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GCSE (9–1)

Examiners' report

# GATEWAY SCIENCE BIOLOGY A

J247

For first teaching in 2016

## J247/02 Summer 2023 series

Version 1

ocr.org.uk/science

# Contents

# 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. A selection of candidate answers is also provided. 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 and the mark scheme can be downloaded from OCR.

# Paper 2 series overview

J247/02 is the second foundation tier paper in the J247 Gateway Biology suite. J247/02 assesses content from Topics B4 to B6 and the practical activities in B7, with assumed knowledge of Topics B1 to B3. Therefore, 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 the skills and understanding that they have developed in B1 to B3, and the practical activities covered in Topic B7. There are also questions involving the assessment of key mathematical requirements from Appendix 5f of the specification. This paper is synoptic so contains elements of material covered by Topics B1 to B3.

| Candidates who did well on this paper generally: | Candidates who did less well on this paper generally: |
|---|---|
| • performed calculations correctly, including converting between units (Question 16 (b))<br>• made suitable conclusions when provided with data presented in graphical form (Question 21 (b) (i) and (b) (ii) and Question 22 (b) (ii))<br>• could use information provided to explain aspects of biological processes or procedures (Question 21 (c) (i))<br>• used their knowledge of biodiversity and competition to explain benefits and consequences within a habitat (Question 19 (b)). | • made errors in calculations, such as using the incorrect method to find ratios (Question 22 (c))<br>• found it difficult to describe modifications to experiments (Question 20 (b) (iii) and 20 (b) (v))<br>• identified benefits and consequences within a habitat without explaining them (Question 19 (b))<br>• confused practical techniques for estimating the number of plants within an area (Question 19 (a)). |

# Section A overview

Section A contains multiple-choice questions. This section of the paper is worth 15 marks. Candidates performed particularly well this series on the multiple-choice section of this paper. Questions 6, 8 and 9 were usually answered correctly. Question 14 was the most challenging question in this section with only some candidates showing knowledge of the definitions of ecological terms.

## Question 1

**1** Which process in the carbon cycle **decreases** the amount of carbon dioxide in the air?

**A** Combustion

**B** Decomposition

**C** Photosynthesis

**D** Respiration

Your answer ☐ **[1]**

About half the candidates answered correctly. If candidates answered incorrectly, they tended to select A combustion or D respiration.

## Question 2

**2** Which of these is a **biotic** factor that can affect the growth of plants?

**A** Carbon dioxide levels

**B** Light availability

**C** Mineral content of the soil

**D** Number of primary consumers

Your answer ☐ **[1]**

Half of all candidates selected the correct answer of D.

## Question 3

**3** Using the data in the table, how many people living in the UK have a Y chromosome in their cells?

| Number of individuals of each sex in the UK, rounded to 2 significant figures | |
|---|---|
| males | females |
| 33 000 000 | 34 000 000 |

**A** 33 000 000

**B** 34 000 000

**C** 66 000 000

**D** 67 000 000

Your answer ☐ **[1]**

The most common incorrect response was B.

## Question 4

**4** A genetic disorder is caused by a dominant allele (D). The recessive allele is (d).

Which row shows all the possible genotypes for heterozygous and homozygous individuals?

| | Heterozygous | Homozygous |
|---|---|---|
| **A** | Dd | dd |
| **B** | DD or dd | Dd |
| **C** | Dd | DD or dd |
| **D** | Dd | DD |

Your answer ☐ **[1]**

Half of all candidates answered this correctly.

## Question 5

**5** Which sentence is a correct description of a chromosome?

**A** A length of protein that contains the genetic material.

**B** A long molecule of DNA that contains genes.

**C** A part of a gene that codes for a particular protein.

**D** A strand of DNA that can leave the nucleus.

Your answer ☐ **[1]**

Half of all candidates answered this correctly.

## Question 6

**6** What does the lining of the trachea (windpipe) produce to defend the body against pathogens?

**A** Acid

**B** Antigen

**C** Enzymes

**D** Mucus

Your answer ☐ **[1]**

Over half of all candidates answered this correctly.

## Question 7

7 There are 28 chromosomes in each elephant sperm cell.

What is the diploid number of chromosomes in elephants?

**A** 14

**B** 28

**C** 56

**D** 112

Your answer ☐ **[1]**

Around half of all candidates answered this question correctly. A and B were the most common distractors for candidates.

## Question 8

8 Charles Darwin and Gregor Mendel did important work in the development of science.

Which row gives the areas of their work?

| | Charles Darwin | Gregor Mendel |
|---|---|---|
| **A** | evolution | medicine |
| **B** | medicine | genetics |
| **C** | evolution | genetics |
| **D** | genetics | evolution |

Your answer ☐ **[1]**

Answered correctly by majority of candidates.

## Question 9

**9** Ecotourism can cause benefits and problems for conservation.

Which row gives a benefit and a problem caused by ecotourism?

| | Benefit | Problem |
|---|---|---|
| **A** | educates people about conservation | brings money into the local economy |
| **B** | brings money into the local economy | tourists can cause pollution and damage |
| **C** | tourists can cause pollution and damage | educates people about conservation |
| **D** | brings money into the local economy | educates people about conservation |

Your answer ☐ **[1]**

Answered correctly by the majority of candidates.

## Question 10

**10** When a drug is developed to treat a disease, the drug is tested.

What is the final stage in this testing?

**A** Testing on animals to see if it is safe.

**B** Testing on animals to work out the correct dose.

**C** Testing on healthy people to see if it has side effects.

**D** Testing on people with the disease to see if it is effective.

Your answer ☐ **[1]**

Half of all candidates answered this correctly. C was a commonly seen incorrect response.

## Question 11

**11** The cuticle on plant leaves helps to prevent pathogens entering the plant.

Which statement describes how the cuticle does this?

