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F

Tuesday 14 May 2019 – Afternoon

GCSE (9–1) Biology B (Twenty First Century Science)

J257/01 Breadth in biology (Foundation Tier)

Time allowed: 1 hour 45 minutes

7711547176

You must have:
- a ruler (cm/mm)

You may use:
- a scientific or graphical calculator
- an HB pencil

J257701

Please write clearly in black ink. **Do not write in the barcodes.**

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

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Answer **all** the questions.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- This document consists of **28** pages.

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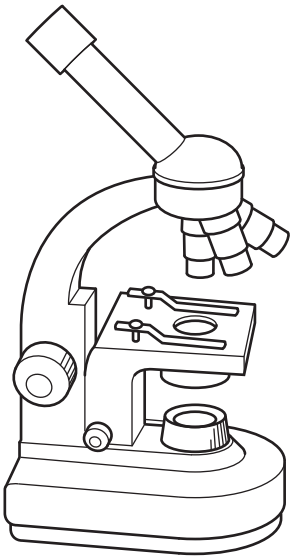
Answer **all** the questions.

1 A student is setting up a light microscope to look at a slide of onion cells, as shown below.



light microscope

(a) Draw an arrow **on the diagram** to show where the student should place the slide. **[1]**

(b) When the student looks down the lens the image is blurry.

Describe what the student needs to do to focus the image.

..... **[1]**

(c) The student knows the power of the eyepiece lens and the power of the objective lens.

How should the student work out the total magnification of the image?

.....

..... **[1]**

(d) The student draws one of the onion cells. The teacher asks the student to label the structure where the chromosomes are located.

Which structure should the student label?

Tick (✓) **one** box.

Cell wall ☐

Chloroplast ☐

Nucleus ☐

[1]

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2 Cellular respiration takes place in all cells.

(a) In which two parts of a cell does cellular respiration take place?

Tick (✓) **two** boxes.

- Cell wall ☐
- Chloroplast ☐
- Cytoplasm ☐
- Mitochondria ☐
- Nucleus ☐

[2]

(b) Cellular respiration is described as an exothermic process.

What is an exothermic process?

..... **[1]**

(c) Which of the following statements are true for **anaerobic** respiration in animal cells?

Tick (✓) **true** or **false** for each statement.

Statement about anaerobic respiration in animal cells	**True**	**False**
Produces ethanol		
Produces lactic acid		
Does not produce ATP		
Uses glucose		
Uses oxygen		

[3]

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(d) Electron microscopes can be used to see small cell structures such as mitochondria.

Which statement explains why?

Tick (✓) **one** box.

They are easy to use. ☐

They are expensive. ☐

They have a higher resolution. ☐

They have a lower magnification. ☐

[1]

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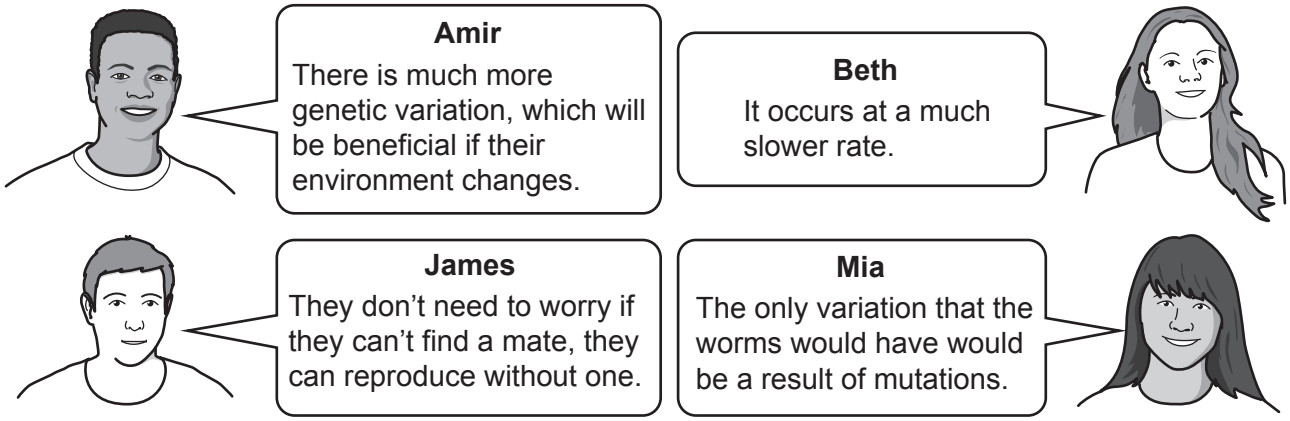
3 Blackworms are animals that can reproduce sexually **and** asexually.

