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Biology 2411

BIOL2   The variety of living organisms

Report on the Examination

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General Comments

Overall candidates seemed to find the paper accessible with no evidence of any general misinterpretation of questions. There were some very impressive answers with candidates displaying an excellent understanding of the unit content covered on the examination paper. However, it was also clearly evident that some candidates had not thoroughly prepared for this test as indicated by some of the responses on straightforward recall questions. Generally, questions involving interpretation of data presented graphically or in tables were well answered but calculations caused problems for many candidates. A number of the longer questions proved to be effective discriminators and often gave better candidates the opportunity to show their understanding of a topic or to demonstrate their analytical skills. One area of concern was the poor responses in question 5 relating to practical work. There was also considerable variation in the ability of candidates to express their ideas clearly and logically, and to use appropriate scientific terminology. Consequently, many weaker candidates failed to gain credit due to imprecise or incorrect use of scientific terminology.

Question 1

(a)   The vast majority of candidates correctly named the process as differentiation or specialisation. The most common incorrect response was 'mutation'.

(b)   (i)   Even more candidates correctly named structure **A** as the (cellulose) cell wall. A common incorrect response was 'cell membrane'.

(b)   (ii)   It was disappointing that over a third of candidates scored zero on this question. Most candidates did gain one mark for the principle of dividing the measured length by the magnification. However, only one in every four candidates was able to complete the calculation to provide the correct answer in micrometres.

(b)   (iii)   Almost two thirds of candidates failed to obtain the mark for this question. Most candidates mentioned chloroplasts, but only better candidates outlined their role in absorbing light. A significant number of candidates confused chloroplasts with chlorophyll. Very few candidates provided answers relating to the thin cell wall or to chloroplasts being at the periphery of the cell.

Question 2

(a)   (i)   The vast majority of candidates gained at least one mark for completing the column relating to taxonomic group. Completing the genus and species rows proved more troublesome with a significant number of candidates including 'gladiator' in their answer.

(a)   (ii)   It was clearly evident that many candidates had no idea of what *hierarchy* means in terms of classification and attempted to give a non scientific definition. However, almost a third of candidates gained one mark for various descriptions of 'groups within groups'. Very few candidates referred to no overlap between the groups resulting in less than 10% of candidates gaining both marks.

(b)   Most candidates gained this mark often by explaining that similar features could be compared.

Question 3

(a) (i) Most candidates correctly named part **R** as deoxyribose. Answers identifying part **R** as pentose or as a five carbon sugar were considered too imprecise due to the question clearly identifying the molecule as being DNA.

(a) (ii) Most candidates correctly named part **Q** as a phosphate group or as phosphoric acid. Unfortunately, some candidates incorrectly named parts **R** and **Q** the wrong way round.

(b) Almost every candidate correctly stated 'hydrogen bonds'.

(c) Approximately fifty percent of candidates obtained this mark. Although there was a wide range of incorrect answers, the most common error was to divide, rather than multiply the number of amino acids by three.

(d) Over 90 % of candidates were able to correctly work out the sequence of amino acids.

(e) This question proved to be an effective discriminator. Most candidates gained at least one mark, often by mentioning a change in the sequence in amino acids. However, a significant number of candidates incorrectly referred to 'different amino acids being formed'. Many of these candidates gained a second mark for describing that the active site or tertiary structure would be altered. Better candidates gained maximum marks either by linking this to enzyme-substrate complexes not being formed or to changes in hydrogen/disulfide bonds.

Question 4

(a) Most candidates had little difficulty obtaining at least one mark by referring to an increase in the production of carbon dioxide. However, candidates were far less successful in describing the effect of an increase in respiration on the oxygen dissociation curve of haemoglobin. There were almost as many responses indicating that the curve would move to the left as there were correct answers indicating a shift to the right. Unfortunately, many candidates disqualified a correct description by suggesting that this would increase the affinity of haemoglobin for oxygen.

(b) (i) Most candidates did gain a mark for referring to an increase in the haemoglobin content of the blood. However, most candidates then linked this to an increase in the oxygen carrying capacity of the blood rather than to an increase in the oxygen uptake in the lungs. The latter being the main advantage to people living at high altitudes where there is less oxygen in the air.

(b) (ii) As expected this question proved more demanding with approximately one in four candidates obtaining both marks. These candidates used the information provided on the graph to explain that haemoglobin would release more oxygen to the tissues as its affinity for oxygen decreases.

