Version 1.0

General Certificate of Secondary Education

Biology 4411

BLY3H Unit Biology 3

Report on the Examination

2011 examination – January series

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Set and published by the Assessment and Qualifications Alliance.

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Registered address: AQA, Devas Street, Manchester M15 6EX

Biology
Higher Tier BLY3H

General

Particular problems which occurred quite frequently included:

The inability to express ideas clearly and unambiguously
Paying insufficient attention to information provided in the stem of a question in order to guide a reasoned response
Careless reading of the question resulting in an inappropriate answer
Not reading data accurately from a graph
Mathematical weakness in calculations
Limited ability to apply what has been learned to a novel situation
Poor understanding of certain topics, such as gaseous exchange, kidney function, absorption from the intestine, diffusion and active transport.

Question 1 (Standard Demand)

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

a) While nearly all candidates were able to select the brain as the organ whose blood flow did not change with varying levels of exercise, rather fewer were able to work out that the skin had the greatest reduction in blood flow in heavy compared to light exercise. A little over half of Higher Tier candidates were able to calculate that the heart muscle took 1/25 of the total blood flowing around the body during heavy exercise.

b) Just over a quarter of candidates were able to suggest **two** ways in which the body increases the flow of blood through the skeletal muscles during exercise, and approximately half could think of **one** way. The methods suggested usually related to an increased heart rate and sometimes to a description of vasodilation – although the latter was often spoiled by imprecision, e.g. 'widening of blood vessels' or 'dilation of capillaries' were not credited by examiners. Some thought, incorrectly, that an increased breathing rate would help with blood flow.

c) Candidates were moderately successful with this section. Many knew that carbon dioxide was a by-product of respiration, but fewer related the increase in carbon dioxide to an increased rate of respiration. As at Foundation Tier, hardly any stated that the carbon dioxide would need to diffuse from the muscles into the blood. Some thought, incorrectly, that deeper breathing would draw extra carbon dioxide into the blood from the inhaled air.

Question 2 (Standard Demand)

This was the second of two common questions.

a) The vast majority of candidates appreciated that boiling the milk before using it to make yoghurt would kill any microorganisms already in it. Some used terminology that was too imprecise – boiling does not 'remove' or 'get rid of' microorganisms.

b) Over half the candidates were able to calculate successfully the rate from the graph. Many were only able to select the correct values of 6.0 and 4.5, and probably subtract

them, giving '1.5' as a very common answer, with relatively few dividing by the time taken which was 100 minutes. Approximately a third of candidates were able to suggest a sensible reason for the slowing of the rate towards the end of the investigation – such a running out of 'food' or the denaturing of enzymes at the lower pH.

c) There was rather more success in this section and approximately half of the candidates knew that lactic acid was formed during the production of yoghurt.

d) Again, approximately half of the candidates knew that, in school laboratories, bacteria should not be grown at temperatures above 25°C and the same proportion could give a sensible reason for this in terms of reducing the growth of pathogens. Some included rather imaginative reasons, more akin to science fiction than to scientific fact, such as the danger of the bacteria 'taking over the school'. A common misconception was that yoghurt-producing bacteria would *become* pathogenic, possibly due to a mutation induced by the higher temperatures.

Question 3 (High Demand)

a) Around half of the candidates were able to describe two features of the alveoli, but relatively few could give all three. The unfortunate inclusion of the term 'cell wall' (rather than a wall which was one cell thick) disqualified the mark for a substantial proportion of candidates. Many omitted the concept of a *thin* surface, despite the inclusion of a scale bar in the diagram which emphasised this point.

b) Less than two-thirds of candidates could state that oxygen entered the blood by *diffusion*, a substantial minority favouring 'active transport'. And most had little idea of the benefits of breathing: most could only make the point that breathing took air, or oxygen, into the lungs (others were often imprecise and had the air / oxygen entering the 'body'). Very few appreciated that breathing topped up the concentration of oxygen in the alveoli and thereby maintained a concentration gradient between the air and the blood.

