AQA

Surname _____

Forename(s) _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

BIOLOGY

F

Foundation Tier **Paper 2F**

8461/2F

Friday 7 June 2024 **Afternoon**

Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and forename(s), your centre number, your candidate number and add your signature.

[Turn over]

JUN248461 2F 01

MATERIALS

For this paper you must have:

- **a ruler**
- **a scientific calculator.**

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Pencil should only be used for drawing.**
- **Answer ALL questions in the spaces provided.**
- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**
- **In all calculations, show clearly how you work out your answer.**

INFORMATION

- **The maximum mark for this paper is 100.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

Answer ALL questions in the spaces provided.

0 1

The nervous system allows humans to:

- **respond to stimuli**
- **coordinate their behaviour.**

0 1 . 1

Complete the order of structures to link a stimulus to a response. [2 marks]

Choose answers from the list.

- **coordinator**
- **effector**
- **receptor**

stimulus → _____ → _____ →

_____ → **response**

0 1 . 2

Some human actions are reflex actions.

What is a reflex action? [2 marks]

0 1 . 3

Which is an example of a reflex action? [1 mark]

Tick (✓) ONE box.

- ☐ **Blinking in sudden bright light**
- ☐ **Kicking a ball in a game**
- ☐ **Writing a message to a friend**

0 1 . 4

Many reflex actions are movements.

What type of tissue causes movement? [1 mark]

Tick (✓) ONE box.

- ☐ **Blood**
- ☐ **Gland**
- ☐ **Muscle**

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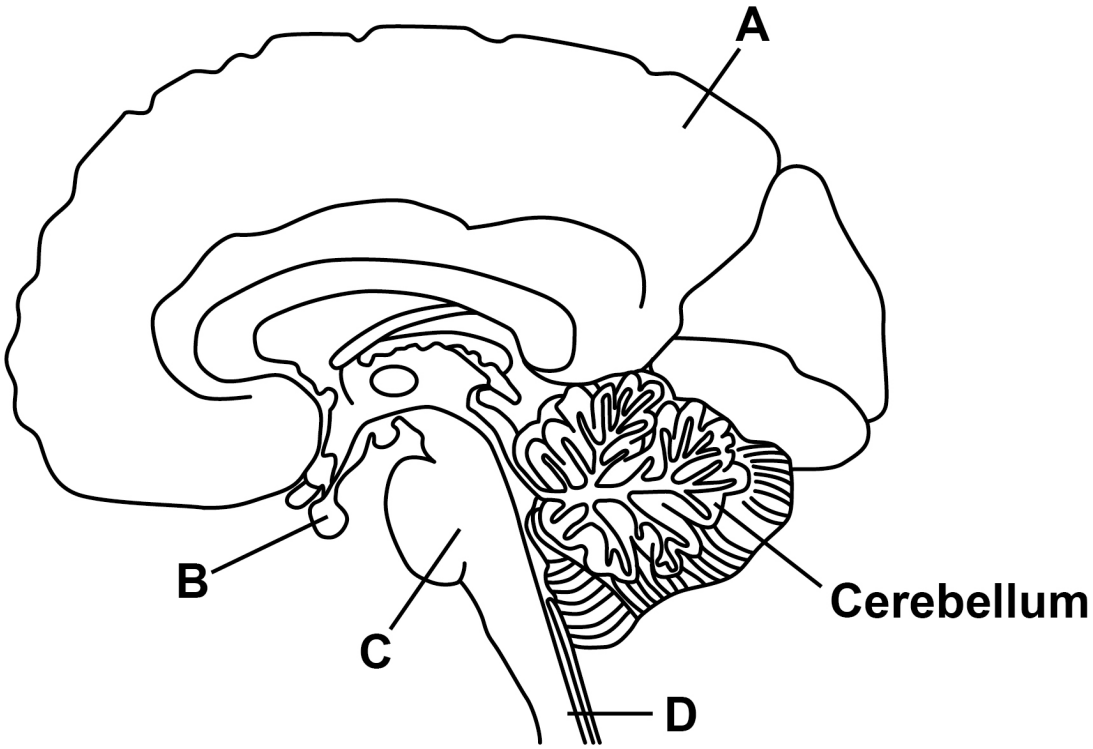
[Turn over]

Many human activities are coordinated by the brain.

FIGURE 1 shows the human brain.

FIGURE 1



0 1 . 5

Which structure in FIGURE 1 is the pituitary gland?
[1 mark]

Tick (✓) ONE box.

☐ **A**

☐ **B**

☐ **C**

☐ **D**

[Turn over]

0 1 . 6

Which structure in FIGURE 1, on page 8, is the cerebral cortex? [1 mark]

Tick (✓) ONE box.

- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

0 1 . 7

What is the function of the cerebellum? [1 mark]

Tick (✓) ONE box.

- ☐ **Balance**
- ☐ **Hearing**
- ☐ **Sight**

[Turn over]

9

0 2

Carl Linnaeus invented a classification system that places organisms into groups.

0 2 . 1

What is the name of the largest classification group in Linnaeus's system? [1 mark]

Tick (✓) ONE box.

- ☐ **Family**
- ☐ **Kingdom**
- ☐ **Order**

0 2 . 2

Linnaeus gave each species a binomial name.

Which TWO classification groups form the binomial name? [2 marks]

Tick (✓) TWO boxes.

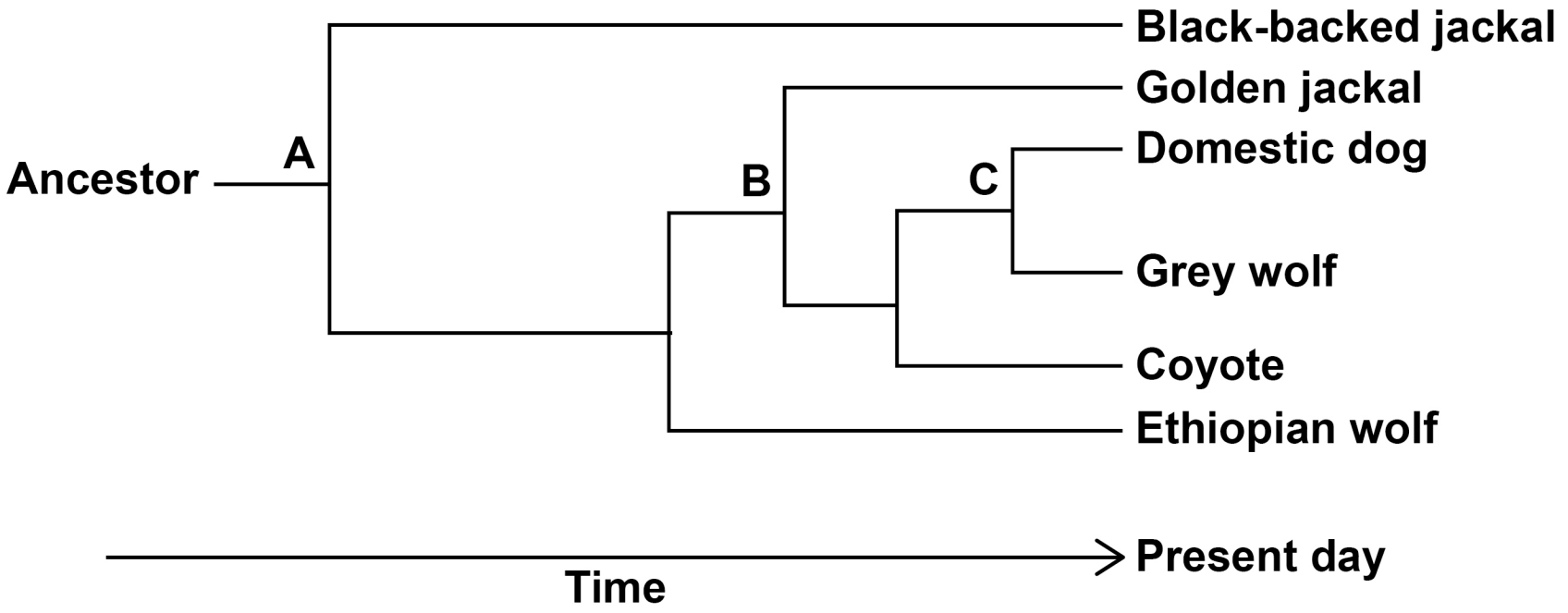
- ☐ **Class**
- ☐ **Genus**
- ☐ **Order**
- ☐ **Phylum**
- ☐ **Species**

