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GCSE (9-1)

*Examiners' report*

# TWENTY FIRST CENTURY BIOLOGY B

**J257**
For first teaching in 2016

## J257/03 Summer 2018 series

Version 1

# 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. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

# Paper J257/03 series overview

J257/03 is one of the two examination components for the new revised GCESE 9-1 examination for GCSE Biology B. This component covers the whole of the specification using many short answer response questions to allow broad coverage of the seven chapters. One question can examine several chapters within that question. Questions require candidates to recall knowledge from the specification, work synoptically, apply their knowledge to unfamiliar contexts as well as show their ability to plan and analyse practical information. To do well on this paper, candidates need to be comfortable applying their knowledge and understanding to unfamiliar contexts across the full specification, to be familiar with a range of practical techniques and Ideas about Science.

J257/03 has a greater emphasis on the recall of knowledge than J257/04 and has less application based and analysis questions than J257/04. There are also less practical based questions and no level of response questions on this paper.

## *Candidate performance overview*

Candidates who did well on this paper generally did the following.

- Applied knowledge and understanding to questions set in a novel context.
- Were concise in their explanations, using key terminology.
- Were able to analyse data provided in a variety of different formats to form reasoned conclusions or suggest explanations. They were also able to clearly justify their answers.
- Worked synoptically.

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

- Found it difficult to apply what they had learnt to unfamiliar situations.
- Produced responses that lacked key terminology, and sometimes simply repeated information provided e.g. 5d, 6bi.
- Found the questions containing content from the emboldened statements in the specification particularly challenging e.g. 5d, 6bi, 6bii, 8a.
- Struggled to recall and apply practical activities.
- Struggled to analyse information e.g. 5ci.

| *Aspects tackled well by the majority* | *Areas for centres to focus on* |
|---|---|
| • Maths – use of ratio and percentage and understanding probability, correct use of significant figures, interconversion of units.<br>• Analysis of data to identify trends.<br>• Able to assess risk and explain a willingness to accept risk.<br>• Understood reasons for communicating with a range of audiences.<br>• Understood the terminology associated with genetic crosses and were able to apply their knowledge to unfamiliar crosses.<br>• Showed a good understanding of communicable diseases, how they are spread and how this could be prevented.<br>• Showed a good understanding of the causes of cancer and risk factors. | • Encourage candidates to become familiar and confident in translating data from one form to another.<br>• Recognise practical based questions and apply their knowledge to the planning of experiments to include control of variables (Q 2a and Q4aiii).<br>• Constructing answers that justify decisions – particularly with reference to genetic engineering (Q 6biv).<br>• Key terminology used in describing treatment using monoclonal antibodies, protein synthesis, effect of mutations on protein structure and genetic engineering.<br>• Providing opportunities for candidates to work synoptically within questions to increase confidence when tackling these questions. |

There was no evidence that any time constraints had led to a candidate underperforming. The vast majority of candidates tackled every question and the omit levels were very low for this paper suggesting candidates were able to access the questions and, on the whole, had been well prepared for the paper.

## Question 1(a)(i)

**1** The Galapagos Islands are a group of 13 islands found in the Pacific Ocean.

**(a)** Charles Darwin visited the Galapagos Islands during the 19th century.

He collected samples and made observations.

This work helped Darwin to develop a new explanation for the evolution of species.

**(i)** Which of the following are observations made by Darwin?

Tick (✓) **two** boxes.

- There are differences between fossils and living examples of similar organisms. ☐
- Pea plants with red flowers can produce offspring with white flowers. ☐
- There is usually extensive variation within a population of a species. ☐
- Some bacteria have become resistant to antibiotics. ☐
- Isolated populations of the same species living in different places have different characteristics. ☐

**[2]**

## Question 1(a)(ii)

**(ii)** Darwin suggested a theory to explain his observations.

Write down the name of the theory he suggested.

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

Question (a) (i) and (a) (ii) tested candidate knowledge of the work carried out by Darwin in the development of his theory of evolution by natural selection. A common error in (a) (i) was the selection of the statement 'There is usually extensive variation within a population of a species'. In (a) (ii) candidates often only used the stem of the question to state the theory was evolution, rather than natural selection.

## Question 1(b)(i)

**(b)** Algae live in the marine environment around the Galapagos Islands.

Photosynthesis takes place in the cells of algae.

**(i)** In which cell structure does photosynthesis take place?

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

**(ii)** Many factors can limit the rate of photosynthesis.

Which factor will **not** limit the rate of photosynthesis in the algae?

Put a (ring) around the correct answer.

