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Examiners' report

GATEWAY SCIENCE BIOLOGY A

J247
For first teaching in 2016

J247/02 Summer 2019 series
Version 1

Contents

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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 2 series overview

J247/02 is the second paper candidates take for Gateway GCSE Biology Foundation Tier. It assesses content from specification topics B4-6 and B7 practical skills. There is a multiple-choice question section and a short answer question section, which includes one Level of Response type question. The Level of Response question accesses the quality of communication as well as knowledge and understanding. For candidates to perform well on this paper they will need to have a sound knowledge of the theory covered in B4-6 and be able to apply this to novel situations.

The candidates will also need to apply the skills and understanding that they have developed in the practical activities covered in B7. This paper includes synoptic assessment and therefore the paper assumes knowledge of B1-3 in addition to B4-6. 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 percentages from fractions sampled: Q17(b)(iii), Q19(c)(i) and ratios Q20(b).
- Demonstrated knowledge and understanding of correct selection of features for GM crops Q17(b)(ii), the immune system Q18(a), role of platelets Q20(a) and communicable and non-communicable disease Q21(a).
- Applied knowledge and understanding to explain observations: natural selection Q20(c), mitochondria Q20(d) and interdependence in food webs Q22(a)(i), Q22(a)(ii).
- Demonstrated and applied knowledge and understanding of land use and the need to maintain biodiversity in the Level of Response Q19(d).
- Applied knowledge and understanding of scientific enquiry and techniques in understanding the importance of repeating clinical tests Q18(c) and generating bar charts Q22(b)(i).
- Analysed information and ideas to interpret and evaluate in graphs correctly Q19(c)(ii) and Q21(b)(ii).
- Correctly analysed information and ideas to draw conclusions Q16(c)(ii).

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

- Could not recall knowledge and understanding and analyse information to draw conclusions of selective breeding Q16(a) and Q16(b).
- Found it difficult to perform calculations involving percentages from fraction sampled Q17(b)(iii) and Q19(c)(ii).
- Could not draw conclusions from data or experimental results Q19(c)(iii).
- Did not apply their knowledge of land use and biodiversity to unfamiliar situations, e.g. Level of Response Q19(d).
- Could not identify the correct gametes or genotype in a Punnett square and draw the correct ratio Q20(b).
- Did not gain any marks when applying their knowledge and understanding in generating a bar chart Q22(b)(i).

Section A overview

Candidates coped well with selecting choices and there were very few "No Response" answers. There were some instances where candidates made it difficult for examiners to distinguish between B and D due to handwriting styles. Candidates should make sure the letters can be clearly read to avoid any confusion and missed marks.

Questions 2, 4, 5 and 14 were answered correctly by the majority of candidates, while Questions 3 and 8 only the higher ability candidates correctly answered.

Question 1

1   Which of these is an **abiotic** factor that can affect organisms?

    A   Food availability

    B   Light intensity

    C   Pathogens

    D   Predators

Your answer   ☐   **[1]**

This question assessed knowledge and understanding of abiotic factors. Just over half of candidates did not achieve this mark and responded incorrectly with a named biotic factor.

Question 2

2   The diagram shows the water cycle.
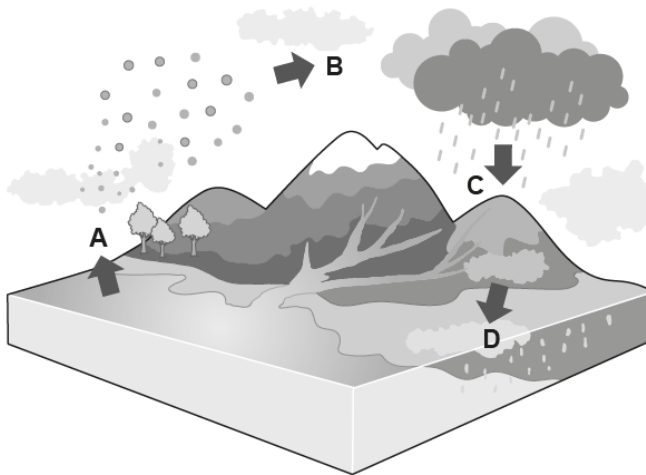
Which label, **A**, **B**, **C** or **D**, represents evaporation?

Your answer ☐   **[1]**

This question was the most accessible question in the multiple-choice section A, with most candidates correctly answering A which represents evaporation.

Question 3

3   Which combination of gametes will produce a **male** baby?

   A   A sperm with **XY** chromosomes and an egg with **XX** chromosomes.

   B   A sperm with one **X** chromosome and an egg with one **Y** chromosome.

   C   A sperm with one **Y** chromosome and an egg with one **X** chromosome.

   D   A sperm with **XX** chromosomes and an egg with **XY** chromosomes.