[Turn over]

Scientists think that the animals in FIGURE 2 all evolved from an ancestor that lived about 6 million years ago.

FIGURE 2 shows how the animals may have evolved.

FIGURE 2



KEY

A 6 million years ago
B 3 million years ago
C 32 thousand years ago

0 2 . 3

What was the MOST RECENT time that the domestic dog and the golden jackal shared a common ancestor? [1 mark]

Tick (✓) ONE box.

- ☐ **32 thousand years ago**
- ☐ **3 million years ago**
- ☐ **6 million years ago**

0 2 . 4

Which present-day animal in FIGURE 2 is the MOST DISTANT relative of the domestic dog? [1 mark]

Scientists think the grey wolf and the domestic dog had a common ancestor.

The common ancestor:

- **lived about 32 thousand years ago**
- **is now extinct.**

0 2 . 5

Give TWO possible causes of extinction. [2 marks]

1 _____

_____

_____

2 _____

_____

_____

0 2 . 6

32 thousand years ago, humans hunted other animals for food.

Wolves also hunted other animals for food.

Suggest ONE reason why wolves began to follow groups of humans. [1 mark]

_____

_____

_____

[Turn over]

0 2 . 7

Some wolves are more aggressive than other wolves.

Describe how selective breeding of wolves could produce a domestic animal that is less aggressive than the wolf. [2 marks]

10

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[Turn over]

0 3

Genetic engineering can be used for making many useful products.

FIGURE 3, on the opposite page, shows how a vaccine against a virus can be made by genetic engineering.

Use information from FIGURE 3 to answer questions 03.1 and 03.2.

0 3 . 1

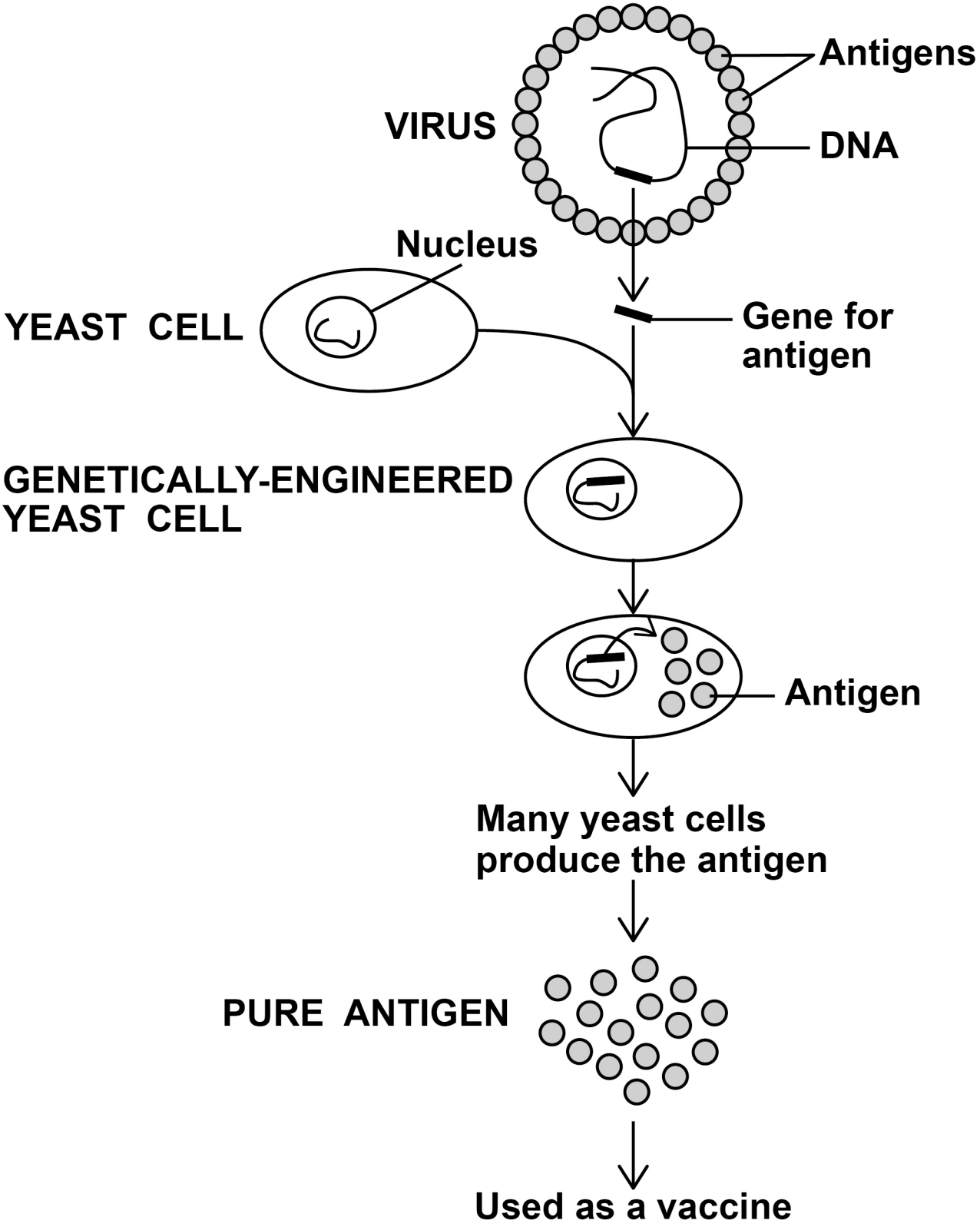
Which part of the virus is put into the yeast cell?
[1 mark]

0 3 . 2

Which part of the virus is made by the yeast cell?
[1 mark]

FIGURE 3

The diagram is not to scale.



0 3 . 3

A long time ago, vaccines were made in a different way.

The virus was heated to stop it reproducing.

The vaccine contained whole viruses.

Why might the vaccine containing heat-treated viruses be dangerous? [1 mark]

Tick (✓) ONE box.