**A** Acts as a physical barrier

**B** Engulfs microbes

**C** Produces antimicrobial substances

**D** Releases antibodies

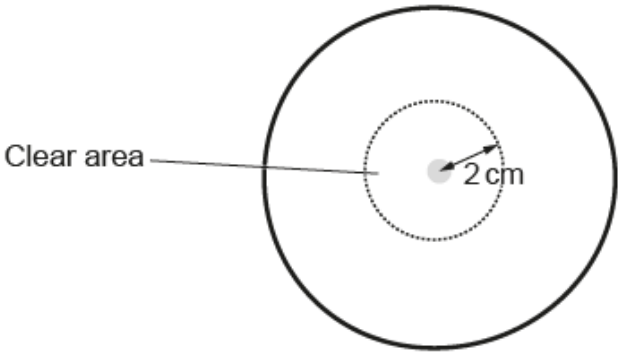
Your answer ☐ **[1]**

Over half of all candidates answered this correctly.

## Question 12

**12** Antibiotics can be tested on bacteria growing on a Petri dish.

The clear area around an antibiotic disc gives information about how effective the antibiotic is.




What is the closest estimate of the clear area on this Petri dish?

(Include the disc and use the formula: Area = $\pi r^2$ where $\pi = 3$)

**A** $3\,cm^2$

**B** $4\,cm^2$

**C** $6\,cm^2$

**D** $12\,cm^2$

Your answer ☐ **[1]**

Over half of the candidates answered this correctly. C was the most common distractor.

## Question 13

**13** Which statement describes why seeds from seedbanks are an important tool in conservation?

**A** If there is a food shortage then the seeds can be used for food.

**B** The seeds can be used if certain species of plants become extinct.

**C** The seeds can be used to feed endangered animals.

**D** The seeds grow fast as the temperature is warm inside the seedbank.

Your answer ☐ **[1]**

Over half of all candidates answered this correctly.

## Question 14

**14** Which group will have the **most** organisms in any ecosystem?

**A** Community

**B** Population

**C** Species

**D** Trophic level

Your answer ☐ **[1]**

This was the most challenging question, as candidates did not show knowledge of ecological terms. B was the most commonly seen incorrect response.

## Question 15

**15** Biomass is lost as it passes through a food chain.

Which processes are responsible for this loss in biomass?

**A** Egestion, excretion and respiration

**B** Egestion, transpiration and respiration

**C** Excretion, transpiration and respiration

**D** Photosynthesis, egestion and excretion

Your answer ☐ **[1]**

Less than half of candidates gained this mark. D was the most commonly seen incorrect response.

# Section B overview

Candidates scored well on the first three questions. The only exception was Question 17 (a) (iv) where candidates seemed to struggle to link uncontrolled cell growth to tumours, and Question 18 (b) where they had to identify that antibiotics only treat bacterial infections.

In questions involving practical skills the responses were mixed. In Question 19 (a) there was confusion between using quadrats and transects. In Question 20 (b) (iii) and 20 (b) (v), candidates found it difficult to describe modifications to the experiment.

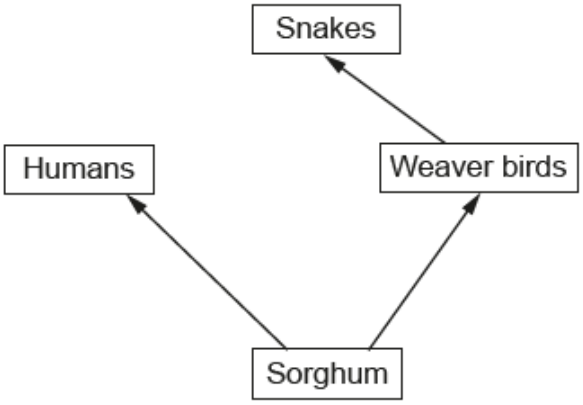
## Question 16 (a)

**16** Sorghum is a crop plant grown in Africa for its seeds as shown in **Fig. 16.1**.

**Fig. 16.1**

**(a)** **Fig. 16.2** shows a food web containing sorghum.

**Fig. 16.2**




Write down the trophic level for each of these organisms in the food web.

Use the words from the list.

| | | |
|---|---|---|
| **primary consumers** | **producers** | **secondary consumers** |

Sorghum .....

Snakes .....

**[2]**

This was answered correctly by the majority of candidates.

## Question 16 (b)

**(b)** Weaver birds are a major problem for farmers who grow sorghum.

One weaver bird can eat 15 g of sorghum seeds in a day.
A large colony of weaver birds has 5 000 000 birds.

Calculate the mass of seeds in **kilograms** that this colony eats in a day.

Mass of seeds = ..... kg **[2]**

Approximately half of all candidates answered this correctly, gaining the maximum marks. Where candidates only scored 1 mark, it was often because they did not convert grams to kilograms. There is still a significant number of candidates who haven't shown any working, which may have allowed them to gain a mark for processing even if their final answer was incorrect.

## Question 16 (c)

**(c)** Sorghum produces a bitter chemical in its seeds.
This makes the seeds less likely to be eaten by birds.

Complete each sentence about how the bitter chemical was first made by sorghum.
Use the words from the list.

| | | | | |
|---|---|---|---|---|
| **gene** | **meiosis** | **mutation** | **pathogen** | **sugar** |

The bitter chemical was first made due to a change in a ..... .

This type of change is called a ..... .

**[2]**

The majority of candidates answered this question correctly. Candidates that scored 1 mark on this question tended to get the mark for mutation.

## Question 16 (d)

**(d)** Farmers have developed varieties of sorghum with lower levels of the bitter chemical.

To do this they:

- chose two plants with less bitter chemical than other plants
- bred these plants together
- repeated the same steps with the offspring.

What is the name of this process?

