FOR OFFICIAL USE

N5

National
Qualifications
2023

Mark

X807/75/01

Biology
Section 1 — Answer grid and Section 2

THURSDAY, 27 APRIL

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 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.

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

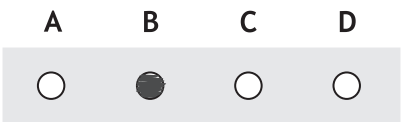
A humerus

B femur

C tibia

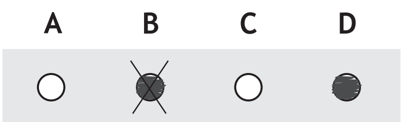
D fibula.

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

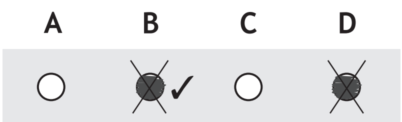


Changing an answer

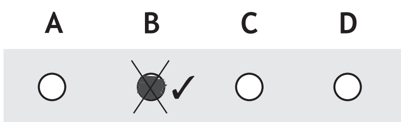
If you decide to change your answer, cancel your first answer by putting a cross through it (see below) and fill in the answer you want. The answer below has been changed to **D**.



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:



or



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	○	○	○	○

X807750103

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SECTION 2 — 75 marks

Attempt ALL questions

1. Cells vary in their size and structure.

(a) Both bacterial and fungal cells have a cell wall.

(i) Name one other structure that can be found in both bacterial and fungal cells. **1**

____

(ii) Plant cells also have a cell wall.

Name the material that plant cell walls are made of. **1**

____

(b) The average size of different types of cell are shown in the table.

Cell type	Average size (μm)
Animal	32.0
Bacterial	0.8
Fungal	6.4
Plant	52.0

(i) Calculate how many times bigger the average plant cell is compared to the average bacterial cell. **1**

Space for calculation

______________ times bigger

(ii) Apart from the difference in size, give one other difference between typical bacterial and plant cells. **1**

____

____

MARKS DO NOT WRITE IN THIS MARGIN

2. Plants transport water and mineral ions from their roots to the leaves.

(a) Mineral ions can move from the soil to the root cells by active transport.

Describe the process of active transport. **2**

___

___

___

(b) Water enters a plant by osmosis, which is an example of passive transport.

(i) State what this means in terms of the energy required for osmosis. **1**

___

(ii) Name the vessels that transport water to the leaves. **1**

___

(iii) When water enters a plant cell the vacuole fills and swells until no more water can enter.

State the term used to describe a plant cell in this state. **1**

___

3. (a) The four DNA bases represented by A, C, G and T make up the genetic code.

Part of the base sequence that codes for a protein is shown.

------ G C A T A T A G A ------

(i) Name base A and base C. **2**

Base A ______________________________

Base C ______________________________

(ii) The sequence shown is only 5% of the bases in this strand.

Calculate the total number of bases in this DNA strand. **1**

Space for calculation

______________ bases

(b) Name the type of molecule that proteins are made from. **1**

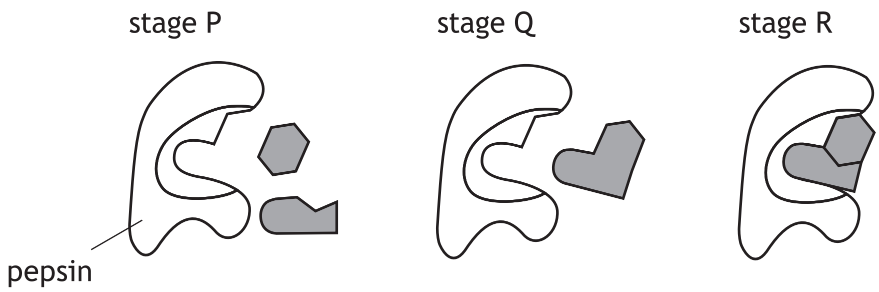
____

[Turn over

MARKS | DO NOT WRITE IN THIS MARGIN

4. Pepsin is an enzyme involved in the digestion of proteins, which is a degradation reaction.

The diagram represents three stages that occur in this reaction.



(a) (i) Using letters from the diagram, put the stages into the correct order to show this degradation reaction. **1**

stage ________ → stage ________ → stage ________

(ii) Describe the feature of pepsin that allows it to bind to only one substrate. **1**

____

____

(b) The graph shows the results of an experiment to investigate the effect of pH on pepsin activity.