- ☐ **The viruses may be inactive.**
- ☐ **The viruses may cause an infection.**
- ☐ **The viruses will not mutate.**

Genetic engineering can also be used in agriculture.

Weeds are a problem for farmers because the weeds compete with crop plants.

0 3 . 4

Give THREE factors that the weeds and crop plants compete for. [3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

[Turn over]

Glyphosate is a weed killer used in agriculture.

Genetically modified (GM) maize is a food crop that is resistant to glyphosate weed killer.

Farmers can spray glyphosate on a field to kill the weeds where the GM maize is growing.

0 3 . 5

Suggest ONE advantage of using glyphosate on fields where GM maize is growing. [1 mark]

0 3 . 6

Suggest ONE problem of using glyphosate on fields where GM maize is growing.

Do NOT refer to cost in your answer. [1 mark]

_____

_____

_____

[Turn over]

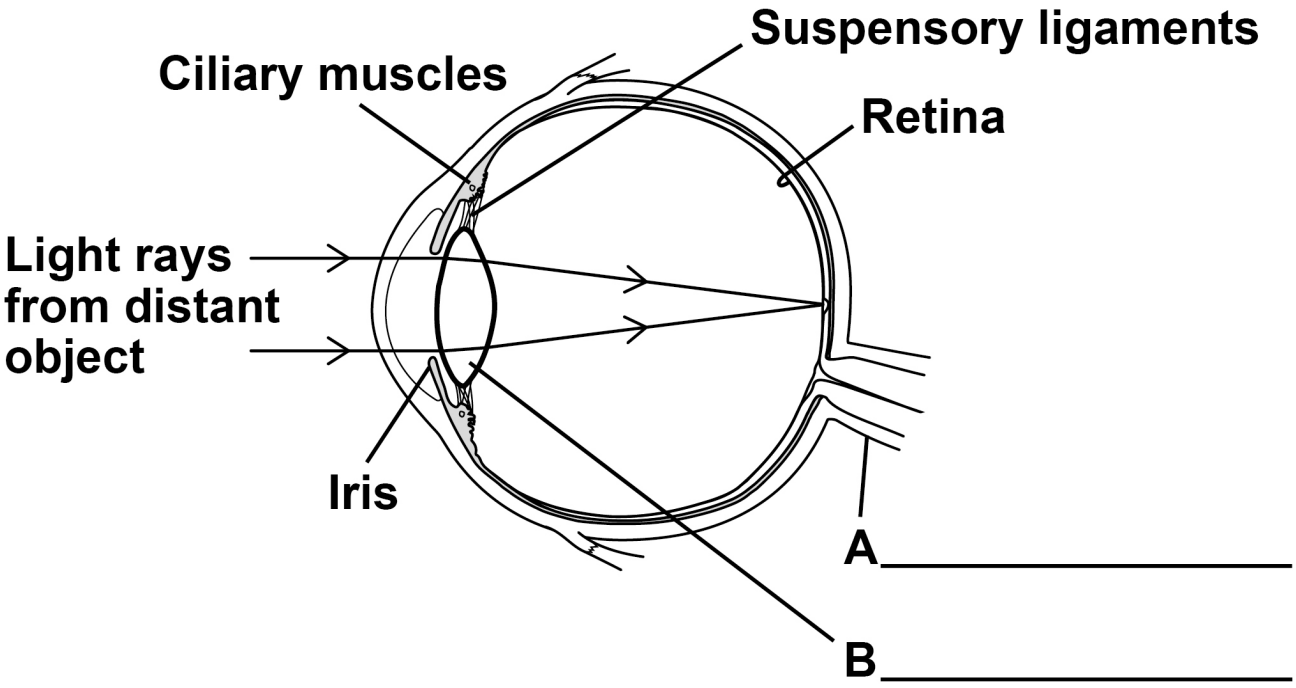
8

0 4

The human eye can make clear images of objects.

FIGURE 4 shows how the human eye focuses light rays from a distant object onto the retina.

FIGURE 4



0 4 . 1

Label structures A and B on FIGURE 4.

Choose answers from the list. [2 marks]

- **cornea**
- **lens**
- **optic nerve**
- **sclera**

The eye in FIGURE 4 is focused on a distant object.

0 4 . 2

Complete the sentence.

Choose the answer from the list. [1 mark]

- **contract**
- **expand**
- **stretch**

To focus on a NEAR object the ciliary muscles

_____ .

[Turn over]

FIGURE 4 is provided on page 26.

0 4 . 3

Complete the sentence.

Choose the answer from the list. [1 mark]

- **longer**
- **thicker**
- **thinner**

To focus on a NEAR object structure B in FIGURE 4

becomes _____ .

0 4 . 4

The eye in FIGURE 4 is looking at an object in dim light.

Complete the sentence on the opposite page.

Choose the answer from the list. [1 mark]

- **iris**
- **retina**
- **suspensory ligaments**

When the eye looks at an object in BRIGHT light the pupil gets smaller.

The size of the pupil is controlled by the

_____ .

0 4 . 5

The retina is sensitive to light.

How does information from the retina reach the brain via structure A in FIGURE 4, on page 26? [1 mark]

_____

_____

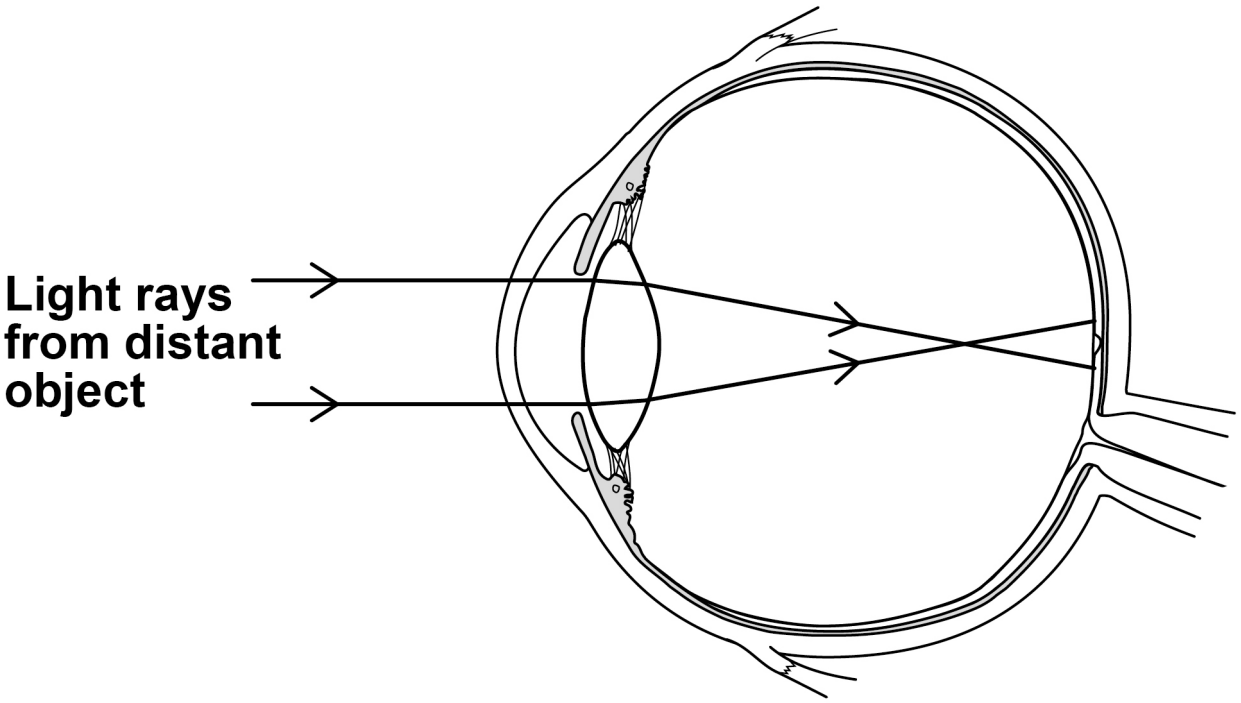
_____

[Turn over]

FIGURE 5 shows the eye of a person who is short sighted looking at a distant object.

