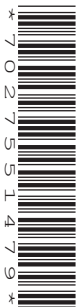


## GCSE (9–1) Combined Science (Biology) A (Gateway Science)

J250/08 Paper 8, B4–B6 and CS7 (PAGs B1–B5) (Higher 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.

## SECTION A

Answer **all** the questions.

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

- 1 A farmer chooses the healthiest of their beef cattle. They mate these repeatedly over many generations to increase resistance to disease.

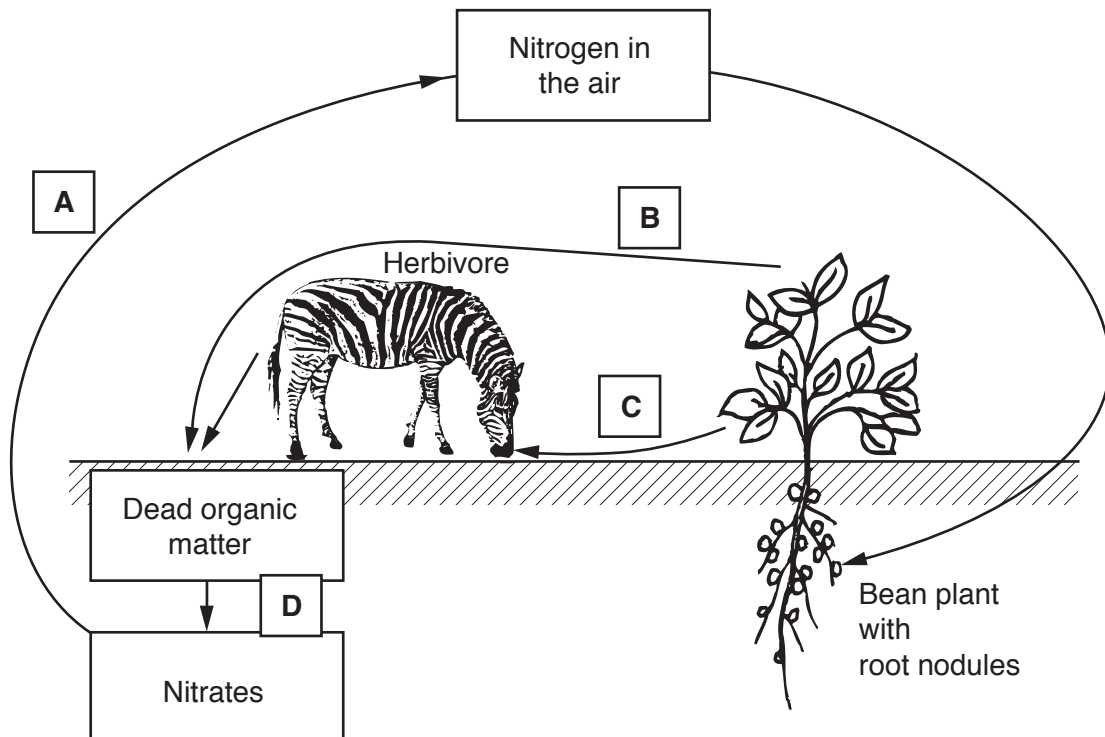
What is the name of this type of process?

- A Environmental selection
- B Genetic engineering
- C Natural selection
- D Selective breeding

Your answer

[1]

- 2 Look at the diagram showing parts of the nitrogen cycle.

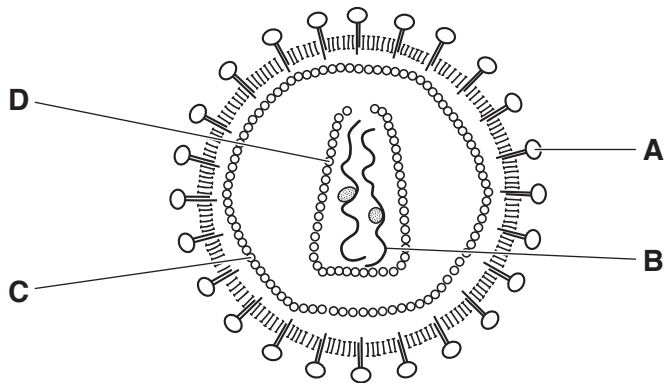


Which part of the nitrogen cycle involves bacteria as decomposers?

Your answer

[1]

3 The diagram shows a virus.



Which structure **A**, **B**, **C** or **D** is the **antigen** when the virus invades a host?

