

**GCSE (9-1)**

*Examiners' report*

# **GATEWAY SCIENCE COMBINED SCIENCE A**

**J250**

For first teaching in 2017

## **J250/02 Summer 2018 series**

Version 1

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## Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

## Paper J250/02 series overview

J250/02 is the second biology foundation tier paper in the Gateway GCSE Combined Science suite. It assesses content from specification topics B4-B6 and CS7. It also assumes knowledge of the topics in B1-B3. To perform well on this paper, candidates need to have a sound knowledge of the theory covered in topics B4-B6 and be able to apply this to novel situations. They also need to apply the skills and understanding that they have developed in the practical activities covered in topic CS7. This paper also contains questions that have elements of synopticity, drawing on material covered by topics B1-3. There are also questions that involve the assessment of key mathematical requirements from Appendix 5f of the specification.

### *Candidate performance*

Candidates who did well on this paper generally did the following:

- Performed calculations involving substituting into equations: Q16(c)(i), interpreted ratios correctly: Q15(a) and accurately read figures from a graph: Q12(a).
- Demonstrated a good knowledge of the water cycle: Q11(a), Q4 and understood the information conveyed in a food web: Q11(b)(i).
- Applied their knowledge of experimental skills to novel situations: Q16(a).
- Analysed experimental situations to identify possible precautions that should be taken: Q16(b) and suggestions for improvements Q15(c).

Candidates who did less well on this paper generally did the following:

- Found it difficult to convert 63.2 million into thousands before dividing by 70: Q14(b)(i).
- Confused excretion for respiration in the release of energy in decomposition: Q11(b)(ii).
- Failed to recall the terms mutualism or predation: Q11(c)(i).
- Assumed that beta carotene (or vitamin A) had been inserted into golden rice rather than the gene: Q13(c).
- Failed to understand what assumptions must be made when using a capture-recapture technique: Q16(c)(ii).

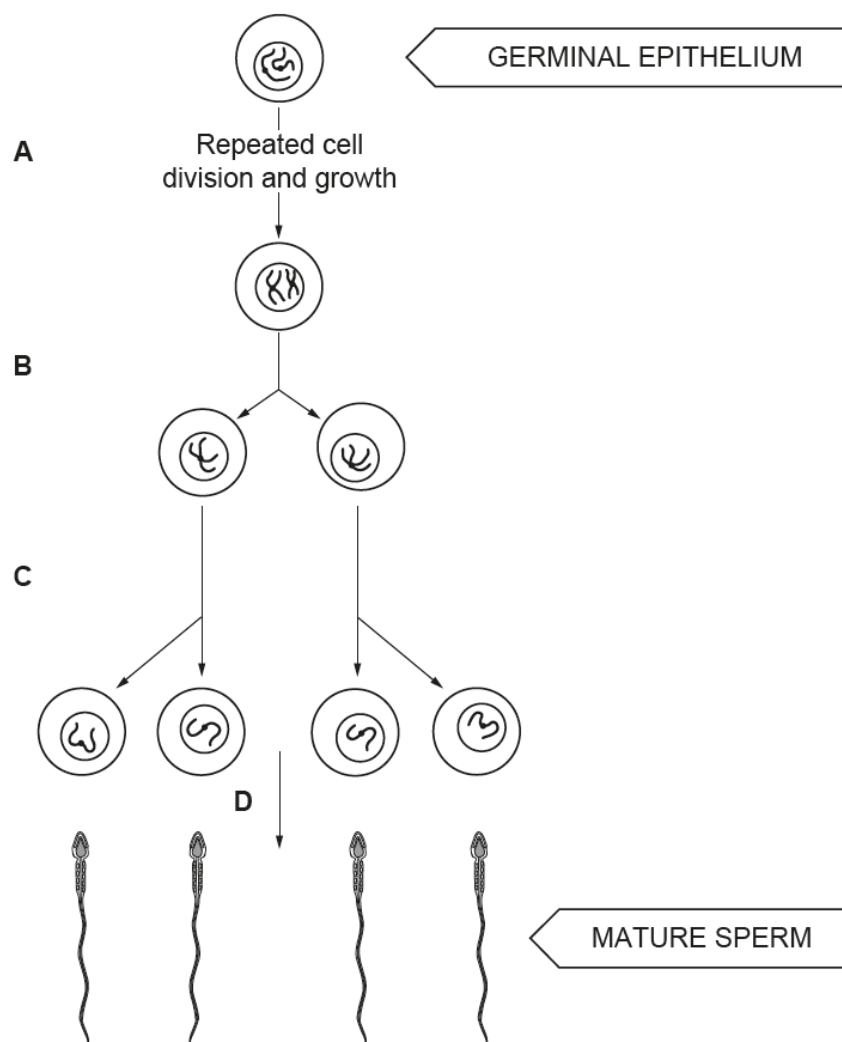
There was no evidence that any time constraints had led to candidates underperforming.

