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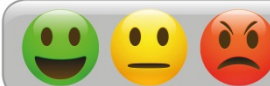
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Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

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

Paper 3 series overview

J257/03 is one of the two examination units for the new revised GCSE 9-1 examination for GCSE Biology B. This unit 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 demonstrate 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.
- Used key terminology well and were concise in their explanations.
- Were able to analyse data provided in different formats to form reasoned conclusions or suggest explanations.
- 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, e.g. Q10
- Produced responses that lacked key terminology, e.g. Q5(a), Q7(b)
- Found the questions containing content from the emboldened statements in the specification particularly challenging, e.g. Q6(d), Q11(c)
- Struggled to recall and apply practical activities, e.g. Q5(b)(i)
- Had difficulty with some key command words, such as describe.

Aspects tackled well by the majority	*Areas for centres to focus on*
• Maths – calculating percentage, understanding probability. • Used their knowledge of genetics and applying the skills learned to complete a genetic cross in an unfamiliar scenario. • Showed a good understanding of communicable diseases and were able to apply this to a new setting to reduce spread. • Showed a good understanding of the need to conserve species. • Could name and knew the stages of natural selection.	• Maths – use of percentage change, correct use of significant figures and correct use of the terms mean, mode and median. • Encourage candidates to become familiar and confident in translating data in detail. • Recognise practical based questions and apply their knowledge to an unfamiliar setting as in Q5 (b)(i). • Comparing anaerobic respiration in animal and yeast cells and how ATP is used. • Key terminology used in describing variation and the role of platelets. • Distinguishing between genetic testing and genome testing and their uses. • Providing opportunities for candidates to work synoptically within questions to increase confidence when tackling these questions.

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)

1 Reflexes help us to respond to stimuli. In a simple reflex, nerve impulses are passed along a pathway called a reflex arc.

The diagram in **Fig. 1.1** shows a reflex arc.
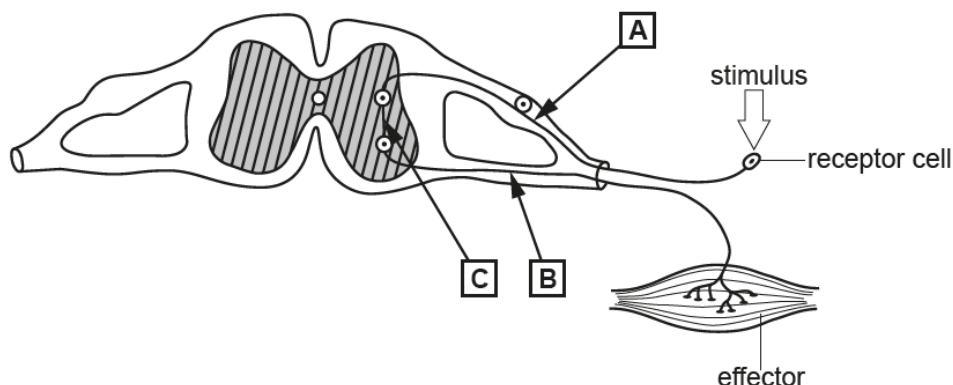
Fig. 1.1

(a) Name the structures labelled **A**, **B** and **C**.

	Name of structure
A	
B	
C	

[3]

Many candidates cored at least 1 mark for this question. A common answer identified structure A correctly as the sensory neuron but then incorrectly identified neurone B as the relay neuron and neuron C as the motor neuron. Candidates should be reminded to look closely at any visual material before deciding on their answer. A common incorrect answer for B was the central nervous system (CNS).

Question 1 (b)

(b) Write down **one** advantage of a reflex arc **not** involving the brain.

....

.... [1]

This question was answered well by most candidates. The majority of candidates correctly identified that it would be 'quicker or faster' than if the brain was involved. Some candidates stated that it would prevent damage. Those that did not score any credit on this question often identified the reflex arc as 'involuntary' or 'unconscious' but did not explain why this would be advantageous.

Question 1 (c) (i)

(c) Two students want to investigate reflex actions.

They set up an experiment as shown in **Fig. 1.2**.
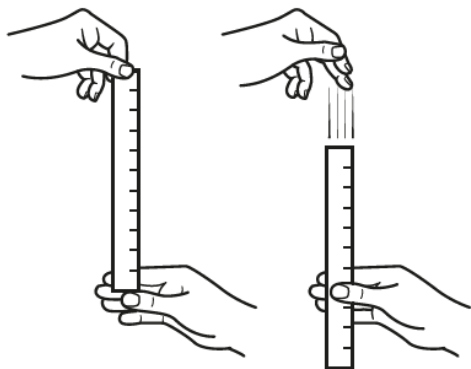
Fig. 1.2

Each student decides to use a different method.

*   Using a stop clock, student **A** measures the time it takes for the participant to catch the ruler.
*   Student **B** measures the distance the ruler falls through the participant's hand.

(i) Write down **one** reason why student **B's** method is better than student **A's**.

    ....

    .... **[1]**

Candidates who gained a mark in this question often stated that there would be an additional reaction time involved when student A pressed the stop clock. Others described the delayed response, for example 'the student will press the timer quick enough', which also gained a mark. Some candidates referred to this as human error, or made general comments such as 'it is more accurate' 'it is more precise' or 'it is more reliable' without any further clarification of what they meant by this and were not given the mark.

	OCR support	Centres are encouraged to tackle definitions, such as accuracy and precision, in relation to practical questions to make sure candidates have a firm understanding of these key scientific terms. There is a list with the key terms and definitions on the following link: https://www.ocr.org.uk/Images/467774-glossary-of-terms.doc

Question 1 (c) (ii)

(ii) Write down **two** variables that both students would need to keep the same.

1 ....

2 ....

[2]

The majority of candidates scored full marks in this questions. A good range of answers were seen suggesting that candidates had completed the practical and were familiar with the idea of constant variables..

