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BIOLOGY

Paper 0610/12
Multiple Choice (Core)

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

General comments

There was good understanding of cell structures; the function of a root hair cell; the features of osmosis; the test for starch; the term transpiration; the meaning of phototropism; interpreting a pyramid of numbers and the effects of deforestation.

There was some uncertainty about the characteristics of living things, with some candidates believing that breathing is a characteristic of all living things. The features of meiosis were not widely understood.

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Comments on specific questions

Question 1

Many candidates appreciated that excretion is a characteristic of all living things. Some candidates incorrectly believed that breathing is a characteristic of all living things, possibly confusing breathing with respiration.

Question 3

Many candidates appreciated that both insects and arachnids have an exoskeleton. Some candidates incorrectly believed that both insects and arachnids have three pairs of legs.

Question 5

The majority of candidates appreciated that the material in the diagram represented a tissue; some incorrectly identified it as a cell or an organ.

Question 8

Many candidates knew the characteristics of active transport. Some incorrectly believed that active transport is the net movement of particles from a high concentration to a low concentration, possibly confusing active transport with diffusion.

Question 10

Many candidates gave the correct response. A common misconception was that boiled protease would work better than unboiled protease. Boiling would denature the protease enzyme, so the egg albumen would not be broken down.

Question 11

There was some uncertainty about what is left at the end of an enzyme-controlled reaction. Enzymes are biological catalysts and remain unchanged at the end of the reaction. During enzyme-controlled reactions the substrate is converted to the product, or products.

Question 13

The majority of candidates gave the correct response. Some incorrectly identified the palisade mesophyll cell as an epidermal cell and therefore selected leaf epidermis.

Question 14

This question proved challenging with only a minority of candidates appreciating that coronary heart disease can be caused by malnutrition.

Question 15

Many candidates understood that tooth decay is frequently associated with sugar intake and therefore a low sugar diet would result in a low percentage of students with tooth decay. Some incorrectly believed that less calcium in the diet would result in less tooth decay.

Question 17

Many candidates appreciated that the blue stain is transported in the xylem. The commonest incorrect response was phloem.

Question 20

The majority of candidates correctly determined the direction of flow in the blood vessel but candidates seemed less certain as to whether the blood vessel was an artery or a vein.

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Question 23

The majority of candidates appreciated that yeast, water and sugar at 20°C would produce the most alcohol. Some did not appreciate the need for sugar.

Question 24

The majority of candidates could recall the structure of the excretory system. The commonest incorrect response was to identify a ureter rather than the urethra.

Question 25

This proved to be a demanding question. Many candidates incorrectly believed that the salivary glands are endocrine glands. Salivary glands have ducts and are classed as exocrine glands.

Question 28

Many candidates appreciated that the oxygen carrying capacity of blood is affected by carbon monoxide. A common incorrect response was tar.

Question 30

There was some uncertainty here and only some candidates understood that not all seeds require light to germinate. A significant number of candidates incorrectly thought that oxygen and a suitable temperature are not always required for germination. Both of these factors are required for respiration and are therefore required by all seeds.

Question 32

The features of meiosis were not widely understood, with some candidates believing that meiosis results in genetically identical cells. Candidates would benefit from having a clear understanding of both meiosis and mitosis.

Question 33

While many candidates responded correctly, some did not, suggesting that the term pure-breeding was not familiar to all.

Question 37

Many candidates understood that carbon dioxide is removed from the air by photosynthesis. The commonest incorrect response was respiration.

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BIOLOGY

Paper 0610/22
Multiple Choice (Extended)

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

General comments

There was good understanding of the sites of digestion of carbohydrates; the correct sequence for the movement of blood in the double circulation of a mammal; the effects of cholera infection and the changes that occur in muscles during inspiration. Most candidates knew how a protein is made, understood the meaning of active immunity and how energy flows through a biological system.

There were some areas of uncertainty. Some candidates were not aware that coronary heart disease can be caused by malnutrition. A significant number of candidates could not deduce the sequence that may lead to evolution in a population and many were not aware that an increase in carbon dioxide concentration in the blood stimulates the brain to increase the breathing rate.

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Comments on specific questions

Questions 14

While many candidates gave the correct response, some did not appreciate that coronary heart disease can be caused by malnutrition.