Your answer

[1]

4 If a person has one disease, it is sometimes more likely that they will develop another disease.

Which pair of diseases affects each other this way?

- A HIV infection and cervical cancer
- B HPV infection and cervical cancer
- C HPV infection and tuberculosis
- D Tuberculosis and cervical cancer

Your answer

[1]

5 The number of deaths in the UK in 2012 was 569 024.

It is estimated that 165 818 of these were cancer-related deaths.

What percentage of the deaths in the UK in 2012 were cancer-related?

- A 0.29
- B 3.43
- C 29.14
- D 34.32

Your answer

[1]

6 Some bacteria have evolved to become resistant to antibiotics.

Which statement is true about the evolution of these bacteria?

- A Antibiotics killed the resistant bacteria.
- B Bacteria reproduce slowly allowing the resistance to have affect.
- C Mutations in some bacteria were an advantage.
- D Mutations occurred within the nucleus of the bacteria.

Your answer

[1]

7 Countries can compensate for their greenhouse gas emissions by planting new trees.

Why does planting new trees help compensate for their greenhouse gas emissions?

- A Produces biomass
- B Removes carbon dioxide from the air
- C Releases oxygen into the air
- D Water absorbed from the soil prevents flooding

Your answer

[1]

8 Which statement is **not** true about line transects?

- A They allow study of a linear habitat like a roadside verge.
- B They can be used to study which species are present in a habitat.
- C They give an exact measure of how many of each species is present in a habitat.
- D They show how the abundance of a species changes across a particular habitat.

Your answer

[1]

9 Testing drugs using a double blind trial improves reliability.

Why is reliability improved?

- A Observer and volunteer bias is not removed.
- B Observer and volunteer bias is removed.
- C Volunteer bias is removed but not observer bias.
- D Observer bias is removed but not volunteer bias.

Your answer

[1]

10 Antiviral drugs can work in different ways.

Which statement shows how an antiviral drug can work?

- A It acts as a vaccine against the virus.
- B It causes phagocytosis of the virus.
- C It contains antibiotics to destroy the virus.
- D It stops the virus releasing its genetic material.

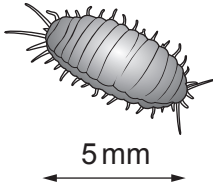
Your answer

[1]

## SECTION B

Answer **all** the questions.

- 11 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.

(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.

.....

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.....

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.....

.....

..... [3]

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

1 .....

.....

2 .....

.....

3 .....

.....

..... [3]

(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 .....

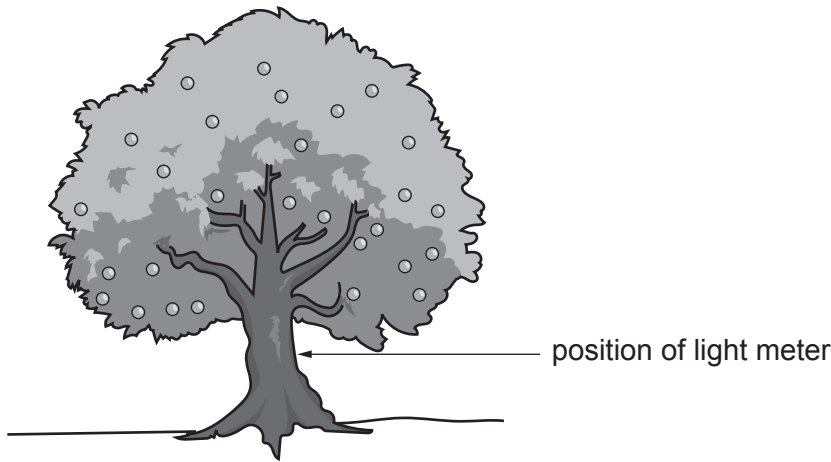
.....

[2]



(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]

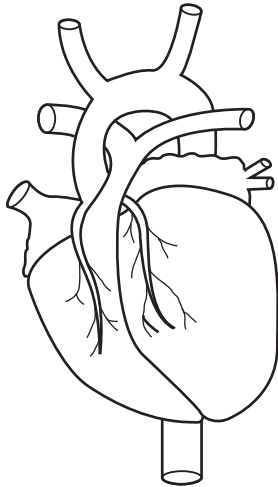
(ii) Errors can occur when taking light meter readings.

