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GCSE (9-1)

Examiners' report

TWENTY FIRST CENTURY SCIENCE BIOLOGY B

J257

For first teaching in 2016

J257/03 Summer 2022 series

Version 1

ocr.org.uk/science

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate answers 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.

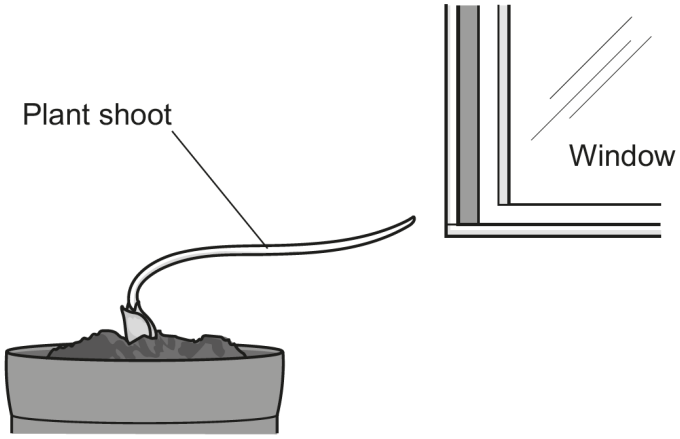
Paper 3 series overview

It was good to see that even after a challenging couple of years the candidates sitting this paper had clearly spent time consolidating their biology knowledge in preparation for this examination. Candidates engaged well with the whole paper, there were very few omissions observed and some interesting suggestions for questions that required a little more creative thought. Candidates demonstrated a good range of knowledge and there were some exemplary answers highlighting their abilities in this subject. The questions that focused on practical skills proved more challenging for most candidates, and this in part could be a result of the lack of practical work that candidates have had exposure to over the past few years. There were also some questions where candidates did not read the question rubric carefully enough, rather they spotted a topic that they were familiar with and then proceeded to write at length about content, that while related, was not what the question was focussing on. It was pleasing to see candidates handling data well, drawing conclusions and gathering evidence to support or refute ideas.

Candidates who did well on this paper generally did the following:	Candidates who did less well on this paper generally did the following:
• Engaged well with unusual contexts and could apply their knowledge. • Critically analyse data to provide evidence for and against a statement. • Understood and used scientific knowledge accurately. • Were more familiar with the practical work tested in questions.	• Found it difficult to express their scientific knowledge in prose. • Lacked depth and key terminology. • Were unfamiliar with the practical aspects assessed. • Were unable to apply knowledge to unusual contexts.

Question 1 (a)

1 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]

Candidates were clearly familiar with the role of the auxins, and their involvement in generating a plant response to light. Many candidates correctly identified that the distribution of the hormone would be uneven, and that more hormone would collect on the side in the shade and as a result many were given 2 marks. The most common error observed was for the final mark point, with candidates incorrectly selecting the word dark, rather than shade.

Question 1 (b)

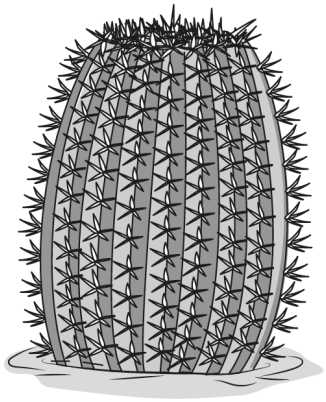
(b) What word is used to describe a plant root's response to gravity?

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

For the most part candidates answered this question well, selecting either gravitropism or geotropism. Some candidates did incorrectly state that a phototropism was the name of the root's response to gravity, perhaps this mistake was made as candidates were still considering the previous question.

Question 2 (a)

2 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]

A range of marks were observed for this question, and it demonstrated well which candidates understood what happened to the number of chromosomes during events in the life cycle of a species.

Unfortunately, some candidates did not read the question carefully and instead of selecting one box for each row and placing a tick in that box, they filled each of the twelve boxes with numbers. Centres should remind candidates to read all the instructions before answering the questions.

Question 2 (b)

A cactus must get water from the soil.

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

Tick (✓) **one** box.

- Active transport ☐
- Cellular respiration ☐
- Photosynthesis ☐
- Transpiration ☐

[1]

Most candidates answered this question correctly. Those that did not often selected cellular respiration as their answer.

Question 2 (c)

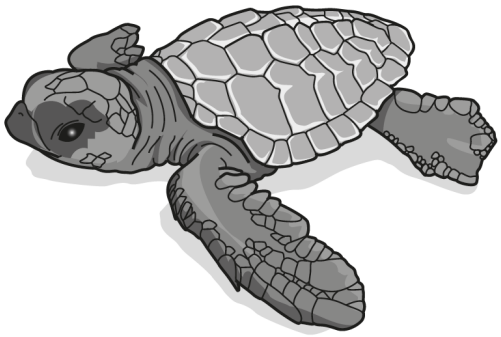
(c) Name the vessel in a plant that transports water up the stem.

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

It was very pleasing to see that most candidates knew that the vessel that transports water up the stem was the xylem. Occasionally candidates identified the phloem as the answer and while the phloem does move water, along with sucrose, the direction of movement is both up and down the stem, hence no mark was given for this answer. The most common incorrect answer given was roots, suggesting that perhaps candidates had not read the question carefully.