(a) Four students discuss blackworm reproduction.



(i) Which student gives an **advantage** of the blackworm reproducing **asexually**?

Tick (✓) **one** box.

Amir ☐

Beth ☐

James ☐

Mia ☐

[1]

(ii) Which student gives a **disadvantage** of the blackworm reproducing **asexually**?

Tick (✓) **one** box.

Amir ☐

Beth ☐

James ☐

Mia ☐

[1]

(iii) Which student gives an **advantage** of the blackworm reproducing **sexually**?

Tick (✓) **one** box.

Amir ☐

Beth ☐

James ☐

Mia ☐

[1]

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(iv) Which student gives a **disadvantage** of the blackworm reproducing **sexually**?

Tick (✓) **one** box.

- Amir ☐
- Beth ☐
- James ☐
- Mia ☐

[1]

(b) When blackworms reproduce asexually they split into two pieces. The pieces grow a new head and a new tail.

What type of cells must be present to allow the pieces to do this?

Tick (✓) **one** box.

- Differentiated cells ☐
- Gamete cells ☐
- Meristem cells ☐
- Unspecialised cells ☐

[1]

(c) Earthworms are a different type of worm. They are classified into a different group.

What sources of evidence do scientists use to classify species into different groups?

Tick (✓) **two** boxes.

- DNA ☐
- Physical similarities and differences ☐
- Their age ☐
- What they feed on ☐
- Where they are found ☐

[2]

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4 **(a)** Cows are used to produce milk and meat.

(i) Milk and meat contain protein.

Which reagent would you use to test for protein?

Tick (✓) **one** box.

Benedict's ☐

Biuret ☐

Ethanol ☐

Iodine ☐

[1]

(ii) Cows produce different amounts of milk.

A farmer wants a calf that will produce a lot of milk in the future. The farmer carefully chooses which female cow to mate with a male bull.

What is the name of the process the farmer is using?

Put a (ring) around the correct answer.

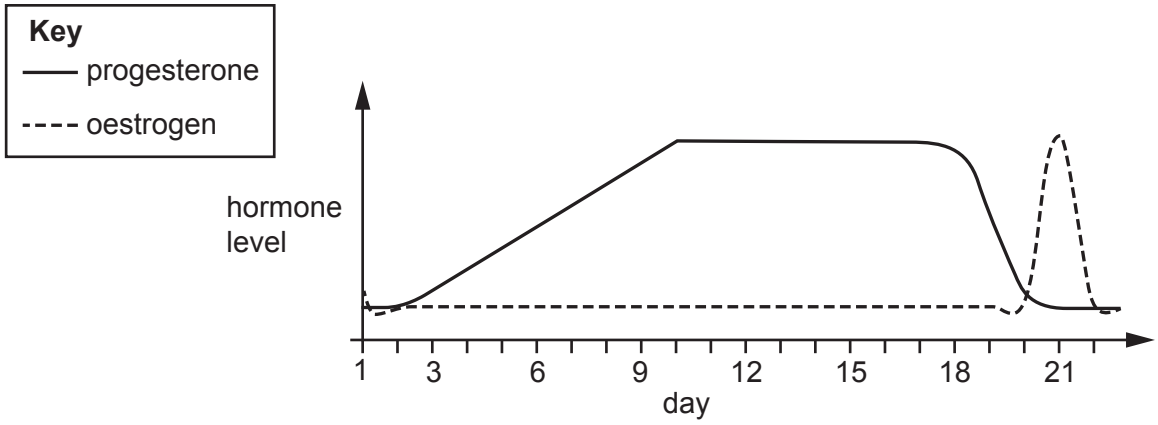
Asexual reproduction **Evolution** **Natural selection** **Selective breeding**

[1]

(b) Adult female cows have an oestrus cycle. It is similar to the menstrual cycle in adult female humans.

A cow can become pregnant when it is in a phase called 'heat'. A cow is in the heat phase when oestrogen levels peak.

The graph shows how levels of progesterone and oestrogen change during the oestrous cycle in one individual cow.