Question 1 (c) (iii)

(iii) Both students decide to repeat their experiment.

Explain why.

....

.... **[1]**

This question again highlighted the need for centres to refer consistently to the scientific terminology outlined in the 'Language of Measurement' document. Candidates who did not gain this mark they referred to reliability and accuracy. Many candidates were close to scoring a mark, with the answer 'average', but again precision in the use of terms prevented this. Some candidates incorrectly stated that repeating the experiment would 'exclude outliers', rather than allowing outliers to be detected, this could be a misconception and centres are encouraged to address this.

	AfL	When discussing 'averages' with students, centres should refer to the terms, mode, mean and median and expect students to do the same.

	OCR support	The mathematical skills handbook can offer support when using the terms mean, mode and median (M2f): https://www.ocr.org.uk/Images/310651-mathematical-skills-handbook.pdf

Question 1 (d) (i)

(d) Some nerve impulses can travel at a speed of 119 m/s.

(i) Which of the following shows 119 written in standard form?

Tick (✓) **one** box.

1.19×10^2　　　　　　☐

1.19×10^{-2}　　　　　☐

11.9×10^1　　　　　　☐

119×10　　　　　　　☐

　　　　　　　　　　　　　　　[1]

This question was answered correctly by the vast majority of candidates. No trends in incorrect answers were observed.

Question 1 (d) (ii)

(ii) Which part of a neuron speeds up transmission of a nerve impulse?

Tick (✓) **one** box.

Axon　　　　　　　　　☐

Fatty sheath　　　　　　☐

Neurotransmitter　　　　☐

Synapse　　　　　　　☐

　　　　　　　　　　　　[1]

This question was answered correctly by most candidates. Axon was the most common incorrect answer.

Question 2 (a)

2   Read the newspaper article.

> ## Scarlet fever cases increase
>
> The number of scarlet fever cases is increasing. The number of confirmed cases in 2016 is reported to be > 19 000, the highest level in 50 years.

(a)   The article states that > 19 000 cases were reported in 2016.

What does the '>' in this statement mean?

.... **[1]**

This question was answered correctly by the majority of candidates. Occasionally candidates incorrectly identified the '>' for meaning less than.

Question 2 (b)

(b)   Look at the data in the table showing the number of confirmed cases of scarlet fever.

Year	Number of confirmed cases of scarlet fever
2013	4700
2014	15 637
2016	19 206

Explain why doctors and scientists may be concerned by the data in the table.

....

....

....

.... **[2]**

Candidates found this question more difficult than anticipated. Candidates were expected to look closely at the data in the table to conclude that the number of cases has risen dramatically over the 3-year period. However, when looking at the data in more detail they should have observed that that the rate of increase is different. Many candidates did not look closely at the data and as a result most scored 1 mark only with very few candidates scoring both marks. Centres could practice this skill with students for future examinations.

Question 2 (c)

(c) Calculate the percentage increase in the number of cases from 2013 to 2014.

Put a (ring) around the correct answer.

23%   30%   233%   333%   **[1]**

This question proved challenging for candidates, with many incorrectly selecting 333% as their answer..
Only a few candidates were identified the correct answer (233%).

i	**OCR support**	The mathematical skills handbook can offer support when using percentages (M1c): https://www.ocr.org.uk/Images/310651-mathematical-skills-handbook.pdf

Question 2 (d) (i)

(d) Scarlet fever is common in children under 10 years old.

　(i) Scarlet fever is a bacterial infection. It is transmitted easily by close contact.

　　How could the spread of this infection be reduced?

　　...

　　...

　　.. **[2]**

Candidates tackled this application question well and there were some sensible ideas on how to reduce
the spread of infection presented. Many candidates correctly identified isolation as a method or
suggested that practising good hygiene would be important. Only occasionally there was a reference to
the use of antibiotics to treat those infected, despite the cue in the stem of the question to the infection
being bacterial. Candidates were clearly confident in tackling this application question and it was clear
that centres had prepared them well for this type of question.

Question 2 (d) (ii)

(ii) Doctors could prescribe some medication to treat this infection.

Write down **one** factor that doctors will consider before prescribing this treatment.

....

.... **[1]**

As with part Q2 (d)(i) this was tackled well by candidates. A good range of answers were seen which indicated that the candidates had engaged with this question well. Answers included: consideration of the age of the patient, other medications, resistance to antibiotics, dose, side effects and whether the medicines were needed or if the body would be able to tackle the disease without their use. Those that did not gain credit for this question they thought the medicine had not been tested for safety. It was also pleasing to see that candidates have moved away from the stock answer of 'benefits outweigh the risks' which would not have scored.

?	**Misconception**	A small number of candidates thought that people would develop resistance to the antibiotic, which indicates a misunderstanding

Question 2 (d) (iii)

(iii) Which of the following diseases is also caused by bacteria?

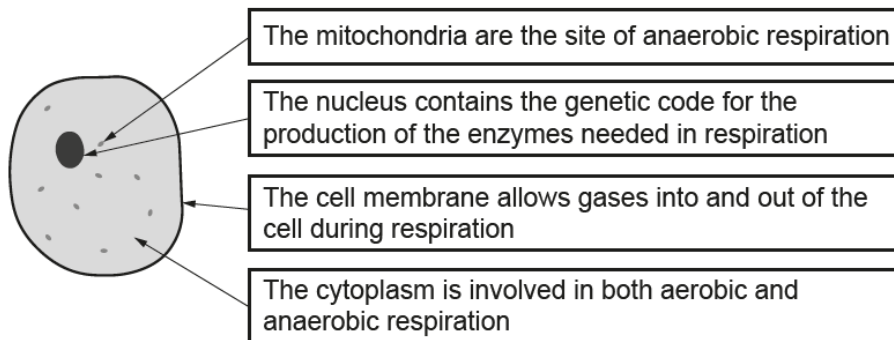Tick (✓) **one** box.