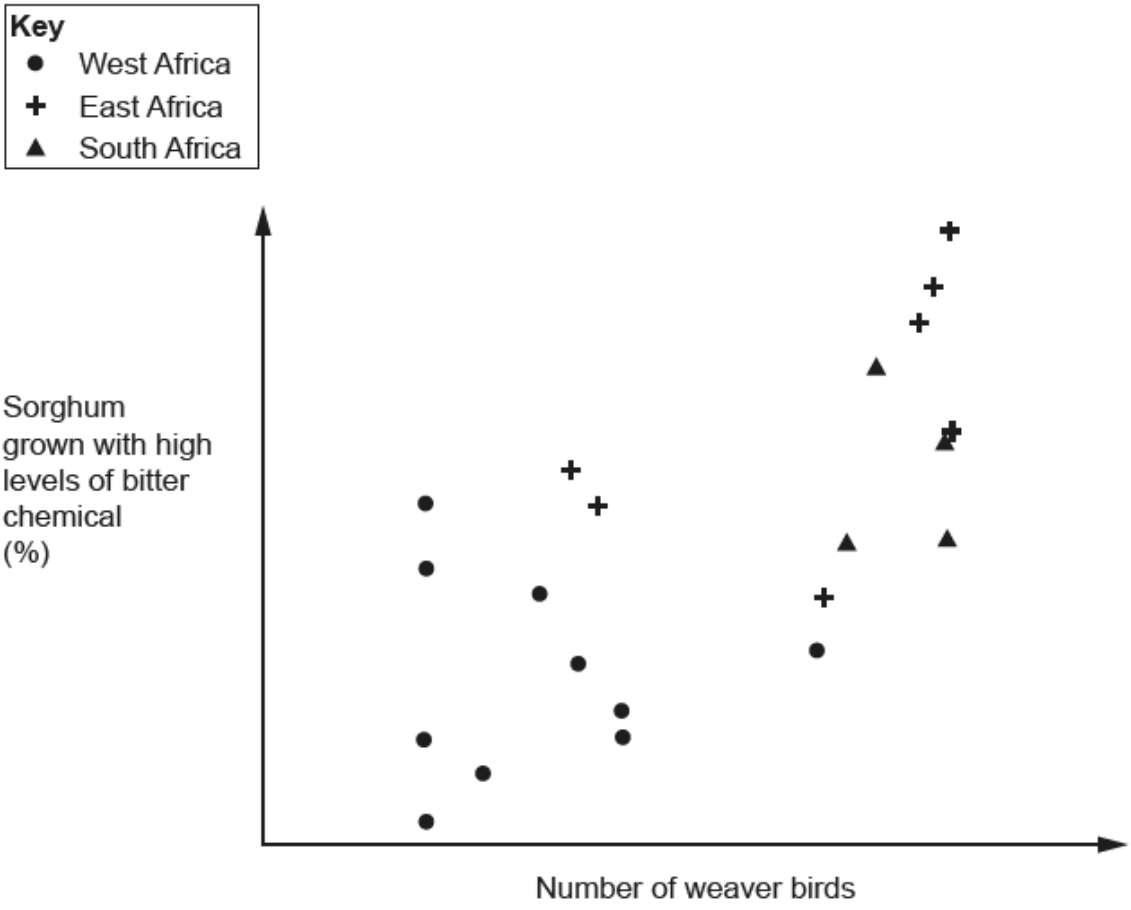
..... **[1]**

There was considerable confusion between selective breeding and genetic engineering in these responses.

## Question 16 (e) (i)

**(e)** Scientists recorded the percentage of sorghum grown with high levels of bitter chemical in different areas of Africa. They also recorded the number of weaver birds living in the same areas.

The graph shows the data they collected.




In some areas, there are low numbers of weaver birds.

**(i)** Which area of Africa, west, east or south, has the **least** number of weaver birds that eat sorghum?

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

Approximately half of all candidates answered this correctly.

## Question 16 (e) (ii)

**(ii)** Complete the sentence about the graph.

Put a (ring) around the correct option.

In the areas with low numbers of weaver birds, farmers choose to grow

**a lower / a higher / the same** percentage of sorghum with high levels of

bitter chemicals. **[1]**

Half of all candidates answered this correctly.

## Question 16 (e) (iii)

**(iii)** Give a reason why the farmers make this choice.

.....

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

Candidates who were credited a mark showed the link between there being fewer birds, so less sorghum would get eaten. Other candidates showed confusion and talked about it 'tasting less bitter, so the farmers could sell more crops'.

## Question 17 (a) (i)

**17** The table shows the mean mass of four types of rodent and the mean number of years they live.

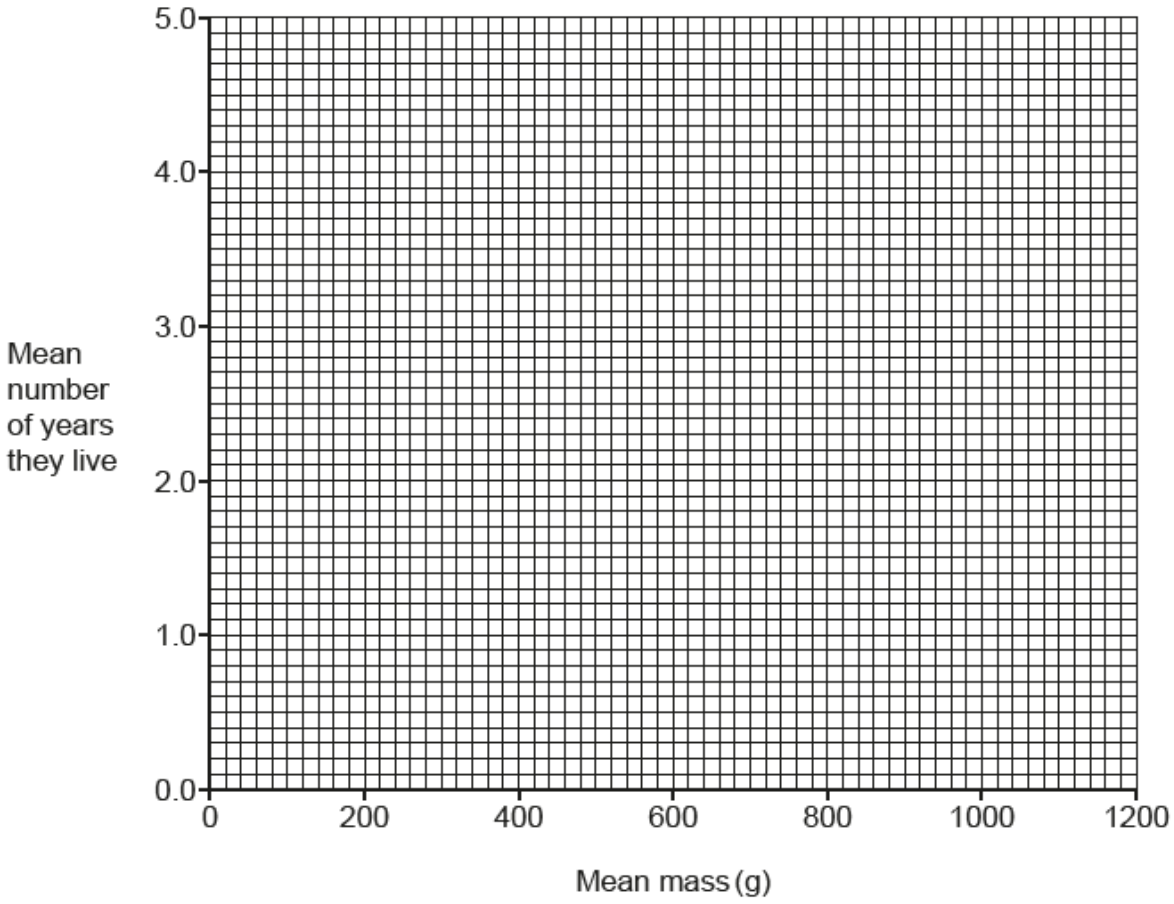
| Type of rodent | Mean mass (g) | Mean number of years they live |
|---|---|---|
| **Gerbil** | 40 | 1.5 |
| **Guinea pig** | 1000 | 4.0 |
| **Rat** | 200 | 2.0 |
| **Squirrel** | 600 | 3.0 |

