National Qualifications 2018

X807/75/02

Biology
Section 1 — Questions

TUESDAY, 15 MAY

1:00 PM – 3:30 PM

Instructions for the completion of Section 1 are given on *page 02* of your question and answer booklet X807/75/01.

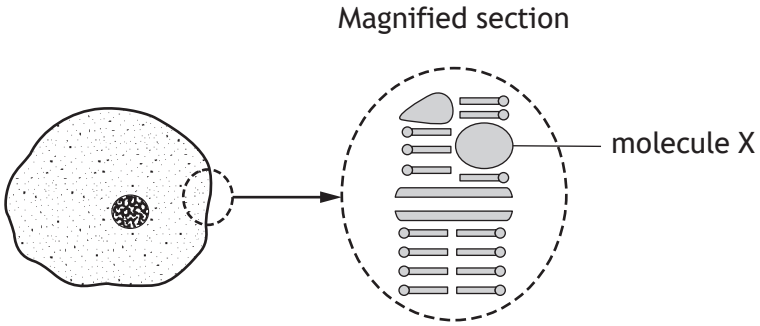
Record your answers on the answer grid on *page 03* of your question and answer booklet.

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

SQA ©

SECTION 1

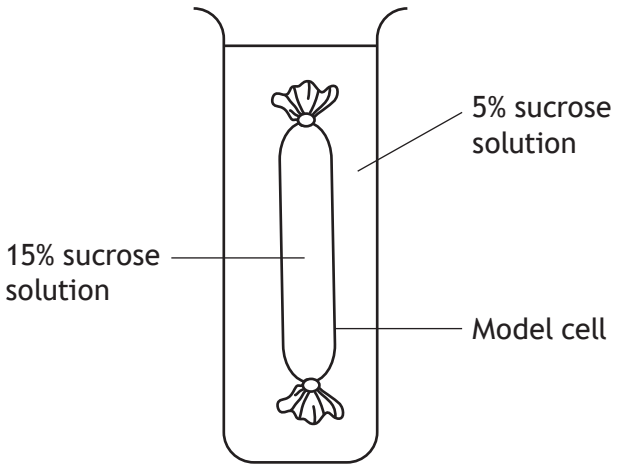
1. The diagram shows a cell with a section of the cell membrane magnified.



Molecule X is

A phospholipid
B protein
C cellulose
D starch.

2. The diagram shows an experiment in which a model cell was placed in a sucrose solution.



At the start of the experiment the model cell weighed 25 g and at the end it weighed 30 g.
What was the percentage increase in mass?

A 5·0%
B 16·7%
C 20·0%
D 83·3%

3. Glucose molecules in low concentration in the kidney have to be moved into the bloodstream, where there is a higher concentration of glucose.

The process responsible for this action is

A osmosis

B diffusion

C passive transport

D active transport.

4. Which of the following represents the sequence of events in the production of a protein from the genetic code?

A DNA → amino acids → mRNA → protein

B DNA → mRNA → amino acids → protein

C mRNA → DNA → amino acids → protein

D amino acids → DNA → mRNA → protein

5. Which of the following are all types of proteins?

A Hormones, enzymes and nitrates

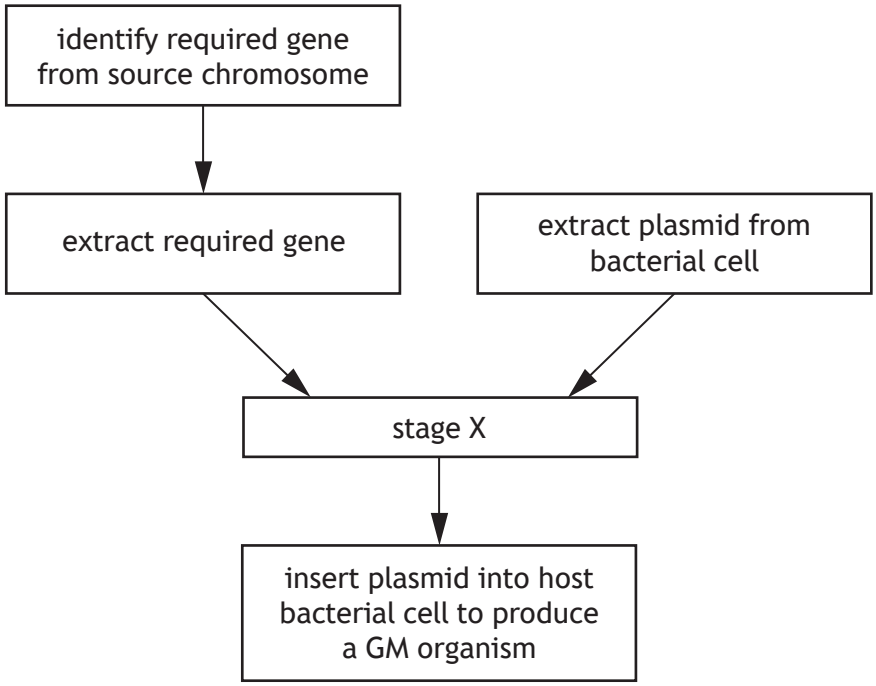
B Antibodies, enzymes and plasmids

C Hormones, receptors and antibodies

D Receptors, antibodies and nitrates

[Turn over

6. The flowchart represents some of the stages of genetic engineering.



A suitable description of stage X would be

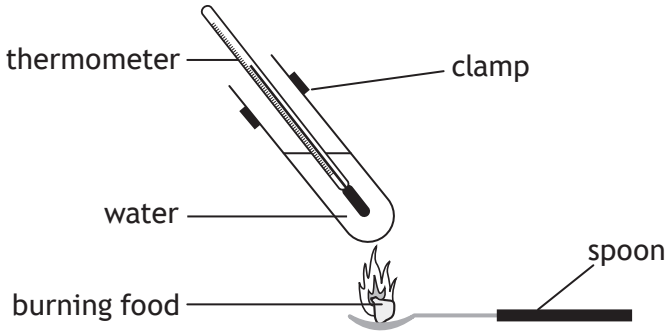
A insert bacterial plasmid into required gene

B insert bacterial plasmid into source chromosome

C insert required gene into host bacterial cell

D insert required gene into bacterial plasmid.

