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OCR
Oxford Cambridge and RSA

GCSE (9–1)

Examiners' report

GATEWAY SCIENCE BIOLOGY A

J247

For first teaching in 2016

J247/04 Summer 2024 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 responses 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 4 series overview

J247/04 is the second paper candidates take for the higher tier Gateway GCSE Biology suite. It assesses content from specification topics B4-B6 and B7 practical skills with synoptic questions linked to B1-B3. Therefore, for candidates to perform well on this paper they will need to have sound knowledge of the theory covered in B1- B6 and be able to apply this to novel situations. The J247/04 component includes a multiple choice section and a short response section that also includes a Level of Response question. The Level of Response question assesses the quality of communication as well as knowledge and understanding.

Candidates need to apply the skills and understanding that they have developed through practical activities covered in B7. There are also questions that involve the assessment of key mathematical requirements from Appendix 5f of the specification.

It is important that candidates understand the command words and what is expected when a particular command word is used. In some cases, responses were given when explanations were needed and so not all marks were accessed. In other case responses were given that did not have the scientific terminology required for the higher level responses.

Exam practice is essential so that candidates understand the requirements of a paper. In some cases, it was clear candidates were not reading the question carefully and were unable to gain some marks due to not using the information provided or not answering in enough specific depth demonstrating a sound and knowledge and understanding of key scientific concepts and skills.

It is good that candidates are attempting more of the paper and gaining more marks due to maths calculations. Showing workings out is essential in this process.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• Questions 16 (e) (ii) correctly scoring full marks analysing information to evaluate ideas about predator/prey relationships • Question 17 (b) (i) correctly gaining full marks demonstrating knowledge and understanding on aseptic technique and culturing bacteria • Question 18 (c) (ii) correctly applying their knowledge and understanding of controlling population sizes and identifying disadvantages • Question 18 (d) gaining at least Level 2 four marks on the Level of Response question applying their knowledge and analysing information to draw conclusions about population sizes • Question 19 (b) correctly applying their knowledge of the translocation of sugars in the phloem • Question 19 (c) (i) and Question 19 (c) (ii) correctly applying their knowledge and understanding on photosynthesis • Question 20 (b) correctly applying their knowledge of how to present their data in a line graph • Question 21 (b) (iii) correctly applying their knowledge by interpreting colour is subjective • Question 22 (b) correctly applying their knowledge and understanding of nervous responses.	• Question 16 (c) could not identify ways in which biomass is lost through the food chain • Questions 16 (d) (ii) (e) (i) (e) (ii) could not correctly apply their knowledge and analyse information on predator prey interdependence • Question 17 (a) could not correctly demonstrate knowledge on culturing bacteria • Question 17 (c) (i) could not correctly drawing conclusions from experimental results • Question 18 (c) (iii) could not correctly demonstrating knowledge and understanding on how contraceptive pills work • Question 19 (c) (ii) could correctly analyse data and draw conclusion relating to photosynthesis • Question 20 (a) could correctly apply knowledge of lactic acid to rate of decomposition • Question 20 (b) could correctly demonstrate scientific skills in rules of a line graph • Question 20 (d) could correctly draw conclusions on the consequences for decay if temperature goes above the optimum • Question 21 (a) (i) could correctly demonstrate knowledge and understanding on cancer effects on cells • Question 21 (c) (i) could correctly demonstrate knowledge and understanding on how genes are expressed.

Section A overview

Candidates responded well to Section A; all multiple choice responses were attempted. Candidates have performed better than previous years on this section, which demonstrates that it has become more accessible which the lowest scoring question still had just over half of candidates achieving the mark. Most candidates have responded to feedback from pervious series and selected upper case responses to make sure the desired letter is easily distinguishable.

Question 1

1 Which row shows correct abiotic and biotic factors?

	Abiotic	Biotic
A	food	light intensity
B	food	predators
C	pH of soil	predators
D	temperature	light intensity

Your answer ☐ **[1]**

This was one of the highest achieving multiple response questions whereby almost all candidates correctly identified that pH of soil was an abiotic factor, and predators were biotic factors.

Question 4

4 Which processes in the carbon cycle return carbon to the atmosphere?

A Decomposition and photosynthesis

B Decomposition and respiration

C Photosynthesis and fossilisation

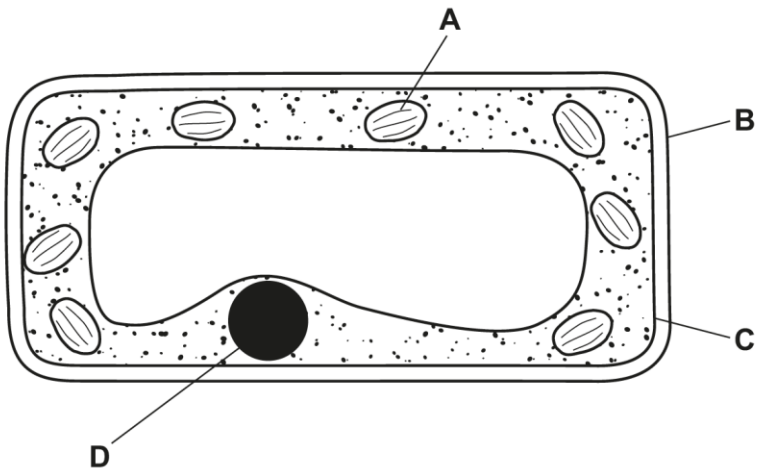
D Respiration and fossilisation

Your answer ☐ **[1]**

Candidates also demonstrated good knowledge and understanding of the carbon cycle by correctly identifying decomposition and respiration return carbon to the atmosphere. The most common incorrect response was C photosynthesis and fossilisation.

