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GCSE (9–1) Combined Science (Biology) A (Gateway Science)

J250/02 Paper 2, B4–B6 and CS7 (PAGs B1–B5)

(Foundation Tier)

Monday 11 June 2018 – Morning

Time allowed: 1 hour 10 minutes

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

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

First name									
Last name									
Centre number						Candidate number				

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- 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.
- Do **not** write in the barcodes.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **24** pages.

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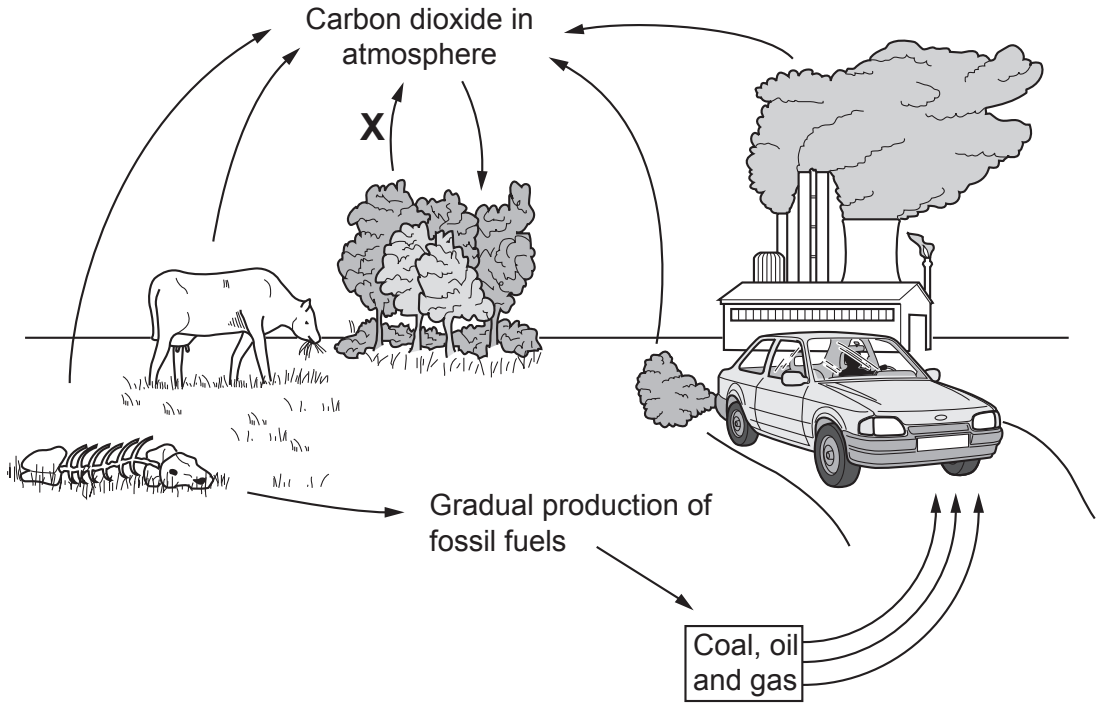
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SECTION A

Answer **all** the questions.

You should spend a maximum of 20 minutes on this section.

1 Look at the diagram of the **carbon** cycle.



Which process is shown by the arrow labelled **X**?

A Decomposition

B Evaporation

C Photosynthesis

D Respiration

Your answer ☐ **[1]**

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2 AIDS is a human disease.

Which statement describes AIDS?

A Communicable bacterial disease

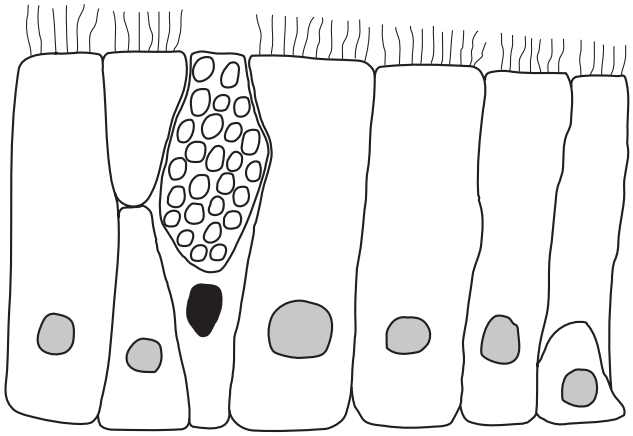
B Communicable viral disease

C Non-communicable bacterial disease

D Non-communicable viral disease

Your answer ☐ **[1]**

3 The diagram shows tissue that lines the airways of the lungs.



This tissue has structures to help defend the body against pathogens.

