

GCSE (9-1)

Examiners' report

**TWENTY FIRST
CENTURY SCIENCE
BIOLOGY B**

J257

For first teaching in 2016

J257/01 Summer 2022 series

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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. A selection of candidate answers are 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.

Advance Information for Summer 2022 assessments

To support student revision, advance information was published about the focus of exams for Summer 2022 assessments. Advance information was available for most GCSE, AS and A Level subjects, Core Maths, FSMQ, and Cambridge Nationals Information Technologies. You can find more information on our [website](#).

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Paper 1 series overview

The specification content of J257 Biology B is divided into eight chapters. The first six chapters describe the science content of the specification. Chapter seven describes 'Ideas about Science' and covers the requirements of 'Working Scientifically'. The final chapter describes the requirements for practical skills. The Breadth in Biology paper assesses content from across the specification. The paper includes short answer response questions such as structured questions, calculations and questions based on practical skills.

It appeared that candidates were entered for the correct tier, with almost all of them engaging fully with the paper and making a good attempt at answering the questions. A wide spread of marks was obtained, questions were rarely left unanswered and there was no evidence of shortage of time being an issue. Candidates demonstrated that they understood the instructions for each question, were able to access them and many of them were well prepared for the examination. Compared to previous series, candidates followed instructions much better, for example in the past when candidates have been asked to tick one box or draw one line and they have regularly ticked or drawn more than one. This year, the only question that caused problems in this way was Question 5 (d).

Candidates who did well on this paper generally did the following:	Candidates who did less well on this paper generally did the following:
<ul style="list-style-type: none"> • demonstrated sound communication skills to explain their scientific ideas. For example, used the word 'increase' to describe an increase, rather than a vague term such as 'spike' • engaged fully with the questions, read them carefully and answered in specific rather than generic terms for example in questions (c) and 1(e) • demonstrated good mathematical skills and always showed their working in Questions 5 (c) (i) and (ii), 6 (b) (i) and (ii) and 14 (b) (i) • demonstrated that they had attempted to practise or revise practical skills – this chapter of the specification is often overlooked. They showed their understanding of practical procedures in questions 5 (d), 7 (a) and 10 (a) and how they could develop investigations in Question 10 (b). 	<ul style="list-style-type: none"> • demonstrated a lack of knowledge of basic ideas. Compared to the 'Depth' paper, a greater proportion of the 'Breadth' paper covers the Assessment Objective AO1 (knowledge of scientific ideas and techniques). Questions 1, 2 (a), 3 (a), 3 (b), 3 (d), all of question 4 and 9 (a) assessed knowledge of basic biological ideas and candidates who struggled with these questions often went on to perform at a lower level overall • omitted to show their working in questions assessing mathematical skills • didn't attempt every question – even ones requiring candidates to tick a box or circle an answer • used vague or absolute terms to communicate their ideas for example on Questions 8 (a) (ii) and 14 (b) (ii) when asked to describe an effect on a population they wrote that the population 'will become extinct' rather than just 'decrease'.

Question 1

1 Complete the sentences about DNA and the production of proteins in cells.

Put a **ring** around each correct answer.

The shape of DNA is called a **double helix / nucleotide / nucleus**.

Sections of DNA called **genes / nucleotides / sugars** tell the cell how to make proteins.

A protein is a polymer made of **amino acids / fatty acids / sugars** joined together in a particular order.

Carbohydrates / enzymes / fats are examples of proteins found in cells.

[4]

Most candidates obtained at least 2 marks on this question. Double helix and amino acids were well known. Some candidates confused nucleotides with genes, and enzymes was the least well known option.

Question 2 (a)

2 Hormones in the human body are produced by the endocrine system.

(a) Draw **three** lines to identify the **features** of hormones.

Features	
Hormones	Are transported in the blood
	Are transported as an electrical impulse
	Are secreted by a gland
	Are made of nerve cells
	Have effects that can last a long time

[3]

Most candidates were given at least 2 marks on Question 2 (a). The fact that hormones are transported in the blood was well known, but the options of them being secreted by a gland and having effects that last a long time were less commonly selected. There was no evidence of candidates misunderstanding what they had to do, e.g. drawing four lines not three.

Question 2 (b)

(b) Insulin is an example of a hormone produced by the human body.

Which disease can insulin be used to treat?

..... [1]

The majority of candidates gave the correct answer of diabetes. They were not penalised if they named either Type 1 or Type 2 diabetes.

Question 3 (a)

3 This question is about cellular respiration.

(a) Which statement describes the process of cellular respiration?

Tick (✓) **one** box.

It is a photosynthetic reaction.

It is an endothermic reaction.

It is an exothermic reaction.

It is an immune response.

[1]

Some candidates appeared to be confused between exothermic and endothermic reactions with only around a third of candidates selecting the correct answer. However, cellular respiration was rarely thought to be an immune response.

Question 3 (b)

(b) Which type of cellular respiration produces ethanol?

Tick (✓) **one** box.

Aerobic respiration in animal cells

Aerobic respiration in plant cells

Anaerobic respiration in animal cells

Anaerobic respiration in microorganisms

[1]

More than half of candidates were unable to select the correct answer, although the type of cellular respiration that produces ethanol was rarely thought to be aerobic respiration in animal cells. The other two incorrect options were selected approximately equally.

