

BIOLOGY

Paper 0610/11
Multiple Choice (Core)

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

General comments

There was good understanding of: the magnification formula; the features of vertebrates; that mineral ions are obtained from the soil and the definition of a pathogen.

There was some uncertainty about: the process of dental decay; the definition of a population; the use of antibiotics; the approximate percentage of oxygen in expired air and the effects of drinking alcohol.

It is important for candidates to work methodically through information provided in questions, such as in **Question 35**.

Comments on specific questions

Question 4

Few candidates appreciated that root hair cells have a cell wall and sperm cells do not. A number of candidates incorrectly believed that root hair cells contain chloroplasts.

Question 8

Many candidates correctly worked out that the potato cylinder in the solution with the highest sucrose concentration would have the greatest negative percentage change in mass. Some candidates incorrectly selected option **C** which increased in mass.

Question 9

While many candidates appreciated that the chemical used to test for the presence of protein in a food sample is biuret solution, some candidates incorrectly believed that Benedict's solution is used.

Question 10

Many candidates understood that the substrate binds to an enzyme with a complementary shape and a product is formed. Some candidates incorrectly believed the product binds to an enzyme with a complementary shape and a substrate is formed.

Question 13

Most candidates knew the requirements for photosynthesis. Some candidates incorrectly believed that chlorophyll is not required for photosynthesis.

Question 14

While most candidates understood that the stomach secretes hydrochloric acid, some incorrectly opted for the gall bladder.

Question 15

The process of dental decay was not understood by the majority of candidates. Statements 1, 2 and 3 were correct descriptions of the process of dental decay.

Question 18

There was some uncertainty about the process that occurs during transpiration. While many candidates understood that transpiration is the movement of water vapour through the stomata by diffusion, a significant number opted for one of the distractors.

Question 22

The approximate percentage of oxygen (16%) in expired air was not widely known.

Question 23

Many candidates understood which processes use energy from respiration. Some candidates incorrectly believed that osmosis uses energy from respiration.

Question 24

Many candidates knew the word equation for anaerobic respiration in yeast and selected option **A**. Some incorrectly believed that this type of respiration produces lactic acid and selected options **C** or **D**.

Question 25

Many candidates understood that carbon dioxide, urea and water are excreted from the human body.

Question 29

Many candidates did not appreciate that non-bacterial and viral diseases cannot be treated with antibiotics.

Question 30

Few candidates understood that drinking alcohol increases reaction time.

Questions 31

Most candidates appreciated that both oxygen and water are required for seeds to germinate, some incorrectly believed that oxygen is not required.

Question 35

Many candidates were able to determine that option **C** gave the correct proportions from the genetic cross. Some candidates did not read the question carefully and crossed two heterozygous parents.

Question 38

The definition of a population was not well known. Some candidates understood that a population would be all the three-spined stickleback fish living in a lake but many candidates incorrectly believed that a population is all the organisms living in a lake or all the fish living in a lake.

Question 39

Most candidates knew that lipase in washing powder removes an oil stain. Some candidates incorrectly selected pectinase.

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Paper 0610/12
Multiple Choice (Core)

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

General comments

There was good understanding of: the definition of a pathogen; the definition of fertilisation; that plants obtain mineral ions from the soil; the effects of adrenaline on the body; the definition of a drug and the role of testosterone in the development of secondary sexual characteristics in human males.

There was some uncertainty about: the position of the xylem in the root and the leaf; the approximate percentage of oxygen in expired air; transpiration; anaerobic respiration and the part of the eye that refracts light.

It is important for candidates to work methodically through information provided in questions, such as in **Questions 33 and 37**.

Comments on specific questions

Question 4

Few candidates appreciated that root hair cells have a cell wall and sperm cells do not. A number of candidates incorrectly believed that root hair cells contain chloroplasts.

Question 5

While many candidates knew that ciliated cells and sperm cells have structures that can move, some candidates incorrectly believed that nerve cells also have structures that can move.

Question 6

Many candidates were able to calculate the length of the cell in the image. Some candidates incorrectly divided the magnification of the image by the actual length of the cell.

Question 7

There was some uncertainty about the position of the xylem in the root and the leaf. Candidates often confused the xylem with the phloem.

Question 9

While many candidates appreciated that the chemical used to test for the presence of protein in a food sample is biuret solution, some candidates incorrectly believed that Benedict's solution is used.

Question 10

Many candidates understood that enzymes have a complementary shape to their substrate. Some candidates incorrectly believed that enzymes are used up during the reaction.

Question 14

Few candidates correctly identified the parts of the tooth. Some candidates were uncertain about which part is the enamel and which part is the dentine.

Question 16

Few candidates understood that the small intestine absorbs most of the water in the alimentary canal. Some candidates incorrectly believed that the large intestine absorbs most of the water in the alimentary canal.

Question 18

There was some uncertainty about the process that occurs during transpiration. While many candidates understood that transpiration is the movement of water vapour through the stomata by diffusion, a significant number of candidates opted for one of the distractors.

Question 19

Few candidates were able to correctly identify the coronary artery.

Question 22

The approximate percentage of oxygen (16%) in expired air was not widely known.

Question 24

Many candidates did not know the products of anaerobic respiration in humans and yeast.

Question 26

Most candidates did not know that the part of the eye that refracts light is the cornea.

Question 28

While many candidates identified the tropic responses that represented phototropism and gravitropism, some candidates incorrectly believed that in gravitropism, the root grows away from gravity.

Questions 33

Few candidates were able to derive the correct answer for the cross.

Question 34

While many candidates knew that sex is an example of discontinuous variation in humans, a significant number of candidates selected one of the distractors.

Question 35

It was understood by many candidates that mutation can increase the genetic variation in a species. Some candidates incorrectly believed that mitosis can increase genetic variation in a species.

Question 36

Many candidates were able to correctly identify the processes that reduce or increase the carbon dioxide concentration in the atmosphere. Some candidates incorrectly believed that decomposers reduce the carbon dioxide concentration in the atmosphere.

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Paper 0610/13
Multiple Choice (Core)

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

General comments

There was good understanding of: the magnification formula; that mineral ions are obtained from the soil and the word equation for photosynthesis.

There was some uncertainty about: transpiration; identifying the coronary artery; the use of energy from respiration and the approximate percentage of oxygen in expired air.

It is important for candidates to work methodically through information provided in questions, such as in **Questions 29** and **39**.

Comments on specific questions

Question 2

Many candidates appreciated that a species is a group of individuals that can reproduce to produce fertile offspring. Some candidates incorrectly selected genus.

Question 4

Few candidates appreciated that root hair cells have a cell wall and sperm cells do not. A number of candidates incorrectly believed that root hair cells contain chloroplasts.

Question 8

Many candidates were able to identify the description of active transport. Some candidates did not realise that the particles move through a cell membrane.

Question 9

While many candidates appreciated that the chemical used to test for the presence of protein in a food sample is biuret solution, some candidates incorrectly believed that Benedict's solution is used.

Question 10

Many candidates understood that protease is a catalyst. Some candidates incorrectly identified protease as a substrate.

Question 15

The structure of the tooth and the process of dental decay were not well understood by many candidates.

Question 18

There was some uncertainty about the processes that occurs during transpiration. The majority of candidates opted for one of the distractors.

