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BIOLOGY

Paper 0610/12
Multiple Choice (Core)

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

General comments

The paper provided a good balance of questions and challenges for candidates working at this level. It is important that candidates study the information in diagrams and the stem of the question carefully before choosing their response, as in the case of **Question 4**. Candidates demonstrated a sound knowledge of how to solve problems involving magnification.

Comments on specific questions

Question 1

While most candidates optioned correctly, quite a large number believed that having four limbs is a characteristic of mammals.

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Question 3

Most candidates understood that palisade cells, being leaf cells, have a greater number of chloroplasts than other cells in the same plant.

Question 4

While the majority of candidates identified the cells as coming from the bronchus, quite a large number of candidates thought that they were from the alimentary canal and plant roots. This suggests the cells were wrongly identified as villi or microvilli or root hair cells.

Question 5

Most candidates showed a good understanding of magnification calculations.

Question 8

Most candidates were aware that proteins are substances that contain nitrogen.

Question 9

Many candidates selected the correct option. Some candidates seemed uncertain about the effect of temperature on enzyme activity.

Question 13

While some candidates correctly identified acid as the cause of tooth decay, the majority opted for sugar. This suggests that many candidates did not understand the relationship between sugar and acid production in the mouth.

Question 14

Many candidates correctly applied their knowledge of factors affecting transpiration. Some candidates found it challenging to relate humidity and temperature to transpiration and hence the final volume of water in the measuring cylinders.

Question 16

While most candidates knew the function of platelets, some candidates believed them to be involved in antibody production and carrying oxygen.

Question 17

The majority of candidates understood the definition of the word pathogen.

Question 19

Many candidates showed a good understanding of the composition of inspired and expired air and were able to predict the effect that a plant would have on the air composition in the container.

Question 20

While most candidates realised that anaerobic respiration in muscle cells results in the production of lactic acid, many candidates also thought that carbon dioxide is produced during this process.

Question 23

This question proved to be challenging for many candidates. Only a few appreciated that the receptors for blood temperature are located in the brain.

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Question 26

This was also a challenging question for some candidates and required a clear understanding of the differences between the terms antibody and antigen.

Question 27 and 28

Candidates showed a good level of knowledge of sexual and asexual reproduction and whether these forms of reproduction result in genetically identical or non-identical offspring. Candidates also had good knowledge of flower structure.

Question 29

While most candidates identified the correct option, some thought that a human fetus would grow in the ovaries.

Question 32

Many candidates were able to correctly identify the definition of a gene.

Question 34

This question proved challenging for some candidates. An understanding the meaning of the terms homozygous and heterozygous was essential. Many candidates realised that a homozygous brown-coated parent could not produce an albino offspring. The correct option could also have been reached by crossing the parents, using a Punnett square.

Question 35

Only a few candidates could identify the correct description of an adaptive feature.

Question 38

This proved to be a challenging question for many candidates. It required them to recall that it would be a length of human DNA rather than bacterial DNA that is inserted into a bacterium to produce insulin.

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BIOLOGY

Paper 0610/22
Multiple Choice (Extended)

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

General comments

Candidates demonstrated a good understanding of the subject matter presented. An area of improvement for some is the interpretation of diagrams and graphs.

Comments on specific questions

Questions 1, 2 and 3

These questions were very well answered by the majority of candidates, who showed a good understanding of classification, the characteristics of living things and the use of dichotomous keys.

Question 4

Candidates had a very good understanding of the levels of organisation in organisms. Some candidates did not appreciate that these were not individual cells but cells grouped together to form a tissue.

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Question 13

While the majority of candidates correctly identified acid as the cause of tooth decay. However, some opted for sugar, suggesting that the relationship between sugar, acid production and tooth decay was not well understood by all.

Question 18

This question was answered well by the majority of candidates. A few candidates only looked for a greater rate of breathing and missed the fact that the depth of breathing also increases.

Question 20

While the majority of candidates realised that anaerobic respiration in muscle cells results in the production of lactic acid, some candidates also thought that carbon dioxide is produced during this process.

Question 23

This question was very well answered, although some candidates were not sure whether the pupil widens or narrows in response to adrenaline.

Question 24

The majority of candidates showed a good understanding of limiting factors in photosynthesis. Some candidates incorrectly opted for light intensity or temperature as the limiting factor at X.

