BIOLOGY

Paper 0610/12
Multiple Choice (Core)

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

General comments

There was good understanding of: magnification; food tests and selective breeding.

There was some uncertainty about: the definition of excretion; the process by which water escapes from stomata and the identification of motor neurones.

It is important for candidates to work carefully and methodically through information provided in the question, such as in **Questions 12**, **23** and **33**.

Comments on specific questions

Question 1

A significant number of candidates incorrectly believed that undigested food is removed by excretion. Egestion is the process that removes undigested food. Excretion is the removal of waste products of metabolism and substances in excess of requirements.

Question 3

Whilst some candidates understood that insects have three pairs of jointed legs, the majority of candidates selected an incorrect distractor.

Question 4

Many candidates appreciated that the presence of structure Q (the cell wall) and S (a chloroplast) indicate that this is a plant cell.

Question 6

It was understood by many candidates that if the thickness of the cell membrane is increased then there would be a decrease in the rate of diffusion of oxygen into cells. Some candidates incorrectly believed that increasing the concentration gradient would decrease the rate of diffusion.

Question 8

Many candidates understood that in active transport, particles move through a cell membrane from a region of lower concentration to a region of higher concentration, using energy from respiration. Some candidates incorrectly opted for the diagram showing particles moving from a region of higher concentration to a region of lower concentration.

Question 11

It was well understood by candidates that at the end of an enzyme-controlled reaction there will be both enzymes and products. Some candidates incorrectly believed that only products remain at the end of an enzyme-controlled reaction.

Question 13

The main source of error in this question was candidates incorrectly identifying the cuticle as the epidermis.

Question 14

Many candidates correctly identified the teeth which are used for grinding food, that is the premolars (tooth 1) and the molars (tooth 2). Some candidates incorrectly believed that the incisors (tooth 4) are used for grinding food.

Question 16

Only a minority of candidates responded correctly. In order to answer the question correctly, candidates needed to know that amino acids and simple sugars are small molecules.

Question 18

This proved to be quite a demanding question, with candidates mainly opting either for diffusion, which is correct or evaporation, which is incorrect.

Question 19

Few correctly selected option **A**, with many candidates incorrectly believing that capillaries and arteries have valves.

Question 23

A significant proportion of candidates incorrectly believed that carbon dioxide is taken in by seeds and oxygen is given out.

Question 24

Many candidates understood that yeast is used in bread-making because anaerobic respiration produces carbon dioxide. Some candidates incorrectly believed that it was because anaerobic respiration produces alcohol.

Question 25

Whilst many candidates correctly identified the urethra, some candidates incorrectly selected the ureter.

Question 26

The majority of candidates were unable to correctly identify the motor neurone.

Question 27

Many candidates were aware that insulin decreases the blood glucose concentration. Some candidates incorrectly believed that insulin increases the blood glucose concentration.

Question 28

This proved to be a demanding question with most candidates not appreciating that inside a dark box phototropism cannot occur in the roots or the shoots.

Question 29

A significant proportion of candidates incorrectly believed that antibiotics kill resistant bacteria.

Question 32

Whilst many candidates understood that fertilisation usually occurs in the oviducts, some candidates incorrectly opted for the uterus lining.

Question 33

The majority of candidates were unable to derive the correct answer from the genetic cross. It is important that candidates work methodically through the information given.

Question 34

Most candidates opted incorrectly. Some candidates incorrectly believed that continuous variation is caused only by the genes and that an example of this type of variation is ABO blood groups.

Question 37

Many candidates appreciated that there were four trophic levels in the food chain. Some candidates incorrectly opted for three. Possibly, these candidates did not know that the producers also represent a trophic level.

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Paper 0610/22
Multiple Choice (Extended)

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

General comments

There was good understanding of: magnification; food tests and the function of teeth.

There was some uncertainty about: anaerobic respiration; phototropism and the similarities between natural and artificial selection.

It is important for candidates to work carefully and methodically through information provided in the question, such as in **Question 21**.

Comments on specific questions

Question 12

Whilst most candidates selected correctly, some incorrectly identified the cuticle as the epidermis.

Question 16

Many candidates correctly identified diffusion as the process by which water escapes from stomata in the leaves. Some candidates incorrectly opted for evaporation.

Question 21

Many candidates opted correctly but some candidates were uncertain about which gas is taken in by the seeds and the direction of movement of the coloured liquid.

Question 26

Most candidates opted correctly but some did not appreciate that inside a dark box phototropism cannot occur in the roots or the shoots.