Question 22

Many candidates understood that an increase in carbon dioxide concentration in the blood stimulates the brain to increase the breathing rate. A minority of candidates incorrectly thought that it was the decrease in oxygen concentration in the blood that stimulates the brain to increase the breathing rate.

Question 25

Many candidates understood the transport of glucose through the kidneys. Some incorrectly believed that glucose is only transported in the artery leading to the kidney. This suggests they did not recall that glucose is reabsorbed back into the blood and so would be in the vein also.

Question 28

This question was well-answered by most candidates. Some candidates incorrectly thought that auxin will move to the light side of the shoot, this would cause the shoot to bend away from the light.

Question 30

Most candidates identified the middle piece as the part of a sperm cell that contains the mitochondria. Some candidates incorrectly identified the nucleus as the site where mitochondria are found.

Question 33

The majority of candidates appreciated that stem cells are unspecialised cells that divide by mitosis. A small proportion of candidates incorrectly thought that stem cells are specialised cells.

Question 35

Many candidates knew that for an individual to have sickle-shaped red blood cells, they must possess the allele Hb^S.

Question 36

This proved to be a demanding question. The sequence starts with mutation giving rise to variation in the population. The struggle for survival means that only better adapted organisms survive to pass on their alleles.

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Paper 0610/32
Theory (Core)

Key messages

Candidates would benefit from learning the definitions that are stated in the syllabus so they can provide clear responses when required.

Candidates would benefit from reading the question carefully, particularly noting how many points they need to give. In general if a question is worth two marks, two valid points are required if full marks are to be awarded.

General comments

Candidates generally responded with well-written answers that showed a good understanding of topics from across the syllabus.

Question 2(d) was about the features of gas exchange surfaces and **Question 8(a)** was about intensive livestock farming. Candidates would benefit from a greater understanding of these topics as many found them challenging.

Comments on specific questions

Question 1

(a) (i) Candidates were required to use a key to identify six species of reptile from the diagrams provided. The majority of candidates performed well on this question, often being awarded full marks. A few candidates appeared to be unfamiliar with using a key for identification, as a letter was entered in each of the ten spaces in the final column.

(ii) Few candidates were awarded full marks for this question. A number of candidates were awarded one mark for stating that the term was applied to a group of organisms but fewer stated that the offspring need to be fertile. Some candidates confused the definition of a species with that of a population.

(b) Many candidates correctly identified the genus from the binomial name. Other candidates either selected the species name or misunderstood the question and gave answers such as reptile or vertebrate.

(c) Candidates were asked to identify which of the five characteristics listed applied to reptiles. The majority of candidates correctly selected egg-laying but selecting a second characteristic was more challenging. Many candidates incorrectly suggested that the second feature was compound eyes rather than internal fertilisation.

(d) Most candidates could state the features shared by cells of all living organisms. The commonest answers were cell membrane and cytoplasm.

Question 2

(a) (i) Most candidates gained one mark for stating that the breathing rate for student **A** was lower than the class average (in all activities). Candidates need to be aware that if two marks are available for a question, then the answer requires two different pieces of information if full marks are to be awarded. Candidates that supported their comparison with data quotes often neglected to state the

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units and therefore could not be awarded the mark. Better responses compared the differences in breathing rates during different activities.

(ii) This calculation proved challenging. Only some candidates correctly performed the percentage increase calculation. Of those that did, many did not give their answer to the nearest whole number. Candidates would benefit from reading the question carefully.

(b) Good responses gave two differences between the composition of inspired and expired air and expressed these differences unambiguously. Less well-executed responses explained the difference in terms of breathing in or breathing out and some stated that there were differences in the oxygen and carbon dioxide concentrations but did not indicate what these were.

(c) Labelling the diagram of the respiratory system was performed accurately by most candidates. The bronchus and the bronchiole were sometimes confused.

(d) **T**he term gas exchange surface was not well-known and many were unfamiliar with their general characteristics. A few candidates gave two correct answers. The most commonly known feature was that the surfaces are moist. Very few mentioned thinness (i.e. a small diffusion distance).

Question 3

(a) (i) and **(ii)** The genetic information needed for answering these questions was well understood by candidates.

(iii) Calculating the percentage of heterozygous offspring from the cross was performed well by many candidates. Those who used the space to construct a Punnett square usually determined the correct answer.

