AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
BIOLOGY

F

Foundation Tier Paper 2F

Time allowed: 1 hour 45 minutes

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.
- Fill in the boxes at the top of this page.
- 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	

Do not write outside the box

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.

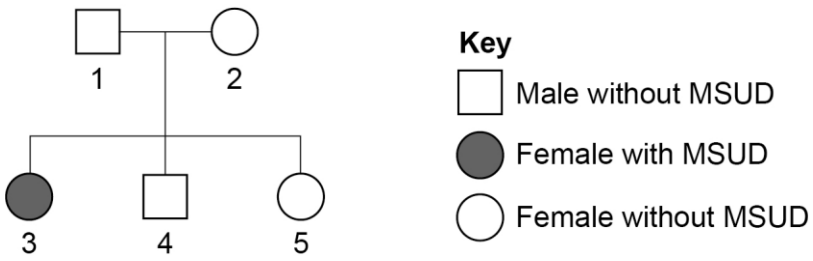
An allele expressed only if a person has two copies of the allele ✓

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



0 1 . 2 The symbol ■ is **not** in the key for **Figure 1**.

What would this symbol represent?

[1 mark]

male with MSUD

Do not write outside the box

Persons **1** and **2** in **Figure 1** have a child with MSUD and some children without MSUD.

0 1 . 3 Complete **Figure 2** 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

Person 2

Person 1	**N**	**n**
N	NN	**Nn**
n	Nn	nn

0 1 . 4 What is the phenotype of a person with the genotype **Nn**?

[1 mark]

does not have MSUD

0 1 . 5 What percentage of the offspring in **Figure 2** will have MSUD?

[1 mark]

Tick (✓) **one** box.

25% ☑ 50% ☐ 75% ☐ 100% ☐

Question 1 continues on the next page

Do not write outside the box

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]

DNA

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

Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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. ☐

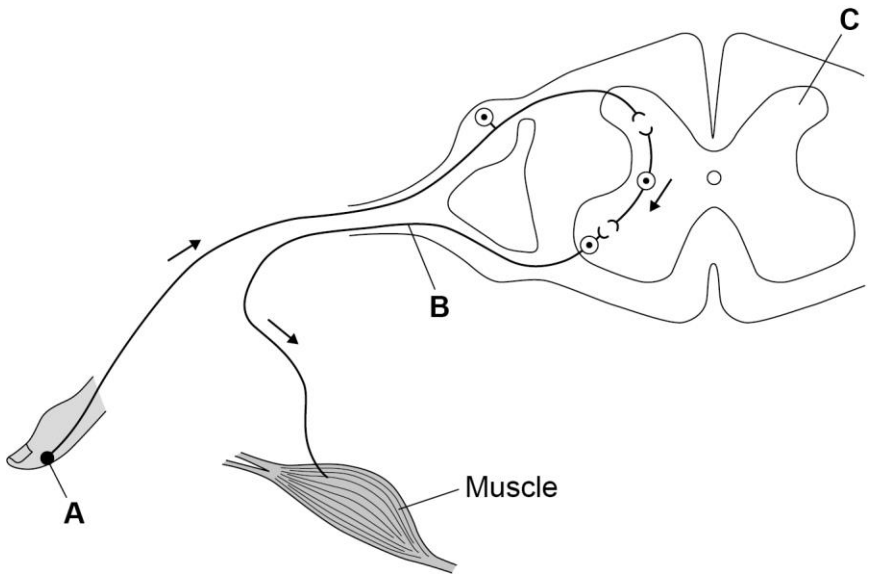
A reflex action is a slow action. ☐

A reflex action is automatic. ☑

Figure 3 shows the nerve pathway for a reflex action.

The arrows show the direction of the nerve impulse.