Question 3 (c)

(c) ATP is a product of cellular respiration.

Complete the table about ATP.

Tick (✓) **one** box in each column.

	Active transport	Diffusion	Muscle contraction
Does not use ATP			
Uses ATP			

[2]

Around half of candidates obtained at least one mark on this question. They often knew that active transport uses ATP but did not tick the box for muscle contraction too and therefore were unable to be given the mark. Candidates gaining one or more marks were able to apply their knowledge to correctly identify that diffusion does not use ATP.

Question 3 (d)

ATP is produced in mitochondria.

A light microscope **cannot** be used to see the detailed structure of mitochondria.

(d) State **one** reason why an electron microscope **can** be used to see the detailed structure of mitochondria.

..... [1]

Few candidates demonstrated the correct terminology with respect to magnification and resolution. Many incorrectly used the phrase 'zooming in' or said the electron microscope was 'stronger'. Candidates often stated that electron microscopes allow you to see electrons.

Question 4 (a)

4 Complete each sentence about structures in the human body.

Use words from the list.

artery	brain stem	cerebellum	heart	kidney	lens
motor	pancreas	retina	sensory	vein	

(a) A neuron that connects a receptor to the central nervous system.

..... [1]

Around a third of candidates selected the correct answer. The most commonly selected alternative was 'motor'.

Question 4 (b)

(b) The organ that secretes insulin.

..... [1]

The majority of candidates knew that the pancreas secretes insulin. Candidates who selected the incorrect organ commonly chose 'kidney'.

Question 4 (c)

- (c) A blood vessel that contains valves and returns blood to the heart. [1]

Around half of candidates selected 'vein'. Some candidates were confused between the features of arteries and veins, and therefore incorrectly selected 'artery'.

Question 4 (d)

- (d) An organ that removes water and urea from the blood. [1]

The majority of candidates knew that the kidney removes water and urea from the blood. Candidates who selected the incorrect organ commonly chose 'pancreas'.

Question 4 (e)

- (e) The part of the eye where an image forms. [1]

Around half of candidates correctly identified 'retina' as the part of the eye where an image forms. Candidates who selected the incorrect part of the eye commonly chose 'lens'.

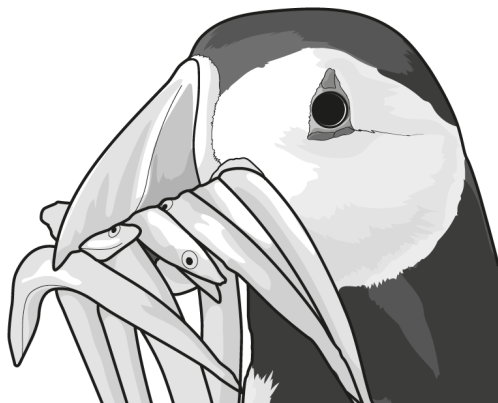
Question 4 (f)

- (f) The part of the brain that regulates heart rate. [1]

A minority of candidates were able to identify the part of the brain that regulates heart rate, often stating 'cerebellum' instead.

Question 5 (a)

5 Puffins are a species of bird.



Puffins nest on the Farne Islands off the coast of North East England.

Every 5 years the number of breeding pairs of puffins is counted. The data are shown in the table.

Year	Number of puffin breeding pairs
2003	55 674
2008	36 835
2013	39 962

(a) Describe the overall trend in the data from 2003 to 2013.

.....
 [1]

Approximately half of candidates were able to describe the overall trend which was a decrease in the number of breeding pairs. Although not necessary on this particular question, some even calculated the decrease in number of puffin breeding pairs to support their answer, which is good practice. Candidates who were unable to be given the mark said the puffin pairs decreased then increased which is not an overall trend.

Question 5 (b)

(b) Which of the following could be a reason for the change in breeding pair numbers?

Tick (✓) **one** box.

There are no predators.

There is a more favourable climate.

There is less competition in the ecosystem.

There is not enough food.