7. The diagram shows an experiment which can be used to find the energy content of different foods. Each food was completely burned and the energy content was estimated by the rise in temperature of the water.



The reliability of this experiment could be improved by

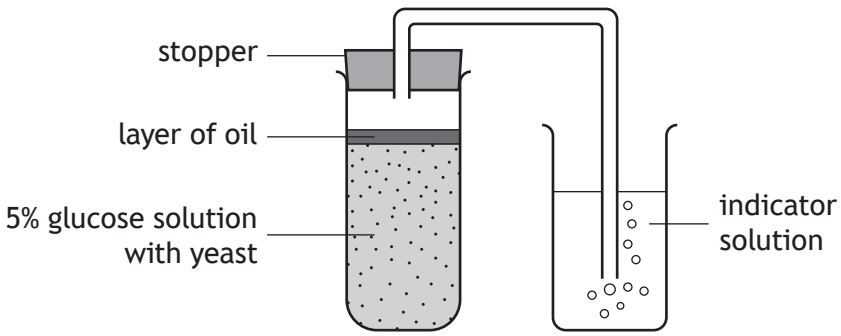
A burning each food for the same length of time

B repeating the experiment with each food several times

C removing the thermometer from the tube to read it accurately

D repeating the experiment using a different food each time.

8. The apparatus shown was used to investigate the rate of respiration in yeast at 20 °C.



Which of the following changes would cause a decrease in the rate of respiration of the yeast?

A Increase the thickness of the layer of oil by 1 mm.

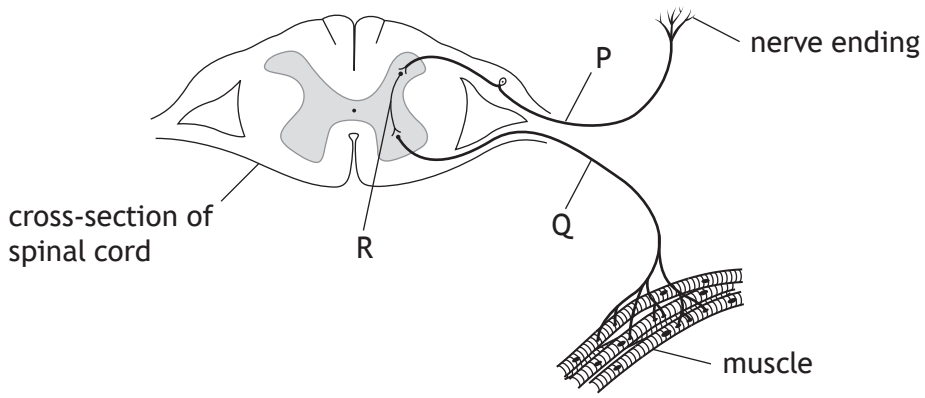
B Increase the temperature of the glucose solution by 1 °C.

C Decrease the concentration of the glucose solution by 1%.

D Decrease the volume of indicator solution by 1 cm^3.

[Turn over

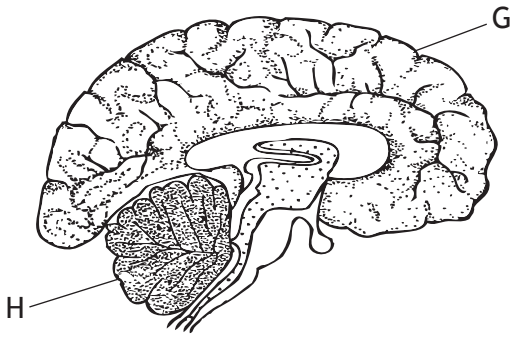
9. The diagram shows some of the structures found in a reflex arc.



Which row in the table identifies P, Q and R?

	Motor neuron	*Sensory neuron*	*Inter neuron*
A	Q	R	P
B	Q	P	R
C	R	P	Q
D	P	R	Q

10. The diagram represents a section through the brain.



Which of the following links a letter to its correct structure and function?

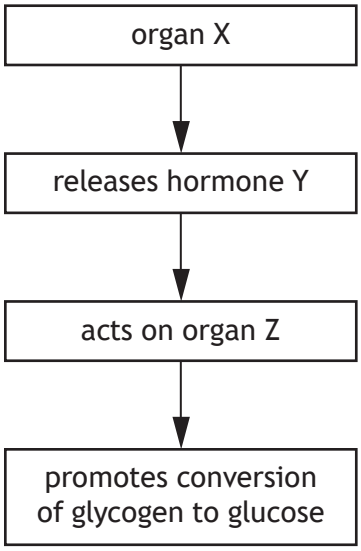
A G is the cerebrum and is the site of reasoning and memory.

B G is the cerebellum and is the site of reasoning and memory.

C H is the medulla and controls muscle coordination.

D H is the cerebellum and controls breathing and heart rate.

Questions 11 and 12 refer to the following flow diagram related to blood glucose regulation.



11. Which row in the table identifies organ X and hormone Y?

	Organ X	*Hormone Y*
A	Liver	Insulin
B	Liver	Glucagon
C	Pancreas	Insulin
D	Pancreas	Glucagon

12. Specialised cells allow organ Z to respond to hormone Y.
This is because the surface of the cells in organ Z have complementary

A synapses
B neurons
C effectors
D receptors.

[Turn over

13. An **increase** in which of the following factors would **decrease** the rate of transpiration in plants?

A Wind speed

B Humidity

C Surface area

D Temperature

14. Which of the following statements about blood cells is **false**?

A White blood cells are part of the immune system.

B Phagocytes are a type of white blood cell.

C Red blood cells contain haemoglobin.

D Phagocytes transport nutrients around the body.