Figure 3



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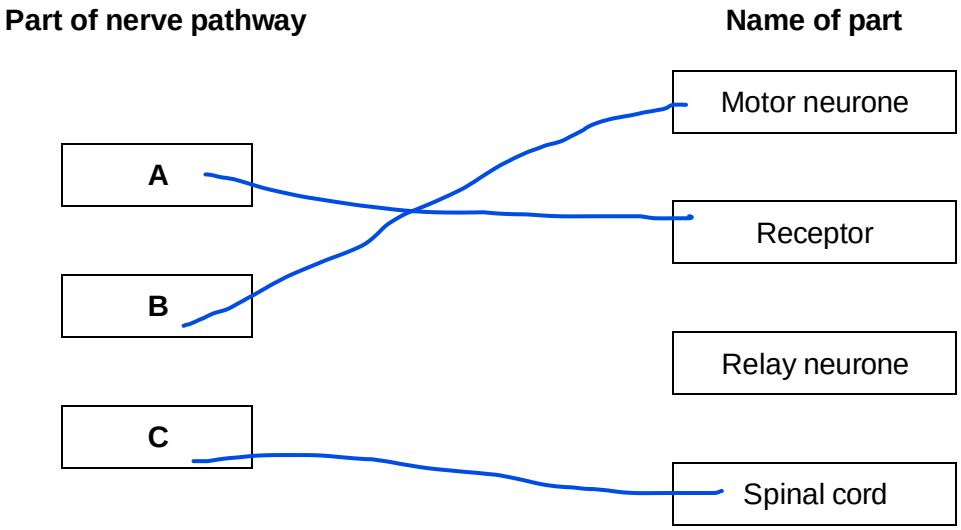
0 2 . 2 Draw **one** line from each part of the nerve pathway to the name of that part.

Use **Figure 3**.

[3 marks]



0 2 . 3 Which **two** human actions are reflexes?

[2 marks]

Tick (✓) **two** boxes.

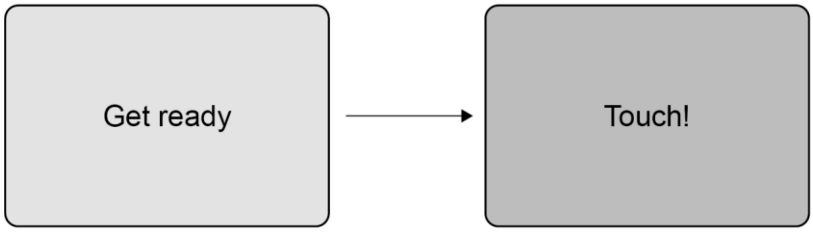
- Blinking when an insect flies into the eye ☑
- Catching a ball in a playground game ☐
- Playing a musical instrument ☐
- Removing the hand from a hot object ☑
- Writing a message to a friend ☐

Question 2 continues on the next page

Students investigated their reaction times using a computer program.

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

Figure 4



Red screen **Green screen**

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**

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0 2 . 4 Calculate mean value **X** in **Table 1**.

[2 marks]

320 + 304 + 315 + 308 + 313 /5

=312

X = _____ milliseconds

0 2 . 5 There is an anomalous result for student **R**.

Draw a ring around the anomalous result in **Table 1**.

[1 mark]

0 2 . 6 Give **two** factors that might affect a person's reaction time.

[2 marks]

1 age

2 drugs

11

Turn over for the next question

Do not write outside the box

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 ☐

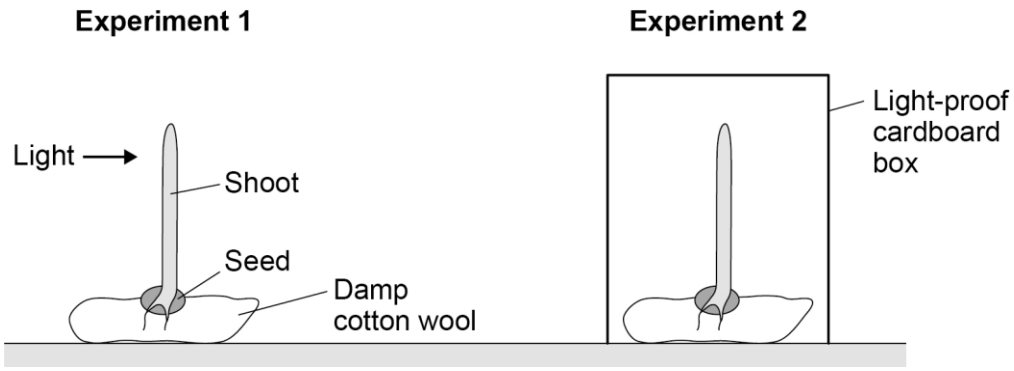
Homeostasis ☐

Tropism ☑

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

Figure 5 shows how the student set up the investigation.