**(a) (i)** Plot the data from the table on the graph. **[2]**

The majority of candidates were able to correctly plot all 4 points. Where only 1 mark was scored, it was due to the first point being plotted incorrectly.

## Question 17 (a) (ii)

**(ii)** Draw a line of best fit through the points. **[1]**




The majority of candidates were able to draw a suitable line of best fit. Where candidates didn't score this mark it was generally for the following reasons: they did not use a ruler, their line was too thick, or they had multiple lines.

## Question 17 (a) (iii)

**(iii)** Mole rats are rodents that have a mean mass of 60 g.

Use your graph to predict the mean number of years that mole rats live.

Mean number = ..... years **[1]**

More than half of all candidates were able to use their line of best fit to make a prediction.

## Question 17 (a) (iv)

**(iv)** Mole rats actually live much longer than predicted by the graph.

Scientists think that one reason for this is that their cells do **not** divide in an uncontrolled way.

Explain why this would help the mole rats to live longer.

.....

.....

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

This question was one of the more challenging questions for the majority of candidates, with candidates not making the link between uncontrolled cell growth and tumours/cancer. Most candidates who were credited marks tended to only gain 1 mark on this question, for stating that mole rats were less likely to get mutations, or less likely to get cancer.

## Question 17 (b)

**(b)** Mole rats spend most of their time burrowing underground in tunnels.

The tunnels may have only 5% oxygen in the air compared with 21% above ground.

Complete the sentences below to show how the mole rats have adapted to live in the tunnels.

Mole rats have a low respiration rate. This means they need less ..... gas from the air.

This gas can be picked up from low levels in the air by the chemical inside their red blood cells called ..... .

Mole rats also have few pain receptors in their tissues.

This means that any ..... acid produced by anaerobic respiration does not hurt.

Scientists think that mole rats have evolved these features by the process of

..... ..... .

**[4]**

More successful responses saw candidates gain 3 or 4 marks on this question. Where a mark was dropped it was for the last response, where candidates confused the processes of natural selection, selective breeding and genetic engineering. Where only 1 or 2 marks were gained, it tended to be for response 1 (oxygen) and response 3 (lactic).

## Question 18 (a) (i)

**18** Hepatitis is the name given to diseases that cause the liver to be inflamed.

The table gives information about four types of hepatitis.

| | Hepatitis A | Hepatitis B | Hepatitis D | Alcoholic Hepatitis |
|---|---|---|---|---|
| **Cause** | Virus | Virus | Virus | Drinking alcohol |
| **Details of cause** | Virus is taken in through food and drink contaminated with faeces. | Virus is taken in through contaminated blood. | Virus is taken in through contaminated blood. | Excessive alcohol consumption over some time. |
| **Effect on the body** | Usually lasts for two months then a person cannot develop the disease again. | Usually lasts for one to three months then a person cannot develop the disease again. | Can only develop symptoms if a person has hepatitis B. | Can cause liver failure and death. |

**(a)** For each of these questions choose your answers from the types of hepatitis shown in the table.

**(i)** List **all** the types of hepatitis that can be treated using antiviral tablets.

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

Half the candidates were able to correctly select the responses from the table.

## Question 18 (a) (ii)

**(ii)** Which type of hepatitis can be prevented by regular hand washing?

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

The majority of candidates correctly selected hepatitis A.

## Question 18 (a) (iii)

**(iii)** Which type of hepatitis is a non-communicable disease?

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

The majority of candidates correctly selected alcoholic hepatitis as being non-communicable.

## Question 18 (a) (iv)

**(iv)** Which type of hepatitis involves interaction between two different diseases?

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

While the majority of candidates correctly identified hepatitis D, a few also mentioned hepatitis B in their response, which meant they did not gain the mark.

## Question 18 (b)

**(b)** Explain why hepatitis **A cannot** be treated using antibiotics. Use information from the table.

.....

.....

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

This question proved to be quite challenging for half the candidates. Some candidates used the wrong information from the table and talked about how it was transmitted through faeces, so antibiotics wouldn't work. Another common error was that because the infection only lasted two months, taking antibiotics wouldn't work. Successful responses identified it as a viral disease and then correctly stated that antibiotics only work on bacterial disease.

## Question 18 (c)

**(c)** Complete each sentence to explain why a person **cannot** develop hepatitis **A** or **B** twice.

Use the words from the list.

| | | | |
|---|---|---|---|
| **antibiotics** | **antibodies** | **antigens** | **immune** |
| **red blood** | **vaccinated** | **white blood** | |

On the surface of the viruses there are molecules called ..... .

These molecules are detected by ..... cells.

These cells produce protein molecules called ..... which attack the viruses.

If the person gets infected again, the protein molecules will destroy the viruses before they can make the person ill.

The person is said to be ..... .

**[4]**

Generally answered well by the majority of candidates. The most common errors were confusing red blood cells and white blood cells, and mixing up antigens and antibodies.

## Question 19 (a)

**19 (a)** Describe how scientists could estimate the number of one type of **plant** in a habitat.

.....

.....

.....

.....

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

The majority of candidates managed to score at least 1 mark on this question. Some candidates confused transects and quadrats and were unable to gain a mark for this. A significant number did not mention random sampling, while others did not mention scaling up to the whole area.

