A

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

BIOLOGY

F

Foundation Tier **Paper 2F**

8461/2F

Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

JUN228461 2F 01

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

Maple syrup urine disease (MSUD) is a rare inherited human condition.

The allele for MSUD is recessive.

0 1 . 1

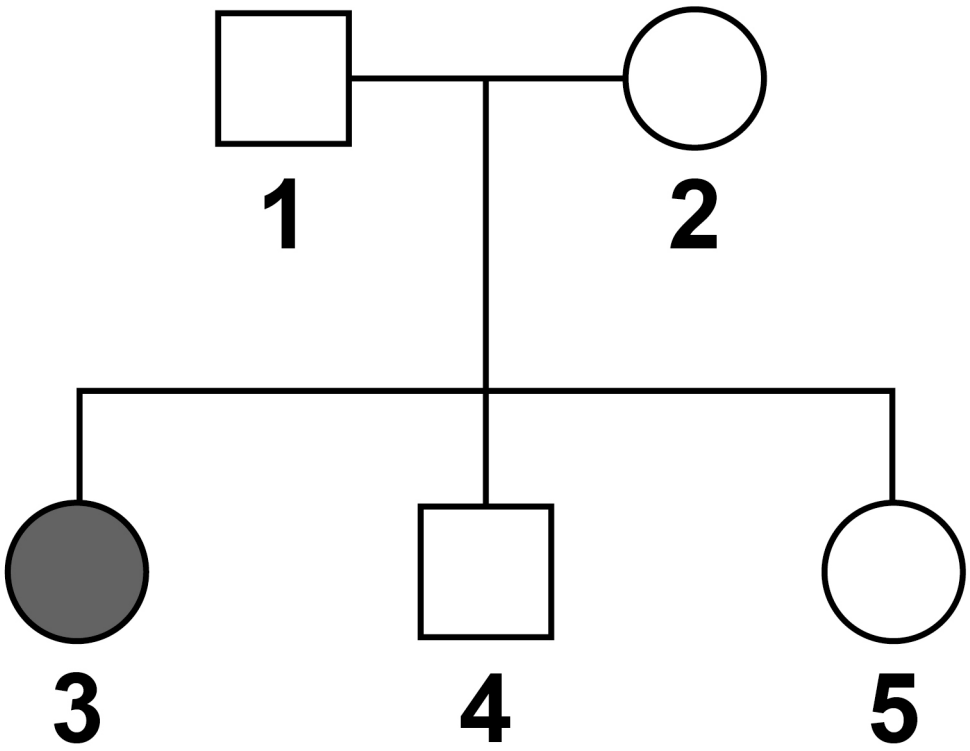
What is a recessive allele? [1 mark]

Tick (✓) ONE box.

- ☐ An allele expressed only if a person has two copies of the allele
- ☐ An allele expressed only if it is inherited from the male parent
- ☐ An allele expressed when it is found on only one of the chromosomes

FIGURE 1 shows the inheritance of MSUD in one family.

FIGURE 1



KEY

Male without MSUD

Female with MSUD

Female without MSUD

0 1 . 2

The symbol  is NOT in the key for FIGURE 1.

What would this symbol represent?
[1 mark]

Persons 1 and 2 in FIGURE 1, on page 6, have a child with MSUD and some children without MSUD.

0 1 . 3

Complete FIGURE 2, on the opposite page, to show the possible genotypes of the children.

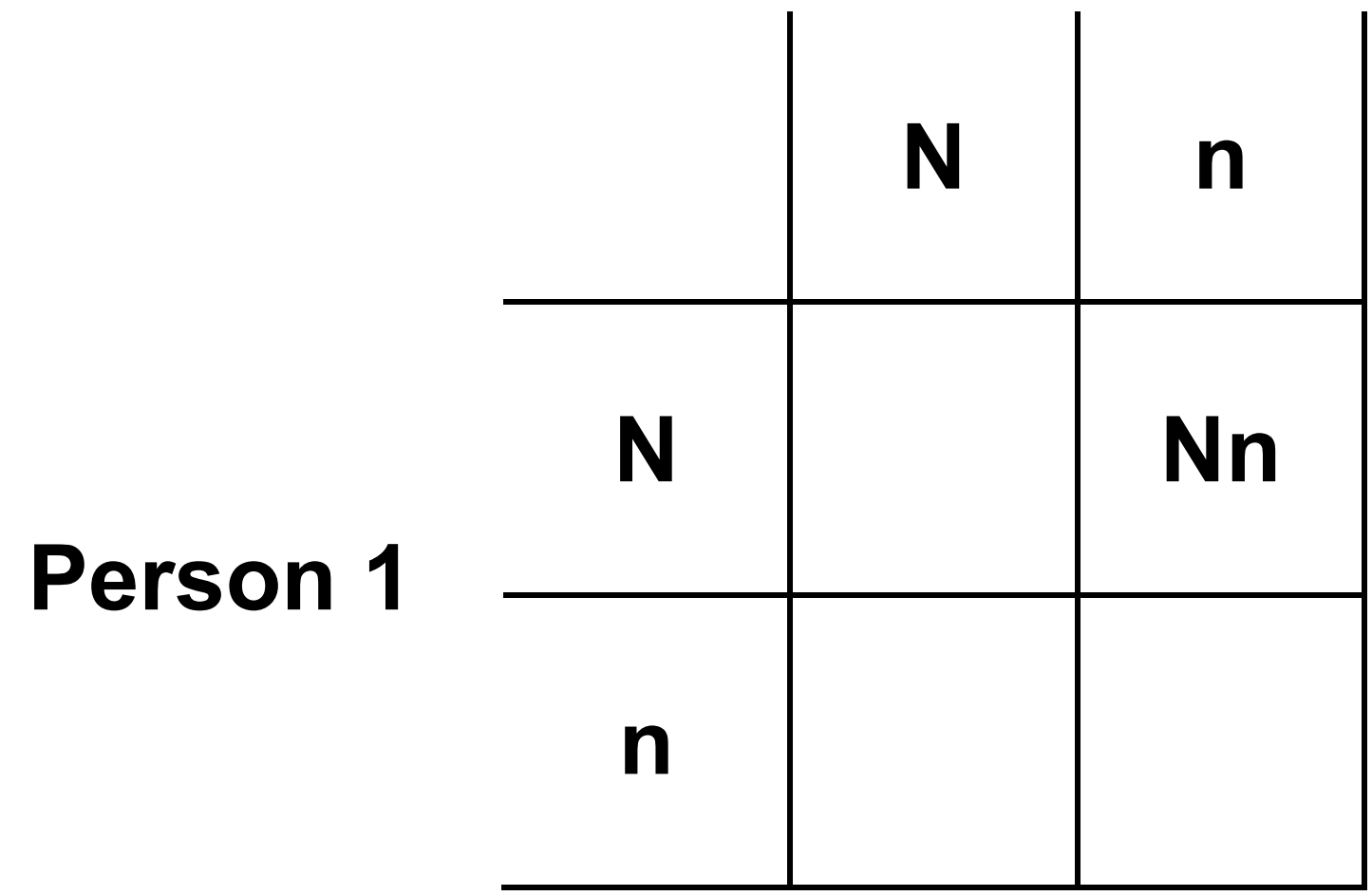
Use the following symbols:

N = allele for NOT having MSUD

n = allele for MSUD

[2 marks]

FIGURE 2



0 1 . 4

What is the phenotype of a person with the genotype Nn? [1 mark]

0 1 . 5

What percentage of the offspring in FIGURE 2 will have MSUD? [1 mark]

Tick (✓) ONE box.

- ☐ **25%**
- ☐ **50%**
- ☐ **75%**
- ☐ **100%**

0 1 . 6

Which scientific term describes the allele N? [1 mark]

Tick (✓) ONE box.

- ☐ **Dominant**
- ☐ **Genetic**
- ☐ **Heterozygous**

0 1 . 7

Alleles are found in the nucleus of a cell.

What chemical substance are alleles made from? [1 mark]

0 1 . 8

People with MSUD must eat a special diet to reduce their intake of some types of amino acid.

Which component of the diet is made of amino acids? [1 mark]

Tick (✓) ONE box.

- ☐ **Carbohydrates**
- ☐ **Minerals**
- ☐ **Proteins**

9

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0 2

Many human actions are reflexes.

0 2 . 1

Which statement describes a reflex action? [1 mark]

Tick (✓) ONE box.

- ☐ **A reflex action does not need a sense organ.**
- ☐ **A reflex action is a slow action.**
- ☐ **A reflex action is automatic.**

[Turn over]

FIGURE 3, on page 18, shows the nerve pathway for a reflex action.

The arrows show the direction of the nerve impulse.