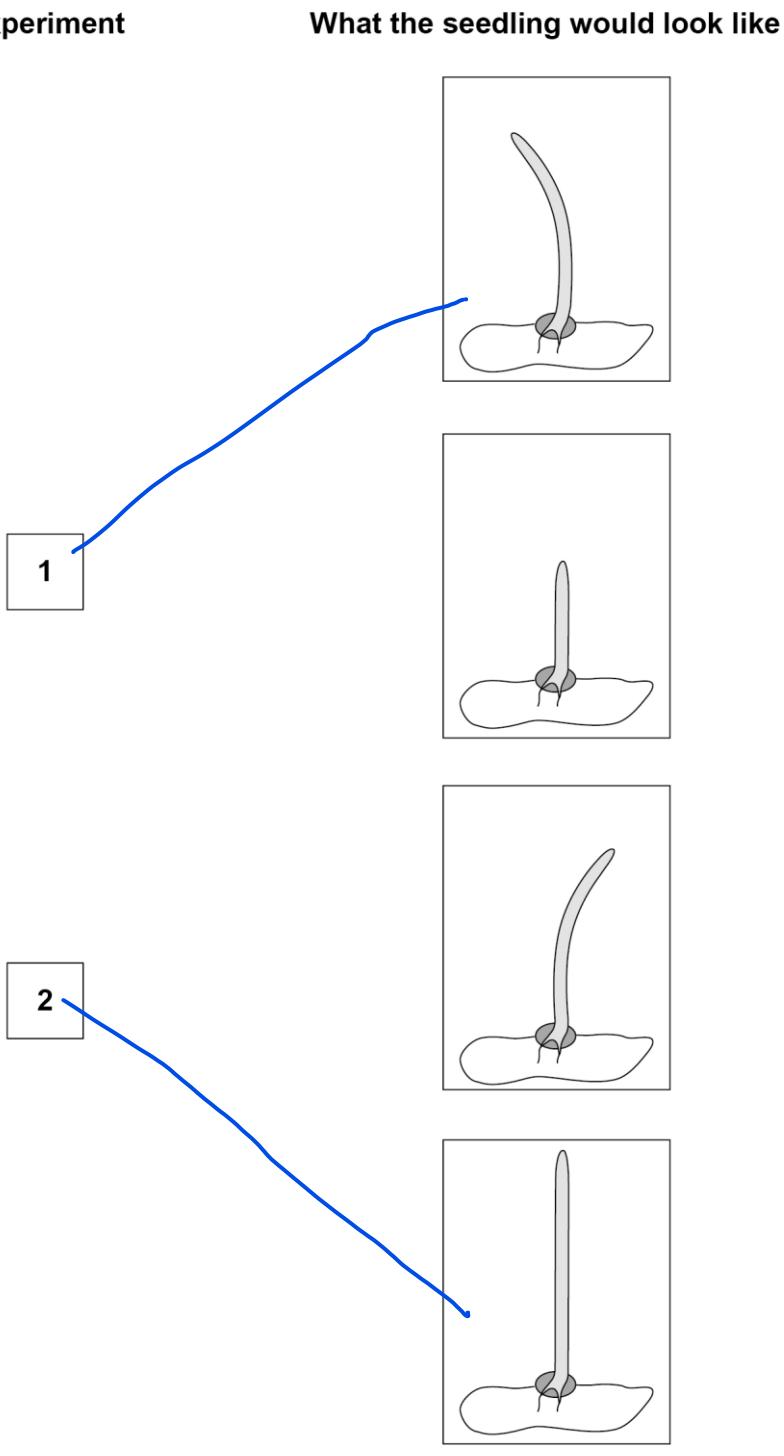
Figure 5



0 3 . 2 Draw **one** line from each experiment to what the seedling would look like after 12 hours.

Do not write outside the box

[2 marks]



0 3 . 3 Why did the student set up experiment **2** in this investigation?

[1 mark]

To show the response in experiment 1 is caused by (1-sided) light

Turn over ►

Do not write outside the box

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]

gravity

Do not write outside the box

0 3 . 7 Scientists often repeat investigations several times.

Give **two** reasons why.

[2 marks]