Question 3 (a)

3 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]**

This question was the opening question to a context that candidates would be unfamiliar with, a context which was abstract. Candidates engaged very well with this context, with the majority being given at least 1 mark. Candidates that performed well on this question correctly identified that sex determination in humans is a result of chromosomes, whereas in turtles the temperature of the environment was the determining factor, not the chromosomes. Some candidates were not explicit in their comparison of sex determination, and it was not clearly communicated that they know temperature was not a factor in the determination of sex in humans. In these instances, the candidates would only be given 1 mark.

Many candidates wrote extensively about the sex chromosomes of humans, even though no marks were given for this extra detail it was good to see they clearly were knowledgeable about the subject.

A small number of candidates misunderstood the use of the phrase 'determination' and thought the question was asking them to explain how humans knew what the sex of a child would be, suggesting that you could use ultrasound.

Assessment for learning

When a comparison is required in a question as was the case in this question, make sure that comparison is explicit.

Question 3 (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]**

Most candidates were given full marks for this question, clearly demonstrating their understanding of ratio. Those that did not, often used 116 in their calculations, they did not appreciate that they needed to add 1 to this number.

Question 3 (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]**

An imbalance of male to female turtles would most likely cause a population decline because there are fewer males to reproduce with females. Candidates are not expected to know how sea turtles' mate and therefore candidates were given marks for sensible suggestions. A range of answers were observed for this question, and it was refreshing to see candidates considering what the outcome could potentially be for the population of turtles because of the imbalanced ratio.

Question 3 (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 can often find suggest questions difficult, there are many potential answers that could be viable, and candidates were given a mark for sensible suggestions. Many candidates focused on the temperature at which you could incubate eggs, suggesting that you could control this temperature and lower it to make sure more males hatched. Other candidates took a slightly different approach, suggesting that action was needed in the natural habitat of the turtles, or in some cases, action at a global scale was needed to reduce to combat the global temperature rise. It was good to see candidates engaging so well with this question.

Question 4 (a)

4 Diseases can be described as communicable or non-communicable.

(a) Explain what is meant by communicable diseases **and** non-communicable diseases.

Give examples of **both** types of disease in your answer.

Communicable diseases .....

.....

.....

Non-communicable diseases .....

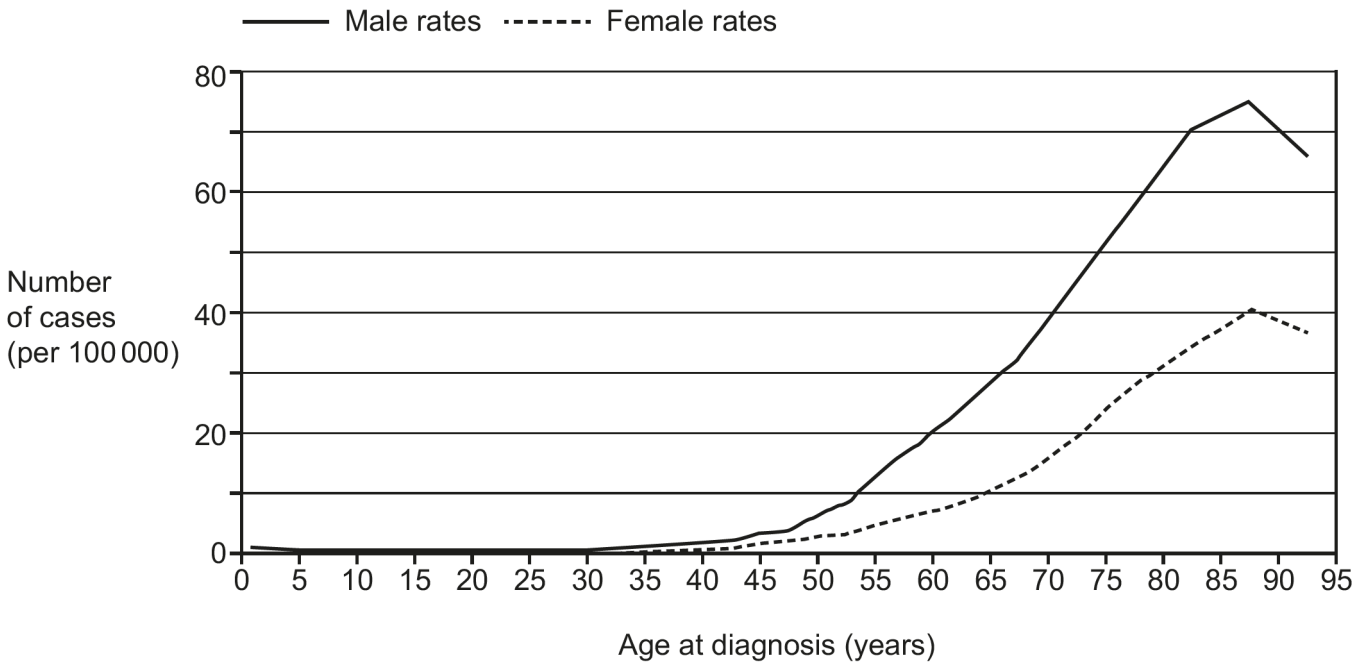
.....