Question 5

5 The diagram shows a labelled plant cell.



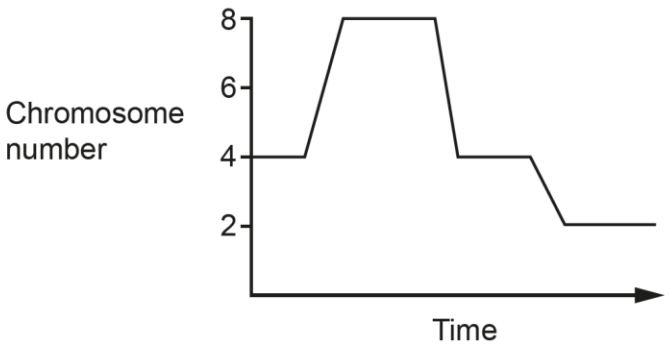
Which part of the plant cell gives **physical** protection against disease?

Your answer ☐ **[1]**

Candidates demonstrated good knowledge and understanding of plant defences, by the majority correctly identifying the cell wall is a physical defence.

Question 6

6 The graph shows the changes in chromosome number in a cell during meiosis.



What is the diploid number of chromosomes for this cell?

A 2

B 4

C 6

D 8

Your answer ☐ **[1]**

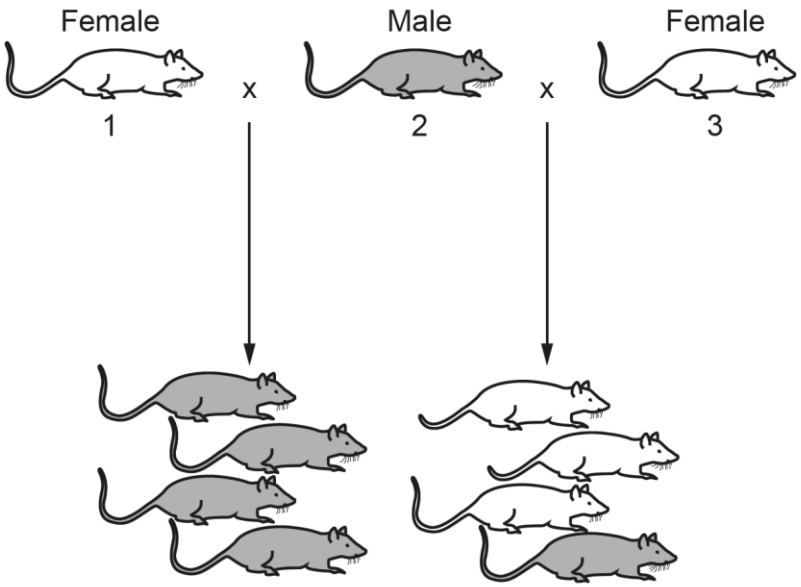
This was one of the lowest scoring questions in this section on meiosis. Just under half of candidates could not identify the diploid number of chromosomes and did not see that meiosis is a process whereby DNA is replicated first then undergoes two divisions to end with a haploid number. The most common incorrect response was identifying the haploid number in the daughter cells as the diploid number.

Assessment for learning

Centres should make sure that meiosis is revisited more than once during the GCSE course as it has been identified as a knowledge gap. This could be through multiple choice questions, progress checks and knowledge retrievals.

Question 9

9 The diagram shows the results of two different crosses of rats.



Which is a possible explanation of the results of these crosses?

A Grey is dominant. Rat 2 is heterozygous.

B Grey is dominant. Rat 2 is homozygous dominant.

C White is dominant. Rat 1 is homozygous dominant.

D White is dominant. Rat 2 is heterozygous.

Your answer ☐ **[1]**

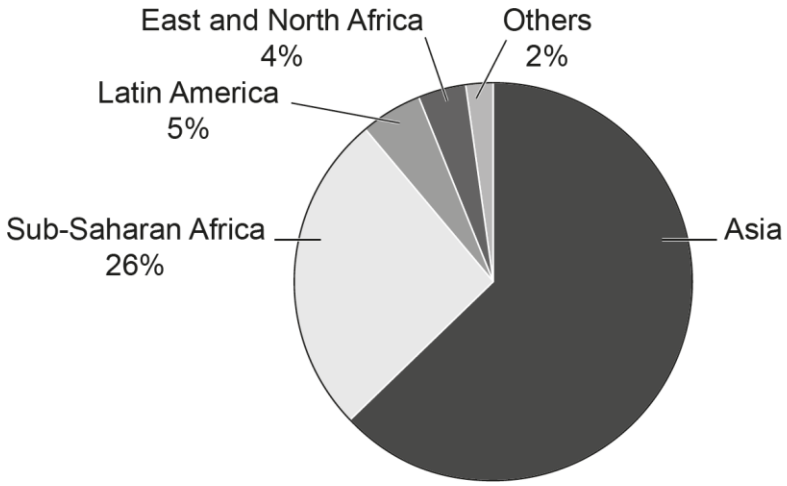
This was one of the lowest scoring questions in this section despite over half achieving this mark, demonstrating good knowledge of genetic inheritance. The most common incorrect question was stating Rat 2 is homozygous dominant which was incorrect because all offspring would be grey if this was the case when reproduced with Rat 3.

Question 11

11 Lack of food security can lead to people being undernourished.

1×10^9 people in the world are undernourished.

The pie chart shows the percentage of undernourished people found in different parts of the world.



How many people are undernourished in Asia?