1 because of variation (in results) or to identify / eliminate anomalies

2 to calculate a mean

9

Turn over for the next question

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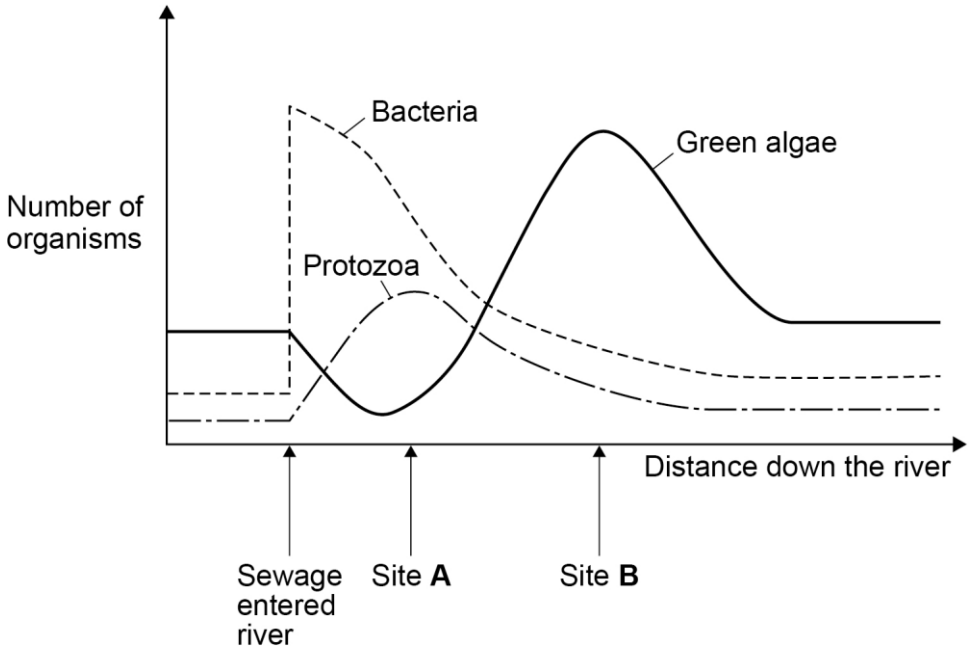
0 4 Rivers are sometimes polluted with untreated sewage.

Figure 6 shows some changes that occurred when untreated sewage entered a river.

Figure 6



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

Do not write outside the box

0 4 . 2 Protozoa are single-celled organisms.

Describe **two** ways **Figure 6** shows that the protozoa in the river feed on bacteria.

[2 marks]

1 Bacteria increase before protozoa increase or when bacteria are high, protozoa increase

2 as protozoa increase, bacteria decrease

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]

aerobic respiration

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]

algae carry out photosynthesis which produces oxygen

Question 4 continues on the next page

Scientists counted the numbers of five different animals in the river at sites **A** and **B**, shown in **Figure 6** on page 14.

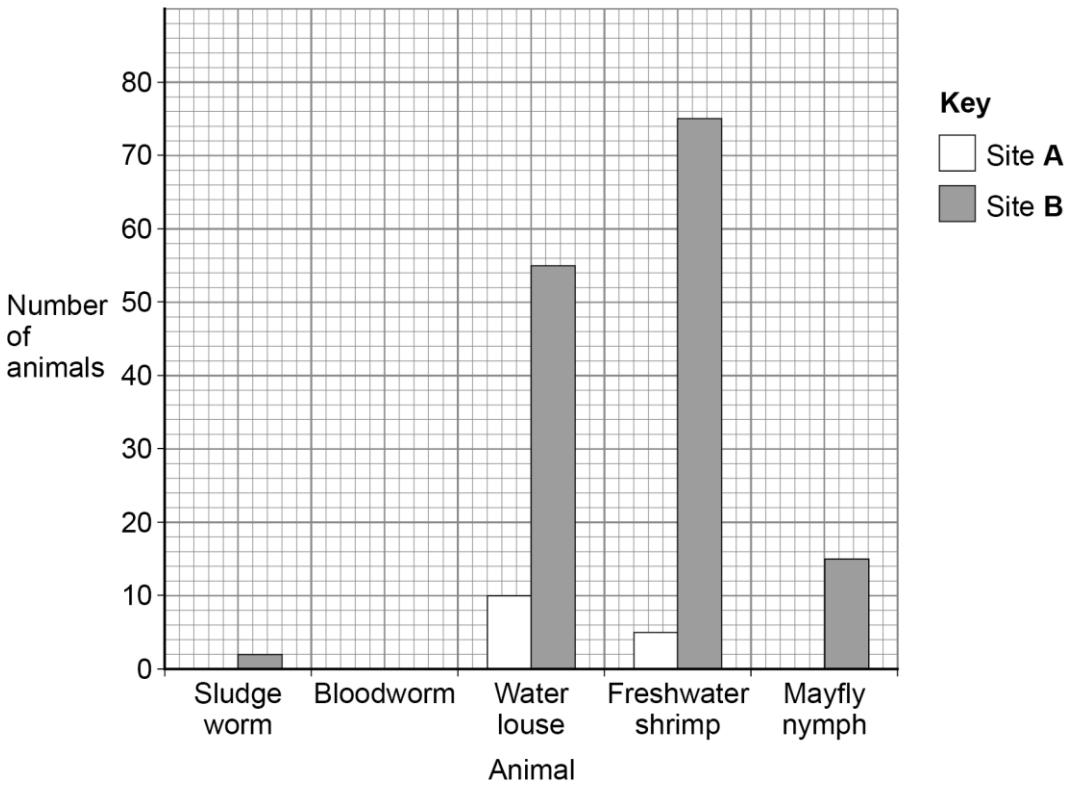
Table 2 shows the results.