**carbon dioxide concentration** **light intensity** **temperature** **water availability**

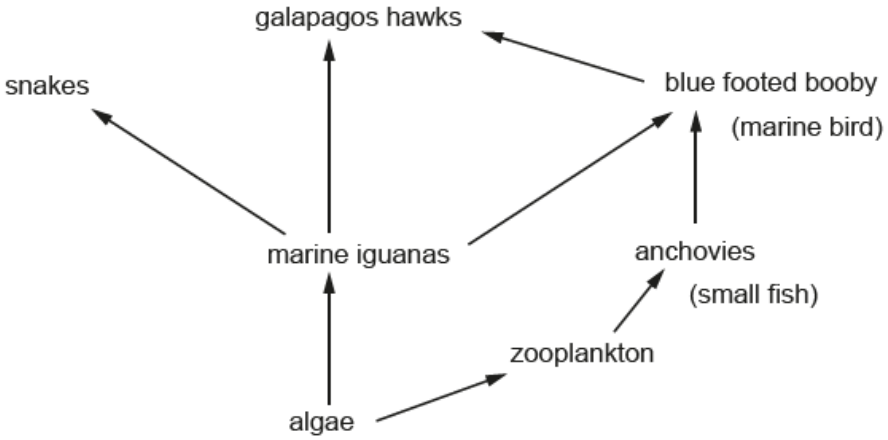
**[1]**

## Question 1(b)(ii)

Question 1 (b) (i) and (b) (ii) tested candidate knowledge of elements of photosynthesis. Many candidates correctly identified the chloroplast as the correct structure in (b) (i), some candidates thought this process took place in the mitochondria. Those that did not score in (b) (ii) often stated that temperature would not limit the rate of photosynthesis.

## Question 1(c)(i)

**(c)** The food web shows the feeding relationships of some Galapagos Islands species.




**(i)** A weather event called El Niño occurs every three years. This causes the population of algae to decrease.

Explain what effect this could have on the population of marine iguanas.

.....

.....

.....

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

It was pleasing to see that candidates were able to interpret food webs to consider the impact of events on the population of groups of species. The majority of candidates correctly stated that this event would result in the reduction in numbers of iguanas, some candidates did not score this mark for stating there would be no iguanas left. Many candidates took the idea of reduced numbers forward to explain that this resulted from a lack of food, or even in some cases an increase in competition for food. Those that lost this second mark generally did so for making absolute statements, for example, there will be **no food** left. Centres could help candidates to decode the questions more successfully by drawing their attention to the words used in the stem of the question, in this instance, the use of the word decrease when discussing the effect of El Nino on algae population should cue candidates into moving away from absolute statements. It is also worth using this as an opportunity to consider that the food web only shows some of the feeding relationships and how this therefore determines the answers that will therefore be acceptable.

## Question 1(c)(ii)

Scientists have discovered that during this event the marine iguanas can shrink in size.

**(ii)** The length of the marine iguana is determined by measuring the distance from the snout to the end of the tail.

Below is a drawing of a marine iguana.


Use the scale bar to calculate the actual length of this marine iguana in metres.

Length of marine iguana = ..... m **[2]**

## Question 1(c)(iii)

**(iii)** Some marine iguanas can shrink by up to 20% of their original length.

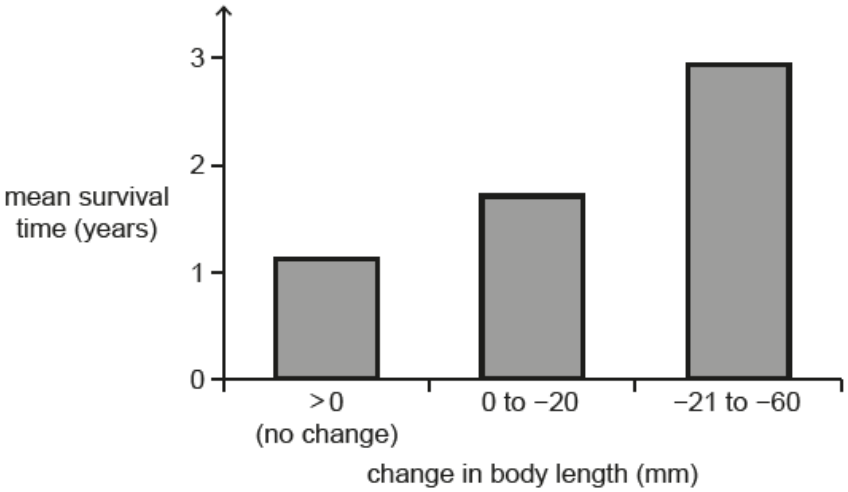
Calculate the length of this marine iguana after maximum shrinkage.

Length after maximum shrinkage = ..... m **[1]**

## Question 1(c)(iv)

Scientists calculated the change in body length of the iguanas and measured how long they survived during the El Niño event.

The results are shown in the graph.




**(iv)** What can be concluded from the data?

Tick (✓) **two** boxes.

- The marine iguanas that decreased in size the least survived longer. ☐
- The change in body length made no difference to the survival time of the marine iguanas. ☐
- The marine iguanas that decreased in size the most on average lived for a greater length of time. ☐
- The marine iguanas that did not decrease in size survived for approximately 2 years less than the marine iguanas that decreased in size by up to 60 mm. ☐
- The marine iguanas that decreased in size by 20 mm survived more than double the length of time than those that did not change in size. ☐

**[2]**

Questions 1(c)(ii), (iii) and (iv) were well answered by candidates. These were questions targeting maths skills and most candidates were credited some if not all the marks for these questions.