Question 30

Most candidates understood that the sequence of amino acids is determined by the sequence of bases in the mRNA. Some candidates incorrectly believed that the gene coding for the protein moves from the nucleus to the cytoplasm.

Question 32

Whilst most candidates could identify the genotype of a red-green colour-blind male, some candidates incorrectly opted for the dominant allele on the X chromosome.

Question 33

Many candidates appreciated that hydrophytic plants do not have a waxy cuticle. Some candidates incorrectly believed that in hydrophytes stomata are sunk in pits in the epidermis.

Question 34

Many candidates selected correctly, understanding that during both natural selection and artificial selection only certain individuals reproduce and alleles are passed on to the offspring. Some candidates incorrectly believed that the only statement correct for both natural selection and artificial selection was that alleles are passed on to offspring missing the idea that in both types of selection only certain individuals reproduce.

BIOLOGY

Paper 0610/32
Theory (Core)

Key messages

It is essential that candidates read questions carefully and make sure that they are following all instructions within the question. In several questions, candidates were hampered, not by a lack of biological knowledge, but by not following instructions.

Candidates should take note of the marks allocated to each question. For example, where three marks are available, three distinct points must be made if full marks are to be awarded.

General comments

Candidates performed well on the short answer questions. Some candidates found it difficult to express their ideas where longer answers were required.

Comments on specific questions

Question 1

(a) (i) Almost all candidates selected food **B** as having the highest carbohydrate content per 100 g.

(ii) Most candidates performed the calculation required to identify food **C** and food **D** as the foods that would provide more than the recommended daily fat intake.

(iii) The majority of candidates found this calculation difficult. In most cases, no working was shown, so it is not possible to say what mistakes candidates are making.

(iv) Vitamins, mineral (ions) and water all appeared regularly in responses. A few candidates gained only one mark as they named two specific minerals or two specific vitamins. Some candidates did not appreciate the requirements of the question and gave answers such as glucose or amino acids.

(v) Candidates of all abilities did not perform well in explaining why food **E** would be recommended as part of a balanced diet. Most candidates stated that food **E** contained all the nutrients in the correct proportions. This could not be given any credit, as although all the nutrient groups are present, they are not in the correct proportions. Those who made the point that all the nutrients were present, gained one mark. It was rare for a candidate to give further explanation, such as the reasons why carbohydrates, protein and fibre are necessary or why the low level of fats present in food **E** would be advantageous in a diet.

(b) Some candidates had difficulty naming the elements present in carbohydrates and often answered by naming different examples of carbohydrates. Carbon, hydrogen and oxygen were well known to more able candidates, although carbon dioxide was stated fairly frequently instead of carbon.

(c) Relatively few candidates selected both cellulose and glycogen. The pattern was for candidates to know one of these and then select one of the distractors.

Question 2

(a) (i) Some candidates produced excellent answers with very full and accurate descriptions of the investigative results. There was a tendency for some candidates to only give one or two descriptive

points when three marks indicate that three points are required. When figures are quoted, it is important that the units are also stated.

(ii) The last two answers, stomata and transpiration, were well known. The first two answers proved more difficult for most candidates. Instead of mesophyll cells, common answers provided were plant cells or leaf cells, and instead of air spaces, candidates stated tiny spaces or empty spaces. Many did not identify the process as transpiration.

(iii) Xylem was well known.

(b) (i) Identification of a guard cell proved difficult for many candidates. Frequent incorrect responses were stoma, epidermal cell and leaf cell.

(ii) Most candidates stated either the cell wall or the presence of chloroplasts as features which identify the cell as a plant cell. Those candidates who cited the presence of a large vacuole were not given credit as this feature of plant cells cannot be seen in the photomicrograph.

(c) In general, candidates knew that the large surface area of a leaf was connected to the absorption of light for increased photosynthesis or the production of glucose. Fewer candidates linked the larger surface area to increased gas exchange, though this was equally valid.

Question 3

(a) (i) Candidates of all abilities correctly identified two males with Huntington's disease.

(ii) **HH** and **Hh** were stated by most candidates. Less able candidates often gave one answer only. Some candidates used the notation that would be applicable for blood groups (i.e. $I^{H}I^{h}$) This was not accepted.