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

Figure 7 shows some of the data from **Table 2**.

Figure 7



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0 4 . 5 Complete **Figure 7**.

You should use data from **Table 2** for the sludge worm and the bloodworm.

[2 marks]

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]

More sludge worms at A than at B and no mayfly nymphs at A and mayfly nymphs present at B.

10

Turn over for the next question

Do not write outside the box

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 ☐

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. ☐

Do not write outside the box

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 9 to day 15

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]

oral contraceptive / the 'pill' : (contains hormones / oestrogen / progesterone) to prevent egg / follicle maturing or prevents ovulation

• injection / implant / skin patc: (contains hormones / oestrogen / progesterone) to prevent egg / follicle maturing or prevents ovulation

• condom / femidom: prevents sperm reaching egg or prevents sperm entering woman's body / vagina

• diaphragm : prevents sperm reaching egg / womb / oviduct

• IUD : prevents implantation

• spermicide: kills sperm

• sterilisation / vasectomy / tubular ligation :prevents passage of sperm / egg

• rhythm method :no egg available for fertilisation

10

Do not write outside the box

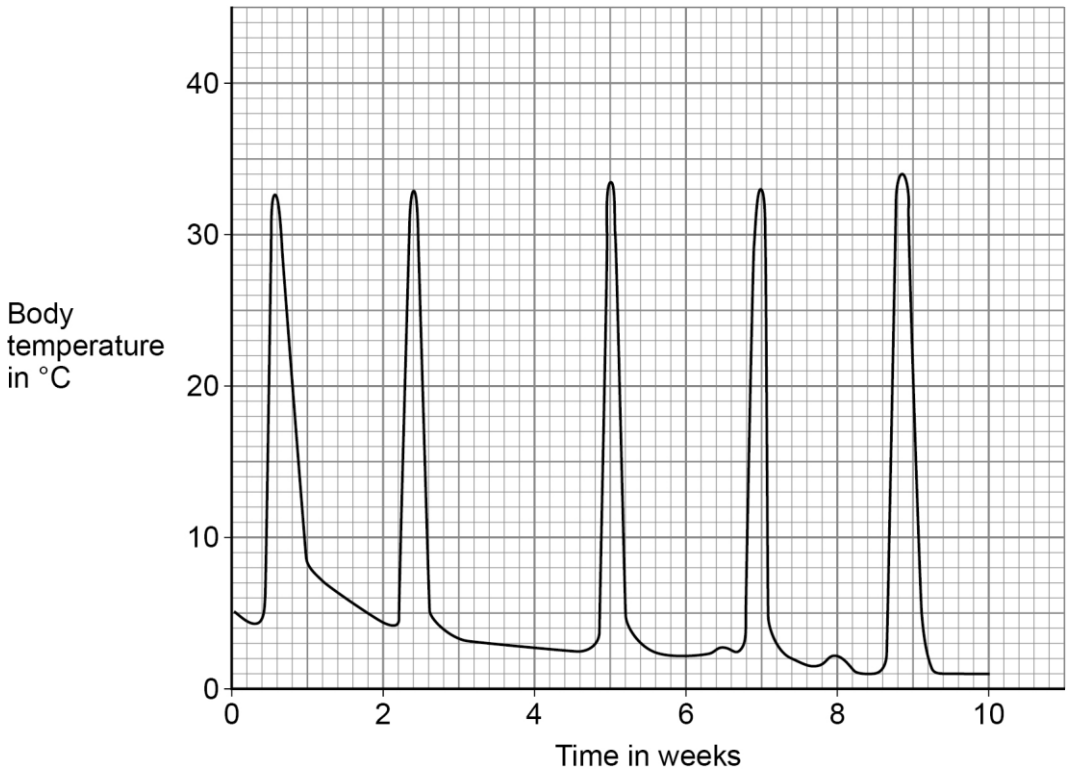
0 6 The echidna is a mammal that lives in Australia.

Figure 8 shows an echidna.

Figure 8

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

Figure 9



Do not write outside the box

0 6 . 1 Give the lowest and highest body temperatures for the echidna shown in **Figure 9**.

