

BIOLOGY

Paper 0438/11
Multiple Choice

<i>Question Number</i>	<i>Key</i>	<i>Question Number</i>	<i>Key</i>
1	B	21	A
2	B	22	C
3	A	23	B
4	D	24	B
5	C	25	C
6	C	26	D
7	A	27	D
8	D	28	A
9	A	29	D
10	D	30	A
11	A	31	B
12	C	32	C
13	C	33	A
14	C	34	B
15	C	35	C
16	D	36	B
17	C	37	D
18	D	38	C
19	B	39	C
20	B	40	B

General comments

The majority of candidates were able to cope very well with most of the questions on this paper. A small minority selected correct responses to all questions and are to be congratulated.

Comments on specific questions

Question 1 A significant number of candidates overlooked the fact that the removal of carbon dioxide from respiration is also an excretory process, and thus incorrectly chose option **C**.

Question 2 Almost all candidates knew that insects have six legs, however, a considerable number believed that insects have only two body parts.

Question 10 Whilst it is true that water enters cells by osmosis, many candidates, even the most competent ones, did not appreciate that cells of the mesophyll in a leaf receive their water, by osmosis, from the xylem within the leaf, not from the water that has just evaporated from their surfaces. This led to **A** being a popular, but incorrect choice.

Question 20 Candidates at this level commonly believe that we 'breathe in oxygen and breathe out carbon dioxide' and are unfamiliar with the fact that the oxygen and carbon dioxide content of inspired and expired air changes by only about 4% in each case. The nearest figures to those of the misheld belief were offered as option **A** which was selected by a considerable minority of the candidates.

Question 23 There were several problems to be solved here, and it proved too great a task for many. Candidates need to realise how alcohol reaches the liver, what happens to it there, and then what happens to alcohol (a toxin) in the blood as it passes through the kidneys. Even some otherwise capable candidates became confused, and opted to suggest that the hepatic portal and hepatic veins would have a low alcohol level, whilst the renal artery would have a high level; this is almost the reverse of the true situation. In this case, they may not have considered that the alcohol, being still in the stomach, would not (yet) have entered the hepatic portal vein.

Question 29 This was a relatively straightforward question based on graph interpretation and it proved to be the easiest on the paper. Although there was nothing particularly taxing for candidates, it is often in the interpretation of graphs that many problems are revealed, and thus the candidates' performances on this question is to be complimented.

Question 37 This was another relatively straightforward question based on graph interpretation. The only contender to the correct answer was option **C**, where the population curve begins to show signs of rising, but, having appreciated this fact, it is difficult to understand why that should have been more popular than the steep rise that immediately follows.

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Paper 0438/21

Core Theory

Key Message

Candidates should be aware of the need to read each question thoroughly and to take note of the demands of each section before beginning their response. Reading the instruction carefully is vital if the response is to fit the question.

Handwriting should be clear and mistakes should be clearly crossed out and written again.

General comments

There were very few cases where candidates failed to attempt whole sections of a question and little evidence that candidates had insufficient time to complete the paper. There were candidates who showed very limited knowledge and understanding of some topics from the syllabus, especially the eye (**Question 2**) and flower and seed structure (**Question 4**). Most candidates appeared to find the paper demanding in at least some of its aspects. There was evidence in a number of places, that candidates had not read the questions carefully or thoroughly enough. Some responses, although on the topic, failed to answer the question asked. Many candidates found it difficult to explain how or why biological phenomena occurred although their basic knowledge was adequate. In a significant number of cases, candidates' handwriting was very hard to interpret. It should be noted that illegible work cannot be awarded credit. Over-written work and very small writing presents problems especially when the spelling of a term is crucial to the biology.

Question 1

Many candidates gained full credit on this question. In **(a)** some quoted common names such as snakes rather than the names of vertebrate classes and a number thought amphibians had a scaly skin.

Question 2

Very few candidates were able to identify the structures in the eye correctly. Some did identify the iris, **X**, but **Z** should have been named as the optic nerve. It was insufficient to call it a sensory nerve. Part **(b)** was poorly answered with many candidates confusing the roles of the iris muscles with those of the ciliary muscles. Some candidates described the mechanism for focussing on a distant object but did not go on to describe how this was changed to focus on the diagram, which was the essence of the question. Many seemed to think the role of the iris was critical. In **(c)**, the graph was usually well drawn although some candidates failed to gain full credit as they extrapolated back below the age of 10 unnecessarily and incorrectly. Most were able to extract data from their graphs correctly. A few candidates failed to label the axes of their graphs although they had inserted scales.