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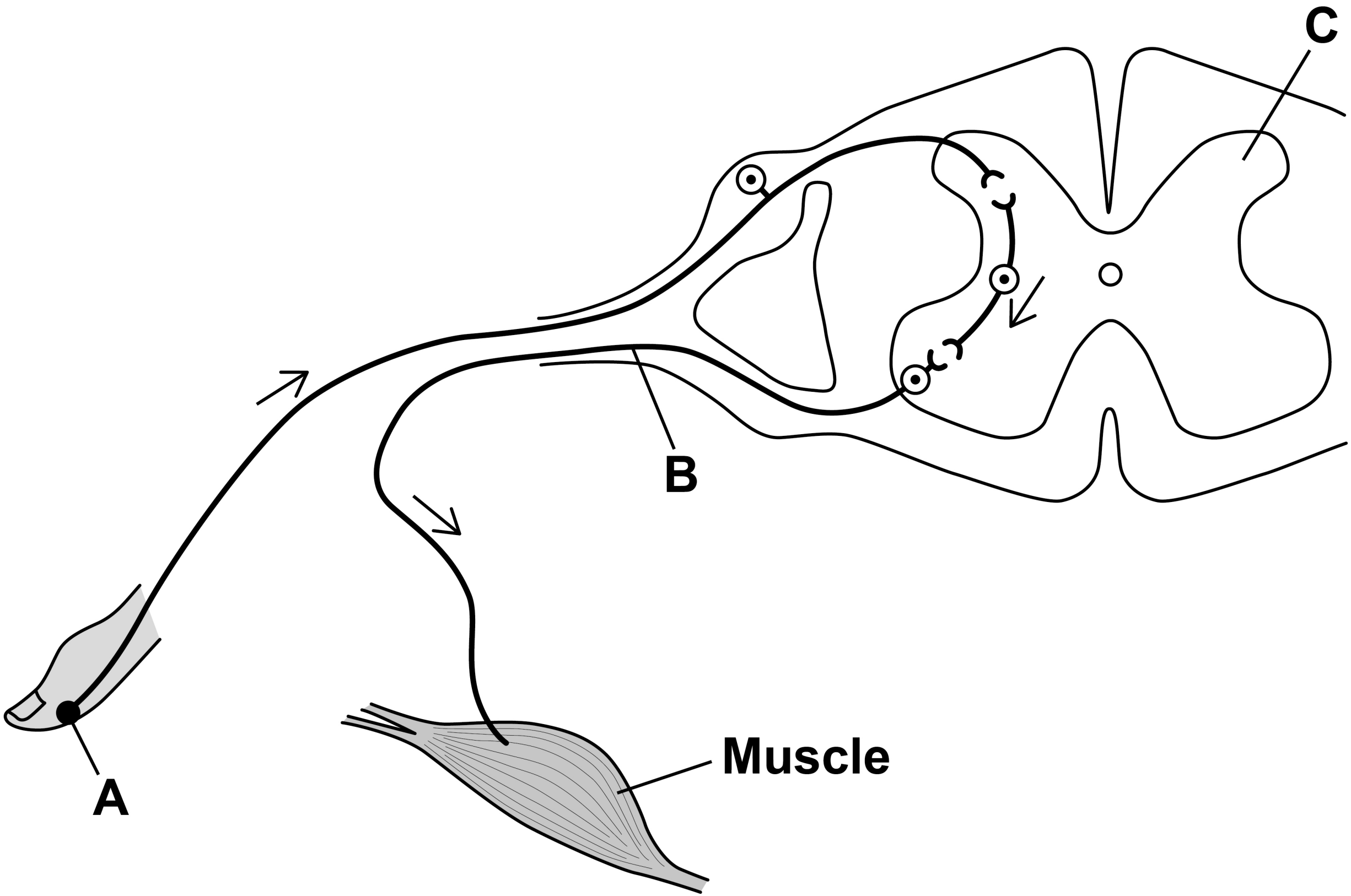
[Turn over]

FIGURE 3



0 2 . 2

Draw ONE line from each part of the nerve pathway to the name of that part.

Use FIGURE 3. [3 marks]

PART OF NERVE PATHWAY	NAME OF PART
A	Motor neurone
B	Receptor
C	Relay neurone
	Spinal cord

0 2 . 3

Which TWO human actions are reflexes? [2 marks]

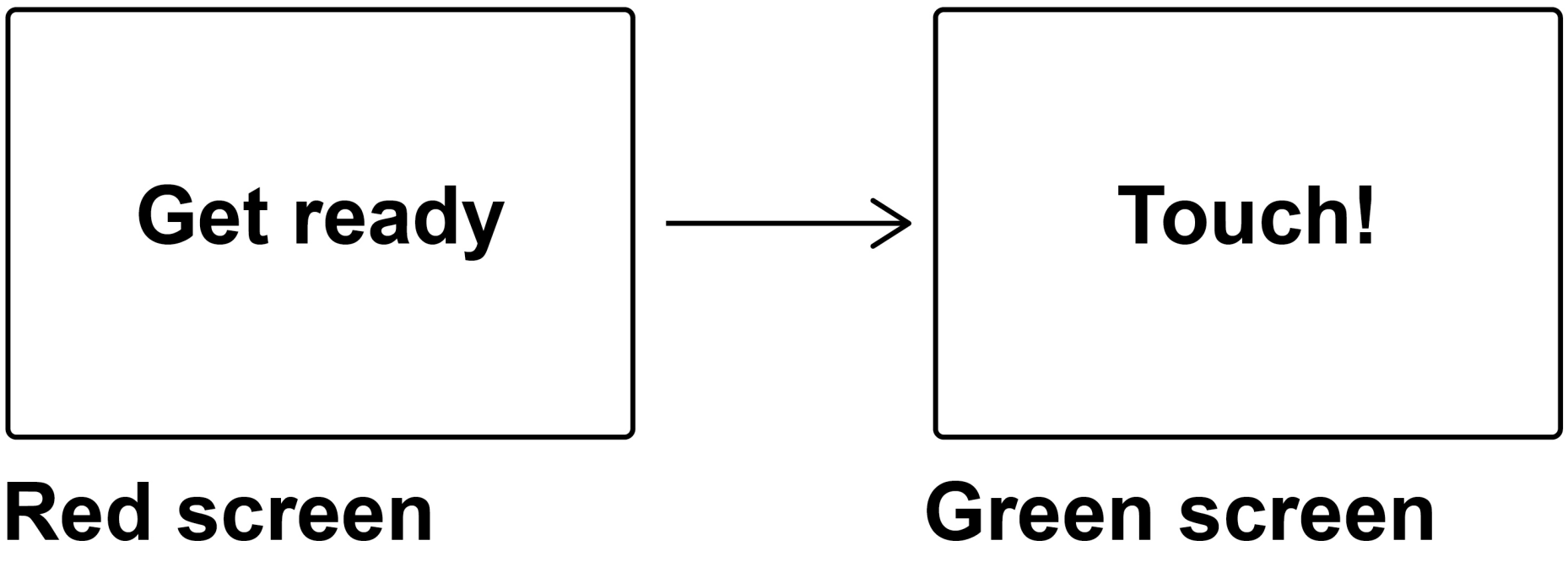
Tick (✓) TWO boxes.

- ☐ Blinking when an insect flies into the eye
- ☐ Catching a ball in a playground game
- ☐ Playing a musical instrument
- ☐ Removing the hand from a hot object
- ☐ Writing a message to a friend

Students investigated their reaction times using a computer program.

FIGURE 4 shows a sequence of two screens in the computer program.

FIGURE 4



[Turn over]

This is the method used.

1. Open the reaction time program.
2. When the screen turns from red to green, touch the screen as quickly as possible.
3. Record the reaction time shown on the screen.
4. Re-set to the red screen.
5. Repeat steps 2 to 4 four more times.
6. Repeat steps 1 to 5 for each student.

TABLE 1 shows the results.

TABLE 1

Test	Reaction time in milliseconds			
	Student P	Student Q	Student R	Student S
1	317	310	367	320
2	309	293	352	304
3	290	312	350	315
4	333	307	359	308
5	328	312	635	313
Mean	315	307	357	X

[Turn over]

0 2 . 4

Calculate mean value X in TABLE 1, on page 23. [2 marks]

X = _____ milliseconds

0 2 . 5

There is an anomalous result for student R.

Draw a ring around the anomalous result in TABLE 1, on page 23. [1 mark]

0 2 . 6

Give TWO factors that might affect a person's reaction time. [2 marks]

1 _____

_____

2 _____

_____

_____

11

BLANK PAGE

0 3

A plant shoot responds to the stimulus of light shining on it from one side.

0 3 . 1

What name is given to the type of response shown by the plant shoot? [1 mark]

Tick (✓) ONE box.

