FOR OFFICIAL USE

N5

National Qualifications 2022

Mark

X807/75/01

Biology
Section 1 — Answer grid and Section 2

THURSDAY, 19 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.

SQA ©

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:

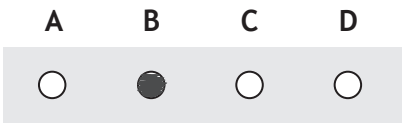
A humerus

B femur

C tibia

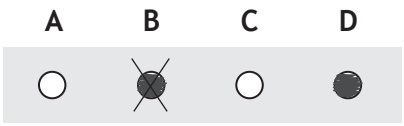
D fibula.

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

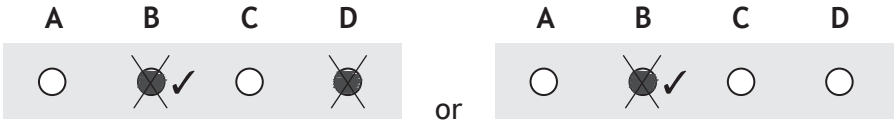


Changing an answer

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

0BJ25AD1

	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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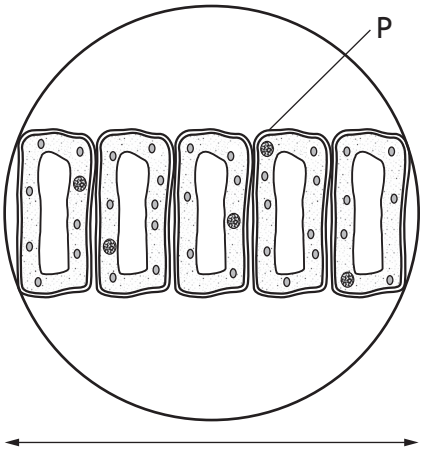
DO NOT WRITE ON THIS PAGE

SECTION 2 — 75 marks

Attempt ALL questions

1. Palisade mesophyll cells are found in leaves and carry out photosynthesis.

The diagram shows a layer of these cells viewed under a microscope.



0.25 mm
(1 mm = 1000 μm)

(a) (i) Name structure P. **1**

_____

(ii) Calculate the average width of a single palisade mesophyll cell in micrometres (μm). **1**

Space for calculation

_____ μm

(b) Describe the difference that would be found in the ultrastructure of plant cells that do not carry out photosynthesis. **1**

_____

[Turn over

2. The diagram represents a section of DNA.



(a) Give the term used to describe the structure of a DNA molecule. **1**

_____

(b) The following results show an analysis of the DNA bases contained in a cell.

DNA Base	Composition (%)
X	28
Guanine	22
Y	22
Z	28

Which letter in the table represents the base cytosine? **1**

_____

2. (continued)

(c) (i) Name the type of molecule coded for by a section of DNA. **1**

_____

(ii) A mutation occurred in a section of DNA as shown.

original code	C A T G T A A A T
mutated code	C A T C T A A A T

Describe the effect of this mutation on the molecule produced. **1**

_____

_____

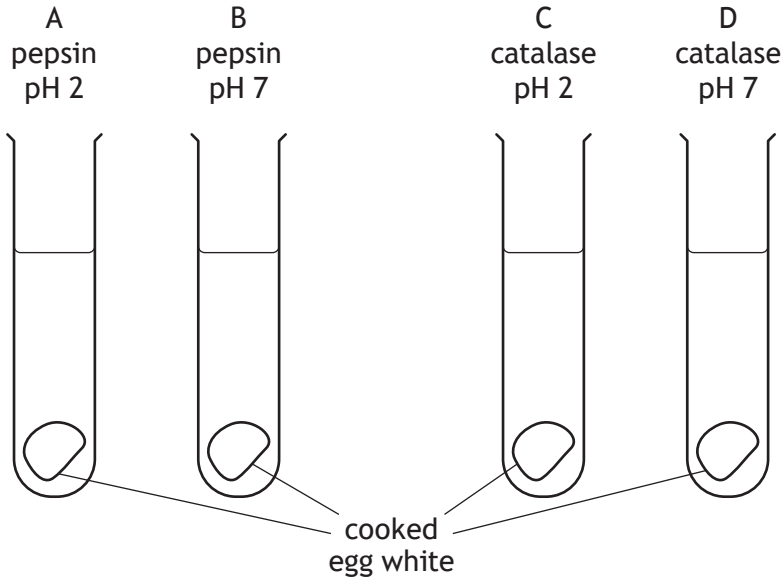
(iii) State one environmental factor that can increase the rate of mutation. **1**

_____

[Turn over

3. An investigation was carried out into the breakdown of cooked egg white by enzymes.

2 g of cooked egg white was placed in each of four test tubes containing different enzyme solutions at different pH levels as shown.



