May 2023 Biology

Overall grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-16	17-33	34-46	47-55	56-65	66-74	75-100

General comments

Teachers, candidates and examiners praised the interactive nature and creativity of the assessment. The clarity of the questions and interactive media was rated highly. The difficulty of the exam was thought to be appropriate. A number of teachers and candidates commented that the exam seemed long this year; however, the number of unanswered questions remained on par with previous years and the expected range of quality in candidate's responses was again seen.

The exam gave equal waiting to the four assessment criteria and reflected the published topic list. Multimedia support was provided to support students in tasks where skills are at the forefront, in particular the more open-ended tasks assessing criteria B and D. Candidates should not expect to be familiar with the experiments or scenarios covered in these tasks but should be able to apply the required skills to solve them.

It is not possible to provide a more detailed topic list, nor is the exam written using a textbook as a resource.

The assessment team would welcome more feedback on the exam at the end of the assessment period as teacher and candidate feedback informs the development of future assessments. We would urge coordinators to facilitate this by circulating the exam and survey links, as well as setting aside dedicated time for teachers to engage with this task.

The area of the programme and examination which appeared difficult for the candidates

Candidates found the following areas difficult:

- Comparing and contrasting aerobic and anaerobic respiration in humans
- applying the idea of osmosis to a less familiar context
- providing scientific justification to support identified patterns
- describing the significance of control variables
- using data to justify the validity of a hypothesis
- suggesting and justifying relevant improvements and extensions to experimental methods
- processing of data: calculation of percentage increases
- developing economic and environmental impacts beyond what is provided in the examination media.

The area of the programme and examination in which candidates appeared well prepared

- Candidates were well prepared for the following areas:
- the role of the skeleton, including muscles and joints.
- the importance and action of enzymes
- inheritance; deriving genotypes and outlining phenotype

- plotting simple data
- identifying and selecting relevant and correct variables for scientific investigations
- planning to collect sufficient data (range and repeats)
- suggesting actions different stakeholders may employ to improve sustainability
- selecting relevant economic and environmental impacts for a given solution to a problem

The strengths and weaknesses of the candidates in the treatment of individual questions

Question 1

(a) Most candidates correctly answered knee.

(b) Almost all candidates selected bicep.

(c) Stronger candidates performed well, but most answers lacked the required specificity and repeated information about muscles pulling from the question. The marks required the correct action of a correct muscle and its associated movement, for example: the bicep contracts to bend/flex the arm. Lots of alternative wording was seen and allowed here. Common mistakes included identifying the alternative muscle or saying that one muscles pushed while the other pulled.

(d) A number of good answers in what was a surprisingly challenging question. A frequent similarity given was that both processes produce energy and the difference being the use of oxygen or not. A fair number correctly described glucose as the common reactant or described the different products. A small number confused respiration with breathing or gave incorrect equations.

(e) Most candidates had the idea of bones protecting internal organs, with many giving valid examples such as the rib cage or cranium protecting the lungs or brain. A common error was to describe how muscles (or sometimes skin) protected the bones. A few candidates interpreted protection in terms of immunity (white blood cell production), or behavioural responses (e.g. lifting the arm to protect the face). Blood production required reference to stem cells or bone marrow. Some candidates wrote about blood cell production using stored iron to produce haemoglobin.

Question 2

(a) Many candidates answered well, with all three marking points being regularly seen. No marks were given for generic advantages of (any) packaging, which was seen quite a few times.

(b) Candidates most commonly gained marks for the ideas that microbe activity is reduced (although no credit was given for microbes being killed, which appeared quite a few times) and that food therefore lasts longer. Only a few mentioned that at this temperature food won't freeze, and even fewer explained a benefit of that. No credit was given for cooling slowing down ripening.

(c) No marks were given for the idea simply that salt kills bacteria. All three marking points were regularly seen, although naming the process as osmosis was probably the least common. Common mistakes included describing the impacts on the meat rather than the bacteria.

Question 3

(a) The question allowed candidates to show what they knew, with many good answers gaining full marks, and a few answers going beyond the mark scheme, referring to active sites or activation energy.

(b) Most answers were fully correct.

(c) Most answers correctly referred to physical or observable characteristics, although there were some candidates who thought the term referred to some aspect of genes or genotype.

(d) A good discriminator with all parts of the mark range frequently seen. Often candidates who didn't gain full marks did so because they failed to address the question fully, for example, describing a difference or similarity without attempting an explanation (justification). A few candidates lost marks for a lack of specificity in their answers, e.g. saying that pigs and rats are of different sizes, rather than that pigs are larger. In this question, it was important that candidates used the correct terms; the use of lactase or lactose gave answers different meanings.

(e) Most candidates correctly described the link between milk consumption and percentage lactose tolerance, although it was clear that some thought that consuming more milk increased lactose tolerance in individuals.

(f) The most common correct answer pointed out that the data came from only five countries, although the other alternatives on the markscheme were all seen.

