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AQA

General Certificate of Secondary Education

Biology 4411

BLY3H Unit Biology 3

Report on the Examination

2011 examination – June series

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Biology
Higher Tier BLY3H

General

Particular problems which occurred quite frequently included:

- The inability to express ideas clearly and unambiguously, or giving extra, alternative answers – an examiner cannot be expected to choose between correct and incorrect information; for example, describing diffusion as movement ‘along’ or ‘across’ a gradient rather than *down* it, or choosing the appropriate alternative between words like ‘accurate’, ‘valid’, ‘precise’, ‘reliable’.
- Excessive verbosity rather than making specific points succinctly and precisely – this merely wastes time as no marks are available for re-stating the question nor for making the same point more than once.
- Paying insufficient attention to information provided in the stem of a question in order to guide a reasoned response – this being particularly important when confronted with an unfamiliar scenario.
- Careless reading of the question resulting in an inappropriate answer – for example, not distinguishing between the meanings of the instructions *Explain* and *Describe.*
- Not reading data accurately from a graph.
- Mathematical weakness in calculations – candidates really need to consider whether their answers are actually sensible, eg ‘0.6’ of a bacterium is a very odd concept.
- Limited ability to apply what has been learned to a novel situation.
- Poor understanding of certain topics, such as the production of biogas and the methodology involved in culturing and measuring the activity of microorganisms.

Question 1 *(High Demand)*

(a) (i) The majority of candidates scored just one mark out of the two available. This was for the principle of sterilisation (or heating to a sufficient degree to kill microorganisms, eg ‘boiling’) before assembly of the simple fermenter. Many suggested the use of ‘disinfectant’ but this was disallowed as it would require rinsing out before addition of the yeast. If separate sterilisation of both the apparatus and its contents was suggested (but before addition of the yeast) then two marks were available. Other sensible, mark-worthy, ideas included working near a flame and putting disinfectant in the air lock. Non-sensible ideas included the fitting of a swan-neck tube (despite the similarly-shaped, labelled, ‘air lock’ already included in the diagram).

(a) (ii) It was disappointing that less than half the candidates could explain the importance of using the same concentrations of the different sugars in the two different flasks. Many answers were rather vague, eg ‘so that the results can be compared’. The idea of a valid comparison was acceptable but terms such as ‘accurate’, ‘reliable’ and ‘precise’, which candidates frequently used either singly or in conjunction, indicated a lack of understanding of the underlying principle and were penalised. Alternative, suitable answers related to the concentration being a control variable, or to there being only one variable, or to being able to see the effect of the different types of sugar (a concept that could have been gleaned from the introductory stem to this question).

(b) Nearly all candidates knew that the gas released by yeast was carbon dioxide and two-thirds of candidates appreciated that, over 120 hours, a person would probably make errors or lose count (although very few hinted that the person might actually fall asleep!). Again, many candidates considered that indiscriminate use of terms such as 'accurate', 'reliable', 'precise' and 'valid' constituted per se a suitable answer.

(c) Most candidates appreciated that the yeast fermented sugar A better than sugar B as A produced the larger volume of gas. Better candidates, who had understood the nature of the experiment, realised that the horizontal section of the graph indicated that gas production had stopped. Weaker candidates (and these were just in the majority) misinterpreted this as representing a constant rate of gas production.

Question 2 *(Standard Demand)*

This was the first of two standard-demand questions common to both the Foundation and Higher Tier papers.

(a) Nearly all candidates were able to see in the diagram that the protein molecules were too large to fit through the pores in the dialysis membrane. One error was to state that the protein could not pass through the membrane without giving the reason why.

(b) The vast majority of Higher Tier candidates understood that urea molecules moved through the membrane by diffusion although 'osmosis' was a common error. A similar proportion were able to explain, using information from the table, that the urea was moving from high to low concentration. Some answers were too vague, with the urea molecules moving 'along' or 'across' the concentration gradient.

(c) Around two-thirds of Higher Tier candidates were able to suggest a suitable value for the concentration of sodium ions in the blood plasma at the end of dialysis which should, sensibly, have been somewhere between the starting plasma value and the value given for the dialysis fluid. Some gave answers outside of this range.

(d) (i) Well over three-quarters of Higher Tier candidates were able to give at least one advantage of a kidney transplant over dialysis treatment. Most answers related to economics and convenience. These were allowed provided they were suitably elaborated: a kidney transplant is not cheaper initially, but only in the long term; and the 'convenience' point only made sense if it was qualified by reference to reduced hospital visits or time spent on dialysis. Many candidates pointed out correctly that a transplant would mean that the diet did not need such rigorous regulation. Disappointingly, relatively few made any reference to biological points such as avoiding the build-up of toxins in the blood which would otherwise have occurred between dialysis sessions. Some did, however, make other valid points, such as additional risks associated with dialysis like blood clotting or infection.

(d) (ii) Nearly all cited the problem of rejection of the transplanted kidney or the need to take immunosuppressant drugs and, if the latter were mentioned, the point that the patient would thus be rendered susceptible to other infections quite frequently followed. Many mentioned the hazards associated with a surgical procedure or the potential shortage of suitably-matched donors.

Question 3 *(Standard Demand)*

This was the second of the two common questions.

(a) The vast majority of Higher Tier candidates knew that the gas missing from the given ingredients of biogas (gas X) was methane. ‘Hydrogen’, ‘oxygen’ and even ‘alcohol’ were among suggested answers. Nearly all were able to calculate that the percentage of gas X in the biogas was 70%; one prevalent error was to ignore the decimal point in the values for hydrogen sulfide and ammonia, thus 0.5 % became ‘5 %’.