The test tubes were placed in a water bath at 37 °C for 2 hours.

The cooked egg white was then removed and weighed.

The results are shown in the table.

Test tube	Mass after 2 hours (g)	Change in mass (g)	% change in mass
A	0.3		85.0
B	1.9	0.1	5.0
C	2.0	0	0
D	2.0	0	0

(a) Complete the table by calculating the change in mass of the egg white in test tube A. **1**

Space for calculation

3. (continued)

(b) (i) Explain why the change in mass in test tube B was less than in test tube A. **1**

(ii) Explain why there was no change in mass in test tubes C and D. **1**

(c) If the investigation was repeated at 70 °C, describe the change in the:

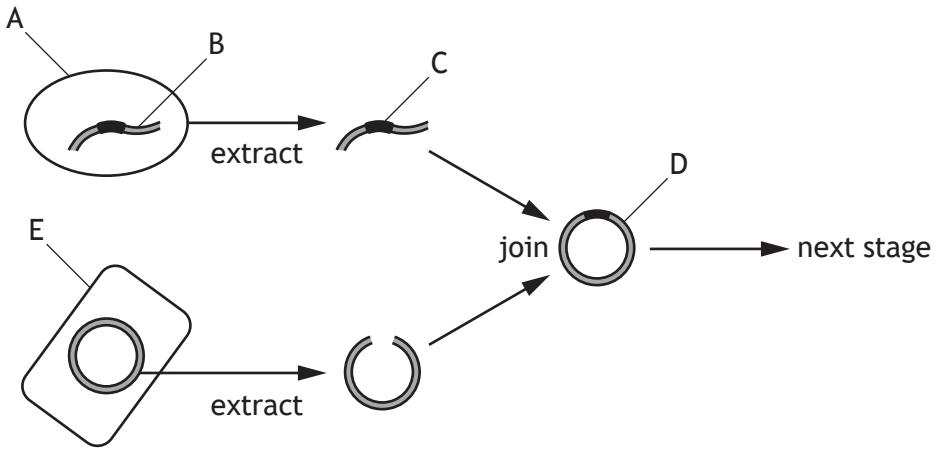
(i) structure of the active site of the enzymes **1**

(ii) rate of the reaction in test tubes A and B. **1**

[Turn over

4. Describe similarities and differences in the process of fermentation in yeast cells and muscle cells. **4**

5. Penicillin was the first antibiotic used to treat bacterial infections.
Bacteria have been genetically engineered to produce large quantities of penicillin.
The diagram represents some stages of this process.



(a) Using information from the diagram, complete the table. **3**

Structure	Letter
Bacterial cell	
Gene for penicillin	
	D

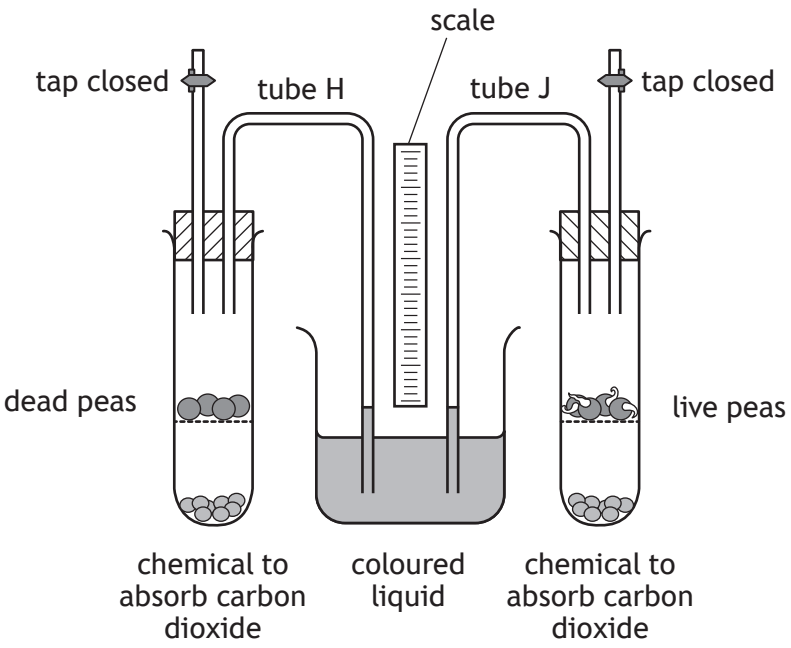
(b) Describe the next stage in the production of penicillin. **1**