The person CANNOT see the object clearly.

FIGURE 5



0 4 . 6

Give the reason why the person CANNOT see the object clearly. [1 mark]

0 4 . 7

Short sightedness can be corrected using spectacle lenses.

Give ONE other way short sightedness can be corrected.

Do NOT refer to spectacles in your answer. [1 mark]

_____

_____

_____

[Turn over]

8

0 5

The hormone insulin helps to control the concentration of glucose in the blood.

0 5 . 1

Which organ produces insulin? [1 mark]

Tick (✓) ONE box.

- ☐ **Adrenal gland**
- ☐ **Pancreas**
- ☐ **Thyroid**

People with Type 2 diabetes:

- produce insulin
- have body cells that do NOT respond to insulin
- often have a high concentration of glucose in their blood.

0 5 . 2

Why do people with Type 2 diabetes often have a high concentration of glucose in their blood? [1 mark]

Tick (✓) ONE box.

☐ The body cells change glucose into glycogen for storage.

☐ The body cells have a high rate of respiration to release energy.

☐ The body cells take in a low amount of glucose from the blood.

[Turn over]

Drug X is used for treating people who have Type 2 diabetes.

Scientists investigated the effect of drug X on the concentration of glucose in the blood of mice.

This is the method used.

1. **Give two groups of mice the same diet for 8 weeks.**
2. **Give each mouse in group A 2 cm^3 of water to drink.**
3. **Give each mouse in group B 2 cm^3 of drug X to drink.**
4. **After 30 minutes, give each mouse 1 cm^3 of glucose solution to drink.**
5. **Measure the concentration of glucose in the blood of each mouse at intervals for 3 hours.**

0 5 . 3

Give TWO control variables used in the investigation. [2 marks]

1 _____

_____

_____

2 _____

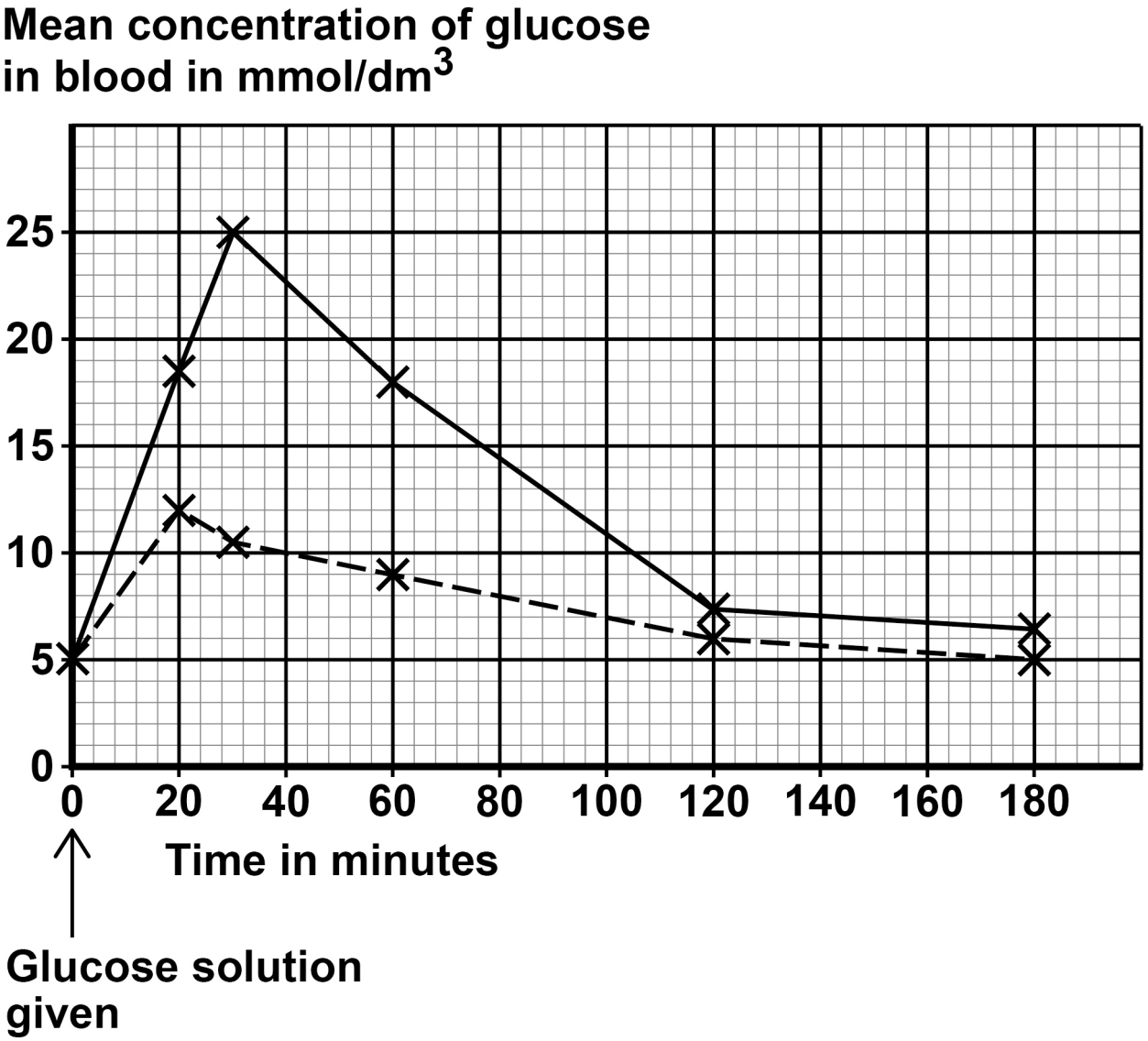
_____

_____

[Turn over]

FIGURE 6 shows the results.

FIGURE 6



In each group of mice, the concentration of glucose increases to a maximum value and then decreases.

0 5 . 4

Group B reached a maximum value earlier than group A.

Determine how many minutes earlier. [2 marks]

Number of minutes earlier = _____

[Turn over]

0 5 . 5

Give TWO conclusions about the effect of drug X on the concentration of glucose in the blood.

Do NOT refer to reaching the maximum value earlier.
[2 marks]

1 _____

_____

_____

2 _____

_____

_____

0 5 . 6

How could scientists find the best DOSE of drug X for controlling blood glucose concentration? [1 mark]

Tick (✓) ONE box.