Question 4

(a) Most candidates gained the mark for stating the research question in terms of how humidity affects the strength of the fibre. Relatively few gave the more precise answer of how humidity affects the mass needed to break the fibre.

(b) Most candidates correctly identified the independent variable as humidity. To gain the mark, the dependent variable had to be described as the mass needed to break the fibre. Although some did give this, many referred, less precisely, to the strength of the fibre, which in this question was not sufficient as it is not a measurable quantity. Another common mistake was to swap these two answers.

(c) Common correct answers included references to the size of the fibre (such as its diameter or length), the type of plant the fibre came from, the temperature the fibre was stored in and the time it was stored for. Some candidates incorrectly suggested the independent or dependent variables.

(d) Many non-scoring answers referred to making sure the experiment was, for example, 'accurate' or 'valid'. Credit was given for referring to fair testing, with relatively few candidates clearly explaining that control variables are important to ensure that the dependent variable is only affected by the independent variable, or that the control variables could also affect the outcomes if they weren't controlled.

(e) To gain both marks, candidates had to make a suggestion and justify it. Many did do this, either suggesting increasing the number of values for humidity or repeating tests, along with giving appropriate explanations to justify their suggestions. However, candidates who gave two suggestions without any justifications limited themselves to one mark.

(f) Many candidates gained the full four marks. Most gave a scale with equal increments, and usually chose a scale that was relatively easy to plot against. The points for Group 1 were usually plotted correctly. If there were any errors, they were usually in the plotting of Group 2's results. The most common errors were uneven scales, for example (0 then 10, 15, 20 etc.) or all data values being used as axis values.

(g) Most candidates wrote about what the graphs showed. In some cases, this was simply quoting values, but better answers described the patterns shown. It was not enough to say that both graphs showed an increase: for Group 1, the subsequent plateau was also needed; for Group 2, that it was a linear or constant increase was required. Some candidates indicated that an increase in 25% humidity resulted in an increase in mass needed to break the plant fibre of 5g.

(h) This was a challenging question. Few candidates referred directly to natural variation in fibre strength, although some got a mark for the idea that the fibres could have differed if they had come from different individual plants. Although some answers explained why the larger masses gave less precise results, many candidates simply stated that the two groups had used different-sized masses without clearly explaining the significance of that.

Question 5

(a) A majority correctly gave 95 (micrometres), but there were also many other candidates who gained the mark for being within the bounds of tolerance (90–100).

(b) A minority gained the full three marks, even with any errors from part 5a not being penalised a second time. A common error was not dividing by 80 to calculate the percentage increase. Most followed the instruction to provide their answer to the nearest whole percentage. Incorrect percentages given to the correct degree of accuracy but without evidence of correct rounding were not credited.

(c) Many candidates correctly explained that water entering the fibres/cells by osmosis or diffusion caused the cells to increase in size. Some wrote about water entering the fibres but didn't give sufficient detail or name the process to gain any marks. Few candidates gained more than two marks.

(d) This was a challenging question and many failed to score. Some candidates suggested changing the humidity values, but what was required was a further measurement, other than had already been used, that could be made of the fibres, for example, any change in mass.

Question 6

(a) Most candidates gained the mark, with the most common responses being fibre length or diameter. The other alternatives on the markscheme were all also seen.

(b) No credit was given for the idea that including the length of time of immersion in the method would allow the effect of time on the results to be identified since this was not the purpose of the experiment. Commonly seen answers that did gain credit were the ideas that including the time made the method more precise and easier to repeat, or that the time is a control variable and if it was not controlled it might affect the results.

(c) Many candidates correctly explained that the alkali should be identified, as well as the direction of change be given, as either an increase or decrease. Candidates also gained credit for improving the original hypothesis. No credit was given for references to lacking scientific explanation as this did not make the hypothesis more testable.

(d) Candidates found this a challenging question. To gain credit it was necessary to correctly refer to specific values of concentration in their arguments. Unfortunately, many candidates failed to quote any data from the graph. Of those that did, some misread the graph (the value of 2% was often mis-identified as 2.5%) or made statements that were too general to gain any marks.

Question 7

There was a wide range of marks awarded for this question, from zero to a full score of 15. Candidates who addressed the bullet points, in order, in a series of separate sections, were more likely to gain higher marks. Some candidates seemed to confuse this question with Question 4 and thought that it was about breaking the fibres.

Research question: When giving their research question, weaker answers just referred to investigating how different masses would affect how far the rope would stretch, whereas a better answer would explain that the length of the rope, before and after stretching, needed to be measured.

Variables: Candidates often correctly identified the independent variable as fibre % but were more likely to struggle with the dependent variable, the length (of stretch) of the rope. Control variables were frequently correctly identified, but occasionally lacked specificity and were not awarded, for example, stating temperature by itself.

Equipment: Candidates were credited for equipment provided in a list or in the method. The most common reason for gaining only one mark was stating that a ruler was needed, and then not stating what it was for or not using it to measure the length in the method.