Use the graph to identify the optimum pH of pepsin. **1**

pH ____________

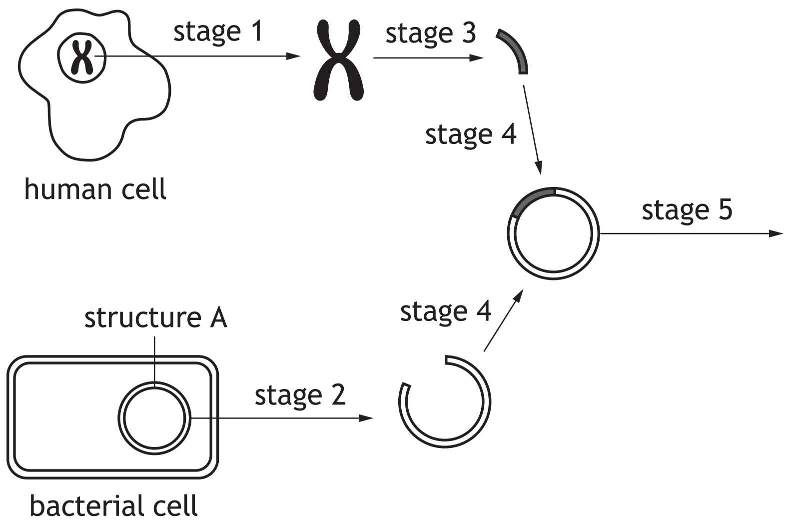
(c) Enzymes can be denatured by changes in pH.

Give a reason why the rate of reaction will be affected. **1**

____

____

5. The diagram shows some of the stages in the transfer of a section of DNA from one cell to another.



(a) Name the process shown by the diagram. **1**

____

(b) Name structure A. **1**

____

(c) Describe what happens during stage 5. **1**

____

____

[Turn over

MARKS | DO NOT WRITE IN THIS MARGIN

6. An investigation was carried out into the effect of modifying cotton plants on the yield of cotton.

Three farms had two fields of cotton, one of each type: original and modified.

The yields of both types were recorded.

The results are shown in the table.

	Yield of cotton (kg)	
Farm	**Original type**	**Modified type**
1	340	510
2	240	348
3	380	540

(a) Calculate the percentage increase in yield when using modified cotton in farm 2. **1**

Space for calculation

_______________ %

(b) (i) Identify the variable altered in this investigation. **1**

____

(ii) Suggest a variable that would have to be controlled to ensure validity. **1**

____

(c) The fields planted with the original type of cotton were used as a control.

Give a reason for using a control in **this** investigation. **1**

____

____

(d) Describe how the reliability of these results could be improved. **1**

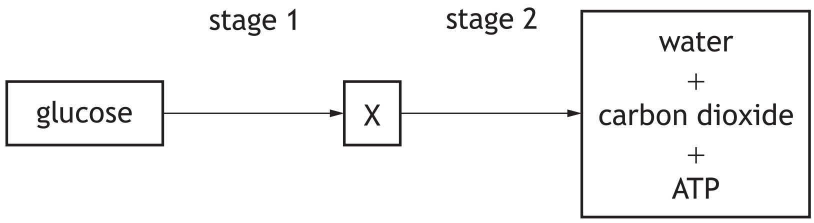
____

MARKS | DO NOT WRITE IN THIS MARGIN

7. Muscle cells can carry out different types of respiration.

(a) Name the type of respiration that yields the most ATP per glucose molecule. **1**

(b) The diagram shows a summary of one type of respiration in muscle cells.



(i) Name substance X. **1**

(ii) Name the substance that must be present for stage 2 to occur. **1**

(c) The number of mitochondria found in four different cells is shown in the table.

Cell	**Number of mitochondria per cell**
Red blood	0
Skin	800
Liver	1300
Muscle	7000

(i) Calculate the simplest whole number ratio of mitochondria in muscle cells to skin cells. **1**

Space for calculation

_____ : _____
muscle skin

(ii) State why a muscle cell requires more mitochondria than a skin cell. **1**

8. Tissue stem cells can be transplanted to replace blood cells.

(a) Describe the feature of stem cells that allows them to be used in this way. **1**

____

____

(b) To successfully treat a blood disorder, between 2 million and 4 million stem cells per kilogram of the patient's body mass are needed.