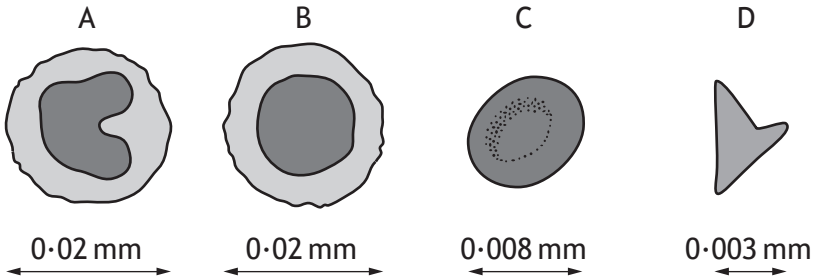
15. Which row in the table identifies how lymphocytes destroy pathogens?

	Antibody production	*Phagocytosis*
A	Yes	No
B	No	No
C	No	Yes
D	Yes	Yes

16. The following key can be used to identify the different components of blood.

1.	Nucleus absent	go to 2
	Nucleus present	go to 3
2.	Diameter greater than 0·005 mm	**red blood cell**
	Diameter less than 0·005 mm	**platelet**
3.	Nucleus is circular	**lymphocyte**
	Nucleus is not circular	**macrophage**

Use the key above to identify which of the diagrams represents a platelet.



17. Which of the following statements is true of villi?

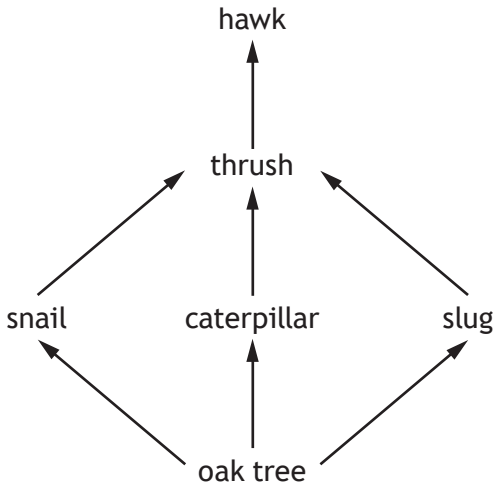
A Blood capillaries absorb glycerol and amino acids.
B Blood capillaries absorb glucose and fatty acids.
C Lacteals absorb glycerol and fatty acids.
D Lacteals absorb glucose and amino acids.

18. An ecosystem consists of abiotic factors plus a

A community and its biodiversity
B population and its biodiversity
C population and its habitat
D community and its habitat.

[Turn over

19. The diagram shows part of a food web.



A chemical was used to control the number of slugs.

Which of the following could be a result of a large decrease in slug numbers?

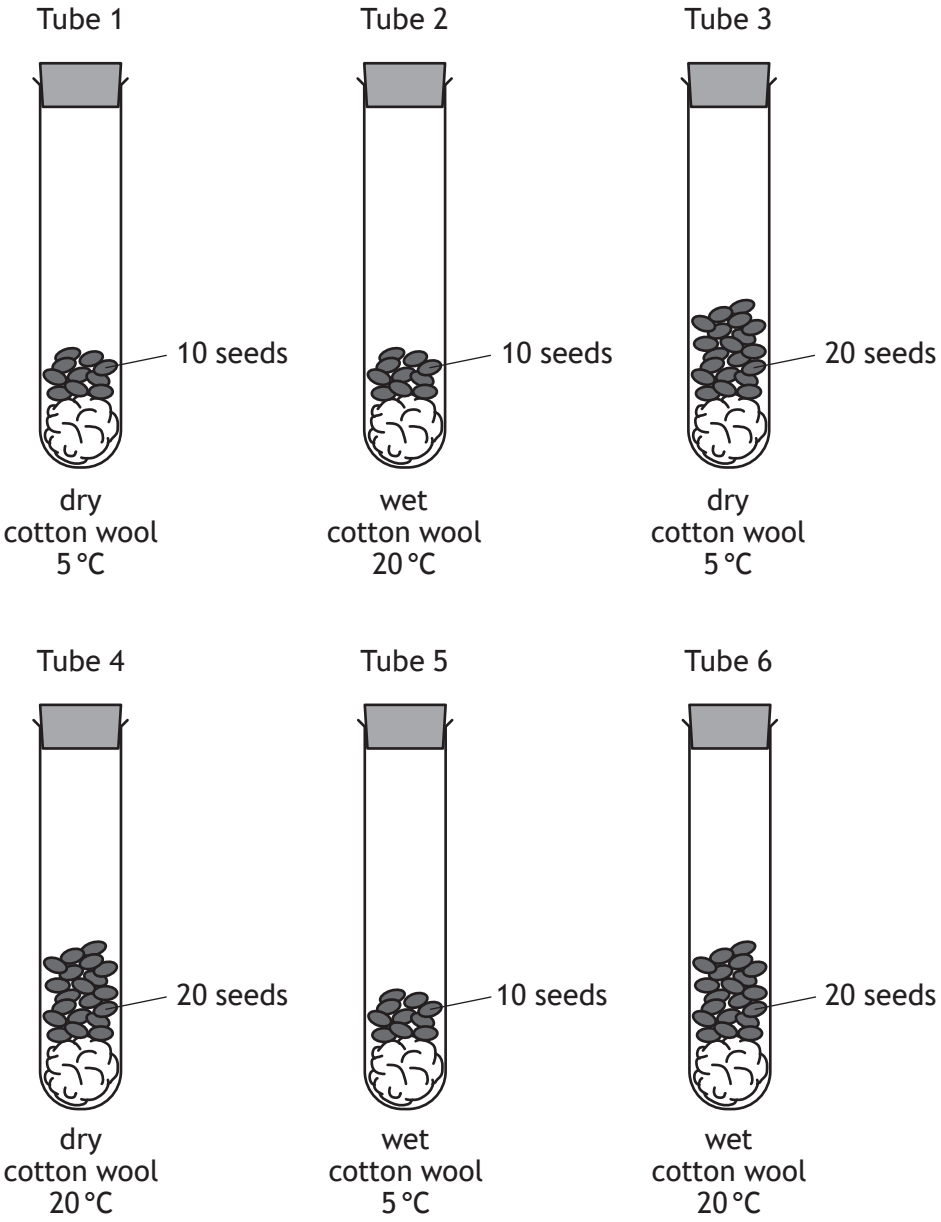
A An increase in snails.