Your answer ☐   **[1]**

This question proved to be the most challenging question in section A. Many candidates did not recognise the correct combination of gametes which will produce a male baby which is C - A sperm with one Y chromosome and an egg with one X chromosome. All incorrect responses demonstrated equal weighting.

Question 7

7   Which of these is an example of **discontinuous** variation?

   A   Body weight

   B   Hand span

   C   Height

   D   Sex

   Your answer ☐   [1]

This question assessed knowledge and understanding of discontinuous variation. Roughly half of candidates achieved this mark. Those who didn't opted for a named example of continuous variation instead.

Question 8

8   The prickly pear is a cactus plant that was introduced into Australia.
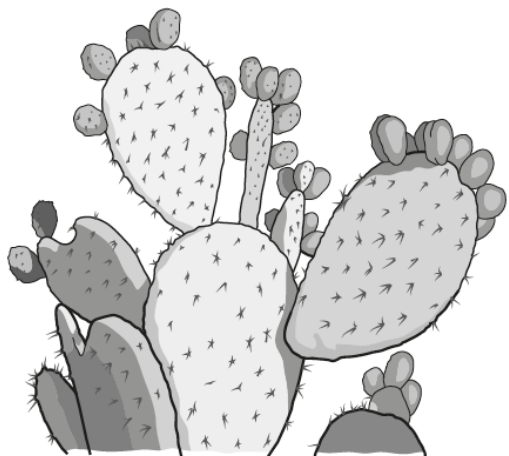
The prickly pear cactus spread across the country.

To control the spread of the prickly pear cactus, a caterpillar was released to eat it.

What is the name of this type of control?

A   Biodiversity

B   Biological

C   Mutualism

D   Pesticide

Your answer ☐   [1]

This question assessed knowledge and understanding of biological control. Main incorrect response chosen by the majority of candidates was D, confusing pesticide with biological control in stopping the spread of the prickly pear cactus.

Question 11

11   Cystic fibrosis is a genetic condition caused by a recessive allele **(f)**.

Which is the genotype of a person **with** cystic fibrosis?

A   Heterozygous and **ff**

B   Heterozygous and **Ff**

C   Homozygous and **ff**

D   Homozygous and **FF**

Your answer ☐   **[1]**

This question assessed the candidate's application of their knowledge and understanding of genotypes. All incorrect responses demonstrated equal weighting, confusing homozygous and heterozygous along with dominant and recessive genotypes.

Question 12

12   Each cell in the eye of a kangaroo has **16** chromosomes.

How many chromosomes are there in one kangaroo **sperm cell**?

A   4

B   8

C   16

D   32

Your answer ☐   **[1]**

This question assessed the candidate's application of their knowledge and understanding of gamete chromosome numbers. The main incorrect response was D, and candidates doubled the body cell diploid number provided instead of halving it to provide the haploid chromosome number.

Section B overview

Higher ability candidates coped well with the mathematical aspects of the questions in this section and there were many numerically correct answers. Detailed subject knowledge was often lacking which meant that some candidates could not apply this to novel situations in some of the questions. This was particularly the case in Q20(d,) Q21(bi) and Q23(b).

Candidates have prepared and responded well to the AO3 questions in this paper. However many candidates did not gain full marks in some of these questions and improving exam technique could aid this. The most challenging AO3 question was Q22(bii) whereby candidates were asked to analyse information and ideas to draw conclusions; candidates could benefit from more exam practice on this skill.

Question 16 (a)

16   This question is about selective breeding.

   (a)   The table shows the main steps in the process of selective breeding.

   They are **not** in the correct order.

A	Repeat the process over many generations.
B	Decide which features are wanted.
C	Choose the individuals that have the features that are wanted.
D	Choose the offspring that have the features that are wanted.
E	Allow the individuals to mate.

   Write the letters in the boxes below to give the correct order.

   Two have been done for you.

   [ ]   [C]   [ ]   [ ]   [A]

   [2]

The question required the candidates to have knowledge and understanding of the process of selective breeding. The majority of lower ability candidates did gain at least one mark here.

Question 16 (b)

(b) Cows are female and are used by farmers to produce milk.

Bulls are male.

Look at the details of different varieties of cows and bulls.

Variety	Milk production	Aggressive
Cow A	thin and watery	no
Cow B	medium yield and creamy	no
Cow C	medium yield and creamy	yes
Bull A	mother produced high yield	yes
Bull B	mother produced high yield	no
Bull C	mother produced low yield	no

A farmer wants to produce cows that produce a high yield of creamy milk.

He does **not** want his animals to be aggressive.

Suggest which cow and bull he should choose to mate with each other.

Explain your answer.

cow ....   ×   bull ....

explanation ....

....

....

....

....