## Question 2(a)

**2** A student is carrying out a field investigation to determine the population of woodlice in the school's wildlife garden.

**(a)** Describe a method the student could use to determine the population size of woodlice.

.....

.....

.....

.....

.....

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

This question tested candidate's knowledge of and exposure to fieldwork activities. It required them to use their experiences and to apply their knowledge to a new and potentially unfamiliar situation. Ideally the method that would be used in this scenario would be mark- release -recapture and many candidates gave thorough and well thought out answers, describing clearly and concisely how this could be achieved. Those that opted for the quadrat route often did not score as highly, frequently missing out the need for placement of the quadrats to be random or that many quadrats would be needed. Some candidates missed out on marks for discussing the use of systematic sampling using line transects.

Regardless of the route taken, the marking point that was credited less frequently was the final point explaining how the data collected would allow the student to work out the population size.

Centres may find it helpful when teaching this area of the specification to present candidates with several examples of fieldwork that could be conducted to demonstrate the range of techniques used and consider the appropriateness of each technique in a number of different settings.

## Question 2(b)

**(b)** Woodlice are often found under logs and bark where it is damp.

Suggest why woodlice prefer damp places.

.....

.....

.....

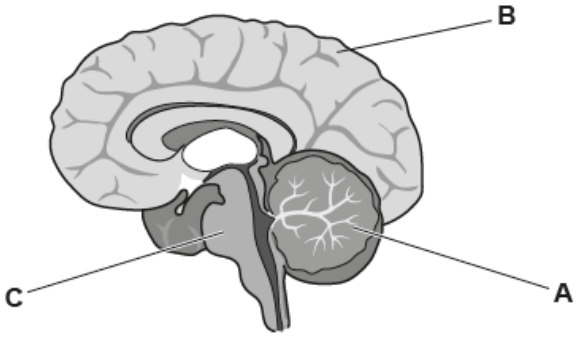
..... **[2]**

Candidates found this question difficult. Those that were credited marks generally made reference to food source availability. Very few considered that the woodlice may dry out.

## Question 3(a)(i)

3 Different areas of the brain are responsible for different functions.

Three areas have been labelled **A**, **B** and **C** on the diagram of the brain.




**(a) (i)** The table describes the functions of areas **A**, **B** and **C**.

Complete the table by writing the correct area of the brain for each function.

| Area of the brain | Function |
|---|---|
| | Responsible for conscious movement. |
| | Responsible for intelligence, memory, consciousness and language. |
| | Responsible for the regulation of heart rate and breathing rate. |

**[2]**

## Question 3(a)(ii)

**(ii)** Scientists want to find out more about the functions of the brain. One way they can do this is to use patients with brain damage.

Suggest why there are concerns about using patients with brain damage.

.....

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

## Question 3(a)(iii)

**(iii)** Write down **one other** way scientists could study the brain.

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

Questions 3 (a) (i), (ii) and (iii) were all focussed on the functions of the brain and how we are able to study these functions. Part (a) (i) should have been relatively straightforward but did cause candidates some difficulty with many only scoring 1 mark, often for correctly identifying B (cerebral cortex) as being responsible for intelligence, memory, consciousness and language. In part (a) (ii) most candidates scored a mark for either stating informed consent may not be possible or further damage could be caused. Ideally for Part (a) (iii) we were looking for the role of fMRI in imaging or electrical stimulation, however this was not seen as frequently as we would have liked. Centres should be encouraged to discuss the role of MRI in studying the brain. Candidates that did not gain credit on this question often suggested the use of animal brains or dissection of human brains.

## Question 3(b)

**(b)** The cerebral cortex is a highly folded area of the brain made up of billions of neurons.

Describe the features of a neuron that allow it to transmit electrical impulses quickly and over long distances.

.....

.....

.....

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

Few candidates gained both marks for this question. The fatty sheath was the answer that was seen most frequently. Many candidates did not to score the second mark for stating the neuron was long rather than the axon, this was unfortunate as the clearly did have an understanding of the structure of a neuron, but their answer lacked precision. Synapses and dendrites were often referred to, suggesting candidates did not read the question carefully.

## Question 3(c)(i)

**(c)** Parkinson's disease is a disease of the central nervous system.

It is caused by the loss of neurons in one part of the brain. These neurons are responsible for producing a transmitter substance called dopamine.

**(i)** Dopamine acts as a transmitter substance in parts of the brain and nervous system that control movement.

Which neurons are most likely to be affected by Parkinson's disease?

Tick (✓) **one** box.

- Relay neurons only. ☐
- Relay and motor neurons. ☐
- Sensory neurons only. ☐
- Sensory and motor neurons. ☐

**[1]**

## Question 3(c)(ii)

**(ii)** At a synapse, transmitter substances are released from the first neuron.

Which word describes how the transmitter substances move across the gap from the first neuron to the second neuron?

Tick (✓) **one** box.

- Active transport ☐
- Diffusion ☐
- Net movement ☐
- Osmosis ☐

**[1]**

When answered incorrectly, active transport was a common error.