_____

_____

[Turn over

6. The following apparatus was set up to investigate aerobic respiration in peas.



When peas respire this alters the composition of the gases in the test tubes, causing a change in the liquid levels in tubes H and J.

Liquid levels were recorded as shown in the table.

	Liquid level (mm)		
Tube	**At start**	**30 minutes**	**60 minutes**
H	0	0	0
J	0	25.5	40.8

(a) Explain why the same number of peas were placed in both test tubes. **1**

_____

_____

(b) Calculate the percentage increase between the 30 minute and 60 minute readings in tube J. **1**

Space for calculation

_____ %

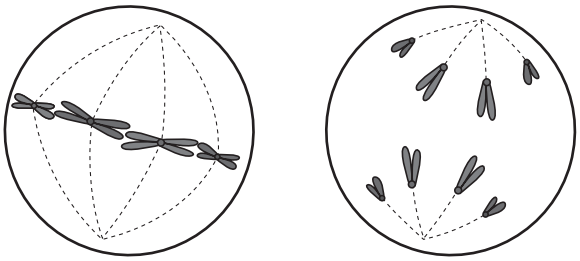
6. (continued)

(c) Give a suitable conclusion for this investigation. **1**

(d) Suggest an improvement to this investigation that would make the results more reliable. **1**

[Turn over

7. (a) Two stages of mitosis are shown in the diagrams.



stage B stage C

(i) Name the structures that pull the pairs of chromatids apart. **1**

_____

(ii) Describe what happens immediately after stage C. **1**

_____

_____

(b) Stem cells can divide in order to self-renew.

State the feature of stem cells that gives them the potential to develop into different types of cell. **1**

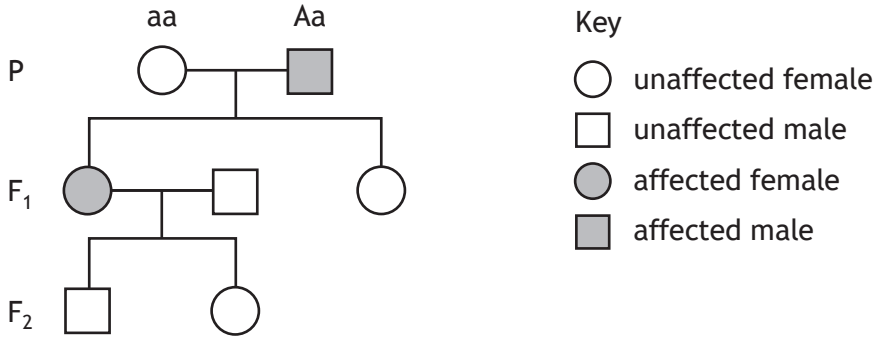
_____

8. Cholesterol is a fatty substance found in blood. High cholesterol levels can be caused by a condition known as familial hypercholesterolemia (FH).

The following diagram shows part of a family tree showing the inheritance of FH.

'A' represents the FH allele.

'a' represents the non-FH allele.



(a) Use the information given about the male in the parental generation to explain how it is known that the FH allele is dominant. **1**

_____

_____

_____

(b) The unaffected female in the F_2 generation has a child with a male who is homozygous dominant for FH.