Question 19

Only a minority of candidates was able to identify the coronary artery as label **D**.

Question 21

While many candidates correctly selected pathogen, some candidates incorrectly selected disease.

Question 22

The approximate percentage of oxygen (16%) in expired air was not widely known.

Question 23

Most candidates could not identify all the actions that use energy released from respiration. All four actions use energy released from respiration.

Question 24

Only a small proportion of candidates correctly selected option **D** with option **A** being frequently selected. Option **A** involved oxygen so could not be correct as the equation was for anaerobic respiration.

Question 25

Few candidates opted correctly. Many candidates incorrectly thought that urea is formed in the kidneys from excess amino acids.

Question 26

Less than half the cohort appreciated that when a person moves from a place with dim light to a place with bright light, the pupils decrease in size and this is controlled by the iris.

Questions 27

Most candidates understood that the pancreas is the endocrine gland that secretes insulin. Some candidates incorrectly selected the adrenal gland.

Questions 28

Most candidates realised that light and temperature affect the growth of plants. Few candidates appreciated that gravity also affects the growth of plants.

Questions 29

Most candidates were able to work through the information in the table to deduce that the person would be at risk from developing scurvy.

Questions 32

Most candidates opted incorrectly for vasectomy. Candidates should be aware that vasectomy is not a barrier method of birth control.

Question 34

Many candidates understood which processes are involved in producing a new fig tree. It was important for candidates to read the stem of the question carefully before answering the question.

Question 37

Many candidates correctly identified the different parts of the water cycle.

Question 39

The question required candidates to work carefully through each part of the carbon cycle in order to avoid making mistakes.

Question 40

Many candidates understood that an increase in soil erosion and an increase in carbon dioxide in the atmosphere are undesirable effects of deforestation. Some candidates incorrectly believed that a decrease in soil erosion is an undesirable effect.

BIOLOGY

Paper 0610/21
Multiple Choice (Extended)

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

General comments

There was good understanding of: DNA base sequences; that mineral ions are obtained from the soil; the definition of a pathogen and human gametes.

There was some uncertainty about: the requirements for active transport; water potential changes; that non-bacterial and viral diseases cannot be treated with antibiotics; the approximate percentage of oxygen in expired air and the definition of stem cells.

It is important for candidates to work methodically through information provided in questions, such as in **Questions 35, 36 and 38**.

Comments on specific questions

Question 3

Many candidates appreciated that the root hair cell has a cell wall and a sperm cell does not. Some candidates incorrectly believed that root hair cells contain chloroplasts.

Question 5

Only a minority of candidates appreciated that the movement of glucose molecules into the epithelium and the movement of nitrate ions from a dilute solution in soil into a more concentrated solution in root hairs require oxygen.

Question 11

Most candidates incorrectly believed that the hydrogencarbonate indicator in test-tube **A** would turn yellow. Since the leaves in test-tube **A** were exposed to light, photosynthesis would occur, removing carbon dioxide from inside the test-tube. An increase in carbon dioxide is required to turn the hydrogencarbonate indicator yellow, which occurs in test-tube **B**. In this test-tube, the leaves are in the dark and respiring, giving off carbon dioxide.

Question 13

This was a demanding question with only a minority of candidates selecting correctly. Candidates need to appreciate that a reduction of chloride ions in a solution will increase the water potential.

Question 14

Few candidates appreciated that at X, maltose is broken down by maltase and therefore the concentration of maltose is decreasing.

Question 16

Some candidates correctly interpreted the diagram and understood that the phloem vessels have been removed and sucrose cannot move to the sink.

Question 17

Most candidates were able to identify the coronary artery.

Question 20

The approximate percentage of oxygen (16%) in expired air was not widely known.

Question 22

While most candidates knew the word equation for anaerobic respiration in yeast, some candidates incorrectly believed that lactic acid is produced.

Question 23

Many candidates were aware that carbon dioxide, urea and water are excreted from the human body. Some candidates incorrectly selected option **A**, carbon dioxide and urea only.

Question 24

Many candidates appreciated that glucagon will cause the body to convert glycogen into glucose. Some candidates incorrectly believed that insulin would cause the body to convert glycogen into glucose.

Question 27

Most candidates did not appreciate that non-bacterial and viral diseases cannot be treated with antibiotics.

Question 28

Many candidates appreciated that platelets are produced by mitosis and are genetically identical. Some candidates incorrectly believed that platelets are produced by meiosis.

Question 29

Most candidates knew that the male gamete has an acrosome and is motile.

Question 31

The description of stem cells was only known by a small proportion of candidates.

Question 35

With this type of question, it is important for candidates to work methodically through each part of the diagram.

BIOLOGY

Paper 0610/22
Multiple Choice (Extended)

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

General comments

There was good understanding of: the definition of a species; enzymes; the role of hormones and energy flow.

There was some uncertainty about: the requirements for active transport and water potential changes.

It is important for candidates to work methodically through information provided in questions, such as in **Question 31**.

Comments on specific questions

Question 3

Many candidates appreciated that the root hair cell has a cell wall, and a sperm cell does not. Some candidates incorrectly believed that root hair cells contain chloroplasts.

Question 5

Only a minority of candidates appreciated that the movement of glucose molecules into the epithelium and the movement of nitrate ions from a dilute solution in soil into a more concentrated solution in root hairs require oxygen.

Question 6

Few candidates selected correctly with many not understanding the meaning of higher and lower water potential.

Question 8

Many candidates understood that the concentration of an enzyme during the course of an enzyme-controlled reaction remains the same.

Question 11

Many candidates did not appreciate that the colour changes in the hydrogencarbonate indicator in test-tube X are caused by photosynthesis removing carbon dioxide from inside the test-tube and decreasing its concentration. The colour changes in the hydrogencarbonate indicator in test-tube Y are caused by respiration releasing carbon dioxide inside the test-tube and increasing its concentration.

Question 13

This was a demanding question with only a minority of candidates selecting correctly. Candidates need to appreciate that a reduction of chloride ions in a solution will increase the water potential.

Question 14

Few candidates appreciated that at X, maltose is broken down by maltase and therefore its concentration is decreasing.

Question 18

While most candidates correctly identified the function of the cell labelled X as phagocytosis, some candidates incorrectly thought that it produced antibodies.

Question 20

The approximate percentage of oxygen (16%) in expired air was not widely known.

Question 22

Many candidates correctly selected option **B**. Some candidates incorrectly believed that anaerobic respiration in humans produces lactic acid and carbon dioxide whereas only lactic acid is produced.

Question 24

Many candidates appreciated that glucagon will cause the body to convert glycogen into glucose. Some candidates incorrectly believed that insulin would cause the body to convert glycogen into glucose.

Question 28

Most candidates correctly selected option **D**. Some candidates incorrectly believed that the pollen tube grows before pollination occurs.

Question 31

Few candidates were able to correctly derive the answer. It is important that candidates work through each stage of the problem, in order to derive the correct answer.

Question 32

Most candidates did not appreciate that the cells were stem cells undergoing mitosis.

Question 34

Many candidates appreciated that the development of antibiotic-resistant bacteria is an example of evolution. Some candidates incorrectly believed that the changes made to livestock as a result of artificial selection is an example of evolution.

Question 36

Most candidates correctly identified nitrification. Some candidates incorrectly selected option **A** which is nitrogen fixation.