## Question 3(c)(iii)

**(iii)** Scientists have been investigating the use of stem cells in the treatment of Parkinson's disease.

Suggest **one** feature of stem cells that makes them useful in the treatment of Parkinson's disease.

.....

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

This question was answered very well. Those that lost the mark did so for a description of an unspecialised cell, for example it can become any type of cell, or it can become a nerve cell rather than using the correct term(s), (unspecialised/undifferentiated or can specialise/differentiate).

## Question 4(a)(i)

**4** Plants respond to their environment.

**(a) (i)** What term is used to describe a plant's growth response to light?

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

## Question 4(a)(ii)

**(ii)** The growth response to light can be explained by the distribution of the plant hormone auxin in the plant shoot.

Jamal finds three diagrams that could explain what happens in the plant shoot.

**Key**

← direction of light

• auxin

Diagram **A**

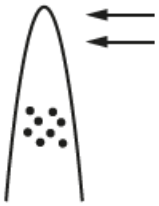


Diagram **B**

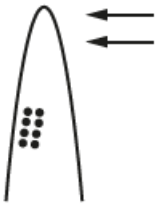
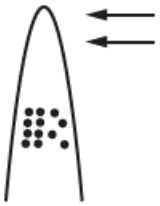


Diagram **C**



Which diagram, **A**, **B** or **C**, best explains what happens to make the plant shoot grow towards the light?

Explain your choice.

Diagram .....

Explanation .....

.....

.....

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

Candidates found this question one of the more difficult questions on the paper, with very few. The vast majority of candidates incorrectly identified diagram B as the showing the correct distribution of auxins. Candidates then explained that the auxin would move to the side of the shoot in the dark so this side would grow. They did not appreciate that there would still be auxin (less) on the side of the shoot in the light. Very few described the movement of the shoot as a result of greater cell elongation as a direct result of a greater concentration of auxin. This is certainly an area that centres should focus on and doing so will better prepare those candidates moving to study biology at a higher level.

## Question 4(a)(iii)

**(iii)** Jamal's teacher gives him two boxes of cress seedlings, each box contains ten seedlings.

Describe an experiment Jamal could do to investigate the growth response to light in the cress seedlings.

.....

.....

.....

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.....

.....

.....

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

This question tested candidates' ability to recall an experiment that they should be familiar with. Candidates found this question difficult with many presenting an answer which included mix of experiments that they had conducted and been taught about (foil caps and light boxes). Very few candidates went on to consider the importance of variables when describing an experiment that could be carried out. Centres should be encouraged to provide candidates with the opportunity to describe the practicals they have conducted during this course and to focus on variables that may need to be controlled.

## Question 4(b)

**(b)** A gardener is growing fruit. He wants to ripen his fruit quickly and decides to use the plant hormone gibberellin.

Do you agree with his choice of hormone?

Explain your answer.

.....

.....

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

## Question 4(c)

**(c)** Plants can be infected by communicable diseases, so they need to protect themselves against pathogens.

Describe **one** chemical defence and **one** physical defence that plants have against pathogens.

Chemical defence .....

Physical defence .....

**[2]**

Question 4 (b) and 4 (c) tested new content to the biology specification. Both questions did not score as well as may have been anticipated. In 4 (b) those candidates that realised the wrong hormone had been chosen either identified why it was the wrong hormone OR stated that ethene should be used. Very few candidates gave both parts to their answers. Candidates should be encouraged to look at the number of marks available for the question to help guide them to the number of points needed to gain full marks. In 4 (c) very few candidates gained both marks, those that did gain one mark often did so for stating a physical defence. Examples of chemical defences were seen less often.

## Question 4(d)

**(d)** State the function of stomata in plants.

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

Common errors seen in this question included water or sunlight entering the plant via the stomata.

## Question 5(a)(i)

**5** Cancer is a non-communicable disease.

**(a) (i)** Describe what causes cancer.

.....

.....

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

Most candidates scored well on this question, but it was noted that very few candidates referred to mitosis when stating 'uncontrollable cell division'. Terminology used could also be improved upon, many candidates used terms such as cells reproducing, replicating or duplicating rather than dividing. Those that did not score on this question often did so for referring to risk factors such as smoking or for referring to cell growth.

## Question 5(a)(iii)

**(iii)** In the past it has been estimated that 1 in 3 people will develop cancer in their lifetime.

Recent estimates suggest the ratio is 1 in 2.

The UK population is 65 640 000.

If the **recent estimate** is correct, how many people can be expected to develop cancer?

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

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

## Question 5(a)(iv)

**(iv)** Suggest why the figure calculated in **(a)(iii)** will be an estimation.

.....

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

Many candidates gained both marks for the calculation in 5 (a) (iii), those that did not score 2 marks generally scored 1 mark for either using the correct ratio (1 in 2) to determine the number or for using the wrong ratio (1 in 3) but presenting the number to two significant figures. Many candidates then utilised the idea that this number would be an estimate of the number of people who would develop cancer and took it through to 5 (a) (iv). It would be helpful if centres could discuss with candidates why figures such as this are an estimation as very few candidates suggested that there could be a change to risk factors. Those candidates that did attempt to answer this question in this way often missed the mark for stating there could be lifestyle changes without qualifying what this could be. Candidates were not given credit for this answer as only some lifestyle changes would affect numbers.