(b) (i) In order to answer this part, it was essential to stress that the bubbles of biogas passing through the reactor enabled better mixing of the organic matter with the microorganisms – very few candidates, even at Higher Tier, gave a full answer here. A suitable alternative answer was that the movement of the bubbles helped to maintain the optimum temperature throughout the reactor for chemical reactions to occur – again, relatively few candidates went beyond ‘temperature maintenance’ unqualified.

(b) (ii) Only one-third of candidates seemed to understand that anaerobic conditions were required for biogas production – hence stirring with bubbles of biogas would be suitable but with air would not due to the oxygen content of the latter.

(c) The ideas sought here were that 35 °C would be the optimum temperature for chemical reactions / respiration / growth of the microorganisms, which would thus lead to a high yield of biogas (which, after all, is the main purpose of a biogas generator). Relatively few candidates commented on the yield of biogas and many who had the optimum temperature idea did not qualify it further in relation to any process.

Question 4 *(High Demand)*

(a) About one-third of candidates appreciated that blood contained haemoglobin, which could combine with oxygen and hence improve the blood’s oxygen-carrying capacity compared to that of water. Many candidates scored just one mark for stating that red blood cells carried the oxygen, with no mention of haemoglobin. Some candidates missed the point entirely and wrote about a temperature effect (not seeming to realise that both of the figures given were for the same temperature).

(b) Many candidates concentrated on what happened to the blood’s oxygen in the skeletal muscles and omitted any reference to the lungs, or merely stated that oxygenated blood left the lungs, without stating that the blood actually became oxygenated in the lungs. Most knew that the skeletal muscles would take oxygen from the blood and use it to release energy, sometimes mentioning the process of respiration. However, only a small proportion included all the relevant details in their answers.

Question 5 *(High Demand)*

This was an unstructured question on the adaptations of villi in the small intestine to the absorption of the products of digestion. Candidates were also given a very helpful, labelled diagram which showed that the villi were covered in a large number of microvilli, that the surface layer was one cell thick, that these cells contained many mitochondria (labelled as the ‘site of aerobic respiration’) and that the villi contained an extensive network of capillaries very close to the surface.

Despite this, many candidates simply ignored all, or most, of the clues they had been given and produced an answer they had pre-prepared, reciting what they had learnt rather than using what they understood. Better candidates related the presence of many microvilli to having a large surface area, the many mitochondria to the release of energy (or ATP) for active transport and the many capillaries (or good blood supply) to the maintenance of a concentration gradient by transporting away the absorbed products of digestion. Some weaker candidates evidently confused microvilli with cilia which, apparently, either helped to move the food along the intestine or caught pieces of it ready for absorption. The villi were often incorrectly described as being one cell thick and there were many incorrect references to a 'cell wall' (rather than to a wall that was one cell thick).

Question 6 ***(High Demand)***

(a) Nearly all candidates were able to name a product made by microorganisms grown in a fermenter, the most common being penicillin and mycoprotein.

(b) (i) Many candidates did not appreciate the benefit of diluting the samples of culture medium containing the microorganisms. Many considered the microorganisms to be safer if more dilute (evidently not appreciating that any benefit gained would soon be counteracted by microbial reproduction). Less than one-third understood that there might otherwise be too many bacteria to count.

(b) (ii) It was clear that the principle behind counting colonies in order to estimate the number of bacteria in a sample was very poorly understood. Some candidates pointed out correctly that a colony of bacteria is visible to the naked eye whereas a single bacterium is not. But most candidates did not seem to understand that each colony on the agar jelly in a Petri dish arose by reproduction from a single bacterium. Many expressed a very peculiar idea about counting the bacteria in a single colony (How?), assuming all other colonies were the same, then multiplying the number in one colony by the number of colonies – evidently forgetting that the answer would relate to the number of bacteria after growth on the agar and not to what was originally put onto the agar from the fermenter samples.

(c) A large proportion of candidates successfully calculated that there would be 8.8 million bacteria per mm^3 of the undiluted culture. '88 000' was a common error (although this was allowed one out of the two marks available). Mathematical weakness was vey apparent here, some answers indicating that, although 22 bacteria could be counted in 1/4000 mm^3, there would be less than one bacterium in a larger volume of undiluted culture medium.

(d) (i) On the graph, most candidates started at the correct position and correctly drew a downward-sloping line, hence indicating a decrease in glucose concentration. Only the better candidates realised that a low number of bacteria (approximately the first 10 hours) would consume glucose slowly, that the rate would speed up as more bacteria were produced (approximately 10 to 25 hours) and then slow down again as the glucose began to run out, ie a sigmoid curve. Some candidates drew two lines, one for method A and one for B, indicating a lack of understanding that A and B were just two ways of measuring growth in the same fermenter. A few candidates even showed an increase in glucose concentration, presumably just copying the shape of graph A.

(d) (ii) Most candidates concentrated on the decrease in bacterial numbers that occurred after 34 hours, correctly suggesting that the glucose was running out and that some of the bacteria were dying. If an explanation was offered for the increase in numbers before 34 hours, this was often just attributed to glucose being present or, if it was used in respiration, then the release of energy thereby was rarely linked to bacterial growth or reproduction. Some candidates merely described the graph rather than offering an explanation for its shape.

(d) (iii) Only a small number of the most able candidates appreciated that only live bacteria formed colonies whereas both living and dead would be visible in a microscope and therefore countable: hence the higher numbers found using method B which involved cell counting. Some thought that the molten agar would have killed some of the bacteria, others considered that counting the bacteria with a sophisticated instrument like a microscope was bound to be more accurate than counting colonies in a Petri dish.

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