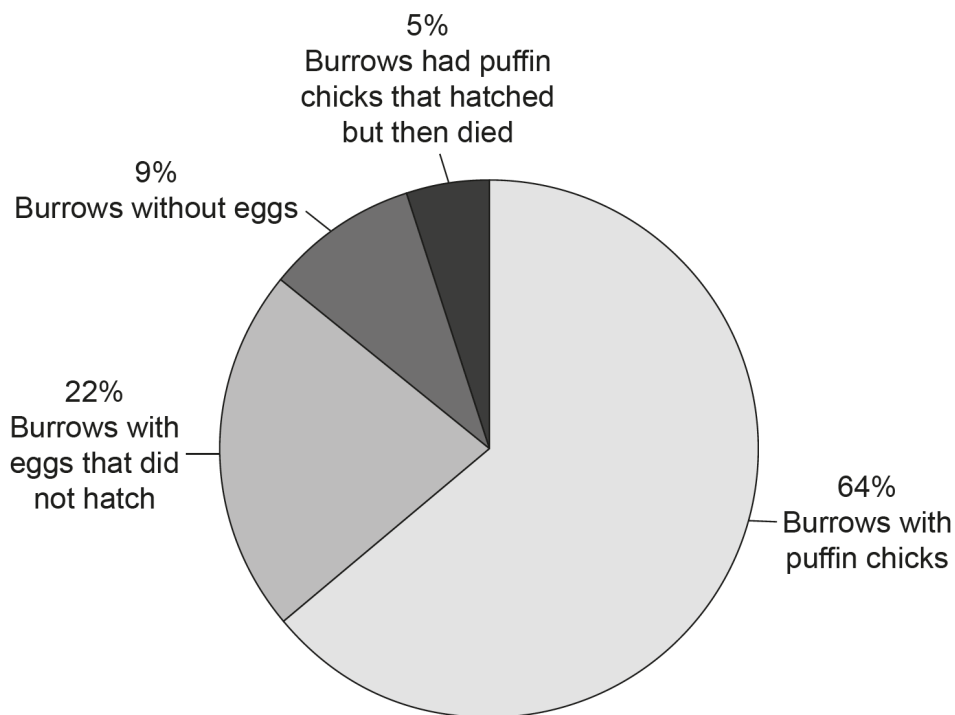
[1]

While the majority knew that the breeding pair numbers decreased because of a lack of food, other candidates incorrectly identified that there was less competition in the ecosystem.

Question 5 (c) (i)

(c) Puffins lay their eggs in burrows. They lay 1 egg each year.

The pie chart shows data about puffin burrows.



(i) What percentage of burrows had puffin chicks that hatched?

Percentage = % [2]

Most candidates gave the correct answer of 69%, understanding that this value was derived from not only the number of chicks that hatched, but also the number that hatched and then died. 64% was sometimes stated, as candidates only accounted for the chicks that hatched and remained alive.

Question 5 (c) (ii)

- (ii) Use the data in the pie chart to calculate how many chicks would survive if there were 40 000 breeding pairs of puffins.

Put a **ring** around the correct answer.

25 600

27 600

36 400

34 400

[1]

Candidates were required to calculate 64% of 40 000. Over half of candidates found this challenging and were not able to select the correct answer. There was no particular 'second choice', with other incorrect answers being selected equally, although it was clear that some candidates had used the value they calculated in Question 5 (c) (i) (69%) and calculated 69% of 40 000.

Question 5 (d)

- (d) Puffins eat a diet high in protein.

Draw **one** line to connect the **reagent used to test for protein** and the **colour of a positive test**.

Reagent used to test for protein

Colour of positive test result

Benedict's

Black

Biuret

Purple

Iodine

Red

[2]

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Candidates found this question challenging and few were given 2 marks. Many did not follow the instruction to draw one line and drew three lines linking all reagents with a different colour. Nevertheless, provided that each reagent was correctly matched to the colour of its positive test result, candidates could still obtain one mark.

OCR support



OCR have created a [Practical Support Guide](#). The guide has been provided to help with delivery of the course where some practical activities are not possible and includes many links to online videos and tutorials. The guide is also a useful revision or homework resource for students. It can be accessed via the link below.

Question 6 (a)

6 Elephants must maintain their body temperature within a set range.

(a) Which word describes the maintenance of a constant internal environment?

Put a **ring** around the correct answer.

active transport

homeostasis

osmosis

respiration

[1]

Candidates appeared to be confident in their knowledge of the meaning of the term homeostasis, and the majority correctly selected this term from the options available.

Question 6 (b) (i)

(b) Some elephants are kept in zoos.

A zookeeper measures the body temperature of five healthy elephants. The results are shown in the table.

Elephant	Body temperature (°C)
1	36.0
2	36.2
3	37.0
4	36.8
5	36.4

(i) Use the data in the table to work out the normal body temperature range of these elephants.

Normal body temperature range = to °C **[1]**

Candidates performed very well on this question and most of them were able to work out the normal body temperature range.

Question 6 (b) (ii)

- (ii) Calculate the mean body temperature of the five elephants.

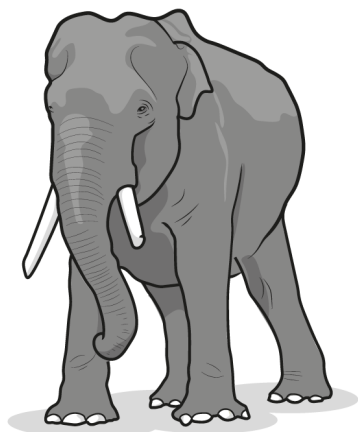
Give your answer to **one** decimal place.

Mean body temperature = °C [2]

Half of candidates gained both marks on this question. However, a significant number of candidates did not show their working and therefore could not be given the first marking point if their final answer was incorrect. For example, a candidate demonstrating their calculation of $182.4 \div 5 = 36.48$ but then incorrectly rounding this to 36.4 would be given one 'working' mark. A candidate simply writing 36.4 on the answer line with no working, would not.

Question 6 (c) (i)

(c) An elephant is shown in the diagram.



(i) Elephants live in hot climates and have very few sweat glands. They find it difficult to lose heat.

Which statement explains why elephants find it difficult to lose heat?

Tick (✓) **one** box.