- ☐ **Repeat the investigation twice more.**
- ☐ **Use different concentrations of drug X.**
- ☐ **Use more mice in the investigation.**

[Turn over]

9

0 6

Plants grow in response to the direction of light and to gravity.

0 6 . 1

What name is given to a plant's growth response?
[1 mark]

Tick (✓) ONE box.

- ☐ **Accommodation**
- ☐ **Adaptation**
- ☐ **Tropism**

0 6 . 2

Which substance controls the response to light in plant shoots? [1 mark]

Tick (✓) ONE box.

- ☐ **Amylase**
- ☐ **Auxin**
- ☐ **Lactic acid**

[Turn over]

0 6 . 3

A plant root grows downwards in response to gravity.

Which TWO substances can the root absorb in larger amounts when it grows downwards? [2 marks]

Tick (✓) TWO boxes.

- ☐ **Carbon dioxide**
- ☐ **Glucose**
- ☐ **Nitrate ions**
- ☐ **Protein**
- ☐ **Water**

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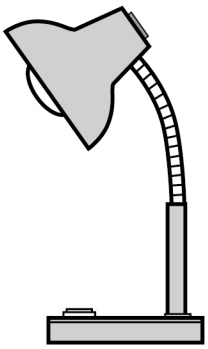
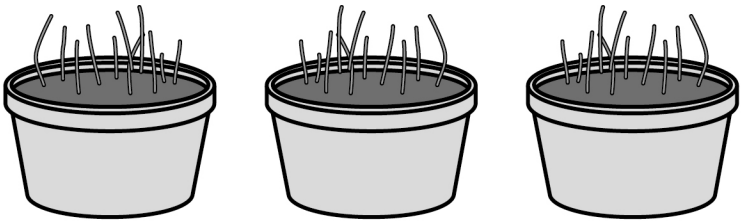
[Turn over]

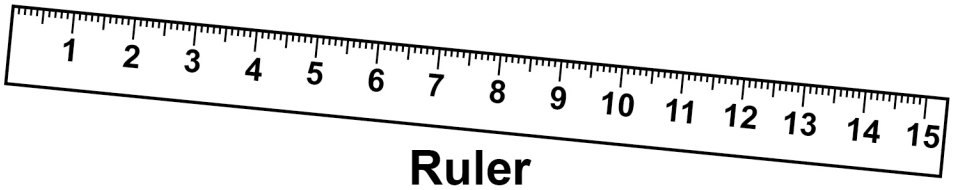
FIGURE 7



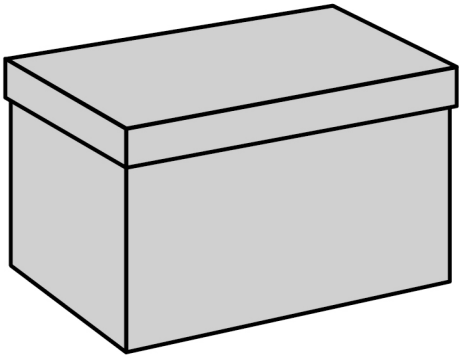
Lamp



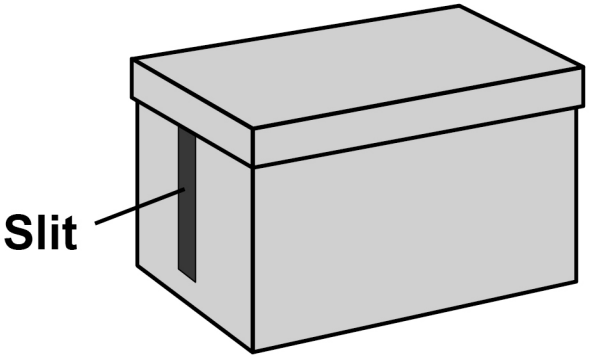
Pots of seedlings



Ruler



Cardboard box



Cardboard box with slit cut in one side

0 6 . 4

Plan an investigation to show the effect of light from one direction on the growth of plant seedlings.

You should include:

- **a control**
- **the measurements you would record**
- **any other observations you would make.**

You may use the equipment shown in FIGURE 7 and any other laboratory apparatus. [6 marks]

[Turn over]

10

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0 7

Gardeners can grow plants from:

- **seeds**
- **cuttings taken from adult plants.**

A gardener investigated the growth of roots on cuttings from a geranium plant.

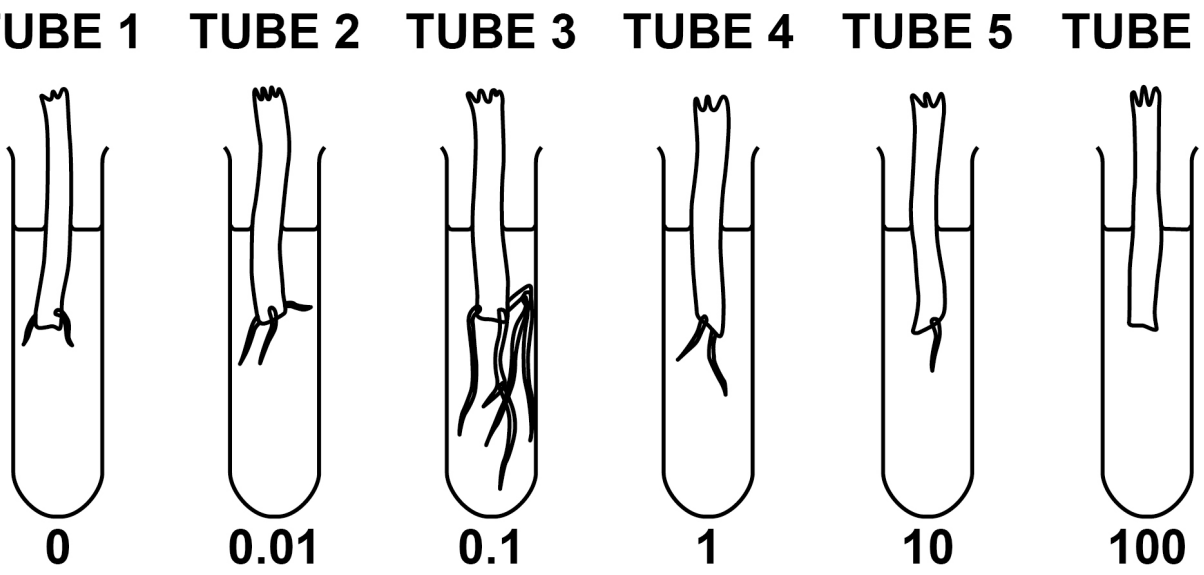
This is the method used.

1. **Take 6 cuttings from the stems of the same plant.**
2. **Prepare 6 test tubes, each containing a different concentration of a solution of chemical Q.**
3. **Place 1 cutting in each test tube with the cut end of each stem in the solution.**
4. **Leave the test tubes at room temperature for 10 days.**

FIGURE 8, on page 50, shows the results.

[Turn over]

FIGURE 8



0 7 . 1

Tube 1 contains no chemical Q.

Tube 1 is a control.