☐ **Adaptation**

☐ **Homeostasis**

☐ **Tropism**

[Turn over]

A student investigated the effect of one-sided light on the growth of plant seedlings.

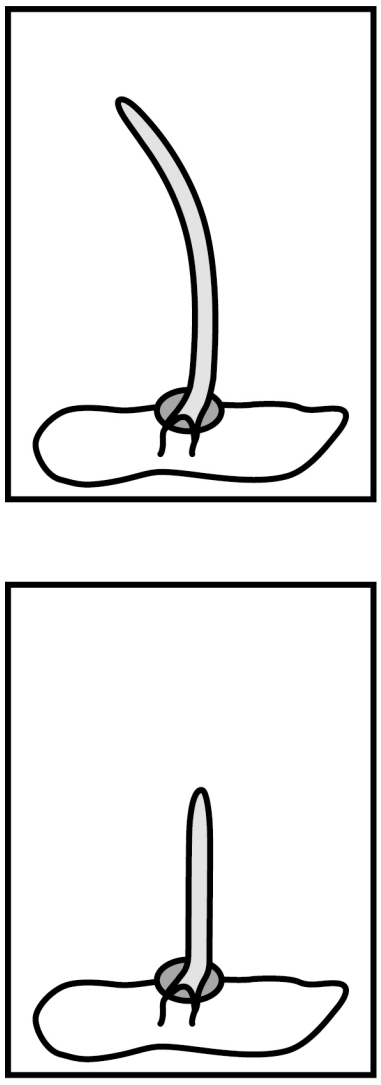
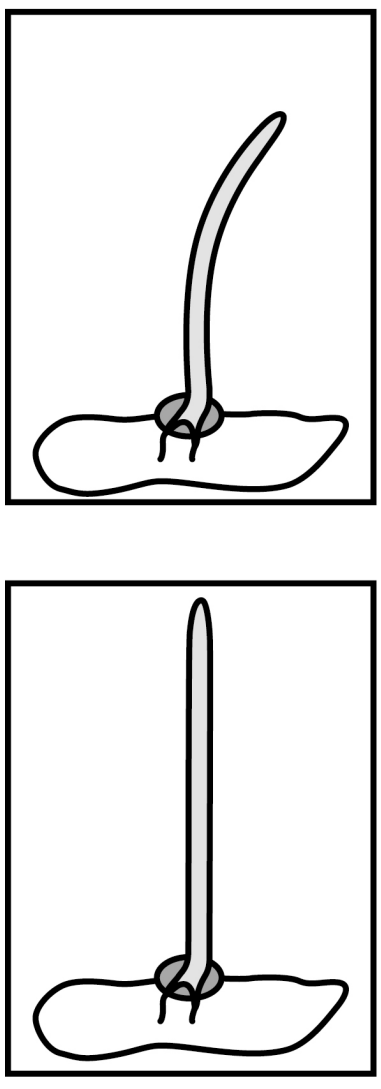
FIGURE 5, on the opposite page, shows how the student set up the investigation.

FIGURE 5

[Turn over]

0 3 . 2

On the opposite page, draw ONE line from each experiment to what the seedling would look like after 12 hours. [2 marks]

Experiment	What the seedling would look like
1	
2	

[Turn over]

0 3 . 3

Why did the student set up experiment 2 in this investigation? [1 mark]

0 3 . 4

The student wanted to make the investigation of the effect of one-sided light more valid.

The student decided to set up a third experiment.

How should the student set up the third experiment? [1 mark]

Tick (✓) ONE box.

☐ **Give no water to the third seedling.**

☐ **Shine light from all sides on the third seedling.**

☐ **Turn the third seedling so it is upside-down.**

0 3 . 5

What is a suitable control variable for the investigation? [1 mark]

Tick (✓) ONE box.

- ☐ **Keep each seedling at the same temperature.**
- ☐ **Keep each seedling the same height above the floor.**
- ☐ **Use the same size cardboard box for each seedling.**

0 3 . 6

Give ONE stimulus a plant ROOT responds to.

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

_____

_____

[Turn over]

0 3 . 7

Scientists often repeat investigations several times.

Give TWO reasons why. [2 marks]

1

2

9

BLANK PAGE

[Turn over]

0 4

Rivers are sometimes polluted with untreated sewage.

FIGURE 6, on the opposite page, shows some changes that occurred when untreated sewage entered a river.

0 4 . 1

Which type of organism had the most rapid increase in numbers when sewage entered the river? [1 mark]

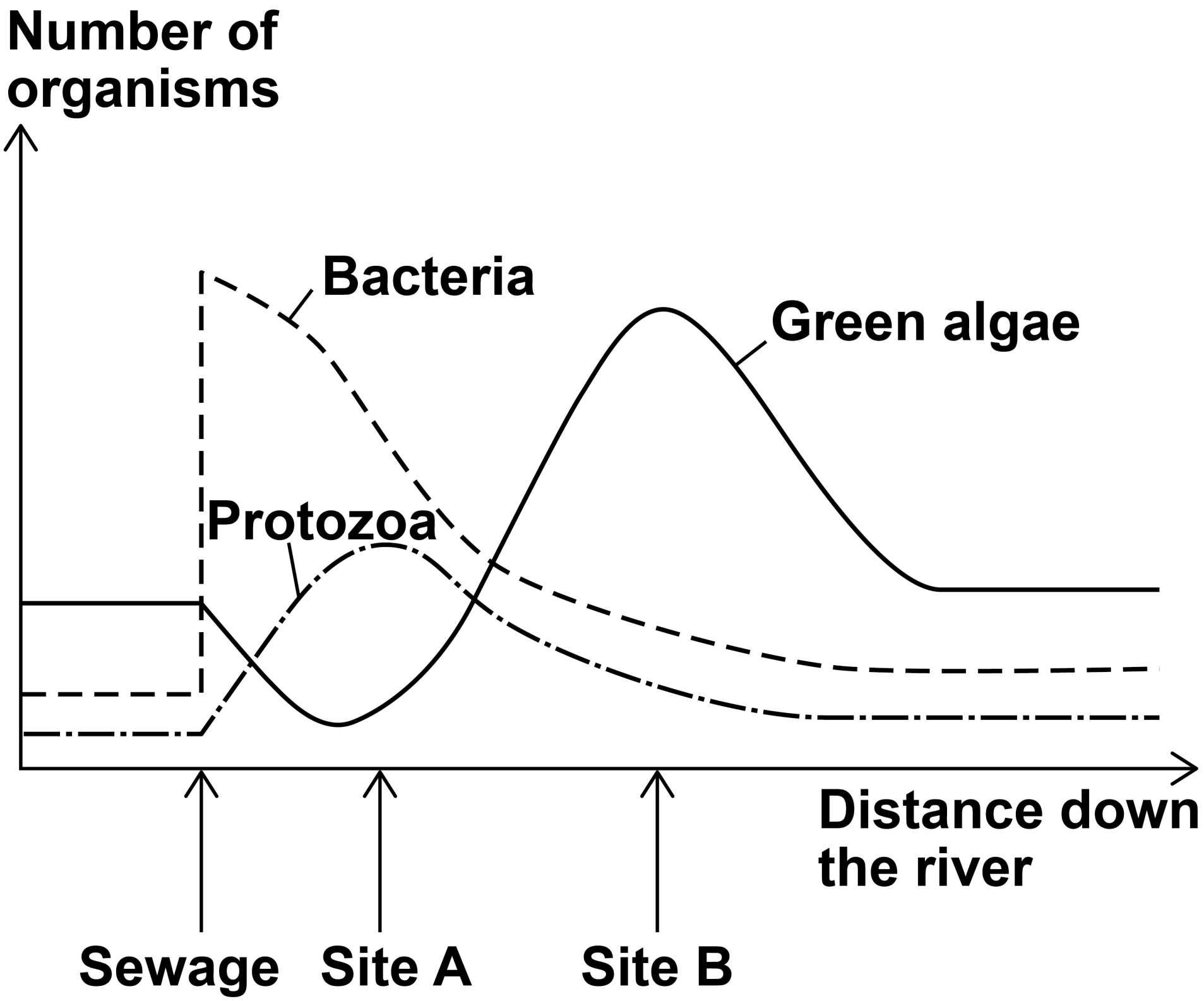
Tick (✓) ONE box.

☐ **Bacteria**

☐ **Green algae**

☐ **Protozoa**

FIGURE 6



[Turn over]

0 4 . 2

Protozoa are single-celled organisms.

Describe TWO ways FIGURE 6, on page 39, shows that the protozoa in the river feed on bacteria. [2 marks]

1

2

0 4 . 3

When sewage enters a river, the concentration of dissolved oxygen decreases.

The decrease in oxygen concentration is caused by organisms in the water.