Elephants have a large surface area.

Elephants have a small surface area : volume ratio.

Elephants have a small volume.

Elephants sweat a lot.

[1]

Many candidates thought that elephants have a large surface area and only a minority knew that they had a small surface area:volume ratio.

Question 6 (c) (ii)

(ii) Suggest **one** way elephants can reduce their body temperature.

.....

..... [1]

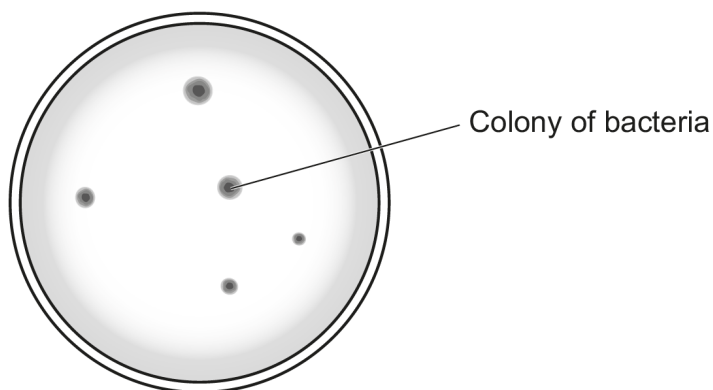
Candidates engaged well with this question. Only a very small minority did not attempt an answer and most candidate responses were correct. Although few answered in terms of increasing blood flow to the skin, many were given the mark because they described a correct behavioural response.

Question 7 (a)

7 Anika is investigating the growth of bacteria.

She takes a sample from a yoghurt drink that contains live bacteria and spreads it on an agar plate.

Anika incubates the agar plate for 3 days. After three days bacterial colonies have grown, as shown in the diagram.



Anika uses a light microscope to look at the bacterial colonies.

(a) The image Anika can see under the microscope is blurry.

Describe how she should change the microscope to get a better image.

.....

.....

.....

..... [2]

Candidates appear to have a better understanding of the parts of the microscope than in previous series, although there are still those who are unable to correctly name the parts of the microscope. Simply writing 'use the knob' - a common response - does not include sufficient detail to for a response to be given the mark. Over half of candidates were given at least one mark on this question, often for the idea that Anika needed to focus the microscope, but without specifying how she would do this.

Question 7 (b) (i)

(b) (i) There can be millions of bacteria in one colony.

Assume each colony on the agar plate has 2 million bacteria.

Use the diagram to estimate the total number of bacteria on the agar plate.

Estimated number of bacteria on the agar plate = [1]

This question was generally well answered with the majority of candidates being given the mark. Problems arose because a) candidates did not correctly count the number of colonies on the agar plate (rather than being unable to multiply that number by 2) and b) candidates attempted to write 10 million as a number and wrote an incorrect number of zeros, e.g. 100 000 000 rather than 10 000 000.

Question 7 (b) (ii)

(ii) Explain why this estimated number is **not** accurate.

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

Many candidates observed that the colonies on the agar plate were different sizes and therefore were given the mark. Those who did not obtain the mark often attempted to explain what an estimate is in general terms without specifically answering this question.

Question 7 (c)

(c) Where is the genetic material in a bacterial cell found?

..... [1]

A minority of candidates were able to correctly state where the genetic material in a bacterial cell is found. Many candidates incorrectly stated 'nucleus' which would suggest they were not secure in their knowledge of the location of genetic material in prokaryotic cells.

Question 8 (a) (i)

8 Fig. 8.1 shows a coral reef. Coral reefs are underwater ecosystems that support many different species.

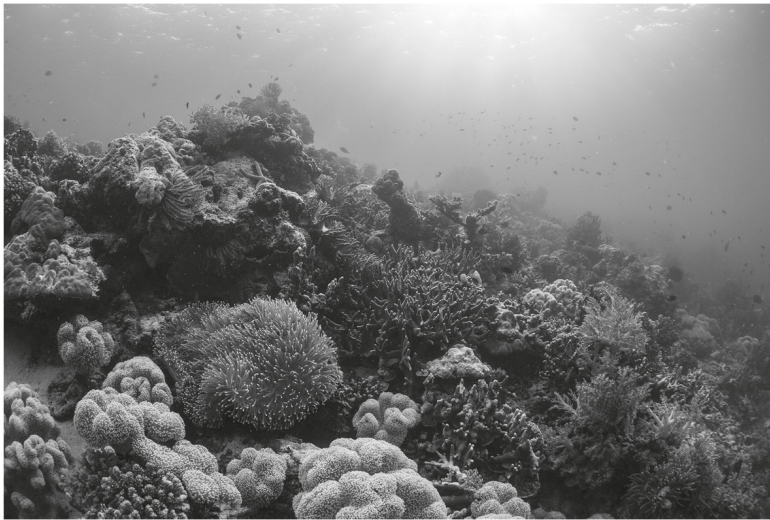


Fig. 8.1

(a) Fig. 8.2 shows the amount of one species of coral present in a coral reef over time.