Method: Candidates should aim to give an experimental method that is clear and precise, in which suitable identified values for the variables would allow someone else to carry out the experiment as planned. Some high scoring candidates provided these values in the variable section too. No credit was given to candidates where methods referred to previous questions, for example, "follow the same method as in question 4" and candidates writing a method that culminated in fibres breaking due to different masses being added scored a maximum of one point here.

Data: It was expected that candidates used at least five values for the independent variable (using the minimum and maximum increments made available) and repeated at least three times.

Safety: When describing safety precautions, candidates should be aware that no credit is given for listing generic school laboratory safety procedures, and any precautions given should be relevant to the investigation.

Question 8

(a) Transpiration was the most selected answer.

(b) The full range of marks was seen. No credit was given for simply repeating the information from the question – candidates had to go beyond that. So, while there was no mark for saying that there would be fewer pollinators, there was a mark for saying that a reduction in the number of pollinators would mean there was less pollination of plants. The question simply referred to a reduction in the bee population, so credit was not given to those candidates who said that the plants would die out or go extinct. Stronger candidates developed responses to include the impacts on food chains beginning with producers, and then linked this to a decrease in biodiversity. No marks were given for simply stating that biodiversity decreased as this was provided in the question.

(c) Those candidates who set out their answers using terms from the bullet points as headings were often those who gained the highest marks. Those who didn't follow this structure often missed out some of the aspects. To gain marks it was necessary that the justifications and difficulties were clearly linked to the specific actions. While most candidates gained at least one mark for the conclusion, relatively few gained two marks for a conclusion that referred to both individuals and governments and wasn't simply repeating earlier points.

Question 9

Candidates were provided with a lot of information in the stimulus material from which they had to select relevant points to address different parts of their answer. However, to gain the higher marks it was necessary to go beyond that by making links between aspects of the stimulus material that weren't immediately obvious and by bringing in additional information from their own knowledge and MYP

studies. In general, candidates who set out their answers with separate paragraphs to address each of the bullet points in the question tended to gain higher marks than those who didn't, often because the latter failed to address some of the aspects. Overall, the question discriminated well with marks ranging all the way up to the full 13.

Environmental and economic: Candidates usually picked up most of their marks for addressing the environmental and economic impacts but selecting aspects from the stimulus material. However, to access the higher marks these points must be further developed.

Biosolar: The least well tackled part of the question was for the additional benefits of combining green roofs and solar panels, for which many candidates simply gave separate benefits of each - or benefits of biosolar technology that were only contributed by the green roof aspect. Stronger candidates commented on how the cooling effect of the plants ensured the efficiency of the solar panels did not decrease.

Location: This part was often omitted by candidates. When answered, it was often answered well. Considerations needed to encompass both aspects of biosolar technology, not just one. For example, selecting a sunny location because otherwise the panels will not generate sufficient energy and the plans will not photosynthesise or transpire sufficiently were both needed.

Conclusion: Most concluding statements were satisfactory.

Recommendations and guidance for the teaching of future candidates

Teachers must continue to use the full range of MYP command terms in their teaching and assessment, to enable candidates to become more familiar with what is expected of them in terms of level. In addition, teachers should model how to answer questions using higher level command terms such as explain, discuss and evaluate, justify, and compare and contrast to help candidates further develop these skills.

Teachers must expose candidates to a range of varied, open-ended practical tasks as well as partially completed lab plans and data sets during their MYP studies. Candidates should not be surprised when unfamiliar investigations are presented in the examination.

Teachers could focus on and model different aspects of the scientific method; it is not always necessary to complete the full process to practice the skills needed. For example, candidates could be given opportunities to construct research questions and hypotheses, as well as to evaluate and improve them without always having done the experiment. Teachers can provide candidates with data sets that encourage candidates to support and reject hypotheses to differing extents.

Opportunities for meaningful processing of data should be planned for, beyond that of calculating the mean.

The selection of pieces of equipment or experimental techniques should be discussed in terms of accuracy, precision and reliability and the impact on the validity of the data should be explored using the correct terminology. The inclusions of controls should be more commonplace.

Candidates must be taught the difference between improvements or extensions to experimental methods.

Teachers must provide candidates with regular opportunities to engage with source material linked to real world issues.

Candidates need time to plan and produce extended responses where they are challenged to consider relevant factors beyond the environment and economy.

Teachers must model how information found in source material can be identified and subsequently used as a starting point for further justification and developed accordingly. The interactive media and questions in the exam can be used to support this.

Teachers should model how to breakdown big questions into smaller parts.

Candidates should practice using the bullet points to structure their answers and ensure all parts of the question are covered.

Teachers should work with candidates to develop writing strategies that encourage candidates not to repeat the question in their answers as this wastes time.

Schools should make use of the past exams available and the familiarization material, ensuring that candidates are familiar with the style of the on-screen presentation and have experience interacting with the different tools and available media. This will also help candidates with their time management skills.