[1 mark]

Lowest temperature = 1 °C

Highest temperature = 34 °C

In the cold winter months, the echidna hibernates.

Figure 9 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]

5

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]

so stored food or glycogen does not run out

Question 6 continues on the next page

Do not write outside the box

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]

movement

Do not write outside the box

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]

3200 × 2.5

=8000 (kJ)

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]

6000/ 24 000 × 100

=25 (%)

Percentage = _____ %

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]

Reduced

10

Turn over ►

Do not write outside the box

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 gives the classification of two species of trilobite.

Table 3

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

0 7 . 1 Complete **Table 3**.

[2 marks]

Choose answers from the box.

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

Do not write outside the box

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**.

[1 mark]

Tick (✓) **one** box.

- *Arthropoda kingii* ☐
- *Elrathia kingii* ☑
- *Trilobita kingii* ☐

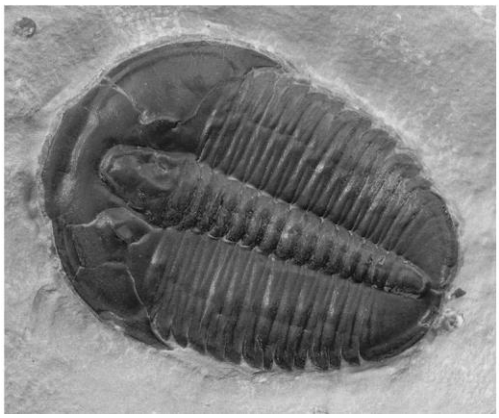
Question 7 continues on the next page

Do not write outside the box

Figure 10 shows fossils of the two species of trilobite.

Figure 10

Trilobite A



Trilobite B

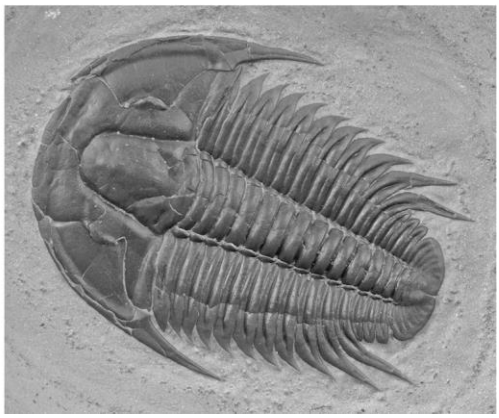
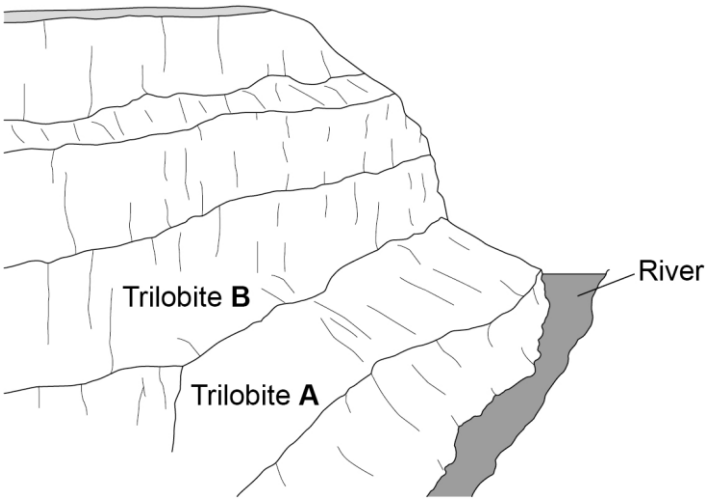


Figure 11 shows:

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

Figure 11



Do not write outside the box

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 box.

[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 sediments .

The soft parts of the animal decay.

The remains which do **not** decay are replaced by minerals .

Turn over ►

Do not write outside the box

0 7 . 6 Trilobites **A** and **B** are now extinct.

Give **three** possible causes of extinction.

[3 marks]

1 drought OR ice age OR global warming

2 volcanic activity

3 competition for food

0 7 . 7 Suggest **one** reason why scientists **cannot** be sure what caused the trilobites to become extinct.

no / insufficient evidence

[1 mark]

13

Do not write outside the box

0 8 There are two types of reproduction:

- sexual reproduction
- asexual reproduction.

0 8 . 1 Complete **Table 4** 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		✓

0 8 . 2 Gametes are formed in sexual reproduction.

Name the male gamete formed in flowering plants.