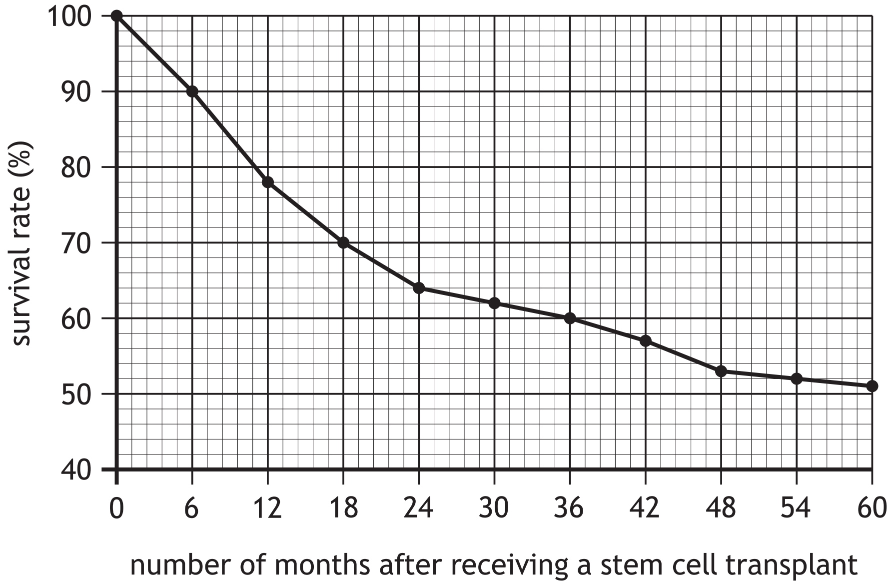
Calculate the **minimum** number of stem cells required to treat a patient with a mass of 78.5 kg. **1**

Space for calculation

______________ million

8. (continued)

(c) The graph shows the survival rates of patients with a blood disorder who have received a stem cell transplant.



(i) Identify the survival rate of patients 24 months after receiving a stem cell transplant. **1**

_____________ %

(ii) Describe the relationship between the number of months after receiving a stem cell transplant and the survival rate. **1**