Question 4 (High Demand)

a) *Carbohydrase* was quite a common correct answer for the name of the enzyme that catalysed the conversion of starch to glucose (more specific examples, such as *amylase* and *maltase* were also credited); with 'protease' being the most common incorrect answer. For the name of the process which changed glucose into ethanol and carbon dioxide, *fermentation* and *anaerobic respiration* were equally acceptable, the former being more prevalent.

b) In explanations of why the use of ethanol might be preferable to petrol in car engines, around one-third of candidates were able to make just a single point – either that the ethanol was renewable or that it was 'carbon neutral'. Relatively few were able to make three valid points. Some answers were rather too vague, framed in terms of 'less pollution', while better candidates gave examples of specific pollutants, such as sulfur dioxide or oxides of nitrogen, or mentioned acid rain that might result from burning petrol.

Question 5 (High Demand)

Many candidates experienced difficulties in answering this question as they addressed only one or two points from the substantial amount of information given. Although most knew that active transport required energy, only better candidates explained that *aerobic* respiration in the mitochondria was the source of that energy and that, this being so, it made sense that the uptake of glucose from the small intestine by active transport would result in a greater consumption of oxygen. Thus more energy would be available due to an increase in the rate of aerobic respiration. Very few went on to explain that the membrane proteins involved in the active transport process would be able to distinguish between glucose and xylose and that, since the latter did not stimulate oxygen uptake, it was presumably absorbed by a non-energy requiring process such as diffusion. Many candidates became very confused and some propounded the unlikely hypothesis that glucose was actually entering the intestine from the blood as an energy supply to enable the active uptake of oxygen by the intestine. This question successfully differentiated amongst the most able candidates.

Question 6 (High Demand)

a) There were no marks available in this question for simply stating that the jacket of cold water would cool down the fermenter. At this level, this was taken as read. The question was about what caused the fermenter to heat up in the first place and why it was necessary to cool it down. The vast majority of candidates were able to make one or two sensible points – that respiration by the fungus would release heat and / or that a constant, or optimum, temperature needed to be maintained. The third mark was for explaining the unfortunate consequences of overheating – denaturation of enzymes or the death of the microorganism. A number of candidates applied these terms inappropriately – it is impossible to kill an enzyme and microorganisms are *not* denatured.

b) Many candidates struggled to make sensible points in answer to this question, often because they did not express themselves in sufficient detail or with sufficient clarity. The most frequently rewarded points were for noticing that the protease concentration rose as that of the glucose declined and for explaining that the fungus actually made the protease. Very few candidates related lack of protease before 20 hours to the low amount of fungus present at that time. Similarly, few explained that the glucose could be used as a supply of either energy or materials for the growth of the fungus and hence production of the protease. A substantial number of candidates appeared to think that the protease was an organism (which grew) rather than an enzyme.

c) Most candidates noticed that the highest yield of protease occurred when glucose was supplied at 40 grams per dm^3 (it was rather odd to find that a substantial minority tried to argue the case for either of the other two glucose concentrations). Those who noticed that this concentration of glucose gave the highest yield *per gram of glucose consumed* and *per gram of fungus biomass produced* (i.e. those who actually quoted the headings from the appropriate columns of the table) scored better than those who made a single, more general, point. A number of candidates also made a sensible point about the sound economic sense of using less glucose in order to get a higher yield of product.

Question 7 (High Demand)

a) Most candidates realised that the largest molecule in the list (A) was the protein and, having done so, were able to explain that the protein would therefore not be able to pass through the filter in the kidney, given that the diameter of the filter's pores was less than that of the protein molecule. However, many candidates remain confused about the principles of filtration and selective reabsorption and often use these terms interchangeably so that it is difficult for examiners to interpret their meaning.

b) The benefits of careful reading of all the information provided were evident in better answers to this question. Thus, given that the filter's pore size was 6 nanometres (as stated in the stem of the whole question) and that the diameter of a haemoglobin molecule was 5.5 nanometres (as stated in the stem to part (b)), then it should have been evident how the urine of a person with haemolytic anaemia could contain haemoglobin. Although many knew that haemoglobin was safely packaged in the red blood cells of a healthy person, few went on to explain that these red cells were too large to pass through the filter: thus only one-fifth of candidates scored full marks.

Mark Ranges and Award of Grades
Grade boundaries and cumulative percentage grades are available on the **Results statistics** page of the AQA Website.