What process in living organisms uses oxygen? [1 mark]

_____

_____

[Turn over]

0 4 . 4

As the numbers of green algae in the river increase, the concentration of dissolved oxygen increases.

Explain why the concentration of dissolved oxygen increases. [2 marks]

BLANK PAGE

[Turn over]

Scientists counted the numbers of five different animals in the river at sites A and B, shown in FIGURE 6 on page 39.

TABLE 2 shows the results.

TABLE 2

Animal	Number of animals	
	Site A	Site B
Sludge worm	80	2
Bloodworm	36	8
Water louse	10	55
Freshwater shrimp	5	75
Mayfly nymph	0	15

BLANK PAGE

[Turn over]

0 4 . 5

Complete FIGURE 7, on the opposite page.

You should use data from TABLE 2, on page 44, for the sludge worm and the bloodworm. [2 marks]

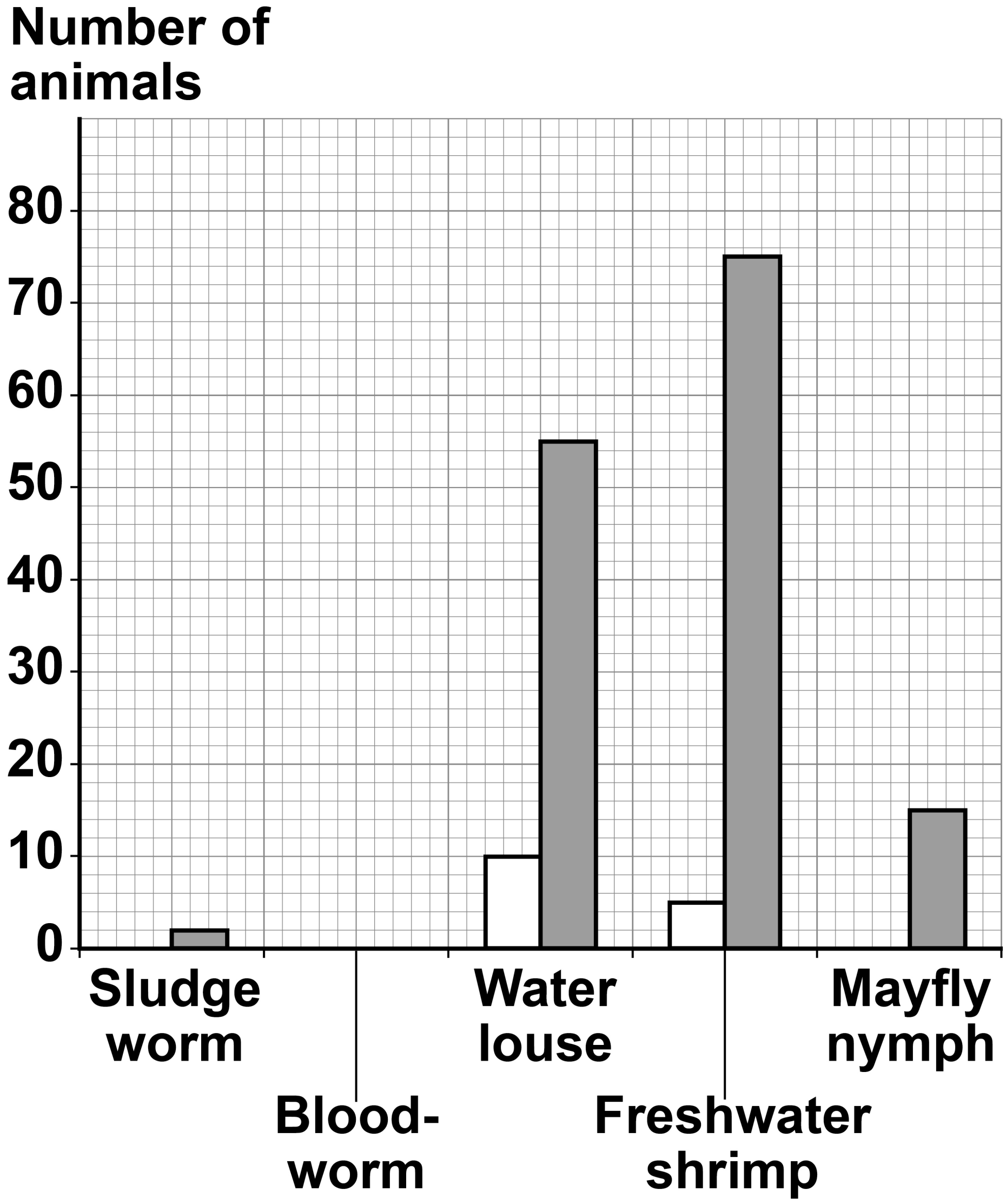
FIGURE 7 shows some of the data from TABLE 2.

The key for FIGURE 7 is provided below.

KEY

☐ Site A ■ Site B

FIGURE 7



[Turn over]

REPEAT OF TABLE 2

Animal	Number of animals	
	Site A	Site B
Sludge worm	80	2
Bloodworm	36	8
Water louse	10	55
Freshwater shrimp	5	75
Mayfly nymph	0	15

0 4 . 6

The concentration of oxygen in the water at site A is much lower than at site B.

- **Sludge worms live in places which have a low concentration of oxygen.**
- **Mayfly nymphs need a high concentration of oxygen.**

Give evidence from TABLE 2 for the difference in oxygen concentration at sites A and B.

Refer to sludge worms and to mayfly nymphs in your answer. [2 marks]

10

0 5

In the human female, an egg is released from one of the ovaries about once every four weeks.

During the four weeks, the lining of the uterus thickens and then breaks down.

This is called the menstrual cycle.

0 5 . 1

Which TWO hormones are female reproductive hormones? [2 marks]

Tick (✓) TWO boxes.

- ☐ **Adrenaline**
- ☐ **Oestrogen**
- ☐ **Progesterone**
- ☐ **Testosterone**
- ☐ **Thyroxine**

[Turn over]

0 5 . 2

Follicle stimulating hormone (FSH) is another female reproductive hormone.

What is the function of FSH in the menstrual cycle? [1 mark]

Tick (✓) ONE box.

- ☐ **FSH causes an egg to mature in the ovary.**
- ☐ **FSH causes breast development.**
- ☐ **FSH causes the uterus lining to break down.**

0 5 . 3

Sperm cells can survive inside a woman's reproductive organs for five days.

An egg cell can survive for one day after ovulation.

In one woman ovulation occurred on day 14.

Give the range of days on which sexual intercourse could result in fertilisation.
[1 mark]

From day _____ to day _____

[Turn over]

0 5 . 4

If a man and a woman have sexual intercourse and do NOT want to produce a baby, they may use contraception.

Explain how different methods of contraception prevent pregnancy.
[6 marks]

10

[Turn over]

BLANK PAGE

0 6

The echidna is a mammal that lives in Australia.