____

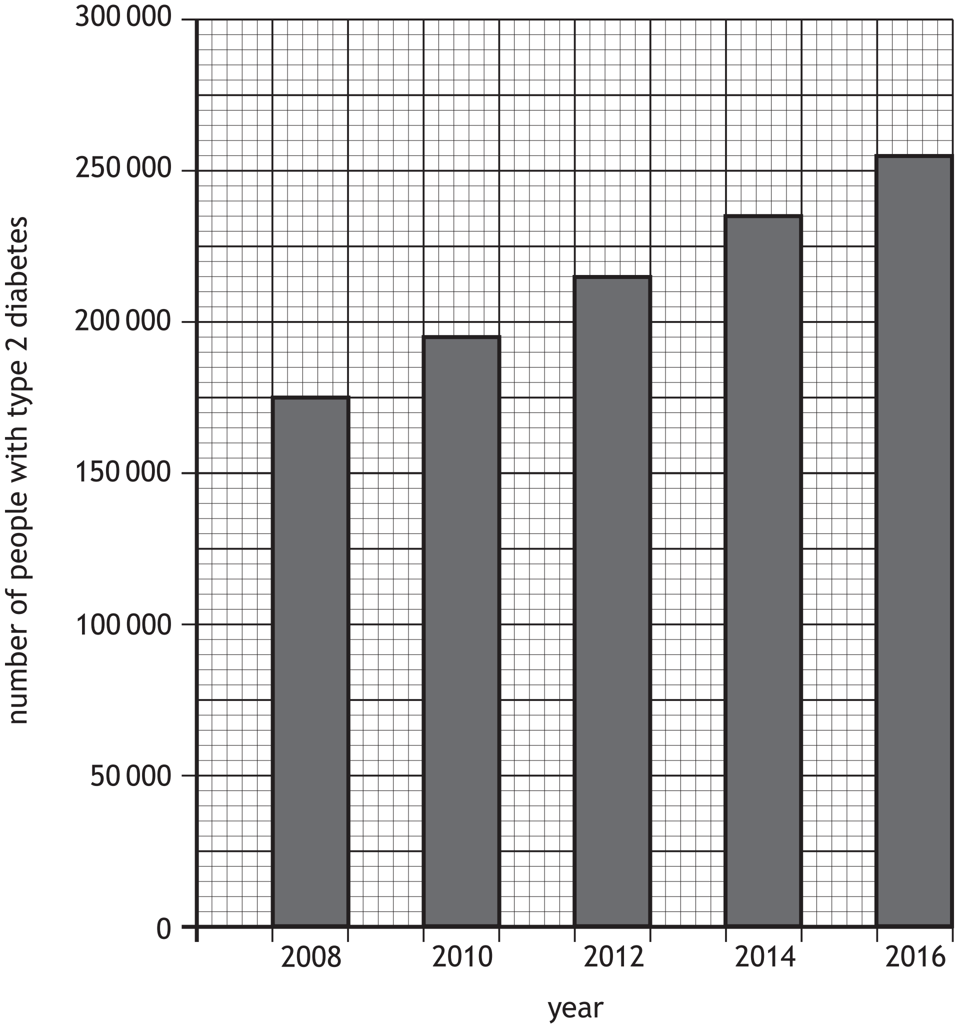
____

(d) Other than tissue, name another type of stem cell. **1**

____

[Turn over

9. The graph shows the number of people in Scotland with type 2 diabetes over a period of nine years.



(a) (i) Identify the number of people with type 2 diabetes in 2012. **1**

(ii) If the trend shown continued, predict the number of people that would be expected to have type 2 diabetes in 2018. **1**

MARKS DO NOT WRITE IN THIS MARGIN

9. (continued)

(b) Insulin is a hormone involved in the regulation of blood glucose.

(i) Insulin has an effect on cells in the liver.

Explain why insulin does not affect cells in other organs. **1**

____

____

(ii) Describe the reaction that occurs in the liver cells in response to insulin. **1**

____

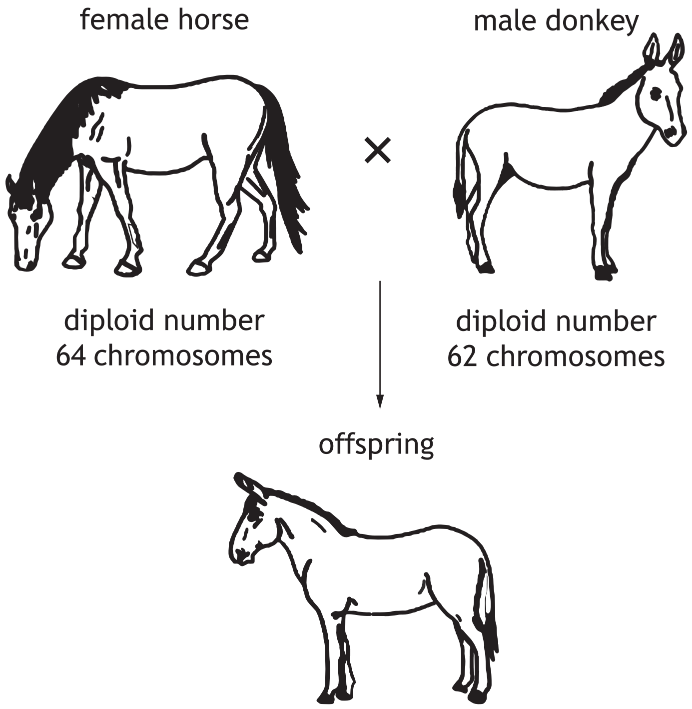
(c) Name the type of glands that release hormones into the bloodstream. **1**

____

[Turn over

10. The diagram shows a cross between a horse and a donkey and the resulting offspring.

The diploid number of chromosomes for the horse and donkey are given.



(a) The horse and the donkey produce gametes required for reproduction.

(i) Name the type of gamete produced by the female horse in this cross. **1**

____

(ii) Name the organ where the gametes of the male donkey are produced. **1**

____

(b) Name the cell produced when the nuclei of male and female gametes fuse. **1**

____

(c) (i) State the diploid number of chromosomes in the offspring in this cross. **1**

____

(ii) This offspring is not fertile.