Athlete's foot ☐

HIV ☐

Malaria ☐

Salmonella food poisoning ☐

[1]

This question was a simple recall statement from the specification and the majority of the candidates answered this correctly. Only a few candidates didn't gain this mark.

Question 3 (a) (i)

3   (a)   Cellular respiration takes place in all cells. A student annotated a diagram of a cell to describe how different parts of the cell are involved in respiration.

The mitochondria are the site of anaerobic respiration

The nucleus contains the genetic code for the production of the enzymes needed in respiration

The cell membrane allows gases into and out of the cell during respiration

The cytoplasm is involved in both aerobic and anaerobic respiration

The student has made a mistake in their annotations.

(i)   Identify the mistake in the annotation by **drawing** a (ring) around it.   **[1]**

This question was designed to test whether candidates knew where cellular respiration takes place in the cell. Many candidates found this difficult and many did not identify that only aerobic respiration takes place in the mitochondria. The most common error observed was candidates identifying the final box as the location of the mistake; this was then carried forward to the next question.

Question 3 (a) (ii)

(ii)   Write a correction for the student's mistake.

....

.... **[1]**

Candidates that were given a mark in Q3(a)(i) were not always given a mark in this question. A common incorrect response included stating that both aerobic and anaerobic respiration took place in the mitochondria, again highlighting the misunderstandings candidates have about cellular respiration.

Question 3 (b)

(b) Describe the similarities **and** differences between **anaerobic** respiration in animal cells and yeast cells.

....

....

....

....

....

.... **[3]**

This question differentiated well, and a range of marks were given, with relatively few candidates scoring all three marks. A common error was stating that anaerobic respiration in animal cells produced carbon dioxide. Many candidates gained marks for writing the correct equations. Very few candidates identified both reactions as exothermic or that ATP was a product.

	AfL	When answering similar type of questions centres should encourage students to be more explicit in their identification of similarities and differences. Candidates should make direct comparisons and make sure that in their written responses those comparisons are explicit.

Exemplar 1

In anaerobic respiration in yeast cells its called fermentation. In both the reactants is always glucose. But in yeast cells the products are ethanol, carbon dioxide and energy whereas in animal cells the product will be lactic acid and carbondioxide. Carbon dioxide is both similar to both **[3]**

This exemplar highlights a common error. Many candidates, as shown by this response, thought that anaerobic respiration in animal cells produced carbon dioxide.

Question 3 (c)

(c) Write down **two** uses of the ATP produced during **aerobic** respiration in the human body.

1 ....

2 ....

[2]

Overall this question was not answered well by candidates. Very few candidates referred to examples given in the specification (e.g. muscle contractions and active transport). Some candidates identified movement as a use but did not gain credit for this, as it was vague answer. Centres are encouraged to explore the many uses of ATP in the human body so that candidates gain an understanding of the importance of this molecule.

Question 4 (a) (i)

4   Deforestation is happening to rainforests in Malaysia and Indonesia.

The rainforests are being replaced with palm oil trees.

Palm oil is used in many products, such as soaps, body creams and food.

(a) (i)   Some people talk about this.

Mia
I don't think it matters if rainforests are replaced with palm oil trees because there will still be the same amount of trees.

Alex
Palm oil trees will remove carbon dioxide out of the atmosphere.

Nina
Palm oil plantations are a monoculture. They reduce biodiversity.

Amir
Palm oil plantations do not provide a habitat for as many different species.

Which **two** people have the best arguments as to why we should conserve rainforests?

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

The majority of candidates scored both marks for this question demonstrating a good grasp of the term conservation and its importance. This was pleasing to see.

Question 4 (a) (ii)

(ii)   Describe the effect deforestation can have on climate change.

....

....

....

.... **[2]**

It was clear for this question that candidates had studied this content, but the language used was not precise enough. Many candidates stated that less carbon dioxide would be removed, but they did not clarify where from. Others stated that there would be an increase in carbon dioxide, but again did not state where. Many candidates stated the outcome of more carbon dioxide in the air would result in the greenhouse effect but they didn't identify that this would enhance this effect. Many correctly identified the outcomes of global warming, such as sea level rise, drought, etc. The majority of candidates were given a mark for identifying that trees would photosynthesise or that there would be a reduction in photosynthesis.

|	**AfL**	Centres should encourage candidates to write full explanations and be precise in what they write.

Exemplar 2

Due to photosynthesis plants produce oxygen which is let into the atmosphere and they absorb carbon dioxide. If trees are cut down the concentration of CO_2 will increase which causes the greenhouse effect. **[2]**

This candidate comes very close to several marking points. The first statement is about plants photosynthesising, this is too general and not tailored to the question so does not gain credit, the candidate then correctly identifies that the carbon dioxide level will increase, but they do not specify in the atmosphere. The third statement is about the greenhouse effect, this candidate shows that they have a misunderstanding about the greenhouse effect and the enhanced greenhouse effect. This is a good example of where precision in the language used is essential.

Question 4 (b) (i)

(b) Deforestation can affect the water cycle.

The diagram below shows the water cycle.

underground water
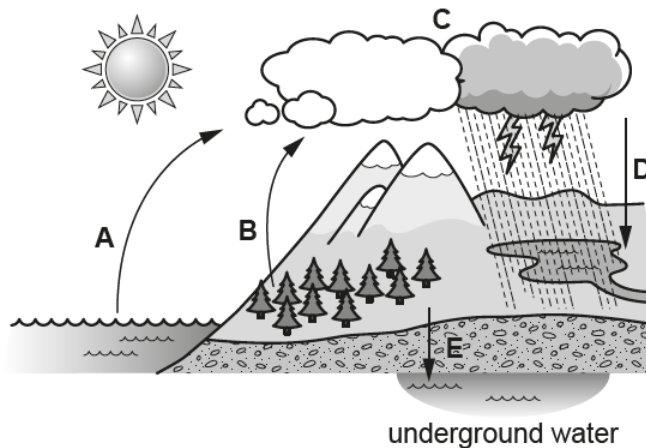
(i) Put a (ring) around the letter, **A**, **B**, **C**, **D** or **E**, in the diagram which shows the process of transpiration. **[1]**

This question was answered correctly by the majority of the candidates by correctly identified B as transpiration. However, this question was omitted in a few cases; it is assumed that many candidates simply did not see the question as there were no answer lines provided.