Question 3

Knowledge of the consequences of a blockage in the coronary artery was good, although a few talked about disruption to the blood flow through the heart. Many candidates also made sensible suggestions about measures a person could take to reduce the risk of such a clot forming. The commonest responses were to reduce the amount of animal fats in the diet, stop smoking and take more exercise. Candidates should realise that instructions such as 'stop stress' unless explained are not practicable and ideas such as having a healthy or balanced diet or visiting the doctor are not specific enough.

Question 4

The parts of the pea fruit were often not known, and in **(b)** many did not label the parts of the seed. Many candidates identified the radicle, plumule and testa correctly. Part **(c)** was about dispersal of seeds but many responses were in terms of pollination. Mechanisms or agents of dispersal were acceptable responses, but it should be noted that insects are not usually agents for seed dispersal. In **(d)**, both external and internal factors, needed for seeds to germinate, were acceptable, but few candidates mentioned any of the latter. Many incorrectly thought that light and the presence of carbon dioxide were essential for germination to occur. Light is not a trigger for germination in the majority of plant species. These factors only become important when the shoot emerges and photosynthesis begins, i.e. after germination has occurred. 'Temperature' could not gain credit without being further explained.

Question 5

Knowledge of the carbon cycle was quite good. Most realised that arrow **A** represented respiration and that **E** was combustion. 'Burning' was accepted for the latter but 'breathing' was too vague for the former. Most candidates could name a suitable group of organisms in **(b)(i)** and many mentioned the need for water, oxygen or a suitable temperature in **(b)(ii)**. A significant number of candidates could not complete the word equation for photosynthesis in **(c)(ii)**. Many gave solar energy as the form of energy needed. This is not a correct term for the visible spectrum of light emitted from the Sun which is used in photosynthesis. In **(d)** most candidates attempted a response but had difficulty expressing their ideas clearly. The majority could only say that light energy could not be recycled. A minority utilised the carbon cycle to explain that the carbon dioxide taken from the atmosphere in photosynthesis is eventually released back into it by respiration, decomposition and combustion and thus can be recycled.

Question 6

Very few candidates dealt well with questions that began with 'explain'. In **(a)** many linked the rise in temperature to the heart beating faster or to an increased pulse rate. A full explanation required noting that the rise in energy demand and increased respiration lead to extra heat being generated. Some suggested that the heat was dispersed more rapidly or that sweating increased. A simple definition was required in **(b)(i)** but many gave statements that were too vague such as 'how temperature is controlled'. Responses for part **(b)(ii)** showed some understanding of the topic but many responses were inaccurate. It should be noted that only the water in sweat evaporates, although most knew that sweating helps to reduce body temperature.

Question 7

Candidates who knew the difference between mitosis and meiosis usually scored highly on this question. A few got the two processes the wrong way round but many were able to display their knowledge and understanding in this question format.

Question 8

In spite of the instruction to tick three boxes, a significant number of candidates ticked four (or more) boxes. This meant that at least one response was incorrect and thus the candidate could not gain full credit. A number also filled in all the boxes by naming the parts indicated, again failing to answer the question. In **(b)** most were able to describe the functions of two suitable features. Most knew that red blood cells lack a nucleus and also that they transport oxygen around the body.

Question 9

In **(a)** candidates' responses usually showed that they were familiar with the two terms but most did not fully describe the differences between them. Most correctly identified a carnivore and a producer in **(b)**, but many incorrectly thought that the secondary consumers, the lizards, bats and snakes, would be found in the second trophic level, suggesting that they had confused the two terms. Part **(c)** was usually well answered, although a minority misunderstood the food web and suggested that the deer fed on the mountain lions and would now have to eat more coyotes.