Using this information, give a conclusion about horses and donkeys. **1**

____

____

11. Faeces is the waste material that remains after food has been digested and the nutrients absorbed.

Clostridium difficile (*C. difficile*) is a bacterium found in the gut that is usually harmless. However, in some people there can be an overgrowth of *C. difficile*, resulting in persistent diarrhoea that can sometimes be life-threatening.

A recent study developed a capsule containing frozen faeces from healthy donors to treat diarrhoea caused by *C. difficile*.

Twenty patients with diarrhoea caused by *C. difficile* were each given 30 capsules over an eight-week period.

No serious side effects were reported in the study group, and diarrhoea was cured in 14 of the 20 patients. The 6 who did not respond were treated again in the same way and 4 of them were then cured. This was considered a success as 18 of the 20 patients no longer suffered from persistent diarrhoea.

(a) Using the information in the passage:

(i) identify the type of pathogen that causes persistent diarrhoea **1**

____

(ii) suggest the aim of the study described in the passage. **1**

____

____

(b) Suggest why each patient was given the same number of capsules. **1**

____

____

(c) Calculate the percentage of patients who were cured after one treatment with the capsules. **1**

Space for calculation

__________ %

(d) Name the system in the human body involved in destroying pathogens. **1**

____

12. High altitude training is an important part of athlete preparation for endurance sports such as long-distance running.

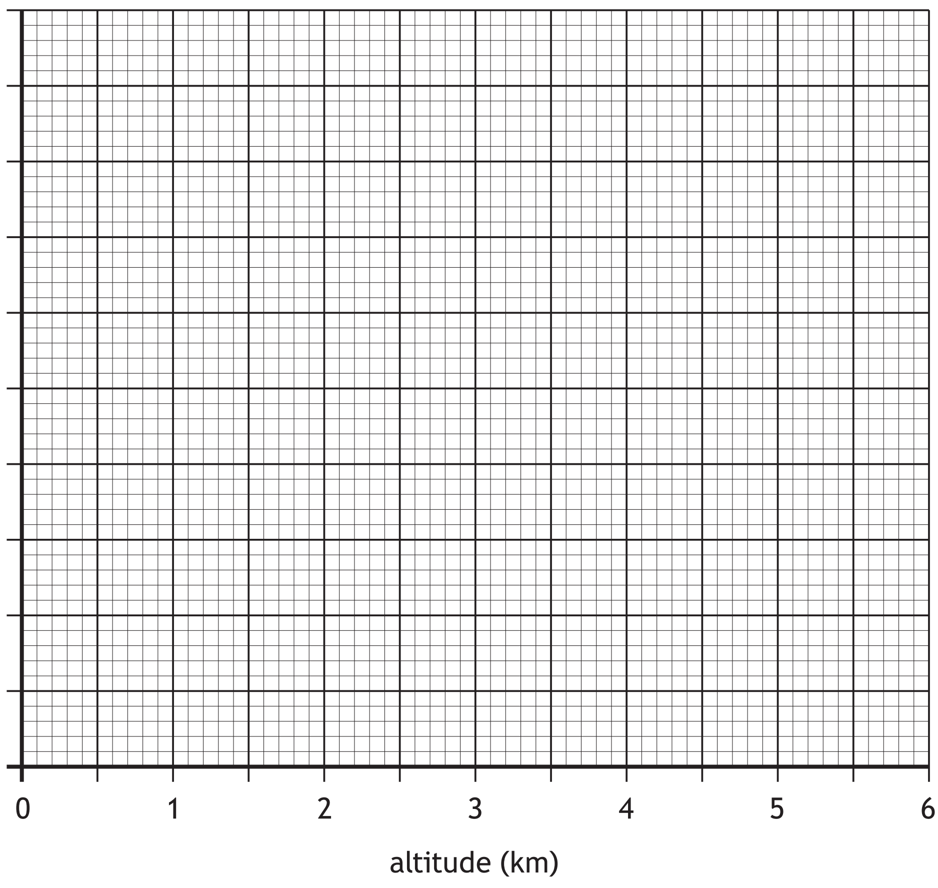
As altitude increases the oxygen concentration of the air decreases.

The table shows the effect of training at different altitudes on athletes' red blood cell count.