### OCR support

Estimating the number of plants in a habitat has been tested on a number of previous examination papers. ExamBuilder can be used to find and use those questions with candidates as practice material.

### Misconception

Application of appropriate sampling techniques to investigate the distribution and abundance of organisms in an ecosystem is the focus of PAG 3. Some candidates showed confusion between when to use quadrats and when to use transects.

## Question 19 (b)*

**(b)*** 

### Buddleia, a pest or a friend?

Many people grow buddleia bushes in their gardens.

Buddleia flowers attract butterflies that feed on nectar. Birds and bats feed on butterflies. Foxes and badgers can live under the cover of the bushes.

Buddleia bushes spread and grow very quickly. In some areas this has caused the numbers of other plants to decrease.

In these areas, scientists have seen large numbers of butterflies. However, they only see the more common types of butterflies and not rare ones.

Some scientists say buddleia are 'pests' but others say they are 'friends'.

Use information from the passage to explain these different opinions about buddleia.

In your answer use ideas about:

- interdependence
- competition
- biodiversity.

.....

.....

.....

.....

.....

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

This was the level of response question on this paper. To obtain Level 3, candidates had to identify reasons why buddleia may be thought of as both 'friends' and 'pests', and explain these opinions using ideas about interdependence, competition and biodiversity. Very few candidates at Level 3 explained the opinions using ideas about interdependence, with the majority explaining the opinions using ideas about competition and biodiversity. At Level 2, candidates mainly identified reasons why buddleia may be thought of as both 'friends' and 'pests'. Level 1 candidates only identified one opinion.

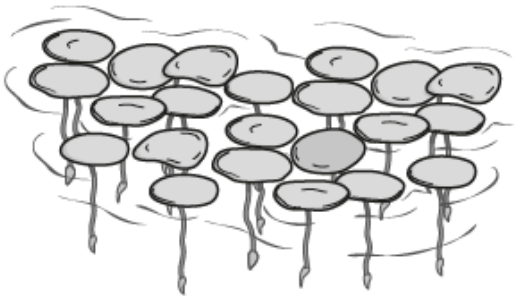
## Exemplar 1

They are pests because they compete with other plants for space and as they spread and grow quickly, they take a lot of space from other plants This causes the amount of other plants to decrease. They are friends because they attract butterflies that birds and bats eat and they also provide cover for foxes and badgers. They attracts lots of different types of butterflies and other animals which is biodiversity. Foxes and badgers depend on them for cover. Birds and bats depend on them to attract their prey (butterflies). [6]

Exemplar 1 shows an answer that was given Level 3, 5 marks. The response is well constructed and relevant. The candidate has clearly identified why buddleia may be considered 'pests' and 'friends', and has given one explanation, linked to competition, for why they might be considered 'pests'. To gain L3, 6 marks, the candidate should have provided at least one further explanation using ideas about competition, interdependence or biodiversity.

## Question 20 (a)

**20** Duckweed is a small plant that floats on the surface of ponds.



Each plant has one leaf and it usually reproduces by dividing into two.

Only occasionally does it reproduce sexually by growing flowers.

**(a)** In the box next to each statement, put **A** if it applies to asexual reproduction or **S** if it applies to sexual reproduction.

It is a quicker process. ☐

It introduces variation into the population. ☐

**[1]**

The majority of candidates answered this correctly.

## Question 20 (b) (i)

**(b)** A student investigates the effect of acid rain on the reproduction rate of duckweed.

This is the student's method:

- Put pondwater with a pH of 4.5 in four different beakers.
- Add five duckweed plants to each beaker.
- Repeat this with beakers containing pondwater at pH 6.5 and 8.5.
- Leave the beakers for 10 days in the same conditions.
- After 10 days count how many duckweed plants are in each beaker.

The table shows the student's results.

| | Number of duckweed plants after 10 days | | | | |
|---|---|---|---|---|---|
| **pH of pondwater** | **Beaker 1** | **Beaker 2** | **Beaker 3** | **Beaker 4** | **mean** |
| 4.5 | 6 | 5 | 7 | 6 | 6 |
| 6.5 | 12 | 14 | 11 | 11 | 12 |
| 8.5 | 7 | 6 | 5 | 14 | 8 |

**(i)** What is the **independent** variable in this investigation?

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

This question caused some confusion, with just over half the candidates identifying the independent variable as pH of pondwater. Common incorrect responses were number of plants or number of days.

## Question 20 (b) (ii)

**(ii)** Identify the **pH** of the pondwater where the mean number of duckweed plants is the same as the mode for the four beakers.

Tick (✓) **one** box.

4.5 ☐

6.5 ☐

8.5 ☐

**[1]**

The majority of candidates were able to correctly identify the mode.

## Question 20 (b) (iii)

**(iii)** The student thinks that there is a problem with their data at pH 8.5. This resulted in the mean being inaccurate.

Explain how the student could improve their investigation to get a more accurate result for the mean.

.....

.....

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

This was a challenging question for the majority of candidates. There were many vague references to 'repeat the experiment', rather than identifying which beaker needed to be repeated.

## Question 20 (b) (iv)

**(iv)** The student concluded that acid pollution slows the rate of duckweed reproduction.

Explain how acid pollution slows the rate of duckweed reproduction.

Use ideas about enzymes and photosynthesis in your answer.

.....

.....

.....

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

Where candidates did not score on this, it was because they said 'the enzymes die', or that there would be 'no photosynthesis', rather than talking about it occurring more slowly.

## Question 20 (b) (v)

**(v)** The student also concluded that pH 6.5 is the best pH for duckweed reproduction.

The student's teacher says that they need to extend the experiment to be sure of this.

Describe how the student should extend their experiment.

.....

.....

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

While there were a lot of vague 'repeat the experiment' responses, the majority of candidates identified that you would need to test more pH values. The more successful responses identified a suitable range of pH values.