(iii) Common responses were that 'we are told it is dominant', 'it has a capital letter,' neither of which answer the question. Many candidates relied on the fact that, of the three offspring of individuals 1 and 2, two of them inherited the condition, and that this indicated it was dominant. This also did not answer the question as it is a vague indication and not proof. The actual proof lies in the fact that if the condition were recessive, then all the offspring of individuals 1 and 2 would have to inherit the condition. They do not, therefore the condition must be dominant.

(b) Some candidates did not write the gametes in the correct format. Other candidates tended to use a di-hybrid cross, instead of the one asked for in the question. In this situation, the first mark would not be awarded, but the other two marks would be available if the work followed through accurately.

(c) (i) The syllabus defines a gene as a length of DNA that codes for a protein. Candidates tended to know the first point, but few stated that it codes for a protein. Many candidates relied on a general definition stating that a gene is a unit of inheritance that is transferred from parent to offspring. Whilst this is correct, it does not include the more detailed knowledge expected of a student of Biology at this level. All candidates would benefit from learning syllabus definitions.

(ii) Many candidates did not know where chromosomes are found.

(iii) The knowledge of sex chromosomes was good. Again, a significant minority used the notation as for blood groups i.e. $I^{X}I^{Y}$. These were not accepted.

Question 4

(a) (i) Most candidates could identify **C** as containing DNA, but fewer also identified **F**.

(ii) The cell wall was identified by nearly all candidates.

(iii) Few candidates knew that the function of **D** was to make proteins. Some students identified **D** as a ribosome but could not state its function.

(b) The majority of candidates knew that a transmissible disease could be passed from host to host or from person to person. Few stated that a pathogen was involved.

(c) Answers from more able candidates centred around blood or sexual intercourse. Less able candidates mistakenly referred to coughing and sneezing. Some candidates answered by naming diseases that are transmissible.

(d) The majority of candidate struggled to state four distinct points in their answers, probably because they ignored the instructions to use their knowledge as well as using the information about Salmonella given in the question. There was also a lack of clarity in the wording of their answers, for example, 'keep the food above 75 °C' could mean store the food at this temperature or cook the food at this temperature. Most students managed to gain two marks.

Question 5

(a) Students were required to identify three parts of the breathing system. A wide variation in spelling was accepted as all the words are difficult ones. The diaphragm was well known. However, the larynx tended to be called the trachea and the bronchiole was usually identified as a bronchus. Greater attention to detail would be of benefit.

(b) Most candidates knew that ciliated cells move mucus. A few mistakenly referred to goblet cells, and some to villi.

(c) Candidates of all abilities recognised that the mouth is involved in physical digestion.

(d) (i) In this question, students were presented with information on a bar chart and asked to select information from it that supported, or did not support, a given statement. Two areas of improvement became apparent from the answers given. Firstly, the supporting evidence needs to use information taken from the bar chart, and not just a quote of 'The larger the species, the larger the total alveolar surface area.'. Secondly, evidence needs to be complete: i.e. 'Species **F** has a smaller alveolar surface area than species **E**' needs to have 'but **F** has a larger body size' added to make this evidence which is not in support of the original statement.

(ii) Candidates of all abilities performed the calculation accurately.

(e) Many candidates knew the characteristics of gaseous exchange surfaces. Some candidates repeated the feature that was in the stem of the question (a large surface area) or re-stated it in other words e.g. many alveoli are present.

Question 6

(a) Many candidates were not aware that only one process removes carbon dioxide from the atmosphere.

(b) This question was answered fairly accurately by all candidates. The most frequent error was to link **D** to decomposition.

(c) (i) Drawing an arrow to represent herbivores feeding proved difficult for some candidates.

(ii) Nearly all candidates identified the Sun or sunlight.

(d) Many candidates gave one valid reason even though the mark allocation indicated two reasons were required. Many candidates did not appreciate the length of time required for fossil fuel formation, with many incorrect examples being seen of figures between 10 and 200 years. Additionally, it needs to be noted that whereas fossil fuel use increases global warming, this is not an argument that can be used as to why they are not sustainable as a fuel source. There appeared to be confusion between renewable and re-usable.

(e) Many candidates could state two adverse effects of deforestation. A significant number did not follow instructions and gave increased atmospheric carbon dioxide concentrations as one of their answers.

(f) (i) Very few candidates could state the percentage concentration of carbon dioxide in the atmosphere.

(ii) This was well answered. The most frequent answer was methane.

Question 7

(a) Nearly all candidates selected the testis and ovary correctly. The prostate gland was frequently named instead of the adrenal glands.

(b) (i) Many candidates identified the eye or the iris as being the target organ. Common errors were the brain or the pupil. The latter is not a structure, so cannot be a target organ.