.... **[4]**

The question required the candidates to analyse information from the table to evaluate and make judgements. The majority of candidates gained full marks here, with a select few identifying the wrong cow and bull to selectively breed.

Question 16 (c) (i)

(c) The graph shows the number of cows and the yield of milk per cow on farms in the USA since 1985.
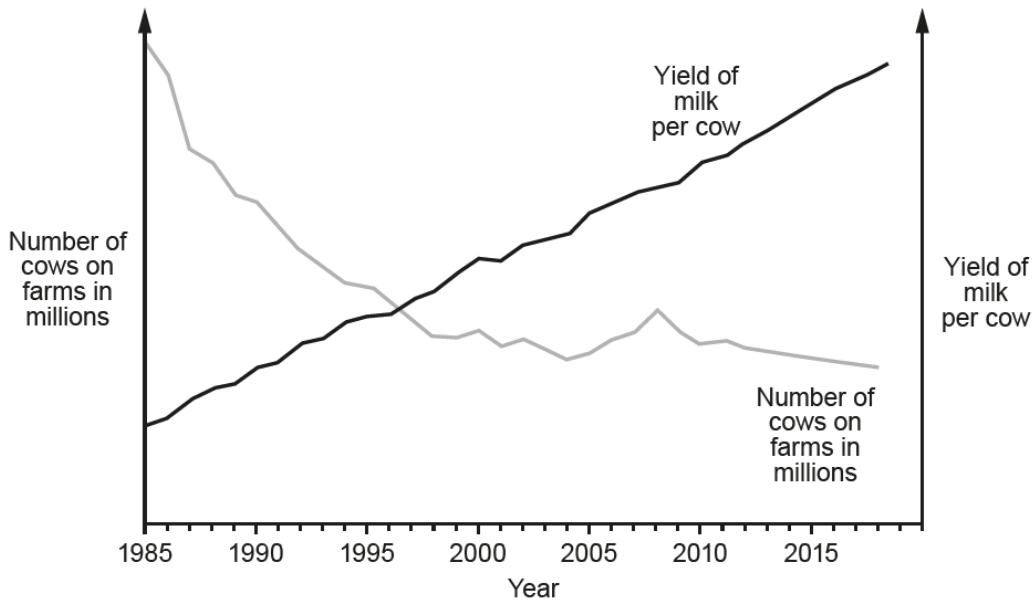
(i) Describe the relationship between number of cows and yield of milk shown in the graph.

....

.... **[1]**

Many candidates could successfully analyse the graph and describe the relationship between number of cows and yield of milk. Lower ability candidates described the wrong relationship by incorrectly identifying that as the yield of milk increases so does the number of cows.

Question 16 (c) (ii)

(ii) Suggest **two** reasons for the relationship shown in the graph.

1 ....

....

2 ....

....
                                                                                                                   [2]

The question required candidates to analyse the relationship in the graph and draw conclusions, which challenged candidates. Few gained full marks here and didn't appreciate the impact of intensive farming on the increase yield of milk. The most common marking point given was due to selective breeding.

Question 17 (a)

17   Over the whole world the demand for food to feed humans is increasing.

   (a)   Describe why is there an increasing demand for food.

     ....

     .... **[1]**

This question which tested the candidate's knowledge and understanding was well answered with the majority of candidates gaining the mark.

Question 17 (b) (i)

   (b)   Genetic modification (GM) is one method that humans are using to try and produce more food.

     (i)   What is genetic modification?

         ....

         ....

         .... **[2]**

Candidates found this question which tested their knowledge and understanding challenging. Most candidates just repeated the question that genetics/genes are modified and did not score.

Question 17 (b) (ii)

     (ii)   Scientists can use GM to alter the features of crops.

         One feature is crop yield.

         Suggest **two other** features of crops they could change.

         1 ....

         2 ....

                                                    [2]

A lot of candidates did not read this question properly. They referred to features which were linked to yield, which was already stated in the stem of the question, such as crop size or repeated crop yield. The most common awarded marking points were colour/taste/disease resistance.

Question 17 (b) (iii)

(iii)   In a recent survey **200** people were asked about GM crops.

The people surveyed were shown six statements. Three were negative statements and three were positive statements.

They were asked to choose **one** statement they agreed with.

These are the results.

	Statement	Number of people choosing statement
Negative	GM crops are not safe enough to use.	42
	Growing GM crops does more harm than good.	32
	Growing GM crops tampers with nature.	22
Positive	Growing GM crops can prevent people being hungry.	35
	Eating GM crops has very little risk to consumers.	35
	Growing GM crops can make food more nutritious.	34

Calculate the percentage of people in the survey that have a **negative** opinion of genetic modification.