Why did the gardener include tube 1 in the investigation? [1 mark]

0 7 . 2

How many times more concentrated is chemical Q in tube 6 than in tube 2? [2 marks]

Number of times more concentrated = _____

0 7 . 3

What was the best concentration of chemical Q for stimulating root growth? [1 mark]

Tick (✓) ONE box.

- ☐ **0.01 arbitrary units**
- ☐ **0.1 arbitrary units**
- ☐ **1 arbitrary unit**
- ☐ **10 arbitrary units**

[Turn over]

0 7 . 4

Give evidence from FIGURE 8, on page 50, that a high concentration of chemical Q may be toxic to geranium plants. [1 mark]

0 7 . 5

The gardener has four types of geranium plant: A, B, C and D.

Plant A produces larger, more brightly-coloured flowers than any of the other plants.

The gardener wants to grow more plants of type A.

Explain why the gardener chooses to take cuttings from plant A instead of growing seeds from plant A.
[4 marks]

[Turn over]

9

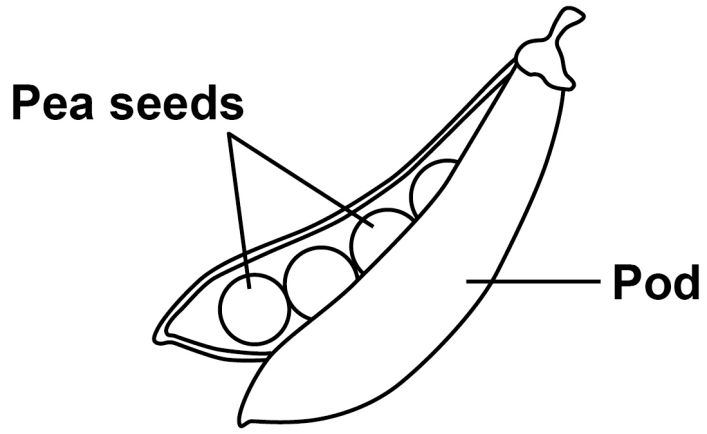
0 8

In 1866, a monk called Gregor Mendel published the results of his investigations into inheritance in pea plants.

Pea plants produce seeds in a pod.

FIGURE 9 shows a pea pod.

FIGURE 9

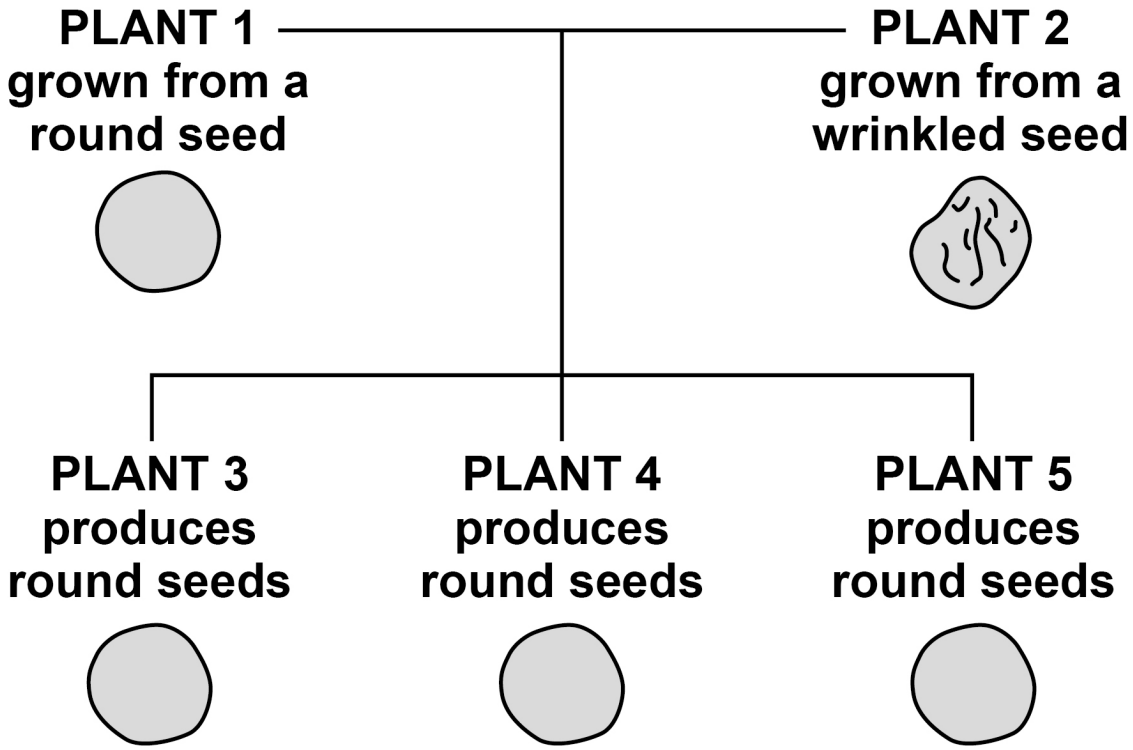


Pea seeds can be round or wrinkled in shape.

Mendel crossed pea plants that produced round seeds with pea plants that produced wrinkled seeds.

FIGURE 10, on the opposite page, shows the results.

FIGURE 10



In questions 08.1 to 08.3 use the following symbols to represent the alleles:

R = dominant allele for round seeds

r = recessive allele for wrinkled seeds.

0 8 . 1

In FIGURE 10, the genotype of plant 1 is RR.

Give the genotype of plant 2. [1 mark]

_____

[Turn over]

Mendel collected the seeds from plants 3 and 4 and grew new plants from the seeds.

Mendel crossed the new plants.

0 8 . 2

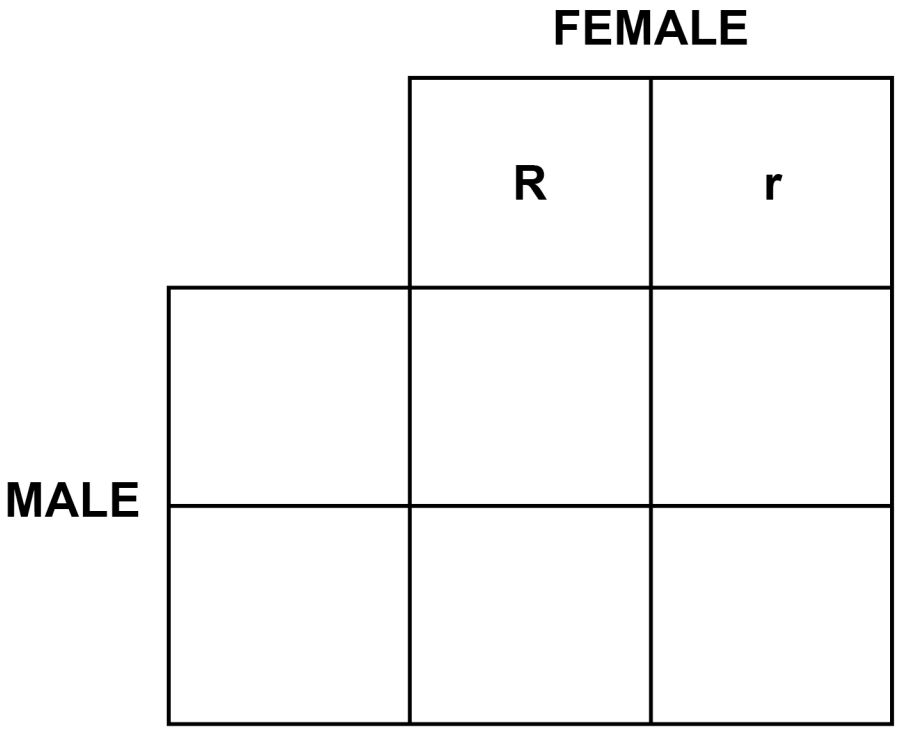
Complete the Punnett square diagram in FIGURE 11.