(ii) Other effects of adrenalin on the body were known quite well. However, less able candidates tended to state 'fight or flight' without specifying how this would affect the body.

(iii) Only the strongest candidates knew that plasma transports adrenaline. Many candidates named red blood cells or, less frequently, white blood cells.

(c) Nearly all candidates correctly selected the two statements associated with nervous control.

BIOLOGY

Paper 0610/42
Theory (Extended)

Key messages

Precision in labelling is an important skill for candidates to practise. Often candidates missed marks due to inaccuracies in their label lines and annotations. This was particularly evident when asked to annotate diagrams in questions **3(c)(ii)**, **3(c)(iii)** and **5(c)(i)**.

Bringing together knowledge from several parts of the syllabus and applying that knowledge to the context of the question was important in several questions. **Questions 2(a)** and **4(b)** are examples of this. It is useful for candidates to practise questions that require accessing knowledge from several areas of the syllabus.

It is particularly important for candidates to read questions carefully and use their knowledge to give a response to the context of the question. Some candidates gave scientifically accurate answers but did not answer the question posed. Candidates should take care not to automatically provide a practised response without checking all the requirements of the question.

General comments

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

Some areas of the syllabus were better known than others. Candidates should be reminded to revise all the material detailed in the syllabus. A useful tool is to use the syllabus as a revision guide and go through the syllabus ensuring that they have covered each learning objective in their revision.

Comments on specific questions

Question 1

(a) (i) Most candidates identified the correct blood vessel as **B**. The most common incorrect blood vessel identified was **A**. The blood vessel transporting blood with the highest concentration of oxygen will be the one directly from the lungs.

(ii) Most candidates correctly identified blood vessel **C** as the hepatic portal vein. The most common incorrect blood vessel identified was **D**, the artery transporting blood to the digestive system.

(iii) Some candidates only identified one of the three arteries in the diagram. The question required all the arteries to be identified. Another common error seen was to include the letter **Y**, which is the label identifying the septum.

(iv) Candidates that correctly identified the septum, generally answered well. The septum's role in separating oxygenated blood from deoxygenated blood was commonly seen. The role in separating the right side of the heart from the left side of heart was less commonly seen. Occasionally candidates misidentified the part as the heart organ.

(v) The main feature of a double circulatory system shown in the diagram was commonly described. Most candidates were able to describe the pathway of blood as travelling through the heart twice in one circuit around the body. Several candidates simply stated that blood travels through the heart twice. These responses were not creditworthy. Fewer candidates described the pulmonary and systemic circuits. Some candidates described the pulmonary and systemic circuits using the letters

from the diagram or the blood vessel names. This was acceptable if their descriptions were correct and of a complete circuit.

(b) (i) The correct response of arterioles was often seen. Some candidates struggled with the spelling of arterioles. Common incorrect responses included shunt vessels and other named blood vessels such as vena cava.

(ii) This question proved challenging for many candidates. A common misconception was that the change in pressure seen was due to the contraction and relaxation of the arteries rather than the heart itself. Very few candidates described the action of muscular contraction. Some stated that the pressure changes or fluctuates but did not explain why. Several candidates described the decrease in blood pressure the further the blood travels from the heart. The best responses described the cause of the increase in blood pressure in the arteries as the contraction of the heart and the cause of the decrease in blood pressure in the arteries as the relaxation of the heart.

(iii) Many candidates simply compared the structure of arteries and veins in relation to carrying blood at high and low pressure. The question instructed candidates to explain the structural adaptations. To gain each marking point candidates were required to state the structural adaptation and explain its importance. For example: arteries have thick walls in order to withstand the high pressure of the blood. Candidates could often explain the importance of a thick wall in arteries and the function of valves in veins. Explanations of the importance of elastic fibres in arteries and relative lumen size in arteries and veins were often vague and confused. A common error was to say that elastic fibres contract and relax.

Question 2

(a) There were many detailed and accurate answers seen, with many candidates scoring highly on this question. The syllabus states that amylase breaks down starch to maltose (a reducing sugar). A significant number of candidates stated that glucose was the product. Glucose is produced through the action of maltase. The less able candidates often described the movement of starch or amylase across the dialysis tubing. Candidates that understood the action of amylase often gave particularly good descriptions of the breakdown of starch and the resulting movement of smaller molecules of maltose across the dialysis membrane by diffusion. A small number of candidates confused the Benedict's test for reducing sugars with the iodine solution test for starch.