B An increase in hawks.

C A decrease in caterpillars.

D A decrease in oak trees.

20. The diagrams show an investigation into seed germination.



For a valid conclusion to be drawn, which two tubes should be compared to show the effect of temperature on germination?

A 1 and 3

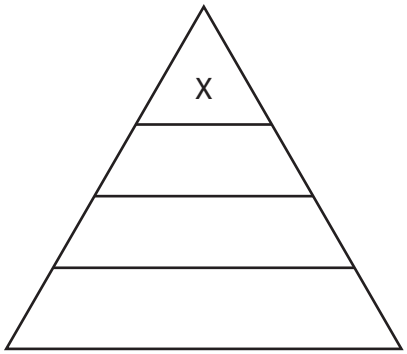
B 3 and 6

C 2 and 5

D 4 and 6

[Turn over

21. The diagram represents a pyramid of energy.



There is less energy at level X in the pyramid because

A there are fewer organisms at each level in the food chain
B the organisms at level X are very small
C energy is lost at each level in the food chain
D energy is stored in each level and not passed on.

22. Mutations result in changes to genetic material.
Which of the following is **not** true of mutations?

A Radiation can increase their rate.
B They always have a harmful effect.
C Genetic material is affected at random.
D New alleles may be produced.

23. Natural selection occurs when there are selection pressures.
Which of the following could be a result of selection pressures?

A Organisms with favourable alleles survive and reproduce.
B Organisms with new alleles always have an advantage.
C All alleles in a population increase in frequency.
D All alleles in a population decrease in frequency.

24. Pesticides sprayed onto crops can get into food chains. The following statements refer to stages in this process.

J Pesticides are absorbed by plants.

K Pesticides build up in animals.

L Plants are eaten by animals.

Identify the order of steps by which pesticides could reach lethal levels in the bodies of animals.

	Step 1	*Step 2*	*Step 3*
A	J	K	L
B	L	J	K
C	L	K	J
D	J	L	K

25. Which row in the table identifies biotic and abiotic factors which can affect a population?

	Biotic factors	*Abiotic factors*
A	grazing and predation	pH and temperature
B	predation and temperature	pH and grazing
C	pH and temperature	grazing and predation
D	pH and grazing	predation and temperature

[END OF SECTION 1. NOW ATTEMPT THE QUESTIONS IN SECTION 2 OF YOUR QUESTION AND ANSWER BOOKLET.]

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FOR OFFICIAL USE

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National Qualifications 2018

Mark

X807/75/01

Biology
Section 1 — Answer Grid and Section 2

TUESDAY, 15 MAY
1:00 PM – 3:30 PM

X8077501

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.

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X807750101

SECTION 1 — 25 marks

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

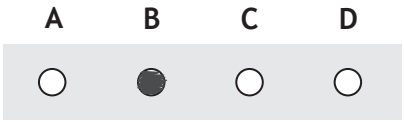
A humerus

B femur

C tibia

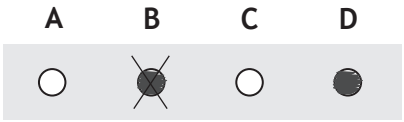
D fibula.

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

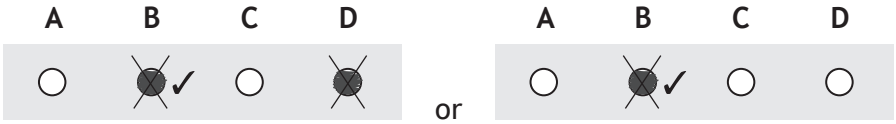


Changing an answer

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**.



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:



SECTION 1 — Answer Grid

OBJ25AD1

	A	B	C	D
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○
6	○	○	○	○
7	○	○	○	○
8	○	○	○	○
9	○	○	○	○
10	○	○	○	○
11	○	○	○	○
12	○	○	○	○
13	○	○	○	○
14	○	○	○	○
15	○	○	○	○
16	○	○	○	○
17	○	○	○	○
18	○	○	○	○
19	○	○	○	○
20	○	○	○	○
21	○	○	○	○
22	○	○	○	○
23	○	○	○	○
24	○	○	○	○
25	○	○	○	○

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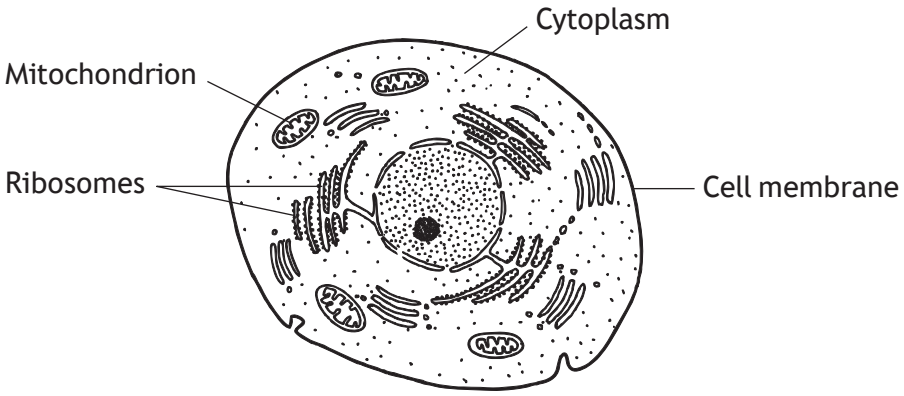
SECTION 2 — 75 marks

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.