What are the structures?

A Cilia and cells that make acid

B Cilia and cells that make mucus

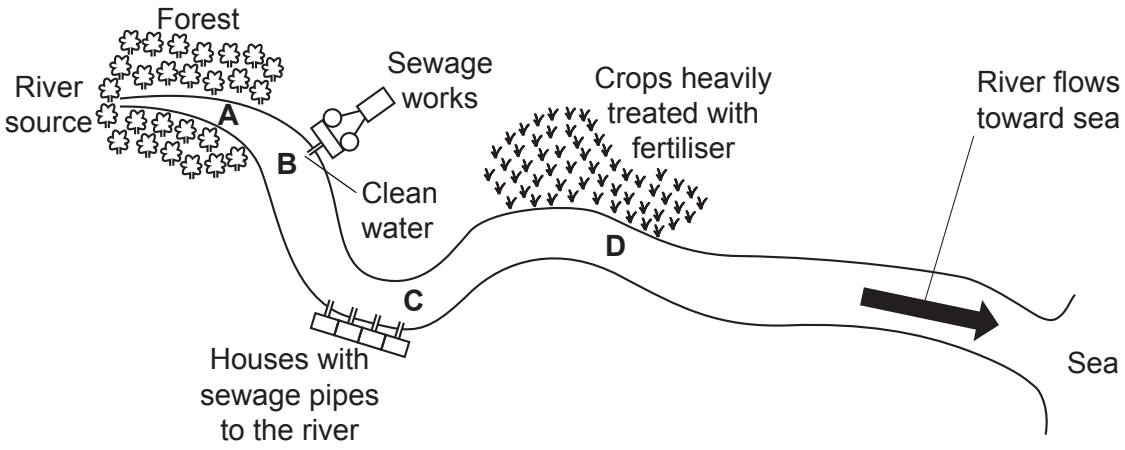
C Nasal hairs and cells that make acid

D Nasal hairs and cells that make mucus

Your answer ☐ **[1]**

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4 Human waste can contain bacteria called ***E. coli***. Human waste is found in sewage.



Which zone of the river will have the **highest** levels of *E. coli*?

Your answer ☐ **[1]**

5 Some countries plant new forests to help reduce their **greenhouse gas** emissions.

Why does planting new forests help reduce greenhouse gas emissions?

A Trees produce biomass.

B Trees take carbon dioxide from the air.

C Trees put oxygen into the air.

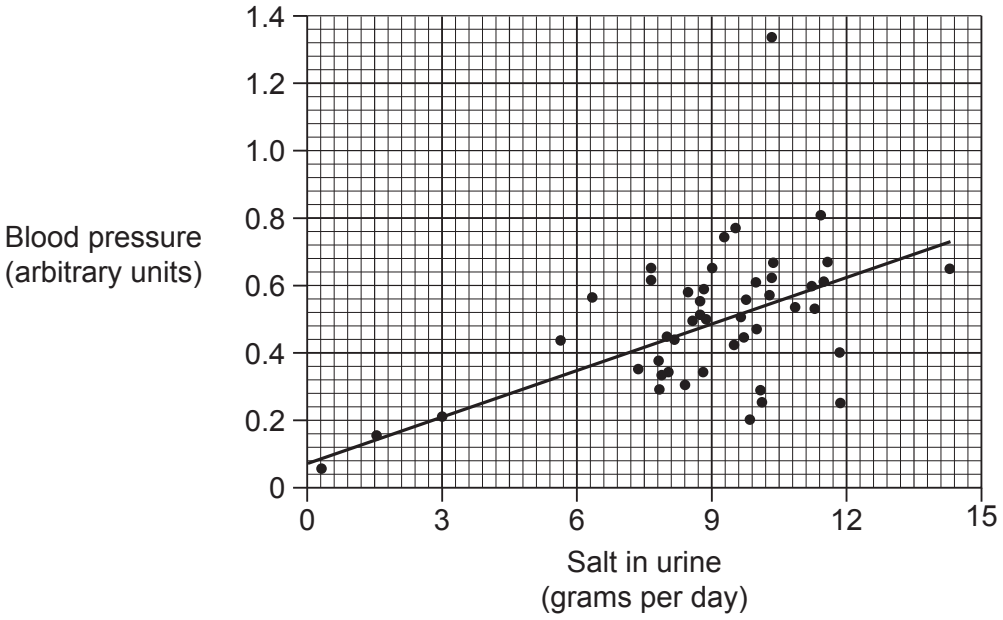
D Trees take water from the soil to prevent flooding.