[1 mark]

pollen

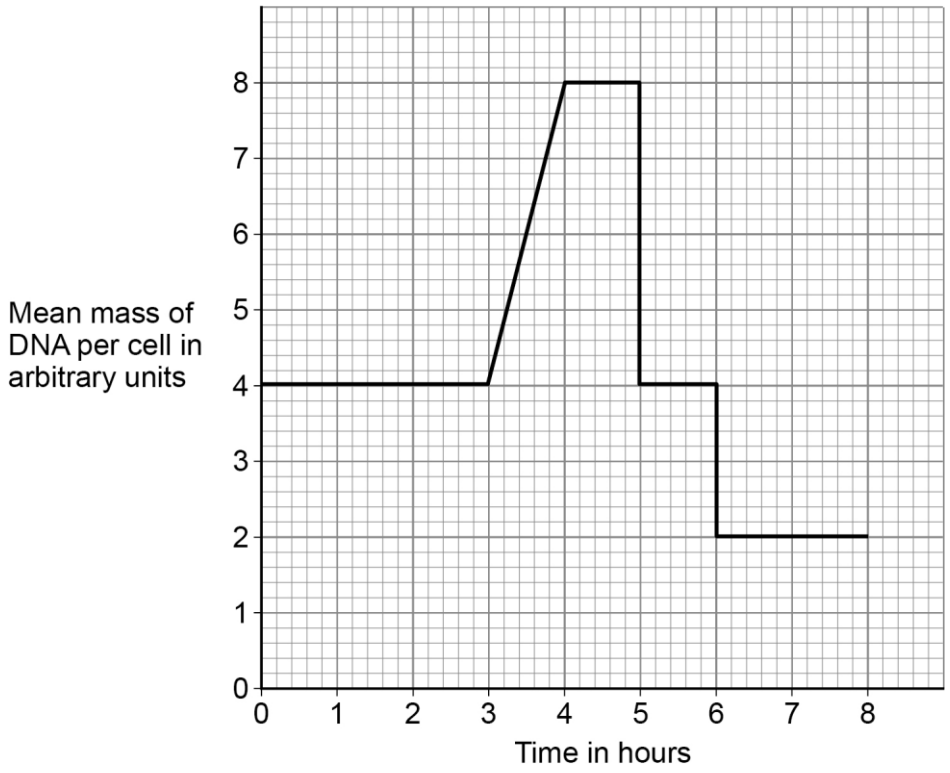
Question 8 continues on the next page

Do not write outside the box

Cell division by meiosis forms gametes.

Figure 12 shows the mean mass of DNA per cell before, during and after meiosis.

Figure 12



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 ☐

Do not write outside the box

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 ☐

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

Turn over for the next question

Do not write outside the box

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 water

2 oxygen

Biotic factors

1 food

2 predators

Do not write outside the box

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]

- same concentration of chemical / X applied to the soil
- same volume / amount of chemical / X applied to the soil
- same size of area sampled – eg 1 m2 or 0.25 m2
- use of a quadrat
- same time between application and collecting worms
- same time allowed for collecting worms after application

- each sample area selected randomly
- method of achieving randomness – eg random coordinates

- (collect and) count worms in each of areas A and B

- at least 5 repeats in each of areas A and B
- calculate mean (per unit area) or total for each of areas A and B
- compare means / totals for areas A and B