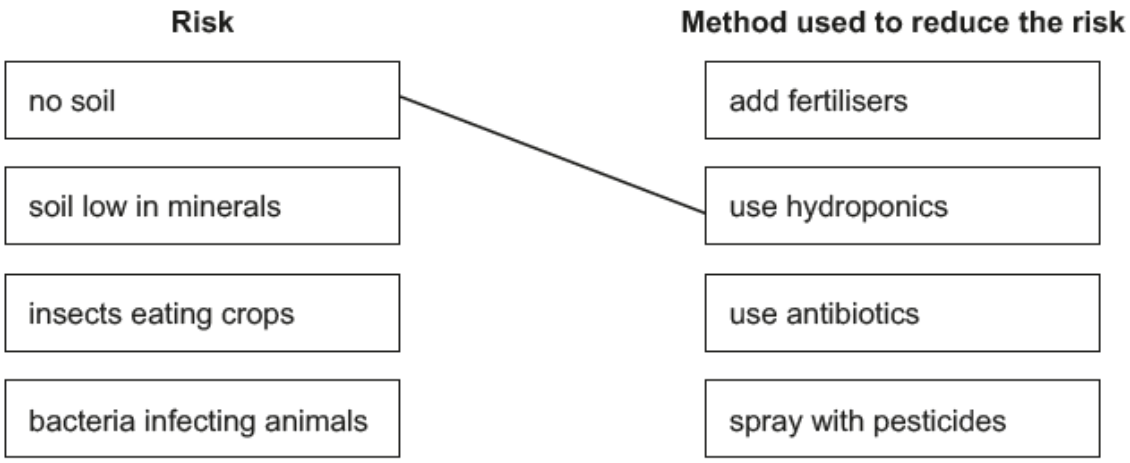
## Question 21 (a)

**21** The demand for food in the world is growing but there are risks to the supply of food.

There are methods that can be used to reduce these risks.

**(a)** Draw lines to connect each **risk** with the correct **method used to reduce the risk**.

One line has been drawn for you.




**[2]**

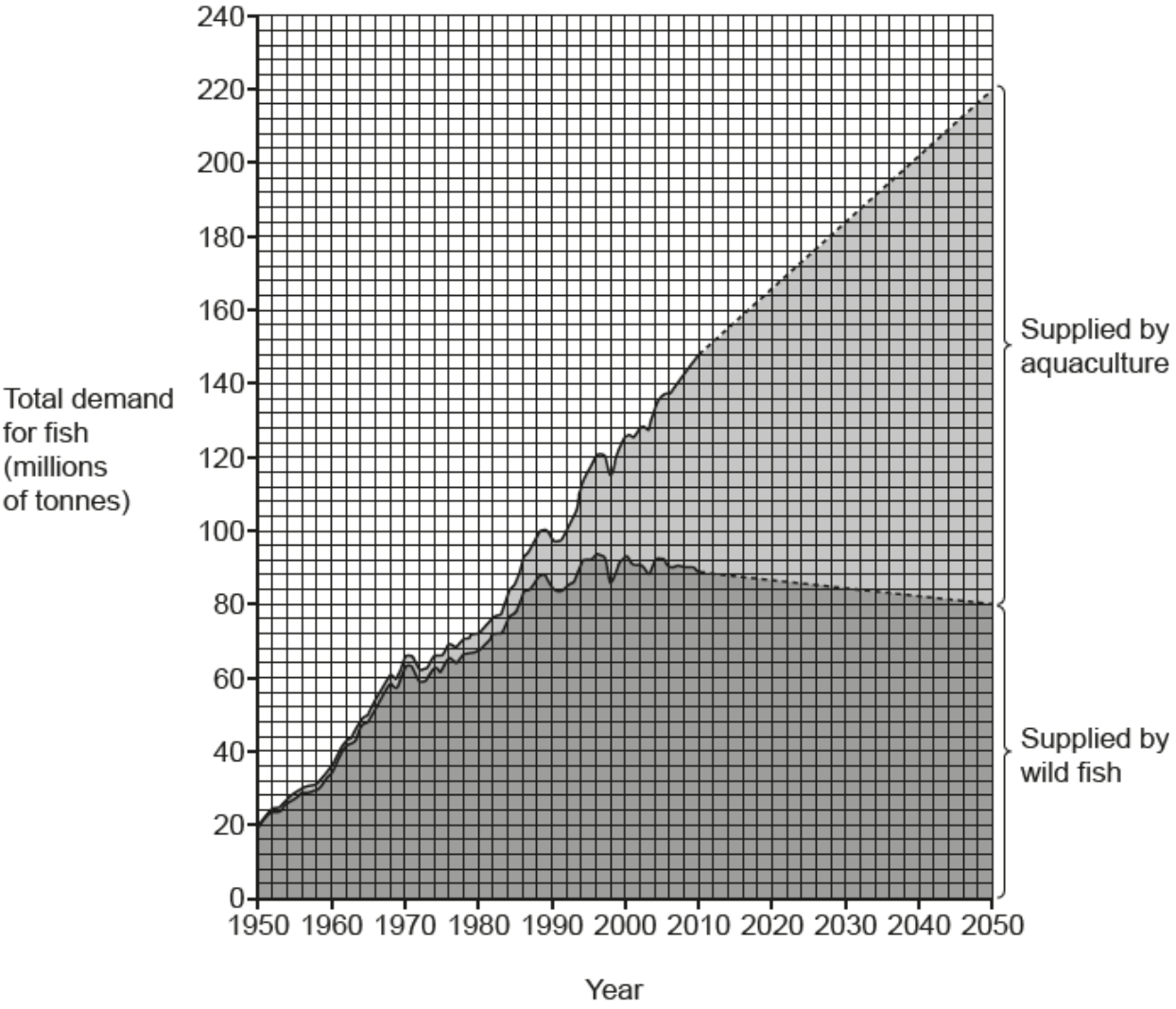
The majority of candidates answered this well.

## Question 21 (b) (i)

**(b)** Many people in the world eat fish as their main source of protein.

| |
|---|
| Wild fish: caught from the sea<br>Aquaculture: fish grown in large tanks in lakes or the sea |

The graph shows how the total demand for fish has changed since 1950 and how it is expected to change up to 2050. It also shows how the total demand is met by the supply of wild fish and fish from aquaculture.




Use the graph to complete each sentence about the demand for fish.

Put a (ring) around each correct number.

**(i)** The total demand for fish is expected to increase from 20 million tonnes in 1950 to

**80 / 140 / 220** million tonnes in 2050. **[1]**

The majority of candidates read the data off the graph correctly.