	AfL	Candidates should be prepared by centres to look out for such questions by drawing their attention to the marks on the right-hand side of the page or the sub question notation on the left.

Question 4 (b) (ii)

(ii) Describe the effect deforestation will have on the amount of transpiration.

....

.... **[1]**

Failure to identify the correct process in Q4(b)(i) did not always prevent candidates answering this question correctly. Most candidates correctly identified that deforestation would result in a decrease in transpiration. Occasionally candidates gave the definition for transpiration and a number of candidates gave explanations to accompany the description.

	AfL	Centres are encouraged to spend time ensuring candidates know the difference between command words, this question would be a good starting point as it could easily be changed into a question that requires an explanation or one that asks for both command words, allowing candidates to see the difference in the answers that would be required.

Question 4 (c) (i)

(c) Orangutans live in the rainforests of Malaysia.

Orangutan

A century ago there were 230 000 orangutans.

The table shows the estimated number of three species of orangutans which remain today.

Species of orangutan	Number
Bornean	104 700
Sumatran	7500
Tapanuli	800

(i) Calculate the percentage (%) of orangutans which remain today.

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

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

Most candidates performed well on this question gaining 2 or 3 marks. Very few scored no marks. Candidates that were not given full marks did not convert the calculated value into two significant figures.

i	**OCR support**	The mathematical skills handbook can offer support in using the correct significant figures (M2a): https://www.ocr.org.uk/Images/310651-mathematical-skills-handbook.pdf

Question 4 (c) (ii)

(ii) The number of orangutans living in the rainforests of Malaysia is an estimate.

Explain why.

....

.. **[1]**

The majority of candidates answered this correctly. A wide variety of responses were seen for this question, candidates were clearly aware that populations would be constantly changing. A common answer was the birth rate and death rate could change. Other common responses seen included; it would be difficult to find all the orangutans to count them or that some could be counted twice. There was the occasional reference to mark -release- recapture, which was not credited.

Question 4 (d) (i)

(d) The diagram shows the evolutionary relationship of the orangutan to some other primates.
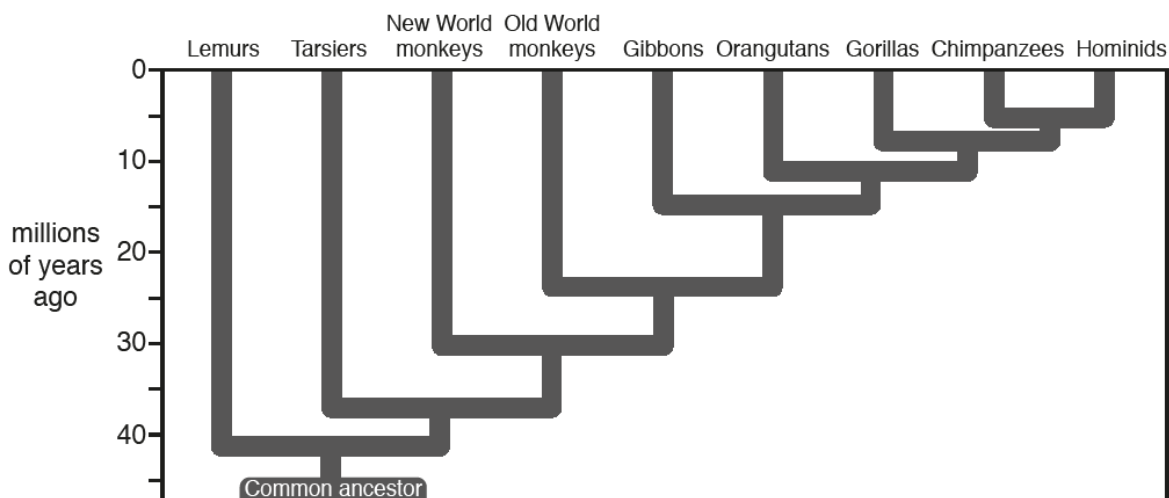
(i) Which one of the other primates is the orangutan **least** closely related to?

.... **[1]**

Centres had clearly spent time discussing evolutionary relationships and how they are represented with candidates, as this question was answered correctly by the vast majority of candidates. The most common incorrect response was hominids.

Question 4 (d) (ii)

(ii) Which biological molecule can provide scientists with evidence of how closely related two species are?

Tick (✓) **one** box.

Amino acid ☐

DNA ☐

Glucose ☐

Lipid ☐

[1]

This was a well answered question by the vast majority of the candidates. Very few candidates did not gain a mark for this question.

Question 5 (a)

5 John has cut his leg.

(a) What role will platelets play in the healing of the cut?

....

....

.... **[2]**

Most candidates were given at least one mark for this question. Common errors included stating the platelets would clot or referring to the formation of a scab. The most common correct answers were the identification that further blood loss would be prevented, or microorganisms would not be able to enter.

Question 5 (b) (i)

(b) The cut gets infected. John's doctor decides to take a sample from the wound and culture the microorganisms.

(i) The doctor must use aseptic techniques to do this.

Describe **three** aseptic techniques the doctor may use when culturing the microorganisms.

1 ....

....

2 ....

....

3 ....

....