You should show:

- **the male gametes**
- **the offspring genotypes.**

[3 marks]

FIGURE 11



0 8 . 3

Give the ratio of round seeds to wrinkled seeds in the offspring in FIGURE 11. [1 mark]

Ratio of round seeds to wrinkled seeds =

_____ : _____

0 8 . 4

Some of the offspring in FIGURE 11 are homozygous and some are heterozygous.

What does 'heterozygous' mean? [1 mark]

_____

_____

_____

[Turn over]

0 8 . 5

Mendel published his work in 1866.

Suggest TWO reasons why the importance of Mendel's work was NOT recognised until the early 1900s.
[2 marks]

1 _____

_____

_____

2 _____

_____

_____

8

0 9

Evolution of new species occurs by mutation and natural selection.

0 9 . 1

What is a mutation? [1 mark]

0 9 . 2

Describe the process of natural selection. [3 marks]

0 9 . 3

Which scientists suggested the theory of evolution by natural selection? [1 mark]

Tick (✓) ONE box.

- ☐ **Alexander Fleming and Carl Woese**
- ☐ **Alfred Wallace and Alexander Fleming**
- ☐ **Alfred Wallace and Charles Darwin**
- ☐ **Charles Darwin and Carl Woese**

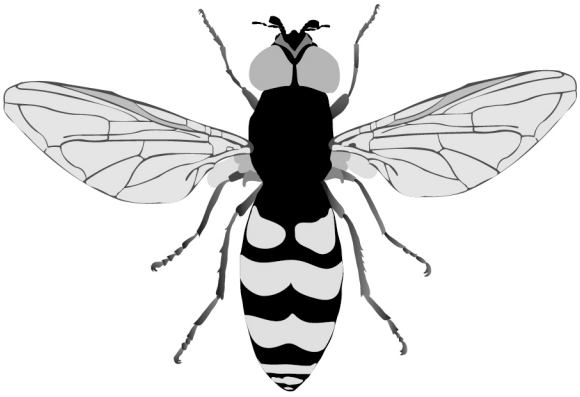
[Turn over]

0 9 . 4

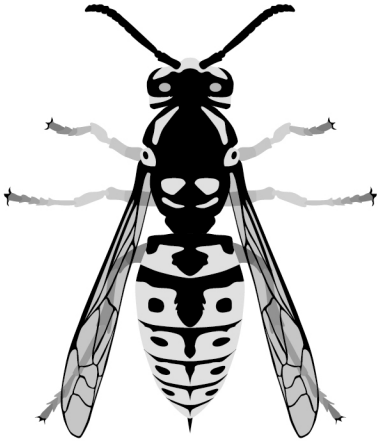
The hoverfly and the wasp are insects with bright yellow and black markings.

FIGURE 12 shows a hoverfly and a wasp.

FIGURE 12



HOVERFLY



WASP

The wasp has a sting to defend itself against predators.

The hoverfly does NOT have a sting.

Hoverflies and wasps live in the same habitat.

Explain how having yellow and black markings helps the HOVERFLY survive. [3 marks]

[Turn over]

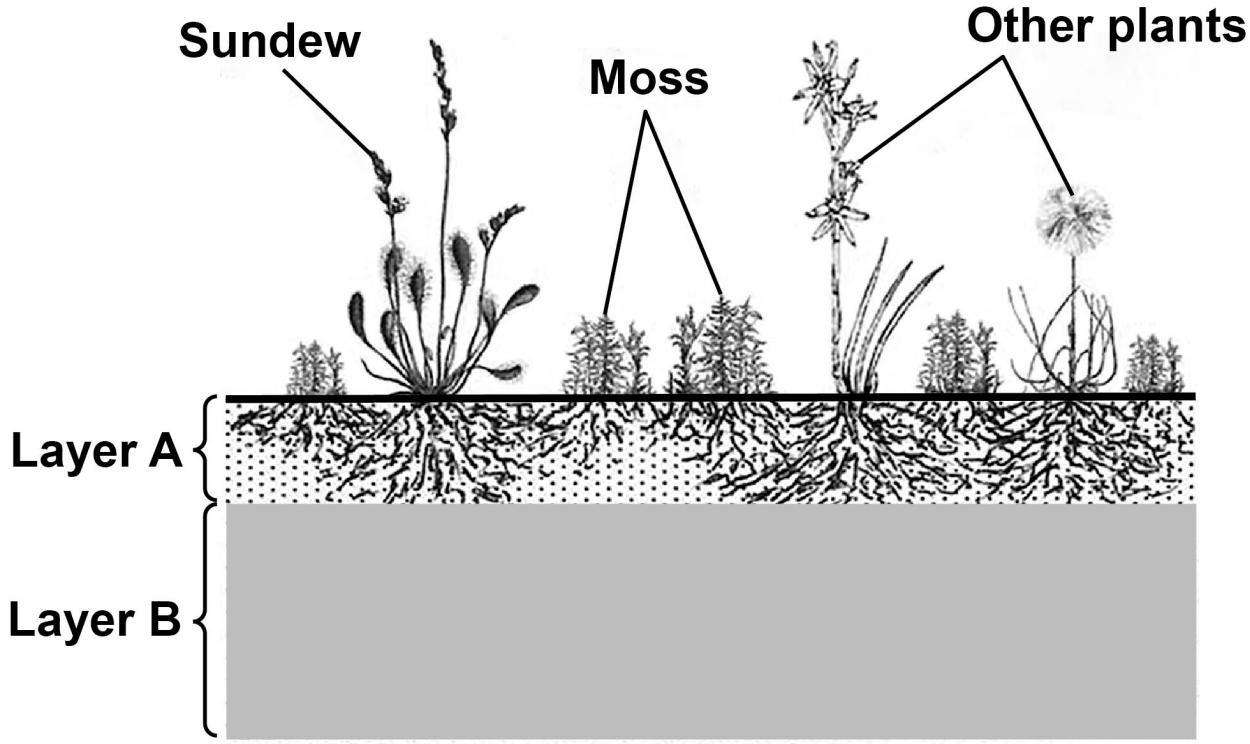
8

1 0

Peat bogs are estimated to contain twice as much carbon as all the world's forests.

FIGURE 13 shows a section through part of a peat bog.

FIGURE 13



Layer A contains a lot of air.

Layer B:

- **contains the dead remains of plants**
- **has a low pH**
- **contains very little oxygen**
- **contains carbon dioxide and methane.**

1 0 . 1

Explain why most of the dead remains of plants in layer B do NOT decay. [3 marks]

1 0 . 2

The peat bog in FIGURE 13, on page 64, is a stable community.