(b) This question was generally well answered. The most common error was stating starch and amylase as the substrate and enzyme that produces glucose. Occasionally pepsin and trypsin were not recognised as proteases.

(c) Almost every candidate correctly stated villi or microvilli. On rare occasions the incorrect responses of ileum and bile were seen.

Question 3

(a) (i) The different groups of plants were generally well known, with the group of dicotyledons commonly given. The response of flowering plants was less commonly seen, with incorrect responses such as mosses and flowers given. Angiosperm was an acceptable alternative to flowering plants.

(ii) Candidates were able to identify several correct identifying features of monocotyledons. The most common correct responses included parallel veins and flower parts in multiples of three. Occasionally candidates were imprecise in their responses. For example, responses such as three petals, thin leaves and one seed were not creditworthy.

(b) (i) The vast majority of candidates were able to deduce the correct number as 600.

(ii) There was some confusion evident in the responses to this question. The key information given in the figure is the stage in the life cycle going from a diploid adult sporophyte to haploid spores. Candidates should have recognised this as a reduction division and described meiosis. A significant number of candidates identified the process as seed dispersal or pollination. These responses were rarely successful. Candidates that were able to identify the process as meiosis, generally described the process well, with reference to halving the number of chromosomes and the production of genetically different spores.

(iii) The question required the name of the process. The correct answer was fertilisation. Occasionally, candidates gave a description of the fusion of nuclei, which did not answer the question and could not be credited.

(c) (i) The definition of the term species was generally well known, with many references to the production of fertile offspring. Several candidates described how members of the same species would be similar in terms of genetics or morphology, whilst true this is not the definition of a species. A few candidates described the binomial naming system, which was irrelevant in this instance.

(ii) Some excellent annotations were seen. Some candidates labelled all the flower parts, which was unnecessary. Occasionally candidates did not include an arrowhead to show the direction of the pollen transfer. Very occasionally there were some inaccuracies in the labelling with the style being labelled the stigma and the filament being labelled the anther. Candidates were required to have the correct names and the labels lines pointing accurately at the correct structure.

(iii) The question required an **X** to be placed on the diagram. Very occasionally candidates labelled the ovary instead. Candidates should be reminded to read all the instructions carefully and complete them, in order to achieve the maximum credit available.

(iv) Only the strongest candidates were able to access all the available marks. The best responses referred to varying points about the unreliability of cross-pollination in terms of the smaller likelihood of success. Many knew that cross-pollination relies on pollinators or a method of transferring the pollen to a different plant. Fewer described the increased energy demand of producing additional materials such as flowers and nectar. Several candidates identified that the resulting offspring may be less well adapted to the environment but did not explain this as being caused by increased genetic diversity.

Question 4

(a) (i) It was evident there was some confusion about the function of phloem. Several candidates imprecisely described phloem as the transport tissue for glucose or food. There were indications that some candidates did not know the meaning of the terms sink and source. Candidates that recognised that the leaves were the source, responsible for production, generally were able to gain the rest of the marking points. There were some misguided suggestions that the swelling was caused by the bark sinking down the trunk, or the tree repairing itself.

(ii) Candidates that knew the function of xylem generally did well. For this question it was important to read all the information in the stem. The key to this question was realising that only the phloem was removed, leaving the xylem intact.

(b) Most candidates could describe the need of energy for active transport as mineral ions are being transported against their concentration gradient. Fewer candidates were able to explicitly link the idea of glucose being a reactant required for respiration to occur. Candidates should be reminded to read questions carefully and ensure they are answering the question in full.

(c) Most candidates could recall the balanced symbol equation for photosynthesis.

Question 5

(a) Many descriptions of the eye being able to detect or respond to light stimuli were seen. Fewer candidates described that the eye contains receptor cells.

(b) Almost all candidates gave the correct parts of the central nervous system. Very occasionally the incorrect responses of spine or nerves were seen.

(c) (i) There were some inaccuracies seen in the identification of the blind spot. Several candidates were imprecise and placed their **X** too far into the vitreous humour or too far into the optic nerve. Several candidates incorrectly identified the fovea.

(ii) This question was generally well answered. Occasionally the retina was misnamed as the fovea. The function of the cornea was the least well known. Inaccuracies included describing the function of the cornea as focussing the light rather than refraction of light.

(d) The muscles of the iris were generally well known. Occasionally the effectors of accommodation were given, or ciliary muscle given in place of circular muscle.