## Section A

### Question 7

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]

This multiple-choice question was well answered by many candidates, correctly interpreting the chromosomes shown on the diagram.

## Question 9

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
<b>A</b>	All BB	1:0	All brown eyes
<b>B</b>	BB and Bb	1:1	All brown eyes
<b>C</b>	BB and Bb	3:1	Brown eyes and blue eyes
<b>D</b>	Bb and bb	3:1	Brown eyes and blue eyes

Your answer

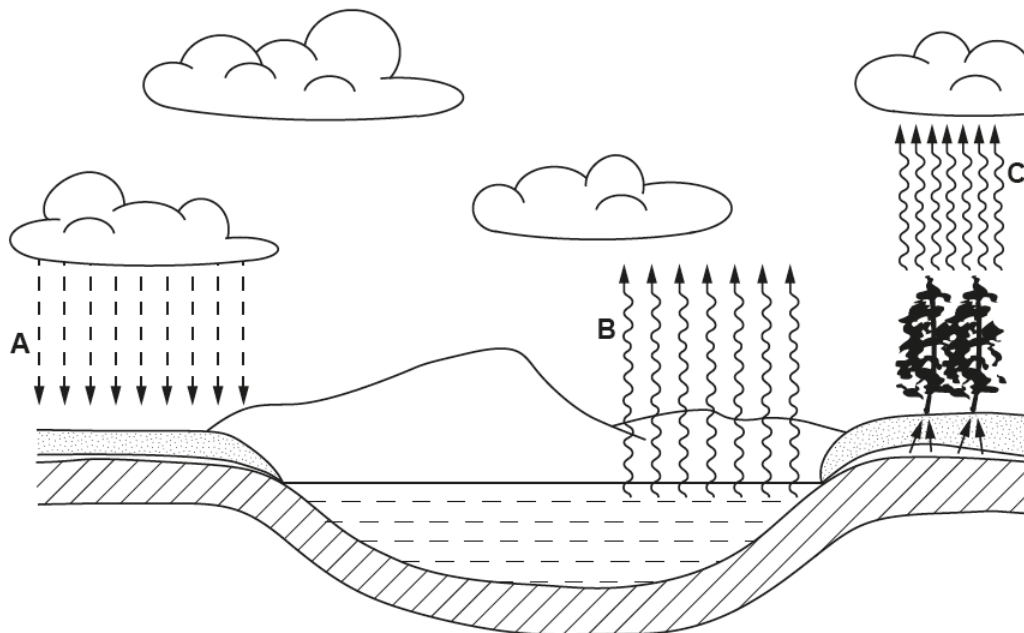
[1]

This question proved to be the most challenging multiple-choice question.

## Section B

### Question 11 (a) (i)

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]

This question was quite well answered by many candidates, with incorrect answers being spread amongst the distractors.

### Question 11 (a) (ii)

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

This was correctly answered by most candidates. The link between the water in the lake and evaporation was made by all but a few candidates.