State the percentage chance of their child having FH. **1**

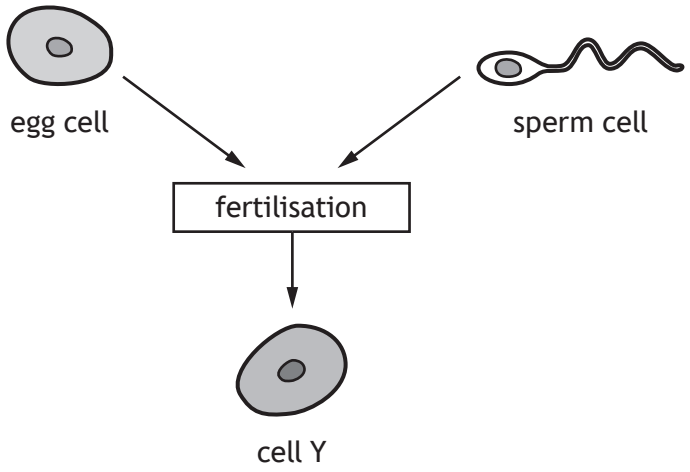
_____%

(c) Identify the type of variation shown by FH. **1**

_____

[Turn over

9. The diagram shows the process of fertilisation in animals.



(a) Name the organ that produces egg cells. **1**

_____

(b) Underline one option in the brackets to complete the following sentence. **1**

Cell Y contains a { haploid / diploid } number of chromosomes.

9. (continued)

(c) In vitro fertilisation (IVF) is a technique that can be used to help people with fertility problems to have a baby.

The table shows the results of IVF treatments for women of different ages.

Age of woman (years)	IVF treatments resulting in births (%)
Under 35	32.2
35–37	27.7
38–39	22.0
40–42	14.0
43–44	4.4
45+	1.9

(i) Calculate how many times greater the chance of a 38 year old woman giving birth to a baby is compared to that of a 44 year old woman. **1**

Space for calculation

_____ times greater

(ii) Calculate the number of births likely to occur if an IVF clinic treated 250 women aged 41. **1**

Space for calculation

_____ births

(d) One of the causes of fertility problems is that some sperm are unable to swim to the egg due to a lack of energy.

Name the organelle that is low in number in these affected sperm. **1**

_____

[Turn over

10. Multicellular organisms require efficient communication amongst their cells, tissues and organs.

(a) (i) Name the chemical messengers carried from one part of the human body to another in the blood. **1**

_____

(ii) Explain why only the target tissues are affected by these chemical messengers. **2**

_____

_____

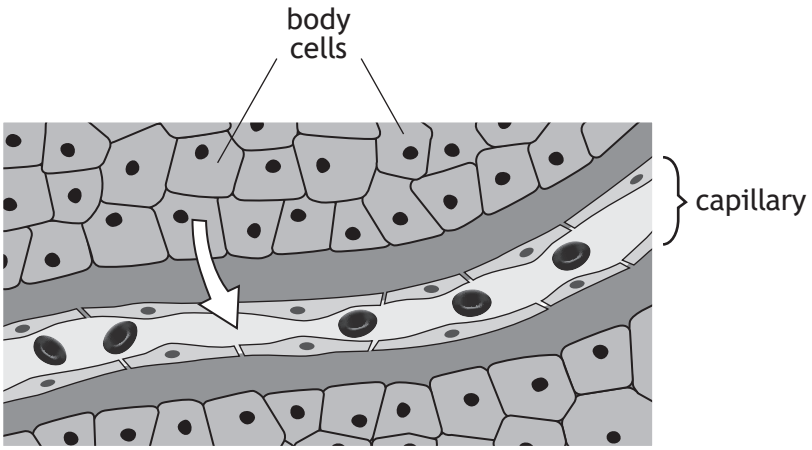
_____

(b) Chemical messengers are also found in plants.

Name a transport structure through which these chemicals could flow to move around the plant. **1**

_____

11. The diagram represents a blood capillary passing through the body cells of a mammal.



(a) Name a gas that is transported in the direction shown by the arrow in the diagram and name this method of transport. **2**

Gas _____

Method of transport _____

(b) Give a feature of a capillary network that increases the efficiency of absorption of materials. **1**

_____

[Turn over

12. Measles in the UK

Measles is a disease that can be prevented through two doses of the MMR vaccine. The target set by health experts to achieve measles-free status is to have at least 95% of the population vaccinated. The World Health Organization declared the UK measles-free in 2016.

However, since 2016, cases of measles in the UK have been increasing, with too few people being vaccinated. It was suggested by experts that when measles cases became less common, some people believed that the threat of the disease was less. Another factor was the publication in the late 1990s of a controversial, and since discredited, piece of research wrongly linking the MMR vaccine with autism.

In 2018, there was a marked increase in reported cases, with 994 cases in England and Wales, compared with 284 cases in 2017. There were 307 cases across the UK during the first three months of 2019. In 2019, only 87% of the population in England received their second dose of MMR. In both Wales and Scotland it was 92%, and in Northern Ireland it was 91%.

(a) Measles is caused by a pathogen.

State the meaning of the term 'pathogen'. **1**

(b) (i) Describe the relationship between the uptake of the vaccine and the number of cases of measles. **1**

(ii) Suggest a reason why the uptake of the vaccine in the UK has been lower since 2016. **1**

12. (continued)

(c) Calculate the simplest, whole number ratio, of measles cases in England and Wales in 2017 to 2018. **1**

Space for calculation

_____ : _____ cases
2017 2018

(d) Using data from the passage, explain why Scotland lost its measles-free status in 2019. **1**

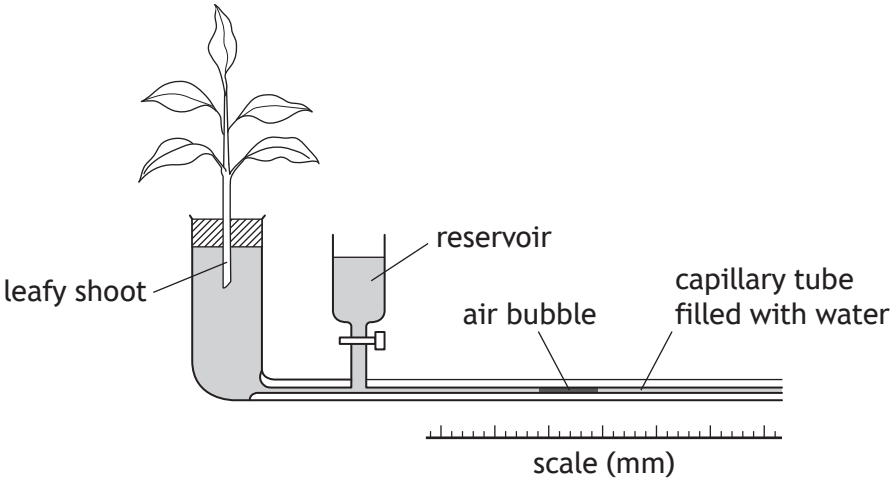
_____

_____

[Turn over

13. The apparatus shown can be used to investigate the effect of the total leaf surface area on the rate of water uptake.

The rate of water uptake can be calculated by measuring the distance the air bubble moves along the capillary tube in a set time.



(a) Name this apparatus. **1**

_____

(b) The apparatus was set up and the distance moved by the bubble in 10 minutes was recorded. One of the leaves was then removed from the plant and the distance moved by the bubble was measured over another 10 minute period. This was repeated until only one leaf remained.

The results are shown in the table.

Number of leaves	Distance moved by bubble in 10 minutes (mm)
5	85
4	69
3	52
2	12
1	8

With reference to the aim, give a conclusion for this investigation. **1**

_____

_____

13. (continued)

(c) (i) Name the process responsible for the movement of water and its evaporation from the leafy shoot. **1**

_____

(ii) Water evaporates from leaves through stomata.

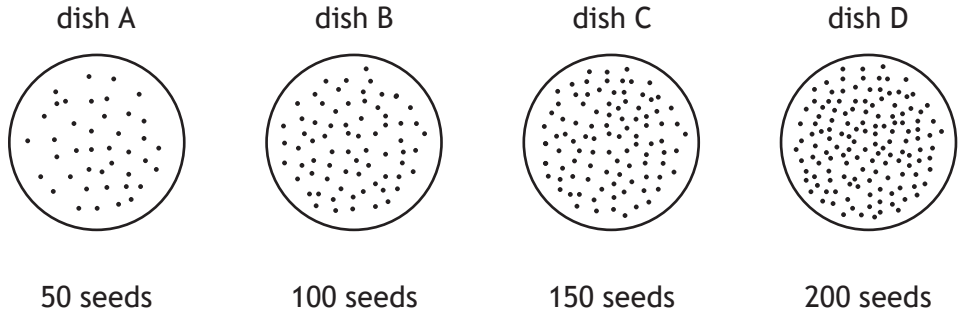
Name the cells surrounding the stomata that control their opening and closing. **1**

_____

[Turn over

14. A student set up four Petri dishes of equal size to investigate competition in cress seeds of the same species. The seeds were scattered on moist filter paper and left to germinate (grow) in the dark.