BIOLOGY

Paper 0610/23
Multiple Choice (Extended)

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

General comments

There was good understanding of: the definition of a species; tissues; DNA structure; catalysts; that mineral ions are obtained from the soil; the definition of a pathogen and genetic crosses.

There was some uncertainty about: water potential changes; the production of urea and the production of progesterone.

It is important for candidates to work methodically through information provided in questions, such as in **Questions 31, 32 and 40**.

Comments on specific questions

Question 3

Many candidates appreciated that the root hair cell has a cell wall and a sperm cell does not. Some candidates incorrectly believed that root hair cells contain chloroplasts.

Question 5

Only a minority of candidates appreciated that the movement of glucose molecules into the epithelium and the movement of nitrate ions from a dilute solution in soil into a more concentrated solution in root hairs require oxygen.

Question 6

Many candidates did not appreciate that in diagram **B**, the membrane has a larger surface area for diffusion than the membrane in diagram **A**.

Question 7

Many candidates correctly selected option **B**. Some candidates did not appreciate that all enzymes contain the element nitrogen.

Question 13

This was a demanding question with only a minority of candidates responding correctly. Candidates need to appreciate that a reduction of chloride ions in a solution will increase the water potential.

Question 14

Few candidates appreciated that at X, maltose is broken down by maltase and therefore the concentration of maltose is decreasing.

Question 23

While many candidates understood that urea is formed in the liver from excess amino acids, some candidates incorrectly believed that urea is formed in the kidneys from excess amino acids.

Question 26

Most candidates understood that gravity, light and temperature affect the growth of plants. Some candidates did not appreciate that gravity affects the growth of plants.

Question 29

Most candidates were aware that the hormone progesterone is produced by the ovaries but it was less well known that it can also be produced by the placenta.

Question 34

Many candidates realised that the process used to produce the broccoli and cauliflower plants from wild plants is artificial selection. Some candidates incorrectly selected natural selection.

Question 40

Many candidates correctly selected option **A** but a number incorrectly selected option **D**, reduced oxygen concentration in the atmosphere due to reduced respiration of trees. Respiration uses oxygen and so option **D** cannot be correct. This highlights the importance of reading the question carefully and working through the information methodically.

BIOLOGY

Paper 0610/31 Theory (Core)
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Key messages

Candidates would benefit from reading the question carefully, as it often contains specific information that must be used in the answer. For example, when the question asks for four lines to be drawn, it's important that only four lines are drawn. Also, the question may ask for a definition rather than a discussion and that indicates the level of detail required in the answer.

Command words such as describe, explain, suggest and compare require different responses from candidates. If a description is required, including a reference to a graph or table, then it will be expected that data will be used in the description given. Many candidates can do this effectively. An explanation requires more than just a description and candidates should be encouraged to practice the difference between explain and describe.

General comments

Many candidates were well prepared for the exam and had obviously referred to past papers and mark schemes when preparing. This type of preparation allows candidates to express themselves clearly.

Comments on specific questions

Question 1

- (a) (i) Many candidates did not recognise that the description was for a dichotomous key. There were a range of incorrect answers including genus and binomial.
- (ii) Most candidates achieved full marks on this question although a small number were unsure about how to use a key.
- (iii) Most candidates gained two marks for correctly identifying feathers and wings. Several mentioned eggs but failed to say these were hard-shelled.
- (b) (i) The most common incorrect answer was to give the full binomial name rather than just *Recurvirostra*.
- (ii) Few candidates gained full marks. Many gained one mark for correctly calculating the change in numbers (1975) but were unable to express this as a percentage. A common incorrect answer was 8000.
- (iii) A good range of marks were awarded for candidates considering the potential causes of extinction. Some candidates described the cause, particularly hunting and poaching.

Question 2

- (a) Many candidates scored all four marks. Dominant and phenotype appeared to be the definitions candidates were most familiar with.
- (b) Candidates were uncertain about the relative sizes of the three cell structures. From smallest to largest the order was allele – chromosome – nucleus.

- (c) Very few candidates gained six marks. Some candidates confused the two types of division – so all the mitosis ticks were in the meiosis boxes – suggesting they knew the features of each but confused the names.

Question 3

- (a) (i) Mostly well answered, the most common mistake was not identifying the sperm duct or naming it the sperm tube and stating that the testes stored semen. Often **Z** was confused with **S**.
- (b) (i) Generally answered very well. Most gained three marks. The vast majority gained at least one for correctly identifying the last two processes. Most common mistake was **M** and **K** the wrong way round.
- (ii) Some candidates clearly identified the possible sex chromosomes as X and Y. Some incorrectly put XX and XY.
- (c) (i) Most candidates correctly identified testosterone.
- (ii) Most candidates were awarded three marks. The most common incorrect answer was that the pelvis widens.

Question 4

- (a) (i) Some candidates wrote about eating a range of different foods (meat, vegetables) rather than nutrients. Many missed a mark because they said 'fat, protein, etc.' rather than listing them all. Few referred to energy requirements.
- (ii) Many candidates thought that bread and pasta have a high fat content. Vegetable oil was the most common correct answer.
- (iii) Almost all candidates stated obesity and most also gave another valid answer. Common insufficient answers were high cholesterol, blocked arteries, heart problems and unqualified diabetes.
- (iv) Many candidates listed protein and carbohydrate and gave a valid importance. Some candidates mentioned producing (instead of releasing) energy for either protein or carbohydrate. Another common answer was to say protein was to make us strong. Some also listed either two different minerals or vitamins. There were some very specific answers about deficiency diseases such as scurvy and also some mentioned antibodies and enzymes for protein.
- (b) (i) Most correctly identified teenage males from the graph.
- (ii) Most answered correctly but a common incorrect answer was 2.3 MJ, due to misreading the graph and giving the adult male requirement as 10.3 MJ.
- (iii) Most candidates correctly stated that males have a greater energy requirement than females.
- (iv) Most mentioned feeding the baby or embryo or fetus but did not refer to its growth or development.

Question 5

- (a) (i) Some candidates thought that aerobic respiration only occurs in animals. This was by far the most common mistake. Most scored one mark for glucose and oxygen – when two were awarded it was usually for enzymes and glucose and oxygen – products were seen less often.
- (ii) Most candidates knew that aerobic respiration releases more energy than anaerobic respiration.
- (iii) Most candidates gained at least one mark on this question, most commonly for mentioning alcohol or bread.
- (b) (i) Most candidates interpreted the graph correctly.
- (ii) Many candidates misread the graph and gave the answer as 1 dm³ instead of 0.5 dm³.

- (iii) Candidates found this question demanding. During physical activity, the amplitude and frequency of the wave would increase.
- (c) Few gained two marks on this question. Many candidates wrote about the misuse of illegal drugs. Many just gave examples of drugs (either prescription or illegal).