Question 27

The majority of candidates correctly identified the acrosome as being involved in the digestion of the ovum cell membrane. Some candidates thought that this was the area where genetic information is carried. The acrosome may have been incorrectly identified as the nucleus.

Question 28

While the vast majority of candidates identified FSH as the hormone which is given to women undergoing fertility treatment, some opted for oestrogen.

Question 30

The majority of candidates answered this question correctly, appreciating that no matter how many times the cell divides by mitosis, the diploid number will be maintained. Some candidates though, halved the diploid number (16) twice and incorrectly opted for four chromosomes.

Question 33

Most candidates identified the correct option but some were less secure in their knowledge of the key features of xerophytes.

Question 34

Most candidates showed a good understanding of the differences between natural and artificial selection. A few did not recall that it is based on humans selecting the desired characteristics.

Question 35

Many candidates were able to perform the calculation and select the correct option.

Question 37

This proved to be a challenging question for candidates. Many did not appreciate that the exponential phase is limited by the rate of reproduction.

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Question 40

This question was answered well by the majority of candidates. A few incorrectly thought that the level of oxygen rises when sewage is released into a river.

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BIOLOGY

Paper 0610/32
Theory (Core)

Key messages

Candidates need to read each question very thoroughly and before starting to write their answers. Frequently marks cannot be awarded, not because what has been written is incorrect, but because the answer does not cover the information asked for in the question.

General comments

Many candidates performed well on this paper and some scripts were excellent. There was no evidence that candidates were short of time. The majority of candidates attempted every part of the paper.

Comments on specific questions

Question 1

Candidates of all abilities had difficulty in linking enzymes to the gland responsible for their secretion. Despite being asked to draw four lines, many candidates drew one or two only. The most frequent correct answers given were to link amylase production with salivary glands and protease production with the stomach lining. The secretion of enzymes by the pancreas was not well known.

Question 2

(a) (i) Most candidates identified the muscular wall accurately. Candidates with a firmer grasp of the heart structure could identify the atrium and ventricle, but some tended to confuse the aorta, pulmonary vein and pulmonary artery.

(ii) This question was difficult for candidates of all abilities. Candidates were asked to name a heart chamber (the right ventricle) but the majority named a blood vessel. Candidates need to be clear that the heart is responsible for pumping the blood, whereas the role of a blood vessel is to transport the blood.

(b) (i) Nearly all candidates read the two required figures from the graph accurately and so gained one of the possible marks. The second mark was awarded for stating the units correctly, and many candidates either did not give any unit, or stated the unit as dm^3 and not dm^3 per minute.

(ii) The majority of candidates could not calculate the percentage accurately. It is a useful technique for candidates to look at the graph and work out an approximate answer, so that they can judge whether their calculated answer is likely to be correct.

(iii) The question was not answered well. More able candidates were credited with one mark for stating that the heart would beat faster. A few candidates only suggested that the heart would pump out an increased volume of blood at each beat.

(iv) Many candidates supplied an acceptable reason for the difference in students F and G.

Question 3

(a) (i) This was fairly well answered by most candidates.

(ii) Many candidates could identify a synapse accurately.

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(iii) Most candidates could give one characteristic of a reflex arc and many could state two characteristics. Hardly any candidates cited the fact that reflexes are coordinated, which is an important facet of a reflex action.

(b) (i) Most candidates recognised the fact that reflex actions have a protective function and help prevent further damage. It follows that, as few candidates mentioned that reflexes are coordinated in **part (b)(i)**, it was not referred to here. It needs to be stressed that a particular stimulus results in the appropriate actions, involving more than one part of the body if necessary.

(ii) More able candidates gained credit either for stating the name of a specific reflex action or for describing one in detail. Weaker candidates gave incomplete answers, such as 'a bright light' which was insufficient as although the stimulus is given, the response is unclear.

Question 4

Most candidates gained full marks by linking each specialised cell to its function correctly.

Question 5

(a) It is advantageous for some definitions to be learnt as it is difficult for candidates to be precise when using their own words. The majority of candidates did not know the definition of a *species*. Relatively few appreciated that to be of the same species, the offspring had to be fertile. Some thought that the term *species* applied to animals only.

(b) Many candidates answered accurately throughout and gained full marks. Common misconceptions were that amphibians had scales, that amphibians did not lay eggs and that only mammals could maintain their body temperature.