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

This proved to be quite a challenging question on the paper, with few candidates being given full marks. Many candidates were given 1 mark, and this was most often for the correct identification of an example of both a communicable and non-communicable disease. Those candidates that were given 2 marks most often correctly identified a non-communicable disease as one which was caused by either lifestyle, the environment or was inherited. Very few candidates were given the mark for the correct description of a communicable disease, while they understood that such a disease was passed from one organism to another they did not mention that pathogens were responsible for the spread.

Question 4 (b)

(b) The graph shows the number of cases of liver disease in people in the UK.



Give **two** conclusions that can be made from the graph.

Conclusion 1 .....

.....

Conclusion 2 .....

.....

[2]

This question was generally answered well by most candidates, with very few candidates scoring 0 on this question. It was pleasing to see candidates engaging with the data so well. A conclusion that was seen frequently but was not given marks, stated that as a person got older there was a greater chance of liver disease, this is, to a degree correct, but beyond 87 the number of cases rates drop. Another common error was that the highest number of cases occurred at 85, the peak of this data is at 87.

Question 4 (c) (i)

(c) There are several causes of liver disease.
These causes include obesity, alcohol consumption and some viral diseases.

(i) Which of these causes can be prevented by vaccination?

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

Almost all candidates correctly identified viral disease as the correct answer.

Question 4 (c) (ii)

(ii) Different types of disease can interact.
Explain what this statement means.

.....

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

This question proved a difficult question for candidates to express their understanding of this concept. However, there were some examples of very clearly worded answers, and some candidates used an example. e.g. sickle cell disease reducing the chance of malaria, to convey their understanding of disease interaction, which was fantastic to see.

Question 5 (a)

5 **(a)** Complete the sentences to explain how individuals in the same family can have different phenotypes.

Use words from the list.

alleles	**chromosomes**	**DNA**	**gene**	**genomics**
genotype	**mutations**	**phenotype**	**protein**	**variants**

..... are long molecules of DNA that store genetic information.

A ..... is a small section of this DNA.

You inherit two copies of a gene, one from your father and one from your mother. These

different copies are called ..... .

There can be many different versions of a gene, which are referred to as genetic

..... .

A ..... is the collection of alleles that an individual has.

An individual's ..... is the result of their genotype interacting with the environment.

[5]

Candidates performed well on this question, demonstrating their clear understanding of genetic terms. with very few scoring less than 3 marks and many being given 5.

Question 5 (b)

(b) Genes code for proteins that are made by cells.

Put sentences **A–D** in the correct order to describe protein synthesis.

A mRNA leaves the nucleus.

B mRNA enters the cytoplasm and joins to a ribosome.

C The ribosome 'reads' the mRNA and joins the amino acids together in the right order.

D The gene is copied and mRNA is formed.

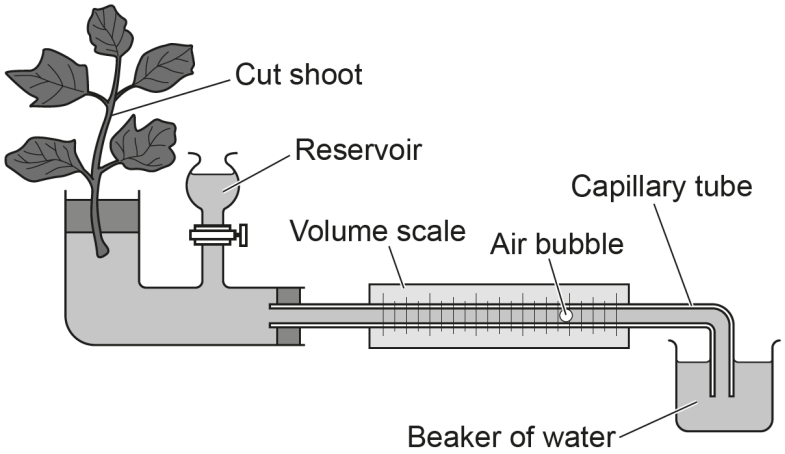
[2]

This question was also answered well, with the vast majority gaining both marks.

Question 6 (a)

6 Kai is investigating transpiration in plants. He sets up a potometer, as shown in the diagram.

Kai fills the potometer with water, then inserts a cut shoot and checks that none of the apparatus is leaking.



(a) Describe how Kai can use the potometer he has set up to investigate the rate of transpiration in a plant.

.....

.....

.....

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

Candidates found this question more challenging. To gain both marks we were looking for the idea that both time and distance that the air bubbled travelled were measured. Candidates could present this in a variety of forms, the idea that the time taken for the air bubble to move a set distance was given both marks, as was the distance travelled by the air bubble in a set time. Less than half of the candidates were given 2 marks. Candidates appeared a little muddled or unfamiliar with the practical apparatus and what it was measuring, confusing it with an experiment used to investigate the rate of photosynthesis, with many stating the number of air bubbles released should be counted.

Question 6 (b)

(b) Kai wants to compare the rate of transpiration in cut shoots from **two** species of plant.

He uses the potometer to investigate one of the species, and then repeats the experiment with the other.

State **three** variables that Kai should control with the plant shoots so that he can compare the results from the two species.

Variable 1 .....

.....

Variable 2 .....

.....

Variable 3 .....

.....