A 1.75×10^8

B 6.3×10^8

C 1.75×10^9

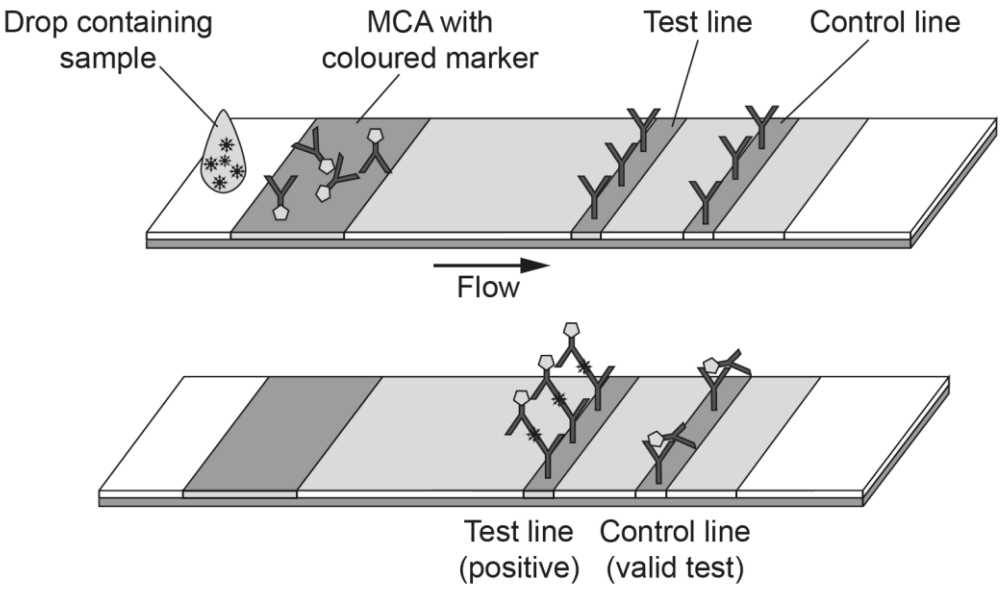
D 63×10^9

Your answer ☐ **[1]**

This was the highest scoring question in this section with nearly all candidates able to correctly convert a percentage into numbers and understand standard form.

Question 13

13 The diagram shows how monoclonal antibodies (MCA) are used in a test to detect pathogens.



Which statement describes how the tests work?

A MCA carry the antigens along to bind with other antibodies on the test line.

B MCA have antibiotics attached that combine with both the test and control antibodies.

C The coloured marker combines with antigens and with antibodies on the test line.

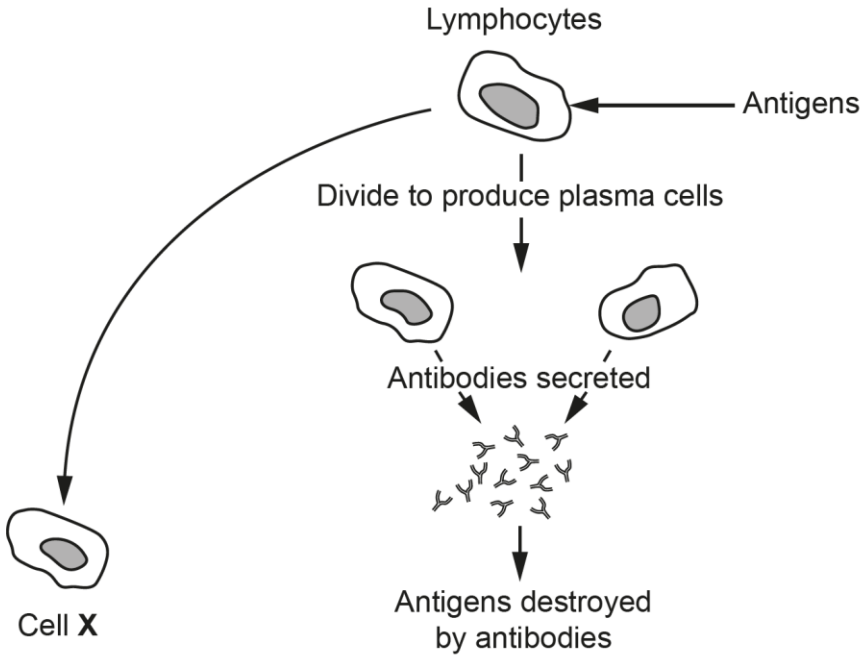
D The drop contains antibodies that get carried along by the MCA.

Your answer ☐ **[1]**

This question on monoclonal antibodies was the lowest scoring multiple choice question despite over half of candidates achieving this mark. The most common incorrect response was identified as C that the coloured marker combines with antigens and with antibodies on the test line instead of MCA carry the antigens along.

Question 15

15 The diagram shows how lymphocytes in the immune system respond to antigens.



What is the function of cell **X**?

A Cell **X** will live for many years and engulf foreign bacteria and viruses.

B Cell **X** will produce antibodies that will destroy plasma cells.

C Cell **X** will respond rapidly if the antigen reinfects the body again.

D Cell **X** will respond to antigens from different pathogens.

Your answer ☐ **[1]**

The candidates also demonstrated good knowledge and understanding of the immune response and gaining immunity by identifying C as the correct response. The most common incorrect response was B that antibodies will destroy plasma cells.

Section B overview

This section assesses AO1, AO2 and AO3 and includes a selection of questions where candidates choose between options provided (by ringing a word or by ticking a box), plus short response responses and a Level of Response question. The overlap questions were Question 16 and Question 17 in this paper.

All questions were attempted with only a handful number of questions being omitted by candidates. The question with the most no attempts was Question 22 (c) which was one of the more challenging questions.