Question 6

- (a) (i) A common mistake was to identify the phloem or xylem as the vacuole.
- (ii) Most candidates correctly stated high to low concentration but very few mentioned random movement. Common incorrect answers for the third gap were net and diffusion.
- (iii) Most correctly stated oxygen. Carbon dioxide was a common incorrect answer.
- (iv) Many candidates did not read the question correctly and put stomata rather than the cell membrane.
- (b) (i) Most candidates correctly identified 10 cm as the distance with the highest rate of photosynthesis.
- (ii) Some candidates wrote about the number of bubbles rather than the rate of photosynthesis and therefore could not be awarded the mark.
- (iii) Many were awarded the mark for stating that increased carbon dioxide would increase the rate of photosynthesis.
- (c) (i) The names of large carbohydrates found in plants were not well known. A range of incorrect answers were seen, including glycogen, fructose, glucose and also other biological molecules. Some candidates listed elements rather than molecules.
- (ii) Candidates were unsure of the elements in glucose and proteins. Many included magnesium in one or both columns.

BIOLOGY

Paper 0610/32 Theory (Core)
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Key messages

Candidates would benefit from reading the question carefully, as it often contains specific information that must be used in the answer. For example, when the question asks for four lines to be drawn, it is important that only four lines are drawn. Also, the question may ask for a definition rather than a discussion and that indicates the level of detail required in the answer.

Command words such as describe, explain, suggest, and compare require different responses from candidates. If a description is required, including a reference to a graph or table, then it will be expected that data will be used in the description given. Many candidates can do this effectively. An explanation requires more than just a description and candidates should be encouraged to practice the difference between explain and describe.

General comments

Many candidates were well prepared for the exam and had obviously referred to past papers and mark schemes when preparing. This type of preparation allows candidates to express themselves clearly.

Comments on specific questions

Question 1

- (a) This question was well answered. A few candidates confused the two hairy crustaceans.
- (b) While most candidates gave the correct names for the groups, some gave examples of the groups. Other common incorrect answers included vertebrates and names of vertebrate groups.
- (c) Candidates showed an excellent understanding of the difference between arthropods and vertebrates. Candidates should make it clear in their answer whether it is vertebrate or arthropod which is being referred to.

Question 2

- (a) (i) Many candidates did not identify the red and white blood cells. The presence of a nucleus identifies the cell as a white blood cell. Some detail of the role of each cell is needed, rather than just protection or transport. Common incorrect answers included fighting or killing infection / disease.
- (ii) It is important to read the question carefully, as many candidates listed various items carried in the blood, rather than the liquid that carries the cells.
- (b) Very few candidates were able to fully complete the table. Most scored one or two marks, usually for the column describing energy and the column describing the movement of water. The most difficulty was with osmosis, where many thought that it takes place against a concentration gradient.

Question 3

- (a) (i) The vast majority of candidates were able to read off the correct year from the bar chart.



- (ii) Candidates were usually able to read the correct figures from the graph but were not always able to correctly calculate the percentage decrease. Candidates generally set out their working clearly so if they did the calculation incorrectly, they could gain credit for selection of the correct figures.
- (b) Many candidates were able to explain that plastic pollution could be reduced by recycling or reusing it. Many answers incorrectly made references to fines for dumping plastic, burning the plastic, legislation and having more bins.
- (c) Candidates gave a good range of responses with most able to state hunting, predation, and lack of food as the most common causes for the population decrease. Many candidates incorrectly gave examples of pollution and deforestation as causes. Candidates should be reminded to read the question carefully and take note of all the information given in the question.
- (d) Candidates did not always gain full credit on this question as they used terms which did not show full understanding of the concept. Candidates should be encouraged to learn set definitions. Finished was a common but incorrect response for the second gap.

Question 4

- (a) Candidates commonly confused dentine and enamel. Gum and nerve were consistently identified correctly.
- (b) The majority of candidates were able to recall two of the four tooth types. The occasional references to wisdom teeth, milk and baby teeth were seen.
- (c) Many candidates gave the answer to (d) here – and then repeated it again in (d). Candidates frequently referred to the main causes of dental decay as not brushing teeth but without references to this meaning that food and bacteria would remain on the teeth. Many responses referred to bacteria feeding on the sugar or tooth. Acid was referenced in many responses though not all candidates linked the acid as being a waste product of respiration. Candidates were aware that the acid could damage the tooth, but many were too vague and did not link it to dissolving the enamel or dentine. They thought that the acid came directly from ingested food and drink.
- (d) Candidates gave a good range of responses including brushing, visiting a dentist, and reducing sugary foods. Quite often the same marking point was made, for instance stating both brushing and flossing.
- (e) Many candidates were able to recall mechanical or less commonly physical, as the correct type of digestion. Common incorrect answers included ingestion, digestion, indigestion, and chewing.

Question 5

- (a) Almost all candidates correctly identified the bladder with an **X**.
- (b)(i) Almost all candidates correctly identified **C** as the mammal species with the lowest volume of urine. Occasionally **D** was seen.
- (ii) Almost all candidates correctly identified **B** as the mammal species with the largest range of volumes of urine.
- (c) Candidates found it difficult to express their ideas often referring to non-scientific language such as going to the bathroom, etc. Most candidates identified variation in water intake but did not explain the point. Some incorrectly linked high temperatures with higher volumes of urine produced – either because they simply got the link the wrong way round or because they thought that if it is hotter you drink more, so you would produce more urine. Some referred to the frequency of urination or the concentration of urine rather than volume as required by the question. Very few mentioned exercise.
- (d)(i) Many candidates were confused as to which organ produces urea with many incorrectly stating the kidneys.
- (ii) Some candidates knew that the kidney excretes urea, but ureter and urethra were also seen.

- (e) Mostly well-known but a significant number answered ureter, urethra, or kidney – still choosing an answer from the list in (d).

Question 6

- (a) Many candidates correctly stated lactic acid, but ethanol was frequently seen. Candidates need to ensure that they read the question carefully.
- (b) (i) The majority of candidates were able to correctly perform the calculation.
- (ii) Candidates demonstrated a good recall of the word equation for aerobic respiration although some responses stated the equation for photosynthesis. Some candidates attempted to write a balanced chemical equation.
- (c) (i) Majority of candidates could use the information given to calculate and select the correct responses. Selecting which country that produces twice as much biofuel as country E was the most likely to be incorrect with students selecting country B.
- (ii) Candidates generally recalled carbon dioxide.
- (iii) Candidates often gave answers that were too vague, e.g., baking or alcohol. Bread-making was the most frequent correct answer.

Question 7

- (a) Some answers referred to wind or insect pollinated plants, e.g. nectar, scent, or colour instead of pollen. Some answers referred to pollen from insect-pollinated plants rather than wind-pollinated plants.
- (b) Generally, these structures were well known by candidates. Some were not awarded the mark for the site of fertilisation as the X was placed outside the ovary.
- (c) Water (or moisture) was a frequent correct response. Light was a common incorrect answer. Many were not awarded the mark for stating a suitable temperature as they stated temperature unqualified or simply referred to warmth.
- (d) Candidates found this question demanding. The fact that xylem are hollow or dead cells was the most common correct answer. Many candidates described water uptake and transpiration rather than how xylem tissue is adapted for this function.

Question 8

Many candidates were awarded full marks for this question.

Question 9

- (a) (i) Many candidates incorrectly stated parts of the nervous system with only a few correctly stating temperature.
- (ii) Candidates needed to consider what makes the arm move, rather than the arm itself as an effector. Common incorrect answers were hot pan, receptor, and spinal cord.
- (iii) This question was generally well answered. Some gave spine or backbone which were insufficient.
- (b) Very few candidates were able to recognise the different neurones in the diagrams even though they were aware of the different types. Some got the right names but in the wrong order.
- (c) Some candidates correctly named the synapse. Septum was an incorrect answer.