Percentage = ... % **[2]**

The majority of higher ability candidates and over half of all candidates could correctly calculate the percentage in the survey that had a negative opinion. A small number of candidates picked up the error carried forward mark for the mathematical element to correctly calculate a percentage, even if the response was wrong.

	AfL	It is important for all candidates to show full working out, as a significant number displayed no working out. Showing full working out gives candidates a chance of scoring the error carried forward mark, even if the final answer is incorrect.

Question 18 (a)

18   Some people get very painful headaches called migraines. Scientists think that these are caused by a protein in the brain called CGRP. Levels of the CGRP protein are higher in the brains of people who get migraines.

Doctors are trying to find a treatment to prevent migraines. They have produced an antibody against the CGRP protein.

(a)   Complete these sentences to describe how **antibodies** are made in the body.

Use words from the list.

Each word can be used once, more than once, or not at all.

antibiotics   antigens   antivirals

platelets   red blood cells   white blood cells

Foreign cells have chemical groups on their surface called ....

These chemical groups are detected by .... which then produce antibodies.

[2]

This question differentiated well, with the majority of higher ability candidates correctly gaining full marks here and the lower ability candidates did not. This question required the candidates to demonstrate their knowledge and understanding on the immune response.

Question 18 (b) (i)

(b) The doctors test the antibody treatment on migraine patients.

The patients are divided into two groups:

- One group is given an injection of the antibody.

- The second group receives an injection of a placebo which does not contain the antibody.

They record the mean number of days each patient had migraines before and after treatment.

The table shows their results.

Treatment	Mean number of migraine days per patient **before treatment**	Mean number of migraine days per patient **after treatment**	Percentage decrease in migraine days per patient
antibody injection	9.1	4.4	51.6
placebo	9.1	6.4	29.7

(i) The placebo group does **not** receive the antibody.

Suggest why this group is included in the study.

....

.... **[1]**

This question was correctly answered by about half of all candidates, which required demonstration of their knowledge of the role of a placebo group. Most responses which didn't score focused on the placebo not receiving the antibody, which repeated the stem of the question.

Question 18 (b) (ii)

(ii) The total number of **migraine days** for the patients on the placebo **after treatment** was 480.

The mean number of migraine days per patient after treatment was 6.4.

Calculate the number of patients in the placebo group.

Number of patients = ... **[2]**

Just over half of candidates were able to correctly calculate the number of patients in the placebo group. This question contributed to the papers ten percent allocation to the mathematical element.

Question 18 (c)

(c) Explain why it is important that a second group of doctors should repeat this test.

....

....

....

.... **[2]**

The majority of candidates did not gain full marks on this question, but a significant number of candidates gained one mark. The most common awarded mark was the idea of checking. Most candidates did not use the accepted language of measurement and the correct use of the term validity.

Question 19 (a)

19　A salt marsh is a large, muddy area of land where a river joins the sea.

(a) When the tide comes in, the salt marsh gets covered with seawater.

　　Suggest **one** reason why salt marshes are difficult places for plants to grow.

....

.... **[1]**

Candidates found this question one of the most challenging on the paper. Few candidates could apply their knowledge of salt water on osmosis in plant cells or light on photosynthesis. Exemplar 1 demonstrates a common response which did not score.

Exemplar 1

Suggest **one** reason why salt marshes are difficult places for plants to grow.

When the ~~river~~ tide comes in, the plants would be submerged in water and may drown. [1]

Question 19 (b)

(b) Student **A** and student **B** study the plants growing on a salt marsh.

They both sample the plants present by laying out two tape measures at right angles across the salt marsh.

They then place a square frame on the ground in different places and count the number of plants in the square, as shown below.
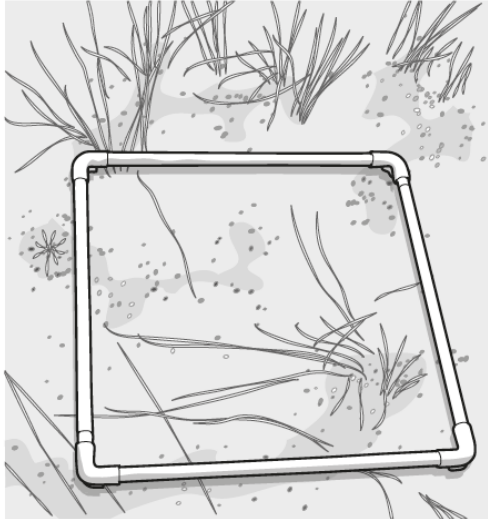
What is the name of the square frame that they use to sample the plants?

.... **[1]**

The majority of higher ability candidates gained this mark. Those candidates that didn't score couldn't recall the piece of equipment as a quadrat. Common errors included square frame and Punnett square.