On which day of the oestrus cycle is this cow most likely to become pregnant?

.....

[1]

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(c) The heat phase lasts for a different length of time in each cow.

The table shows the length of the heat phase in eight different cows.

Cow	Length of heat phase (hours)
A	2
B	4
C	5
D	30
E	8
F	2
G	10
H	3

(i) Calculate the range for the length of the heat phase for all cows in this group.

Range = ... hours **[1]**

(ii) Calculate the mean length of the heat phase for all cows in this group.

Mean = ... hours **[2]**

(d) The cow oestrus cycle is controlled in the same way as the human menstrual cycle is controlled.

What controls the human menstrual cycle?

Tick (✓) **one** box.

- Hormones ☐
- Nerves ☐
- The heart ☐
- The kidney ☐

[1]

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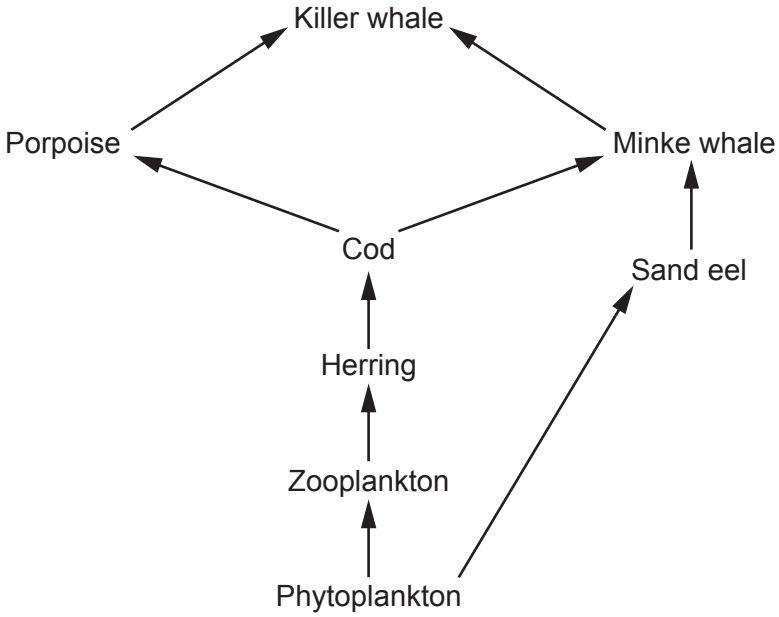
5 Killer whales can be found off the coast of Scotland.

The diagram shows part of their food web.



(a) If the population of killer whales decreased, what effect would this have on the population of sand eels?

Explain your answer.

.....

.....

..... **[2]**

(b) An adult killer whale was found dead off the coast of Scotland.

Scientists concluded that chemicals called PCBs caused the killer whale's death.

The PCBs had entered the killer whale's body from the food chain.

(i) The PCBs increased in concentration in the bodies of organisms higher up the food chain.

Which word describes this process?

Put a (ring) around the correct answer.

Active transport **Bioaccumulation** **Eutrophication** **Translocation**

[1]

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(ii) The dead killer whale's body will be decomposed.

Describe how this will happen **and** explain why it is important.

.....

.....

.....

..... **[2]**

(iii) Decomposition is affected by temperature.

Use words from the list to complete the sentences below.

You may use each word once, more than once or not at all.

amino acids

decreases

enzymes

fats

increases

water

As the temperature ..... the rate of decomposition increases. This is because the temperature will affect the ..... involved in decomposition.
[2]

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6 Plants photosynthesise and respire.

(a) Carbon dioxide and water are needed by plant cells for photosynthesis.

These substances need to be transported into the cells.

Draw a line from each **substance** to the **process** that transports it into a cell.

Substance	**Process**
Carbon dioxide	Active transport
Water	Diffusion
	Osmosis

[2]