(e) This question proved challenging, with many candidates describing what would happen to the parts of the eye when focussing on a distant object. Few candidates were able to successfully describe the impact of overstretched suspensory ligaments on accommodation. Some candidates incorrectly described the lens as becoming thinner or remaining thin. Other candidates incorrectly described the suspensory ligaments as contracting and relaxing or the ciliary muscles and suspensory ligaments as being antagonistic. Few of the candidates that recognised that the lens would remain wide, were able to describe the effect of this on the refraction of light.

Question 6

(a) Some excellent responses were seen with many candidates achieving full credit. Occasionally a misspelling of restriction enzyme was given. The most common omission was recombinant plasmid. Part **C** was often identified as a genetically modified organism rather than a recombinant plasmid.

(b) Several correct reasons why bacteria are useful in genetic modification were seen. The question specifies not to give structural features so any reference to the presence of plasmids was ignored. Some candidates need to be clearer and more accurate in their responses; Describing bacteria as having a fast reproduction rate is a more accurate response than ‘they grow fast’.

(c) Some candidates went into depth about the disadvantages of monocultures instead of the disadvantages of genetic modification of crops. There were several vague responses referring to cost or long-term effects. Some students focussed on bacteria causing disease or mutating and others referred to the plants being expensive rather than the seeds. The best responses described the issues with having to purchase seeds every year and the associated expense of this as well as the risk of cross-breeding with wild rice. Although there is some overlap, it is worth highlighting the unique advantages and disadvantages of practices such as genetic modification of crops, monocultures and intensive farming in candidates learning.

(d) The causes of scurvy and rickets were very well known amongst the candidates. Occasionally candidates confused vitamin C and vitamin D.

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Paper 0610/52
Practical Test

Key messages

Candidates should manage their time so that they are able to complete the practical activity but also have enough time to complete all questions.

Candidates should ensure that they read the questions carefully before starting to answer. This is particularly important for any planning exercise that is required. Identification of the dependent and independent variables is vital before a plan is completed. Controlled variables must also be considered and included in a plan.

Candidates are advised to show their working in calculations. This ensures that partial credit can be awarded even if a mistake is made during the calculation.

General comments

Many candidates performed well on this paper, with good answers seen in many cases. It is essential that all questions are attempted, even if the candidate is unsure of the answer as they may gain partial credit even if full marks are not awarded.

The drawing of the graph was done well by most candidates, but care should be taken with labels and scales on the axes.

The drawing skills of most candidates were good, with suitable details included. Lines should not be incomplete or feathered. Drawings should be neat, in proportion and show sufficient detail.

Comments on specific questions

Question 1

(a) (i) Most candidates were awarded two marks for this question. The first mark was for giving accurate temperatures for hot water in step 2 and step 11. The water temperature in step 2 needed to be higher than in step 11. The second mark was for using appropriate units.

(ii) Many candidates were able to draw a suitable table for the data they collected. The most common error was not including units in the heading.

(iii) The majority of candidates were able to state a valid conclusion based on their results. It was important for them to give a suitable reference to diffusion. Simply restating the results was insufficient for credit.

(iv) In order to be awarded the mark, candidates needed to give a suitable source of error in step 8. Many candidates simply stated rinsing, but it is the difference in rinsing that is a potential source of error. The most commonly credited answer was that the potato cylinders could be different lengths due to inaccurate measuring.

(v) Many candidates were able to provide answers of a good standard, such as using a knife or the use of hot water. Some candidates confused hazards with errors.

(vi) Candidates confidently described how to improve the error of the temperature changing over the course of the experiment. Simply stating a water-bath on its own or just a thermostat was not accepted. It is important that candidates use a thermostatically controlled water-bath to prevent this error.

(b) (i) Some candidates find the concept of independent and dependent variables challenging. Most candidates were able to identify the size or surface area of the potato as the independent variable. A larger proportion found it difficult to accurately name the dependent variable. Only percentage of light absorbed was accepted, rather than diffusion.

(ii) A good portion of candidates were able to correctly identify time, the potato or the dye as suitable constant variables. The question asked for a variable that was kept constant and the most common incorrect variable suggested by candidates was temperature as there was no reference to this in the investigation described in 1(b).

(iii) For this question candidates were asked to show on a graph how they could estimate the percentage of light absorbed by the methylene blue dye at a given surface area. It is important that candidates read the instructions carefully, so that they are answering all parts of the question. Some candidates omitted to show on the graph how their value was obtained.