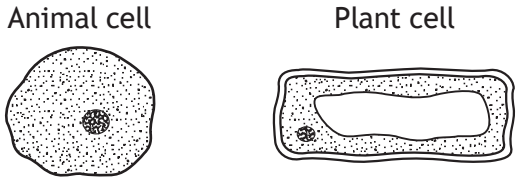
1 mm = 1000 micrometres

Calculate the average size of a cell in micrometres. **1**

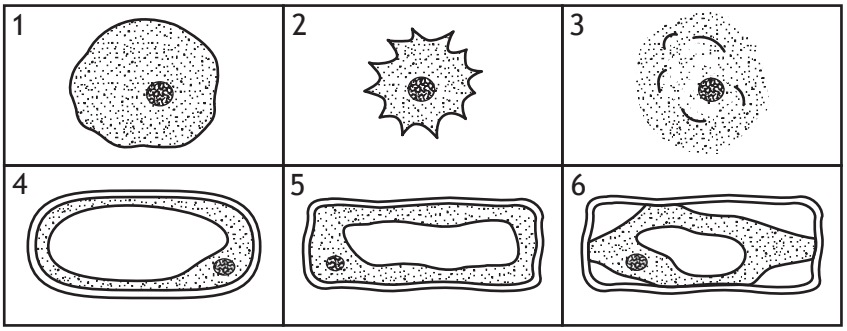
Space for calculation

_____ micrometres

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



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**

_____

_____

_____

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**

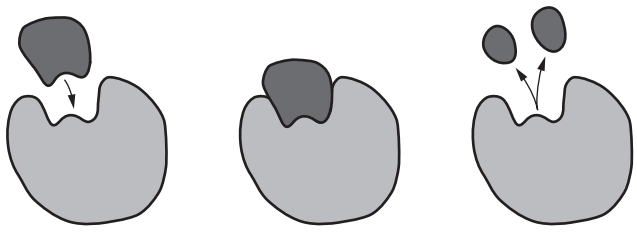
_____

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

_____

[Turn over

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



Stage 1 Stage 2 Stage 3

(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**

	Type of respiration	
Statement	*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**

_____

[Turn over

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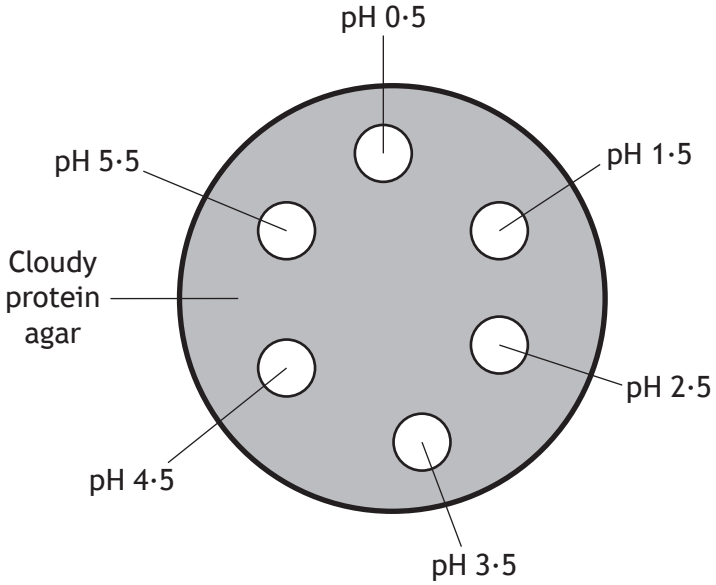
6. An investigation was carried out into the effect of pH on the activity of the enzyme pepsin.

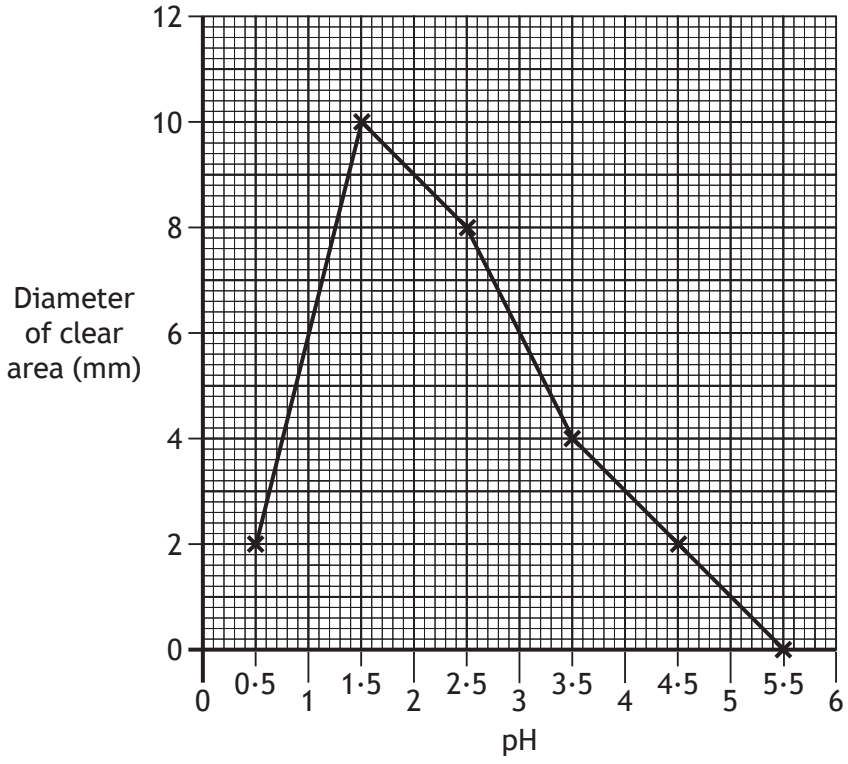
A Petri dish was filled with cloudy protein agar. Six holes were made in the agar and each was filled with pepsin solution at the pH values shown.



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.