Question 6

(a) (i) This was well answered with most candidates being able to write the word equation for photosynthesis. There were a few instances of candidates giving the word equation for respiration.

(ii) Many candidates, instead of naming the part of the cell that contained chlorophyll, named the part of the plant where chlorophyll was found.

(iii) To gain the mark, candidates had to state two different cell types that contain chlorophyll. Most candidates could name one cell type, but not two. A common error was to state palisade mesophyll cells as one type and mesophyll cells as the second type. It was necessary to be specific and state spongy mesophyll cells to gain the mark. Some more able candidates stated correctly that guard cells contain chlorophyll.

(b) (i) The majority of candidates gained a mark for stating that, as the temperature increased, so did the rate of photosynthesis. Some less able candidates thought that photosynthesis only took place between 15°C and 25°C. The second mark was awarded for additional information, such as the rate doubling with a 10°C rise in temperature, or the quotation of some relevant figures from the graph.

(ii) Few marks were awarded for answers given. Many candidates stated that as the temperature increased there would be more light, which accounted for the increased rate of photosynthesis. This is an example of candidates not reading the material carefully, as the information that the plant was in bright light for the duration of the experiment was stated at the start. More able candidates linked higher temperature with increased enzyme activity or with increased transpiration, but very few stated two reasons. It is important that candidates realise that if two marks are available, they must state two different points in the answer.

(iii) Many candidates gained marks for predicting that the rate of photosynthesis would decline or stop. Most related this to enzymes being denatured, or some stated that transpiration would be rapid causing the plant to wilt. Less able candidates predicted that the rate of photosynthesis would rise (and gave an extrapolated rate). It needs to be emphasised to candidates that enzymes control reactions in plants as well as in animals, and that the same conditions for enzyme activity apply.

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Question 7

(a) This question was fairly well answered. Most candidates gained at least three marks and many gained full marks. The least known fact was that methane is a gas that contributes towards the greenhouse effect.

(b) Most candidates knew this topic thoroughly and gained at least two marks, with many being awarded full marks. The question asked for a description of two reasons why humans cut down trees. This means that two reasons must be stated and each must be described. Those candidates who gained less than four marks usually did so as they gave a number of reasons, but no description of any of them.

(c) This was less well answered than **part (b)**. Candidates were asked to give two undesirable effects of cutting down trees, but were told not to include the effects of greenhouse gases. Some candidates did not follow the instruction and so did not supply relevant information.

Question 8

(a) (i) More than half the candidates wrongly identified the grass as the principle source of energy. Most of the rest answered correctly.

(ii) Candidates need to know that the arrows represent the flow of energy. The majority of candidates gave answers in terms of organisms eating/being eaten, for example some candidates thought that the lizard ate the snake.

(iii) This was answered accurately by most candidates.

(iv) This was also well answered.

(v) Many candidates gave sound and detailed explanations and so were awarded full marks. Weaker candidates stated that, as hawks did not eat snakes, nothing would happen to the number of hawks. It is important that candidates realise the interdependence of organisms within a food web.

(b) (i) Most candidates entered the correct information on the diagram. A few placed the arrows in the wrong direction, and some did not attempt the question at all.

(ii) This was well answered. Even those candidates who had not entered the information on the diagram understood the implications.

(iii) The majority of candidates gained one mark only for their answer, usually for stating that a population is a group of organisms living in the same area/at the same time.

Question 9

(a) This was fairly well answered. Most candidates could identify the scrotum and the testis, but fewer knew the sperm duct and the prostate gland.

(b) (i) Most candidates could identify the testis as the place that produced sperm cells, although some placed the cross on the epididymis.

(ii) This was answered correctly by most candidates.

(c) Most candidates were unable to answer this question accurately. The role of the prostate gland was not known by most. The most frequently awarded mark was for the function of the scrotum to protect the testis. Few knew about the temperature requirement for sperm production.

(d) The majority of candidates could name a barrier method of birth control.

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BIOLOGY

Paper 0610/42
Theory (Extended)

Key messages

A high standard of biological knowledge and understanding was displayed by many of the candidates. Many candidates should be congratulated for their clear, articulate and accurate responses.

When answering extended questions, candidates should be reminded to use the correct scientific terminology when describing or explaining phenomena.