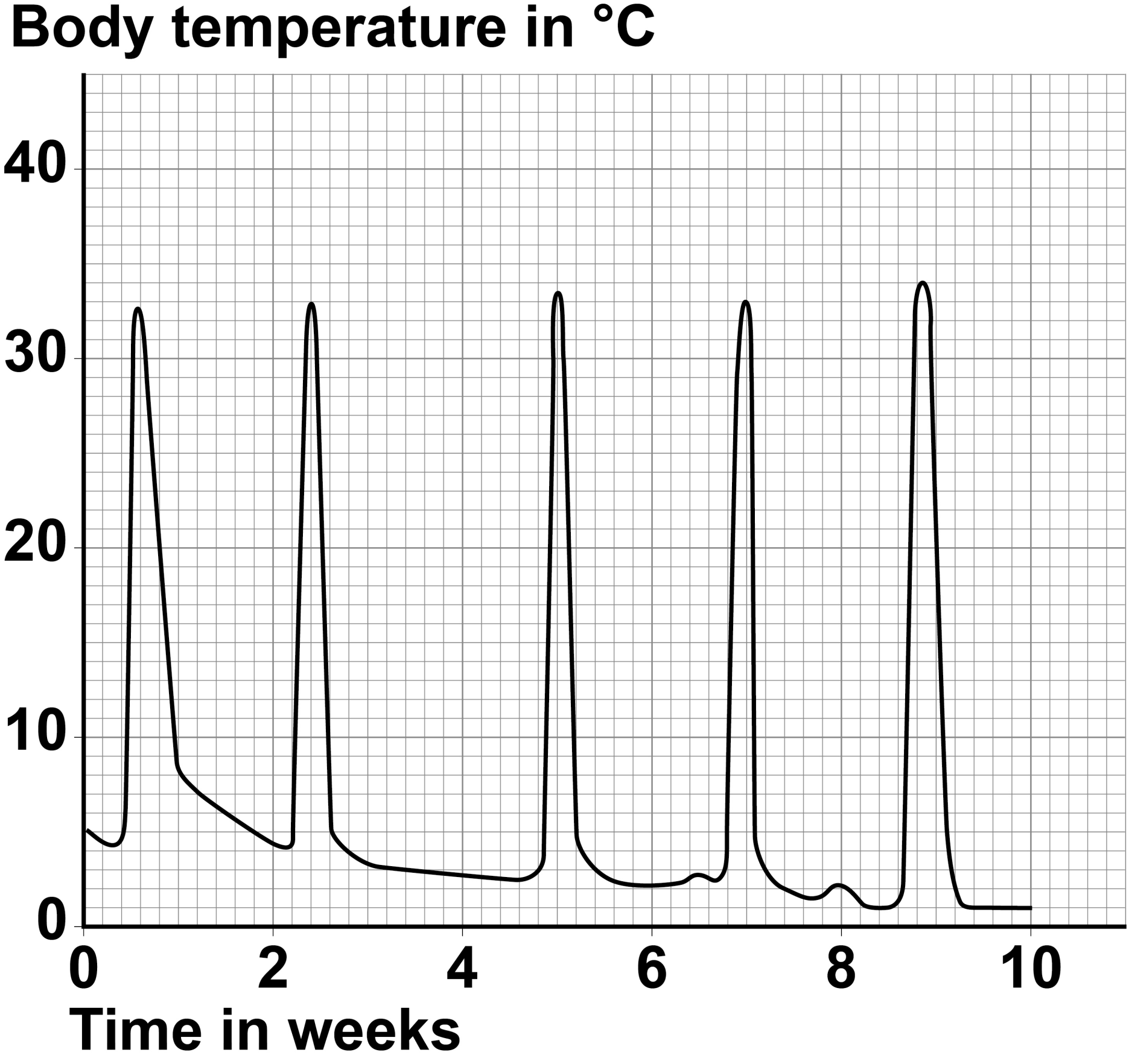
FIGURE 8 shows an echidna.

FIGURE 8

[Turn over]

FIGURE 9 shows how the body temperature of the echidna varies during the cold winter months.

FIGURE 9



0 6 . 1

Give the lowest and highest body temperatures for the echidna shown in FIGURE 9. [1 mark]

Lowest temperature = _____ °C

Highest temperature = _____ °C

[Turn over]

In the cold winter months, the echidna hibernates.

FIGURE 9, on page 58, shows that the echidna woke up from hibernation several times.

The echidna's body temperature increased to over 30 °C each time the echidna woke up.

0	6	.	2

How many times did the echidna wake up?

Use information from FIGURE 9.
[1 mark]

0 6 . 3

Each time the echidna wakes up, it hunts for food.

Suggest why the echidna needs to eat food several times during hibernation.

[1 mark]

_____

_____

_____

[Turn over]

0 6 . 4

During hibernation:

- **the echidna sleeps**
- **the echidna's body temperature decreases to below 5 °C**
- **the echidna uses food stored in its body cells to provide energy.**

What process releases energy from stored food? [1 mark]

Tick (✓) ONE box.

☐ **Diffusion**

☐ **Excretion**

☐ **Respiration**

0 6 . 5

Most mammals use a lot of energy to evaporate sweat.

The echidna does NOT sweat.

Suggest ONE use of energy in the echidna's body. [1 mark]

_____

_____

[Turn over]

The control of body temperature is important in the human body.

An athlete trained in a hot climate.

0 6 . 6

On one day, the athlete lost 3 200 cm^3 of water in sweat.

Evaporation of 1 cm^3 of sweat requires 2.5 kJ of energy.

Calculate the energy the athlete used for evaporation of sweat. [2 marks]

Energy = _____ kJ

0 6 . 7

On a different day the athlete used 6 000 kJ of energy to evaporate sweat.

The athlete's energy intake was 24 000 kJ.

Calculate the percentage of the athlete's energy intake used for evaporation of sweat. [2 marks]

Percentage = _____ %

[Turn over]

0 6 . 8

Some days the athlete did NOT do any training and rested at home.

What effect would resting have on the volume of sweat produced each day?

[1 mark]

10

0 7

Living organisms can be classified into groups.

Trilobites are animals that lived in the sea 400 to 500 million years ago.

TABLE 3, on page 68, gives the classification of two species of trilobite.

[Turn over]

TABLE 3

Classification group	Trilobite A	Trilobite B
	‘Animalia’	‘Animalia’
Phylum	‘Arthropoda’	‘Arthropoda’
Class	‘Trilobita’	‘Trilobita’
Order	‘Ptychopariida’	‘Ptychopariida’
Family	‘Alokistocaridae’	‘Marjumiidae’
	‘Elrathia’	‘Modocia’
Species	‘kingii’	‘typicalis’

0 7 . 1

Complete TABLE 3, on the opposite page. [2 marks]

Choose answers from the list.

- **Community**
- **Genus**
- **Kingdom**
- **Mammal**
- **Population**

0 7 . 2

Which scientist invented the classification system given in TABLE 3? [1 mark]

Tick (✓) ONE box.

- ☐ **Darwin**
- ☐ **Lamarck**
- ☐ **Linnaeus**
- ☐ **Mendel**

0 7 . 3

What is the binomial name of trilobite A?

Use information from TABLE 3, on page 68. [1 mark]

Tick (✓) ONE box.

☐ **‘Arthropoda kingii’**

☐ **‘Elrathia kingii’**

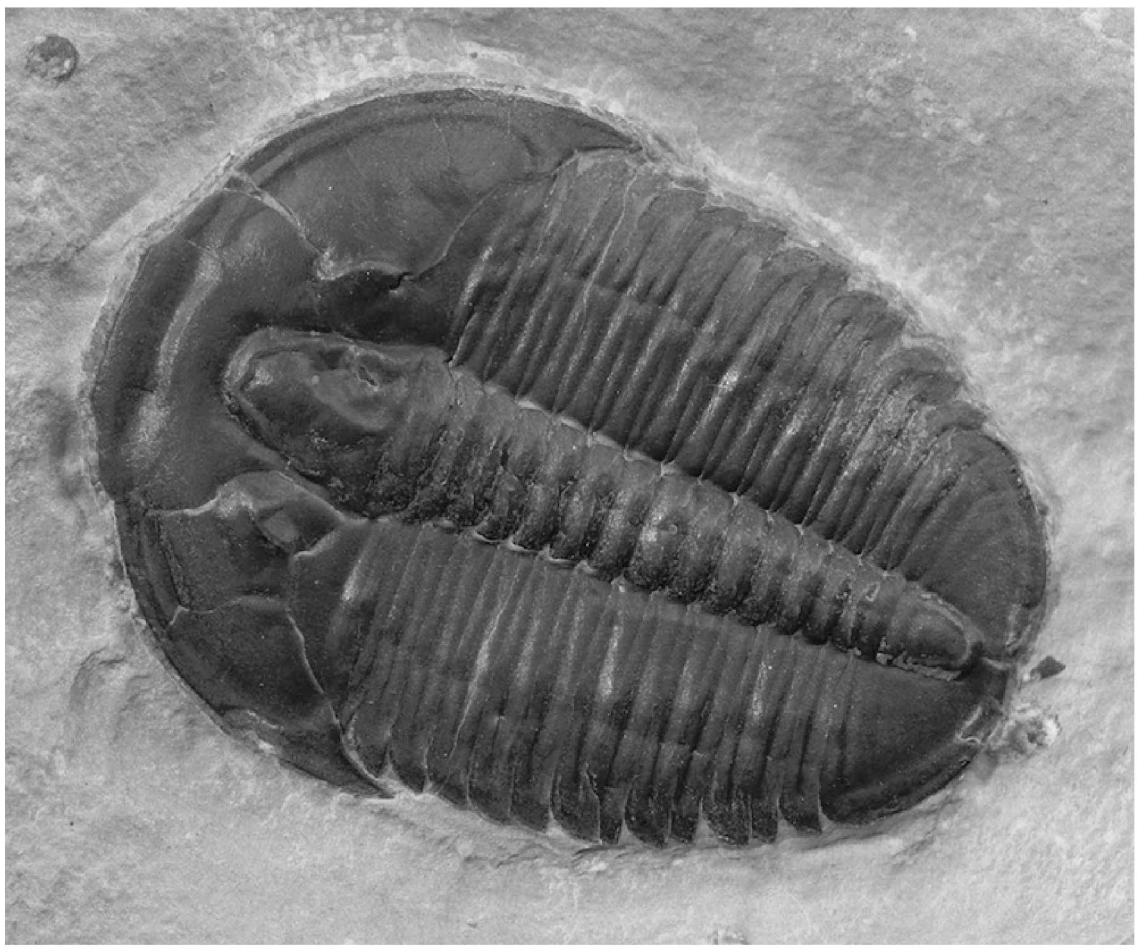
☐ **‘Trilobita kingii’**

[Turn over]