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

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

12 (a) Cardiovascular disease (CVD) is a major cause of death in the UK.

Look at the diagram of the external features of a heart.



(i) The coronary artery supplies the cardiac muscle with oxygen.

Label the diagram to show the position of **one** of the coronary arteries. [1]

(ii) Angina is a symptom of CVD. Pain from angina is caused by cardiac muscle respiring **anaerobically**.

Explain why angina causes pain.

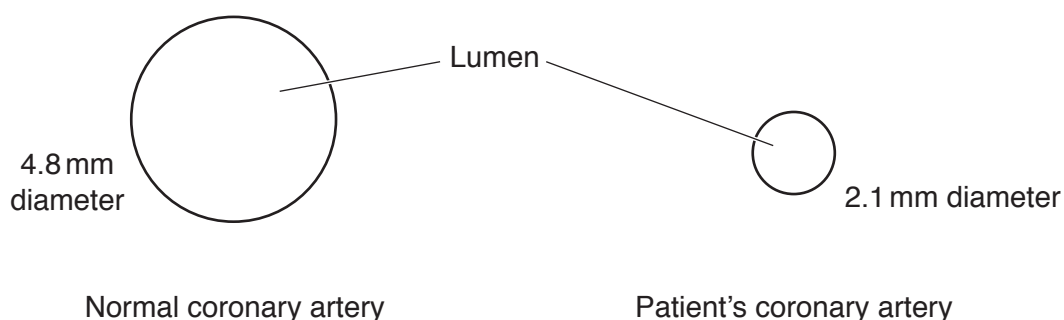
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..... [2]

- (b) (i) A 55 year old patient has severe chest pains due to a narrowed coronary artery.

The diagram shows the cross-section of a normal coronary artery and the patient's artery.



The cross-sectional area of the normal coronary artery lumen is  $18.1 \text{ mm}^2$ .

Calculate the cross-sectional area of the lumen of **the patient's** artery.

Use the equations:

$$\text{Area of a circle} = \pi r^2$$

$$\pi = 3.14$$

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

Answer = .....  $\text{mm}^2$  [3]

- (ii) Calculate the **percentage reduction** in cross-sectional area for the lumen of the patient's artery.

Answer = ..... % [1]

(iii) CVD can be treated by different combinations of lifestyle changes, medicine and surgery.

Look at the information on CVD and how much the coronary artery has been narrowed in (b)(ii).

	Percentage decrease in lumen diameter		
	< 50%	50 to 80%	> 80%
Severity of CVD	Mild	Moderate	Severe

Justify why the patient would need surgery.

.....

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..... [2]

(c)\* Doctors rely on different types of surgery to treat cardiovascular disease.