BIOLOGY

Paper 0610/33 Theory (Core)
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Key messages

Candidates would benefit from reading the question carefully, as it often contains specific information that must be used in the answer. For example, when the question asks for three lines to be drawn, it's important that only three lines are drawn. Also, the question may ask for a definition rather than a discussion and that indicates the level of detail required in the answer.

Command words such as describe, explain, suggest, and compare require different responses from candidates. If a description is required, including a reference to a graph or table, then it will be expected that data will be used in the description given. Many candidates can do this effectively. An explanation requires more than just a description and candidates should be encouraged to practice the difference between explain and describe.

General comments

Many candidates were well prepared for the exam and had obviously referred to past papers and mark schemes when preparing. This type of preparation allows candidates to express themselves clearly.

Comments on specific questions

Question 1

- (a) (i) This question was answered well by most candidates. Both leaves **D** and **C** are smooth but only D is lobed.
- (ii) Many candidates correctly identified the genus as *Quercus*.
- (b) (i) It is important to read the question carefully, as most candidates gave a definition for genus rather than species.
- (ii) Most candidates correctly stated two features of plant cells that are not found in animal cells, with chloroplasts and a cell wall being common correct answers.

Question 2

- (a) (i) Many candidates correctly identified the cell membrane.
- (ii) Most candidates indicated the correct position of chromosomes in the nucleus.
- (iii) Many candidates correctly stated DNA.
- (b) (i) Some candidates stated where the sex chromosomes are found, rather than stating XY.
- (ii) This was a demanding question. Often candidates omitted to split the alleles to form the gametes. Many candidates filled the Punnet square in for two heterozygous parents. These candidates were still awarded marks for giving the correct probability from their cross.

Question 3

- (a) There was some confusion between the roles of different vitamins and iron.
- (b) There were some excellent answers describing the selection of desirable features and breeding.
- (c) (i) There were some good descriptions of mutation as genetic change. Some candidates suggested possible results of mutation rather than giving a definition of mutation.
(ii) Many candidates gave radiation as an answer but failed to say that it was ionising radiation.

Question 4

- (a) Almost all candidates constructed a food chain from the information given in the question.
- (b) (i) This question was generally well answered. Some candidates gave names of organisms rather than numbers. Consumer means all organisms in the food web, except the producer. Many candidates gave the number of primary consumers only.
(ii) Candidates showed a clear understanding of the impact of a new predator.
- (c) Many candidates gave examples of the organisms that get energy from dead or waste organic material rather than naming the term decomposer.

Question 5

- (a) (i) Evaporate means to change from liquid to gas (vapour) and the question asked where this happens during transpiration. Many answers stated **D**, which is where the vapour exits the leaf.
(ii) Most candidates understood that **D** is the point at which water vapour exits the leaf.
- (b) (i) Some candidates found it difficult to relate the information in the diagram to the structure of a plant. The question asked for a vessel in a plant stem and many correctly stated the xylem.
(ii) Candidates were required to perform a simple calculation, $23 \div 3$ and give the answer to three significant figures. Many candidates tried a more difficult calculation, comparing the rates for the previous three temperatures.
(iii) Many candidates correctly described the increase in rate of transpiration with increased environmental temperature.
- (c) (i) The question asked for the name of the cells where water enters a plant. Many candidates stated a tissue rather than a cell.
(ii) Many candidates correctly stated osmosis.

Question 6

- (a) (i) Most candidates correctly identified the valve and muscular wall, but many had ventricle and atrium the wrong way round.
(ii) The pulmonary artery was well known. The question asked for an artery, but some candidates named a vein.
- (b) Candidates often did not give an appropriate way of measuring heart activity. Simply stating pulse is insufficient. Counting the pulse in a set time, measuring pulse rate, or using a monitoring machine is a suitable description. Abbreviations for monitoring machines, such as ECG, are also acceptable.

Question 7

- (a) Very well answered. Some candidates did not fully read the breakdown of food box. It stated without chemical change, so that box could not be linked to the small intestine.

- (b)(i) The question asked for mouth to stomach so descriptions of chemical digestion in the stomach or small intestine were not needed. Some candidates gave good descriptions of mechanical digestion in the mouth and the action of amylase.
- (ii) Some candidates answered correctly and stated either the pancreas or the stomach.
- (c)(i) Many candidates gave the large intestine instead of the small intestine.
- (ii) Most candidates understood the requirement of drinking more water during diarrhoea, but for rehydration it is important to add sugar and salt.

Question 8

- (a) There was some confusion with terminology in this question. Many candidates gave glycogen and glucose instead of glycerol.
- (b)(i) Most candidates selected correct values from the table, and some gave correct answers. There were difficulties finding the correct denominator for the calculation. The correct answer was a very large percentage, so some candidates left off some zeros or tried to recalculate.
- (ii) This was a demanding question. Most correct answers described loss of habitat or biodiversity and food chain disruption. Oil palms are large plants so would not cause changes in carbon dioxide or global warming, which were common answers.

Question 9

- (a) Many candidates were awarded full marks for this question.
- (b)(i) Many candidates correctly identified structure **B** as the pancreas. A common mistake was to identify structure **D**, the liver.
- (ii) This was a demanding question. Candidates understood the need for insulin for regulation but did not specify that it reduces the concentration of blood glucose.
- (iii) Many candidates correctly identified structure **D**, the liver. Some gave **C** or **B**.

Question 10

- (a) Few candidates identified all four elements correctly from the list. Many omitted nitrogen.
- (b)(i) Generally well answered with most selecting **K** at a pH close to neutral.
- (ii) Most candidates drew a correct shape for the enzyme activity within the correct pH range.

BIOLOGY

Paper 0610/41 Theory (Extended)
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Key messages

Candidates are advised to read questions very carefully and to make sure that they are using all the information, including the command words. Candidates should be aware that when they have been asked to make a comparison, their answer should include appropriate vocabulary that makes the comparison clear.

Candidates should look carefully at the key and axes titles and units on graphs before reading data points or making any interpretations. Answers to **Question 3(b)(ii)** often included data quotes that had no units or incorrect units. Candidates should always use appropriate units when quoting data.

Candidates are advised to show their working in calculations, as partial credit may be awarded even if a mistake is made during the calculation.

Answers to some questions suggested that candidates did not always have a good understanding of the command words used in this paper. Descriptions of the command words can be found in the syllabus.

General comments

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

Candidates showed good factual knowledge, but they should carefully read the stimulus material provided for each question. They should also complete all the instructions given within each part question to help maximise their chances of success.

Some topics in the syllabus were better known than others. Candidates should revise all the material detailed in the syllabus. A useful tool is to use the syllabus as a revision guide and encourage candidates to 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 were able to state or describe mechanical digestion to gain credit. A few wrote about chemical digestion and the breakdown of molecules which did not gain credit. Vague references to chewing did not gain credit unless qualified by breaking large pieces of food into smaller pieces.
- (ii) Many candidates did not give enamel as the visible outer layer of the teeth. The most common incorrect answer was crown.
- (iii) A small proportion of candidates misinterpreted this question and wrote about the transition from milk teeth to adult teeth. However, most candidates stated that food is left on teeth, bacteria produce an acid, and the acid dissolves the enamel of the tooth. Several responses referred to incorrect acids being released by bacteria. Hydrochloric acid was a common example. No mark was given for these incorrect answers. Unclear references to acid digesting or melting the enamel also did not gain credit. Many candidates described bacteria eating away at the teeth and also did not gain credit. Very few candidates identified the acid as a waste product of bacterial respiration.