Question 2

(a) (i) Candidates showed a good understanding of tests for biological molecules. The vast majority were able to gain the mark for correctly identifying the iodine test.

(ii) Most candidates correctly identified Benedict's reagent as the solution needed to test for reducing sugars.

(iii) Most candidates correctly stated the positive colour in the biuret test as purple. The most common error was naming the test rather than the colour.

(b) This question required candidates to apply their knowledge of the DCPIP test for vitamin C to determine the effect of temperature on vitamin C in fruit juice. Describing a suitable method, such as titrating the DCPIP in a fixed volume of juice proved challenging. Most candidates were able to state that at least two different temperatures would be needed. Many did not recognise that the number of drops needed would be the dependent variable. Only a small number of candidates discussed the idea of needing time for the reactants to equilibrate to temperature or the need for stirring or swirling between each drop. Some candidates included how to make the data more reliable by repeating it at least two more times.

(c) (i) The majority of candidates were able to gain full marks for this calculation question. Those who missed marks either selected incorrect data or used the wrong expression for percentage change. Candidates are encouraged to use calculators to avoid simple calculation errors.

(ii) This question required candidates to name a factor kept constant in the experiment, such as the volume of juice or sex of the participant. A small number stated that the volume of the beetroot juice needed to be kept constant, this was not credited as both types of juice need to be kept at the same volume.

(d) (i) Almost all candidates were able to accurately measure the line on the bronchiole and calculate the magnification. The most common error was measuring in cm rather than mm. Some candidates found it challenging to express their answers to two significant figures.

(ii) Candidates tackled the drawing of the bronchiole very well indeed. Most candidates were able to draw an outline that was clear and continuous with no shading and drawn without the use of a compass. The most challenging part of the drawing was the detail; Many candidates drew a significantly larger number of invaginations than shown in Fig. 2.1. Some candidates failed to recognise that the tissue on the outer layer was a double layer and that there was a break in this layer in the top left-hand corner.

(e) (i) Drawing a graph to represent the percentage increase in breathing rate and heart rate over time was not easy for some. Candidates are reminded that the scale needs to ensure that the plotted points occupy at least half of the grid. Some candidates did not provide units for the axes labels.

The plotting of the data was less challenging, although a small number of candidates did not plot the point at zero and the plotting mark was not awarded. It is important that candidates do not extrapolate their lines unless instructed to do so.

(ii) Most candidates were not able to provide a suitable conclusion from the trend in the graph. It was important that they discussed the idea that as the length of time of exercising increased, the breathing rate and heart rate increased. The most common error was not discussing exercise.

BIOLOGY

Paper 0610/62
Alternative to Practical

Key messages

Candidates are encouraged to familiarise themselves with the terms, independent variable and dependent variable, and they should be able to identify them in a given context.

Candidates should consider the context of an investigation when suggesting safety precautions to ensure the precautions are appropriate for the hazards in that specific investigation.

When planning an investigation, there is no requirement to predict results, draw a table for results or state an expected conclusion.

If a question instructs candidates to show how they obtained a value from a graph, they should show construction lines that are clearly visible.

Candidates should consider the aim of an investigation when suggesting a conclusion for the results of an investigation. For example, if an investigation aims to investigate diffusion, then reference to diffusion in the conclusion is expected.

General comments

Most candidates were able to demonstrate their knowledge, understanding and practical skills. There was excellent knowledge of the food tests in **Question 2(a)**. Some candidates confused sources of error in **Question 1(a)(iv)** with safety precautions in **Question 1(a)(v)**. Some candidates did not seem confident in their ability to round correctly to the stated number of significant figures in **Question 2(d)(i)** or decimal places in **Question 2(c)(i)**.

Question 1

(a) (i) Almost all candidates were able to correctly read the temperatures off the thermometer diagrams.

(ii) Almost all tables prepared by candidates were suitable to record the data. A few candidates used vague column headings such as ‘results’ that were not credited.

(iii) Many candidates were able to state a suitable conclusion. A few candidates described the trend rather than state a conclusion and others only gave a conclusion for the hot water and not the whole investigation. Those responses were insufficient to gain credit.

(iv) Many candidates were able to identify a source of error in step 8 of the method. The most common correct answer was that the potato cylinders were not the same length. A few candidates considered errors in other steps of the method and therefore could not receive credit.

(v) The most common safety hazards were the cutting of the cylinder with a knife or scalpel and the use of hot water, shown as 61°C on the thermometer in Fig. 1.2. Some candidates did not read the question carefully and stated a precaution, rather than identifying a safety hazard.