Candidates should take note of the command word used in the question. When a definition is asked for candidates are expected to recall the definition as stated in the syllabus. Learning definitions also improves the precision of the responses candidates are able to give in extended writing questions.

General comments

Candidates had a good understanding of biological processes and mechanisms. They were generally able to communicate their responses clearly. There was evidence of a wide variety of knowledge and understanding of all parts of the syllabus and an ability to apply different skills depending on the question demand.

Some candidates provided incomplete responses to some questions or responses this did not answer the question asked. In these cases, candidates should be reminded to read the stimulus material and complete all the instructions contained within the question to be able to access the maximum marks available.

Comments on specific questions

Question 1

(a) (i) The septum was the structure that was most often identified correctly. The semi-lunar valve was identified less frequently and sometimes mistaken for the left ventricle or the atrioventricular valve. The atrioventricular valve was often mistaken for the right atrium. Sometimes valve L was identified as the bicuspid valve, which was acceptable.

(ii) Most candidates were generally able to achieve at least one of the marks available. It was clear that some candidates did not adequately know the origin or destination of the blood vessels of the heart, or muddled the right and left side of the heart. Knowing this information would have helped them to answer this question. The blood vessel which had the highest pressure was most commonly incorrectly quoted as blood vessel P. Candidates were more successful at identifying the blood vessels to and from the lungs, carrying blood with the highest concentration of carbon dioxide or oxygen.

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(b) (i) Candidates generally answered this question well. Candidates knew the passage of the blood through the heart but were less precise about the action of the valves. Some candidates chose to describe the entire circulation, this was unnecessary. Candidates should be reminded to use the correctly terminology and describe the atria and ventricles as contracting to pump the blood, rather than just pushing or pumping. A few candidates incorrectly suggested that blood crossed the septum.

(ii) A common misconception was that the right ventricle pumped the blood at low pressure whereas the left ventricle pumped the blood at high pressure. Both ventricles pump the blood at high pressures, however, the left ventricle pumps the blood at a higher pressure. Many candidates correctly stated the left ventricle has to pump blood over a greater distance.

Question 2

(a) Many correct features were seen. The question specified that the features be shared by all prokaryotes. Structures such as flagella and slime capsules are not features of all prokaryotes.

(b) (i) The vast majority of candidates were able to describe the results shown by the graph and included correct data quotes. In questions such as this one, candidates should be encouraged to use the axis titles as a guide to their descriptions. The graph showed an increase in the number of cases of MRSA infection not the numbers of individual bacteria.

(ii) The development of antibiotic resistance in bacteria was not well known by many of the candidates. The better responses gave an explanation which included reference to variation and natural selection. A common misconception was that antibiotics cause the mutation which creates antibiotic resistance. A few candidates incorrectly stated that bacteria gained active immunity after exposure to antibiotics.

(c) Many good responses were seen, with most candidates describing the development of new antibiotics or the more responsible use of antibiotics. Surprisingly few candidates referred to improved hygiene or screening, which was also acceptable.

Question 3

(a) Most candidates knew the function of the rod and cone cells. Good responses referred to rod cells and low light intensity. Some candidates described the sensory neurone as detecting stimuli as well as transmitting impulses, which is not correct. The term *impulse* should be used rather than messages or signals.

(b) Some very good responses were seen with some candidates being able to describe and explain the distribution of rod and cone cells across the retina. Good responses include a reference to the unit when quoting data from the graph and described the number cone or rod cells per mm^2. There were some responses which did not refer to the fovea or the blind spot, it was important to be able to identify and use the correct terms when describing that patterns on the graph.

(c) It was clear that some candidates found this question challenging. The question required responses to provide evidence from the figure. Many candidates attempted to provide an explanation based on their theoretical knowledge of sex-linkage and not observation of the data provided which did not fully answer the question asked.

(d) Many excellent genetic diagrams were seen. The most common errors were to describe the offspring phenotypes in insufficient detail. Some responses did not include the gender of the offspring. Another common error was to state the probability as being 1:2 rather than 1:1.

Question 4

(a) Most candidates knew the requirements for photosynthesis. A minority of responses stated water but as this was given in the question it was not an accepted answer.

(b) Some candidates found calculating the percentage loss to be challenging. The best responses remembered to round their answer to a whole number, as instructed.

