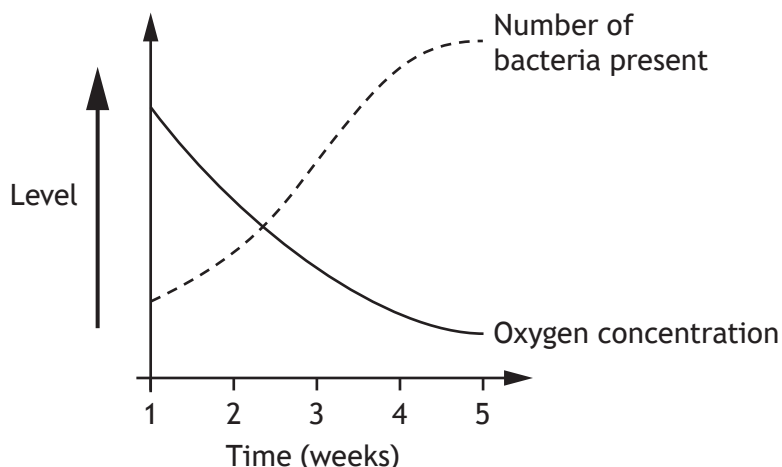


* X 8 0 7 7 5 0 1 2 6 *

16. (continued)

- (b) Later in the year the gardener noticed that the algae in his pond had increased and now covered the surface of the water. He sampled the pond water over 5 weeks and measured its oxygen concentration and number of bacteria present.

The results are shown in the graph.



- (i) What name is given to the increased growth of algae in the pond? 1

- (ii) Explain why the increased growth of algae resulted in an increase in the number of bacteria. 1

- (iii) Using the information in the graph, explain why the increase in number of bacteria resulted in the population of goldfish in the pond decreasing. 1

[END OF QUESTION PAPER]

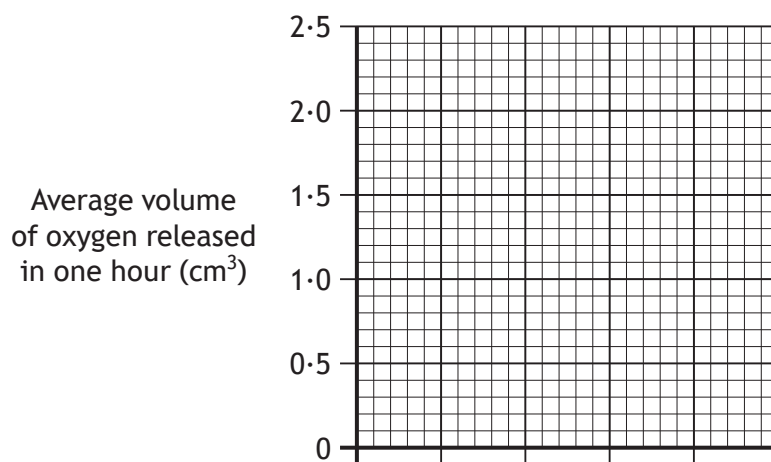


ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional table for Question 9 (b)

Country		

Additional grid for Question 15 (a)



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ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK



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ACKNOWLEDGEMENTS

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* X 8 0 7 7 5 0 1 3 2 *