Your answer ☐ **[1]**

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6 The more salt you eat, the more salt will be found in the urine you make.

The graph shows the relationship between the amount of salt in urine and blood pressure.



Which statement is supported by the data?

A High blood pressure leads to an increased risk of developing heart disease.

B Less salt in the diet can lead to higher blood pressure.

C Less salt in the diet can lead to lower blood pressure.

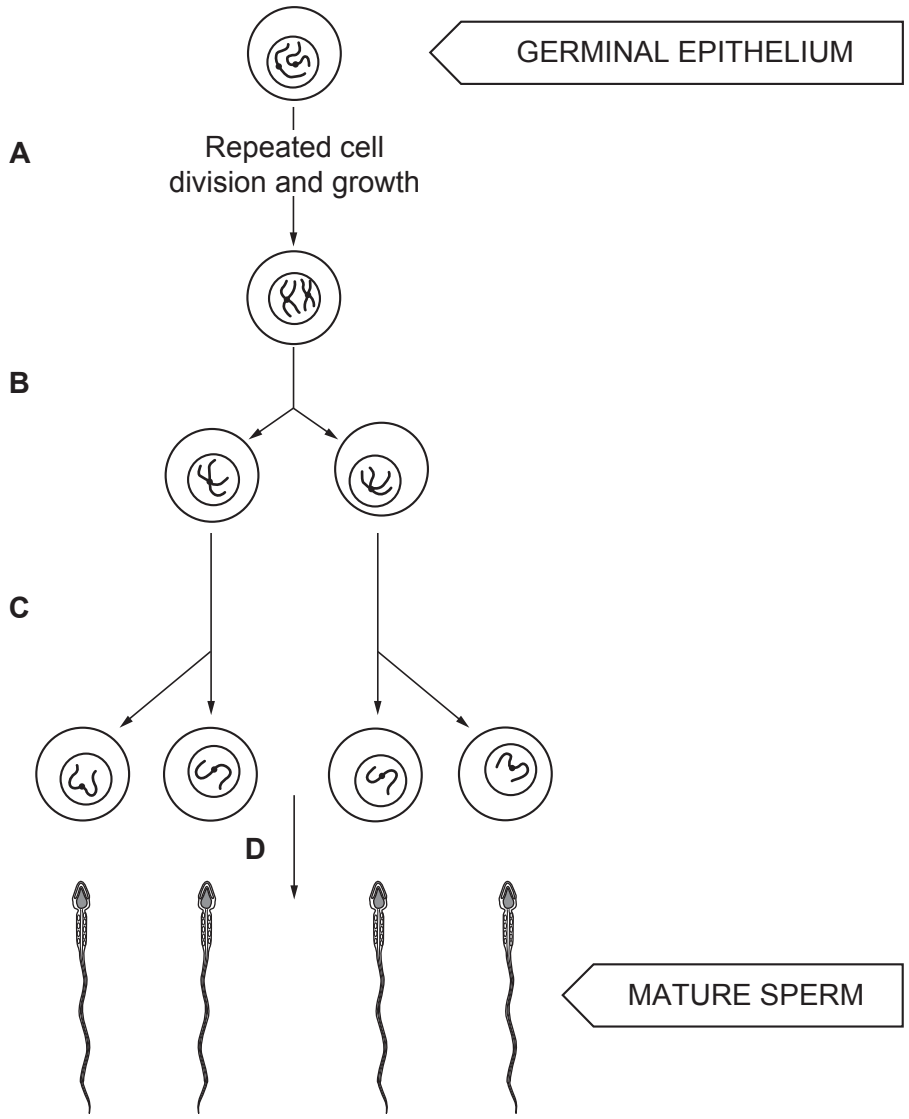
D Low blood pressure leads to an increased risk of developing heart disease.