[3]

This question was answered particularly well by some candidates and from their responses it was clear that those students had completed a similar practical, where using aseptic techniques was a requirement. Sterilising equipment and work surfaces were commonly correct answers, as well as those referring to working under a flame or how to store the petri dish. Only a few candidates referred to the agar needing to be sterile, this could be a result of agar plates being pre- prepared before use by students. Some candidates lost marks as a result of poor expression; they used phrases such as "burning the tools" or "wiping/cleaning the surfaces". Others misinterpreted or misread the question and discussed the cleaning of the wound itself or gave answers that suggested they thought they were to explain **why** they were using aseptic techniques. This question highlights the need for centres to focus on the command word **describe** in preparation for future examinations.
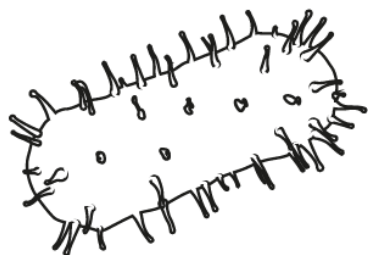
	AfL	Centres are encouraged to spend time ensuring candidates know the difference between command words, such as describe and explain.

Question 5 (b) (ii)

(ii) The doctor looks at some bacteria from the culture using a microscope.

Look at the image of one bacterium.

The actual length of this bacterium is 3.5 μm.
1 μm = 0.001 mm

Calculate the magnification of the image of the bacteria.

Use the equation: magnification = measured size ÷ actual size

Give your answer to **3** significant figures.

Magnification = × .... **[3]**

The full range of marks were given for this question. Candidates that only scored two marks frequently lost a mark for not converting their answer into three significant figures. Some candidates measured the bacterium incorrectly, while others were did not convert mm to μm.

Question 6 (a)

6 This question is about the genome and genetics.

Write down the best term to complete each sentence.

(a) During protein synthesis, a copy of a gene is made from a molecule called

....   **[1]**

Many candidates correctly identified mRNA as the molecule. A common incorrect response was DNA.

Question 6 (b)

(b) A characteristic of an organism that results from the interaction of the environment and the

genome is called its ....   [1]

Most candidates were given this mark by stating phenotype as the correct answer. There were no common incorrect responses, although genotype was seen on occasion.

Question 6 (c)

(c) A .... is a monomer of DNA and is made from a sugar, a phosphate group and a base.   [1]

Many candidates were given this mark, there were no common errors observed although amino acid, protein and gene were seen on occasion.

Question 6 (d)

(d) A mutation in a .... region of DNA can affect the phenotype by altering gene expression.   [1]

This question differentiated well, with generally only the most able candidates correctly identifying the region of DNA, as the non-coding region.

Question 7 (a) (i)

7 Scientists studying birds called great tits think they may be evolving larger beaks.

They think this may be because of bird feeders.

(a) (i) Place the following statements in the correct order to explain how scientists think this may have occurred.

A   The birds are more likely to survive and reproduce.

B   The offspring will be more likely to have larger beaks.

C   The birds get more food.

D   Birds that have longer beaks can feed more successfully on the bird feeders.

E   The birds will pass on the alleles for larger beaks to their offspring.

[1]

Generally, this question was answered correctly by many candidates.

Question 7 (a) (ii)

(ii) What phrase describes the process occurring in part (a)(i)?

.... [1]

Many candidates gave natural selection as the correct answer, those that did not often stated evolution, or survival of the fittest.

Question 7 (b)

(b) Great tits reproduce sexually.

Write down **one** reason why sexual reproduction is an advantage.

....

.... **[1]**

Genetic variation was the most common correct answer, although this was often expressed in other ways. Some candidates referred to variation but did not stipulate that it was genetic variation and therefore did not gain credit. Centres should encourage candidates to be very precise with language when discussing the causes of variation.

Question 7 (c)

(c) Scientists studied populations of great tits in the Netherlands to see if there were any differences between the genomes of birds there and in the UK.

What gene technology would scientists use to work this out?

.... **[1]**

Many candidates incorrectly named DNA screening/testing or sampling as the gene technology that would be used by scientists. As the question was focused on genomes this was not given credit.

Question 8

8 Carbohydrates, lipids and proteins are large organic molecules.

Complete the table to show which small organic molecules are used to make the large organic molecules.

| Small organic molecules	Large organic molecules
	Carbohydrates
	Proteins
	Lipids

[3]

This question differentiated well. Many candidates correctly identified amino acids as the small organic molecule used to make proteins. Sugars, simple sugars were seen often, however some candidates then lost this mark for incorrectly stating sugar AND starch. Many candidates identified starch as a carbohydrate but did not appreciate that it is a large molecule. Only a few candidates correctly identified **both** glycerol and fatty acids as the constituents of a lipid; often candidates wrote only one of the two.
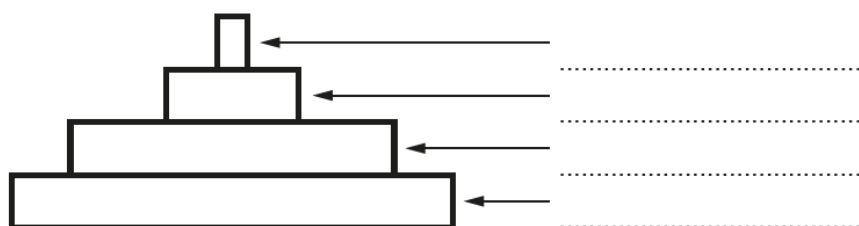
Question 9 (a) (i)

9   (a) Killer whales can be found off the coast of Scotland.