The moss produces biomass at a rate of 340 g/m^2/year.

What is the approximate biomass of the moss that becomes biomass in primary consumers? [1 mark]

Tick (✓) ONE box.

- ☐ **0.34 g/m^2/year**
- ☐ **3.4 g/m^2/year**
- ☐ **34 g/m^2/year**
- ☐ **340 g/m^2/year**

The sundew plant shown in FIGURE 13, on page 64, has leaves with sticky hairs that trap and digest insects.

Digestion of the insects releases phosphates and simple compounds of nitrogen that are used by the sundew plant.

1 0 . 3

What substance can the sundew plant make using the PHOSPHATES? [1 mark]

Tick (✓) ONE box.

- ☐ **Cellulose**
- ☐ **DNA**
- ☐ **Glycerol**
- ☐ **Starch**

[Turn over]

1 0 . 4

What substance can the sundew plant make using the NITROGEN? [1 mark]

Tick (✓) ONE box.

- ☐ **Fatty acid**
- ☐ **Glucose**
- ☐ **Lactic acid**
- ☐ **Protein**

BLANK PAGE

[Turn over]

1 0 . 5

Humans have destroyed large areas of peat bog to collect peat.

The peat provides fuel and provides compost for gardeners to use.

The peat comes from layer B in FIGURE 13 on page 64.

Layer B:

- **contains the dead remains of plants**
- **has a low pH**
- **contains very little oxygen**
- **contains carbon dioxide and methane.**

FIGURE 14 shows the removal of peat from a peat bog.

FIGURE 14

Peat is dug out and cut into 'bricks' that are left to dry

Explain how the destruction of peat bogs and the use of peat affects the temperature of the Earth's atmosphere. [4 marks]

10

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1 1

Frogs are animals that lay their eggs in water. The eggs hatch as tadpoles.

Students investigated the number of tadpoles in a pond for 8 weeks.

This is the method used.

1. **Collect 10 dm^3 of pond water in a bucket.**
2. **Count the number of tadpoles collected.**
3. **Put the tadpoles back into the pond.**
4. **Repeat steps 1 to 3 another three times in different parts of the pond.**
5. **Repeat steps 1 to 4 at intervals for 8 weeks.**

1 1 . 1

Suggest ONE improvement to the method. [1 mark]

TABLE 1 shows the results.

TABLE 1

Sample number	NUMBER OF TADPOLES IN EACH SAMPLE					
	0 weeks	1 week	2 weeks	3 weeks	5 weeks	8 weeks
1	11	17	8	9	5	0
2	15	11	12	7	0	5
3	23	16	14	10	7	3
4	11	14	16	X	4	4
TOTALS	60	58	50	32	16	12

1 1 . 2

Value X is the number of tadpoles in sample 4, at 3 weeks.

Calculate value X. [1 mark]

Value X = _____

[Turn over]

REPEAT OF TABLE 1

Sample number	NUMBER OF TADPOLES IN EACH SAMPLE					
	0 weeks	1 week	2 weeks	3 weeks	5 weeks	8 weeks
1	11	17	8	9	5	0
2	15	11	12	7	0	5
3	23	16	14	10	7	3
4	11	14	16	X	4	4
TOTALS	60	58	50	32	16	12

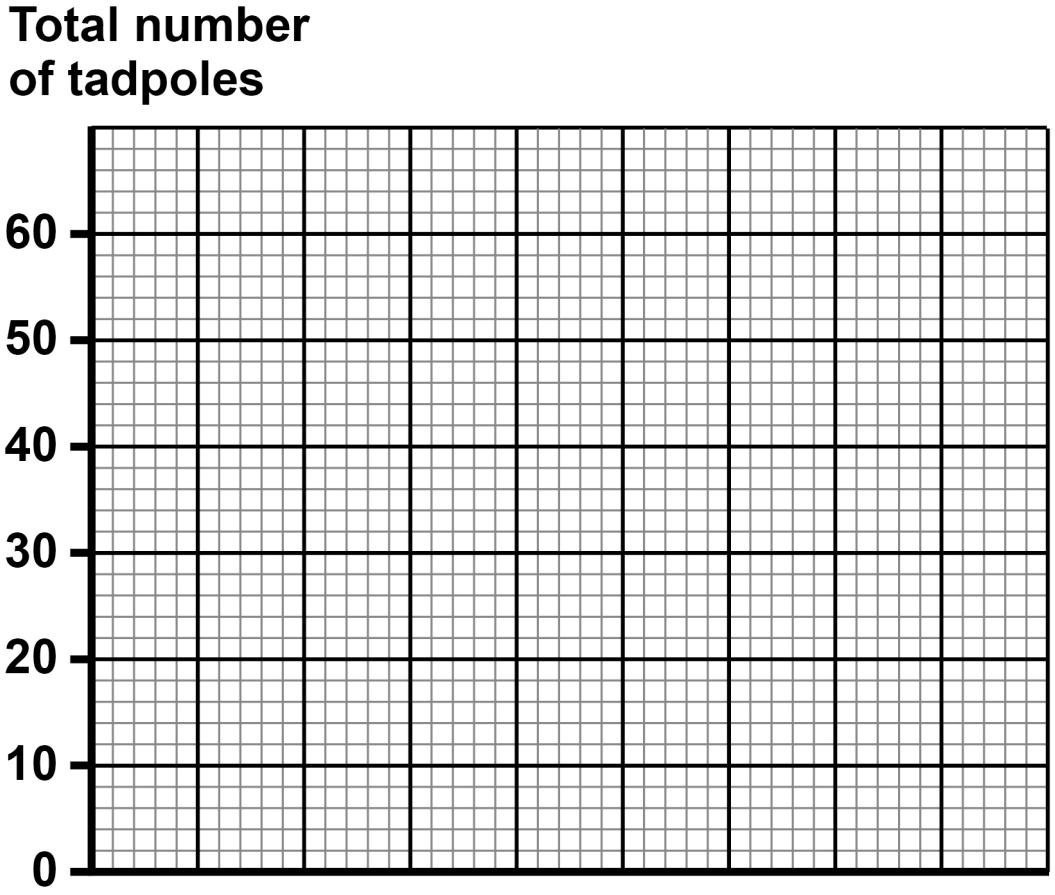
1 1 . 3

Complete FIGURE 15, on the opposite page, to show how the TOTAL number of tadpoles changed over the 8 weeks. [4 marks]

You should:

- **label the x-axis**
- **use a suitable scale for the x-axis**
- **plot the data for the TOTAL numbers of tadpoles from TABLE 1**
- **draw a line of best fit.**

FIGURE 15



[Turn over]

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1 1 . 4

After 0 weeks, no more tadpoles hatched in the pond.

Calculate the percentage of the tadpoles that would still be found in the pond at 4 weeks compared with 0 weeks.

Use information from FIGURE 15, on page 77. [3 marks]

Percentage of tadpoles found at 4 weeks =

_____ %

[Turn over]

1 1 . 5

After 4 weeks many of the tadpoles had died.

Suggest TWO reasons why the tadpoles died. [2 marks]

1 _____

_____

_____

2 _____

_____

_____

END OF QUESTIONS

11

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

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For Examiner's Use	
Question	Mark
1	
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