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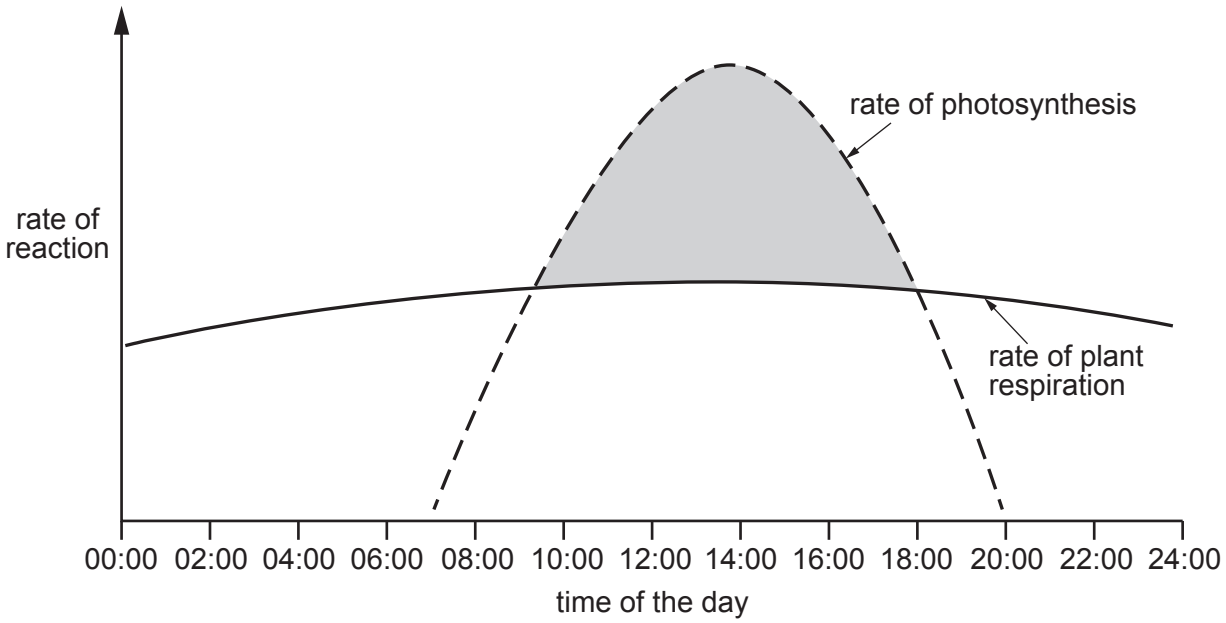
(b) The graph shows the rate of photosynthesis and respiration in a plant during one day.



(i) Over which period of time did the plant photosynthesise?

From ..... to ..... **[1]**

(ii) During which period of time was the rate of photosynthesis greater than the rate of respiration?

From ..... to ..... **[1]**

(iii) A 'compensation point' is a point where the rate of photosynthesis is the same as the rate of respiration.

On the graph place an **X** to show a compensation point. **[1]**

(c) Plants need magnesium to make chlorophyll.

One of Amy's plants is not getting enough magnesium from the soil. It is shorter than the other plants.

Explain why not getting enough magnesium has affected the plant's growth.

.....

.....

.....

.....

.....

..... **[3]**

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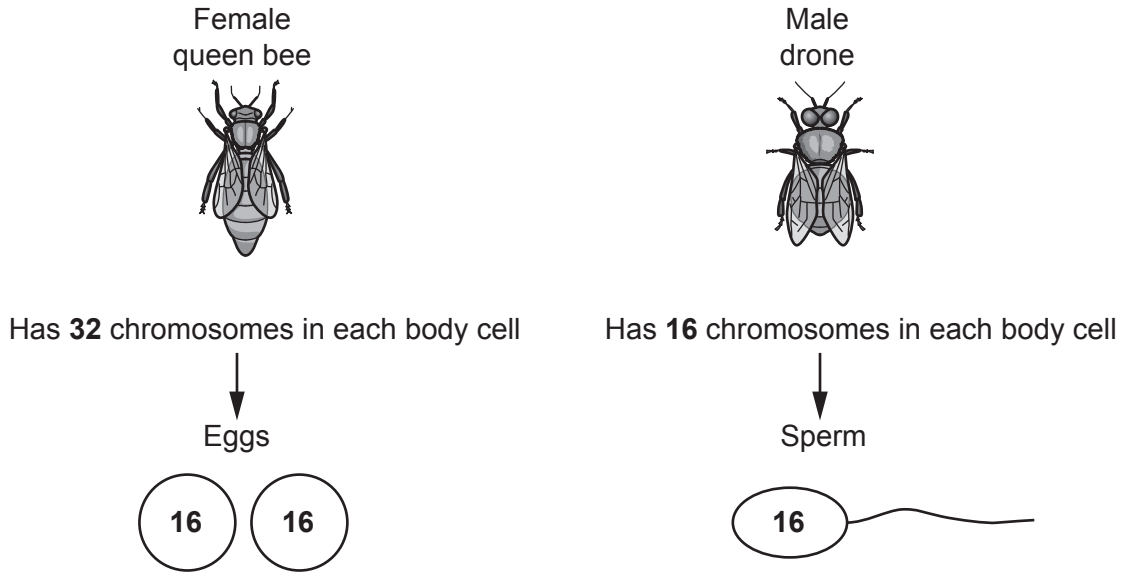
7 Female and male bees have different numbers of chromosomes.