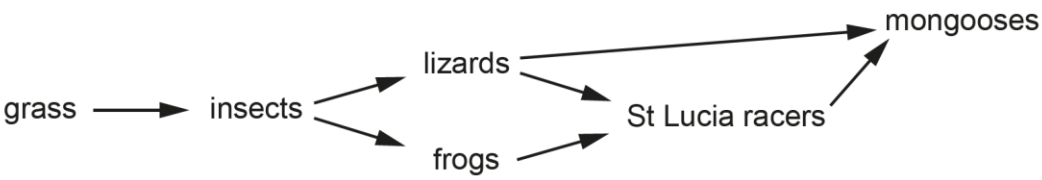
Knowledge gaps have been identified and the key misconceptions where centres could focus and revisit more often throughout the GCSE course were in culturing microbes and techniques; role of the phloem in transport vessels; genetic engineering; co-ordinated nervous responses; scientific skills in rules for a graph and scientific enquiry in evaluation of stem cell research. Where candidates did not score, it was due to a lack of use of scientific subject-specific terminology and vague responses. Teachers can improve this by using knowledge organisers in lessons for candidates to refer to.

Candidates that did require the extra pages provided at the end of the exam booklet clearly linked their responses to the question so not to cause confusion and make full use of the space provided in the response booklet.

Question 16 (a)

16 The St Lucia racer is the rarest snake in the world.

The snake lives on the island of St Lucia. The diagram shows a food web from St Lucia.



(a) How many secondary consumers are in this food web?

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

This was one of the highest scoring questions with candidates correctly identifying there are two secondary consumers using their knowledge and understanding of food webs.

Question 16 (b)

(b) Mongooses are described as both **predators** and **competitors** of St Lucia racers.

Explain why.

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.....

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

This was one of the highest scoring questions with most candidates achieving full marks applying their knowledge and understanding of interdependence. The most common incorrect response incorrectly referenced frogs as the mongoose's prey or mongoose were the racers prey.

Question 16 (c)

(c) Biomass is lost as it passes through this food web.

Put a (ring) around **two** ways that biomass is lost from this food web.

egestion **growth** **photosynthesis** **respiration**

[1]

This was a high scoring question correctly identifying both egestion and respiration in how biomass can be lost through the food chain. The most common error was only identifying one way and only putting a ring around one word or suggesting growth.

Question 16 (d) (i)

(d) Mongooses were introduced into St Lucia by farmers to control pests in their fields.

(i) Which term describes this type of pest control?

Tick (✓) **one** box.

- Abiotic control ☐
- Biological control ☐
- Chemical control ☐
- Genetic control ☐

[1]

This was a high scoring question on the examination paper with almost all candidates correctly identifying biological control as the correct term. Those who did not score identified abiotic control instead.

Question 16 (d) (ii)

(ii) The mongooses soon spread throughout St Lucia.

- Female mongooses can breed 3 times each year and produce 3 babies each time.
- The St Lucia racer lays about 5 eggs each year.

Explain why the mongooses almost made the snake extinct.

.....

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

Most candidates demonstrated good knowledge and understanding of predator prey relationships based on population growth and gained this marking point. Those candidates who did not gain this mark identified that the mongoose had more offspring but did not qualify this further by saying this meant that more racers would be eaten/outcompeted.

Question 16 (e) (i)

(e) By 1973 the St Lucia racers were thought to be extinct but a small number were found on a small island off the coast of St Lucia.

There was a plan to build a bridge to allow tourists to visit the island.

(i) Suggest why these snakes have survived on the island.

.....

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

This was a very high scoring question identifying that snakes would be isolated away from mongoose/predators. The most common incorrect response candidates made was giving a vague response linked to natural selection and they would be better adapted to survive.

Question 16 (e) (ii)

(ii) Suggest why scientists are against the plan to build the bridge.

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.....

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

Half of all candidates gained both marking points and a majority gained at least one mark by analysing the information and evaluating to form a conclusion. The most common scoring point was understanding that mongooses could gain access to the island. Sometimes candidates did not then go and qualify that the consequence would mean more racers eaten. The least common scoring point was introduction to disease to the island.

Question 17 (a)

17 Antibiotics and antiseptics are both used to kill bacteria.

(a) Which is a correct statement about antiseptics and antibiotics?

Tick (✓) **one** box.

Antibiotics are not used inside the body, but antiseptics are. ☐

Antibiotics are used inside the body, but antiseptics are not. ☐

Antibiotics are used on living tissue and antiseptics on non-living tissue. ☐

Antibiotics are used on non-living tissue and antiseptics on living tissue. ☐

[1]

This was a well answered question with most candidates correctly identifying that antibiotics are used inside the body and antiseptics are not. The most common incorrect response was getting it the wrong way round by ticking the first box.

Question 17 (b) (i)

(b) Disinfectants also kill bacteria.

Some students do an experiment to see how well four different disinfectants (**A**, **B**, **C** and **D**) kill bacteria.

This is the method they use:

- Mix 2 cm^3 of each disinfectant solution with liquid nutrient agar.
- Pour each of the mixtures into separate Petri dishes and allow to set.
- Spread bacteria on the surface of the agar.
- Put each Petri dish in an incubator.

(i) Describe how the students should spread bacteria on the surface of the agar.

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

This question discriminated well and there were a spread of marks equally given or not gained by candidates. The candidates needed to demonstrate knowledge and understanding of microbial techniques for culturing bacteria. The most common given marking point was identifying a loop/wire was used. There was a range of equipment selected but loop and spreader were the most common. MP2 was less often seen but was given for sterilising equipment or describing using a Bunsen burner. Most non-scoring responses did not identify the correct piece of equipment to use.

Question 17 (b) (ii)

(ii) The students' teacher told them **not** to seal the lid on the Petri dishes all the way round with tape.

Explain why.