Question 19 (c) (i)

(c) The diagrams show the position of each student's samples across the salt marsh. Each small square in the diagrams represents one sample.

tape measure

Student **A**'s sampling

tape measure

Student **B**'s sampling
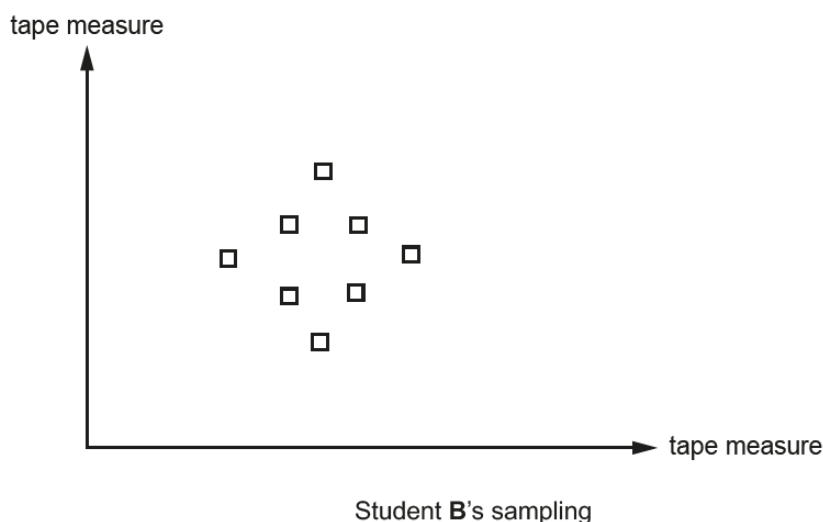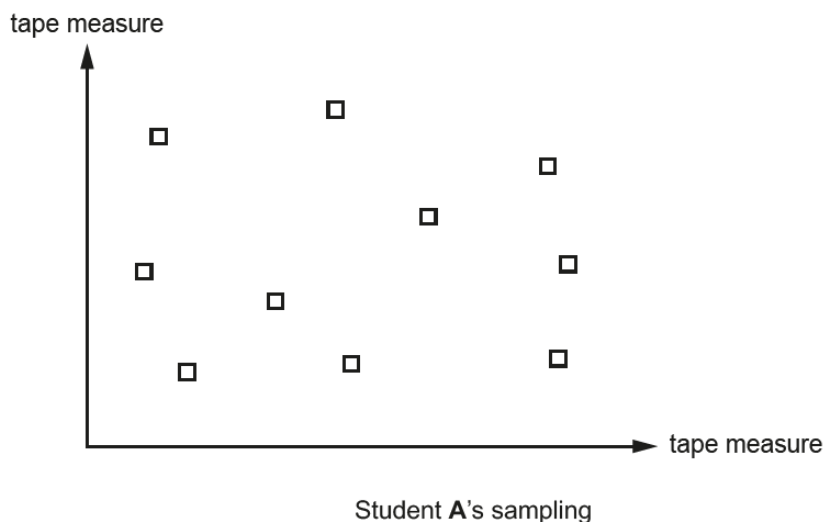
(i) The whole salt marsh has an area of $2500 \, m^2$.

Each square frame has an area of $0.25 \, m^2$.

Calculate the percentage of the whole salt marsh that was sampled by student **A**.

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

Just over half of candidates did not achieve any marks for this mathematical application question and lower ability candidates found having to work out the fraction of the field sampled then convert it into a percentage challenging. The candidates benefited if they showed their working out as there was an error carried forward mark for the correct percentage from an incorrect fraction.

Question 19 (c) (ii)

(ii) Look at the two students' sampling shown in the diagrams.

Explain which student is likely to get the most accurate estimate for the number of plants in the salt marsh.

student ....

explanation ....

....

....

....

.... **[3]**

The majority of higher ability candidates achieved at least one mark here, with the most common credited mark that student A's sample was random. Very few candidates appreciated the sample would be more valid/representative, using the accepted language of measurement.

Question 19 (c) (iii)

(iii) Their teacher said that they should take care as there may be harmful bacteria in the salt marsh.

State **two** things that the students could do to reduce the risk of infection from the harmful bacteria.

1 ....

....

2 ....

....
[2]

Half of candidates achieved one mark on this question. The most common credited response was protective clothing, which was given by candidates analysing the information and making suggestions to improve experimental procedures.

Question 19 (d)

(d)* In some salt marshes large sand banks have been built. These stop tides from entering the salt marsh. The level of soil on the salt marsh builds up and the marsh turns into dry land.

Local farmers want to turn salt marshes into dry land and other people want to leave it as a salt marsh.

Explain why. Use ideas about land use and biodiversity in your answer.

....

....

....

....

....