Your answer ☐ **[1]**

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7 Sperm are made by meiosis.

Look at the diagram of meiosis.



At which stage **A**, **B**, **C** or **D** is the chromosome number halved?

Your answer ☐ **[1]**

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8 There were 452 222 adult deaths in England in 2009.

It is estimated that 81 400 of these adult deaths were caused by smoking.

What percentage of adult deaths were caused by smoking in England in 2009?

A 0.18%

B 5.6%

C 18%

D 56%

Your answer ☐ **[1]**

9 Genes control eye colour.

The allele for brown eyes **(B)** is **dominant** over the allele for blue eyes **(b)**.

Look at the genetic cross.

Bb x BB

Choose the possible outcome of offspring from this cross.

	Genotype	**Offspring genotype ratio**	**Phenotype**
A	All BB	1:0	All brown eyes
B	BB and Bb	1:1	All brown eyes
C	BB and Bb	3:1	Brown eyes and blue eyes
D	Bb and bb	3:1	Brown eyes and blue eyes

Your answer ☐ **[1]**

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10 **Phylogeny** is the study of evolutionary links.

Which of the following is important to make molecular phylogenic links?

A Behavioural features

B DNA sequencing

C Habitat analysis

D Phenotypical features

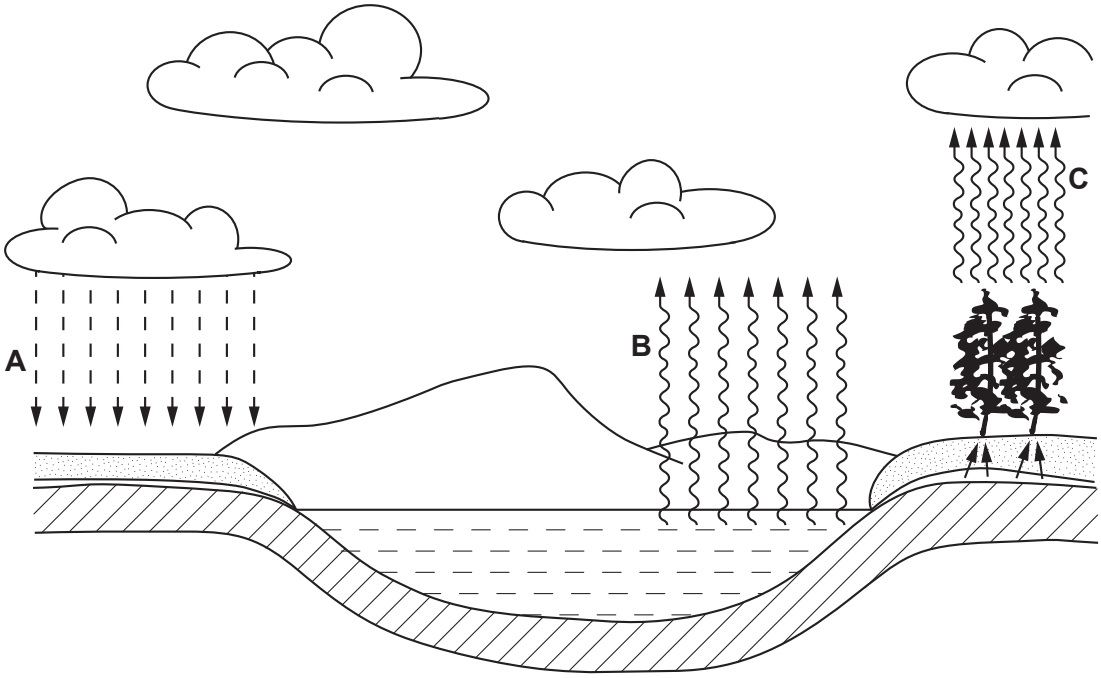
Your answer ☐ **[1]**

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SECTION B

Answer **all** the questions.

11 (a) Look at the diagram of the water cycle.



Complete these sentences about the diagram.