The diagram shows part of their food web.
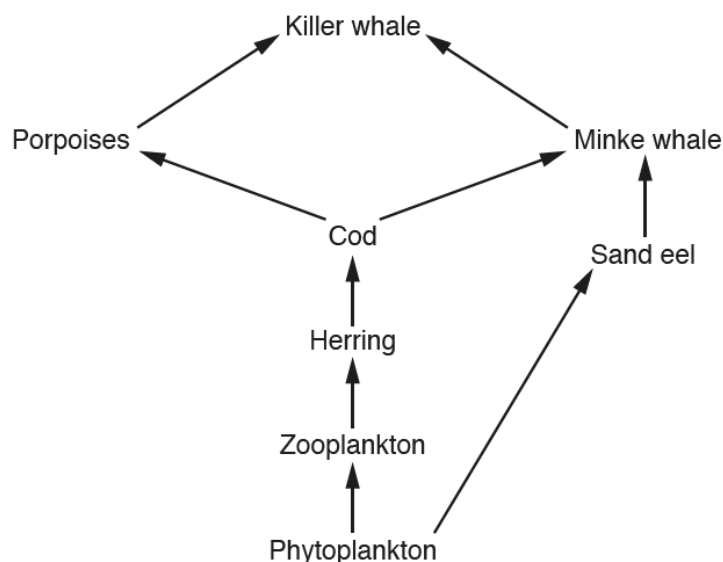
(i) Use the food web to label this pyramid of biomass correctly.

[2]

This question proved quite challenging for candidates with many incorrect responses seen. Those that gained credit often did so for correct labelling of the phytoplankton. Candidates often did not recognise that the food chain required only had four stages, or that each pyramid should only be labelled with one species. Many incorrect answers had several named species at each level, in an attempt to add every species, present in the food chain to the pyramid of biomass. This could be due to candidates being unfamiliar with this type of question. Inverted pyramids were also seen frequently, where the producer was at the top of the pyramid.

Question 9 (a) (ii)

(ii) Describe how biomass is lost at each stage of a food chain.

....

....

.... **[2]**

A good range of responses were seen for this question. The most common correct responses included the idea that not all of the previous organism would be eaten, or that some biomass would be lost through products such as faeces. Some candidates used terms such as 'waste' but this was not precise enough. Some candidates did not seem to understand what the term biomass was referring to and discussed loss of energy.

Exemplar 3

The predator eats Consumer eats the
Producer and the consumer uses the some energy.
to survive and as this happens each time there less energy. [2]

This exemplar indicates that the candidate did not understand what the term biomass is referring to and instead incorrectly discussed energy transfers.

Question 9 (b) (i)

(b) A killer whale was found dead off the coast of Scotland.

The post mortem found that chemicals called PCBs had bioaccumulated in the whale's body.

(i) Use your knowledge of food chains to explain how the PCBs bioaccumulated.

....

....

....

....

.... **[3]**

Candidates tackled this application question well, with many scoring 2 or 3 marks. The majority of the marks were given for the idea that the PCBs would enter lower down in the food chain and would then be passed on through feeding. The higher ability candidates recognised that at each level many of the organisms below would be consumed and that as a result of this the amount of PCBs entering higher up the food chain would be greater. Very few candidates realised that the PCBs would not be broken down or excreted, which is why they would remain in the body.

Exemplar 4

The PCB may have been ingested by animals lower down the food chain. As ~~more~~ a consumer eats more than one organism they will have a build up of poison inside them. As the killer whale ate more organisms the level of PCB increased in ~~the~~ it eventually building up enough to kill it as it bioaccumulated through the trophic levels. **[3]**

This exemplar is an example of a candidate who has constructed their response so that there is no ambiguity in what they are trying to convey. Key terminology is very precise and clear. The candidate scores three of the marking points within the first two sentences, 'ingested lower in the food chain', 'passed along the food chain when organisms are eaten' and an appreciation that those higher in the food chain will consume many individuals. A fourth point, the idea that the amount of PCB therefore increases in each organism higher up the food chain is also present. This is an excellent response.

Question 9 (b) (ii)

(ii) Scientists have worked out that the quantity of PCBs required to damage marine mammal health is 9 mg/kg.

The dead killer whale's blubber (fat) was analysed. They found 9×10^2 mg/kg in the blubber.

Do you think scientists would be concerned by this figure?

Explain your answer.

....

.... **[1]**

Most candidates were given this mark, with some considering order of magnitude in their answers. Those that were not given a mark were often too general in their statements, for example stating that the concentration was very high without quantifying it.

Question 9 (b) (iii)

(iii) Whale calves feed on their mother's milk for 11 months. The milk is high in fat.

Suggest why scientists are concerned about the effect of PCBs on the whale population.

....

....

....

.... **[2]**

Many candidates were given one mark for this question, but fewer than anticipated were given both marks. Those that realised the whale calves were likely die, did not always consider the effect on the population, while others discussed the effect on the whale population without linking this to the death of the calves. Some candidates stated that the whale population would go extinct, which was not creditworthy.

Question 9 (c)

(c) Explain what would happen to the dead whale's body if it was left in the sea.

....

....

....

.... [2]

Most candidates scored at least one mark for this question. While many realised that decomposition occurred they did not develop this answer to discuss the role of microorganisms in this process.

Exemplar 5

The body would Start to decompose or be eaten by other marine and release PCB's in from its body into the sea, and back into the food chain

This candidate correctly identifies that decomposition will occur but gives no further detail.

Question 10 (a)

10 Adult female cows have an oestrus cycle.

(a) The hormones that control the oestrus cycle are the same as those that control the human menstrual cycle.

Which hormone is responsible for the release of an egg when a cow ovulates?

Tick (✓) **one** box.

FSH ☐

LH ☐

Oestrogen ☐

Progesterone ☐

[1]

Many candidates correctly named LH as the hormone responsible for ovulation. There were no common incorrect answers noted.