.... **[6]**

This is the Level of Response question on this paper which required the candidates to demonstrate and apply their knowledge and understanding of land use and biodiversity to salt marshes. This differentiated well between lower and higher ability candidates, whereby there was a spread of marks across the levels given. The majority of higher ability candidate achieved a Level 2. Exemplar 2 shows a Level 2 response, which does not provide a detailed explanation for land use or preserving the salt marsh.

Exemplar 2

Explain why. Use ideas about land use and biodiversity in your answer.

Local farmers would want to turn the Salt Marshes into dry land So that it is a sustained environment. Farmers want this as it means plants / or crops are more likely to grow under an environment which is constantly the same. However other people would want to leave it how it is as some, due to it being a habitat for some species such as small fish and people don't want to take this away [6] from them them.

Question 20 (a)

20 Rats are a major pest in many areas of the world. They can reduce food security and spread diseases.

(a) Warfarin is a chemical that is used as a rat poison. It stops platelets working in the blood.

Describe the function of platelets in the blood.

....

....

.... **[2]**

There was some confusion in the responses describing the role of platelets whereby candidates thought platelets had a role in the specific immune response. Only higher ability candidates gained a mark here.
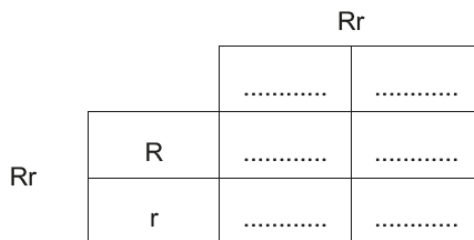
Question 20 (b)

(b) Some rats are resistant to warfarin. When fed with large amounts of warfarin the rats do not die.

Scientists found that the resistance is due to the dominant allele **R**.

Two resistant rats (**Rr**) mate.

Complete this genetic diagram to find the ratio of resistant rats to non-resistant rats that would be expected to be produced.

		Rr	
		....	....
Rr	R	....	....
	r	....	....

Ratio = ...

[3]

The majority of candidates achieved two or three marks correctly identifying the gametes and genotypes. Most went onto correctly identifying the ratio if they achieved the gametes mark. Very few candidates achieved the error carried forward mark.

Question 20 (c)

(c) After several years, the percentage of resistant rats in the population had increased.

Use Darwin's theory of natural selection to explain this observation.

....

....

....

....

....

.... **[3]**

Candidates had to apply their knowledge of natural selection to explain why the percentage of resistant rats was increasing. There were a range of marks given for this question. Most none scoring responses were too vague and not using key terms. Most candidates did not appreciate that there was variation for resistance within the population.

Question 20 (d)

(d) Scientists are now trying to find another poison to use on rats.

They have introduced a chemical called phosphine. This blocks the action of mitochondria in rat cells.

Explain why this might kill rats.

....

....

....

....

.... **[3]**

This question was one of the most challenging application of knowledge and understanding questions. The most common awarded mark was appreciation that energy release would be affected. A lot of responses were very general and would say the rat can't breathe or can't get any oxygen.

Question 21 (a)

21 Animals and plants can get different types of diseases.

(a) Look at the list of four diseases.

AIDS

Type 2 diabetes

Crown gall disease

Barley powdery mildew

Write each disease in the correct column of this table.

Communicable disease			Non-communicable disease
Caused by a bacterium	Caused by a fungus	Caused by a virus	

[3]

The majority of candidates were able to achieve at least one mark on this question which required demonstration of knowledge and understanding on causes of various diseases. Roughly half of all candidates were given full marks.

Question 21 (b) (i)

(b) Sinusitis is an infection that can be caused by bacteria or viruses.

Sinusitis causes a runny nose and bad headaches.

(i) Doctors only give antibiotics to patients with these symptoms if they are sure their illness is caused by bacteria.

Write down **two** reasons why.

1 ....

....

2 ....

....

[2]

Candidates found this question one of the most challenging on the paper. Only the higher ability students scored a mark here, with the most common mark awarded for antibiotics only work on bacteria or don't work on viruses. There were a lot of responses which were too vague and not specific. Very few candidates were given the antibiotic resistance mark.