(b) Most candidates could clearly differentiate between continuous and discontinuous variation.

(c) The majority of candidates recognised kingdom as an incorrect word in the definition. Some then chose individuals rather than similarities.

Question 4

(a) (i) Candidates were required to place some examples of birth control into their correct categories. Most candidates performed well on this task. The examples that caused problems for some candidates were: contraceptive injection (which many selected as a surgical method), and abstinence (where perhaps the term was unfamiliar to them).

(ii) Most candidates selected the two most effective methods of birth control from the information given in Table 4.1.

(iii) The examples of birth control that are effective against the spread of STIs were not well-known. A significant number of candidates stated condoms. This is an effective method but it is not listed in Table 4.1 and so cannot be given credit.

(b) The majority of candidates selected the correct words to complete the sentences about STIs.

Question 5

(a) The majority of candidates correctly identified the giant panda as a mammal. Of those who gave an incorrect answer, bear was a common response.

(b) (i) Most candidates used the graph accurately and determined that the panda population in 1988 was 1100.

(ii) A significant number of candidates misread the graph and decided that the giant panda population in 1977 was either 2500 or 2400. This resulted in the value for the change in population size being incorrect by 50.

(c) Candidates were asked to suggest reasons for species becoming endangered. The number of marks available indicates the number of points required in the answer. In this question, four marks

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were available, so four reasons for species becoming endangered were required. There were some excellent answers with the majority of candidates suggesting three or four reasons. Weaker responses gave one or two reasons only.

(d) Following on from **part (c)**, candidates were asked to suggest how conservation programmes had helped increase giant panda numbers. Three marks were allotted, so three suggestions were required. Those who performed well on **part (c)** often gave good suggestions. However, some candidates expressed their ideas imprecisely and could not be credited.

Question 6

(a) This proved challenging for many candidates and few were awarded all three marks. The uncertainty indicates that candidates are unfamiliar with the definition of transpiration and that the process itself is not fully understood.

(b) (i) Many candidates drew accurate lines in the appropriate position. A considerable number did not attempt the question or drew lines that suggested they did not understand the question.

(ii) Many candidates knew that higher humidity results in reduced transpiration. However, a significant number thought that as humidity increases, so does the rate of transpiration. Many referred to humidity without qualifying it as low or high.

(c) (i) Many candidates stated that water is needed for photosynthesis. Stating a second valid answer proved more difficult.

(ii) Nearly all candidates knew that xylem vessels transport water.

(iii) Root hair cells were well-known. Some candidates wrote root cells which was not precise enough. A few candidates thought that water entered the plant via stomata.

Question 7

(a) This question was exceptionally well-answered.

(b) The constituent parts of the large intestine were well-known. Others answered by suggesting organs that were not part of the digestive system.

(c) Most candidates identified the mouth or stomach as a site of mechanical digestion.

(d) The constituents of the diet were widely known. Some candidates did not gain full marks as they gave an example of the category instead of naming the category itself.

Question 8

(a) This question proved demanding and intensive livestock farming appears to be a topic requiring further study as many could not complete this question correctly.

(b) (i) The names of the greenhouse gases were well-known. The most common error was for carbon monoxide to be named instead of carbon dioxide.

(ii) The majority of candidates knew that global warming (or one of its effects) would result from an increase in greenhouse gases.

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BIOLOGY

Paper 0610/42
Theory (Extended)

Key messages

Candidates should read questions carefully. There were several questions, where this was particularly important; **Questions 1(b)(iii)** where some candidates incorrectly included examples of cancer, **4(b)(iii)** where candidates described the treatment of diarrhoea rather than advice detailing prevention of the spread of pathogens, **5(d)** where some candidates described fertilisation and the development of the fetus rather than labour and birth and **6(a)(iii)** where some candidates interpreted the graph incorrectly and suggested reasons for a population increase instead of decrease.

Candidates should be encouraged to include all steps in their calculations and to complete every stage of the question. **Question1(b)(i)** required candidates to express their answers to two significant figures and **Question 4(b)(i)** required answers to be expressed as a whole number. It would be beneficial for candidates to practise these mathematical skills.

General comments

A very high standard of scientific knowledge and understanding was displayed by many of the candidates.