Choose words from the list.

combustion **evaporation** **photosynthesis** **precipitation**

run-off **respiration** **transpiration**

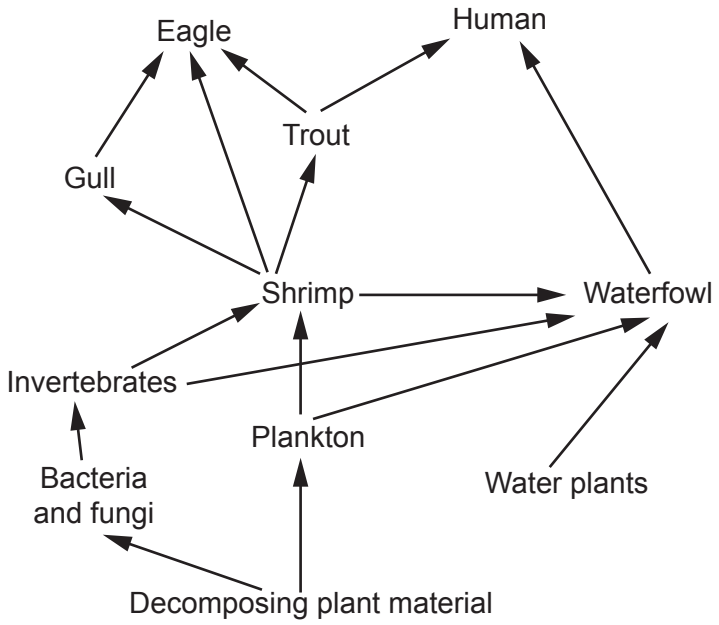
(i) Arrows labelled **A** represent the process of ..... . **[1]**

(ii) Arrows labelled **B** represent the process of ..... . **[1]**

(iii) Arrows labelled **C** represent the process of ..... . **[1]**

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(b) Look at the diagram showing the food web in the lake.



(i) How many **predators** does the shrimp have in this food web?

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

(ii) When plant material is decomposed by fungi, there is an increase in temperature.

Complete the sentences to explain why.

Choose words from the list.

endothermic **excretion** **exothermic**

respiration **photosynthesis**

During decomposition fungi release energy from the plants by the process of

..... .

This process releases energy as heat because the reaction is

..... .

[2]

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(c) Dogfish and minnows are fish that live in lakes.

Dogfish build nests to lay their eggs in. Minnows lay their eggs in the same nests as dogfish.

The dogfish protect the nest from predators.

Minnows move in and out of the nest. This helps to remove harmful bacteria and get oxygen to the eggs.

Dogfish usually eat minnows. When the dogfish have eggs they do **not** eat minnows.

(i) Dogfish have **two** different interactions with the minnows.

Write down the names of these **two** types of interactions.

Describe when each interaction takes place.

Interaction 1 .....

.....

Interaction 2 .....

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

(ii) One of the interactions benefits **both** minnows and dogfish.

Explain how.

.....

.....

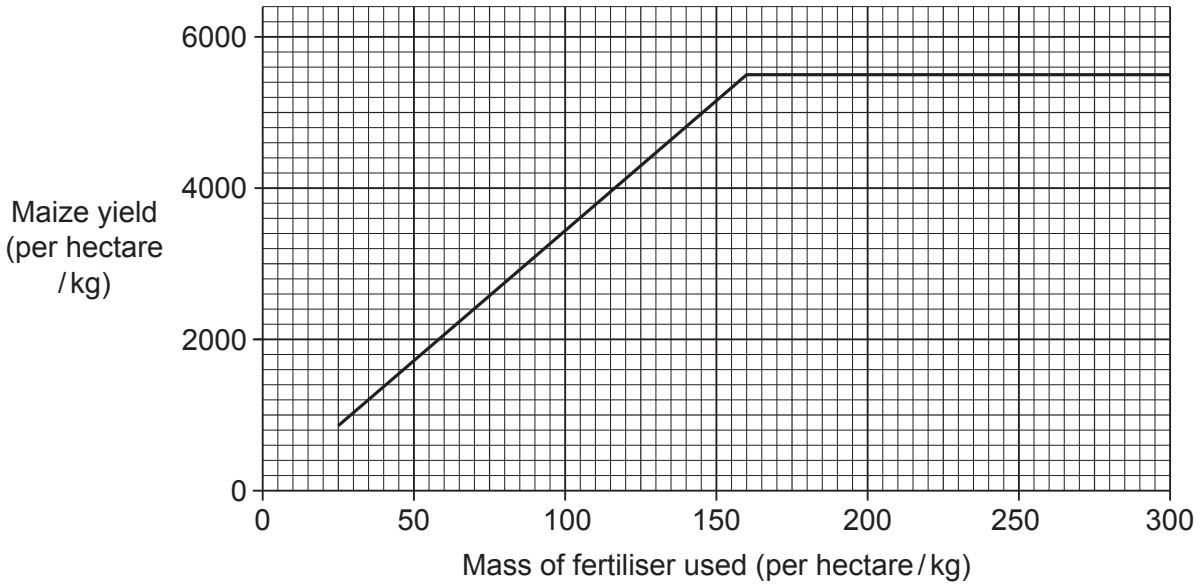
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..... **[2]**