Altitude (km)	Average red blood cell count (million/ml of blood)
0	4.4
0.5	5.0
1.0	5.6
2.5	6.2
3.5	7.4
5.0	8.8
5.5	9.4

(a) (i) On the grid complete the vertical axis and plot a line graph to show the effect of altitude on average red blood cell count. **2**

(An additional grid, if required, can be found on *page 26*.)



12. (a) (continued)

(ii) Describe the relationship between altitude and red blood cell count. **1**

____

____

(iii) **Using information from the table**, predict the average red blood cell count of an athlete training at an altitude of 3.0 km. **1**

________________ million/ml of blood

(b) Red blood cells are important for transporting oxygen.

(i) In what form is oxygen transported by red blood cells? **1**

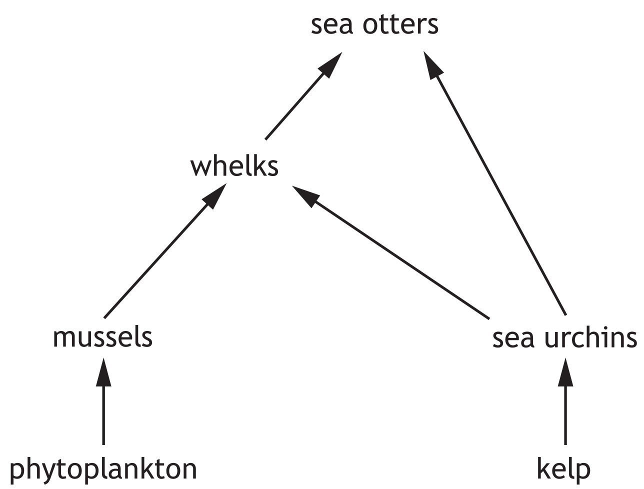
____

(ii) Give one structural feature of a red blood cell that allows it to carry out its function efficiently. **1**

____

[Turn over

13. The food web represents a marine ecosystem in the west coast of Scotland.



(a) Give an ecological term that describes the sea urchins. **1**

____

(b) Pollution from microplastics has led to a decline in the mussel population.

Predict the effect of a decrease in mussels on the sea otter population and explain your answer. **2**

Effect on sea otter population ______________________________

Explanation ______________________________

____

13. (continued)

(c) Marine biologists investigated the effect of salt concentration on the number of microplastic particles in mussel body tissue.

The results are shown in the table.

Salt concentration (ppb)	**Number of microplastic particles per 1 g of mussel body tissue**
31	4
33	8
36	20

A mussel with a mass of **5 g** was found to contain 20 particles of microplastics in its body tissue.

Identify the salt concentration the mussel was found in. **1**

Space for calculation

________________ ppb

[Turn over

14. Students surveyed an area of woodland and recorded the tree species growing there.

(a) The table shows some features that can be used to identify the trees.

Tree	Needle colour	Needle arrangement	Cones
Scots pine	blue-green	in pairs	point outwards from stem tip
Norway spruce	green underside	around the branch	point downwards
Douglas fir	grey underside	around the branch	point downwards
Larch	light green	in clusters	point outwards along the stem
Yew	green	in two rows along the branch	absent

Use the information in the table to complete the key. **3**

1.	Cones are absent	Yew
	Cones are present	go to 2
2.	Cones point downwards	
	Cones do not point downwards	go to 4
3.	Underside of the needle is grey	
	Underside of the needle is green	Norway spruce
4.	Needles arranged in pairs	Scots pine
		Larch

14. (continued)

(b) The students also investigated the effect of soil moisture on the number of Scots pine seedlings growing on the woodland floor.

(i) The students recorded the soil moisture and number of seedlings at 10 sample sites in the woodland.

Suggest why 10 sample sites were used. **1**

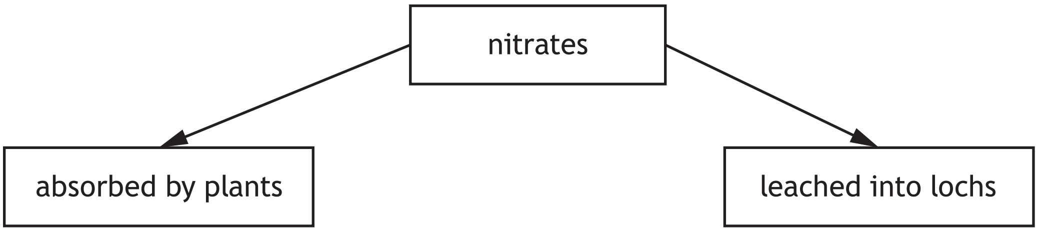
(ii) The students used a moisture meter to measure the soil moisture.