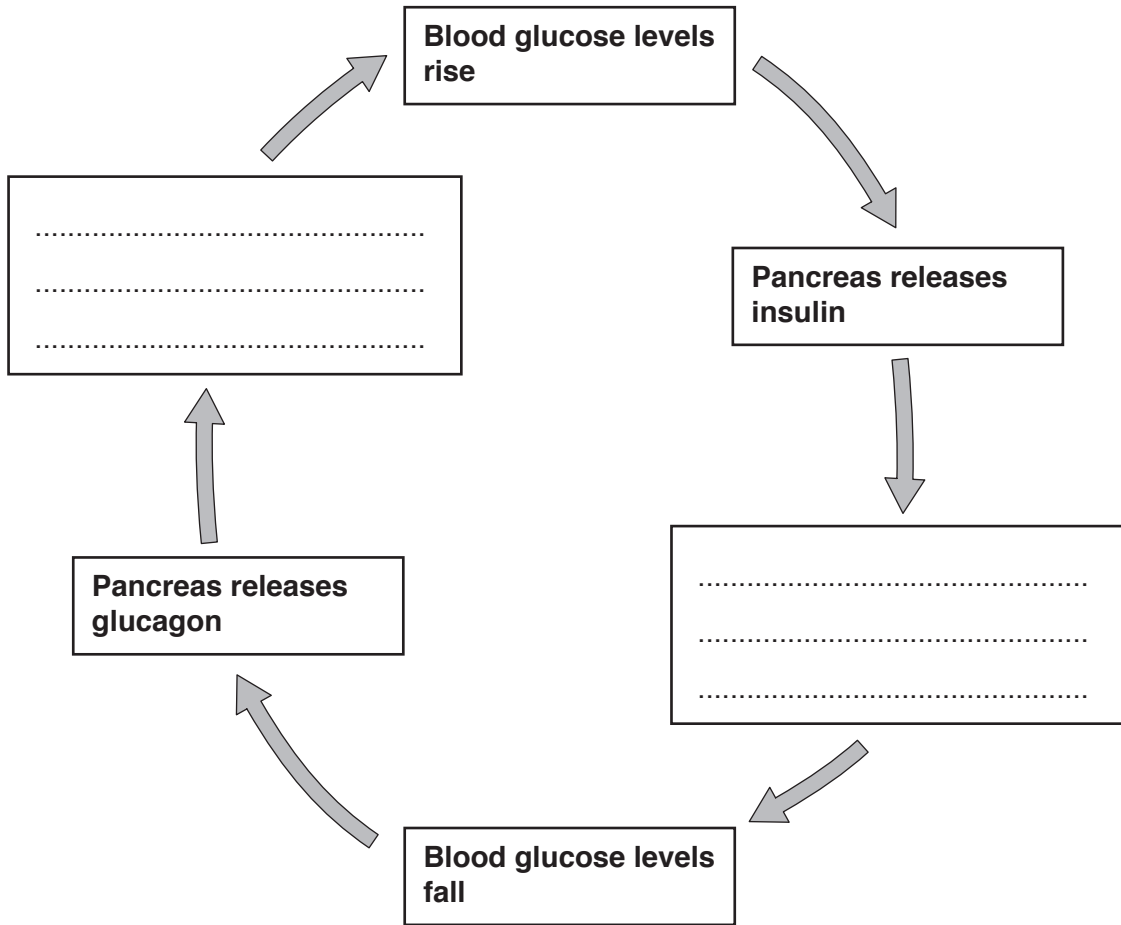
The table shows features of **three** surgical treatments.

Name of treatment	Description of treatment	Features of treatment
<b>Coronary angioplasty</b>	A small balloon is used to widen an artery.  A wire tube (stent) prevents artery narrowing again.	<ul style="list-style-type: none"> <li>Relieves symptoms that fail to respond to medication</li> <li>Short recovery time</li> <li>1 in 25 cases, the coronary artery narrows</li> <li>May require further surgery</li> </ul>
<b>Coronary artery bypass graft</b>	A blood vessel is removed from a part of your body, usually your chest or leg.  This blood vessel is used to direct blood flow around a blocked artery.	<ul style="list-style-type: none"> <li>Long recovery time</li> <li>Pain after the operation</li> <li>May require further surgery</li> </ul> Effective in people: <ul style="list-style-type: none"> <li>Aged over 65</li> <li>With diabetes</li> <li>With extensive disease</li> <li>With poor heart muscle function</li> </ul>
<b>Heart transplant</b>	A diseased or damaged heart is replaced with a healthy donor heart.	<ul style="list-style-type: none"> <li>Further surgery is unlikely to be needed</li> <li>Increases life expectancy especially in patients 55 years old or under</li> <li>Donor hearts needed</li> <li>Long recovery time</li> <li>Arteries connected to the new heart can narrow</li> </ul>



13 Insulin and glucagon are hormones that control blood sugar levels in the body.

The diagram shows interactions between these two hormones.



(a) (i) Complete the diagram to show how insulin and glucagon work together to control blood sugar levels. [2]

(ii) This type of control system is an example of negative feedback.