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12 Farmers use fertilisers to improve crop yields.

The graph shows how the mass of one fertiliser affects maize yield.



(a) What mass of fertiliser would you recommend to produce the **best** yield?

Explain your answer.

.....

.....

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

(b) The fertiliser contains high amounts of nitrogen.

Describe one **negative** effect using fertiliser might have on the environment.

.....

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

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13 (a) Complete these sentences about the hormone FSH.

FSH is secreted by the ..... gland.

FSH causes an ..... to mature in the ovary.

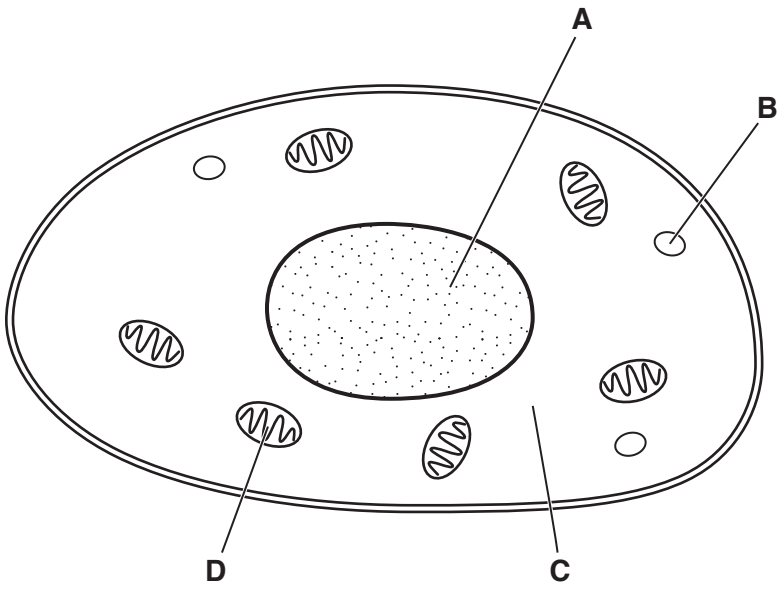
FSH stimulates the ovaries to release the hormone ..... .

[3]

(b) FSH hormone can be genetically engineered.

The human gene for FSH is transferred into an animal cell.

Look at the diagram of a cell.



The gene is put inside one of the structures labelled in the diagram.

Which structure is the gene put inside?

Choose from **A**, **B**, **C**, or **D**. .....

State why the gene is put there.

.....

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

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(c)* Beta carotene is the substance that makes carrots orange. Humans use beta carotene to make vitamin A. Vitamin A is needed for good vision.

'Golden' rice is a genetically modified (GM) crop. 'Golden' rice is made when the gene for beta carotene is added to rice.

Scientists do not know if the levels of beta carotene in 'Golden' rice will have any other effects on people eating the rice.

In some countries many people survive on a diet of mainly rice with no vegetables.

Do you think 'Golden' rice should be made to provide food for these people?

Include arguments **for** and **against** 'Golden' rice in your answer.

.....

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..... **[6]**

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14 (a) Some children can inherit a rare kidney condition called ARPKD. It is caused by a **recessive** allele.

A pregnant woman has ARPKD. The baby's father is **heterozygous** for ARPKD.

What is the probability of their baby having ARPKD?

Complete the genetic diagram to explain your answer.

Use the letters:

- **R** for the dominant allele
- **r** for the recessive allele.

r		
r		

Answer = ... **[2]**

(b) (i) It is estimated that 1 in 70 people in the UK is a carrier of ARPKD.

The estimated population of the UK in 2011 was 63.2 million.

Estimate the number of people in the UK in 2011 who were carriers.