## Question 21 (b) (ii)

**(ii)** In 2050, the percentage of all fish supplied by wild fish is expected to be about

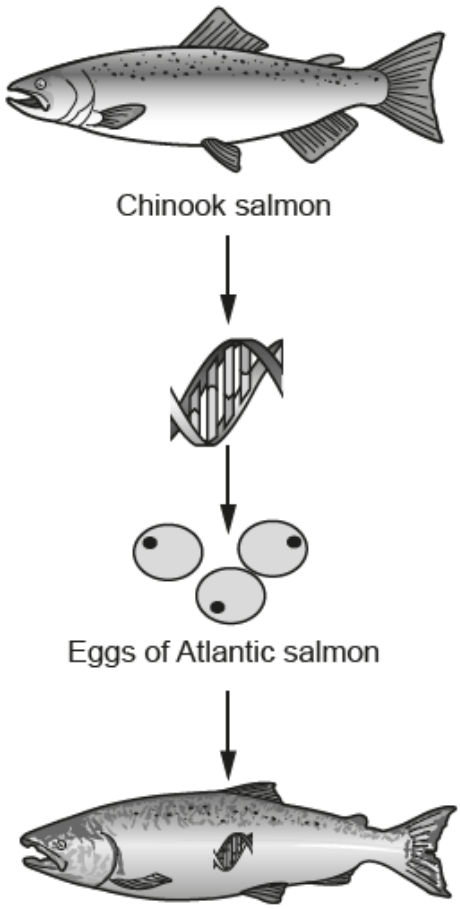
**36% / 57% / 64%.** **[1]**

The majority of candidates read the correct data off the graph and were able to perform the necessary calculation.

## Question 21 (c) (i)

**(c)** Scientists are using genetic engineering to increase the mass of Atlantic salmon produced by aquaculture.
Chinook salmon are fish that grow fast.

The diagram shows how scientists are producing genetically engineered Atlantic salmon.




**(i)** Describe how scientists can increase the mass of Atlantic salmon using genetic engineering.

.....

.....

.....

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

This question proved challenging. A significant number of responses referred to selective breeding rather than genetic engineering, even though the question mentioned genetic engineering. Other candidates provided hybrid responses that mixed up the processes of genetic engineering and selective breeding.

## Exemplar 2

TO increase the mass, the scientist should find a fish that is alike salmon with a high mass and either breed them together or take the DNA/ DNA /reproductive cells and (sperm) [3] from the fish with a high mass and fertilise the egg salmons eggs with this. Therefore, the offspring will have a higher mass. Then they should breed the offspring with the desired/advantageous characteristics together again and repeat this again for many gererations.

Exemplar 2 shows a response where the candidate has confused the processes of genetic engineering and selective breeding and were unable to be credited any marks. Other hybrid responses were seen, where the candidate had mixed up elements of both processes within their response.

## Question 21 (c) (ii)

**(ii)** In 2020 some salmon escaped into the sea from a tank used in aquaculture.

Suggest why this problem makes some people concerned about producing genetically engineered salmon.

.....

.....

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

The most common incorrect responses were the idea that they would spread disease to the fish in the sea, or that it would make the fish in the sea unfit for human consumption. Where a mark was gained, it was usually for the idea that they might breed with the wild fish.

## Question 22 (a)

**22 (a)** Complete each sentence about decomposition.

Decomposition is caused by microorganisms such as ..... .

The microorganisms use the process of ..... to release the energy in dead organisms.

Decomposition also allows minerals to be ..... in nature for plants to use.

**[3]**

This question proved challenging for candidates. Some candidates named detritivores as their first response, despite the question asking for microorganisms. Where 1 mark was gained, it was usually for the third response.

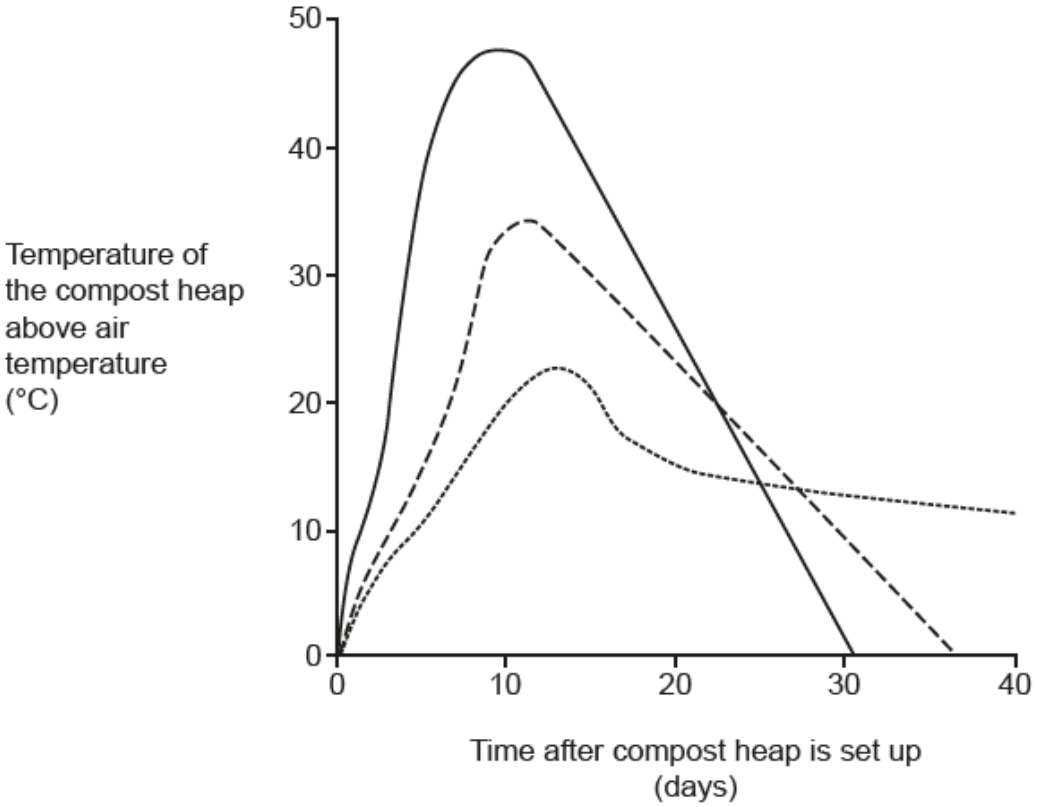
## Question 22 (b) (i)

**(b)** Some students investigate plant decomposition.
They put three different plant wastes into compost heaps.
Each type of plant waste contains different ratios of carbon to nitrogen.