[3]

This question also proved more challenging, with few candidates being given more than 1 mark. The mark that candidates gained marks for, was mainly for the identification of an external environmental factor that needed to be controlled. Only 1 mark was available for such factors, and many candidates gave three examples of external factors, temperature, wind and light intensity. It is important that candidates pick up on the information given in the stem of the question. This question asks candidates to think about what to control 'with the plant shoots', those candidates that paid attention to this generally scored at least 2 marks, as they made reference to the size of the shoot or the number of leaves.

Assessment for learning

Very few candidates acknowledged that the size of the leaves would be an important variable to control in this investigation. Larger leaves are more likely to have more stomata and therefore a higher transpiration rate. This could be a good topic to discuss with candidates and may make them think more deeply about the variables to control in such investigations.

Question 6 (c)

(c) Kai finds that the rate of transpiration is different for the two species.

He thinks this could be due to a difference in the number of stomata on the leaves of the two species. He prepares two slides to investigate this.

Describe how Kai can use a microscope to work out the number of stomata per cm^2 on the leaves of the two plant species.

.....

.....

.....

.....

.....

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

Candidates did not perform very well on this question for two reasons. In the first instance many candidates did not appear to read the question carefully enough and discussed at length (and correctly) how to prepare the slide needed, they did not pick up on the sentence which tells them that Kai has prepared the slides.

The second reason for poor performance was down to a lack of precision when describing how to use a light microscope. Candidates often stated that the slide should be placed on the microscope, rather than the stage, they referred to a magnification or a higher magnification, rather than naming the objective lens and they simply stated focus the microscope without making reference to the use of the coarse (or fine) focussing knob.

Those that did describe how to set up the microscope correctly often did not know how to use the microscope to obtain the data that they needed to work out stomatal density. As a result, very few candidates were given 3 marks.

Question 7 (a) (i)

7 (a) **Fig. 7.1** shows the structure of the brain.
Three areas of the brain have been labelled **A**, **B** and **C**.

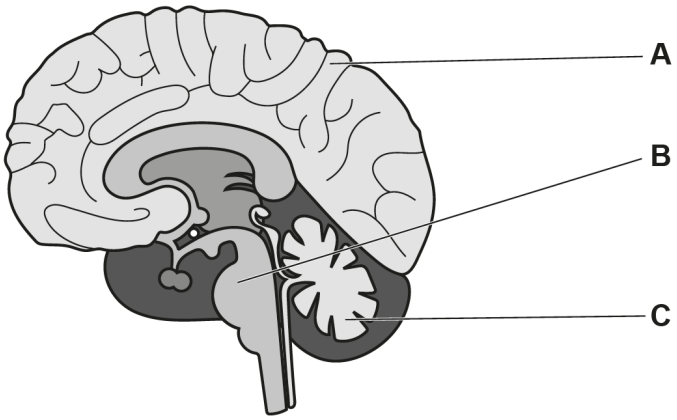


Fig. 7.1

(i) Draw lines to connect each **labelled** part of the brain to its **name** and **function**.

Label	Name	Function
A	Cerebellum	Conscious movement
B	Brain stem	Intelligence, memory, and language
C	Cerebral cortex	Regulation of heart and breathing rate

[3]

A range of marks was given for this question. Those candidates that were given 2 marks usually gained those marks for correctly identifying the parts of the brain on the diagram and one function.

Question 7 (a) (ii)

(ii) Name **two** additional parts of the brain **and** state their functions.

1 .....

.....

2 .....

.....

[2]

In this question candidates needed to name two extra parts of the brain (parts that had not been referred to in the previous question) and to state their function. The two parts of the brain that are outlined in the specification that candidates should be familiar with are the hypothalamus and the pituitary gland. This proved a little more demanding and was rarely given 2 marks. There were many vague answers provided by candidates when trying to describe the function of these parts, for example, the pituitary gland releases hormones, or the hypothalamus detects temperature. There were many incorrect responses observed for example many referred to the CNS and neurons. Centres are encouraged to spend more time on this topic.

Question 7 (b)

Dementia is a term used to describe a decline in mental ability.

Fig. 7.2 shows the number of people diagnosed with dementia in the UK.