The number of marks available for each question and the number of answer lines provided is a good indicator of the level of response required. Candidates should be encouraged to make at least one relevant point for every mark available. Extended prose questions often require a detailed explanation.

Candidates generally expressed their ideas clearly using continuous prose. Correct scientific terminology, as stated in the syllabus, should always be used. Particular care should be taken to spell keywords and biological terms correctly.

Some areas of the syllabus were better known than others. Candidates should be reminded to revise all of the material detailed in the syllabus.

Comments on specific questions

Question 1

(a) (i) The parts of the gas exchange system were generally well-known. Occasionally the bronchus and trachea were transposed. Various spellings of diaphragm were seen. It is important that biological parts of body systems are spelt correctly.

(ii) Many candidates gave excellent responses, accurately describing the process of inspiration. One common omission was to not specify that it is the external intercostal muscles that contract or that the internal intercostal muscles relax. Occasionally candidates described the pathway of air or oxygen through the gas exchange system.

(b) (i) The majority of candidates could correctly calculate the percentage and display the figure to the appropriate number of significant figures. Very occasionally errors were made in the rounding with a few candidates giving the incorrect value of 0.20. There were some candidates that did not give any evidence of their working and just gave a final value. Candidates should be encouraged to set out any working clearly as partial credit may be gained even if the final answer is incorrect.

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(ii) Most candidates understood that an increase in exposure to tobacco smoke increases the risk of developing lung cancer and were able to quote data from the stimulus material to support their argument. Few candidates appreciated that all the people monitored during this investigation were non-smokers. Candidates should be encouraged to read all the stimulus material carefully to gain a clear understanding of what the investigation is about.

(iii) Most candidates gained at least partial credit for this question. The diseases of coronary heart disease and COPD were commonly seen. Other correct examples, such as emphysema and bronchitis, were also credited. Some candidates did not follow the instructions in the question and stated types of cancer in their responses.

Question 2

(a) (i) Candidates found this question demanding. Few candidates could identify both types of fluid with the incorrect answers of plasma or blood commonly given for one of the fluids. Many candidates also thought that red blood cells would be present in one of the fluids.

(ii) Most candidates gave the correct response. Very occasionally the process of osmosis was given.

(iii) One misconception is that energy is required for respiration rather than released by respiration. It is important for candidates to note that energy is never created or produced by respiration. The correct terminology is to refer to the release of energy by respiration. Some candidates thought that glucose was produced by the process of respiration. However, many candidates could describe the use of oxygen for respiration to release energy and were able to link it to a named metabolic process.

(b) There was some confusion over the functions of arterioles. A common misconception was that arterioles move closer or further away from the surface of the skin to aid thermoregulation. There was also a misconception that arterioles provide sweat to the skin. The majority of candidates recognised that arterioles have a role in thermoregulation and could relate this to vasodilation or vasoconstriction. Fewer candidates could state that arterioles also have a role in supplying oxygenated blood to the capillaries or that arterioles control the flow of blood to the capillaries.

(c) The role of the lymph nodes was not well-known. Many candidates stated that white blood cells were produced in the lymph nodes. Some candidates knew that lymph nodes had a role in the body's immune system. Very few candidates could describe the role of the lymph nodes in filtering the lymph. Occasionally candidates tried to link the lymph nodes to the circulatory system and the filtering of blood rather than lymph.

(d) (i) Most candidates gave the correct location of the lacteals, namely villi in the small intestine.

(ii) Most candidates could describe the role of the lacteals. Occasionally candidates incorrectly stated that lacteals were responsible for digestion of fats or linked lacteals to the production of milk.

Question 3

(a) Many excellent definitions were seen with candidates able to give an accurate definition as stated in the syllabus. Some candidates provided examples instead of a definition. Occasionally, some candidates only gave one half of the definition by referring to the detection of stimuli or the response to stimuli rather than both as required.

(b) Almost all candidates were able to provide two examples of sense organs.

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(c) (i) This was a challenging question for many candidates. Most candidates referred to the injection containing saline solution as being the control, or it being used to compare the effects of adrenaline. Very few candidates considered that the rats needed to be injected to ensure it was only the presence of adrenaline that changed. Any reference to the effect on water potential was very rarely seen.