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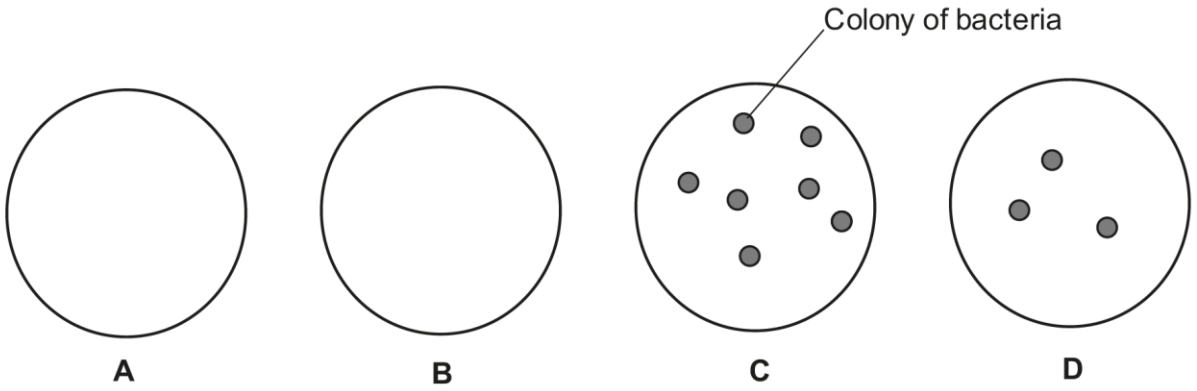
.....

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

This question discriminated well between candidates with a good spread of marks given. MP1 was frequently given for allowing oxygen to enter. Some candidates put air and were not given the mark. Where MP2 was given, candidates correctly linked to anaerobic or aerobic respiration correctly. Candidates who did not gain this mark did not qualify which type of respiration was being carried out/prevented. A number of candidates could correctly appreciate that growing anaerobic bacteria would be harmful.

Question 17 (c) (i)

(c) The diagrams show the Petri dishes after 3 days.



(i) Explain **two** conclusions the students can make about disinfectants **B**, **C** and **D** from these results.

1 .....

.....

2 .....

.....

[2]

The majority of candidates were able to analyse information and draw correct conclusions regarding which disinfectant was the most and least effective and were given both marks. Those candidates who did not gain both marks usually lost the marking point by not comparing C and D disinfectants. Only a small number of candidates did not score here.

Question 17 (c) (ii)

(ii) One of the students said that disinfectant **A** is equally effective at killing bacteria as disinfectant **B**.

Explain how the students could improve their experiment to test if that is true.

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

This question was found challenging by the candidates and very few were given both marking points. A significant number were given one mark and the most common response candidates provided was to use different types of bacteria. A number of candidates did not give two improvements so did not access the second marking point. The most common non-scoring response candidates provided were references to time. Candidates could benefit with analysing practical's and identifying improvements in lessons more often.

Assessment for learning

Microbial techniques and culturing bacteria has been identified as a knowledge gap. Candidates should revisit their PAG's and familiarise themselves with these practical's and techniques such as aseptic technique and identifying improvements.

OCR support

The Practical support guide has practicals and activities that link to the PAGs. There are also examples of different practicals and contexts that cover the same skills and apparatus to help candidates become used to different contexts. It can be a useful resource for in class or as a revision resource.

Question 18 (a)

18 In many areas, the number of elephants living in Africa is decreasing. They are often killed by hunters.

The table shows how the number of elephants in Africa has changed.

Year	**1979**	**1989**	**2015**
Population size	1.3 million	600 000	400 000

(a) Calculate the percentage decrease in the population size between 1979 and 2015.

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

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

Most candidates were given full marks for correctly calculating percentage decrease to two significant figures. The most common incorrect response was 31% but gained the two significant figures mark. Candidates had completed the calculation in reverse but then did not complete the last processing step.

OCR support

The Mathematical Skills Handbook and accompanying check in tasks can be used with candidates to help familiarise them with the calculations and steps required in Science.

Question 18 (b)

(b) What is the best description for how the population of elephants changed between 1979 and 2015?

Tick (✓) **one** box.

Dropping at a decreasing rate ☐

Dropping at a steady rate ☐

Dropping at an increasing rate ☐

[1]

This was a high scoring question whereby candidates could identify from the date that elephant numbers were dropping at a decreasing rate. The most common incorrect response was identified in Box 3 that numbers were decreasing at an increased rate.

Question 18 (c) (i)

(c) In some areas of southern Africa, elephants are very important for ecotourism.

(i) Explain what is meant by the term **ecotourism**.

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

Most candidates were able to identify that ecotourism enabled people to visit habitats/see species or idea of conservation. Only a small number of candidates gained the second marking point by identifying that this would have monetary benefit.

Question 18 (c) (ii)

(ii) In ecotourism areas, elephant numbers are increasing.

This is causing problems as the elephants are eating crops.

Scientists therefore want to control the population size.

They have used three main ways to do this:

- **Culling** – a certain number of elephants from each population are killed.
- **Relocation** – elephants are moved to a country where their numbers have dropped.
- **Contraception** – female elephants are treated to reduce their fertility.

Suggest **one** disadvantage for each of these methods.

Culling .....

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Relocation .....

.....

Contraception .....

.....

[3]

This question did challenge the candidates, most did not gain full marks, and some were not given any marks. It required application of knowledge to an unfamiliar context. The most common response scoring marks identified that culling was unethical/cruel and contraception could put the elephants at risk of extinction if they could no longer reproduce. The most common given mark was correctly identifying relocating the elephant was problematic in transportation or distressing to the animal. The most common non-scoring response here were the elephants would not be adapted to survive in the new habitat.

Question 18 (c) (iii)

(iii) Scientists are using a new method of contraception to try and restrict the numbers of elephants.

This involves injecting antibodies which block the sperm receptor sites on eggs.

Describe **one** way that this method is different to the contraceptive pill used by female humans.

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

Just under half of candidates gained this mark which provided a challenge to the candidates. The most common non-scoring response were those relating to a lack of fertilisation unqualified. The most common given mark was the appreciation that the contraceptive pill contained hormones. A small number of candidates rewrote the question and stated it was a contraceptive pill and not how it was different from the new method.