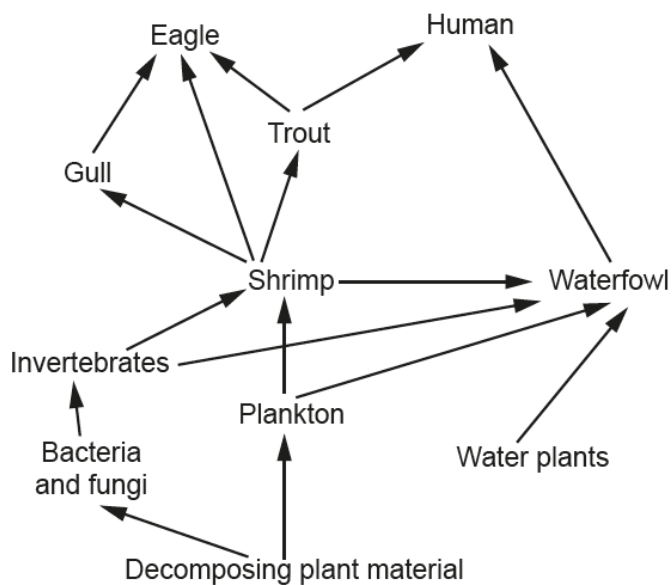
### Question 11 (a) (iii)

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

Although part (ii) was one of the best answered questions on the paper, this was one of the worst. Many candidates focused in on the trees and assumed the answer must be photosynthesis.

## Question 11 (b) (i)

(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]

This question was a good discriminator. The more able candidates understood the construction of the food web and correctly answered four.



## Question 11 (b) (ii)

- (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]

Answers for the second gap were usually either exothermic or endothermic, with the correct answer being more common. The first gap proved more challenging, with many candidates being distracted by the term excretion, presumably knowing that excretion involves the removal of something from an organism.

## Question 11 (c) (i)

- (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]

The majority of candidates did not name the two types of interaction, although this was specifically asked for in the question. Of those that did try and name an interaction, a significant minority were confused between predatory and parasitic behaviour. This is shown in exemplar one, which gained one mark

### Exemplar 1

Interaction 1  Mutualism - the dogfish builds nest + to lay eggs in and minnows helps remove harmful bacteria

Interaction 2 parasites - dogfish eats the minnows

[2]

### Question 11 (c) (ii)

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

Explain how.

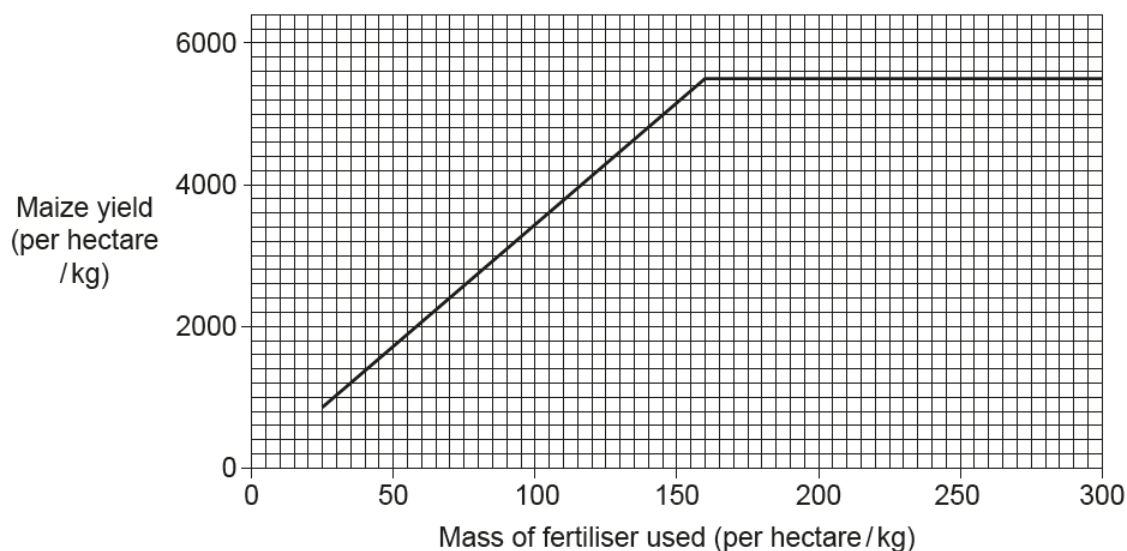
.....  
 .....  
 .....  
 ..... [2]