The diagram shows the number of chromosomes in female queen bees and male drones.



Use the information in the diagram to answer the following questions.

(a) How is the number of chromosomes found in body cells in the queen bee different to those in the male drones?

..... **[1]**

(b) The female queen bee produces eggs.

Which type of cell division makes eggs?

..... **[1]**

(c) Fertilised and unfertilised eggs can both become offspring. The sex of the offspring is determined by whether or not the egg was fertilised.

Complete the table.

Egg	Number of chromosomes in offspring	Sex of offspring
Egg is fertilised		
Egg is not fertilised		

[4]

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(d) Bees make honey from nectar.

Nectar is made of sucrose and water.

Bees have an enzyme called invertase. This enzyme converts the sucrose in nectar into two separate sugars.

(i) Use the 'Lock and Key' model to describe how the enzyme converts the sucrose into two separate sugars.

.....

.....

.....

.....

.....

..... **[3]**

(ii) A student investigates the effect of temperature on the rate of the reaction catalysed by the enzyme invertase.

What effect will increasing the temperature have on the rate of reaction?

Explain your answer.

.....

.....

.....

..... **[2]**

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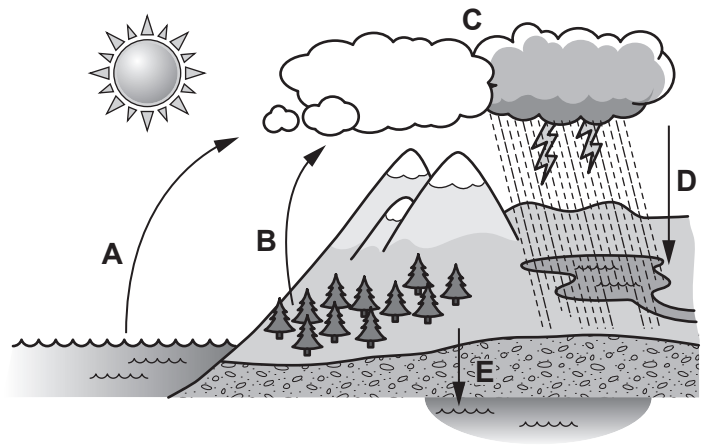
8 The diagram below shows the water cycle.



(a) Draw a line from **A**, **B**, **C** and **D** to the correct name for the process shown in the diagram.

A	Condensation
B	Evaporation
C	Precipitation
D	Transpiration

[4]

(b) Deforestation is happening to rainforests in Malaysia and Indonesia.

Deforestation can affect the water cycle.

Put a (ring) around the word that completes the sentence describing the effect of deforestation on processes **B** and **E**.

Deforestation will **decrease / increase / have no effect** on process **B**.

Deforestation will **decrease / increase / have no effect** on process **E**.

[2]

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(c) The rainforests in Malaysia and Indonesia are being replaced with palm oil trees.

This will have an effect on the biodiversity of the area.

(i) Choose **one** word from the list to complete the sentence.

animals

microorganisms

organisms

plants

Biodiversity can be defined as the amount of living ..... in a particular area. **[1]**

(ii) Biodiversity is important for economic, ethical and environmental reasons.

For each statement in the table, decide if it is an example of an economic, ethical or environmental reason.

Tick (✓) **one** box for each statement.

Statement	**Economic**	**Ethical**	**Environmental**
All living things have a right to live.			
Species provide us with useful products.			
Removing one species can affect a whole ecosystem.			