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

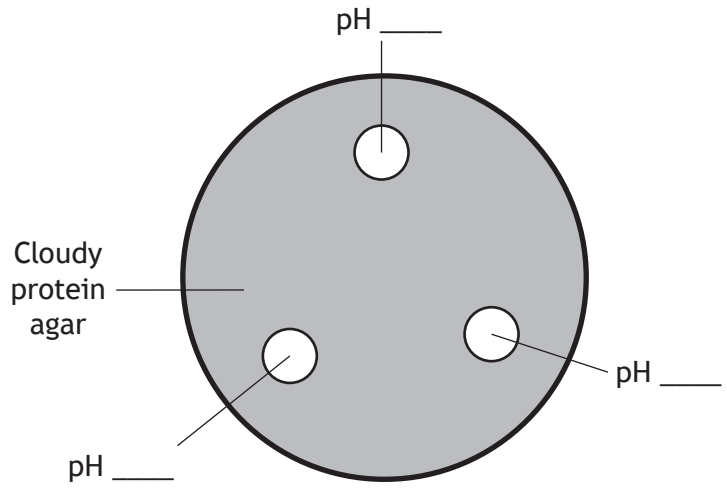
(b) State two variables which should be controlled to make this experiment valid. **2**

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**

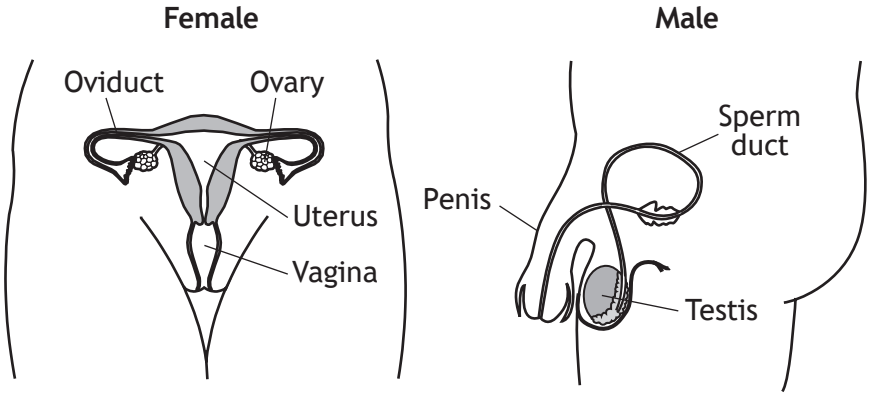


MARKS | DO NOT WRITE IN THIS MARGIN

7. The process of mitosis begins with the chromosomes becoming visible.

Describe the sequence of events which follows on from this resulting in the production of two daughter cells. **4**

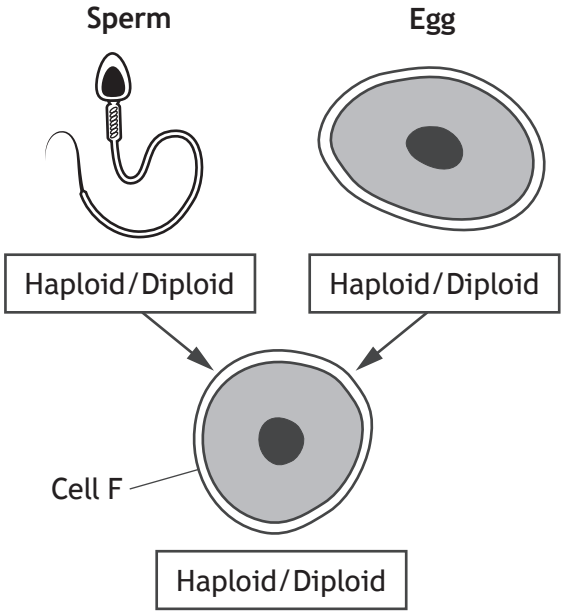
8. The diagrams show the human reproductive system in females and males.



(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*.)

Country		

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

10. The following statements are about blood vessels.

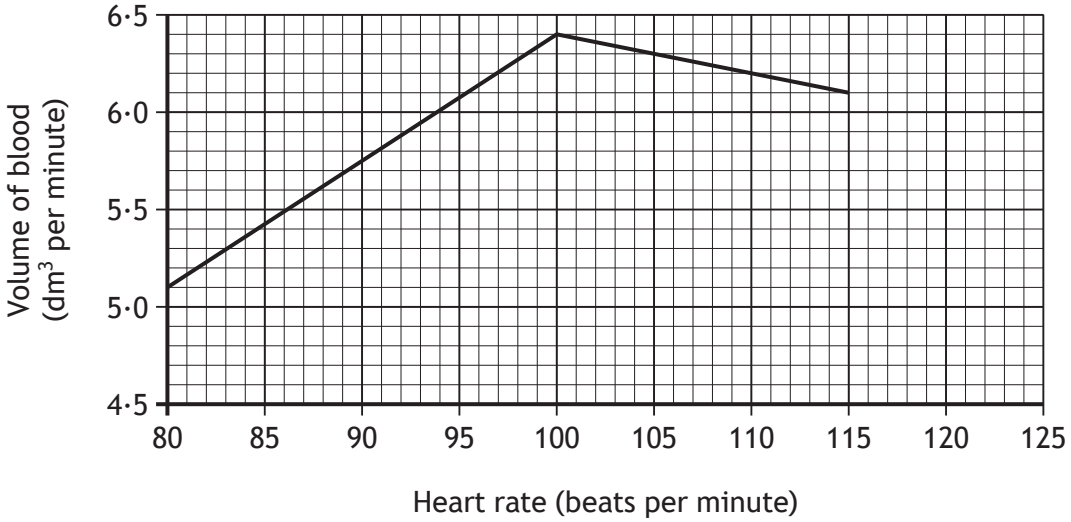
1. Contain valves.
2. Have a narrow central channel.
3. Carry blood under low pressure.
4. Form networks at organs and tissues.
5. Carry blood from the heart to organs.