Question 18 (d)*

(d)* In East Africa, elephants are hunted for their tusks.

Scientists have found that:

- occasionally female elephants are born without tusks,
- the absence of tusks is caused by a mutated dominant allele,
- the allele for an absence of tusks is lethal if inherited by a male embryo.

Explain why the number of tuskless elephants is rapidly increasing in East Africa.

Explain also why the spread of this allele may have negative effects on the elephant population.

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

Just under half of candidates were given Level 2 in the Level of Response extended writing question and could access the question where they had to apply their knowledge and analyse information to explain why the number of tuskless elephants is rapidly increasing and why this may have negative effects on the population. Just under half of candidates achieved Level 1 or Level 3 and a small number were not given any marks.

The most common given explanation was understanding that if less males are born due to the allele being fatal to them, so females would have less mates available to reproduce. Some candidates got confused that males would still be born but tuskless and unable to defend themselves however that would be the argument that the consequence for the tuskless females. Most candidates who correctly explained why the population of tuskless elephants are increasing identified the natural selection idea. Some candidates were able to provide a detailed explanation using their ideas of natural selection and genetic inheritance. Candidates who tried to explain using their knowledge of genetic inheritance got confused that males could pass on the allele so offspring could be homozygous dominant which could not happen. The most common credited response regarding explanations using genetics were candidates appreciating that the dominant allele is always expressed if present. Some candidates stated incorrectly that the dominant allele is always expressed in the offspring if the parent has it which cannot happen as the female cannot be homozygous dominant.

Exemplar 1

The genetic variation in the population, brought about through random mutation, has created an allele for no tusks. This is the desirable allele, as those with it are less likely to be hunted and more likely to survive and reproduce, called survival of the fittest. Over many generations the trait of having no tusks will be the phenotype in a greater proportion of the elephants. This is also due to it being a dominant allele, which also means any male with this allele will die. Therefore female elephants will make up a larger proportion of the population, reducing birth rates since there are fewer males. [6]

The candidate explains why the number of tuskless elephants are increasing due to natural selection and explains why the spread of this allele will have negative consequences on the population so was given Level 2. The candidate did not provide a detailed explanation of why the numbers are increasing because they did not explain using ideas about genetic inheritance.

Question 19 (a)

19 Mistletoe is a green plant that is often seen growing high in a tree in winter.

Mistletoe can photosynthesise, but not at a very fast rate.

It therefore needs to act as a parasite on the tree.

(a) Put a (ring) around the term used to describe the **tree** in this relationship with the mistletoe.

competitor **host** **mutualistic partner** **prey**

[1]

This was one of the most accessible questions with nearly all candidates identifying the relationship of the tree was as a host. The most common incorrect responses selected were competitor or prey.

Question 19 (b)

(b) Explain why the mistletoe grows into the phloem of the tree.

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

This question was a good discriminator, and candidates did find this challenging applying their knowledge of the role of the phloem. Both marking points were equally given. Some candidates did not give specific responses and vague responses relating to nutrients provided so did not gain any marks. Other candidates incorrectly confused the role of the phloem with the xylem.

Misconception

Some candidates identified the role of the phloem transporting water and minerals instead of translocation of sugars. This could be prevented by regular revisiting of key ideas numerous times through the GCSE course.

Question 19 (c) (i)

(c) Scientists investigate two different species of mistletoe growing on a tree. One species of mistletoe has greener leaves than the other.

They give the tree carbon dioxide which contains radioactive carbon.

The carbon dioxide is not supplied to the mistletoe.

They then measure:

- the chlorophyll content of the mistletoe plants,
- the percentage of sugar that is radioactive in each type of mistletoe.

The table shows their results.

Species of mistletoe	Chlorophyll content in mg/g of tissue	Percentage of sugar in the mistletoe that is radioactive (%)
Dwarf mistletoe	0.4	39
Eastern mistletoe	0.9	1

(i) Explain why sugar in the mistletoe becomes radioactive.

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

Candidates found this question challenging and roughly half of candidates did not obtain any marks in their response. The question required the knowledge and application of photosynthesis to score here. Most candidates who did not obtain a mark here incorrectly stated it was the mistletoe photosynthesising and creating the radioactive sugar.

Misconception

Candidates stated that the radioactive carbon passed through the phloem for the mistletoe to use to create radioactive sugar. Centres could revisit photosynthesis and the role of transport vessels more frequently to make sure no misconceptions occur in key knowledge. Some candidates confused respiration with photosynthesis.

Question 19 (c) (ii)

(ii) Explain the relationship between the chlorophyll content and the percentage of radioactive sugar in each species of mistletoe.

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

This question discriminated well between candidates at different grades with equal number of candidates gaining two or three marks. A small proportion did not gain any marks and most marks given were for candidates correctly identifying the relationship in the data between chlorophyl content and percentage of radioactive sugar. Where candidates did not gain more than one mark they repeated the relationship with data with no space left to explain this relationship.

Question 20 (a)

20 Bacteria are found in milk.

They can cause the milk to decompose.

Enzymes from the bacteria convert sugar in the milk into lactic acid.

Some students investigate the effect of temperature on the decomposition of milk.

This is the method the students use:

- Pour 20 cm^3 of milk into 3 different beakers.
- Keep each beaker in a water bath at a different temperature: 15 °C, 25 °C and 35 °C.
- Measure the pH of the milk at different times over 4 days.

The table shows their results.

	pH of milk				
Temperature (°C)	at the start	after 12 hours	after 24 hours	after 48 hours	after 72 hours
15	6.5	6.4	6.3	6.1	5.8
25	6.5	6.3	6.2	5.9	5.5
35	6.5	6.3	6.1	5.5	4.9

(a) Explain why the students measured the pH of the milk.