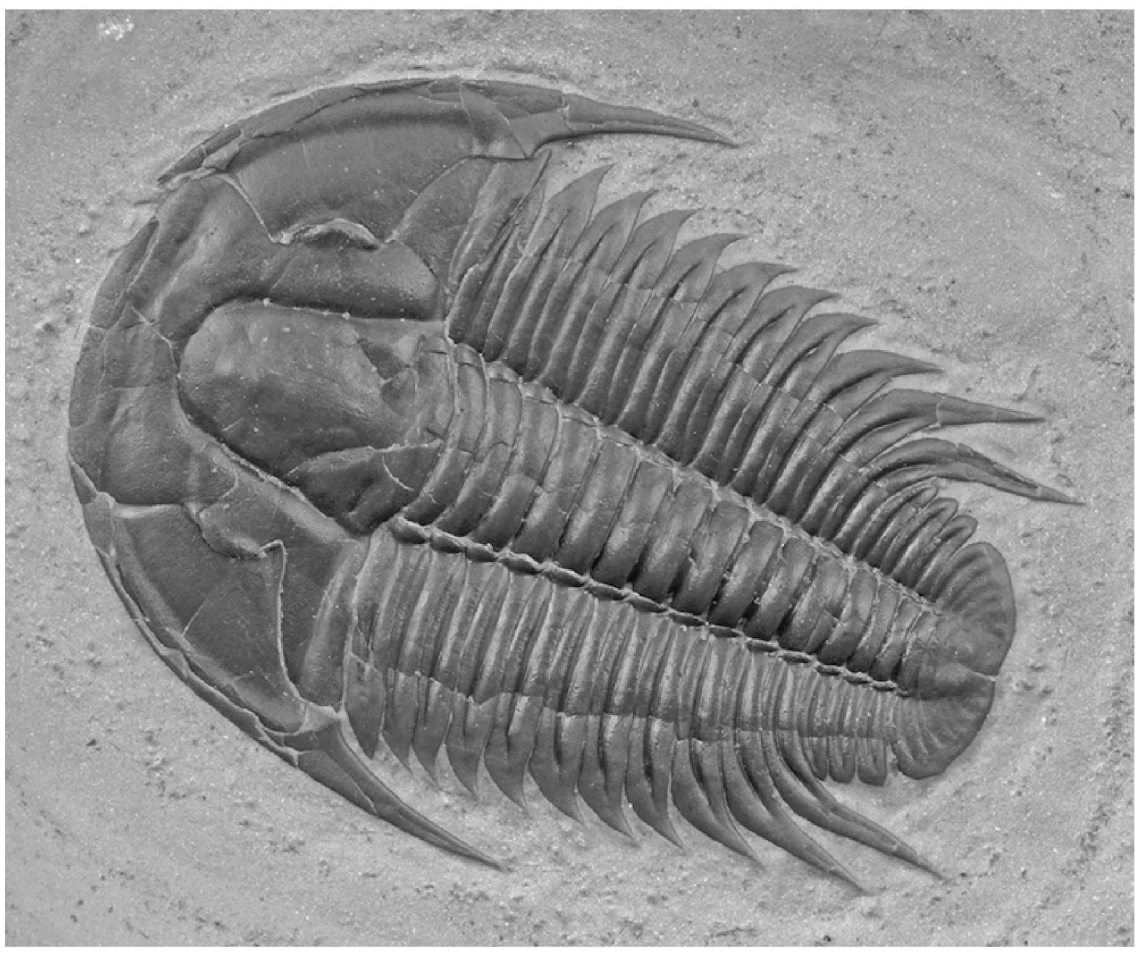
FIGURE 10, on the opposite page, shows fossils of the two species of trilobite.

FIGURE 10

Trilobite A



Trilobite B

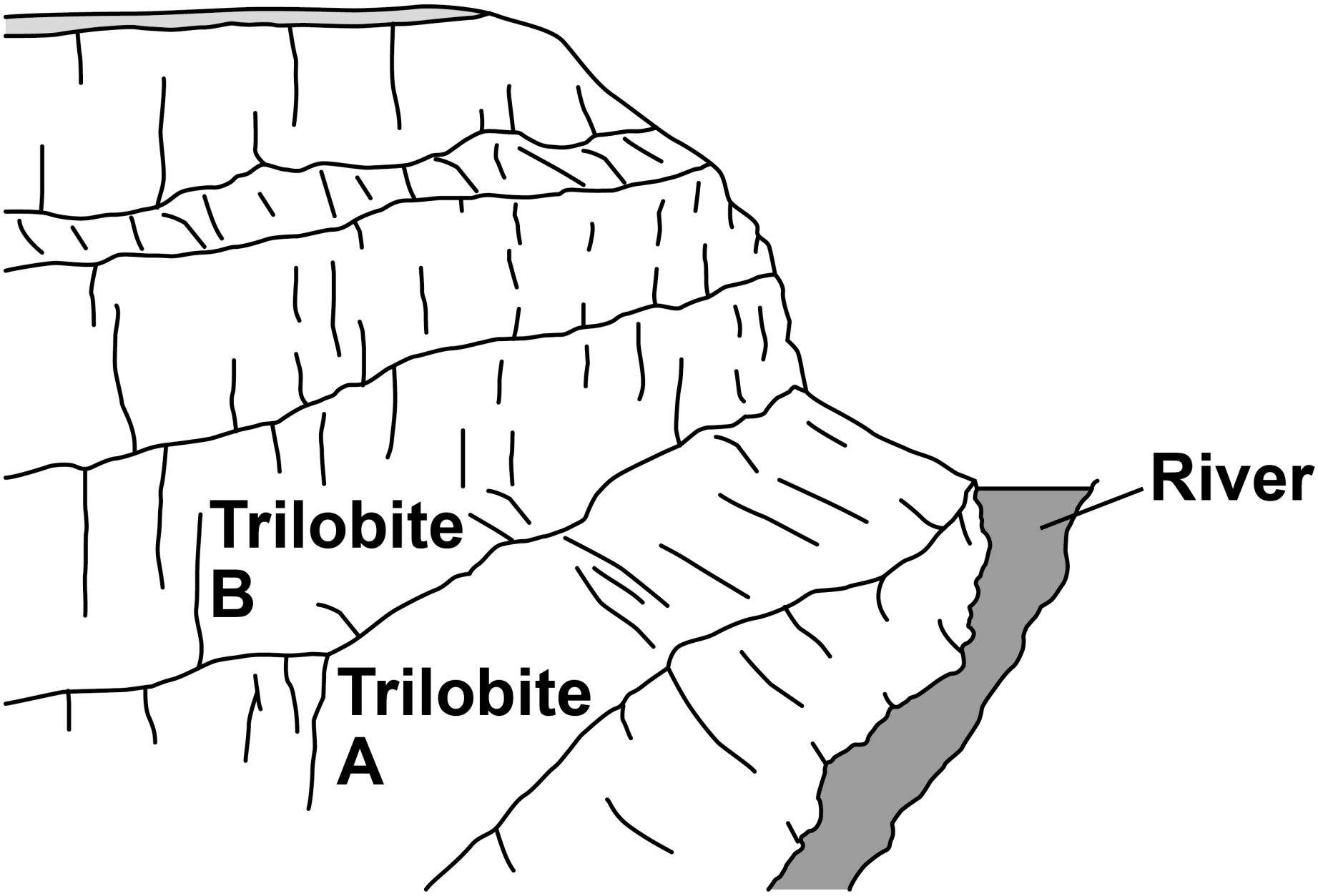


[Turn over]

FIGURE 11 shows:

- **layers of rock in a cliff**
- **where the trilobite fossils were found.**

FIGURE 11



A scientist made the hypothesis:

‘Trilobite B may have evolved from trilobite A.’

0 7 . 4

What TWO pieces of evidence from FIGURE 10 and FIGURE 11 support the scientist's hypothesis?
[2 marks]

Tick (✓) TWO boxes.

- ☐ **Trilobite A and trilobite B were in the same type of rock.**
- ☐ **Trilobite A was found in older rocks than trilobite B.**
- ☐ **Trilobite B has a smaller mass than trilobite A.**
- ☐ **Trilobite B is a different colour from trilobite A.**
- ☐ **Trilobite B is more complex than trilobite A.**

0 7 . 5

Trilobites are animals that lived in the sea.

Complete the sentences about how the fossils of trilobites A and B were formed.