?	**Misconception**	Candidates demonstrated confusion between immunity and resistance to antibiotics. Exemplar 3 highlights this misconception

Exemplar 3

1 The patients will become emune to the antibiotics
2 Antibiotics will not work and the patient will get worse.

[2]

Question 21 (b) (ii)

(ii) Look at the graph. It shows the length of time that patients show symptoms of sinusitis.
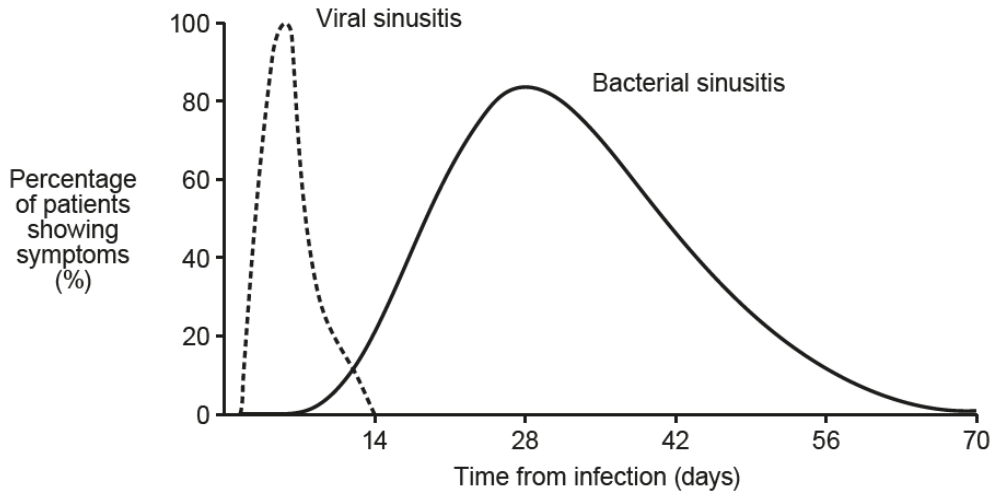
Doctors usually wait 14 days after infection before giving patients antibiotics for sinusitis.
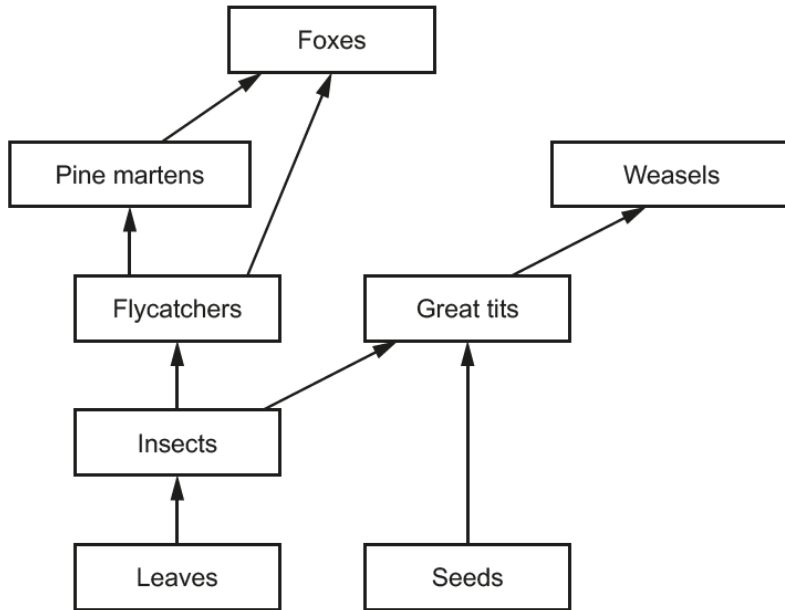
Use the graph to explain why.

....

....

....

.... **[2]**

This question required the candidates to analyse and interpret the graph. There were some good responses that correctly explained why doctors wait 14 days after infection before giving antibiotics.

Question 22 (a) (i)

22   The diagram shows part of a food web from a woodland.

(a)   (i)   Great tits are described as both primary consumers and secondary consumers.

Explain why.

....

....

....

.... **[2]**

This question was on application of knowledge and understanding of interdependence in food webs. Over half of all candidates were given at least one mark.

Question 22 (a) (ii)

(ii)   Foxes are described as both predators and competitors of pine martens.

Explain why.

....

....

....

.... **[2]**

This question differentiated well on application of knowledge and understanding on interdependence. The main reason why the lower ability candidates did not score was due to them not identifying and stating the predator relationship and the competitor relationship.

Question 22 (a) (iii)

(iii)   Which organism in the food web occupies the second trophic level?

.... [1]

This question was well answered by the candidates correctly identifying an organism in the second trophic level using their knowledge and understanding.

Question 22 (b) (i)

(b) Great tits and flycatchers are both birds.

In a conservation project, scientists have built boxes for the birds to nest in. The scientists fixed the boxes on trees at different heights.

The table shows how many birds of each type used the boxes for nesting.

Height of bird box above the ground (m)	Number of bird boxes used	
	By great tits	By flycatchers
1	1	6
2	7	5
4	10	6

(i)   Draw a **bar chart** on the graph paper to show the scientists' results.