Answer = ... **[2]**

(ii) Explain why this number is only an **estimate** and not the real number of carriers.

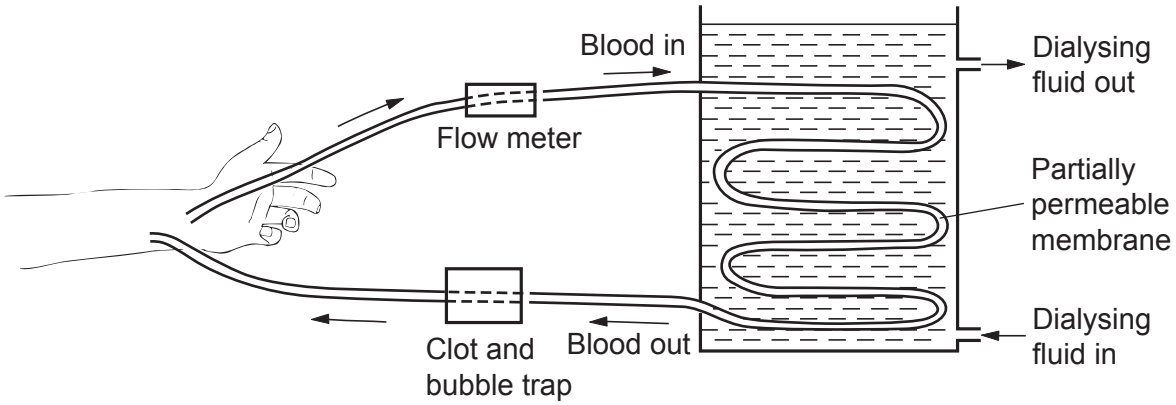
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..... **[1]**

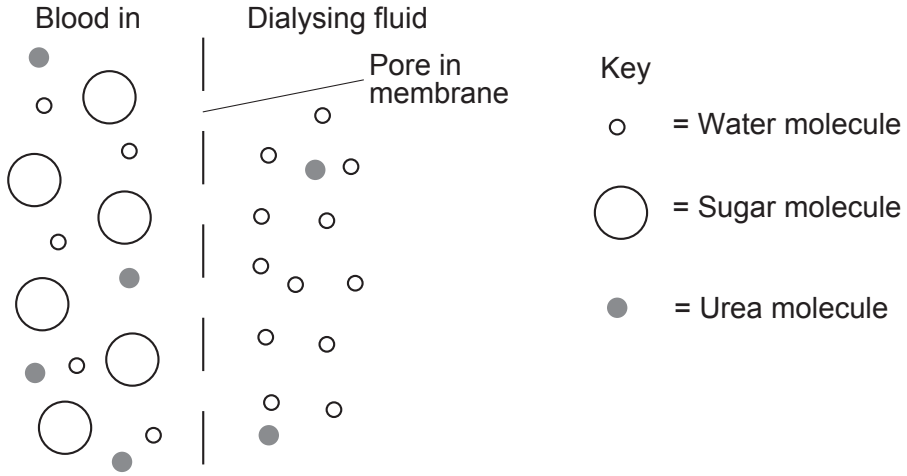
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(c) ARPKD can lead to kidney failure. People with kidney failure can use a dialysis machine.

The diagram shows how a dialysis machine works.



A molecular model can be used to explain how the dialysis machine removes urea.



The dialysis machine removes urea but **not** sugar.

Use the diagram to explain how.

.....

.....

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

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(d) The kidneys in people with ARPKD have not developed normally.

Stem cells could be used to repair the damaged kidneys.

Discuss reasons **for** and **against** using stem cells to treat ARPKD.

Reasons for .....

.....

.....

Reasons against.....

.....

.....

[3]

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15 Three students model the determination of sex in humans.

They toss a coin 18 times and record the result.

The table shows the results and the ratio of the **total** heads : **total** tails.

Toss	Outcome	Total heads	Total tails	Ratio
1	Heads	1	0	1:0
2	Heads	2	0	2:0
3	Tails	2	1	2:1
4	Heads	3	1	3:1
5	Heads	4	1	4:1
6	Heads	5	1	5:1
7	Tails	5	2	5:2
8	Tails	5	3	5:3
9	Heads	6	3	2:1
10	Heads	7	3	7:3
11	Tails	7	4	7:4
12	Tails	7	5	7:5
13	Heads	8	5	8:5
14	Tails	8	6	8:6
15	Heads	9	6	3:2
16	Heads	10	6	.....
17	Tails	10	7	10:7
18	Tails	10	8	5:4

(a) The ratio for **16** is missing.