(ii) There were some excellent responses with some candidates able to provide a detailed and accurate description and explanation of the results of the graph. It was fairly common for some candidates to only describe the results and not be able to explain why these changes were occurring. Descriptions were generally accurate but some candidates required more detail in their responses to access the marks. It is not enough to describe an increase or decrease in the blood glucose concentration. Instead, candidates should refer to how steeply the blood glucose concentration changes and use data with the correct units to aid their descriptions. Some good explanations were seen with candidates able to describe the conversion of glycogen to glucose in the liver to increase the blood glucose concentration. Fewer candidates gave an explanation of the decrease in blood glucose concentration in terms of glucose being used in respiration. However, some linked the decrease in blood glucose concentration to the release and action of adrenaline, which was acceptable. There was very little confusion between the terms; glycogen, glucagon and glucose. The majority of candidates quoted the correct units.

(d) Candidates should be encouraged to read each question carefully. This question instructed candidates to sketch a line on Fig. 3.1. Many candidates missed this question entirely. Those that did attempt the question generally scored highly with nearly all recognising that eating a meal would lead to an increase in blood glucose concentration. A few candidates were inaccurate with when this increase would occur, with a few showing the increase in blood glucose concentration before 2.0 hours.

(e) Some good responses were seen. The most common referred to increased heart rate and dilation of pupils. A few candidates stated heart rate or breathing rate without including the change that would be seen, in this case, increased heart rate and increased breathing rate.

Question 4

(a) It was evident that the causes and effects of marasmus and kwashiorkor were not well-known. More candidates were able to give the similarities rather than the differences. Many candidates could give a reasonable outline of both being deficiency diseases related to a lack of protein. Some candidates were able to give further detail such as effects on the body. Descriptions of differences were less successful. Some candidates confused the two diseases or tried to relate this to a deficiency in specific vitamins or minerals rather than protein.

(b) (i) Many accurate calculations were seen with answers clearly laid out and working shown. Occasionally candidates used the incorrect values or used the year instead of the number of children. A common error was to miss the instruction to round the answer to the nearest whole number.

(ii) Many candidates were able to provide a correct year and reason.

(iii) Some candidates misinterpreted the question and gave advice on how to treat diarrhoea rather than how to prevent the spread of the pathogen that causes diarrhoea. Those candidates that did recognise what was required by the question generally gave three suitable pieces of advice, such as washing hands, boiling water and hygienic food preparation. Occasionally candidates tried to explain one method, such as boiling water, rather than giving more methods of preventing the spread of the pathogen.

Question 5

(a) (i) Candidates who read this question carefully were able to give the correct answer about the mass of DNA increasing. The best responses referred to the mass of DNA doubling.

(ii) Most candidates gave a suitable time. Common errors were to not include the unit (minutes) or to extend the range to 40 minutes, which is when the next stage of mitosis began.

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(b) There were some detailed responses seen, with many able to correctly identify that the nuclei formed from meiosis would be as a result of a reduction division. Many also recalled that the haploid nuclei would be genetically different. Some candidates only referred to the cell rather than the nuclei. Very few candidates confused mitosis with meiosis.

(c) This question proved demanding, with a number of candidates relating this to plant cells and auxin. Few candidates referred to stem cells as unspecialised cells. More were able to describe the differentiation or specialisation of stem cells. The best responses also explained differentiation in terms of the expression of specific genes.

(d) Some excellent and detailed responses were seen with many candidates able to describe at least some of the stages involved in labour and birth. A number of candidates gave excellent descriptions of fertilisation and the development of the fetus, which although correct, could not gain any credit as this did not answer the question.

Question 6

(a) (i) The vast majority of candidates were able to state a correct year from the graph.

(ii) The most common error was to misidentify the year in which the increase stops with many candidates including the year 1984.

(iii) A minority of candidates gave reasons for the increase in the population of Atlantic cod, not taking into account the time-frame specified in the question. Those candidates that recognised that the population size of Atlantic cod decreased during this time generally scored highly, giving several reasonable suggestions.

(iv) It was evident that some candidates were confused about the term restocking with some describing methods for freezing and preserving fish once they had been caught. However, there were also many good descriptions of captive breeding and the subsequent release of fish.

(b) (i) This question was particularly well answered with many candidates giving suitable features, mainly referring to teeth. A few candidates misinterpreted the question and gave general features of sharks, such as fast swimmers, rather than refer to features that were visible in the photograph.