- (b)(i) This was generally well answered though it was clear that some did not make use of Fig. 1.2. Many filled in the greyed-out boxes in the key. This was not necessary, and no marks were awarded if these were the only answers given.
- (ii) Some candidates referred to teeth rather than considering the internal features of the whole animal. The most common correct answers were double circulation, four-chambered heart, lungs, and a feature of mammalian reproduction, such as the presence of a uterus or mammary glands. There were several references to warm blooded which were ignored. A large number of candidates gave features of fish that are not found in killer whales. No marks were awarded for these answers.
- (iii) This question was generally well answered with many stating vertebrates as the group of animals that includes mammals and fish.

Question 2

- (a)(i) Many candidates correctly stated that large insoluble molecules have to be broken down so that they can be absorbed. Fewer went on to state that the smaller molecules are soluble or that they are small enough to diffuse or to be transported actively into the bloodstream.
- (ii) Very few candidates stated that water is the substance that act as a solvent for most molecules that have been digested by enzymes. Many candidates gave either hydrochloric acid, gastric juice, pancreatic juice, or bile. Some candidates gave blood as their answer not realising that it is a tissue rather than a substance.
- (b) This long prose question was often answered very well. The best responses stated the function of proteases as breaking down protein into amino acids, identified **A** and **B** as pepsin and trypsin, stated the organs where they act and gave their optimum pH values. Weaker responses stated that the proteases were acidic or alkaline, rather than the condition that they were found in. Some candidates ignored the stem of the question and suggested that **B** was an amylase or lipase.
- (c) Very few candidates correctly named the membrane of the epithelium. The majority of candidates gave small intestine which is insufficient as it is in the stem of the question.

Question 3

- (a)(i) Most candidates gave the correct answer as transpiration.
- (ii) This question was not well known. Many candidates realised that the question was linked to the xylem, but few stated that the aim was to maintain a continuous column of water in the xylem, or to avoid air entering and blocking the xylem.
- (iii) Many candidates recognised that the layer of oil would stop evaporation of water. A few candidates did not mention water evaporating but described that the purpose of the oil was to stop water leaving the burette and this was given credit. Some candidates incorrectly referred to the oil layer as an aide to measuring the level of water in the burette.
- (iv) The majority of candidates understood that transpiration would reduce the volume of water in the burette. Not all responses made it clear that the difference, or starting and finishing volumes, should be measured. References to difference in mass or height were also given credit.
- (b)(i) Most candidates calculated the correct value and gave the correct unit as g. The most common mistake with the unit was to include 's' and write the unit as g / s.
- (ii) Almost all candidates gained credit for stating that the rate of water loss increased as the temperature increased. Some linked the increase in water loss to an increase in kinetic energy of the water molecules leading to faster diffusion. Some also identified the increase in the rate of water loss above 37°C or 38°C. Very few candidates linked an explanation to the stages of transpiration – responses that included evaporation from mesophyll cells into air spaces and diffusion of water vapour out of stomata were seen very rarely. Some candidates attempted an explanation that included faster diffusion out of the stomata but failed to gain credit as they referred to the diffusion of water, rather than the diffusion of water vapour. Few candidates stated that stomata open wider at higher temperatures or that there is an increase in the number of stomata that are open. Credit was given

for a comparative data quote, but it was rare to find any. The candidates that gave a data quote often failed to gain full credit as they did not include the correct units in their response.

- (c) (i) Many candidates did not gain credit because they answered in terms of water concentration instead of the correct term, water potential. Only the very best candidates stated that when the leafy shoot was kept at 100% relative humidity the water potential inside the leaf would be the same as the water potential outside the leaf, so diffusion of water vapour would not take place.
- (ii) Most candidates stated that there was a continuous supply of water from the jar. It was apparent that some candidates did not know the meaning of the term wilt.
- (iii) A significant number of candidates missed the instruction that the line should be drawn on the figure provided. Some spent considerable time drawing a graph, which was credited if the line drawn was clearly positioned below the line that was drawn in Fig. 3.2. Many candidates drew a sketch graph that was not annotated and therefore could not gain credit.

Question 4

- (a) Many candidates achieved two or three marks, but only a few achieved full marks. A common misconception was that DNA is a protein or a collection of amino acids. The majority of candidates made reference to four bases, and many went on to correctly identify the complementary base pairs as A–T and C–G. Some candidates correctly mentioned the double helix. A few responses included a correctly annotated drawing of a double helix, and this was credited. Responses that suggested DNA is made of two chains did not gain credit.
- (b) (i) Very few candidates gained full credit for this question. A common error was to use the term immunity instead of resistance. Another frequent error was the idea that bacteria mutated for a purpose, in this case to acquire antibiotic resistance. Another error was that the antibiotic triggered the mutation. The most common mark points awarded were for the differential survival of bacteria when exposed to antibiotics and the subsequent reproduction of resistant bacteria. A few candidates included the idea of variation in the bacterial population due to a random change in the base sequence of a gene.
- (ii) There were many alternative ways of achieving credit for this question on the use of base sequences for classifying strains of MRSA, but most candidates found it difficult to express one clearly. The most common correct idea was that the use of differences in base sequences was a more accurate method of classifying the strains of MRSA. A few candidates gave the idea that the bacteria cannot be classified visually as there is no difference in the appearance of the different strains.
- (iii) Most candidates gained at least one of the available marks. The most common responses were that antibiotics would no longer kill resistant bacteria and that new antibiotics would be required. A few candidates realised that scientists are concerned that antibiotic resistance will spread in the bacterial population, increasing disease and death rates in the human population.
- (c) (i) The most commonly awarded marks were for using antibiotics only when essential or when prescribed by a medical professional and for following instructions about the course of treatment. Many candidates gained both available marks.
- (ii) Many candidates did not know that the placenta would prevent MRSA being transmitted from a mother to her unborn fetus. It was a common misconception that the mother provides antibodies to her unborn fetus to prevent transmission of MRSA.
- (d) Many candidates gained one mark for giving decomposition as a natural process involving bacteria. Fewer were able to gain all three marks, those that did obtain full credit generally suggested stages in the nitrogen cycle.

Question 5

- (a) (i) There were many good answers to this question. The most common correct answer was respiration. Decomposition was occasionally seen, and a few candidates included volcanic eruptions. References to the release of carbon dioxide from oceans was not seen. Weaker responses were often too vague and included the idea of exhalation or breathing. These responses were not given credit.

- (ii) A large number of different gases were suggested as greenhouse gases. Methane was the most common correct answer. Carbon monoxide was accepted as although it has a weak effect as a greenhouse gas it is involved with reactions that generate methane.
- (b)(i) Most candidates gained at least two marks for this question, generally for comparing expansion rate and duration. Candidates needed to look carefully at the total number of fires to give a correct statement about them. A few candidates misinterpreted the question and only compared values for managed land or only for natural ecosystems. One mark was available for a comparative data quote, however, candidates that used values from the table often omitted the units.
- (ii) The majority of responses stated the need to multiply the number of fires by the expansion rate and the duration. Some candidates suggested additional steps, such as multiplying by 14 years and therefore did not gain full credit.
- (iii) Extinction of species was the most common correct response to this question, followed by migration or flooding. Responses that referred to altered food chains did not gain credit. Candidates needed to make it clear that habitat destruction has a negative impact on food chains.