The results for great tits and flycatchers should be on the same axis.
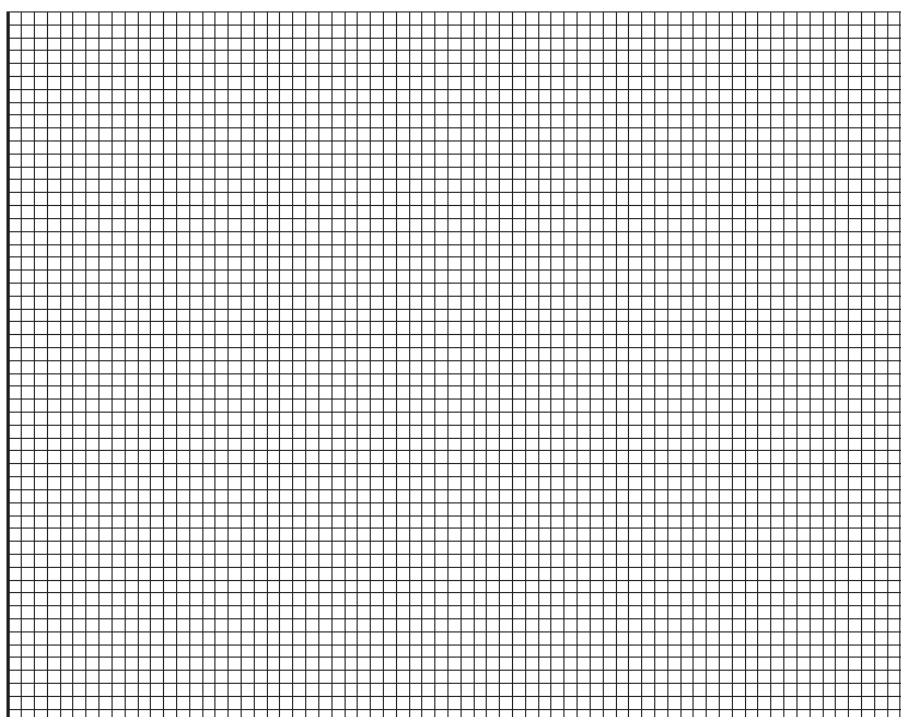
[4]

This was a good question which differentiated between the higher and lower ability candidates whereby they had to generate a bar chart from the information provided. Lower ability candidates struggled to choose the correct axis for the independent and dependant variable. A suitable scale and key were the highest marking points. Over a quarter of candidates were given full marks.

	AfL	Candidates should be encouraged to use the headings in a table to identify the independent and dependent variables. Convention is that the first column is most likely to be the independent variable. This should support them in choosing the correct axis, as the convention is that the independent variable goes on the x axis.

Question 22 (b) (ii)

(ii) The food web shows:

- Weasels feed on great tits

- Pine martens feed on flycatchers.

Weasels live on the ground but pine martens live in trees.

How can this be used to explain the results of the scientists' investigation?

....

....

....

....

.... **[3]**

Lower ability candidates could not analyse the information and draw conclusions. A number of candidates did not interpret the data correctly. Some compared the great tits with the flycatchers instead of identifying the predator prey relationship they had with the weasels or pine martins to explain the number of nests at different heights. A lot of candidates just stated that pine martins live in a tree, which is in the stem of the question.

Question 23 (a)

23 (a) The diagram shows the carbon cycle.

Boxes **1–4** represent different processes in the carbon cycle.

Draw lines to link boxes 1–4 to the correct name for the process in the carbon cycle.

1		Combustion
2		Eating
3		Photosynthesis
4		Respiration

[2]

This question differentiated well, and many candidates were able to demonstrate their knowledge and understanding of the carbon cycle.

Question 23 (b) (i)

(b) Scientists investigated if crops can be grown on the planet Mars.

They used a soil that was similar to the soil found on Mars. The soil contained some minerals but no living organisms.

(i) The scientists managed to grow crops in the soil. However on Mars, the minerals in the soil would soon run out.

Explain why.

....

....

.... **[2]**

Very few candidates were able to apply their knowledge of microbes and decay to this question, and found it challenging to answer. Many candidates misinterpreted the question and talked about lack of oxygen for life or that Mars is too dry for life. This is demonstrated with Exemplar 4 which was given 0 marks.

Exemplar 4

The conditions are different. So it is really hot on mars so the soil would dry out. **[2]**

Question 23 (b) (ii)

(ii) Living organisms could be added to the soil but there is no air on Mars. The plants would need to be grown in an enclosed structure.

At first, air would need to be added, but after a while the organisms in the soil and the plants would supply each other with the gases they need.

Explain how this would happen.

....

....

....

....

.... **[2]**

Candidates had to apply their knowledge and understanding of gases given off by plants in photosynthesis and organisms in carrying out respiration to explain why air would no longer needed to be added after a while. Most non-scoring responses were too vague and just stated gases as in the stem of the question.

Supporting you

For further details of this qualification please visit the subject webpage.

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