Describe what the students should have done each time they used this apparatus to minimise error. **1**

[Turn over

15. Farmers use fertilisers with a high nitrate content to increase the yield of crops.

The diagram shows two possible fates of nitrates in fertilisers.



Describe how the leaching of nitrates can result in a reduction in the number of freshwater organisms in lochs. **4**

MARKS | DO NOT WRITE IN THIS MARGIN

16. Photosynthesis is a two-stage process that takes place in the leaves of green plants.

(a) State the source of energy for the first stage. **1**

____

(b) (i) Name the process by which oxygen moves out of the leaf through stomata. **1**

____

(ii) The number of stomata on both surfaces of five leaves was counted and averages calculated.

The results are shown in the table.

Leaf	**Number of stomata**	
	Upper surface	**Lower surface**
1	4	12
2	20	23
3	8	15
4	12	22
5	16	
Average	12	18

Complete the table to include the number of stomata on the lower surface of leaf 5. **1**

Space for calculation

(iii) Name a substance that enters the leaf through stomata. **1**

____

(c) (i) Describe how sugar is produced in the second stage of photosynthesis. **1**

____

____

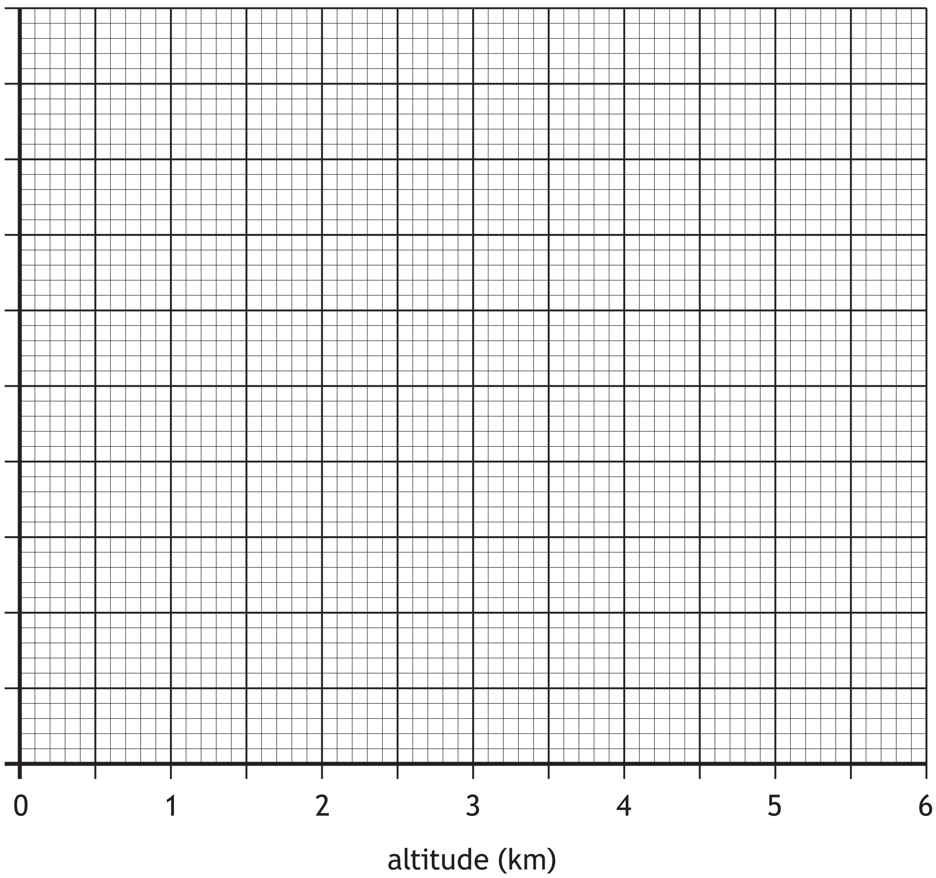
(ii) Name one substance that the sugar produced could be converted into. **1**

____

[END OF QUESTION PAPER]

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional grid for question 12 (a) (i)



MARKS DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

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ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK