FOR OFFICIAL USE

N5

National Qualifications 2024

Mark

X807/75/01

Biology
Section 1 — Answer grid and Section 2

WEDNESDAY, 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.

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

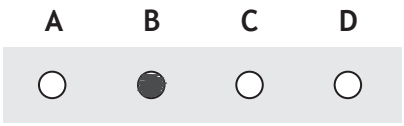
A humerus

B femur

C tibia

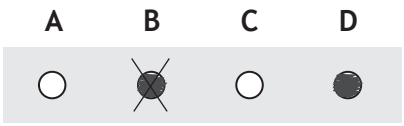
D fibula.

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

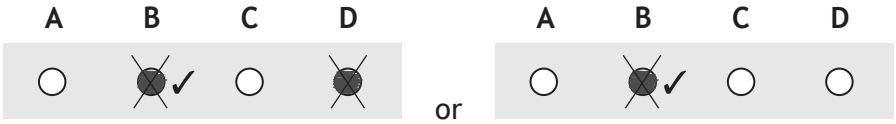


Changing an answer

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:



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You must record your answers to Section 1 questions on the answer grid on **page 03** of your **answer booklet**.

X807750103

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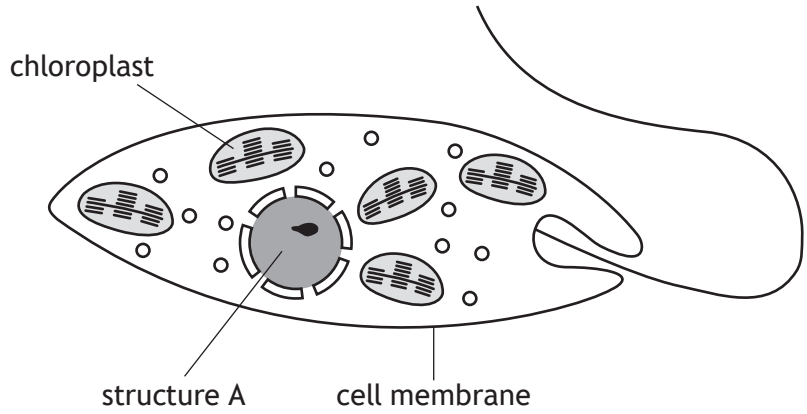
SECTION 2 — 75 marks

Attempt ALL questions

1. Euglena is a single celled organism found in water.

The diagram shows some of the structures within Euglena.



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

(ii) Give the function of a chloroplast. **1**

(b) Suggest why Euglena is **not** a typical plant cell. **1**

(c) The average body length of a Euglena is 50 micrometres.

They can travel 1.3 body lengths in one second.

Calculate how many micrometres a Euglena could travel in 30 seconds. **1**

Space for calculation

micrometres

2. A group of students measured the mass of pieces of turnip tissue before placing them in different concentrations of salt solution. After one hour, the change in mass of the turnip tissue was recorded.

The results are shown in the table.

Concentration of salt solution (g/100 cm^3)	Percentage change in mass (%)
1	+17
3	+11
6	–2
8	–9
10	–16

(a) Predict the percentage change in mass in a 2 g/100 cm^3 salt solution. **1**

[ ] %

(b) Identify the salt solution where most of the turnip cells would be turgid. **1**

[ ] g/100 cm^3

(c) The pieces of turnip used in this investigation all had a starting mass of 6 g.

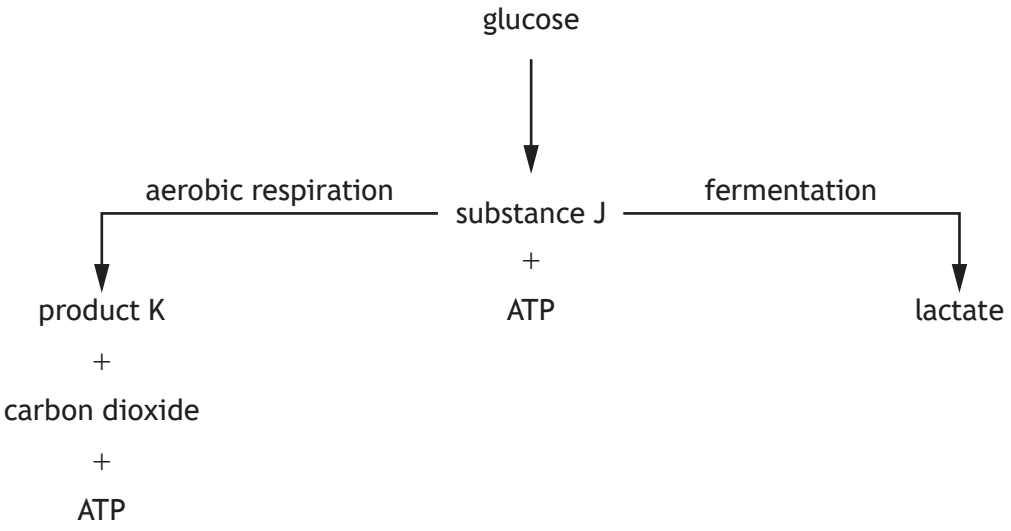
Calculate the final mass of the piece of turnip in the 8 g/100 cm^3 of salt solution. **1**

Space for calculation

[ ]

[ ] g

3. The diagram represents processes that generate ATP in muscle cells.



(a) (i) Name substance J and product K. **2**

Substance J

Product K

(ii) State the number of ATP molecules that would be produced from each molecule of glucose during fermentation. **1**

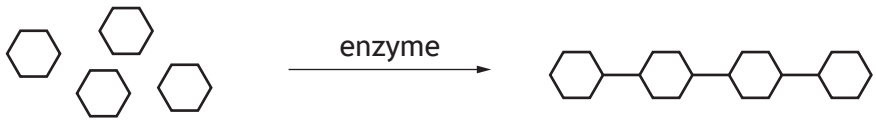
(b) Name the cell structure where aerobic respiration is completed. **1**

(c) Suggest why a muscle cell might carry out fermentation rather than aerobic respiration. **1**

[Turn over

4. Potatoes store sugar in the form of starch. Glucose-1-phosphate (G-1-P) molecules are converted to starch in an enzyme-controlled reaction.

This enzyme can be found in potato extract.



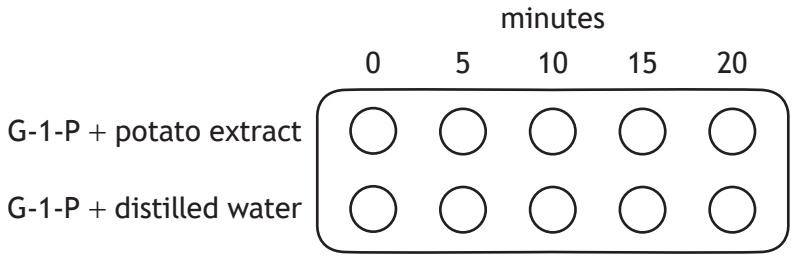
glucose-1-phosphate starch

(a) (i) Identify the type of reaction carried out by this enzyme. **1**

(ii) Identify the substrate in this reaction. **1**

(b) An experiment was set up to investigate the time taken for starch to be produced. All previously made starch was removed from the potato extract.

Two rows of a dimple tile were set up as shown in the diagram.



At 5-minute intervals the content of the dimples in each column was tested for the presence of starch.

The results are shown in the table.

	Starch present	
Time (minutes)	**G-1-P + potato extract**	**G-1-P + distilled water**
0	no	no
5	no	no
10	yes	no
15	yes	no
20	yes	no

4. (b) (continued)

(i) Suggest a reason for any previously made starch being removed from the potato extract. **1**

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

1

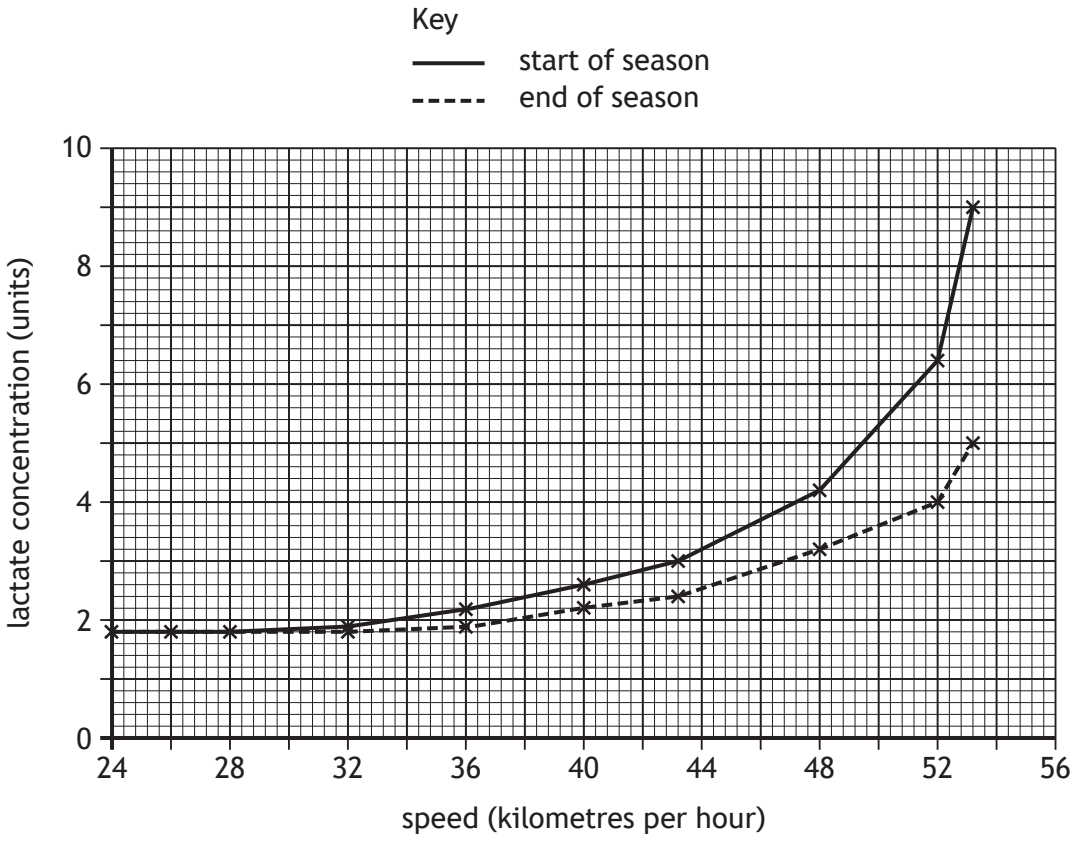
2

(iii) Explain how the results show that the enzyme is required for the reaction to occur. **1**

[Turn over

5. The concentration of lactate in the blood of a long distance cyclist was measured whilst cycling at different speeds.

The graph shows these measurements at the start and end of the competition season.



(a) What was the lactate concentration at the start of the season when the cyclist was travelling at 40 kilometres per hour? **1**

_____ units

(b) Calculate the percentage decrease in lactate concentration at the end of the season compared to the start of the season when the cyclist was travelling at 52 kilometres per hour. **1**

Space for calculation

_____ %

5. (continued)

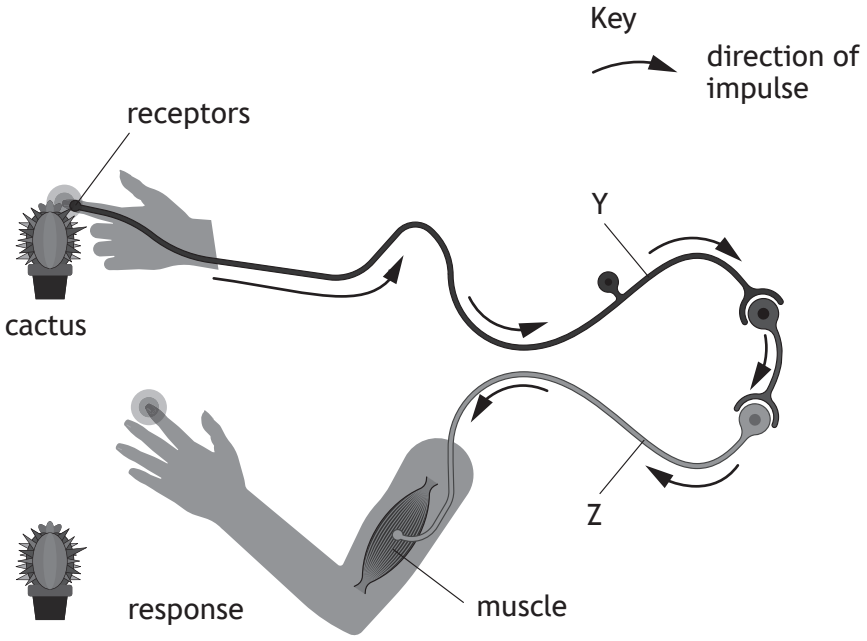
(c) Calculate how many times greater the maximum lactate concentration was at the start of the season compared to the end of the season. **1**

Space for calculation

times

[Turn over

6. The diagram represents a reflex arc when a person touches a cactus plant.



(a) (i) Identify neurons Y and Z. **2**

Neuron Y

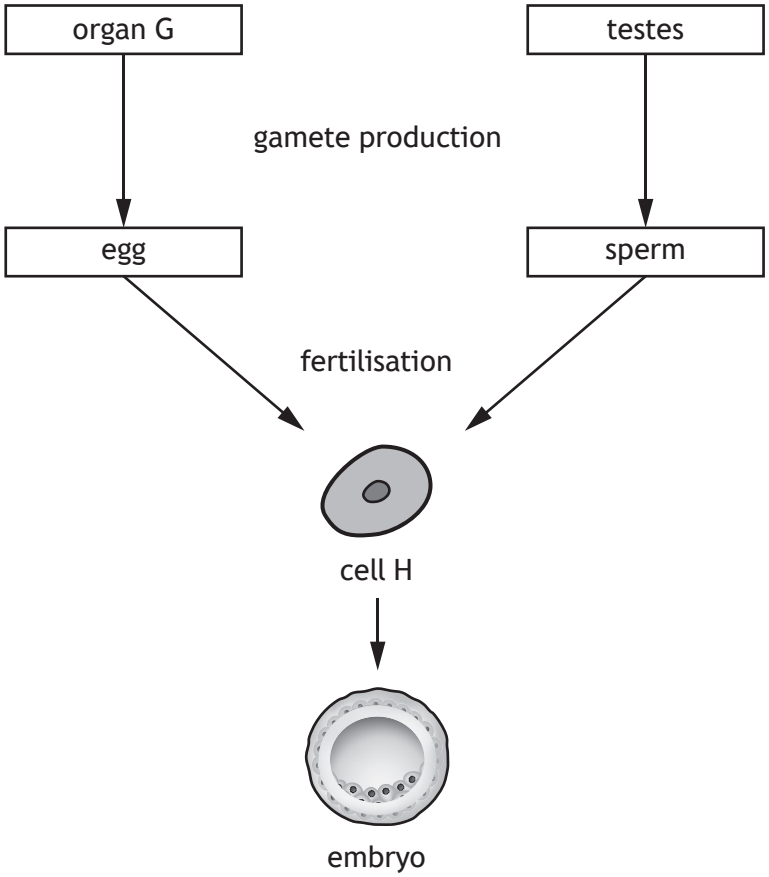
Neuron Z

(ii) State how messages are transferred at a synapse. **1**

(b) Identify the effector in this reflex arc. **1**

(c) State the function of a reflex. **1**

7. The diagram relates to reproduction in humans.



(a) (i) Name organ G. **1**

(ii) Describe what happens during fertilisation. **1**

(iii) Name cell H. **1**

(b) Name the unspecialised cells that can be obtained from an embryo at a very early stage. **1**

8. Progressive retinal atrophy (PRA) is a rare condition in some dogs, such as cockapoos, that can result in blindness.

PRA is caused by the inheritance of the recessive form of a particular gene, which is represented by **r**.

Depending on their genotype, a dog's phenotype can be described as **affected**, **unaffected** or a **carrier**.

A cockapoo breeder tested the DNA of a female dog and three male dogs before choosing which pair to breed. The results are shown in the table.

Dog	Genotype	Phenotype
Female	Rr	carrier
Male 1	Rr	carrier
Male 2	rr	
Male 3	RR	

(a) (i) **Complete the table** by adding the phenotype for male 2 and male 3. **1**

(ii) State the term used to describe the genotype of a carrier of PRA. **1**

(iii) The breeder selected a male based on their DNA results for this condition.

The offspring were as follows:

4 unaffected and 4 carriers

Which male was chosen to breed with the female? **1**

Male

8. (continued)

(b) Another breeder did not carry out DNA tests before breeding a pair of cockapoos. All their offspring were affected by PRA.

Give the genotypes of the parents in this cross. **1**

Male genotype ☐ × Female genotype ☐

(c) Give the term used to describe different forms of a gene. **1**

☐

[Turn over

9. Coronavirus is a pathogen, which causes COVID-19. Most people with COVID-19 feel better within a few days or weeks of their first symptoms. Long COVID can be diagnosed when symptoms last longer.

Symptoms of long COVID include extreme breathlessness, memory and concentration issues. In some cases, other organs can also be affected causing other health issues.

A study monitored changes in the health of 500 patients with long COVID.

Between the start and the end of the study, the percentage of patients with extreme breathlessness decreased from 38% to 30%, those with memory and concentration issues decreased from 48% to 38%, and those with other health issues decreased from 57% to 45%.

At the end of the study, 10% had no organs affected, 65% of patients had only one organ affected and 25% had multiple organs affected.

(a) Name the type of white blood cell that produces antibodies against coronavirus. **1**

(b) Using information from the passage, complete the table by adding:

(i) a column heading **1**

(ii) the relevant data. **1**

(An additional table, if required, can be found on *page 27*.)

	Percentage of patients (%)	
	Start of study	**End of study**
Extreme breathlessness		
Memory and concentration issues		
Other health issues		

9. (continued)

(c) Calculate the simple whole number ratio of the percentage of long COVID patients who had multiple organs affected, to those with one organ affected, to those with no organs affected. **1**

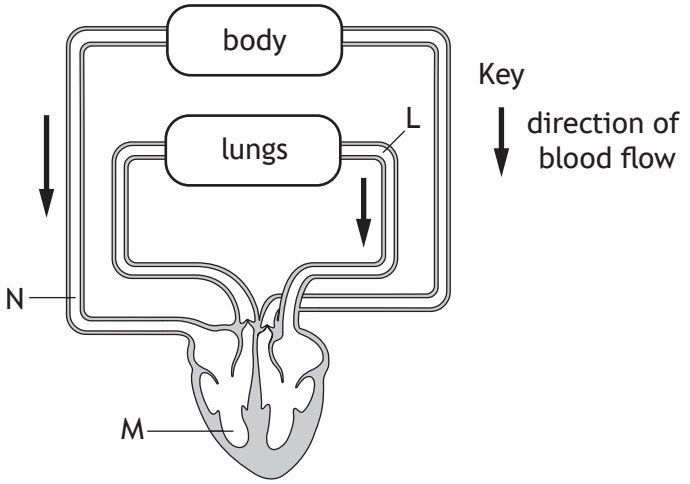
Space for calculation

	:		:	
multiple organs affected		one organ affected		no organs affected

(d) Suggest a reason why the study could be considered invalid. **1**

[Turn over

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



(i) Name the heart chamber labelled M. **1**

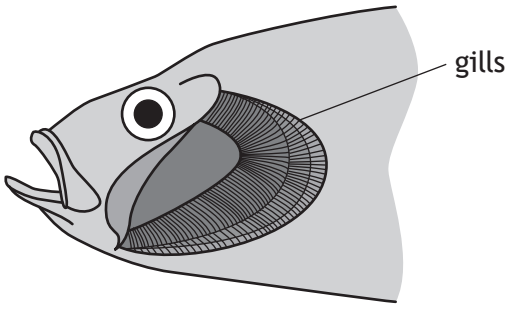
(ii) Compare the carbon dioxide concentrations in the blood travelling through blood vessels L and N. **1**

(b) The heart is composed of muscle tissue that requires its own blood supply.

(i) Name the blood vessel that supplies the heart tissue with blood. **1**

(ii) Explain why the heart muscle cells will stop contracting if this blood vessel becomes blocked. **2**

11. The gas exchange surfaces in fish are called gills. Gills absorb oxygen from water.



(a) Suggest two features of gills that increase the efficiency of absorption. **2**

1

2

(b) An investigation into the effect of water temperature on the breathing rate of fish was carried out. The results are shown in the table.

Water temperature (°C)	Average breathing rate (breaths/min)
4	4
10	26
14	56
20	79
26	100

Use these results to draw a conclusion for this investigation. **1**

[Turn over

12. Students investigated the distribution of some organisms on a rocky shore.

Starting at the lowest tide level, quadrats were placed every two metres along a single transect line and the number of barnacles and mussels were counted.

The results are shown in the table.

Position on shore	Quadrat number	Number of barnacles	Number of mussels
Low tide level ↓	1	7	60
	2	13	58
	3	18	55
	4	15	50
	5	24	32
	6	41	30
	7	42	18
	8	47	13
	9	53	4
High tide level	10	54	0

(a) (i) Calculate the average number of mussels per quadrat. **1**

Space for calculation

mussels

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

12. (continued)

(b) Another group of students conducted a study of 10 rock pools found along the transect.

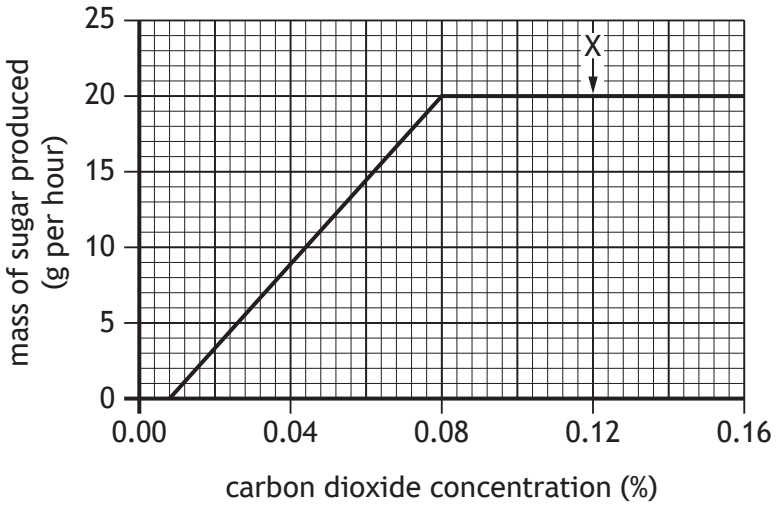
(i) To provide information about the levels of water pollution, samples of water were taken from these rock pools and examined for the presence or absence of certain species.

What name is given to these species? **1**

(ii) Name the type of factors, such as pH, that can affect the distribution of organisms living in rock pools. **1**

[Turn over

13. An experiment was carried out to investigate the effect of carbon dioxide concentration on the rate of photosynthesis. The rate of photosynthesis was measured by recording the mass of sugar produced per hour.



(a) (i) Describe the relationship shown between carbon dioxide concentration and the mass of sugar produced. **2**

(ii) Suggest one factor that could be limiting the rate of photosynthesis at point X in the graph. **1**

(b) (i) Hydrogen is a product of the light reactions and is required for carbon fixation.

Describe how this hydrogen is produced. **1**

(ii) The sugar produced during the carbon fixation stage can be converted into other substances, such as starch.

Name one other substance sugar can be converted into and state its role in the cell. **2**

Substance

Role

14. The following represents a food chain from a Scottish river.

pond weed → tadpole → water beetle → pike

Describe the role of pond weed in this food chain and explain what happens to the energy at each level in this food chain. **4**

MARKS | DO NOT WRITE IN THIS MARGIN

15. (a) The increasing human population requires an increase in food production.

Name a chemical in fertilisers that helps to increase food yield. **1**

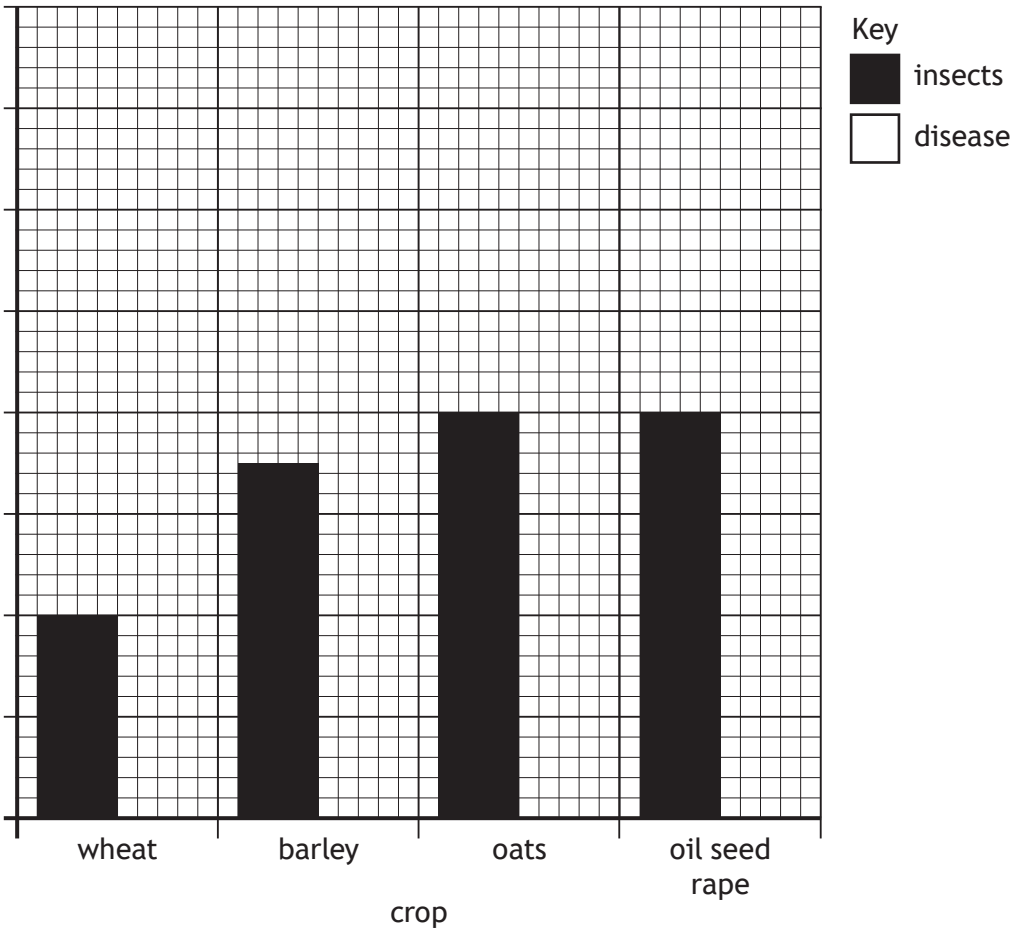
(b) Food crops are often affected by insects and disease.

The table shows the average annual losses in yield caused by insects and disease in the production of four crops in Scotland.

Crop	Average loss in yield (%)	
	Insects	Disease
Wheat	4	7
Barley	7	6
Oats	8	14
Oil seed rape	8	12

(i) On the grid complete the vertical axis by adding a label and scale and plot the remaining bars to show the average losses in yield caused by disease. **2**

(An additional grid, if required, can be found on *page 27*.)



15. (b) (continued)

(ii) Identify the crop with the lowest combined percentage loss from these two causes. **1**

(iii) Explain why it would be incorrect to conclude that the yield for each crop plant is affected more by disease than insects. **1**

(iv) The total crop of oil seed rape harvested was 140 000 tonnes.

Calculate the yield of oil seed rape that would have been produced if insects and disease had **not** affected the plants. **1**

Space for calculation

tonnes

(c) Over time pesticides can build up in the cells of living organisms.

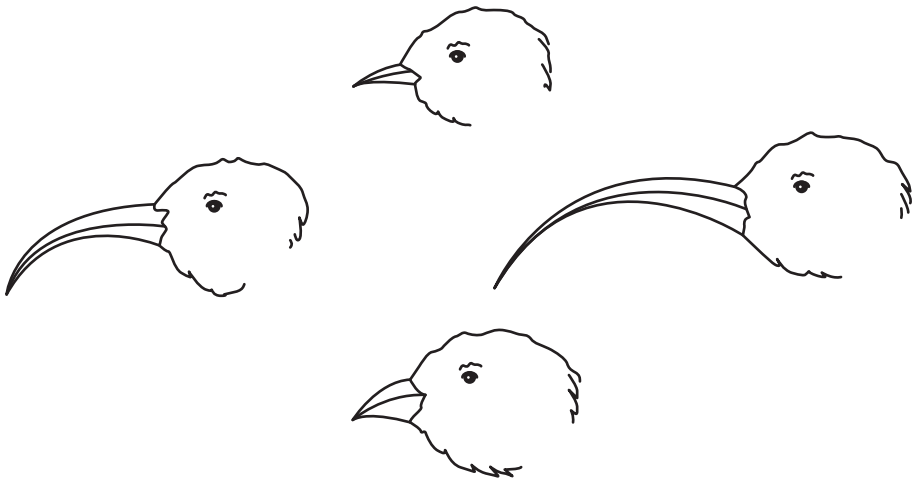
State the term given to this build-up of pesticides. **1**

(d) Sometimes a predator of the pest species is used as an alternative to pesticides.

Name this method of reducing pest species. **1**

[Turn over

16. Hawaiian honeycreepers are species of birds that have evolved from a single ancestor to have different shapes of beak. This is an example of speciation.



(a) For speciation to occur, a population must be split by an isolation barrier.

Name one type of isolation barrier. **1**

(b) Different mutations occurred in each sub-population of honeycreepers after a population was split.

(i) Name the molecule within a cell in which mutations would occur. **1**

(ii) Name one environmental factor which increases the rate of mutation. **1**

(c) Suggest the selection pressure that could have led to the differences in the honeycreepers shown in the diagram. **1**

(d) Explain what is meant by the term species. **1**

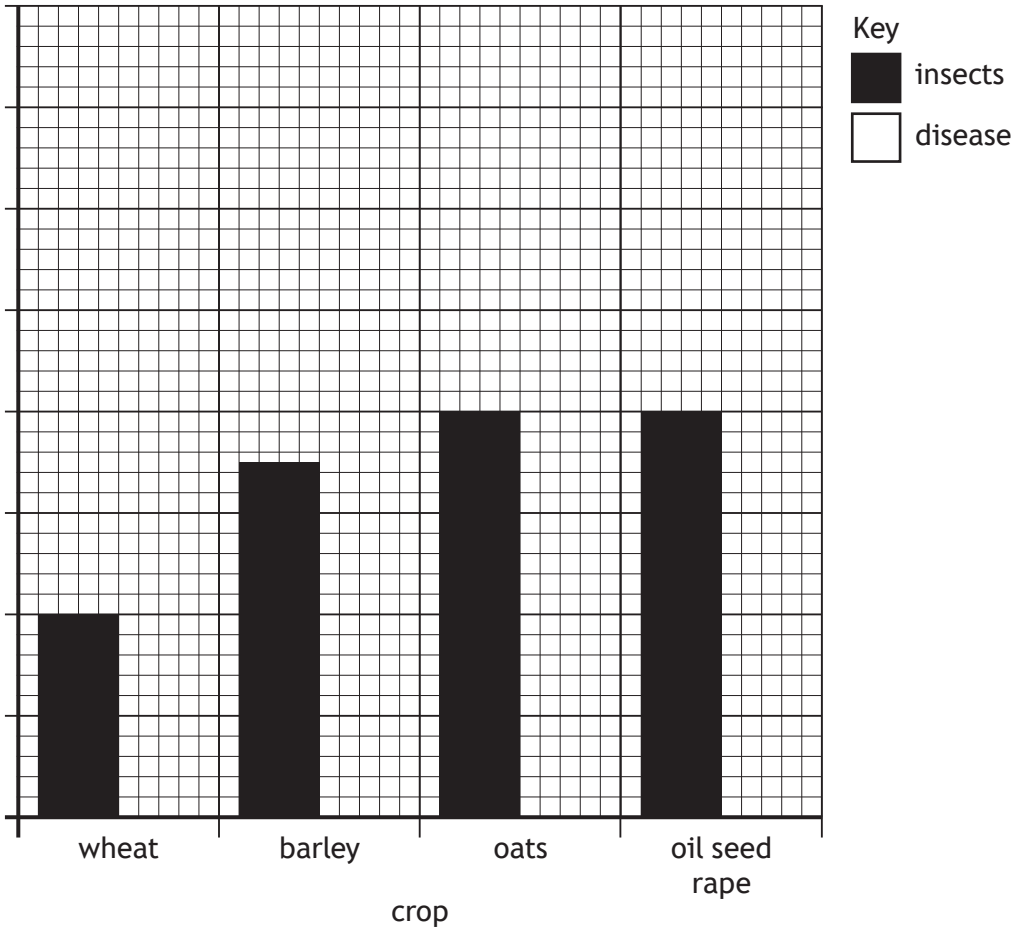
[END OF QUESTION PAPER]

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional table for question 9 (b)

	Percentage of patients (%)	
	Start of study	**End of study**
Extreme breathlessness		
Memory and concentration issues		
Other health issues		

Additional grid for question 15 (b) (i)



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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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