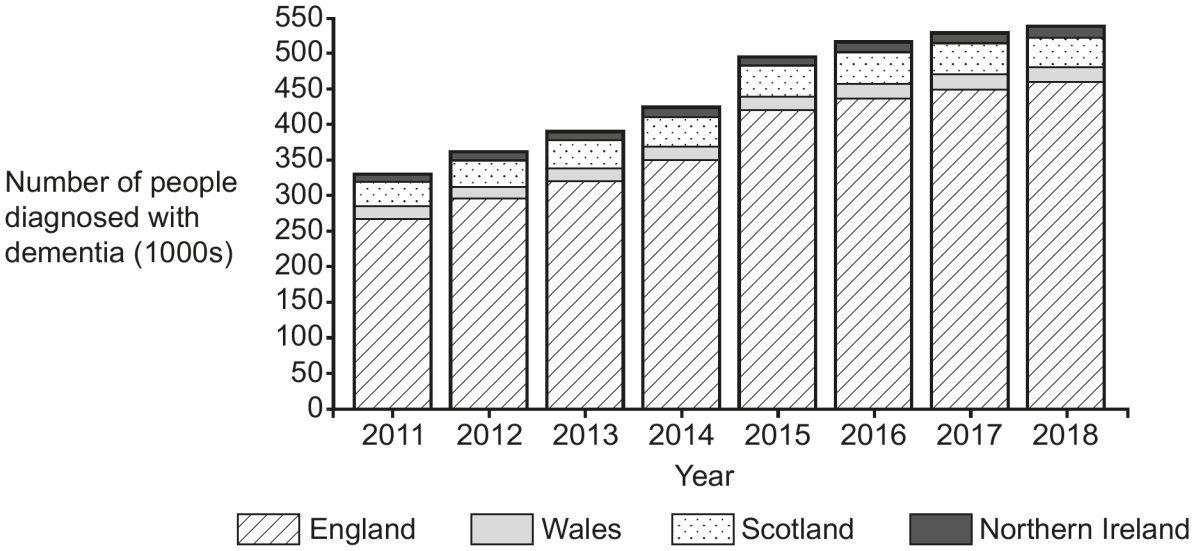


Fig. 7.2

(b) State **two** conclusions that can be drawn from the data in **Fig. 7.2**.

1 .....

.....

2 .....

.....

[2]

Candidates performed well on this question. Correctly analysing the data and drawing two conclusions. The two most common correct conclusion observed was for identifying that the number of people with dementia has increased over time and that the highest number of cases were observed in England. The most common error observed was candidates stating that Northern Ireland had the highest number pf cases, these candidates had not recognised that Northern Ireland was only represented by the top segment of the bar.

Question 7 (c) (i)

(c) Alzheimer's is a form of dementia. Alzheimer's is caused by a build-up of proteins around the cells in the brain.

(i) What name is given to the cells found in the brain?

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

A surprising number of candidates (just over half) got the answer to this question wrong. Common errors included brain cells or nerve cells.

Question 7 (c) (ii)

(ii) What is the role of a transmitter substance?

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

Very few candidates were given the mark for this question. There were a lot of very vague answers referring to transmitting the impulse or signal. The higher achieving candidates described the transmitter as being responsible for enabling electrical impulses to pass from neuron to neuron, or to diffuse across a synapse.

Question 7 (c) (iii)

(iii) The level of transmitter substance released by brain cells is lower in people with Alzheimer's.

Suggest how this could affect the person with Alzheimer's.

.....

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

Candidates came up with a diverse range of suggestions for this question. It was good to see them engaging well with the context and thinking about the impact a lower level of transmitter substance could have on a person with Alzheimer's.

Question 7 (c) (iv)

(iv) Scientists are investigating the use of stem cells to treat Alzheimer's disease.

They implanted human stem cells into the brains of mice.

They observed changes in the mice 4 weeks after transplant and 16 weeks after transplant. They found that the mice had improved brain function.

Suggest what the scientists should do next in this research.
Explain your suggestions.

.....

.....

.....

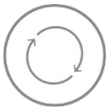
.....

.....

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

Candidates engaged well with this question and provided some interesting answers. Very few candidates picked up on the information that was given in the stem of the question. They did not consider whether 16 weeks was a long enough duration to know if the changes observed were long lasting. Very few candidates suggested extending the length of the study to make further observations. Many candidates thought it would be best to move the research on and either trial the implantation of stem cells on other animals, such as rabbits or primates, or in some cases they thought moving straight to clinical trials would be the next appropriate step. Some candidates made reference to trialling this technique on patients for Alzheimer's, this did not gain marks, unless a prior stage in drug trials had first been described. Candidates were very good at expressing their reasons for their suggestions. Some candidates unfortunately went back to human cell culture tests without realising that these should have already been carried out.

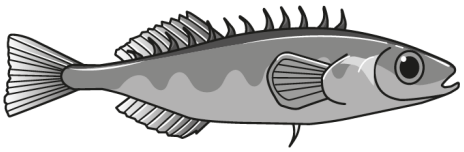
Assessment for learning



Questions like this provide an opportunity for future cohorts to assess the information presented. Encourage candidates to critique the original study, before moving into the realms of testing on humans.

Question 8 (a) (i)

8 The diagram shows a stickleback fish. At the end of the last ice age, stickleback fish were trapped in a lake in Iceland.



The environment in different parts of the lake varies. Some areas are deep and have a lot of vegetation, other areas are shallow and there are cracks in the rocks.

Over time this species of fish has evolved to become two different subspecies.

A subspecies is a smaller group within a species. A subspecies has small differences from other members of the same species.

(a) (i) What caused the fish in the lake to evolve into two different subspecies?

.....

.....

.....

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

Candidates engaged well with this question. There were some examples of excellent answers where candidates expressed their understanding very well, describing how individuals must have become isolated in the two different environments, some even referring to geographical and reproductive isolation and that because the environments were different, that this would drive the change observed. Some candidates did mention mutations, but rarely observed the fact that mutations occurring in individuals in the different environments would be different. Some candidates did not appreciate that these fish now belonged to subspecies and thought that they were different species.

Question 8 (a) (ii)

(ii) Describe how evolution occurs.

.....

.....

.....

.....

.....

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

There were some very good responses to this question that were logically sequenced. Many candidates identified that mutations could arise and that these could provide a survival advantage to individuals. Some high achieving candidates then went on to explain that this mutation (or allele) would be passed on to future generations. Few candidates referred to genetic variants, despite this being the term named on the specification. Many candidates referred to genes being passed on and this was insufficient for the mark, we needed explicit reverence to the genetic variants, alleles, or mutations.