They measure the rate of decomposition by measuring the temperature in the compost.

The graph shows their results.

**Key**
Ratio of Carbon : Nitrogen
——— 30 : 1
– – – – 40 : 1
– – – – 60 : 1




**(i)** The pupils used the temperature of the compost heap as a measure of the rate of decomposition.

Which statement explains why they could do this?

Tick (✓) **one** box.

Carbon dioxide contains more energy than oxygen. ☐

Decomposition involves an endothermic reaction. ☐

Microorganisms give off heat when they decompose waste. ☐

Mineral salts will increase the temperature of the compost. ☐

**[1]**

Around half of candidates answered this question correctly. Some candidates confused endothermic and exothermic reactions, with endothermic being a frequent distractor.

## Question 22 (b) (ii)

**(ii)** Which statement describes the results of the investigation?

Tick (✓) **one** box.

- High levels of carbon results in faster decomposition. ☐
- If the carbon : nitrogen ratio is higher, then decomposition is faster. ☐
- Low levels of nitrogen result in faster decomposition. ☐
- The higher the nitrogen content compared to carbon, the faster the rate of decomposition. ☐

**[1]**

Many candidates struggled to draw a conclusion from the graph.

## Question 22 (b) (iii)

**(iii)** Give **one** abiotic factor that the students should keep constant in their experiment.

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

This question proved challenging for the majority of candidates, with many of them not identifying an appropriate abiotic factor. There was a significant number who gave the vague response of 'temperature', without recognising that it would need to be external temperature.

## Question 22 (c)

**(c)** The table shows the mass of carbon and nitrogen in different plant materials.

| Plant material | Mass of carbon per kg (g) | Mass of nitrogen per kg (g) |
|---|---|---|
| **Fruit waste** | 14 | 0.350 |
| **Horse manure** | 18 | 0.600 |
| **Straw** | 9 | 0.015 |

Which plant material would decompose the **fastest**?

Explain your answer using calculations and the graph in **(b)**.

Plant material .....

Reason .....

.....

.....

**[3]**

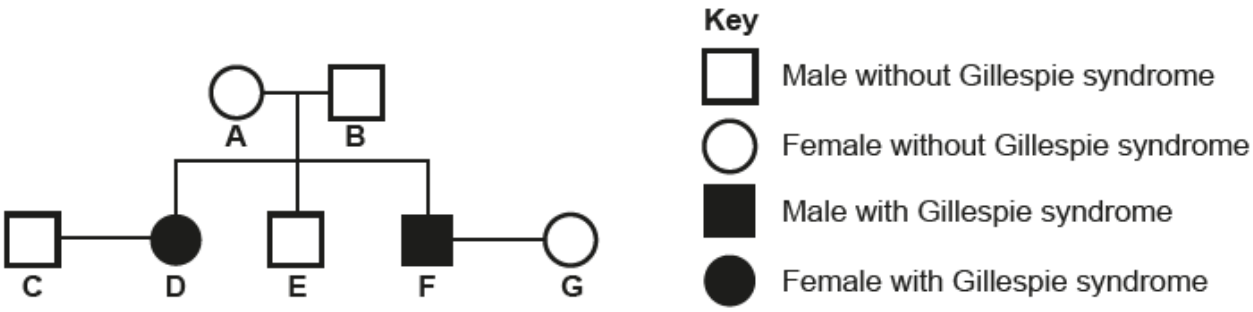
This question proved challenging for candidates. Many candidates did not do any calculations, or they were unsure of how to work out the ratios. Where candidates did correctly select the plant material, they often then did not provide a valid reason for their choice.

## Question 23 (a)

**23** Gillespie syndrome is a rare genetic disorder.
People with Gillespie syndrome have eyes with no iris and damage to their cerebellum.

**Fig. 23.1** shows the inheritance of Gillespie syndrome in a family.

**Fig. 23.1**




**(a)** A doctor makes this statement:
The allele causing Gillespie syndrome in this family is recessive.

Explain why this statement is correct. Use evidence from **Fig. 23.1**.

.....

.....

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

Most successful responses recognised that neither parent had the condition, while two children did. Some candidates incorrectly thought that C and G were offspring of A and B.

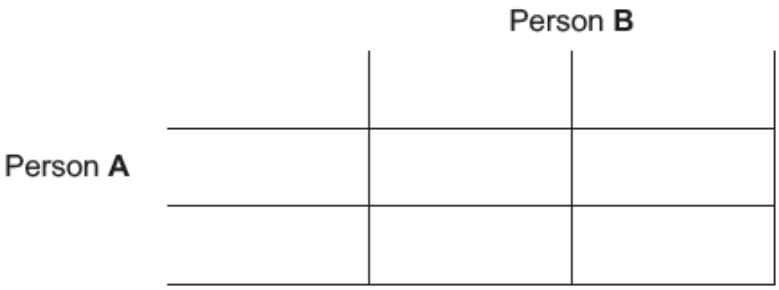
## Question 23 (b)

**(b)** Person **A** and person **B** are expecting another baby.

Complete **Fig. 23.2** to find the probability that it will have Gillespie syndrome.

(Use G for the dominant allele and g for the recessive allele.)

**Fig. 23.2**




Probability = .....

**[3]**

Where candidates could correctly identify the gametes for A and B, they then went on to gain the second mark for their genetic cross. Some candidates then incorrectly interpreted their cross to give the wrong probability.

## Question 23 (c)

**(c)** Person **D** is very sensitive to bright light and has difficulty controlling their balance.

Explain why this is.

.....

.....

.....

.....

.....

..... **[4]**

A significant number of candidates did not identify that this person had Gillespie syndrome, so were not credited the first mark. Many candidates were able to correctly link the lack of iris to being unable to control light entering the eye. Many candidates were also able to correctly link cerebellum to being responsible for controlling balance.

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Question 21 (b) (i): Graph of demand for fish - © www.wri.org, World Resources Institute

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