(ii) A few candidates tried to explain the development of good eyesight in terms of accommodation and pupil reflex. A number of candidates recognised the mechanism involved was natural selection but did not provide enough detail to access all the available marks. Many candidates missed how the alleles might have arisen in the first place. A number tried to explain this in terms of selective breeding. Some candidates referred to individual sharks developing good eyesight rather than this happening over many generations. However, there were also many accurate and detailed responses seen, with the best responses explaining each stage of the process of natural selection.

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BIOLOGY

Paper 0610/52
Practical Test

Key messages

The Practical Test requires candidates to have good experience of using a wide range of practical equipment to gather data that this valid and reliable or to design an experiment that produces suitable data. This data should be presented in a table using the appropriate SI units. Candidates are required to present data in a suitable graphical form with a suitable line to represent the trend. The Practical Test requires candidates to be able to draw an accurate representation of a biological specimen using appropriate conventions.

General comments

In order to be successful on the Practical Test, candidates should be able to:

Use a wide range of practical equipment to gather data that this valid and reliable or to design an experiment that produces suitable data. Candidates should be able to justify their choice of equipment and evaluate its accuracy.

Design an experiment that takes into consideration the variables that need to be kept constant and how the data is going to be collected and analysed.

Data should be presented in a table using the appropriate SI units. Tables must have appropriate headings. Appropriate SI units or suitable abbreviations should be used. Units must not be used in the body of the table.

Present data in a suitable graphical form with a suitable line to represent the trend. Axes must be labelled and have units.

Draw an accurate representation of a biological specimen using appropriate conventions. Lines must be clear and continuous, using a sharp pencil. Candidates should note the appropriate detail of the specimen, including the shape and proportion of the structures.

Comments on specific questions

Question 1

(a) (i) Most candidates were awarded full marks for drawing a table to record their results. A suitable heading and appropriate SI units should always be included in the header row of the table. Units should not be given in the body of the table.

(ii) Most candidates were able to provide a conclusion for the effect of temperature on the leakage of pigment from beetroot cells.

(iii) This question proved to be demanding. Candidates were required to suggest why the beetroot cylinders needed to be the same length. Many answers were too vague to be awarded credit as they referred to giving accurate results or a fair test. A few candidates were able to say that length would affect the pigment leakage, but did not adequately explain why this was the case.

(iv) Many candidates were awarded full marks for this question. Candidates should ensure that the apparatus to reduce the error must match the stated error. The most commonly credited response was that the volume of water was not measured and that a measuring cylinder should be used.

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(v) Most candidates realised that the purpose of step 11 was to ensure that the colour was evenly distributed.

(b) (i) Almost all candidates were able to identify temperature as the variable that was changed in this investigation.

(ii) This proved to be a demanding question with few candidates being awarded full marks. Some misinterpreted or misread the question. The most commonly awarded improvement was that there were more repeats in the second experiment. Some candidates could not be awarded the second marking point as they described the idea of having a range of temperatures but did not specify that the range of temperatures was greater in **1(b)** than **1(a)**.

(iii) Most candidates successfully described an anomalous result as one that does not fit the trend in the data.

(iv) Many candidates were able to recognise that the anomalous data point was not included in the average. Some candidates misread the question and commented on the fact that the trial could be repeated, which was true, but it was not done in this particular experiment.

(v) This graphing question was well-answered by the majority of candidates. Candidates were able to select and correctly plot a line graph to represent the relationship between temperature and the average percentage of light that passes through the liquid. Some candidates did not appropriately label the axes or include units. A smaller number used a non-linear scale. When drawing a line of best fit, it is important that the line is thin, clear and is not extrapolated beyond the plotted data points.

(vi) Many candidates gained both marks for this question. The most common error was not showing on the graph where the lines intersected at 50 °C.

Question 2

(a) (i) This question required candidates to produce a standard biological drawing. Candidates must be able to produce a drawing using a sharp pencil that exhibits clear and continuous lines. It is important that candidates do not use shading or jagged lines. Candidates were required to draw a diagram that was larger than the original; draw the shape of the leaf accurately showing a tapered midrib and a smooth leaf margin at the petiole end.