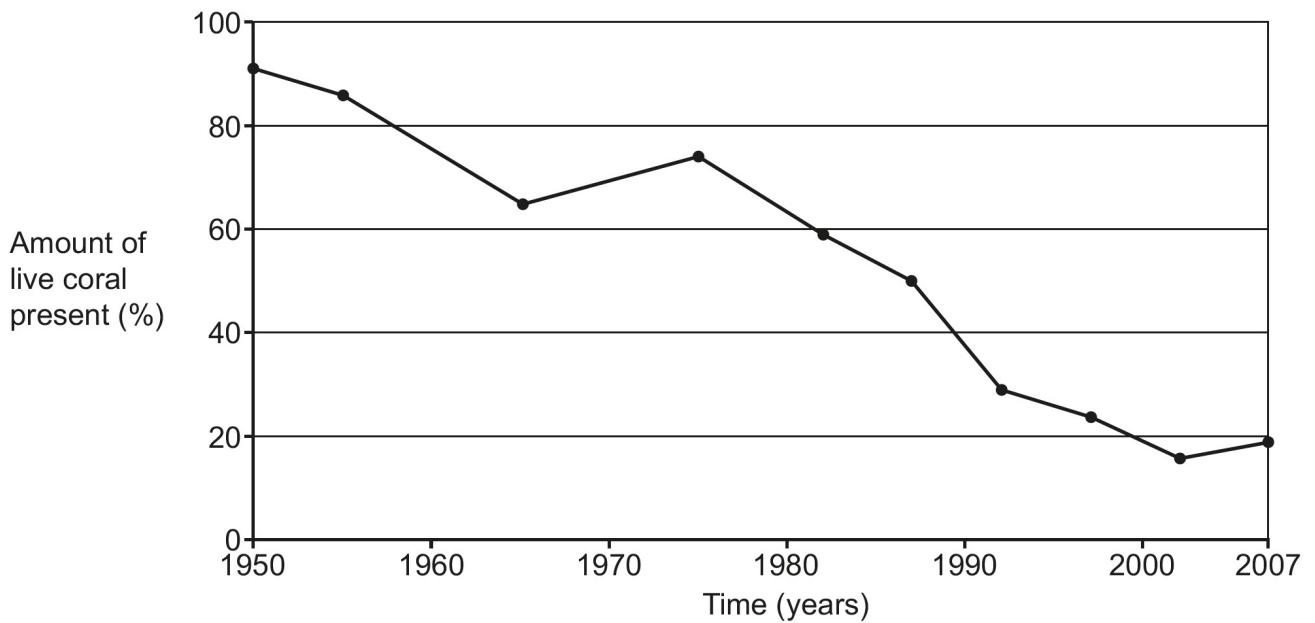


Fig. 8.2

(i) Describe the trend shown by the data in Fig. 8.2.

.....

.....

.....

..... [2]

The majority of candidates were given at least one mark on this question. Many candidates successfully obtained the first marking point for identifying that there was a decrease in live coral over time. Many did not elaborate further though and did not include quantitative data to support the trend. They were therefore unable to be given the second mark. Other candidates attempted to explain why the trend had occurred, even though they were just asked to describe, and not explain, the trend in the question.

Exemplar 1

in 1956 the ~~per~~ percentage of live coral was at over 90%. but 57 years later in 2007 there was only under 20% of live coral present. The amount of coral has decreased from [2] 1950 to 2007.

This candidate is given both marks as they have described the trend shown by the data and they have selected correct data from the graph to support their description. Many candidates simply stated that the percentage of coral had decreased over time.

Question 8 (a) (ii)


(ii) Coral reef is a habitat for many populations of fish.

Suggest how a population of fish may be affected by the trend shown in the graph. Give a reason for your suggestion.

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

Although many candidates just stated the population of fish would be affected without saying that the population would decrease, they were able to be given a mark from the second marking point for giving a reason why the population would be affected.

Assessment for learning



Candidates should avoid just using the term 'affect' with no further explanation and always think about how something would be affected...would it increase, decrease or stay the same?

Question 8 (a) (iii)

(iii) The loss of live coral can be a result of an increase in water temperature.

Predict what will happen to this coral reef in the future.
Give a reason for your answer.

Prediction

Reason

[2]

The majority of candidates were given at least one mark on this question. They were given one mark for predicting what would happen to the coral reef. However, few could give a reason for their prediction, rather they just repeated information in the stem of the question, i.e. the water temperature would increase.

Question 8 (b)

(b) Coral are animals. They benefit from having photosynthesising algae living inside them.

Suggest **one** substance the algae provide the coral with.

..... [1]

Using their knowledge of photosynthesis, candidates were often able to suggest a substance that algae would provide coral with such as glucose. A common incorrect answer was carbon dioxide.

Question 8 (c)

(c) Many marine ecosystems are threatened by human activity, such as overfishing.

Suggest **two** ways in which humans can have a positive effect on these ecosystems.

1

.....

2

.....

[2]

The majority of candidates were able to suggest at least one correct way in which humans could have a positive effect on marine ecosystems. Even candidates who didn't gain both marks attempted two answers. Responses that were only given one mark included suggesting two ways of managing fishing, or two examples of pollutants needing to be removed. Both of these suggestions are examples from the same idea and therefore marking point. Candidates are advised to read the question carefully and make sure that they answer in the context of the scenario given. For example, some candidates wrote about stopping deforestation when this question referred to a marine ecosystem. A number of candidates misinterpreted the question and explained how the ecosystem could benefit humans, e.g. by providing food.