## Question 5(b)(i)

**(b)** Cancer of the ovaries is a common type of cancer. Most women diagnosed with cancer of the ovaries will have an operation to remove their ovaries.

**(i)** Before the operation, the doctor will discuss the risks of the operation with the patient. This is a high risk operation.

Suggest why a patient would decide to go ahead with this operation.

.....

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

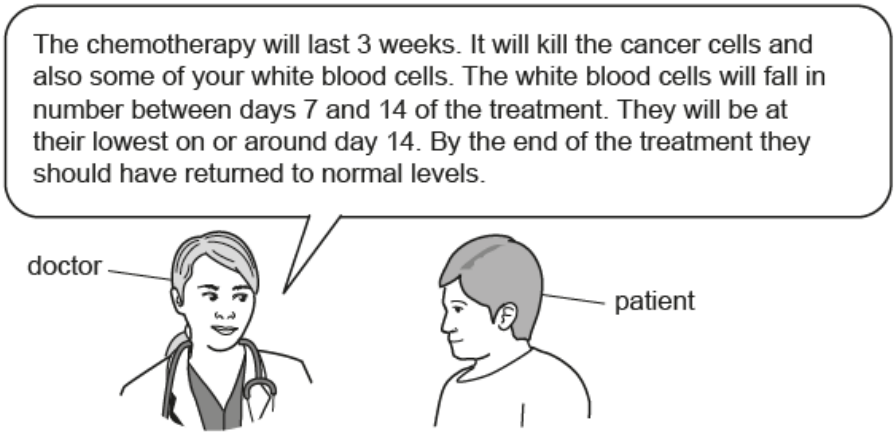
It was pleasing to see that very few candidates simply wrote 'benefits outweigh the risks' unqualified as has been seen all too frequently on previous specifications. Candidates used the context given to suggest a range of valid reasons why this operation would go ahead, demonstrating that they had engaged with the content of the question to formulate their answer.

## Question 5(b)(ii)

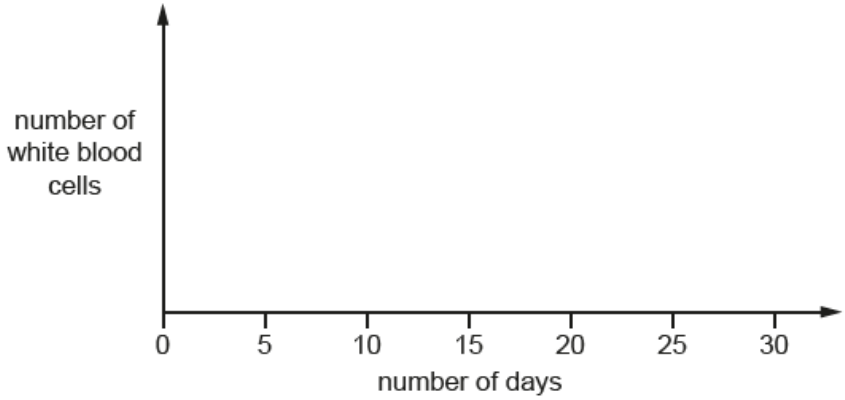
After surgery, the patient may have chemotherapy to kill any remaining cancer cells.

Chemotherapy also kills white blood cells.

A doctor describes this effect to the patient.




**(ii)** Draw a line graph on the axes below to show what happens to the number of white blood cells during each cycle of chemotherapy.




**[2]**

## Question 5(b)(iii)

**(iii)** During the chemotherapy treatment, the patient is advised to seek urgent medical attention if they become ill and have a raised temperature.

Suggest between which days the patient is most at risk of becoming ill.
Use data from the graph in your answer.

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

Question 5 (b) (ii) and 5 (b) (iii) required candidates to process a description given, translate this into graphical form and then use the information to suggest when an event was most likely to occur. Most candidates scored at least one mark for the graph, however, reports from examiners suggested that candidates' graphs were not carefully presented and candidates struggled to scale 7, 14 and 21 on the graph. This could in part be a result of candidates being less well prepared in the production of graphs which are not presented with actual data points to plot and candidates being less familiar with translating information in this way. Many candidates lost the mark on 5 (b) (iii) for the inclusion of day 7 in their answer.

## Question 5(b)(iv)

**(iv)** Why is a high temperature in the human body a problem?

.....

.....

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.....

.....

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

This question proved more difficult with a higher number of candidates failing to score or only scoring 1 mark. It was pleasing to see candidates making the link to enzymes in this question and stronger candidates were able to link enzymes to their use in chemical reactions within the human body. Some candidates gave good examples of reactions that require enzymes, such as respiration and digestion. Three marks was seen less frequently with many stating that all chemical reactions would stop. This question provides an opportunity to discuss the denaturation of enzymes as temperature increases and will encourage candidates to work synoptically.