(vi) The most common suggestion to reduce the error associated with the change in temperature in the beaker during the investigation was to use a thermostatically controlled water-bath. A few candidates did not realise that the beaker was acting as a water-bath because they suggested the use of a water-bath, without any additional suggestions, such as the use of insulation or a lid.

(vii) Many candidates knew that several sets of results were collected to enable the identification of anomalous results. Some candidates stated that this would allow a mean to be calculated without any acknowledgement that any anomalous values would need to be excluded first. Some candidates incorrectly stated that collecting several sets of results would reduce the chance of an anomalous result or prevent an anomalous result. Others incorrectly referred to increasing accuracy and only a small number correctly referenced 'checking for reliability'.

(b) (i) Most candidates were able to identify the independent and dependant variables in the investigation. A small proportion confused the independent variable with the dependant variable and wrote these the wrong way around.

(ii) The most common correct variable that was kept constant was time. A number of candidates did not read the question carefully and stated a variable that they felt should have been kept constant, such as the intensity of the light shone through the solution in the test-tube. However, the question asked for a variable that was kept constant and so those answers were not credited.

(iii) Almost all candidates were able to correctly estimate the percentage of light absorbed for a cube with a surface area of 18 cm^2. The most common error was to draw a skewed line from the trend line to the *y*-axis and therefore read off the wrong value.

Question 2

(a) (i) Almost all candidates knew that iodine solution is used to test for starch.

(ii) Almost all candidates knew that Benedict's solution is used to test for reducing sugars.

(iii) The vast majority of candidates were also able to state that the positive result of a protein test is purple. A small proportion misread the question and stated the name of the test rather than the colour of a positive result.

(b) Some detailed and carefully planned investigations were described. Almost all candidates knew that DCPIP is used to test for vitamin C, but many incorrectly thought that the concentration of vitamin C would be determined by the time for the colour to change, rather than the volume of DCPIP added. Although this meant that their methods tended to include incorrect detail, such as keeping both the volume of the fruit juice and DCPIP constant, a number of them did write sufficient detail about the other aspects of the method to be awarded high marks. Others knew about the starch / iodine method to measure vitamin C and were able to give good detail of the method. Other candidates contradicted themselves, stating the same variable (often temperature) as both a controlled variable and the independent variable. Candidates should avoid suggesting the use of a "known" volume or "about" a stated volume as this is too vague. It was also common to see safety precautions that were not relevant to this investigation. Many candidates gave a prediction of the results they expected, this is not required in a plan.

(c) (i) Most candidates were able to correctly calculate the percentage change in the mean systolic blood pressure. However, some did not round their answer to one decimal place or rounded incorrectly.

(ii) Although the most common variable stated was the volume of juice, a number of candidates stated that the volume of beetroot juice was kept constant, suggesting that they had not read the information carefully and had not considered that the type of juice was the independent variable. A significant proportion of candidates misread the question and suggested other variables which should be controlled, such as age or fitness level.

(d) (i) Almost all candidates were able to measure line **PQ** accurately. A small proportion of candidates gave the value in centimetres and not millimetres but did not change the units. Most calculations of the magnification were correct, but a number of candidates did not round their answers correctly to two significant figures.

(ii) There were some excellent drawings of the bronchiole that showed the candidates had carefully observed the detail of the image.

(e) (i) The majority of candidates were able to choose suitable scales and label the axes correctly. Candidates should be discouraged from choosing awkward scales based on multiples of three.

Whilst this is not wrong, it often results in candidates making plotting errors as it is much more challenging to determine the accurate position of each point. A small proportion of candidates chose to use a secondary *y*-axis. Although this was not required, it was not incorrect and was credited if some of the plots covered at least half the grid. However, some candidates used a broken *y*-axis. This was not appropriate because there was a point at the origin. The point at the origin was missed by a considerable proportion of candidates. The trend lines were often well drawn and almost all candidates gave an appropriate key. The best choice of plot markers to distinguish between two lines is a cross and a small dot inside a circle. Candidates should be advised against using simple dots for plotting points as they can be very difficult to see when a plotting line is drawn over them. Some candidates overcompensate for this issue and make their point plots visible, but overly large.

(ii) Many candidates omitted to refer back to the aim of the investigation to show the effect of exercise on the breathing rate and heart rate while running when stating their conclusions. This meant that their conclusions did not include sufficient detail to be credited.