Calculate the ratio for 16 tosses.

Answer = ... **[1]**

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(b) None of the ratios match the expected ratio of males to females you would show in a genetic cross.

Here are three statements about the results:

Student A – The ratio after **five** tosses is closest to the expected outcome.

Student B – The ratio after **ten** tosses is closest to the expected outcome.

Student C – The ratio after **eighteen** tosses is closest to the expected outcome.

Which statement is correct?

Explain your answer.

.....

.....

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

(c) The students want to improve the method to get a result that matches the expected ratio.

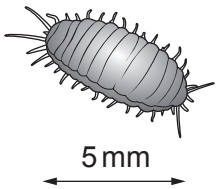
Write down **one** way to improve the method.

.....

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

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16 The picture shows a mealybug insect.



This mealybug is a pest for orange tree growers.

The scientists compared the number of mealybugs found on two trees, **tree A** and **tree B**.

For each tree they:

- Collected a sample of mealybugs from the tree
- Counted the number of mealybugs in each sample
- Marked the mealybugs
- Released the mealybugs back onto the tree they were collected from.

The next day another sample was collected from each tree.

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(a) Describe how the scientists should **collect** and **mark** the mealybugs.

Include the equipment they need to use.

You may include a diagram with your answer.

.....

.....

.....

.....

.....

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

(b) Write down **three** precautions that should be taken when deciding how to **mark** the mealybugs.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

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(c) The table shows the results for **tree A**.

Total number of mealybugs collected on day 1	Total number of mealybugs collected on day 2	Number of marked mealybugs collected on day 2
150	60	18

(i) Estimate the population size of mealybugs on **tree A**.

Use the formula:

$$\text{Estimated population size} = \frac{\text{Number in 1st sample} \times \text{Number in 2nd sample}}{\text{Number in 2nd sample previously marked}}$$

Answer = ... **[1]**

(ii) When using this method to estimate population, the scientists make several assumptions.

One assumption is that there was no immigration of mealybugs between day 1 and 2.

Suggest two **other** assumptions they would make.

1 .....

.....

2 .....

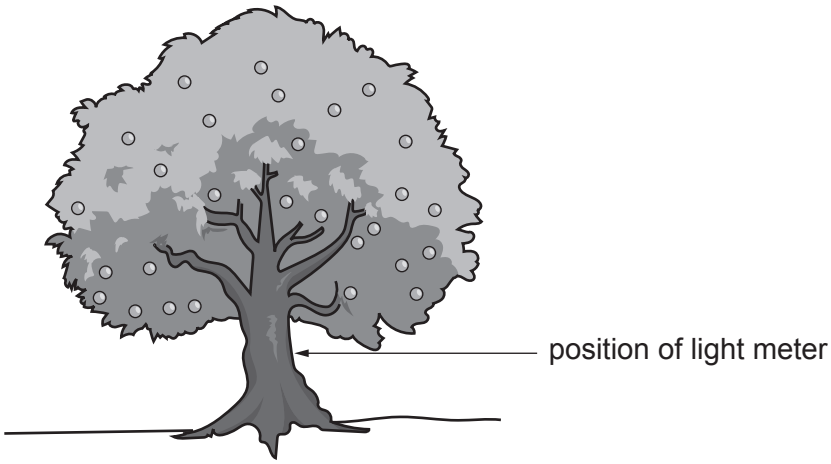
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[2]

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(d) The number of mealybugs on each tree may be affected by the light intensity.

The scientists measured the light intensity for each tree at midday on day 1 of their investigation. Light intensity is measured using a light meter.



(i) **Tree B** had an estimated population of 250 mealybugs at the end of the investigation. **Tree B** had a **higher** light intensity reading than **tree A**.

Read this statement.

> The mealybugs are thought to breed rapidly in **low light** conditions.

Do the results for the two trees support this statement?

Use the information above and your answer to **(c)(i)**.

Explain your answer.

.....

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

(ii) Errors can occur when taking light meter readings.

Explain how errors occur and write down **one** way to take more precise readings.

.....

.....

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

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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