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(c) (i) The effect of a decrease in humidity on transpiration was well understood by many candidates. Good responses described, in detail, how the movement of water through the plant increased and also described the reduction in water vapour outside the leaf causing more water vapour to diffuse out of the stomata. Many referred to increased transpiration and transpiration pull but few described the process of transpiration in enough detail. A minority also described the movement of water into the plant root, which was unnecessary.

(ii) There were some very good responses seen and it was clear that most candidates had a good understanding of how water enters a plant. Candidates should be reminded to use the term *water potential* rather than water concentration. Several candidates gave a good description of osmosis without using the term and many, unnecessarily, went on to describe the movement of water across the root to the xylem.

(d) Again, many excellent responses were seen. Many candidates had a clear understanding of the effects of deforestation. Many candidates described the possible effects of deforestation on animals living in the forest. Some responses described effects of secondary events such as soil erosion and climate change on the animals rather than the required direct effects.

Question 5

(a) (i) Many candidates were able to recall the correct equation. Common errors included the inclusion of oxygen and water or incorrect balancing of the equation. A minority of candidates provided a word equation, which was not required.

(ii) The majority of candidates correctly identified the liver. A small minority gave incorrect answers such as the brain or stomach.

(b) Most of the candidates could explain the importance of the shape of the enzyme using the correct terminology. The best responses referred to enzyme-substrate complexes, lock and key theory and to the complementary shapes of the enzyme's active site and the substrate. Only a few responses incorrectly referred to the active site as being part of the substrate.

(c) (i) A number of responses described the effect of an increase in enzyme activity rather than providing an explanation of why enzyme activity increases. Some candidates described the denaturation of the enzymes at high temperature, which, although true, did not answer the question. The best responses referred to increased kinetic energy and the rate of successful collisions.

(ii) The majority of candidates identified pH as another factor affecting enzyme activity.

(d) (i) Questions asking for a definition require the definition as stated in the syllabus.

(ii) The role of ribosomes in protein synthesis was not well understood. There were many responses that referred to mRNA, amino acids and proteins but many did not specify their actions or involvement in protein synthesis. Most responses correctly stated that amino acids were assembled into proteins. Far fewer were able to describe how the order of amino acids was determined or the role of mRNA. It was also evident that there is some confusion between ribosomes and mitochondria.

Question 6

(a) Most candidates knew at least one enzyme its substrate and the location of enzyme production. Few knew that glucose is the product of maltose digestion. The enzymes responsible for the digestion of proteins were well known. All of the products of the digestion of fats were required. Fewer candidates were able to specify the exact types of protease found the stomach and small intestinal walls.

(b) The best responses referred to the role of bile in emulsification and in neutralising stomach acid. A common misconception was that bile contained enzymes or that bile itself was an enzyme responsible for the break down of fats.

(c) The definition of absorption was not well known. Many candidates described digestion or assimilation instead.

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(d) Most candidates were able to give the name of one disease caused by protein-energy malnutrition, with the most common correct response being kwashiorkor. Very occasionally other incorrect deficiency diseases were seen, such as scurvy.

(e) Many correct health benefits were suggested. Candidates should be careful using the term 'prevent'. A reduction in consuming fats will not prevent CHD but will reduce the risk of it.

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BIOLOGY

Paper 0610/52
Practical Test

Key messages

Candidates should be familiar with all of the practical exercises stated in the syllabus and have an understanding of the basic principles of planning an investigation.

Correct presentation of data is an important skill and the use and inclusion of SI units in table headings, rather than in the data cells and on graph axes labels is essential.

The ability to produce drawings that follow the standard conventions for biological drawing is another essential skill.

General comments

The Supervisor's report is very important and should be completed in as much detail as possible.

It is important that candidates are able to identify the different variables involved in an investigation. They should also consider how the data is going to be collected and how the data will be analysed when planning an investigation. Candidates should also be able to justify their choice of equipment and evaluate its accuracy and precision.

Drawing an accurate representation of a biological specimen requires practice. It is important to observe and determine the appropriate details of a specimen, including the shape and proportion of the structures seen.

Comments on specific questions

Question 1

(a) (i) Most candidates were able to make suitable observations. A few responses erroneously gave predictions instead of observations.

(ii) It was pleasing to see that most candidates were able to draw an accurate and complete table. The best responses provided suitable column headings with units. It is important that candidates do not include units in the body of the table.