Many candidates could describe one interaction, the protection of the eggs from predators by dogfish being the most common example.

## Question 12 (a)

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]

Although the mass of fertiliser (160kg) was identified by many candidates, the explanation proved far more challenging. A number simply stated that 160kg gave the maximum yield or was the peak of the curve. Complete answers, such as shown in exemplar 2, were quite rare.

## Exemplar 2

160 per hectare/kg as this is the lowest amount that produces the highest possible yield, and is most efficient. [2]

### Question 13 (a)

**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]**

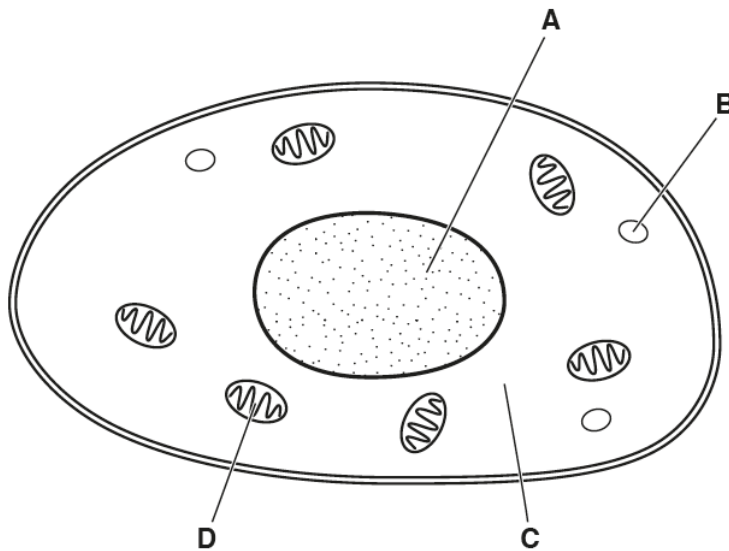
The term pituitary was recalled by many candidates, although the spelling was variable. Egg was answered correctly in most cases but for the final answer there was some confusion between oestrogen and progesterone.

## Question 13 (b)

(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]

Many candidates appreciated that the gene should be inserted into structure A but the explanations were often lacking in detail to gain the second mark. This can be seen in exemplar 3 which would gain one mark for the correct structure.

## Exemplar 3

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

State why the gene is put there.

..... It contains all the information about .....  
 ..... the cell and controls it. .... [2]

### Question 13 (c)

(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.

[6]

Answers often correctly stated an argument for and against the use of golden rice. However, many candidates stated that beta carotene or vitamin A is inserted into the rice, rather than the gene for beta carotene production. Only a small number of answers came to any type of conclusion as to whether the rice should be provided. Exemplar 4 shows an excellent response that gives a conclusion. The only negative factor is that it states that the rice contains vitamin A, rather than beta carotene. This answer gained 5 marks.

## Exemplar 4

L3 A  
No I don't think 'Golden rice' should be made to provide food for these people. If there is a question on whether or not something could potentially have had side effects on those people then it shouldn't be given to them. However 'Golden rice' does contain Vitamin A which helps with vision. Also people in undeveloped countries could benefit greatly with more food, especially when considering that some countries populations live solely on rice and so they could live solely on rice and nothing else. It helps with cost, but people should have a balanced diet. So in conclusion I'm against these people being given 'Golden rice' because it's potentially unsafe and could promote an unbalanced diet.