Question 6

- (a)(i) This table completion question was not well answered with many vague responses given. Few candidates gave a clear description of the function of the diaphragm. Some candidates gained three or four marks, but very few gained full credit. The most common correct answers were identifying the alveoli as **H** and the ribcage as **E**.
- (ii) This was generally well answered, and many candidates gained full credit. Almost all stated that alveoli provide a large surface area and that they are thin with a good blood supply. Some candidates suggested that alveoli are filled with blood capillaries rather than surrounded by (many) capillaries. A few candidates wrote about the process of gas exchange instead of the adaptations of the alveoli.
- (b)(i) The majority of candidates did not explain that inspired air contains more oxygen and less carbon dioxide than expired air. Candidates often wrote only about the difference in one of the gases and therefore no credit was given. A common misconception was that inspired air contains only oxygen and expired air contains only carbon dioxide. Candidates often went on to explain that carbon dioxide was a waste product of respiration. Candidates frequently added that oxygen was required for respiration, but rarely stated that it was needed for aerobic respiration. Stronger responses explained that there is more water vapour in expired air compared with inspired air and gave the correct percentage values for oxygen and carbon dioxide in both inspired and expired air.
- (ii) Almost all candidates knew that the body responds to an increase in carbon dioxide concentration by increasing the rate and depth of breathing and increasing the heart rate. Candidates found it much more difficult to state where changes in carbon dioxide concentration in the body are detected.
- (iii) Some candidates correctly suggested limewater as a solution that can be used to test for the presence of carbon dioxide. A few suggested hydrogencarbonate indicator solution but many candidates failed to include the term indicator in their response.

BIOLOGY

Paper 0610/42 Theory (Extended)
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Key messages

Candidates are advised to read questions very carefully and to make sure that they are using all the information, including the command words. Candidates should be aware that when they have been asked to make a comparison, their answer should include appropriate vocabulary that makes the comparison clear.

Candidates should look carefully at the key and axes titles and units on graphs before reading any key data points or making any interpretations. Answers to **Question 4(b)(i)** often included data quotes that had no units or incorrect units. Candidates should always use appropriate units when quoting data.

Answers to some questions suggested that candidates did not always have a good understanding of the command words used in this paper. Descriptions of the command words can be found in the syllabus.

General comments

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

Candidates should ensure they use terminology appropriately. For instance, organisms do not produce energy or create energy, they release energy during respiration. Some candidates confused respiration with breathing, and it is often a good idea to qualify the term respiration with 'cell' or 'tissue'.

Candidates should always ensure their answers address the questions asked. They must also check that their answers make sense within the context of each question. Many wrote answers to **Question 4(b)(i)** that contradicted the information provided about xylose and ethanoic acid in the stem of the question. Also, in **Question 1(d)**, candidates identified phytoplankton as producers and then wrote that they provide energy for the primary, secondary and tertiary producers.

Comments on specific questions

Question 1

- (a) The majority of candidates identified the kingdom correctly as the plant kingdom or as Plantae. Common incorrect answers were prokaryote and fungi. Some candidates wrote Eukaryote: plants and were given credit.
- (b) Many candidates correctly calculated the actual length as 190 μm . Some answers were incorrect by several orders of magnitude.
- (c) Many candidates used the key to identify the seven types of algae correctly. Some candidates wrote answers in all the boxes including those that were greyed out. A few candidates wrote their answers only in the greyed-out boxes and not in the boxes opposite the scientific names.
- (d) Many candidates realised that the question was asking about trophic levels. They explained that phytoplankton are producers and occupy the first trophic level. Candidates often explained that phytoplankton provide food for herbivores, which they often called primary consumers. Often candidates just referred to fish eating the phytoplankton but did not describe the fish as herbivores

or primary consumers. Many candidates did not refer to the phytoplankton providing energy for the other trophic levels, although some did make it clear that they were a source of energy within the food web or ecosystem. A common error was to describe the consequences for the ecosystem if the phytoplankton were to die or were not in the lake in the first place. Very few candidates stated that light energy was converted to chemical energy.

Question 2

- (a) Few candidates completed the whole table correctly. Common errors were stating the mouth as the organ that secretes amylase, identifying the small intestine as organ 4 and giving starch as the substrate for maltase. Many thought that maltase is secreted by the pancreas.
- (b) Many candidates stated that hydrochloric acid is produced by the stomach or is active in the stomach. Some candidates incorrectly thought that hydrochloric acid was an enzyme.
- (c) Many candidates correctly stated that the colon, labelled 6 on Fig. 2.1, absorbs water.
- (d) There were many detailed answers to this question on mechanical or physical digestion. Many candidates saw chemical digestion in the question and that prompted them to write about the action of enzymes in the stomach. This meant that the churning action of the stomach and emulsification were not included in their answers. Candidates rarely gave full details about the action of the different types of teeth in biting and chewing. A common mistake was referring to mechanical digestion breaking down large insoluble molecules into small soluble molecules; for example, some candidates referred to molecules being broken down by the teeth.

Question 3

- (a) (i) Candidates were asked for two features of the aphid visible in the photograph in Fig. 3.1 that indicate it is an insect. Many gave features of all arthropods, such as jointed limbs and segmented body. As the aphid shown in the photograph does not have wings the only two features that were credited were three pairs of legs and a body divided into three regions or parts (head, thorax, and abdomen). Answers that were not accepted included one pair of antennae (a feature shared with myriapods), jointed limbs (shared with all arthropods) and compound eyes (shared with some crustaceans).
- (ii) Candidates were largely aware of steps that can be taken to reduce infestations of aphids. Spraying pesticides or insecticides was common and so was growing crops that were pest resistant. Many referred to genetic modification in the context of resistance. Some candidates also explained that selective breeding could be used to develop pest resistant crops. Other strong responses explained the use of crop husbandry such as the use of crop rotation and intercropping or planting crops that aphids dislike, such as onion and garlic. Some candidates misread the question and thought that they had to give methods of reducing the effect of the viral pathogens transmitted by aphids.
- (iii) There were many answers to this question that gained full marks. Candidates used their knowledge of leaf structure to state that the tissues through which the aphid mouthparts would penetrate include the upper epidermis, palisade and spongy mesophyll and the xylem. Some candidates incorrectly gave names of cell structures, such as cell walls and cell membranes.
- (b) (i) Candidates gave a wide range of values and clearly did not use the other values in the table to check their answer.
- (ii) A number of candidates realised that this question was about photosynthesis. However, many assumed that the $^{14}\text{CO}_2$ entered the leaf, moved into the phloem, and somehow reached sucrose by diffusion or active transport and then joined onto sucrose. Correct responses explained that the labelled carbon dioxide diffuses through stomata into the leaf and is used by chloroplasts in photosynthesis to make glucose. The glucose that is now radioactively labelled is converted into sucrose and enters the phloem to be translocated throughout the plant.
- (c) (i) This question asked for two examples of sinks for sucrose. The most common incorrect answer was leaf – the main source of sucrose during plant growing seasons. At other seasons, new leaves can be sinks and this was accepted as were other sinks such as buds, roots, seeds, fruits, and storage organs.