(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**

_____ dm^3 per minute

MARKS

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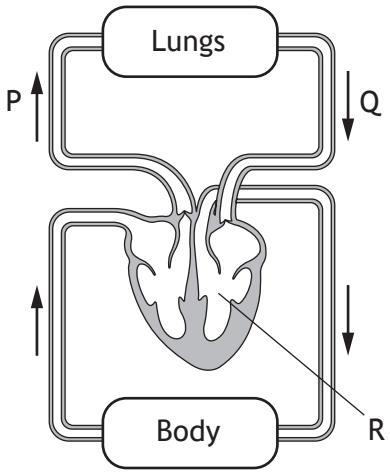
(c) The diagram represents part of the circulatory system in humans.



(i) Describe the difference in oxygen concentration in the blood travelling through blood vessels P and Q. **1**

_____

_____

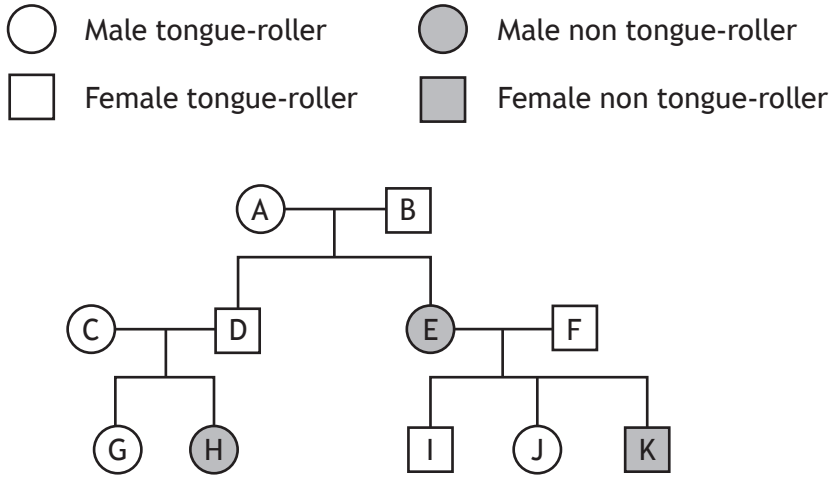
(ii) Name the heart chamber labelled R. **1**

_____

[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 F_2 generation. **1**

_____

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

E _____ F _____

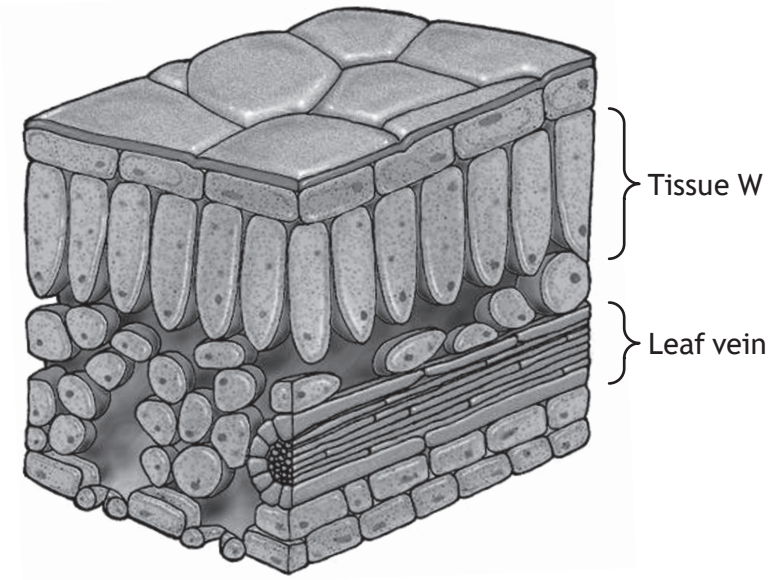
(iii) Complete the Punnett square to show the gametes and expected genotypes of the offspring of E and F. **2**

		Genotype of gametes from F	
Genotype of gametes from E			

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

_____

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 ☐

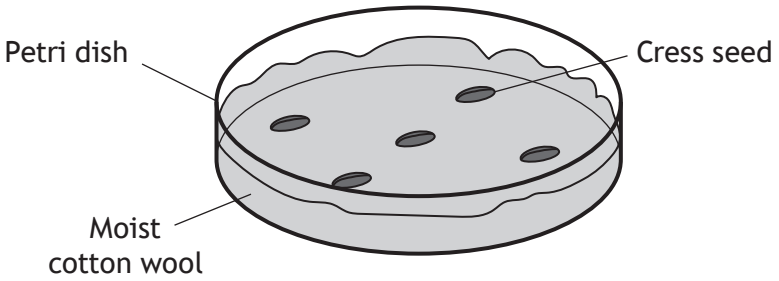
Feature of tissue _____

_____

[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.

Dish	*Number of seeds sown*	*Number of seedlings surviving after six days*	*Percentage of seedlings surviving after six days*
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 cress would occupy in the food chain. **1**

(c) Name one resource, other than water, for which plants may be in competition. **1**

_____

[Turn over

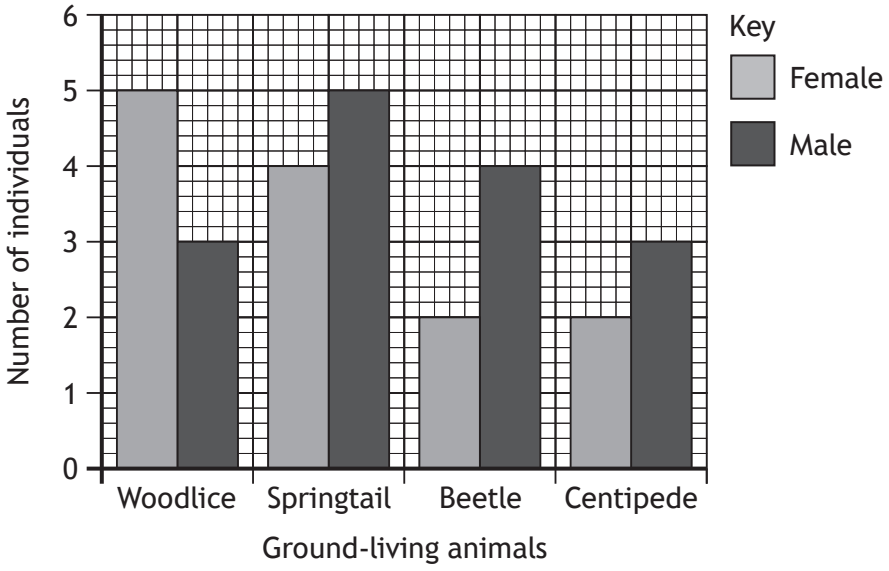
14. Sampling techniques can be used to estimate the abundance of plants and animals.