(iii) This question was well answered by most candidates.

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(b) (i) For many candidates this question proved challenging. The most common error was to give the opposite trend.

(ii) Some candidates found this question challenging. Many responses discussed, in detail, the theory of osmosis, but did not relate this to their results. The best responses compared potato stick B and C in terms of being turgid or flaccid and explained why this occurred rather than how it occurred.

(iii) This question was well answered by many candidates. It was important that the improvement given matched the error that had been identified.

(iv) This question was answered well by candidates. It is important that candidates understand the differences between the variables that are changed, measured and those that are kept constant. A common error was to list all of the variables rather than identifying the variables that were controlled (kept constant) in the investigation.

(c) (i) This was a challenging question for some candidates. A common error was to make a reference to 'accuracy' but with no further qualification, which was not sufficient. The better responses clearly expressed the idea that the mass change would be greater.

(ii) Many candidates clearly understood that surface water would have no effect on the measurement of length and provided good responses to this question.

(iii) Most candidates were able to draw a suitable graph. A common error was to extrapolate the line beyond the plotted points. Good responses included suitable units in the axes labels.

(iv) A pleasing number of candidates gave good responses to this question. The most common error was to omit the units for the sucrose concentration that would cause no change in the mass of the potato stick.

(v) Many candidates gave good responses to this question. Most made reference to the idea that different potatoes would result in different concentration of sucrose solution causing no change in mass. One misconception was that there would be a lack of osmosis.

Question 2

(a) Many candidates were able to produce drawings that followed the standard conventions for biological drawings. The better responses were drawn with a sharp pencil and had outlines that were clear, continuous and unbroken and did not have any shading.

(b) (i) Most candidates were able to successfully measure the length of the anther.

(ii) Most candidates were able to correctly calculate the actual length of the anther. The most common error was incorrectly manipulating the equation.

(c) The quality of responses to this question was varied. Some candidates had a very clear idea of how to plan a valid investigation. Most candidates were able to convey that the seeds should be placed on wet cotton wool and put into at least three different temperatures. Fewer were able to correctly identify the variables involved.

(d) (i) Almost all candidates recalled the test for starch.

(ii) Similarly, almost all candidates correctly identified that a positive test result would give a blue-black colour. A common error was to state the colour as blue. This was considered ambiguous as a negative result for other food tests, such as Benedict's reagent or biuret solution, would be blue.

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BIOLOGY

Paper 0610/62
Alternative to Practical

Key messages

Candidates need sufficient hands-on practical experience covering a broad range of investigative work during the course. This includes planning and evaluating practical work, as well as performing the experimental techniques outlined in the syllabus.
Candidates should read questions and familiarise themselves with the procedures and data shown in the questions.
Candidates should use a sharp HB pencil for drawings and graphs. Any incorrect lines should be erased completely.
Should it be necessary to continue a response on additional paper, candidates should clearly number any continuation and should indicate that the response is continued elsewhere.
Candidates should include appropriate units when quoting data, drawing graphs, tables and performing calculations.

General comments

Most candidates were well prepared and able to access all aspects of the practical work outlined in assessment objectives for practical work. Most candidates were able to confidently draw tables, graphs and diagrams, as well as plan and evaluate investigations. Those candidates who seemed unfamiliar with the experimental procedures used to investigate osmosis (**Question 1**) and seed germination (**Question 2**) found it difficult to describe the procedures and relied on their theoretical knowledge rather than practical experience. This was most evident in **Questions 1(a)(ii)**, **(b)(iii)**, **(b)(iv)**, **(c)(i)**, **(c)(ii)** and **2(c)**.

Comments on specific questions

Question 1

This question involved investigations on the effect of osmosis on potatoes. This type of investigation seemed familiar to most candidates and many confident and well-constructed answers were seen.

(a) (i) Most candidates were able to draw a suitable table. The most common error was to include units in the data cells.

(ii) Most candidates restated the question and acknowledged that it was important to compare the change in length of the potato sticks. Fewer candidates were able to explain that comparisons of final lengths would be invalid if the initial lengths were different.

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(b) (i) Those students who used a combination of all the results (final lengths and the observation) were able to correctly rank the concentrations of solutions A to D. Many candidates relied on just one source of information rather than using all of the tables and figures.