Question 5

(a) Most candidates appreciated that having a thin piece of epidermis would allow light to pass through the specimen. However, far fewer candidates could explain this in terms of a single or few layers of cells being present. A common misconception was that being thin enabled organelles to be identified.

(b)   This proved to be the most demanding question on the paper with over 75% of candidates scoring zero. It was very evident that most candidates had little experience or recall of this type of practical work. Most candidates simply stated that the number of stomata on a leaf would be counted and divided by the area without any reference to using the slide. Almost invariably when candidates did gain a mark, this was for carrying out repeats and calculating a mean.

(c)   Although many candidates gained one mark, a significant minority did not mainly due to poor or imprecise terminology. References to 'trapped water droplets' rather than water vapour or to 'concentration gradient' rather than water potential gradient were frequently penalised. Consequently, few candidates obtained both marks.

Question six

(a)   Most candidates correctly named fluid **F** as plasma or blood plasma. A common response not credited was blood.

(b)   Very few candidates obtained this mark despite the large number of alternative answers available on the mark scheme. A very common error was to state that tissue fluid has no protein rather than less or smaller proteins. References to blood cells were not credited as fluid **F** is plasma rather than blood, the latter consisting of plasma and blood cells.

(c)   (i)   Many candidates did not obtain this mark as most referred to 'pumping' or 'beating' of the ventricle rather than using the precise term contraction.

(c)   (ii)   Unfortunately many candidates simply stated that the pressure decreases as distance from the heart increases. Better candidates explained the reason for this decrease in pressure in terms of friction or loss of fluid from capillaries.

(d)   Answers to this question were very disappointing with very few candidates obtaining all three marks and many candidates scoring zero. Candidates gaining credit often appreciated that a decrease in the concentration of protein in the blood would increase the water potential in the capillary. However, candidates often failed to use the term osmosis in the correct context, describing the movement of a wide range of substances by osmosis. Even better candidates often failed to gain credit by referring to fluid rather than water moving by osmosis. Additionally, there was considerable confusion in the direction of movement of water between the tissue fluid and plasma.

Question 7

(a)   (i)   Most candidates correctly carried out the calculation and obtained both marks. Approximately 10% of candidates obtained a principle method mark but calculated an incorrect answer.

(a)   (ii)   Very few candidates obtained both marks in this question. Approximately a third of candidates gained one mark for indicating that the index of diversity measures the number of species and the number of individuals. However, only the very best candidates used this information that an index of diversity would be more useful when some species were only present in small numbers.

(b)   (i)   Most candidates gained one mark for explaining that removing other plant species or growing a single crop would reduce the species diversity of plants. However, very few candidates gained a second mark for explaining how these plant species would be decreased e.g. by the use of chemicals or by competition from the crop plant.

(b)   (ii)   A majority of candidates gained one mark for appreciating that a decrease in plant species would provide fewer habitats for animals. Better candidates gained a second mark for referring to a decrease in the variety of food sources available. However, many candidates simply stated there would be 'less food' which was not credited.

Question 8

(a)   Most candidates gained at least one mark often by explaining that filaments and/or lamellae in the gills provide a large surface area allowing efficient gas exchange. The failure of many candidates to gain both marks was often due to poor use of terminology particularly in relation to the short diffusion pathway between the blood and water and the countercurrent flow mechanism.

(b)   (i)   Approximately half the candidates obtained this mark appreciating that a logarithmic scale enabled the plotting of a large range of values.

(b)   (ii)   The vast majority of candidates correctly described the relationship between body mass and oxygen uptake.

(b)   (iii)   It was surprising that only one in every five candidates obtained both marks for this question. Many candidates obtained a mark for indicating that measuring oxygen uptake per gram of body mass would enable a comparison to be made. However, only better candidates linked this to the difference in body mass or size of the animals.

(b)   (iv)   This proved a very effective discriminator. Better candidates had little difficulty using the information provided to obtain all three marks. Some of these answers fully appreciated that smaller animals lose more heat per gram of tissue. Others were able to provide parts of the explanation and scored one or two marks. Weaker candidates showed little understanding, often beginning with the incorrect premise that larger organisms have a larger surface area to volume ratio. Better candidates clearly linked oxygen uptake and respiration but did not always refer to the higher rate of respiration in smaller animals.

Question 9

(a)   Most candidates gained at least one mark by stating that the control group would be treated in exactly the same way as the experimental group apart from being injected with taxol. Less than 10% of candidates gained the second mark by indicating that the control group would be injected with saline.