Unfortunately, some candidates incorrectly discussed thermoregulation.

## Question 5(c)(i)

**(c)** New drugs and treatments have to go through rigorous clinical trials.

A clinical trial was conducted to see if using a particular combination of chemotherapy drugs increased survival rates for a type of cancer of the ovaries.

The two drug combinations being tested were:

- drugs 1 and 2
- drugs 3 and 4.

**(i)** The table shows some details of the clinical trial design.

Use your knowledge of clinical trials to justify each part of the design.

| Design | Justification |
|---|---|
| Only women took part in the trial. | |
| All women who took part in the trial had ovarian cancer. | |
| A placebo was not used. | |
| An open trial was conducted. | |

**[4]**

5 (c) (i) was designed to test not only candidates' knowledge of the key terms and stages of drug trials, but whether they understood why trials would use particular methods. Most candidates did score between 1-2 marks on this question, it was rare to see a candidate scoring 4 marks. Most candidates could correctly identify why only women would be used in this trial and why it would be necessary for them to have ovarian cancer to take part in this trial. Candidates clearly understood what a placebo was but did not fully understand why placebos are not used routinely in all drug trials. Very few candidates understood why an open trial would be used in such a trial, most answers for this part focussed on what an open trial was, and candidates did not seem to be aware of the reasons to use open trials when testing drugs such as this. Centres should be encouraged to develop candidates understanding of drug trials using case studies. Examples of drug trials can be readily found on the NHS website.

## Question 5(c)(ii)

The results of the trial are shown in the table.

| | Group A (Drugs 1 and 2) | Group B (Drugs 3 and 4) |
|---|---|---|
| Number of women who took part in the trial. | **305** | **314** |
| Number of women who were still alive two years after treatment. | **247** | **222** |
| Most severe side effects. | • A drop in total blood cell number<br>• Nerve damage<br>• Joint pain | • Loss of appetite<br>• Diarrhoea<br>• Feeling or being sick<br>• High temperature<br>• Low white blood cell number |

**(ii)** Use the information in the table to recommend which drug combination the doctors should use.

Justify your decision.

.....

.....

.....

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

This question asked candidates to weigh up the evidence presented to decide what drug combination they would recommend for the treatment of ovarian cancer. Candidates were able to gain credit for selecting either drug combination, provided, they could justify their decision. For those that selected Group A (Drugs 1 and 2) many candidates did not score a mark as their analysis of the data was too superficial. Many simply considered the differences in the number of deaths and simply stated that more or less patients died, without taking into consideration the sample sizes. To access this mark candidates needed to process the data as the different number of patients used in the two trials differed. Only those candidates that processed the data were able to score the first mark point for the idea of proportion or percentage survival rate being greater. Higher ability candidates calculated and stated the percentage survival rates within their answer. This question provides a good learning opportunity to demonstrate to for future cohorts how data may need further processing beyond the basic presentation.

An additional point worthy of note relates to candidates understanding of side effects. Many felt that because less side effects were observed in Group A, this would be a reason to use this drug combination. They did not consider the difference in the severity of the side effects.

## Question 5(c)(iii)

**(iii)** Explain why scientists should communicate findings such as these to a range of audiences.

.....

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

It was very pleasing to see a great variety of responses to this question. Candidates provided some excellent examples of reasons why scientific findings should be communicated to a wide range of audiences and it was refreshing to see candidates thinking out of the box, rather than answers that had been rote learned. Centres should be congratulated for preparing candidates to 'think' and apply their answers to the situations presented.

## Question 5(d)

**(d)** Scientists have been developing the use of monoclonal antibodies in cancer treatment.

Monoclonal antibodies specific to a cancer cell antigen are produced and are injected into the blood of a cancer patient.

Describe how monoclonal antibodies are used to treat cancer.

.....

.....

.....

.....

.....

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

The use of monoclonal antibodies in medicine is a new addition to the GCSE specification and candidates found this question difficult. Many candidates either misread or misunderstood what the question was asking and rather than describing how the monoclonal antibodies are used to treat cancer, instead, described how to make monoclonal antibodies. Those candidates that did recognise the science required often did not provide the level of detail required and did not include key terminology. Good examples of this would be the failure to explain that the antibodies bound to antigens on the cancer cell rather than the cancer cell itself and the uses of the phrase 'immune response' rather than indicating the role of the white blood cells. It was pleasing to see some candidates referring to the attachment of chemicals to the antibodies which would then be delivered to the cells requiring destruction.

## Question 6(a)(i)

**6** The female mosquito *Aedes aegypti* is responsible for the transmission of diseases such as Zika virus.

In May 2015, Zika virus was reported in Brazil and began to spread rapidly.

The mosquito feeds mainly on human blood. The virus is spread when a female *Aedes aegypti* mosquito bites an infected human and then bites an uninfected human.

**(a)** Zika virus is a communicable disease.

Visitors to Brazil in 2016 were concerned that they could become infected with the virus.

There is no vaccination for this virus.