Some candidates discussed examples of evolution, giraffes getting longer necks to reach more food was seen on occasion, this did not gain any marks. Some candidates referred to the species being better suited to an environment rather than an individual(s).

Misconception

One common error that was observed frequently was candidates suggesting that individuals adapted to their environment, suggesting that they changed to suit their environment, rather than the idea that the differences in individuals (or random genetic mutations) resulted in individuals that were better suited to the environment. This could be in part, a result of a difficulty in expressing their understanding, or potentially a misconception.

Exemplar 1

A genetic variant arises in an animal. This animal has an advantage that allows it to outcompete its competitors for resources such as food and water. This animal lives longer than its competitors and then reproduces more as it survived longer. Its offspring may get inherited the variant and they did, the process repeats for thousand or millions of years until the variant is common in the population of that species. [3]

An example of a very good response. Clear and logically sequenced. Correct terminology used throughout.

Question 8 (a) (iii)

(iii) How could scientists show that the stickleback fish are subspecies and not different species?

.....

.....

.....

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

There were two potential routes that candidates could take to answer this question. The candidates that were given both marks generally chose to discuss the breeding of two individuals (one from each subspecies) to see if they produced fertile offspring. Candidates that considered DNA as a tool for determining if the subspecies were indeed subspecies rather than different species generally only scored 1 mark, predominantly for discussing the idea that they could compare the similarities in the DNA. Very few candidates referred to DNA or genome sequencing.

Some candidates seemed confused by the question and answered it as if one (or both) of the subspecies was no longer alive, discussing fossil records and ancestors.

A relatively high percentage of candidates were not given marks for this question.

Question 8 (b)

(b) Fish form a large part of the diet of Icelandic people.
Some fish contain high levels of oils. Oils are fats.

What are the **two** components that make up a fat?

1 .....

2 .....

[1]

Surprisingly this question was not answered very well. Very few candidates knew that a fat is made of fatty acids and glycerol. There were a wide range of incorrect answers observed, with varying combinations of the biological molecules that are on specification or their component parts. Interestingly many candidates stated lipids as one of the components.

Question 9 (a)

9 Elephants live in a habitat where temperatures can get extremely high.

(a) Which statement explains why elephants find it difficult to regulate their body temperature?

Tick (✓) **one** box.

Elephants have a fast heart rate. ☐

Elephants have a large surface area to volume ratio. ☐

Elephants have a small surface area to volume ratio. ☐

Elephants move slowly. ☐

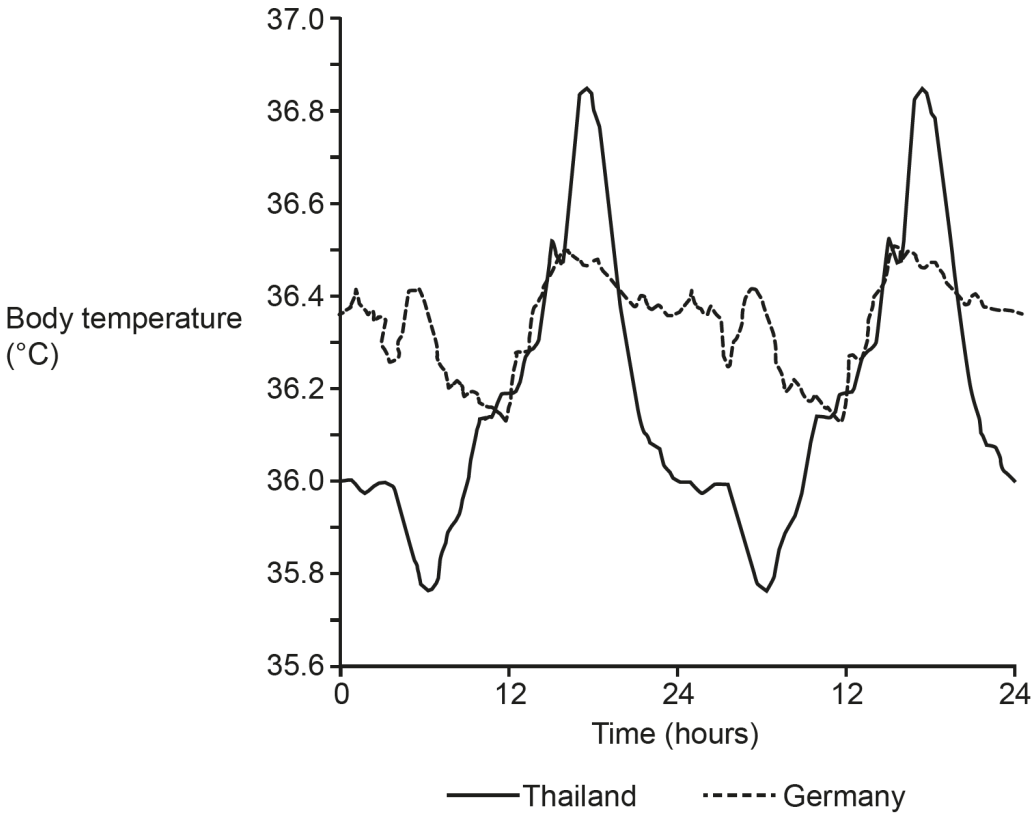
[1]

Elephants cope with these high temperatures using heterothermy.

This means the elephants do not regulate their body temperature during the daytime, so it increases in the sun.
The elephants regulate their body temperature back down to **below** normal overnight.