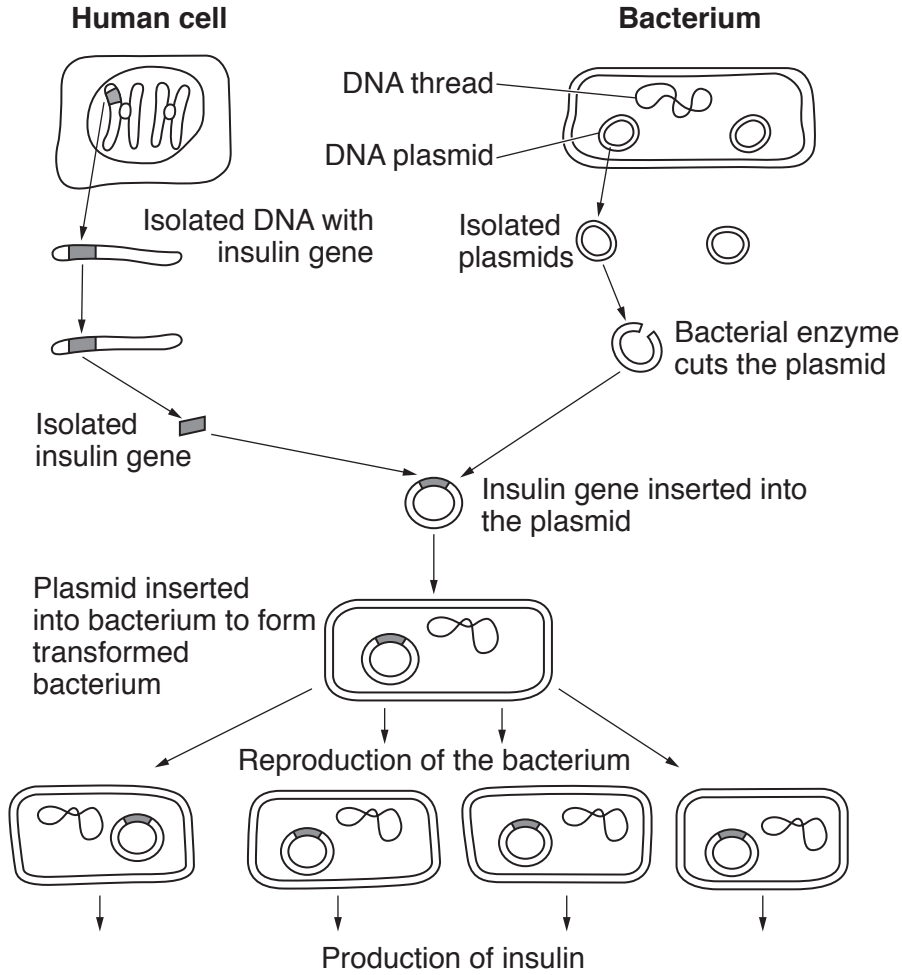
Explain why.

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

(b) In some people the pancreas is unable to make insulin.

Human insulin can be made by genetic engineering.

The diagram shows how bacteria are genetically engineered to make human insulin.



Enzymes are used to genetically engineer the bacteria.

Write down the names of the **two** enzymes used in this process and explain what they do.

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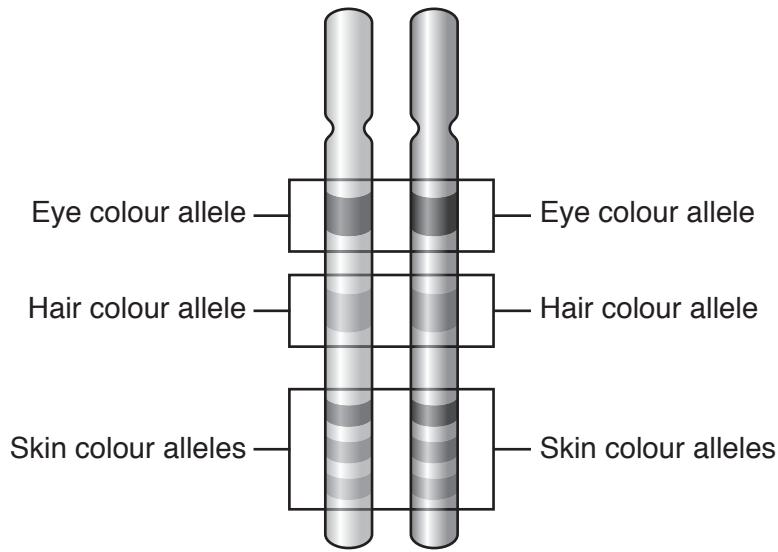
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[4]

14 (a) Look at the diagram of a pair of human chromosomes.



Phenotypes for skin colour are inherited differently to that of eye and hair colour.

Use the diagram to explain why.

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

(b) Type 1 diabetes is a disorder caused by lack of insulin production in the pancreas. Type 1 diabetes has a genetic link.

In humans the haploid number of chromosomes is 23. Insulin is a hormone controlled by a single gene found on chromosome number 11.

(i) How many chromosomes are there in a single human pancreas cell?

..... [1]

(ii) Some individuals have a copy of the gene that would cause diabetes but do not have the disorder.

Suggest a reason why.

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



(c) Some people can inherit a rare condition called ADPKD that results in kidney disease.