10

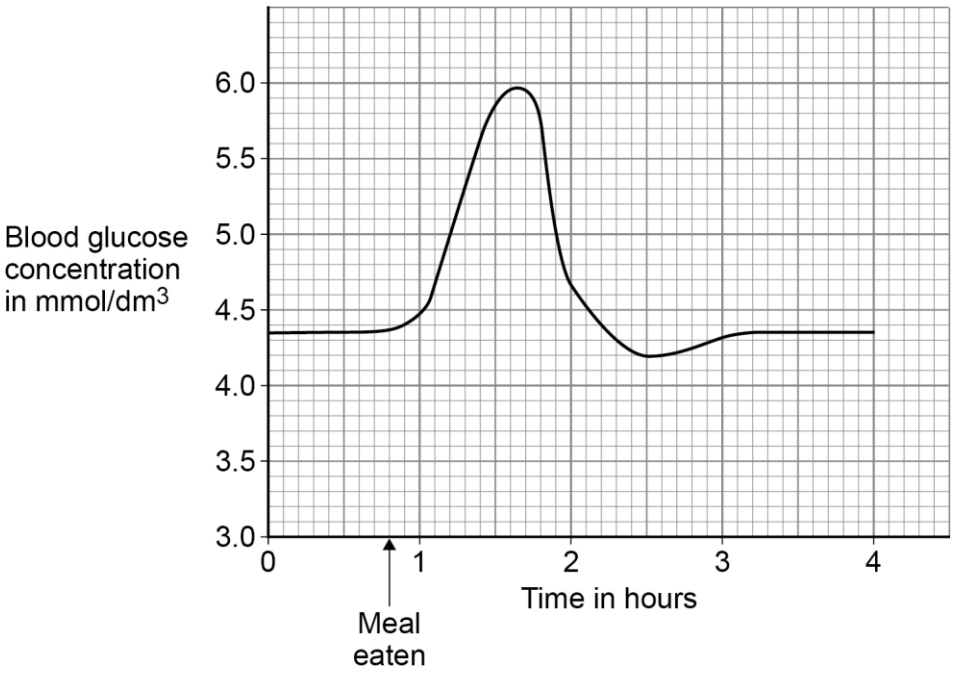
Turn over for the next question

Do not write outside the box

1 0 It is important to control the concentration of glucose in the blood.

Figure 13 shows how the concentration of glucose in the blood of a person changed over 4 hours.

Figure 13



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 = 1.1 to 2 hours

Do not write outside the box

10.2 Explain the effect a high concentration of insulin has on blood glucose concentration.

[3 marks]

Effect : lowered

Explanation glucose converted to glycogen

Question 10 continues on the next page

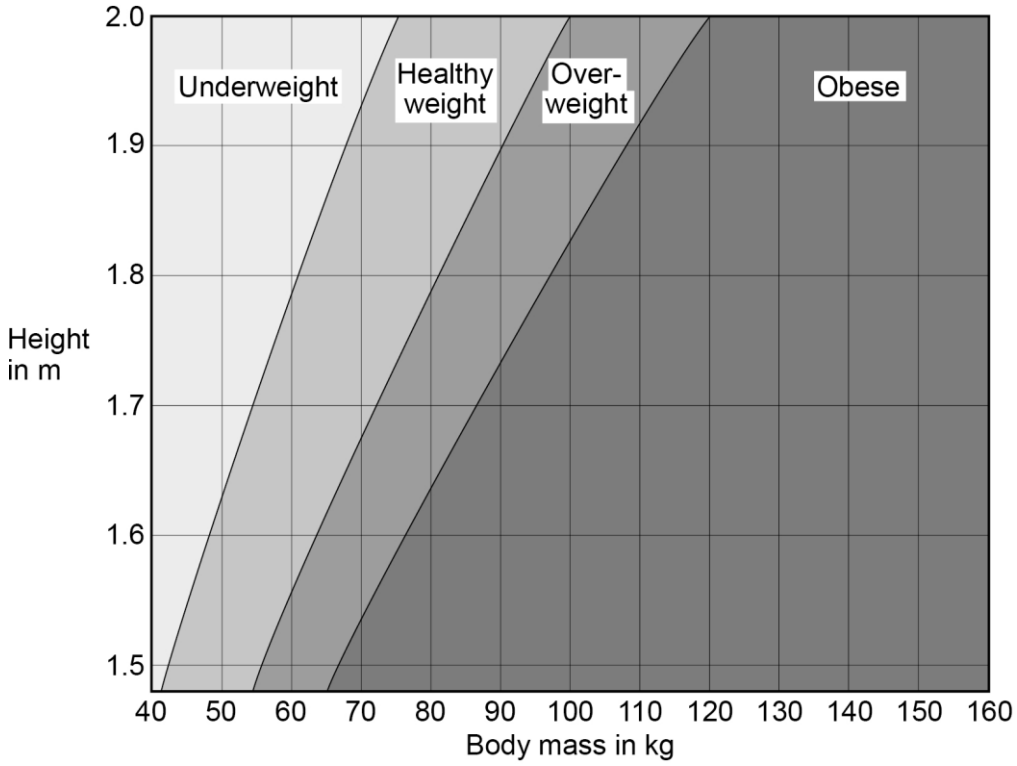
Do not write outside the box

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

Type 2 diabetes is linked to obesity.

Figure 14 shows how to find if an adult's body mass is healthy for their height.

Figure 14



Do not write outside the box

10.3 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

10.4 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 67.5 kg to 90 kg

Question 10 continues on the next page

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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 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

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 person C has higher glucose than mean

2 person C has higher insulin than mean

Do not write outside the box

1 0 . 6 Give **two** ways that a person can reduce the chance of developing Type 2 diabetes.

[2 marks]

1 (more) exercise

2 eat less carbohydrate / sugar

10

END OF QUESTIONS

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