Scientists monitored the temperature of elephants in a zoo in Germany and in Thailand to see if they used heterothermy to regulate their body temperature.

The graph shows the scientists' data.



Roughly half of all candidates answered this multiple-choice question correctly. The most common incorrect response was 'elephants have a large surface area to volume ratio'.

Question 9 (b)

(b) The normal body temperature of an elephant is 35.9 °C.

Does the graph provide evidence for heterothermy in elephants? Explain your answer.

.....

.....

.....

.....

.....

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

This concept and context in this question is very unfamiliar to candidates and differentiated well. Some candidates wrote very impressive answers demonstrating that not only could they engage with the context and the data, but they could critically analyse the data. Some candidates chose just to focus on elephants from one country and based their evidence on this, using data quotes to effectively communicate their points. Other candidates took a more balanced approach discussing how elephants in Thailand showed evidence for heterothermy, but elephants in Germany did not, using the data to clearly explain why.

Some candidates narrowly missed out on marks for being too general with their comments, for example saying the temperature went up and down, without focussing on the normal temperature of an elephant and whether the temperature dropped below this temperature at any point.

Some candidates did not assign their statements to a particular country, when Thailand or Germany were not explicitly mentioned in their answer, we were unable to give marks, as we did not know which data they were using.

Exemplar 2

It provides evidence that elephants in Thailand use heterothermy as their body temperature during the day increases to a peak of T[illegible]≈36.845°C and it decreases during the night to below the normal of 35.9°C. However in Germany this also happens but just on a smaller scale and at different times as it reaches a peak of ≈36.54°C at around [illegible] o'clock 14 hours and reaches a trough of ≈36.12°C at 12 hours the next day. So there is a change in body temperature but a less extreme one. Thailand supports heterothermy but more data may be needed as Germany doesn't fully support it as the temperature never drops below 35.9°C (the normal). [3]

Elephants have large ears which are very thin and have a good blood supply.

(i) Describe **one** method that both elephants and humans use to **regulate** their temperature.

An example of an excellent response. The candidate clearly analyses both sets of data to present a well thought out response.

Question 9 (c) (i)

(c) Elephants have large ears which are very thin and have a good blood supply.

(i) Describe **one** method that both elephants and humans use to **regulate** their temperature.

.....

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

Very few candidates were given both marks for this question. Candidates were often able to name a method used but could not explain how it regulated temperature. The stem of the question should have led candidates to choose vasoconstriction or vasodilation, which many did, but candidate understanding of how this either assists with cooling or retaining heat was poor. Many candidates appeared to have a misconception that the blood vessels 'rose to the surface of the skin' or that 'the heat evaporates'.

Candidates that selected sweating were more likely to gain both marks, as they discussed evaporation. Although elephants do not actually sweat much, candidates would not be expected to know that, so they were given marks for that suggestion.

Question 9 (c) (ii)

(ii) Describe how the human body **monitors** its temperature.

.....

.....

.....

.....

.....

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

This question wanted candidates to discuss monitoring temperature, to include the role of receptors (in the skin and the hypothalamus), what they detect (external temperature or blood temperature) and how the hypothalamus acts as a control centre/coordinator. Very few candidates answered this question correctly with many scoring no marks. The responses to this question were a good example of candidates latching onto a topic and rather than dissecting the question carefully, writing at length about something the question had not asked. Many candidates talked at length (and often accurately) about the mechanisms employed by the body to change temperature and therefore were given no marks.

Centres should remind candidates that words that are emboldened are important and that we are drawing their attention to their importance.

Exemplar 3

The hypothalamus in the brain regulates brain and body temperature as it contains receptors that detect the blood temperature surrounding the brain. To cool down, the body sweats, using water evaporation to cool the skin, erector muscles in hair lie flat, and the blood vessels experience vasodilation. To cool down, the blood vessels [3]

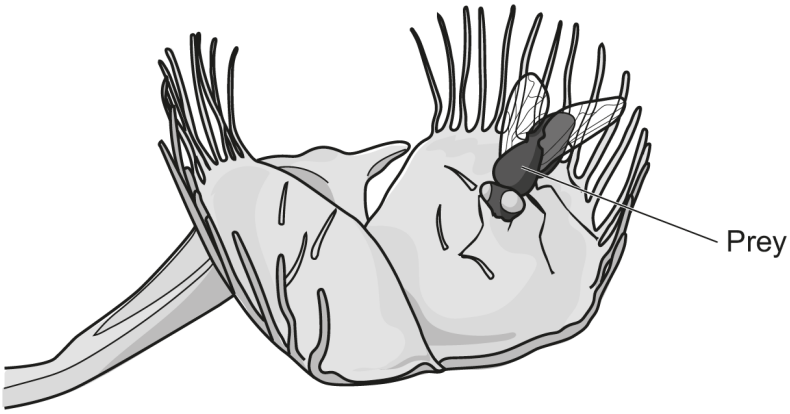
experience vasoconstriction, where the blood vessels move away from the skin to insulate blood and stop heat loss, and the erector muscles in hair stand up to create an insulating layer of warm air next to the skin.

An example of one of the more focused responses, which considers monitoring, although this candidate also continues to discuss mechanism to change body temperature, which gains no marks.