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Paper 0438/31
Extended Theory

Key Messages

1. Candidates must read the data provided in questions and use it appropriately to answer the question concerned. This was especially true for **Questions 2(a), 2(b), 4(e) and 5(c)(i)**.
2. Candidates should use correct scientific terms in their answers, e.g. in **Question 2(e)**.
3. A description should not be repeated or relied upon solely when an explanation is required.
4. Although in most cases Examiners will credit phonetic but incorrect spellings for names of structures or processes, there are questions where a correct spelling is essential to avoid confusion with a similar term, such as mitosis rather than meiosis.
5. Candidates should be advised to pace themselves throughout the examination and to attempt every part of every question rather than leave blank spaces for which credit cannot be given.

General comments

In questions involving experimental methods, careful analysis of the information provided is required. Practice is needed in evaluating the information given and in critical thinking.

Comments on specific questions

Question 1

- (a) Some candidates simply gave the labelled parts as answers, (which were all incorrect except for the eyes), rather than give features common to all arthropods, i.e. segmented body, jointed legs, eyes and exoskeleton.
- (b) Most candidates scored at least some credit in this part. The skill of using a key was being tested, so no letters should have appeared in the grey boxes, the intermediate stages.

Question 2

- (a) The explanation expected was that the blood had been through capillaries in an organ and had lost oxygen to that organ, or that oxygen had transferred from the blood to that organ. Use of the oxygen by the organ did not quite make the point on its own. If the organ was named, it had to be correct. Many candidates stated that the de-oxygenated blood would go to the lungs to be oxygenated, which did not answer the question.
- (b) All the organs shown in the diagram would have been acceptable answers. 'Small intestine' was accepted as an alternative to duodenum or ileum. Colon and rectum were acceptable alternatives to 'large intestine'. A few candidates ignored the 'other than the spleen' instruction and wrote it in. Incorrect answers included kidney and bladder.
- (c) The majority of candidates correctly identified the destination of the blood, (the liver), and many identified the absorbed nutrients as glucose, amino acids, vitamins and minerals. Some candidates lost credit by giving the 'transported from' location as 'intestines' only, rather than small intestines / duodenum / ileum / villi, and credit was lost for not identifying that point as the site of absorption. Almost no candidates mentioned that the substances being transported were in solution, were soluble, or were in the plasma.
- (d) Most candidates took care to spell glycogen and glucagon correctly. Some described the glucose / glycogen conversions and the role of insulin and / or glucagon, but omitted to mention the

circumstances (high / low glucose concentration) that would lead to the conversion of amino acids. Many candidates described protein as being deaminated rather than excess amino acids. Some candidates mentioned the making of plasma proteins. Many candidates mentioned the effect of treatment in vague terms rather than specifically, i.e. broken down, respired or metabolised. Similarly, toxin treatment was frequently mentioned without actually naming one. A wide choice of toxins would have been acceptable responses, including just 'drugs'.

- (e) This part was well answered. Candidates should avoid writing about phagocytes 'eating' or just 'trapping' pathogens; engulfing or ingesting was required. Very few candidates confused the roles of lymphocytes and phagocytes. Bacteria or pathogens were acceptable terms but 'foreign cells' was too vague to gain credit.

Question 3

- (a) This part should have been straightforward for candidates, but many gained less than half of the available credit. In the first box, for which the answer was 'lowered', a clue could have been gained from the box above, i.e. the effect of the diaphragm muscles contracting was required. The third box to be completed was frequently filled in incorrectly, i.e. that pressure of the air in the lungs is increased. This was often followed by an incorrect response in the fourth box, with candidates stating that atmospheric pressure was lower than air pressure in the lungs. Again, clues could have been gained from the previous box in each case.
- (b) Cell **A**, a goblet cell, did not require identifying by name, but the function of secreting or producing mucus was required. It should have been described as being sticky, and therefore trapping dust particles, bacteria, pollen grains, etc. Cell **B** had to be identified as cilia, which move or beat. Further credit was available for explaining that the cilia move mucus (regardless of whether or not it contains particles) in an appropriate direction such as away from alveoli. Many candidates did not mention that the cilia move, or stated that they move particles but neglected to mention mucus or a direction of movement.