Choose answers from the list. [3 marks]

- **acids**
- **bones**
- **hard parts**
- **minerals**
- **rocks**
- **sediments**
- **soft parts**

The animal dies and falls to the sea bed.

The animal is buried in _____ .

The _____ of the animal decay.

The remains which do NOT decay are replaced by _____ .

[Turn over]

0 7 . 6

Trilobites A and B are now extinct.

Give THREE possible causes of extinction. [3 marks]

1

2

3

0 7 . 7

Suggest ONE reason why scientists CANNOT be sure what caused the trilobites to become extinct. [1 mark]

0 8

There are two types of reproduction:

- **sexual reproduction**
- **asexual reproduction.**

0 8 . 1

Complete TABLE 4, on the opposite page, to compare sexual reproduction with asexual reproduction.

Write a tick (✓) in the box if the statement is true.

The first row has been completed for you. [2 marks]

TABLE 4

	Sexual reproduction	Asexual reproduction
Cell division occurs	✓	✓
Fertilisation occurs		
Genes are passed on from parent to offspring		
Offspring are genetically identical to each other		

[Turn over]

0 8 . 2

Gametes are formed in sexual reproduction.

Name the male gamete formed in flowering plants. [1 mark]

Cell division by meiosis forms gametes.

FIGURE 12, on page 84, shows the mean mass of DNA per cell before, during and after meiosis.

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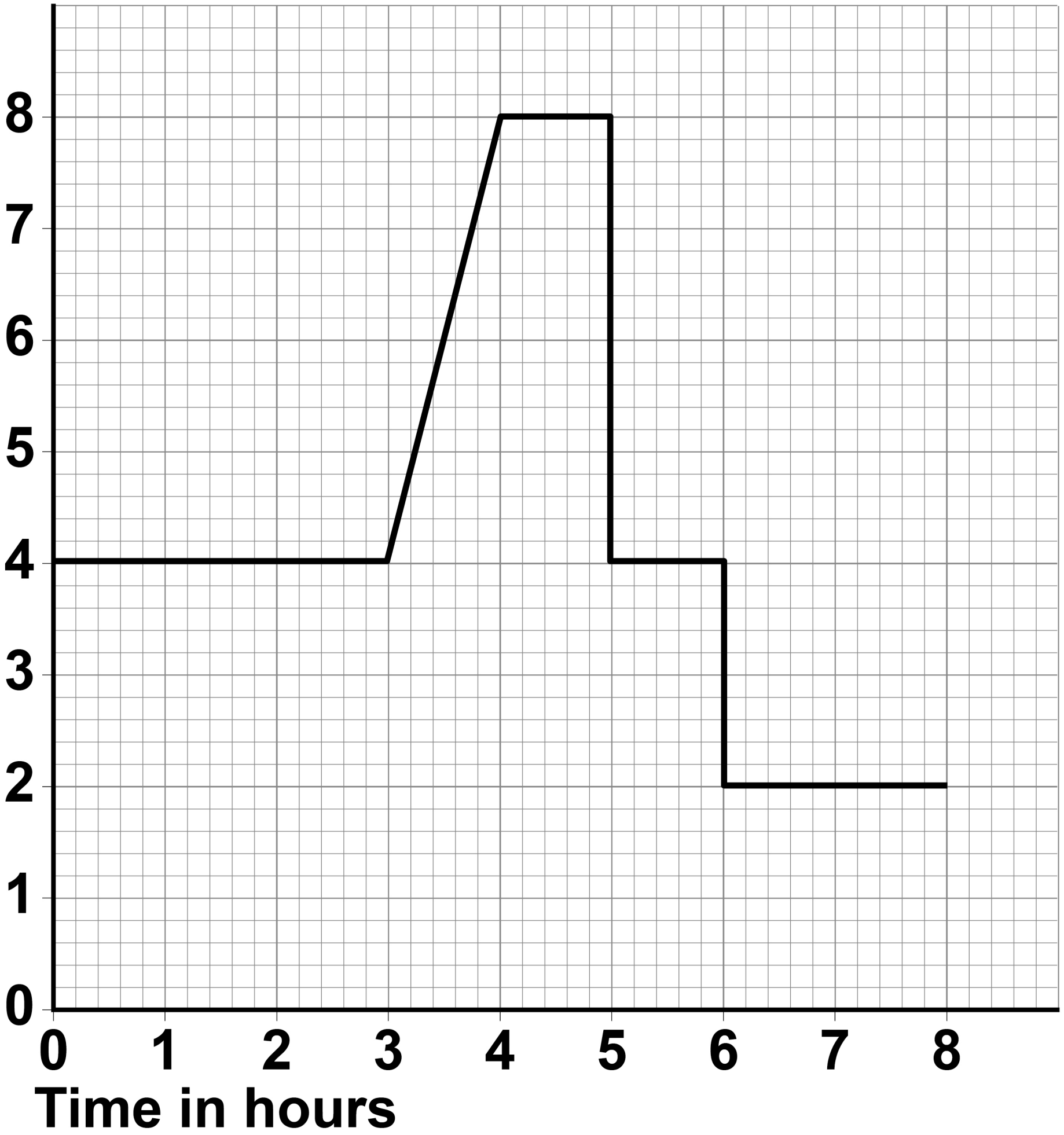
[Turn over]

FIGURE 12


Mean mass of DNA per cell in arbitrary units
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7
8
Time in hours

Use information from FIGURE 12 to answer questions 08.3 to 08.6.

0 8 . 3

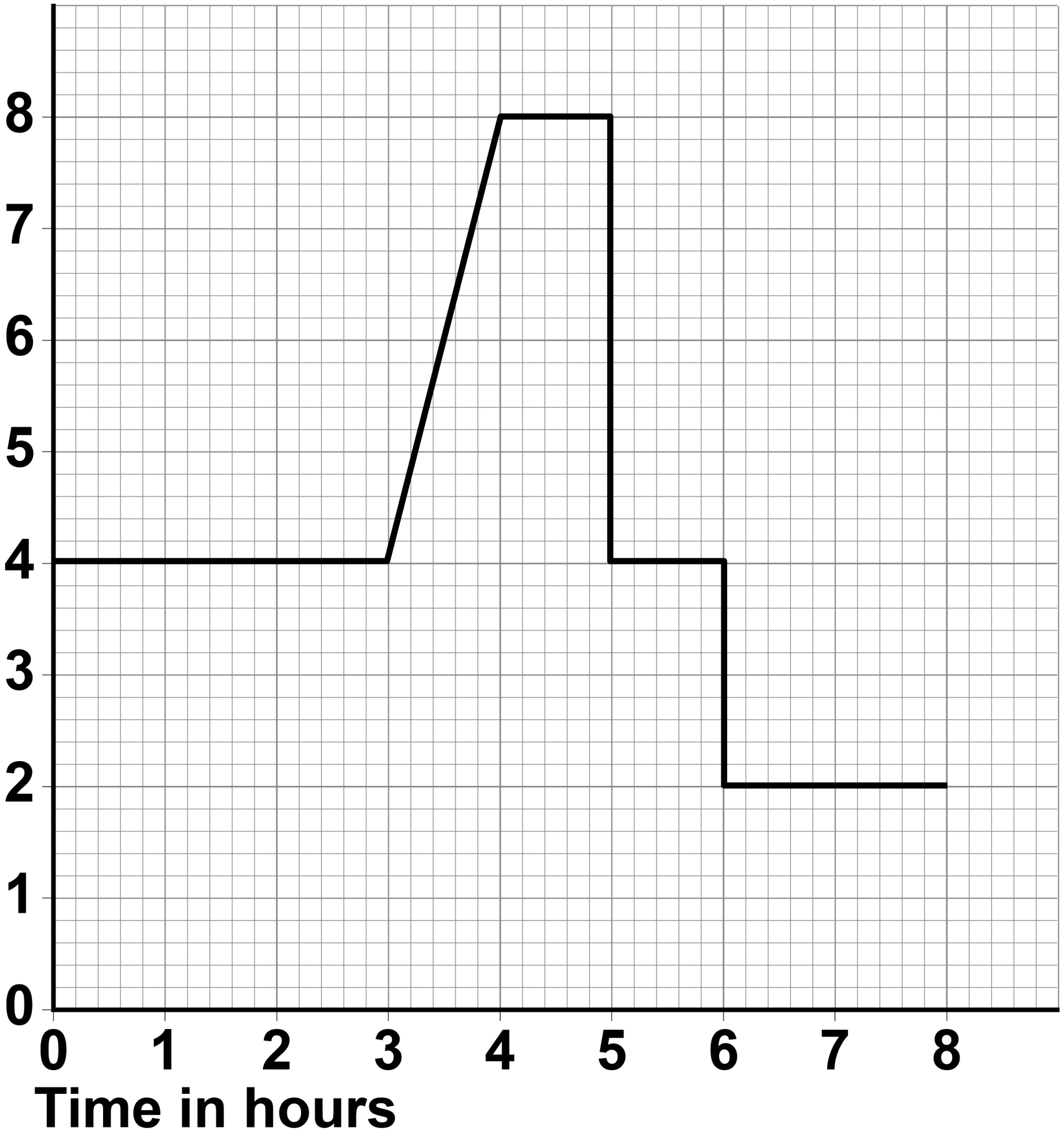
When is the DNA in the chromosomes being copied? [1 mark]

Tick (✓) ONE box.