Question 10 (b) (i)

(b) The graph in **Fig. 10.1** shows the levels of some of the hormones during the oestrus cycle in one cow.
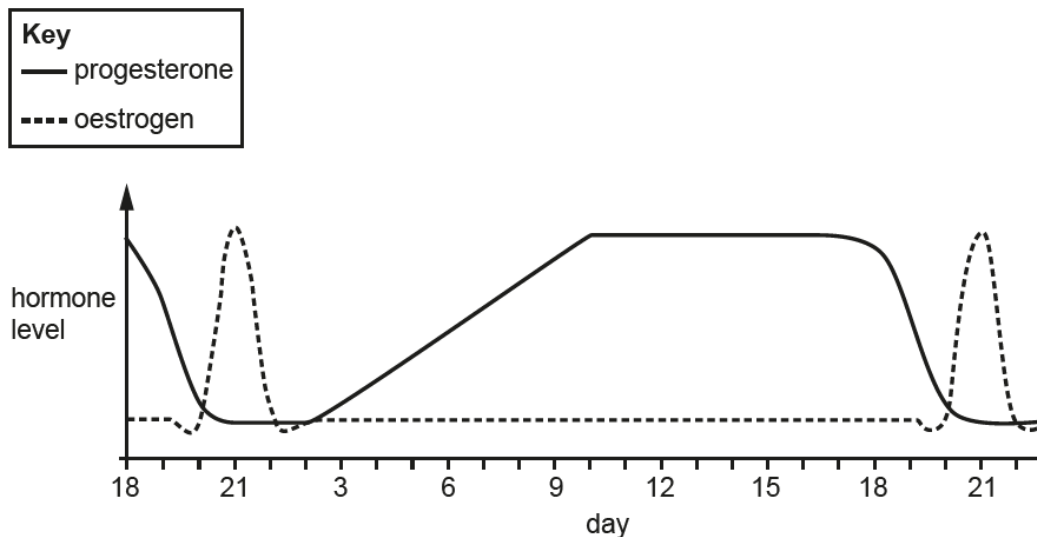
Fig. 10.1

(i) Use the graph in **Fig. 10.1** to work out the length of one cycle.

Length of one cycle = ... days [1]

This was answered correctly by most candidates, although some did find it difficult to determine the cycle length as they are perhaps not as familiar with interpreting graphs that do not start at day 1.

Question 10 (b) (ii)

(ii) The cow is **not** pregnant.

What evidence from the graph in **Fig. 10.1** supports this statement?

Tick (✓) **one** box.

The oestrogen levels rise and fall. ☐

The progesterone levels are high for a period of time. ☐

The progesterone levels fall. ☐

There is no FSH shown on the graph. ☐

[1]

> This question proved more challenging to candidates. All incorrect options were seen. A few candidates were able to identify the hormone levels after ovulation and before a new cycle begins.

Question 10 (c) (i)

(c) Cows are farmed to produce milk.

Each cow produces a different amount of milk.

(i) How could a farmer use selective breeding to try to make sure the cows in the next generation make a lot of milk?

....

....

....

.... **[2]**

> Many candidates did not read this question carefully and did not realise that the question was asking about producing the next generation of cows only. Many candidates did not realise that it would be the female that would be selected for its ability to produce high yields of milk and that this female would then be mated with a bull. Many simply stated 'two cows with a high milk yield would be mated'. Those that did engage better with the stem often stated that a bull would be selected based on the offspring it had produced and if the offspring had high milk yields.

Exemplar 6

Take the cow who produces the most milk and get that cow to reproduce and pass down the alleles for producing more than milk so that the offspring also produces lots. [2]

Very few candidates, as is the case with this exemplar, did not note that it is the female cow that produces milk and that she would be selected based on this characteristic and would be mated with a male (bull).

Question 10 (c) (ii)

(ii) Farmers can carry out selective breeding artificially. To do this they need to manipulate a cow's oestrus cycle by injecting hormones.

Which hormone would a farmer inject to cause a large number of follicles to be produced?

Tick (✓) **one** box.

FSH ☐

LH ☐

Oestrogen ☐

Progesterone ☐

[1]

This question was answered correctly by many candidates; LH was the most common incorrect response.

Question 10 (c) (iii)

(iii) The farmers will collect the eggs from the cow and fertilise them with sperm from a bull.

A fertilised egg (zygote) divides to form an embryo.

What name is given to this type of cell division?

....   **[1]**

A few candidates gave the correct answer which was mitosis. The most common incorrect answer given was 'meiosis'

?	**Misconception**	A small number of candidates seemed to a misconception between the two types of cell division.

Question 10 (d) (i)

(d) The embryos continue to develop.

When the embryo has 8 cells the cells are separated and allowed to develop into several embryos.

Each embryo is then transferred into a surrogate cow as shown in **Fig. 10.2**.
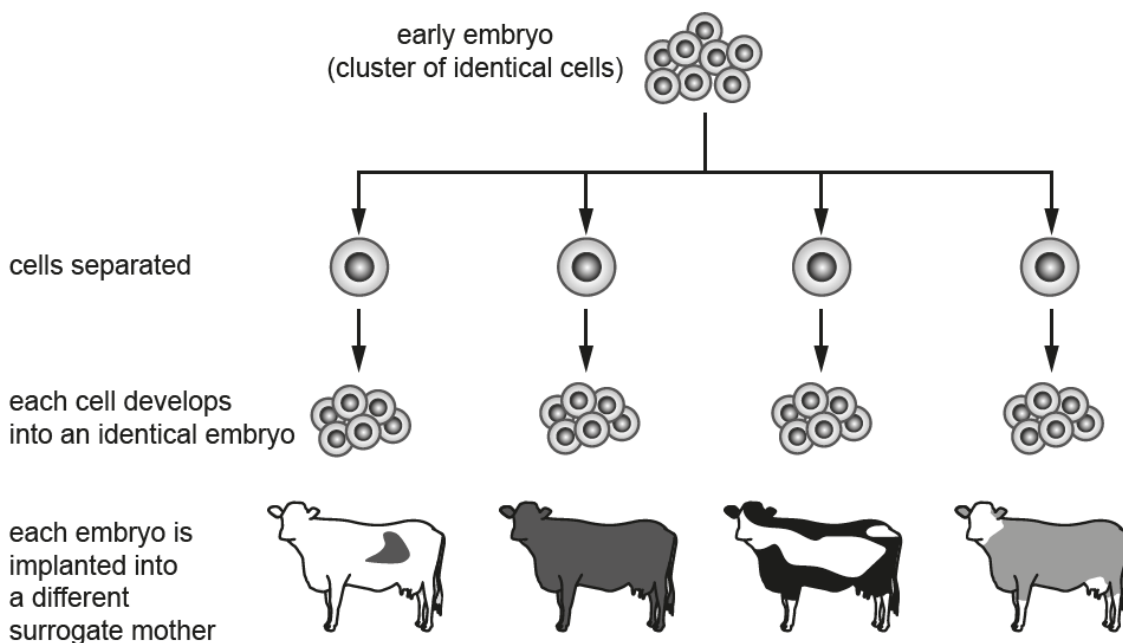
Fig. 10.2