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

This question discriminated well between candidates at different grades, however, did prove challenging to most candidates as roughly only a fifth were given maximum marks. The question required students to apply their knowledge of a PAG practical involving the effect of pH on rate of decomposition. The highest scoring marking point was the appreciation that lactic acid would alter/lower the pH which half of candidates identified.

Question 20 (b)

(b) Describe how the students should display their results in a graph.

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.....

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

Candidates assessed this question well with roughly half of candidates given maximum marks. The most common errors that were suggested by candidates were that a bar chart should be used to display the data, temperature on the x axis, time of the y axis and not identifying the key for different temperatures.

Misconception

There has been a misconception identified. Some candidates have mixed up the dependent and independent on a line graph.

Revisiting the rules for line graphs would help candidates embed this key practical skill.

Question 20 (c)

(c) Explain the effect of increasing the temperature on the decomposition of the milk in the experiment.

.....

.....

.....

.....

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

This question assessed the candidate's ability to draw conclusions from the data and identify pattern/trends from experimental results. Over half of candidates were able to identify that increased temperature the rate of decomposition increased. Many candidates re-wrote this in many different forms such as the more the sugar converted into lactic acid. A few candidates did go onto state that the rate of decay stops at high temperatures which did not happen in the results provided in the experiment.

Fewer candidates went on to explain this pattern by increased kinetic energy and increased collisions. Some candidates stopped short by stating higher temperatures were closer to optimum conditions for enzyme action without any further explanation.

Question 20 (d)

(d) The students plan a further experiment where they boil the milk first before placing it in the beaker.

Predict what effect this would have on the results.

Explain your answer.

Prediction .....

.....

Explanation .....

.....

.....

[2]

This question discriminated well between candidates at different grades, assessing the candidate's ability to analyse information relating to decomposition and bacteria above optimum temperatures. The most common scoring response identified that decay would stop, then half of those candidates were able to qualify this because enzymes had denatured / bacteria were killed.

Question 21 (a) (i)

21 Acrylamide is a chemical that is formed when bread is toasted.

(a) Experiments have shown that significant doses of acrylamide can cause cancer in animals.

(i) Describe the effects of cancer on cells.

.....

.....

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

Most candidates gained at least one marking point here. The most common given mark awarded candidates correctly identified that cancer causes raid uncontrolled cell division. A few candidates stated that cells reproduced faster which we did not accept. The candidates who scored maximum marks went on to qualify this by forming tumours.

Question 21 (a) (ii)

(ii) Some scientists concluded that, 'acrylamide could also cause cancer in humans'.

Other scientists are **not** sure about the effect of acrylamide on humans, despite the results of the animal experiments.

Suggest **one** reason why.

.....

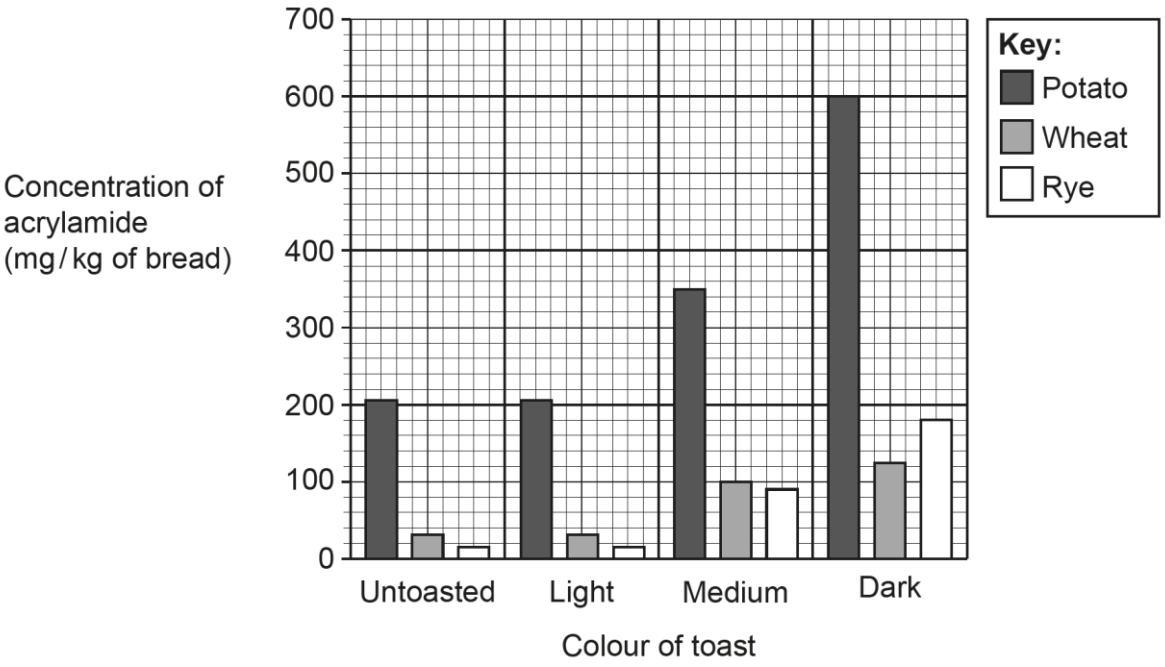
..... **[1]**

This was a high scoring question. The most common non-scoring response candidates wrote was that humans have eaten toast with no effects.

Question 21 (b) (i)

(b) Scientists measured the concentration of acrylamide in toast made from three different types of bread: potato, wheat and rye.

They heated the bread for different lengths of time to get different colours of toast.



(i) Give **two** conclusions that the scientists could make from their investigation.

1 .....

.....

2 .....

.....

[2]

This question was one of the most accessible with the majority of candidates scoring maximum marks. The most common marking points given were candidates correctly identifying the dark toast produces the highest amount of acrylamide and the longer you toast bread for the greater the concentrations of acrylamide. The main error was an incorrect comparison between wheat and rye bread.