(ii) Many candidates were familiar with osmosis investigations and were able to use the information to explain how they had ranked the concentrations of the solutions. Common misconceptions included linking 'hardness' of the potato stick to water loss, or more commonly, thinking that the potato would go soft when it soaked up water, as well as statements relating to the uptake of the solution rather than the water in the solution.

(iii) Almost all candidates were able to describe an error and a related improvement for the method described. Candidates should be reminded to focus on the errors in the procedure described in the question paper rather than errors that commonly occur in unrelated procedures.

(iv) Many candidates were able to correctly identify a variable that was not changed in the investigation. A common error was to provide incomplete information about the variable. For example 'lengths of the potato sticks' with no reference to the idea that it would have been in the initial length; 'amount of solution' with no reference to volume (concentration of solution would have been incorrect in the context of this investigation).

(c) (i) Many detailed answers explaining the value of leaving the potato sticks for 3 hours rather than 30 minutes confirmed that the vast majority of candidates were familiar with the length of time required to obtained distinctive changes in mass in osmosis experiments. A few responses referred only to increased accuracy but did not say why this would be so.

(ii) Although many candidates seemed aware that surface water would not affect the measurement in length of a potato stick, some responses incorrectly stated that the water in the potato would not affect its length.

(iii) Most candidates were able to plot a graph correctly. Common errors included:

omitting axes labels and / or correct units
a scale that covered less than half the available space
the use of a non-linear scale
not plotting all points accurately
an unsuitable line of best fit
an attempt to join plotted points where the lines did not actually meet at a point.

(iv) Many candidates were able to indicate the place on their graph where there was no change in mass, but fewer were able to read this point off their graph correctly. This was particularly noticeable where an awkward *x*-axis scale had been selected.

(v) A number of candidates gave correct suggestions for this question. The better responses described differences in the water potential in the potatoes tested. A common misconception was to suggest that potatoes of different sizes would give different results, even though the data was expressed as a percentage change in mass. Similarly, some incorrectly described how the different concentrations of sucrose solutions tested would give different results, rather than referring to the solute concentration inside the potatoes themselves. A few responses only referred to the last part of the question and explained why there would be 'no change in mass'.

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Question 2

Most candidates seemed well prepared for the drawing skills and magnification calculation questions.

(a) Although many good drawings were seen, some included labels, which was not required. The size and detail of drawings was usually correct. Common errors included drawings with thick or feathered outlines, incorrect proportions and shading of the anthers.

(b) (i) Many candidates were able to measure the anther labelled in the photograph precisely. The most common error was to give the answer in centimetres, rather than millimetres without specifically stating this change of units on the answer line. To avoid ambiguity, it is important that the position of the decimal point is clear.

(ii) Almost all candidates were able to use the formula to correctly calculate the actual length of the anther. The most common error was to use another magnification, rather than that stated underneath the photograph or to multiply by two rather than to divide by two.

(c) The responses seen for the planning question on showed that many candidates clearly understood the principals of designing investigations. However, some response described the theory of the factors that affect germination or described other experiments related to germination which did not answer the question. Some responses lacked the detail required in a specific marking point. Examples of this included:

test at ‘different temperatures’ rather than specifying how many different temperatures should be tested
leave for a 'few' days was insufficient as a controlled variable
‘control all other conditions’ was too general as a controlled variable because the particular conditions need to be stated
‘repeat the experiment’ rather than specifying a particular number of repetitions at each temperature.

Only the best responses extended their answers with suggestions such as conducting further experiments with a temperature range close to the optimum. A lot of candidates suggested common laboratory safety precautions but since the level of risk in this investigation was negligible these were not appropriate in the context given.

(d) (i) Almost all candidates knew that iodine solution was required to test for the presence of starch. However, a minority of candidates describe the de-starching and removal of chlorophyll from a leaf using ethanol. Many did not include a correct method of preparation. Candidates should also be reminded that iodine solution, rather than iodine (which is a solid at room temperature) is used for this test.

(ii) Almost every candidate knew the positive test result colour for a starch. Candidates should be reminded that since ‘dark blue’ could be confused with the ‘blue’ and ‘purple’ colours seen in other food tests, it is advised that they always make reference to ‘black’ in their answers for this test.

(iii) Almost all candidates knew that Benedict’s solution was required to test for reducing sugars. However, a considerable number of candidates described the need for a water-bath, without suggesting that heat needed to be applied.

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