(ii) This question was answered well by most candidates. Most were able to measure the length of line **PQ** accurately and state a suitable unit. A common error was to not round the answer to the nearest whole number.

(b) (i) The question proved demanding with many candidates stating what the control group was, rather than explaining why it was used. Acceptable responses needed to make reference to the idea that a control group would allow the scientists to see the effect of the beetroot juice on the athletes.

(ii) Some candidates understood that water should be used to replace beetroot juice. Some identified a list of variables that should be controlled which did not answer the question. This suggested there confusion about the difference between a control experiment and controlled variables.

(iii) Most candidates successfully answered the calculation and gave their answer to one decimal place. The most common error was either dividing by the wrong value or misreading the values from the graph. Candidates should practice their data-handling skills and be familiar with questions asking for percentage increase or decrease.

(c) Some candidates found planning this investigation very challenging. When candidates are describing the independent variable, in this case the volume of beetroot juice, they should state a suitable range of values to measure. It is not enough to simply say 'different volumes of beetroot juice'; instead they should state appropriate values or how many different volumes. Many candidates listed a variety of variables that should be kept constant. However, these were often limited to participant variables; same gender, age, fitness, health, etc. Higher level responses considered the need to control the concentration of beetroot juice as well as the environmental conditions experienced by the athlete. Many candidates noted the need to repeat the experiment, but this needs to be suitably qualified by stating that each trial at a particular volume of beetroot

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juice will be repeated at least twice more. Few candidates stated a suitable safety precaution such as allowing the athlete to warm-up or ensure that they used appropriate footwear.

(d) Most candidates were familiar with the steps required to carry out the test for reducing sugars and many were awarded full marks. The commonest errors were to misname the reagent as biuret or omit the fact that the Benedict's test requires heat.

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BIOLOGY

Paper 0610/62
Alternative to Practical

Key messages

Candidates would benefit from reading all the instructions and information, including tables and figures, before starting to answer the questions.

Candidates are advised to show all their working in calculations some marks maybe available even if the final answer is incorrect.

Candidates are reminded to use careful observational skills when drawing biological specimens and to use a sharp pencil. Shading or sketching should be avoided.

Candidates are advised to consider the full range of data before deciding on a scale when plotting graphs. Choice of scales must always be linear. Plotting errors are less likely if awkward scales (such as divisions of three) are avoided.

General comments

The majority of questions were answered with confidence, suggesting that many candidates have had opportunities to carry out practical work and were able to apply these experiences to answering the questions.

There was evidence that the difference between the purpose of keeping a variable the constant (a controlled variable) (**1(a)(iii)**) and performing a control experiment (**2(b)(i)**) was not well understood. Similar confusion was apparent in the planning of an investigation (**2(c)**) where many candidates did not mention the variables that they would keep constant. Instead, many included a control experiment in their design, even though the latter was unnecessary in the context of the question.

Comments on specific questions

Question 1

(a) (i) Almost all candidates were able to draw an appropriate table to record the data shown in the two figures. Common mistakes included misreading the temperatures on the thermometers and including the units in the body of the table.

(ii) Most candidates were able to provide a conclusion for the effect of temperature on the leakage of pigment from beetroot cells. The most common reason for not gaining credit was where the results were restated instead of a conclusion being stated.

(iii) This question proved to be demanding. Candidates were required to suggest why the beetroot cylinders needed to be the same length. Many answers were too vague to be awarded credit as they referred to giving accurate results or a fair test. A few candidates were able to say that length would affect the pigment leakage, but did not adequately explain why this was the case.

(iv) Many candidates identified that the volume of water was not measured in step 3 and were able to suggest a suitable piece of apparatus to improve the procedure. Candidates should ensure that the apparatus to reduce the error must match the stated error.

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(v) Most candidates were able to suggest one way to shake the test-tubes consistently, but fewer proposed two correct methods. Some candidates suggested using a centrifuge but this would be inappropriate as centrifuges separate mixtures due to density and would not mix a liquid.

(b) (i) Almost all candidates were able to identify temperature as the variable that was changed in this investigation.

(ii) Most candidates were able to identify at least one improvement in the method in **1(b)** compared with the method in **1(a)** and many gained full credit for describing two methods. The most common method described was the increase in the number of trials, but some candidates wrote vague statements where it was not clear if they meant the number of trials or the number of temperatures that were used. Some stated that **1(b)** was improved by having a range of temperatures when **1(a)** also had a range of temperatures. Candidates should always be as specific as possible, and in this case, should state that the range of temperatures was greater in **1(b)** than **1(a)**.