MARKS DO NOT WRITE IN THIS MARGIN



(a) (i) Identify a variable, not already mentioned, that should have been kept the same for each dish. **1**

_____

(ii) The number of seeds germinating in each dish was counted.

The table shows the results.

Dish	Seeds per dish	Number of germinating seeds	Germinating seeds (%)
A	50	45	90
B	100	80	80
C	150		60
D	200	60	30

Complete the table by calculating the number of germinating seeds in dish C. **1**

Space for calculation

(iii) Competition was greatest in dish D.

Explain why this conclusion was drawn. **1**

_____

_____

14. (continued)

(b) Name the type of competition that occurs among these germinating seeds. **1**

_____

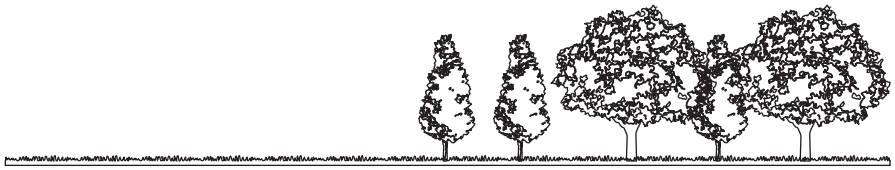
(c) Explain why competition in ecosystems occurs. **1**

_____

_____

[Turn over

15. Light intensity readings were taken at 5 sites along a transect line running from an open field to a woodland.



(a) Name the apparatus used to measure light intensity and give one precaution that should be taken when using it to minimise error. **2**

Apparatus _____

Precaution _____

_____

(b) Three readings were taken at each site at the same time on different days. The results are shown in the table.

Site	Light intensity reading (lux)		
	Day 1	Day 2	Day 3
1	18 160	17 845	18 180
2	11 500	11 306	11 494
3	14 600	14 550	14 590
4	5300	4800	5275
5	3600	3200	3610

(i) Suggest a reason why the readings taken on day 2 were lower than the readings on days 1 and 3. **1**

_____

_____

15. (b) (continued)

(ii) Explain why three readings were taken at each site. **1**

_____

_____

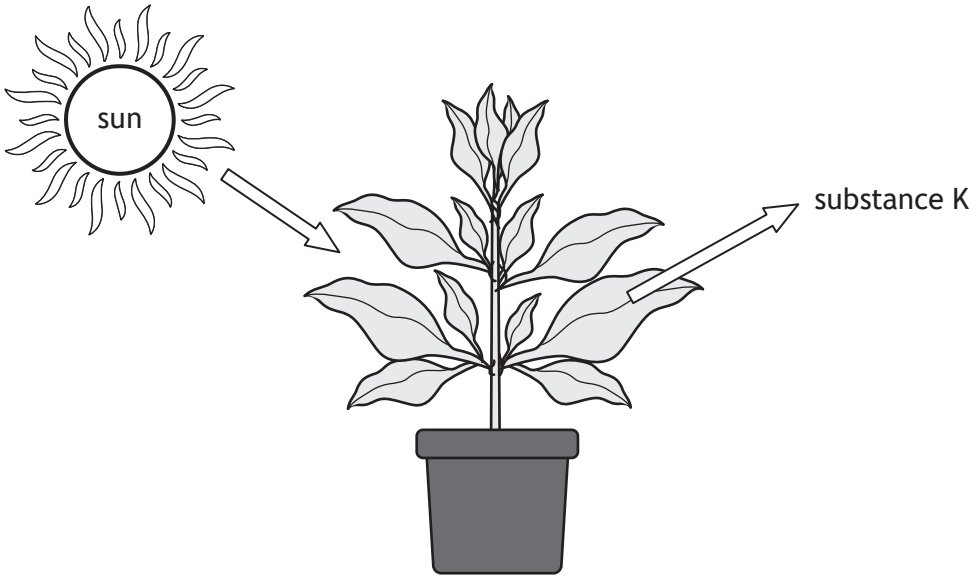
(c) Light intensity is an example of an abiotic factor.