**(i)** Explain what a communicable disease is and suggest how a visitor to Brazil could reduce the risk of becoming infected with Zika.

.....

.....

.....

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

## Question 6(a)(ii)

**(ii)** The first ever human case of Zika was discovered in Nigeria in 1954. The timeline below shows how Zika spread.

| 1954 | | 1977–78 | | 2007 | | 2013 | | 2015 |
|---|---|---|---|---|---|---|---|---|
| **Nigeria** | → | **Pakistan, Malaysia, Indonesia** | → | **Micronesia** | → | **French Polynesia** | → | **Brazil** |

The Zika virus can also be transmitted by sexual intercourse.

People were concerned that hosting the Olympic games in Brazil in 2016 would increase the spread of the virus to other countries.

Suggest how the virus could be spread to other countries **and** how this could be prevented.

.....

.....

.....

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

6 (a) (i) and 6 (a) (ii) tested candidates ability to apply their knowledge of communicable diseases to an unfamiliar context. Candidates engaged well with the context and processed the information provided well. For part (a) (i) most candidates gained at least 1 mark with many good suggestions for how to prevent the spread of the virus. When both marks were not credited, this was often for an incorrect description of a communicable disease. In 6 (a) (ii) it was pleasing to see candidates thinking about the information presented to give sensible suggestions to prevent the spread of this virus globally. The most common answer given was a suggestion of using condoms, though some did lose this mark for just stating contraception without qualification. There were also some good examples of other methods that could be used to minimise spread, such as preventing travel or testing/isolation of the infected. The majority of candidates did not gain the second mark for 6 (a) (ii) for failing to explicitly stating that the infected on return from Brazil could pass the virus on to **uninfected** individuals by sex.

## Question 6(b)(i)

**(b) (i)** The mosquito responsible for the spread of Zika has become resistant to some of the insecticides used to kill it.

Explain how a population of mosquitos could have become resistant to an insecticide.

.....

.....

.....

.....

.....

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

This question required candidates to be very precise when using terminology. Whilst many certainly had the right idea as to how the population would become resistant, they struggled to communicate this effectively. Many lost marks here for stating the mutation would be passed on, rather than stating the genetic variant that arose as a result of the mutation. This is certainly an area where centres could improve candidate use of terminology for future examinations.

## Question 6(b)(ii)

**(ii)** One way scientists tried to solve the problem was to make genetically engineered mosquitoes that had a 'kill switch' gene. This gene caused the mosquitoes' offspring to die.

Describe the steps a scientist would use when genetically engineering a mosquito to have the 'kill switch' gene.

.....

.....

.....

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

This question wanted candidates to state the main stages of the process of genetic engineering, but the context of the question elevated the demand and thus it presented as a challenging question. Those that did well on this question often scored the marks for isolating, removing and replicating the gene. Inserting the gene into the **'cells'** of the mosquito was seen only on occasion. Centres should be encouraged to discuss examples of genetic engineering in a variety of species as this will help prepare candidates for this type of question.

## Question 6(b)(iii)

**(iii)** The 'kill switch' gene codes for the production of a protein called tTAV.

The tTAV protein blocks the transcription of other genes essential for mosquito survival.

When breeding the mosquitos in the laboratory a chemical called tetracycline is used. Tetracycline binds to the tTAV protein and deactivates it.

Suggest why scientists use tetracycline when breeding the genetically engineered mosquitos.

.....

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

This was an abstract question requiring good skills of deduction and linking of ideas to work out why scientists would use the tetracycline when breeding genetically engineered mosquitos. Many did not appear to understand the role of the Tetracycline, were perhaps unfamiliar with the term transcription, or were unable to make the link to the need for those mosquitos used in the breeding process to survive.

## Question 6(b)(iv)

**(iv)** Scientists thought using genetically engineered mosquitos was a better solution than using insecticide.

Do you agree?

Explain your reasons.

.....

.....

.....

.....

.....

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

This question wanted candidates to consider the advantages and disadvantages of both genetic engineering and the use of insecticides. Most candidates agreed that genetic engineering was the better solution but very few candidates were able to explain why they thought this. Many began on the right lines, indicating that the insecticide would not be as effective due to resistance but did not take this forward to consider the wider impact that insecticides could have, such as affecting other species, or potential bioaccumulation. Those candidates that performed better on this question often did so for considering the benefits and drawbacks of using genetically engineered mosquitos.

## Question 7(a)(i)

**7** A gene affects whether people have dimples in their cheeks. There are different variants of this gene.

An individual with the dominant variant, D, of this gene will have dimples.

**(a)** Jack and his wife Nina both have dimples.

Their daughter Mia does not have dimples.

**(i)** Complete the table to show the genotype of each individual.

| Individual | Genotype |
|---|---|
| Jack | |
| Nina | |
| Mia | |

**[3]**

## Question 7(a)(ii)

**(ii)** Jack and Nina decide to have another child.

What is the probability that the second child will have dimples?