(iii) Almost all candidates knew that an anomalous result is one that does not fit the pattern. A number of candidates incorrectly stated that an anomalous result was one that did not fit the 'range of the results'.

(iv) Many candidates were able to describe that the anomalous result was excluded from the calculation of the average value. A common misconception was to think that the anomalous value was replaced with the average value. Some candidates misread the question and commented on the fact that the trial could be repeated, which was true, but it was not done in this particular experiment. This highlights the importance of reading the question and all the information provided very carefully.

(v) Many candidates gained full credit for plotting a line graph of the relationship between temperature and the average percentage light that passed through the liquid. It was very rare for candidates to misread the instructions and plot all the trial data, or plot a bar chart instead of a line graph. Some candidates did not appropriately label the axes or include units. A smaller number used a non-linear scale. When drawing a line of best fit, it is important that the line is thin, clear and is not extrapolated beyond the plotted data points.

(vi) Many candidates gained both marks for this question. The most common error was not showing on the graph where the lines intersected at 50 °C. A minority of candidates misread the question and instead estimated the temperature at 50% of the light passing through the liquid. These candidates were able to gain some credit for the technique even though they had used the wrong axes.

Question 2

(a) (i) The quality of drawings of the beet leaf was very good with many candidates gaining full credit. The most common error was to draw a leaf that did not accurately reflect the detail in the leaf in the photograph. For example, some candidates drew leaves with a smooth margin round the entire leaf, or a pointed tip to the leaf or omitted to include the tapering midrib. Only very few candidates used shading, sketching or used a ruler to draw the midrib.

(ii) Almost every candidate was able to correctly measure the length of the line **PQ**. A minority forgot to include units or stated the wrong units with their measurement. Almost all candidates were able to use the formula to calculate the actual length of the leaf. A minority misread the question and measured their own leaf and then calculated the magnification of their drawing compared with the photograph. A number of candidates did not give their answer to the nearest whole number or switched units and did not record them correctly.

(b) (i) Only those candidates who were confident in the full range of investigative procedures were able to apply their knowledge and explain why a control group was necessary in this investigation. Many candidates realised that it was necessary to make comparisons but were not able to apply this concept to the specific example in the question.

(ii) Most candidates were able to give appropriate suggestions for a suitable control experiment, even extending their answers to include the idea that coloured water that would be indistinguishable to the athletes would be even more suitable than clear water of the same volume as the beetroot juice. Many candidates gave answers that suggested they were thinking more about variables that should be controlled in an investigation, rather than a control experiment.

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(iii) Most candidates successfully answered the calculation and gave their answer to one decimal place. A few candidates did not show their working. This meant that they were not able to obtain credit for their processing if their final answer was incorrect or if they had misread the values from the bar chart. Candidates should practice their data-handling skills and be familiar with questions asking for percentage increase or decrease.

(c) Many detailed and carefully planned investigations were described with the most well-prepared candidates gaining maximum credit. Almost all candidates were able to describe that they would use a range of volumes of beetroot juice, although many also included a water 'control experiment' even though the hypothesis that was being tested did not require one. Most candidates also recognised the need to keep aspects of the athletes the same, such as their age or level of fitness, but did not go on to give other key variables that also needed consideration. For example, very few candidates considered controlling the concentration of beetroot juice, or aspects of the running environment such as the surface. Safety precautions that related directly to the procedure gained credit but suggestions about the treatment of injured runners could not be credited. Some of the best answers included reference to the need for rest intervals between measurements or the timing of the run relative to the consumption of the beetroot juice. Almost all candidates suggested that their experiments should be repeated but often it was unclear whether this was with further volumes of beetroot juice or with repeats of a specified volume.

(d) Most candidates were familiar with the steps required to carry out the test for reducing sugars and many were awarded full marks. The commonest errors were to misname the reagent as biuret or omit the fact that the Benedict's test requires heat. Some candidates mentioned that a water-bath could be used but did not give an indication of the temperature of the water-bath. Since cold water-baths are also used routinely; the use of water-bath without clarification cannot be credited.

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