Name one other abiotic factor. **1**

_____

[Turn over

16. When light is absorbed by a plant, photosynthesis takes place and as a result substance K is released from the leaves.



(a) Name substance K. **1**

_____

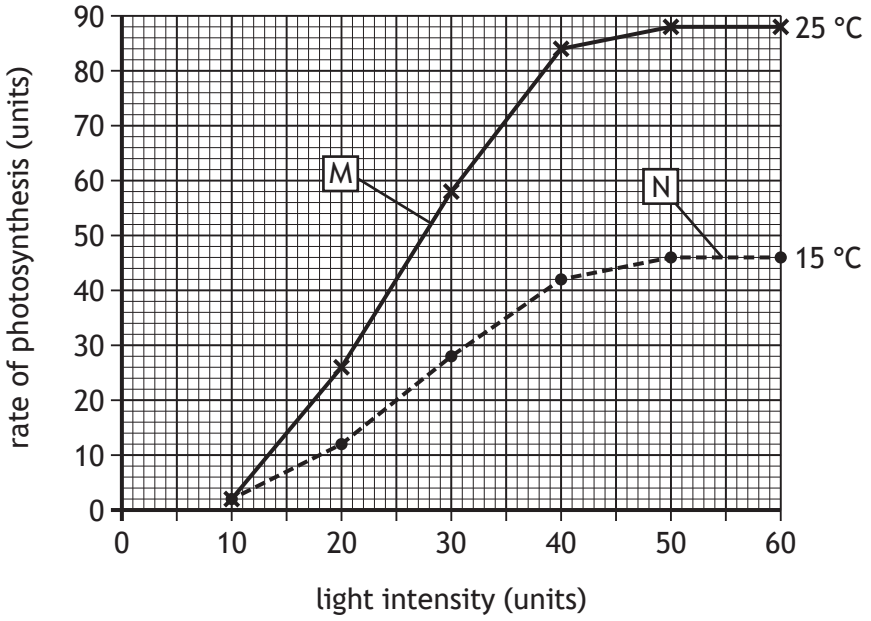
(b) Describe the energy change that takes place during the first stage of photosynthesis. **1**

_____

_____

16. (continued)

(c) The graph shows the effect of increasing light intensity on the rate of photosynthesis at two different temperatures. All other factors were kept constant.



Identify the limiting factor at each of the points M and N. **2**

M _____

N _____

[Turn over

17. A study was carried out to investigate the effect of using the chemicals ethanol and methanol on bacterial growth.

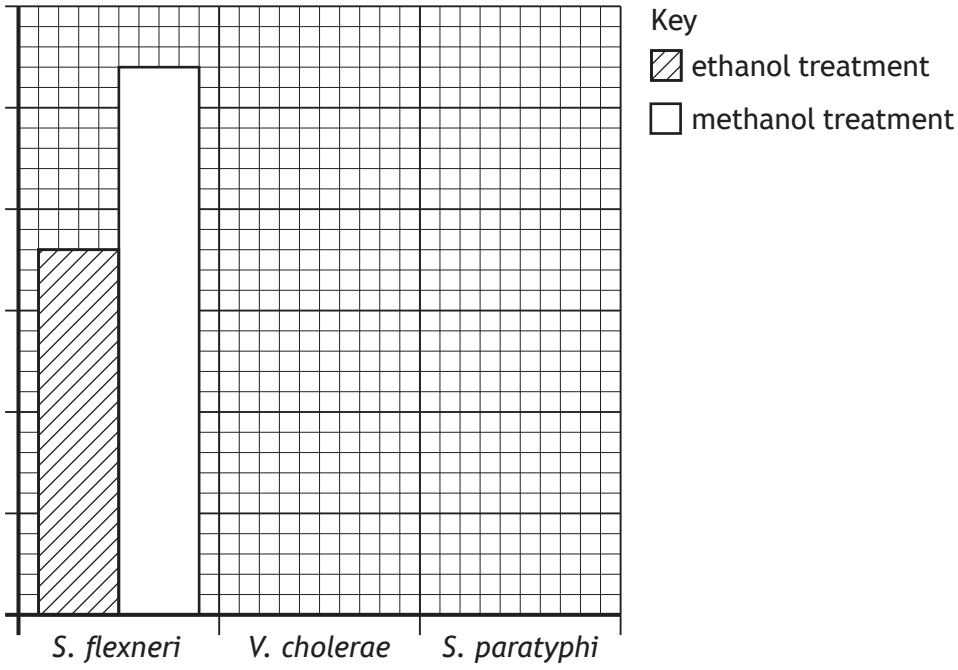
Controls without either chemical were also set up.