Question 9 (a)

9 This question is about genetics.

(a) Draw lines to connect each **genetic term** to its **definition**.

Genetic term	Definition
Alleles	A different version of a gene
Chromosome	The two copies of a gene in a pair of chromosomes
Genetic variant	The characteristic that results from a gene and interaction with the environment
Phenotype	A long thin structure made from DNA

[4]

Only a very small minority of candidates did not obtain any marks on this question, and over a third were given all 4 marks. Candidates were often able to link the definitions of chromosome and phenotype. Most confusion arose between the definitions of alleles and genetic variant.

Question 9 (b)

(b) Sickle cell anaemia is an inherited disease. The disease is caused by a recessive allele.

The recessive allele is represented with an **a**, and the dominant allele is represented with an **A**.

Complete the table to show whether the person with each genotype will have sickle cell anaemia.

Tick (✓) **one** box in each row.

Person's genotype	The person will have sickle cell anaemia	The person may or may not have sickle cell anaemia	The person will not have sickle cell anaemia
AA			
Aa			
aa			

[3]

Higher performing candidates often knew that 'AA' meant the person would not have sickle cell anaemia and 'aa' meant they would. However, candidates did not fully understand the significance of the dominant allele and thought that 'Aa' meant the person may or may not have sickle cell anaemia. Very few candidates were given all 3 marks.

Question 9 (c)

(c) Amaya and Jack do **not** have sickle cell anaemia.

They want to have a baby. They decide to both have a genetic test.

Explain why Amaya and Jack decide to have a genetic test.

.....

.....

.....

.....

.....

.....

..... [3]

Candidates engaged well with this question and there were many thoughtful and mature responses. Many candidates were given at least one mark although fewer were given all 3 marks. Popular responses explaining why the genetic test would be performed either explained that Amaya and Jack could find out if they were carriers or explained that there could be a family history of the condition. A common misconception on this question was that if both parents were carriers, their baby would automatically get sickle cell anaemia. Candidates did not always appreciate that having a genetic test would only allow the assessment of the *risk* of passing on the allele responsible for the condition to the baby. Nevertheless, some candidates did appreciate the use of such a genetic test and were even able to demonstrate correct Punnett squares illustrating the probability of a baby having sickle cell anaemia if both parents were carriers.

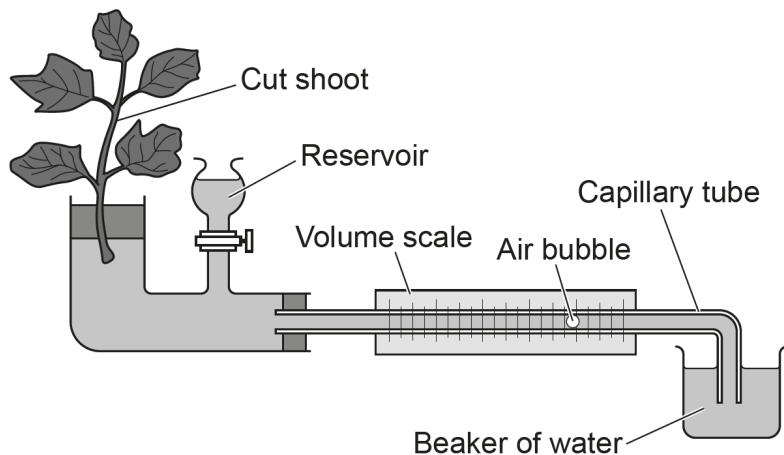
Exemplar 2

To make sure the baby won't have sickle cell anemia in case they have it in their genes or to check for anything else to make sure their baby will be healthy. [3]

This response illustrates a common misconception displayed in many candidate responses, which is that having a genetic test before conception means that the baby will not inherit a genetic condition. The candidate was not credited with any marks.

Question 10 (a)

10 Kai is investigating transpiration in plants. The diagram shows a potometer.



(a) Put sentences **A** to **E** in the correct order to describe how Kai can use the equipment in the diagram to measure transpiration rate.

One has been done for you.

- A** Cut a shoot and place it in the potometer.
- B** Seal gaps with petroleum jelly.
- C** Fill the potometer with water.
- D** Leave for a set amount of time and record the new position of the air bubble.
- E** Note the position of the air bubble.

C				
----------	--	--	--	--

[3]

Most candidates obtained at least one mark on this question, and many were given 3 marks.

Question 10 (b)

(b) Kai thinks temperature affects the rate of transpiration.

Describe how Kai could use the equipment in the diagram to investigate the effect of temperature on the rate of transpiration.

.....

.....

.....

.....

.....

.....

.....

.....

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

Although most candidates attempted to answer this question, many found it question extremely challenging, and few were able to be given marks. Most candidates incorrectly thought that the water in the potometer should be heated in order to investigate the effect of temperature, and only a minority were able to identify a variable that needed to be controlled. A significant number of candidates confused this experiment with the one using pond weed to investigate the effect of light intensity and wrote about how having a higher temperature would produce more bubbles in the capillary tube.