(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.

		Number of plants		
Sample site	*Soil moisture* (units)	*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

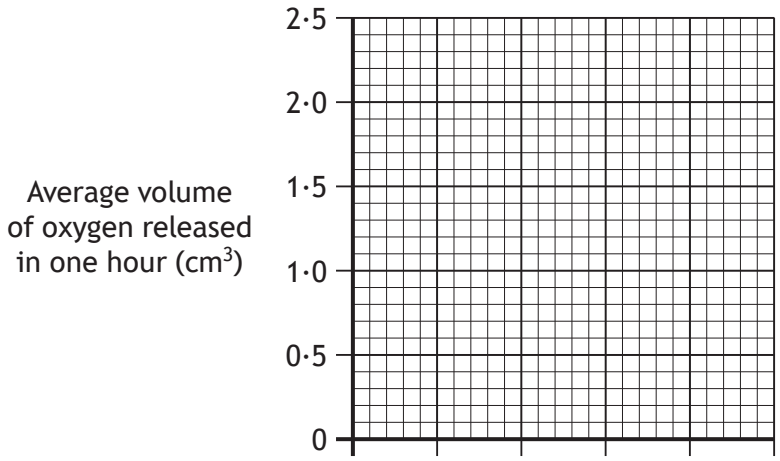
15. A student set up an investigation into the effect of temperature on the rate of photosynthesis in a green plant, by measuring the volume of oxygen released in one hour.

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**

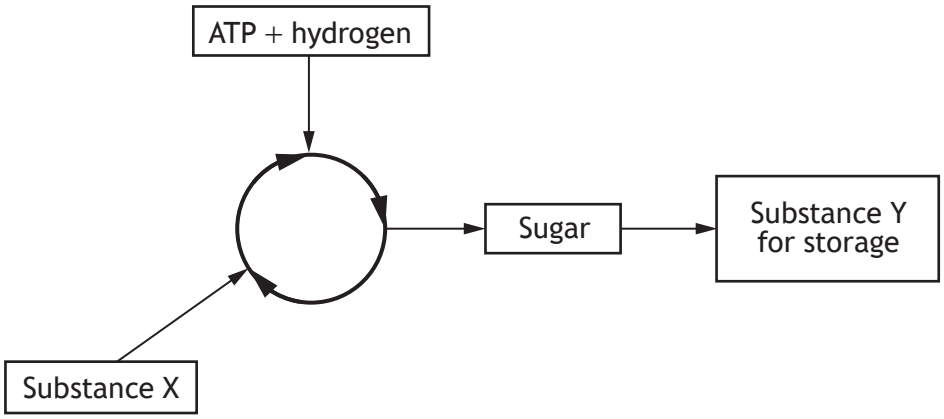
_____ cm^3

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

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**

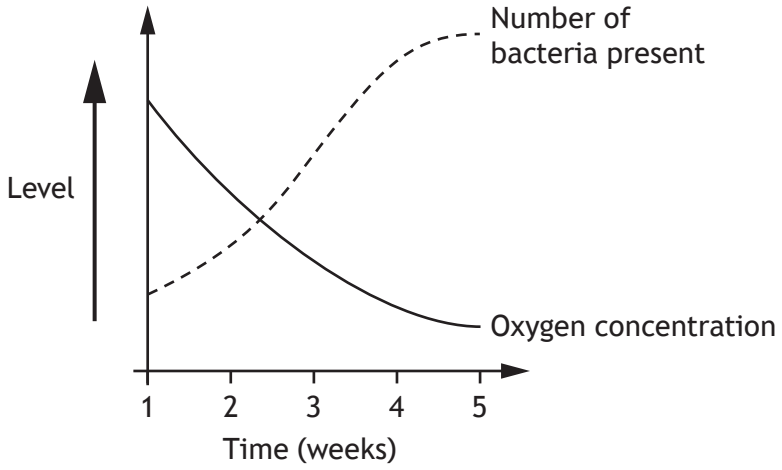
Space for calculation

_____%

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**

_____

_____

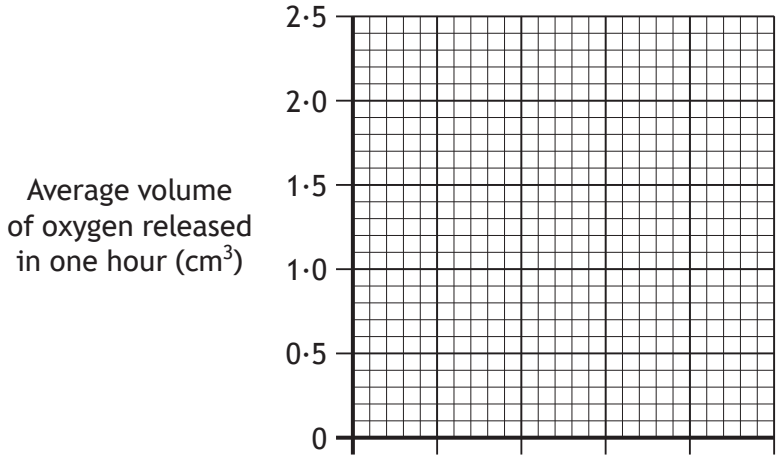
[END OF QUESTION PAPER]

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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ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

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ACKNOWLEDGEMENTS

Question 9 – Article is adapted from *The Herald*, Friday 4th March 2016.

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