The PKD1 gene provides instructions for making a protein called polycystin-1. Polycystin-1 controls kidney cell differentiation.

In ADPKD, polycystin-1 does not work properly.

(i) What name is given to a change in the PKD1 gene that causes ADPKD?

..... [1]

(ii) Explain why the ADPKD version of polycystin-1 prevents the kidney working properly.

..... [1]

(iii) A pregnant woman is heterozygous for ADPKD. The baby's father does not have ADPKD and is homozygous recessive.

ADPKD is caused by a dominant allele (**D**).

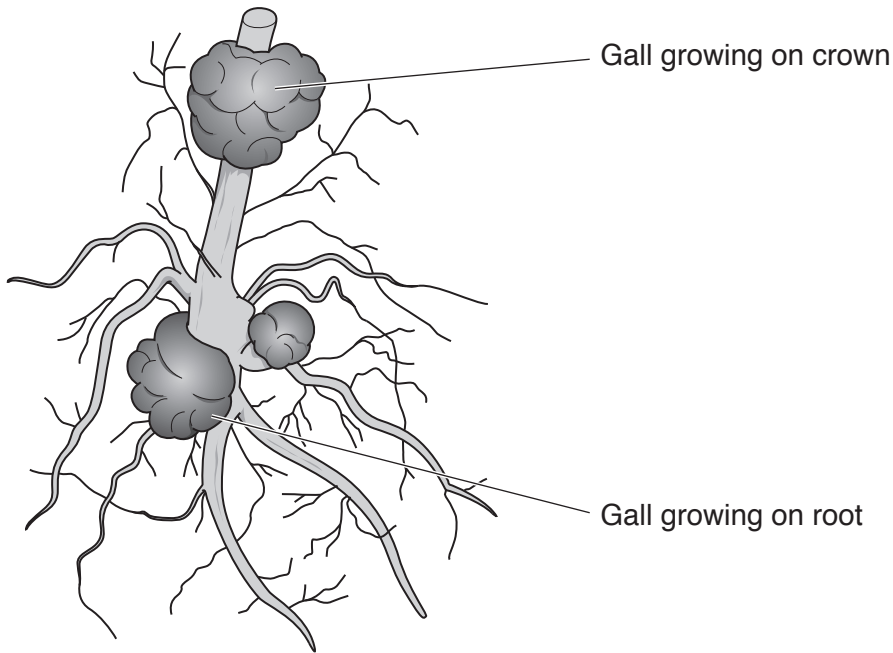
What is the probability of their baby having ADPKD?

Use a labelled genetic diagram to explain your answer.

..... [2]

15 The bacteria, *Agrobacterium tumefaciens*, causes crown gall disease that affects walnut trees.

Galls form on the parts of the plant growing above ground (crown) or on the roots.



(a) Describe how the galls form and cause damage to the walnut tree.

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..... [4]

(b) Scientists investigate how the disease is spread.

They use two groups of young trees without galls taken from a field.

The first group had originally grown next to trees with galls, the second group had not. All the trees are transplanted into a new disease-free field.

They damage half the trees in each group by wounding the crown and root region with a blade.

The table shows their results.

Originally grown next to a tree with galls	Wounded before transplanting	Percentage (%)		
		Trees with galls	Trees with galls on crown	Trees with galls on roots
No	No	17	2	16
No	Yes	24	3	21
Yes	No	26	13	21
Yes	Yes	34	14	26

The scientists made this hypothesis.

‘Wounded trees would have more disease than unwounded trees.’

(i) Explain **one** reason why the scientists thought this would happen.

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

(ii) To what extent does the evidence support their hypothesis?

Explain your answer.

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

(iii) Write down **two** other conclusions that can be made from the data.

1 .....  
 .....  
 2 .....  
 ..... [2]

**END OF QUESTION PAPER**

**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).

A large area of lined paper for writing, consisting of 25 horizontal dotted lines. A solid vertical line runs down the left side of the page, creating a margin. The rest of the page is open for writing.

Lined writing area consisting of horizontal dotted lines and a vertical solid line on the left side, forming a columnar structure for text entry.

Lined writing area with horizontal dotted lines and a vertical solid line on the left side.

A grid for handwritten notes. It features a vertical solid line on the left side, serving as a margin. The rest of the page is filled with horizontal dotted lines, creating a series of rows for writing. There are 20 rows in total, each bounded by two dotted lines.