OCR support



In the [Practical Support Guide](#) there is a further link in the section called 'other useful practical resources' to a BBC resource on how to plan, collect data, analyse data and evaluate an investigation. It also includes several candidate-friendly videos.

Question 10 (c)

(c) Name the vessel that transports sugars in plants.

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

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Misconception



The vessel that transports sugars in plants was not well known and there was often confusion with xylem.

Question 11 (a)

11 Sepsis is an illness. It happens when an infection changes the body's normal immune response to infection.

Sepsis causes the immune system to damage the body's organs and tissues.

(a) Which type of cell in the blood is responsible for the damage to the tissues and organs?

..... [1]

Half of candidates were able to state the correct answer of white blood cells. A common incorrect response was 'red blood cells'.

Question 11 (b)


(b) Sepsis can cause blood clots to form.

Name the part of the blood that starts the clotting process.

..... [1]

A minority of candidates were able to give the correct answer of 'platelets'.

Misconception

 White blood cells were commonly believed to be the part of the blood that starts the clotting process.

Question 11 (c)

(c) Sepsis can be prevented by stopping the spread of microorganisms between people.

Suggest **one** way members of a community could help prevent the spread of microorganisms within the community.

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

This question was very well answered with a variety of answers suggested from the list on the mark scheme.

Question 11 (d) (i)

(d) (i) Sepsis affects 30 million people worldwide each year.

Put a ring around the number that shows 30 million in standard form.

3.0×10^7

30×10^6

30×10^7

$30\,000\,00 \times 10$

[1]

Just over half of candidates were able to recognise the correct way of showing 30 million in standard form.

OCR support



OCR offers support to centres in delivering the mathematical content of the specification. The [Mathematical Skills Handbook](#) – has guidance for teachers and answers for the practice questions. The practice questions can be found in the [Check In worksheet](#).

Question 11 (d) (ii)

- (ii) Of the 30 million people affected by sepsis each year, 1.2 million are children.

Calculate the percentage of people affected by sepsis each year who are children.

Percentage affected who are children = % **[2]**

Only a minority of candidates gained both marks for calculating the percentage in this question. Centres are advised to remind candidates of the importance of including all working in calculations. A common incorrect approach to the question was to divide 30 by 1.2. Other candidates did not multiply the value derived from $1.2/30$ by 100.

Question 11 (e)

Doctors in the USA tried a new treatment for sepsis.

47 patients were given the new treatment. 43 of these patients made a full recovery.

(e) Should this treatment be used on all patients with sepsis?

Give **one** reason why the treatment should be used and **two** reasons why it should not.

Reason to use the treatment

.....

Reasons **not** to use the treatment.

1

.....

2

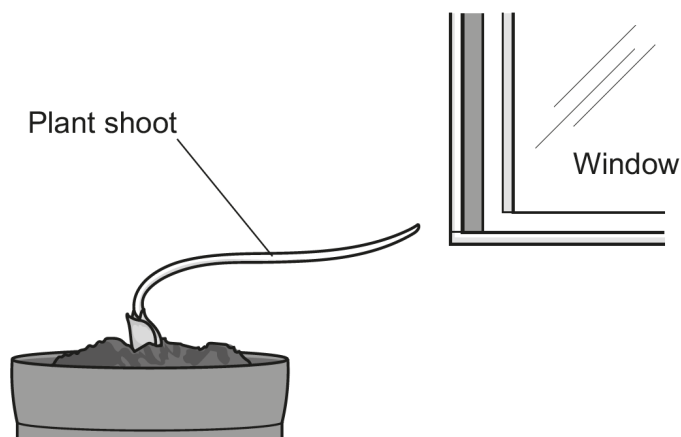
.....

[3]

Candidates offered some sensible and well considered responses to this question and most were able to be given at least one mark. Some candidates processed the data to calculate the percentage of patients that recovered or did not recover in order to support their reasoning which shows sound exam technique. There were some generic answers where candidates did not engage with the question for example just stating 'ethical issues' or 'religion' as objections. Popular reasons not to use the treatment were that the treatment had only been tested on a small number of patients and the idea that potential side effects might outweigh the benefits of treatment.

Question 12 (a)

12 Plants respond to their environment.
One example is their response to light, as shown in the diagram.



(a) Complete each sentence to explain how the plant shoot responds to light.
Use words from the list.

auxins	dark	insulin	less
light	more	progesterone	shade

The response to light is controlled by plant hormones called

When the plant is placed in an environment where the light is coming from one direction, there is an uneven distribution of the hormone in the shoot.

..... hormone collects on the side of the shoot that is in the shade.

This causes more cell elongation on the side of the shoot that is in the

..... so the shoot grows towards the light.

[3]

Most candidates were given at least one mark on this question. 'Auxins' in the first space was best known, with 'more' and 'shade' less well known. Most of the incorrect answers for the first marking point gave progesterone or insulin as the hormone controlling the response to light.