Question 10 (a)

10 Venus fly traps, shown in the diagram, are carnivorous plants.

They attract prey using nectar. When prey land on the leaves, they touch hairs and this triggers the leaves to close and lock.



The prey contains different biological molecules that need to be broken down so that they can be absorbed by the plant.

The Venus fly trap secretes enzymes to digest the prey.

(a) Use ideas of the lock and key model to describe how the enzymes break down different biological molecules found in the prey so they can be absorbed.

.....

.....

.....

.....

.....

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

This question tested candidates understanding of enzyme action in a novel way. This question differentiated well, higher achieving candidates were more likely to be given 2 or 3 marks. Some candidates clearly understood enzyme action, they could apply their knowledge to a new context and recognised that the biological molecules were the substrate. The mark point that was given most often was for recognising that a substrate fits into an enzymes active site.

There was certainly some confusion with terminology for many candidates, some thought the enzyme fitted into the substrates active site, others just did not mention active site at all and discussed the enzyme and substrate binding.

Very few candidates discussed that the result of this enzyme activity would be biological molecules that would have been broken down, into smaller molecules that could be easily absorbed.

Question 10 (b)

(b) Explain why several types of enzymes are secreted by the plant.

.....

.....

.....

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

Candidates found it difficult to express themselves in this question. We often got the impression that they had the right idea but did not know how to write about it. The most common mark given for this question was for the idea of specificity. Candidates did appear to understand that enzymes work with specific substrates.

Question 10 (c)

(c) The Venus fly trap evolved to live in damp soil that is low in nitrogen and phosphorus.

Complete the sentences describing why plants require nitrogen and phosphorus.

Put a (ring) around the correct answer.

Nitrogen is needed by plants to make **fats / glucose / protein**.

Phosphorus is needed by the plants to make **DNA / glucose / starch**.

[2]

This question most definitely made candidates think. The most common incorrect answers observed was nitrogen being linked to glucose and phosphorous being linked to protein.

Question 10 (d)

(d) Venus fly traps use the glucose produced in photosynthesis for aerobic cellular respiration.

Give the balanced symbol equation for aerobic cellular respiration.

..... + ... ⟶ ..... + ... **[2]**

Unfortunately, some candidates incorrectly selected the photosynthesis equation.

Generally, if the correct equation was selected, the candidates also knew how to balance it.

Question 10 (e)

(e) Venus fly traps produce flowers which are pollinated.

Name this type of reproduction **and** give one advantage of reproducing in this way.

Type of reproduction .....

.....

Advantage .....

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

A very high number of candidates did not score any marks on this question. Many incorrectly selected asexual reproduction as the type of reproduction, often this was accompanied by a correct advantage of this method of reproducing, but this meant no marks were given. Some candidates that did correctly state sexual reproduction as the method, narrowly missed out on mark 2 as instead of stating it increases genetic variation, they simply stated that there would be more variation in the offspring.

Question 11 (a)

11 Scientists have used genes from jellyfish to genetically engineer Zebra fish to glow in the dark.

(a) Describe how the scientists genetically modify the Zebra fish eggs.

.....

.....

.....

.....

.....

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

This was the final question on the paper, and it was challenging. Many candidates did have a good attempt at this question and were given some marks, but we did not observe large numbers of candidates being given 2 or 3 marks. There were many muddled answers seen, suggesting that this is a topic that candidates have found difficult to understand, the added addition of a context unfamiliar to them meant that this was difficult, and it did differentiate well. One suggestion for centres would be advised to focus on when teaching this topic is vectors, many candidates referred to plasmids rather than a vector, and others did not seem to know the purpose of a vector.

Question 11 (b)

(b) The Zebra fish were modified because their embryos are very sensitive to water pollutants. When water pollutants are present, the fish glow.

Suggest how scientists use Zebra fish to determine if an area of water is polluted **and** describe one limitation of this method.

Method .....

.....

Limitation .....

.....

[2]

Candidates engaged well with this question with a high proportion being given at least 1 mark. Candidates thought sensibly about why this method may not work, discussing the idea that you would not know what the pollutant was or its concentration. It was good to see such thoughtful answers. The candidates that scored 1 mark often did not state in the method that they would need to observe the fish glowing or discussed the idea that the fish would be harmed as a limitation, which did not gain marks.

Question 11 (c) (i)

(c) Oestrogen is an example of a pollutant that can be detected by the Zebra fish.

(i) Describe **two** roles that oestrogen has in the human body.

Role 1 .....

Role 2 .....

[2]

Candidates found this question rather challenging and it would appear that they do not have a good understanding of the role of oestrogen. Incorrect responses included oestrogen causes the loss of the uterine lining, it is responsible for ovulation, or the idea that it controls the menstrual cycle.

Question 11 (c) (ii)

(ii) Suggest why oestrogen may be found in rivers and oceans.

.....

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

There were many different suggestions put forward by candidates for the reason why oestrogen may be found in water. Some incorrectly thought it was present in fertilisers, but others correctly suggested that it could be in the urine of organisms, part of human sewage or even in discarded contraceptive tablets.

Question 11 (d)

(d) The genetically engineered Zebra fish are now sold as pets that glow under UV light.

Suggest why this concerns some scientists.

.....

.....

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

Many candidates put forward the ethical argument, and some thought the UV light could potentially be harmful to the fish. There were some excellent answers that considered the effect on the ecosystem and the potential for gene flow to occur.

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