[1]

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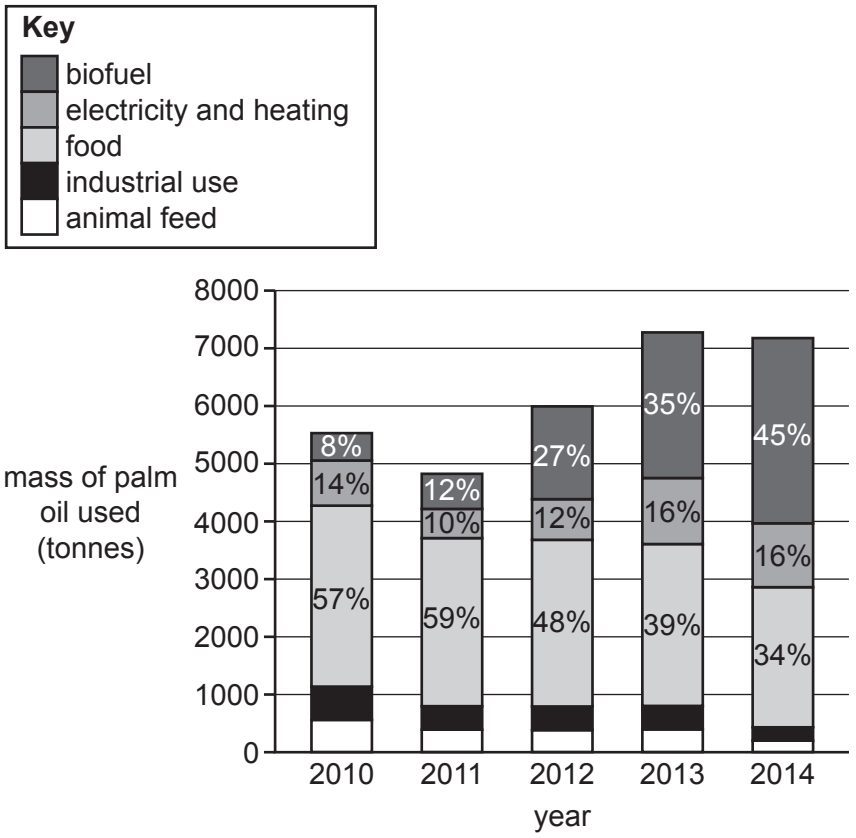
(d) The palm oil taken from the trees is used in different ways.

The bar chart shows changes in the uses of palm oil between 2010 and 2014.



Which use of palm oil increased the most from 2010 to 2014?

Use data from the graph to support your answer.

.....

..... **[2]**

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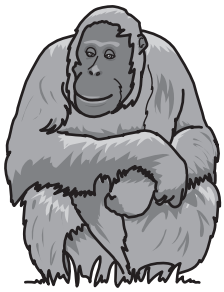
(e) Orangutans live in the rainforests of Malaysia.



Orangutan

A century ago there were 230 000 orangutans.

The table shows the estimated number of three species of orangutans which remain today.

Species of orangutan	Number
Bornean	104 700
Sumatran	7500
Tapanuli	800

(i) Calculate the percentage (%) of orangutans which remain today.

Give your answer to **2** significant figures.

Percentage = ... % **[3]**

(ii) The number of orangutans living in the rainforests of Malaysia is only an estimate.

Explain why.

.....

..... **[1]**

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9 Bacterial cells are used in a process called genetic engineering to make human insulin.

(a) Define the term 'genetic engineering'.

.....

..... **[2]**

(b) What condition could the insulin produced in this process be used to treat?

..... **[2]**

(c) Bacteria were first used to produce human insulin in 1978. Before that, pig insulin was used to treat people who did not make their own insulin.

Suggest **two** reasons why it is better to use insulin produced by bacteria rather than pigs.

1 .....

2 .....

[2]

(d) Insulin is a protein.

What is a protein made from?

Tick (✓) **one** box.

- Amino acids ☐
- Fatty acids ☐
- Glucose ☐
- Glycerol ☐

[1]

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10 Reflexes help us to respond to stimuli. In a simple reflex, nerve impulses are passed along a pathway called a reflex arc.

The diagram in **Fig. 10.1** shows a reflex arc.