Question 12 (b)

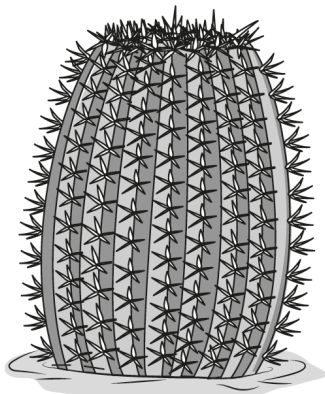
(b) What word is used to describe a plant root's response to gravity?

..... [1]

Candidates were not secure in their knowledge of the term describing a plant root's response to gravity. Few were able to give the correct answer of gravitropism.

Question 13 (a)

13 The diagram shows a cactus. It reproduces sexually by producing flowers.



(a) There are 22 chromosomes in all of the cells in this cactus apart from the gamete cells.

Complete the table to identify how many chromosomes are present during the events that take place in the life cycle of a cactus.

Tick (✓) **one** box in each row.

Event in the cactus life cycle	Number of chromosomes		
	11	22	44
At the end of interphase during meiosis			
At the end of interphase during mitosis			
In the cells produced by mitosis as the cactus grows			
In the pollen produced by meiosis			

[4]

Candidates found this question challenging although most were given at least one mark. It appeared that there was some guessing of the answers, for example every box ticked under 22 chromosomes. The number of chromosomes at the end of interphase during meiosis and mitosis were the least well known answers and candidates were more confident in identifying the number of chromosomes in cells produced by mitosis, and in pollen produced by meiosis.

Question 13 (b)

(b) Which process reacts water with carbon dioxide in plant cells?

Tick (✓) **one** box.

Active transport

Cellular respiration

Photosynthesis

Transpiration

[1]

This question was relatively well answered with cellular respiration a popular incorrect choice.

Question 13 (c)

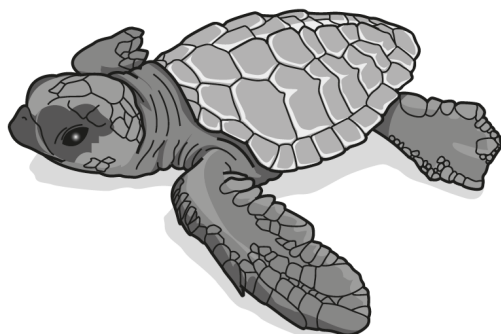
(c) Name the vessel in a plant that transports water up the stem.

..... [1]

The vessel that transports water up the stem in plants was not well known and there was often confusion with phloem.

Question 14 (a)

14 The diagram shows a Pacific sea turtle. The sex of Pacific sea turtles' offspring is determined by the temperature at which their eggs incubate.



(a) Explain how sex determination in **humans** is different to sex determination in turtles.

.....

.....

.....

..... [2]

Many candidates knew that sex in humans is determined genetically and went on to correctly name the sex chromosomes. They also appreciated that sex in humans is not determined by temperature and therefore obtained both marks. A proportion of candidates did not understand the term 'sex determination' and wrote about primary and secondary sex characteristics.

Question 14 (b) (i)

(b) The effect of temperature on the sex of the offspring is shown in the table.

Egg incubation temperature (°C)	Sex of offspring
Below 27.7	male
Between 27.7 and 31.0	mix of male and female
Over 31.0	female

(i) In some locations in 2020 the female turtles outnumbered male turtles in a ratio of 116:1.

Calculate the number of female turtles in a sample of 18 000 turtles.

Give your answer to the nearest whole number.

Number of female turtles = [3]

This question illustrated again the importance of showing working out in calculations. While a correct answer with no working out will obtain full marks, an incorrect answer with working out may still gain one or more marks. Many candidates knew that they needed to divide 18 000 by 117 in the first instance but weren't sure how to then calculate the number of females. Around a third of candidates were able to be given 3 marks.

Exemplar 3

$$18000 \div 31 = 580.64$$

Number of female turtles =581..... [3]

This exemplar demonstrates the importance of showing working. The candidate has calculated the ratio incorrectly, but because they show evidence of correctly converting a number to the nearest whole number, they are given one mark. If they had simply written 581 without writing 580.64 first, they would not have been given the mark.

Question 14 (b) (ii)

- (ii) In the 1970s the ratio of female to male turtles was 6 : 1.

What effect could the change in the ratios from 1970 to 2020 have on the population of sea turtles?

Explain your answer.

.....

.....

.....

..... [2]

Some candidates were able to appreciate that having too many females in relation to males could lower the overall population because it would be difficult for a female to find a mate. There were several other correct answers to this question, but the example given was the most common. Around half of candidates were not able to be given a mark on this question. Incorrect answers focused on explaining the reason why there might be more female turtles and fewer male turtles rather than stating how the ratio could affect the population of sea turtles.

Question 14 (b) (iii)

- (iii) Suggest how scientists could help return the sex ratio in the next generation of turtles to that seen in the 1970s.

.....

..... [1]

Candidates found this question challenging. Although candidates realised that manipulating the temperature of incubation would help to return the sex ratio to that of the 1970s, they did not specify that the temperature would need to be lower, and just stated that the temperature would need to be changed or controlled. This type of response was not given the mark as it did not demonstrate that the candidate knew a lower temperature would produce male turtles. Other incorrect responses suggested removing the females from the area, or genetically modifying the turtles.

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