## Question 14 (a)

- 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.

<b>r</b>		
<b>r</b>		

Answer = ..... [2]

Answers to this question were varied. Some candidates correctly constructed the cross but then could not use this to give a probability.

## Question 14 (b) (i)

- (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]

The majority of candidates appreciated that the population needed to be divided by 70, however there were many errors seen in the conversion of 62.3 million. One of these is seen in exemplar 5.



## Exemplar 5

- (b) (i) It is estimated that 1 in 70 people in the UK is a carrier of ARPKD. ~~2000000~~

The estimated population of the UK in 2011 was 63.2 million.  ~~$\div 70 = 90286$~~

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

$$\begin{array}{r} \cancel{632000000} \\ 6300000 \div 70 = 90000 \end{array}$$

Answer = 90000 ..... [2]

## Question 14 (b) (ii)

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

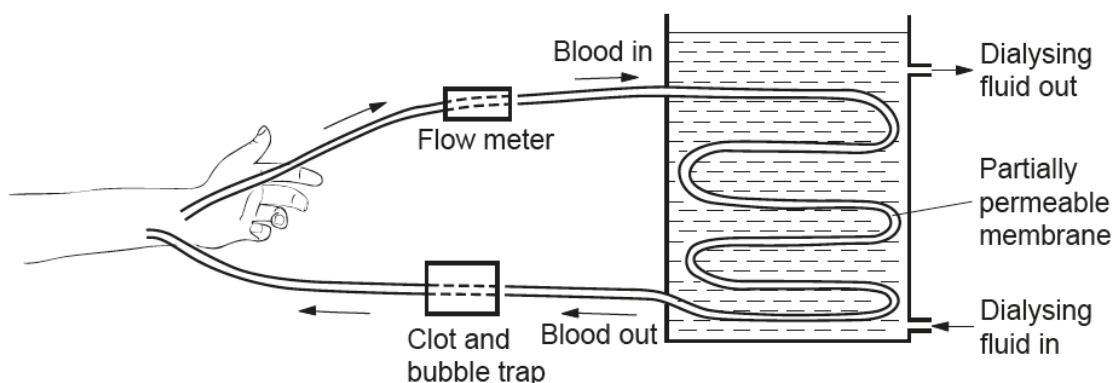
.....  
 ..... [1]

One of the most common errors seen here was the assumption that a person might have the disorder and not realise it, as opposed to being a carrier and not being identified.

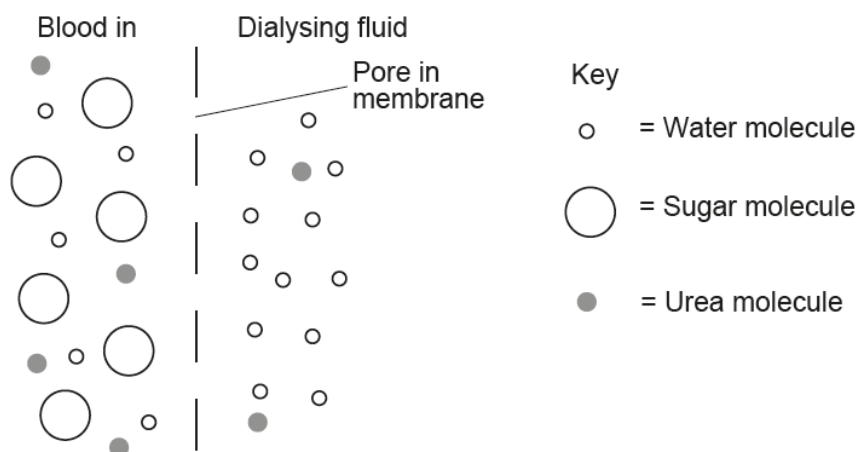
## Question 14 (c)

(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]

Many candidates commented correctly that the large size of the sugar molecules meant that they could not pass through the pores. The urea however was rather neglected in most answers.