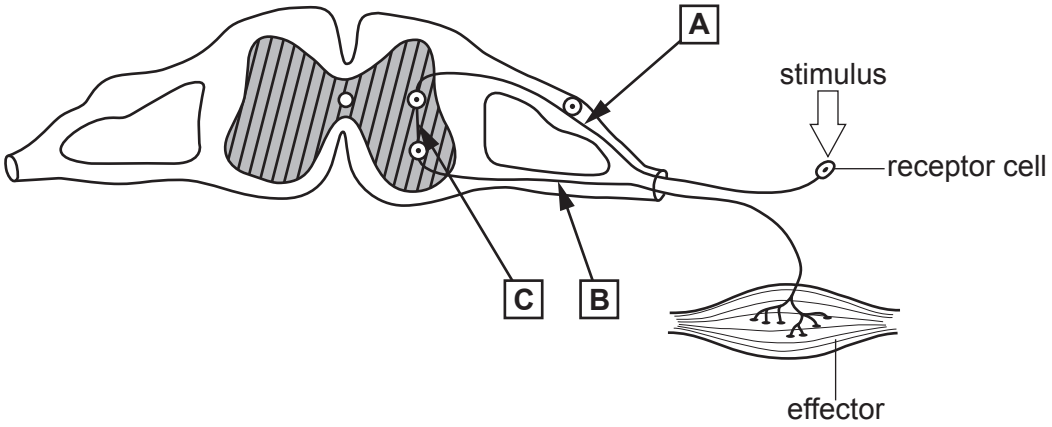

Fig. 10.1

(a) Name the structures labelled **A**, **B** and **C**.

	Name of structure
A	
B	
C	

[3]

(b) Write down **one** advantage of a reflex arc **not** involving the brain.

.....

..... **[1]**

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(c) Two students want to investigate reflex actions.

They set up an experiment as shown in **Fig. 10.2**.

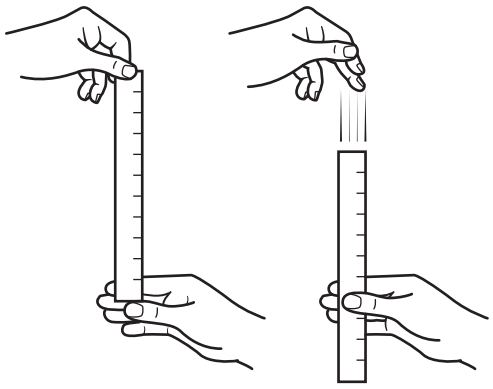

Fig. 10.2

Each student decides to use a different method.

- Using a stop clock, student **A** measures the time it takes for the participant to catch the ruler.
- Student **B** measures the distance the ruler falls through the participant's hand.

(i) Write down **one** reason why student **B's** method is better than student **A's**.

.....

..... **[1]**

(ii) Write down **two** variables that both students would need to keep the same.

1 .....

2 .....

[2]

(iii) Both students decide to repeat their experiment.

Explain why.

.....

..... **[1]**

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(d) Some nerve impulses can travel at a speed of 119 m / s.

(i) Which of the following shows 119 written in standard form?

Tick (✓) **one** box.

1.19×10^{2} ☐

1.19×10^{-2} ☐

11.9×10^{1} ☐

119×10 ☐

[1]

(ii) Which part of a neuron speeds up transmission of a nerve impulse?

Tick (✓) **one** box.

Axon ☐

Fatty sheath ☐

Neurotransmitter ☐

Synapse ☐

[1]

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11 Read the newspaper article.

Scarlet fever cases increase

The number of scarlet fever cases is increasing. The number of confirmed cases in 2016 is reported to be > 19 000, the highest level in 50 years.

(a) The article states that > 19 000 cases were reported in 2016.

What does the '>' in this statement mean?

..... **[1]**

(b) Look at the data in the table showing the number of confirmed cases of scarlet fever.

Year	Number of confirmed cases of scarlet fever
2013	4700
2014	15 637
2016	19 206

Explain why doctors and scientists may be concerned by the data in the table.

.....

.....

.....

..... **[2]**

(c) Calculate the percentage increase in the number of cases from 2013 to 2014.

Put a (ring) around the correct answer.

23% **30%** **233%** **333%** **[1]**

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(d) Scarlet fever is common in children under 10 years old.

(i) Scarlet fever is a bacterial infection. It is transmitted easily by close contact.

How could the spread of this infection be reduced?

.....

.....

..... **[2]**

(ii) Doctors could prescribe some medication to treat this infection.

Write down **one** factor that doctors will consider before prescribing this treatment.

.....

..... **[1]**

(iii) Which of the following diseases is also caused by bacteria?

Tick (✓) **one** box.

Athlete's foot	☐
HIV	☐
Malaria	☐
Salmonella food poisoning	☐

[1]

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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