Question 4

- (a) This part was generally well answered, although a few candidates put the elements of glucose in the wrong order but were not penalised. Some candidates reduced the glucose formula to CH_2O or $\text{C}_3\text{H}_6\text{O}_3$. A number of candidates wrote a word equation, which would not have gained any credit.
- (b) Some answers were difficult to read because of the way in which the numbers were written. It is suggested that, in order to avoid confusion, numbers are written as they are printed.
- (c) (i) The idea of a constant light intensity was sought in this part; that it is kept constant, and that if it is changed, the rate of photosynthesis will also be changed. An answer that merely said that otherwise the results would be invalid did not gain any credit. This part was not well answered.
- (ii) Most candidates recognised that oxygen, (which came from the plant due to photosynthesis), collected at the top of the syringe. It was less commonly noted that the pressure forced the water down the tube.
- (d) The main error was omitting the units in the axis labels. Candidates could draw a straight line between each point or a curve beginning and ending at points. A slight overshoot was allowed at the top, but gaps, sagging between points, sketchiness and excessive line thickness was unacceptable.
- (e) Candidates should have said that the rate of photosynthesis increases as the concentration of carbon dioxide, (not the concentration of sodium hydrogen carbonate), increases. Data quotes should have included units, but these were frequently omitted. Some potentially good answers did not gain credit due to omitting to say that above $0.07 \text{ mol per dm}^3$, carbon dioxide was not the limiting factor or giving an example of another factor that was.

Question 5

- (a) Candidates should learn the genuine sources of methane such as cattle, land-fills, oil extraction facilities, sewage works, etc. Animals and rubbish, unqualified, were too vague. Candidates should be aware that methane is flammable, is a useful fuel and is not a product of combustion as many appear to think.
- (b) Candidates should learn the sequence of events for global warming / greenhouse effect and thus avoid losing credit for contradictions. Vague terms such as light and rays, instead of heat / IR / radiation did not score, and bringing CFCs and the ozone layer into the explanation showed that the issue had been confused with another environmental issue, which has been largely resolved.
- (c) (i) The description of the sulfur emission changes should have been straightforward. Candidates could gain maximum credit for mentioning each obvious change or stage, getting the year references correct (an easy-to-read scale was provided) and putting the correct units in, in this case millions of tonnes of sulfur dioxide. This was essential to earn the credit that was available for quoting data.
- (ii) This question on the effects of acid rain was well answered on the whole, but candidates needed to avoid vague descriptions of acid rain 'affecting the environment' and to make correct references to pH/acidity. Some candidates incorrectly associated an increase in pH with increased acidity. Candidates should be aware that aquatic organisms live in water, but marine organisms live only in the sea. Candidates should have said that acid rain damages limestone buildings or bronze statues; damage to limestone unqualified did not gain credit, as no harm would be done if just limestone outcrops or pavements were involved.
- (iii) This part was fairly well answered but candidates should have referred to high- or low-sulfur fuels. Biodiesel was allowed as a low-sulfur fuel. References to alternative energy sources were credited, but not 'alternative' fuels, as these could refer to other high-sulfur fuels. Technological measures to clean emissions of sulfur were often described in vague terms; flue-gas desulfurisation, scrubbers, chimney electrostatic precipitators, etc. would have gained credit, but less precise terms would not. Methods of reducing demand for fuels (such as factory closures) did not gain credit, but methods of reducing demand for energy (car-sharing, cycling facilities, etc.) did.

Question 6

- (a) This was well answered on the whole. Some self-pollination descriptions were too close to the term 'self-pollination' to serve as explanations. When writing about cross-pollination, many candidates used the word 'flower' in place of 'plant', altering the meaning of the answer and losing the credit which they would otherwise have gained.
- (b) Candidates found this part difficult and most did not score highly. Common successful answers included: longer time taken; need for an agent of pollination; usual need for another plant; seeds being scattered to places where they cannot grow. Mention of pollen and energy waste, and variation leading to poorly-adapted plants was rare.
- (c) Both answers had to be correct, with no contradiction, to score any credit.
- (d) In completing the row for cross **4**, candidates had to cancel 2 : 2 down to 1 : 1 to gain credit. Some candidates could have written the numbers with more care and therefore avoided ambiguity. Overall there was a poor understanding of the expected phenotypes and ratios of offspring.
- (e) Candidates found this part difficult. References to whether or not the phenotype is influenced by the environment were ignored in this part.
- (f) This was reasonably well answered; candidates were able to recognise the advantage of colonisation of new areas and less competition. The point that was least-mentioned was that seed dispersal over a wide area allows breeding with a wider variety of plants, a bigger gene pool or more alleles. Greater biodiversity was not credited, nor were references to breeding with other species, which were frequently suggested.