Use the Punnett square to show your working.

| | | |
|---|---|---|
| | | |
| | | |
| | | |

Probability that the child will have dimples = ..... **[2]**

## Question 7(b)

**(b)** Scientists consider this trait an 'irregular' dominant trait. This is because sometimes a person can have dimples but their children do not.

What could be responsible for this difference?

.....

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

On the whole this question was answered very well. With a large proportion of candidates gaining 5 or 6 marks for the entire question. The most common errors observed in 7(a) (ii) saw candidates stating the probability as 25% rather than 75%. 7 (b) was the question that proved more difficult, a common mistake was to state a parent, rather than both parents would be heterozygous

## Question 8(a)

**8** Amaya reads an article in a magazine which explains that genes code for the production of a taste receptor on the tongue.

Taste receptors are proteins.

**(a)** Complete the sentences to describe how a protein is made.

Use words from the list.

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

**amino acids** **bases** **DNA** **fatty acids** **gene**

**genetic variant** **mitochondrion** **mRNA** **protein** **ribosome**

A copy of the ..... is made from ..... .

This molecule travels to a ..... in the cytoplasm.

Here ..... are joined together to form a protein.

A mutation would create a ..... and therefore a different receptor.

**[4]**

Few candidates gained full marks on this question. The most common errors were seen in the first sentence. Very few candidates realised that it was a copy of the gene which was made from mRNA, many thought it was a copy of the DNA.

## Question 8(b)

**(b)** Scientists think that a mutation created the type of receptor that allows someone to taste a bitter substance.

Explain how a mutation could affect the structure of the receptor protein.

.....

.....

.....

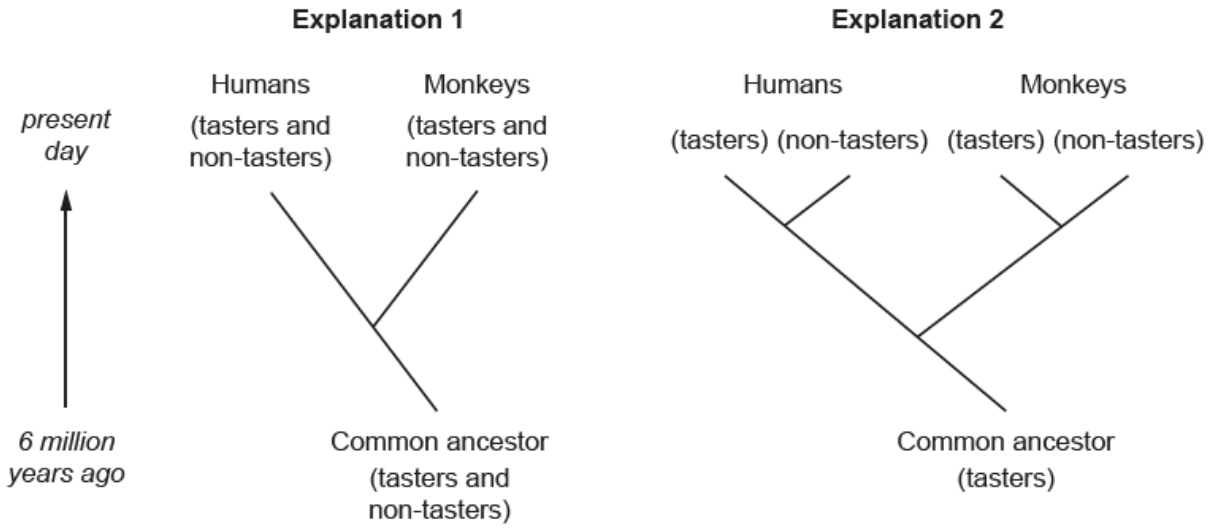
..... **[2]**

This question was aimed at a high level and was designed to test candidates understanding as to why mutations were problematic to protein structure. It was clear from the answers seen that many candidates did have an idea of how mutations affect structure, but their explanations were a little confused and lacked precision when using key terminology. It was pleasing to see that candidates had been taught how the base sequence could change as a result of a substitution, deletion or addition, unfortunately some candidates did not continue with the explanation to discuss the impact this would then have on the base sequence and consequently lost the first marking point. Many candidates incorrectly referred to the change in base sequence resulting in different amino acids being made.

## Question 8(c)

**(c)** Monkeys also have different variants of the gene that affects how they taste bitterness.

Scientists have proposed two explanations for how the non-tasting variants could have evolved in humans and monkeys.




Scientists have discovered that the non-tasting variants in humans and monkeys have different DNA sequences, even though they have the same effect.

Which explanation of how they evolved is most likely to be correct?

Explain your answer.

.....

.....

.....

.....

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

This was a very challenging question which required candidates to analyse a diagram and use some information to determine which explanation of the evolution of non-tasting variants was most likely to be correct. Those that did score on this question generally opted for explanation 2 as the most likely explanation, realising that either there were two separate mutations which gave rise to different DNA sequences or that the mutation must have occurred after speciation. Although few candidates gained credit for this question, it was good to see that the majority of candidates had the confidence to have a go at this very demanding question and in many cases came close to gaining a mark.

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