(b)   Although most candidates were able to suggest two factors relating to the number of mice used in the investigation the explanations provided were not always worthy of credit. A common scoring point was the suggestion that a large number of mice would increase the reliability of the results. However, answers relating to ethical considerations often lacked sufficient detail to gain a mark.

(c)   Slightly less than half the candidates gained this mark often by indicating that growth of tumours vary in shape. There was a wide variety of incorrect responses.

(d)   It was disappointing to note that over half the candidates obtained zero on this question. Approximately 30% of candidates gained both marks. The mark scheme allowed for a variety of approaches but it was clearly evident that many candidates had difficulty calculating a growth rate.

(e)   This question proved a very effective discriminator. Most candidates gained one mark for suggesting that mitosis would be affected, although a small minority referred to meiosis. A good proportion of these candidates then explained how taxol could specifically inhibit the separation of chromatids during mitosis. However, only the most able candidates used the results to explain that mitosis was not completely inhibited by taxol as shown by the increase in the volume of the tumour with this treatment. Candidates who stated that 'mitosis was stopped' did not gain this third mark.

(f)   (i)   Less than 50% of candidates were able to provide a clear definition of standard deviation. Most incorrect answers simply stated that it provided the 'spread of results' with no reference to the mean.

(f)   (ii)   This question also proved a very effective discriminator. Most candidates gained one mark for suggesting the combined treatment seemed to be the most effective treatment. The vast majority of these candidates also noted that taxol is more effective than OGF. However, far fewer candidates clearly explained that both these chemicals on their own were effective in slowing growth of the tumour. Although better candidates also considered the standard deviation only the most able candidates clearly explained how the overlap of standard deviations indicated that the taxol and combined treatments could have been equally effective.

(f)   (ii)   As expected this proved to be a difficult question. Most candidates had difficulty understanding the flow chart and gave a variety of incorrect responses. Despite the information provided in the stem of the question many candidates suggested that the *Giardia* antigen would remain on the plate and cause a positive result. Other misconceptions related to the enzyme reacting with the antigen or with the antibodies. Approximately forty percent of candidates obtained one mark for realising that the second antibody with the attached enzyme would remain on the plate. Far fewer of these candidates went on to explain that the enzyme would react with the substrate to provide a yellow colour.

Question 10

(a)   Most candidates had little difficulty obtaining at least one mark often for stating that courtship behavior enables recognition of the same species. Over a third of candidates gained a second mark. These candidates often linked courtship behaviour to sexual maturity or to the release of gametes. Most candidates failing to gain two marks often provided only one suggestion or there was a lack of clarity in their answers.

(b)   (i)   Almost two thirds of candidates gained this mark. Most candidates used the information in the stem of the question to explain that fusion between gametes would be more likely within a limited area.

(b) (ii) Less than half the candidates obtained this mark by indicating that developing within the pouch protected young seahorses from predators.

(c) (i) Most candidates gained this mark often by stating that the curved tail made it difficult to obtain an accurate measurement of body length.

(c) (ii) This proved slightly more difficult with a number of candidates providing the same answer as in (c)(i). Nevertheless, over 60% of candidates did obtain the mark by suggesting that body length is proportional to head length.

(d) The vast majority of candidates obtained this mark by describing the trend of seahorses with similar head/body lengths pairing together.

(e) This was generally well answered with most candidates obtaining the first marking point by referring to drawing a line of best fit. Over 50% of candidates gained the second mark by explaining how extrapolation of the graph could be used to predict the total head length of selected mate.

(f) This question proved an excellent discriminator. The vast majority of candidates described how DNA hybridisation could be used to find out if the two species of seahorses are closely related. Not surprisingly, the quality of the descriptions of DNA hybridisation varied considerably and a variety of alternative methods were credited. Most candidates gained a couple of marks for naming the technique and for the principle of mixing the DNA strands of the two species. Many candidates also appreciated that a higher temperature would be required to separate hybrid strands from closely related species. A maximum of four marks was available for a full description of DNA hybridisation.

Other methods described included; comparing DNA base sequences, comparing amino acid sequences and immunological studies. There was considerable confusion between the first two methods with many candidates referring to 'amino acid sequences of DNA'. Few candidates appreciated that the same or a named protein should be studied when comparing amino acid sequences. Descriptions of immunological investigations were relatively infrequent and apart from some notable exceptions, were generally of poor quality displaying little understanding of even the basic principles. Nevertheless, over a third of candidates obtained four or more marks for this question with many providing outstanding detailed descriptions of the various methods involved.