(i) Suggest why a farmer may use this technique rather than allowing the cows to reproduce naturally.

....

....

....

.... **[2]**

This question proved challenging to candidates, with very few being given marks for this question. Those that did gain credit often did so for the identifying that the embryos would all be genetically identical or that they would all produce the same high milk yield. Only a minority of candidates were given both marks for this question.
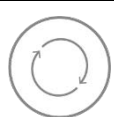
	AfL	Centres should encourage candidates to consider the benefits of such technologies, rather than just focussing on the processes.

Question 10 (d) (ii)

(ii) Why are the embryos split at this early stage rather than at a later stage?

....

.... **[1]**

Many candidates did not realise that the cells of the embryo at this stage would be unspecialised and stated that the embryo itself was unspecialised.

Question 10 (d) (iii)

(iii) Before the embryo is implanted into a surrogate cow, the cow will need to be given a hormone to allow the pregnancy to continue.

Name this hormone **and** explain why this hormone is required.

Name of hormone ....

Explanation ....

....

.... **[2]**

A large number of candidates correctly identified progesterone as the required hormone and explained that it maintained the lining of the uterus. Some candidates stated that progesterone would thicken the lining and were not given the mark. Some higher ability candidates gave more detailed answers and referred to the prevention of egg development and ovulation, as well as progesterone inhibiting the release of other hormones. This was very pleasing to see.

Question 11 (a) (i)

11 Coat colour is inherited in a breed of horse called the American Paint horse.

Horses can either be a solid colour or frame patterned.
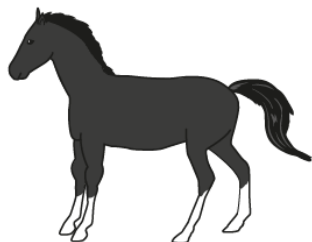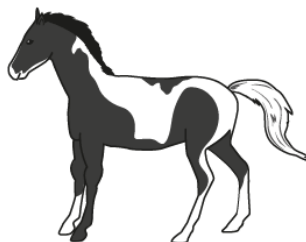
solid colour   frame patterned

(a) Coat colour is determined by two alleles of a single gene.

The table describes the allele combinations that result in each coat colour.

Allele combination	Coat colour
Homozygous dominant	Solid colour
Heterozygous	Frame patterned

(i) Use the letter F to write down the genotypes for a horse with the following coat colours.

Solid coloured ....

Frame patterned ....   **[2]**

Most candidates were given two marks for this question.

Question 11 (a) (ii)

(ii)   Lethal white syndrome (**LWS**) is a genetic disorder found in these horses.

Foals born to these horses have all white or nearly white coats and blue eyes and appear normal.

Horses with this syndrome are homozygous recessive.

Complete the Punnett square to show how two horses **without** lethal white syndrome can have a foal with the syndrome.

Write down the probability of this happening.

Probability of foal having LWS = ... **[4]**

Most candidates answered this question very well. Candidates are clearly used to applying their knowledge to novel scenarios. There were a few cases of crosses where two different letters were used.

	AfL	Centres are asked to remind students that in a cross involving the inheritance of a single characteristic that the same letter should be used. A capital represents the dominant allele and a lower-case letter represents the recessive allele

Question 11 (b)

(b) Foals with LWS do not survive. Producing a LWS foal is now avoidable.

What technology is now available to assist breeders to prevent foals being born with LWS?

.... **[1]**

As with the previous question on genome sequencing, many candidates found it difficult to name the technology used. Some stated embryo testing while others thought it was genetic engineering. Embryo screening and genetic testing were the most common correct answers.

Question 11 (c)

(c) Explain how genetic variants arise **and** how they can influence the phenotype of an individual.

....

....

....

....

....

.... **[3]**

This question was a high demand question and differentiated well, with only the more able candidates being given more than one mark. Many candidates had a good idea about how genetic variants arise but found it difficult to put this into words. Their descriptions of the impact on the genetic code was not clear or incomplete and many thought that a change in the base sequence meant that the amino acids 'produced' would be different, highlighting misunderstandings. 'Mutations' was the marking point that was most frequently given.

Exemplar 7

Genetic variants can arise through mutation. If the mutation impacts the code of the DNA then the amino ~~acti~~ acids used for protein synthesis can be affected and change the proteins produced, resulting in a change in phenotype.

In this response the candidate has a good idea as to how genetic variants arise but needs to be more precise in the language used. This can be seen in the second line where they refer to the impact on the code of the DNA and the amino acids. This lacks the detail and precision to gain marks at this level. They do however correctly identify mutations as the cause and understand that a different protein will be produced. This response was given 2 marks.

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