Question 21 (b) (ii)

(ii) The daily recommended maximum intake for acrylamide is 195 mg.

A slice of toast has a mass of 50 g.

A person eats toast that is dark and made from potato bread.

Calculate the maximum number of **whole** slices of toast the person can eat without exceeding the recommended maximum intake.

Use the graph.

Number of whole slices = ... **[3]**

Candidates were able to apply their knowledge of scientific techniques, and most were given maximum marks for the correct calculation of number of pieces of bread without exceeding the maximum intake of acrylamide.

Question 21 (b) (iii)

(iii) Give **one** reason why another group of scientists would find it difficult to replicate the experiment using just the information in the graph.

.....

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

This challenged half of candidates on their ability to understand scientific techniques. Half of candidates identified that colour interpretation is subjective. The most common none scoring responses candidates stated were concentrations differed between bread, masses are different, were not given specific times.

Question 21 (c) (i)

(c) During toasting, acrylamide is made from a chemical called asparagine.

Asparagine is produced in plant cells by an enzyme called asparagine synthetase.

The gene coding for asparagine synthetase needs to be switched on by other proteins.

(i) Complete these sentences about how genes are expressed.

Use words from the list.

coding DNA	**denaturing**	**non-coding DNA**
nucleus	**ribosomes**	**transcription**
translation	**tRNA**	

Gene expression can be switched on by the action of other proteins on ..... .

When a gene is expressed, ... occurs which makes mRNA.

The mRNA then moves to the ..... .

Proteins, such as asparagine synthetase are then made by the process of ..... .

[4]

This gap fill question all candidates attempted and the majority scored either three or four marks. Only a small number were not given any marks here. The most common given marks were for transcription and translation identified correctly. The most common error candidates made was stating that genes can be switched on by coding DNA instead of non-coding DNA.

Question 21 (c) (ii)

(ii) Scientists want to produce a variety of wheat that contains less asparagine.

This is done by preventing expression of the gene that codes for asparagine synthetase.

Describe the difference between this process and genetic engineering.

.....

.....

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

This question proved the most challenging to the candidates assessing their knowledge and understanding of genetic engineering. Most candidates were not able to describe the process of genetic engineering. Vague references to vectors and various enzymes were answered. Where candidates did identify moving a gene, they did not clearly identify that the gene was from another species. Common responses included genetic engineering swaps/replaces a gene.

Misconception

There has been a knowledge gap identified and most candidates did not know that in genetic engineering genes are introduced from one organism to another. Misconceptions included, swapping genes / replacing genes and part of selective breeding. Revisiting key ideas throughout the GCSE course would help remove and eliminate these misconceptions.

Question 22 (a)

22 The table shows some details of three genetic diseases that can affect humans.

Disease	Cause	Number of UK cases	Effect
Huntington's	a dominant allele	12 in 100 000 people	The mutation produces a protein that stops the cerebrum communicating with the spinal cord.
Muscular dystrophy (MD)	a recessive allele	1 in 4 000 males	The mutation prevents a muscle protein being made.
Spinal muscular atrophy (SMA)	a recessive allele	1 in 10 000 people	The mutation prevents a protein being made that is needed for motor neurones to work.

(a) There are 66 million people in the UK.

Calculate the number of cases of Huntington's disease in the UK.

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

This calculation was one of the higher scoring questions with most candidates given maximum marks for correctly calculating the number of cases of Huntington's in the UK. Where maximum marks were not given candidates made a power of ten error in their calculation.

Question 22 (b)

(b) All three diseases affect proteins in different parts of the body.

Explain why each of these diseases cause difficulty in moving the legs.

Huntington's .....

.....

MD .....

.....

SMA .....

.....

[3]

This question challenged the candidates and demonstrated a knowledge gap whereby candidates could not apply their knowledge of the co-ordinated nervous responses to this question. The most common given mark candidates were awarded was identifying in MD cannot contract muscles. A lot of candidates rewrote the question that they can't move because muscle cannot be made. This was one of the lowest scoring questions on the paper.

Assessment for learning

This has been identified as a knowledge gap. Candidates did not use scientific language to describe nervous impulses, instead spoke about messages and communication. Many candidates described the part of the nervous system affected incorrectly or had the impulses passing the wrong direction. Revisiting key knowledge across the GCSE course is invaluable in ensuring candidates are used to using key scientific terms in the correct context.

Question 22 (c)

(c) Suggest why the mutation that causes Huntington's is dominant but the mutation that causes MD and SMA is recessive.

Use the information in the **effect** column of the table.

.....

.....

.....

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

Over half of candidates achieved a mark here but very few were able to gain both marks. The most common given mark was for candidates having appreciated that Huntington's produces and protein and in MD and SMA it doesn't produce a protein. Very few could qualify this by applying their knowledge of genetic inheritance that this was because you only need one affected allele to be expressed when it is dominant or need both affected alleles when it is recessive. This was one of the most challenging questions for candidates to obtain full marks.

Question 22 (d)

(d) Scientists are trying to develop treatments for Huntington's using stem cells to replace cells damaged by the protein.

Describe **two** risks of using stem cells to treat patients.

1 .....

.....

2 .....

.....

[2]

Candidates demonstrated a lack of knowledge and understanding on the risks of using stem cells. Over half could identify that the cells could be rejected but very few could identify another risk factor. Many misinterpreted the question and spoke about ethical issues, which are not risk factors only negative arguments or stated vague effects such as side effects. Many candidates did not score on this question.

Assessment for learning

This has been identified as a knowledge gap. Candidates would benefit revisiting key knowledge throughout their GCSE course to embed key ideas. Candidates should be able to develop their scientific enquiry skills such as being able to differentiate risks with ethical issues in their evaluation skills.

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