The results in the table show the growth of three species of bacteria as a percentage of the overall bacterial growth in the control experiment.

Species of bacteria	Bacterial growth (percentage of control)	
	Ethanol treatment	Methanol treatment
S. flexneri	36	54
V. cholerae	45	44
S. paratyphi	4	12

(a) On the grid, complete the vertical axis by adding a label and scale, and plot the remaining bars to show bacterial growth for *V. cholerae* and *S. paratyphi*. **2**

(An additional grid, if required, can be found on *page 33*.)



17. (continued)

(b) It was concluded that ethanol was more effective than methanol at preventing bacterial growth.

Tick one box to identify whether this conclusion is valid or invalid.

Give a reason for your answer. **1**

valid ☐ invalid ☐

Reason _____

_____

(c) The researchers used a 6% ethanol solution in their study.

Predict the effect of using a 3% ethanol solution instead, on the growth of the bacteria. **1**

_____

_____

[Turn over

18. (a) Plant growth can be improved if the soil has a suitable nitrate content.

(i) Describe the use of nitrates in a plant. **1**

_____

(ii) Nitrates can be found in compost.

The table gives some information about the nutrient content of three different composts.

Type of compost	Carbon content (g/100 g)	Nitrogen content (g/100 g)	Carbon : Nitrogen ratio
R	9.45	1.35	7:1
S	14.40		24:1
T	9.80	0.20	49:1

Complete the table by calculating the nitrogen content in 100 g of compost S. **1**

Space for calculation

(b) Nitrates can leach from the soil into nearby rivers.

(i) Give the term that describes the increased growth of algae caused by leached nitrates. **1**

_____

(ii) Explain how this increase in algae can cause aquatic plants in a river to die. **2**

_____

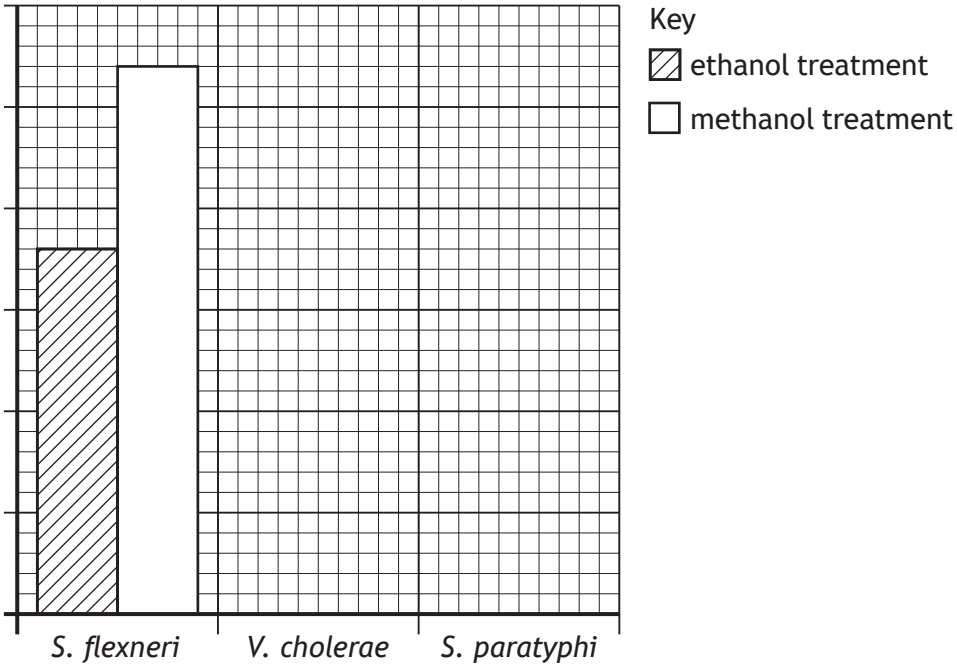
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[END OF QUESTION PAPER]

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional grid for question 17 (a)



MARKS | DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

MARKS | DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

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