- ☐ **Between 0 and 3 hours**
- ☐ **Between 3 and 4 hours**
- ☐ **Between 4 and 5 hours**
- ☐ **Between 5 and 6 hours**

[Turn over]

REPEAT OF FIGURE 12



0 8 . 4

Cells divide twice during meiosis.

Which TWO times in FIGURE 12 show one cell dividing into two cells?
[2 marks]

Tick (✓) TWO boxes.

- ☐ **3 hours**
- ☐ **4 hours**
- ☐ **5 hours**
- ☐ **6 hours**
- ☐ **8 hours**

[Turn over]

0 8 . 5

What is the mean mass of DNA in arbitrary units in a sperm cell? [1 mark]

Tick (✓) ONE box.

- ☐ **2**
- ☐ **4**
- ☐ **8**
- ☐ **16**

0 8 . 6

What is the mean mass of DNA in arbitrary units in each cell in an embryo? [1 mark]

Tick (✓) ONE box.

- ☐ 2
- ☐ 4
- ☐ 8
- ☐ 16

8

0 9

Earthworms:

- **live in soil**
- **feed on dead and decaying plant matter**
- **have soft, moist skin**
- **exchange gases through their skin.**

0 9 . 1

Give TWO abiotic factors and TWO biotic factors that could affect the size of an earthworm population. [4 marks]

ABIOTIC FACTORS

1 _____

_____

_____

2 _____

_____

_____

BIOTIC FACTORS

1 _____

_____

_____

2 _____

_____

_____

[Turn over]

0 9 . 2

Students investigated the populations of earthworms in the soil in two different areas:

- **Area A: a grass lawn**
- **Area B: a farmer's field.**

Chemical X can be mixed with water and poured onto the soil.

The mixture brings earthworms to the surface of the soil but does NOT harm the earthworms.

Plan an investigation using chemical X to compare the number of earthworms per m^2 in areas A and B. [6 marks]

[Turn over]

94

10

BLANK PAGE

[Turn over]

1 0

It is important to control the concentration of glucose in the blood.

FIGURE 13, on the opposite page, shows how the concentration of glucose in the blood of a person changed over 4 hours.

1 0 . 1

Give ONE time when the concentration of INSULIN in the person's blood would be high.

Use FIGURE 13. [1 mark]

Time = _____ hours

FIGURE 13

[Turn over]

1 0 . 2

Explain the effect a high concentration of insulin has on blood glucose concentration. [3 marks]

Effect _____

Explanation _____

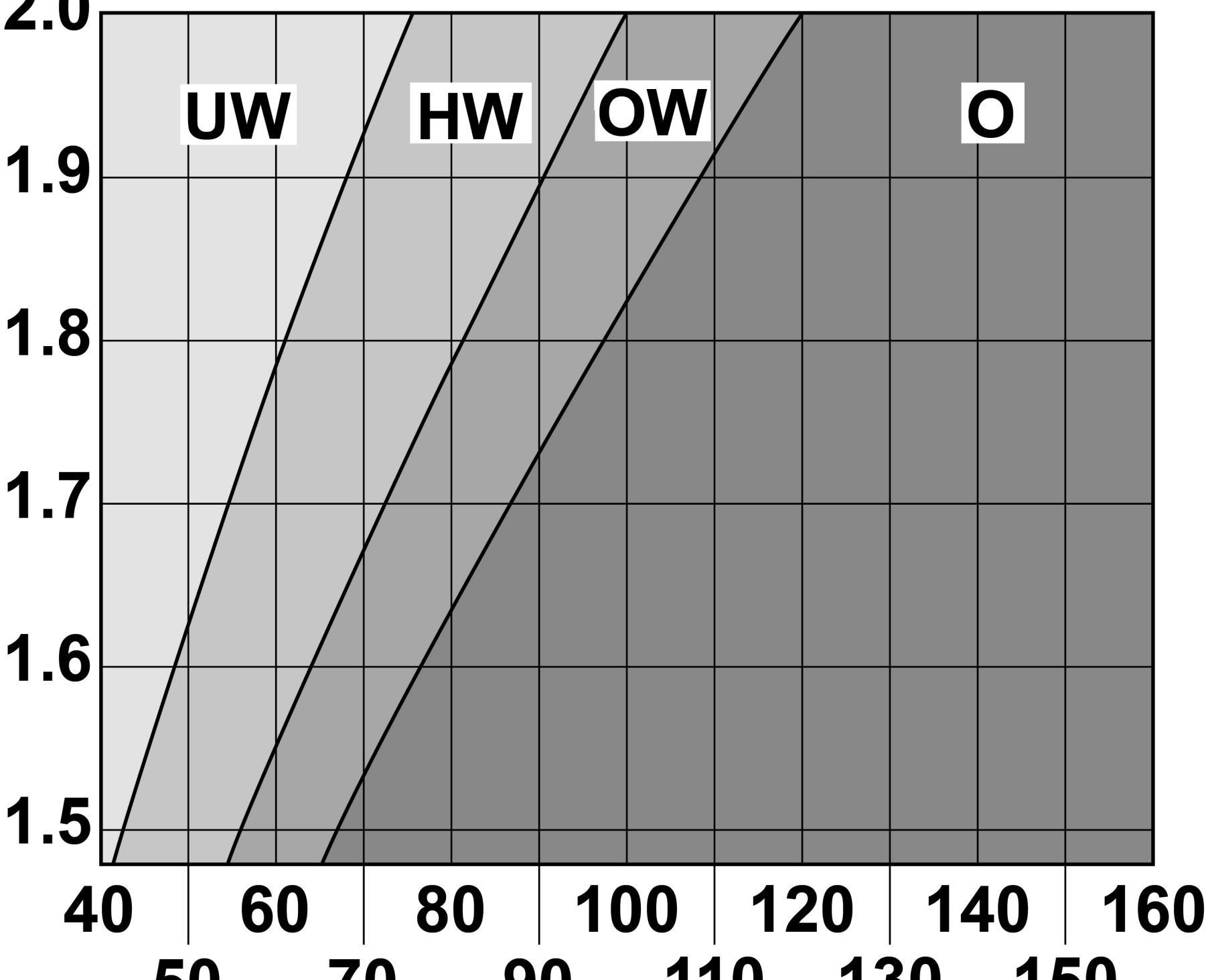
People with diabetes have difficulty controlling the concentration of glucose in their blood.

Type 2 diabetes is linked to obesity.

FIGURE 14, on page 100, shows how to find if an adult's body mass is healthy for their height.

[Turn over]

FIGURE 14



KEY
UW = Underweight
HW = Healthy weight
OW = Overweight
O = Obese

1 0 . 3

Person A:

- **is 1.75 m in height**
- **has a body mass of 52 kg.**

What is person A's weight category?
[1 mark]

Tick (✓) ONE box.

☐ **Underweight**

☐ **Healthy weight**

☐ **Overweight**

☐ **Obese**

[Turn over]

REPEAT OF FIGURE 14

KEY
UW = Underweight
HW = Healthy weight
OW = Overweight
O = Obese

1 0 . 4

Person B is 1.9 m in height.

Give the range of body masses that would put person B in the healthy weight category. [1 mark]

Range from _____ kg to _____ kg

[Turn over]

1 0 . 5

Person C is obese.

A doctor thinks that person C has Type 2 diabetes.

The doctor tests a sample of blood from person C.

TABLE 5, on the opposite page, shows:

- **the results of the blood test**
- **the mean results for people who do NOT have diabetes.**

TABLE 5

Concentration in blood		
	Person C	**Mean for people who do not have diabetes**
Cholesterol in mmol/dm^3	**6.21**	**5.20**
Glucose in mmol/dm^3	**9.56**	**4.51**
Insulin in arbitrary units	**24.32**	**14.83**

[Turn over]

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Type 2 diabetes occurs when body cells have a reduced response to insulin.

Give TWO ways the results of the blood test show that person C might have Type 2 diabetes. [2 marks]

1

2

[Turn over]

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Give TWO ways that a person can reduce the chance of developing Type 2 diabetes. [2 marks]

1 _____

_____

2 _____

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10

END OF QUESTIONS

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