## Question 14 (d)

(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]

There were very few correct answers to this question. Many of the candidates simply reworded the information given in the question that stem cells could be used to repair the kidneys. There were vague ethical reasons given against their use but they were seldom qualified. An example of one of these answers is shown in exemplar 6.

## Exemplar 6

Reasons for <sup>embryo</sup> ~~they~~ stem cells can differentiate in every type of cell, it can help people with ARPKD to have a kidney that develops normally.

Reasons against..... ethical reasons, asking patient moral questions for example, "is someone going to be harmed by this operation?"

[3]

## Question 15 (a)

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]

Candidates coped quite well with the ratio in this question.

### Question 15 (b)

- (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]

Answers seemed to be spread evenly between A, B and C on this question. Of those that correctly answered C, most gave the correct reason.

### Question 15 (c)

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

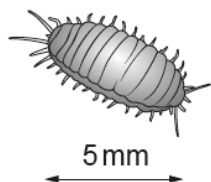
Write down **one** way to improve the method.

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

This was better answered than the previous question with many candidates stating that the coin should be tossed more often. Some candidates missed the point and stated that other students should toss the coin or that the coin should be tossed until the correct answer is obtained.

## Question 16 (a)

**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.

**(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]

It was clear that candidates' practical experience of fieldwork techniques was very limited. Only a small proportion could state that a pooter should be used or give any details of its use.

## Question 16 (b)

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

1 .....

.....

2 .....

.....

3 .....

.....

[3]

The most common correct answers referred to treating the mealybugs carefully, and there were correct references to making sure that the marking did not make the bug stand out to predators. There was some confusion about whether the mark should be permanent, with some incorrectly saying that it should wash off straight away.

## Question 16 (c) (i)

- (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]

The majority of candidates could substitute into this equation and obtained the correct answer.

## Question 16 (c) (ii)

- (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]

It may be that some candidates were confused with the word 'assumption' but a number gave the converse answer e.g. instead of saying that the assumption is that none died, or none were born, the answers said that they died or reproduced. Exemplar 7 shows an example of an answer that gave one correct assumption and one incorrect.

## Exemplar 7

1 That no ~~are~~ none died ✓

.....

2 ~~no many gave birth~~ ~~or many gave birth~~ many gave birth

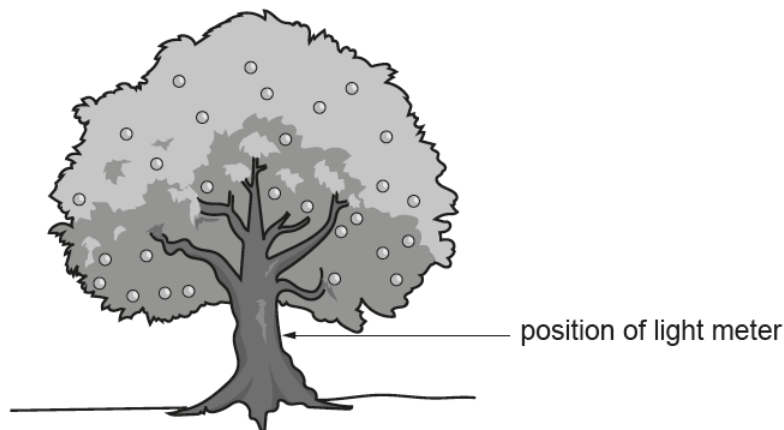
[2]



### Question 16 (d) (i)

- (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]

Although most candidates obtained the correct answer in (c)(i), they did not compare the difference in numbers on the two trees and relate this to the differences in light intensity.

### Question 16 (d) (ii)

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

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

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

The most common errors here related to the difference between precision and repeatability, with many candidates simply stating that more readings should be taken.

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Section A, Q6

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