- (ii) Many candidates realised that sucrose would be converted to glucose once it arrived at a sink and that it would then be converted in to something else or respired to release energy. The uses of the energy released were credited. Other uses of glucose that were often seen included conversion to cellulose for growth of cell walls.

Question 4

- (a) (i) Many correctly completed the balanced chemical equation for respiration by yeast. Common errors included giving incorrect formulae for glucose and ethanol and not balancing the equation correctly. Some gave the word equation rather than the balanced chemical equation.
- (ii) There were some very good answers to this question on the environmental advantages of using biofuels. Most concentrated on the effect of using biofuels as a sustainable alternative to using fossil fuels. They often referred to this as a renewable form of fuel. Others discussed the effect on global warming and climate change; however, some did so in very simplistic terms such as stating that biofuels do not emit carbon dioxide. Others took more care over their answers and stated that the carbon dioxide emitted is equal to the volume of carbon dioxide absorbed by the plants that provide the biomass. A common error was using the term reusable rather than renewable. The pollution aspect of this question was largely ignored or misunderstood, damage to the environment by drilling or mining and the effect on air pollution were rarely given. Simplistic answers such as there would be no greenhouse effect or pollution would not occur did not gain any credit. Candidates also stated that there would be few or no toxic gases emitted without stating what these were likely to be. Stronger answers identified sulfur dioxide as an example.
- (iii) This question was about the disadvantages of monocultures, and it prompted some good answers that dealt with the risks of heavy infestations of pests, the rapid spread of disease through a crop and various negative effects on soils. Many candidates also discussed the fact that land used for growing biofuels could be used for growing crops. Fewer candidates wrote about the genetic consequences of small population size.
- (b) (i) Descriptions of the graph in Fig. 4.2 rarely went beyond stating that the concentrations of xylose and ethanoic acid decreased and the concentration of ethanol increased. A large number of candidates misread the vertical axes and so gave completely incorrect descriptions of the changes in concentration. Better answers supported correct descriptions of the change in concentrations with references to the steep decrease in concentration of the substrates until 62 hours. The final concentration of ethanol was often given as 42 or 43 g per dm³ instead of 44 g per dm³. Many gave 60 hours rather than 62 hours.
- (ii) The majority of candidates stated that the concentration of ethanol would be less if the reaction was conducted at 20°C rather than 30°C. Some referred to the effect of temperature on the reaction to produce ethanol and these answers also gained credit.

Question 5

- (a) (i) Many candidates defined the term community correctly. Common errors were to refer to a single species rather than many species or all species and to omit reference to an ecosystem or place. Some candidates incorrectly wrote about populations of humans.
- (ii) There were many correct answers to this question. Of those that did not gain full credit, the majority gave the environment for the second answer but gave a variety of incorrect answers instead of natural selection or mutation.
- (b) (i) Many candidates found this question demanding, perhaps because they did not spend enough time looking at the information in Fig. 5.2. Those that did understand the data often found it difficult to describe the change in the range of Meyer's goshawk (**A**) on Karkar Island between 1969 and 2013. An example of a good answer was: 'in 2013, the maximum and minimum altitude have decreased, but the range is maintained'. Some candidates also struggled to describe what was happening to the island thrush (**C**) as they confused altitude and range. Some candidates also described ranges as increasing or decreasing populations perhaps because they thought the difference in the thickness of the lines on Fig. 5.2 was significant.
- (ii) Many candidates gave likely reasons for the disappearance of the island thrush from the lower altitudes of the range recorded in 1969. Some candidates incorrectly thought that the birds could be

at risk of predators that lived in the sea. Some thought that the sea level was rising resulting in their death or in habitat destruction.

- (c) Many candidates gave answers similar to those they had given in (b)(ii) and did not state the risks associated with small population size and focused instead on what would decrease the population. Strong responses stated that the birds may be at risk of extinction and developed this idea by explaining they were also at risk of inbreeding and reduced genetic variation and thus less able to adapt to changes in the environment that might happen with climate change.

Question 6

- (a) (i) There were many good answers to this question identifying the blood vessels in a single and a double circulation. Almost all identified the heart in the single circulation. Artery and vein (**X** and **T**) were sometimes confused.
- (ii) Many candidates identified the structure as the septum of the heart. Fewer gave the function as separating the oxygenated and deoxygenated blood. Common errors were to write about the pumping action of the heart and the role of valves in preventing backflow.
- (iii) Although there were many correct answers, candidates often did not make it clear that in a single circulation blood flows through the heart once in each circulation around the body. Answers that simply stated blood flows through the heart once were too vague and could not be credited.
- (iv) Some candidates gave very thorough answers to this question on the advantages of a double circulation. Many of these explained that blood could flow through the lungs at low pressure and the rest of the body at high pressure. Rarely were the advantages of low-pressure blood through the lungs made clear; more often candidates only explained that blood at high pressure leads to a good supply of oxygen to the body. There were only a few references to the advantage of having blood with a high pressure for filtration of blood in the kidneys for removal of waste or to the idea of a high metabolic rate or large size.
- (b) (i) Common incorrect answers were cardiac artery and pulmonary artery. Coronary unqualified was often given.
- (ii) There were many correct answers to this question on the treatment of blockages in the coronary arteries. Some gave surgical treatments, such as the use of stents and by-passes. Others gave the names of suitable drugs to use, such as aspirin. Many candidates chose methods used for prevention of these blockages, such as exercise and avoiding fatty foods.
- (c) The parts of this question asked for a variety of terms relating to the exchange of substances with the blood. The table lists the correct answers and some of the more common incorrect answers.

	Correct answer(s)	Common incorrect answers
(i)	alveolus / alveoli	lungs, bronchus, bronchioles, capillaries
(ii)	glomerulus / Bowman's capsule cortex was also accepted	medulla, loop of Henle, renal capsule kidney was ignored
(iii)	assimilation	absorption, digestion
(iv)	deamination	nitrification, deaminification, ammonification, excretion
(v)	ovary follicle was also accepted	pancreas, pituitary gland, uterus, brain

BIOLOGY

Paper 0610/43 Theory (Extended)
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Key messages

Candidates are advised to read questions very carefully and to make sure that they are using all the information, including the command words. Candidates should be aware that when they have been asked to make a comparison, their answer should include appropriate vocabulary that makes the comparison clear. This was highlighted in answers to **Question 1(c)** where words like 'faster' were often omitted.

Candidates should look carefully at the key and axes titles and units on graphs before reading the data points or making any interpretations. Answers to **Question 2(b)** often included data quotes that had no units or incorrect units. Candidates should always use appropriate units when quoting data.

Candidates are advised to show their working in calculations, as partial credit may be awarded even if a mistake is made during the calculation.

General comments

Candidates gave many detailed answers on environmental issues, such as the impact of chemicals used in farming on the natural environment (**Question 3(b)(ii)**) and eutrophication (**Question 5(b)(ii)**). There were also many answers that showed detailed knowledge on enzyme activity (**Question 2(b)**) and the comparison between nervous and hormonal control (**Question 1(c)**).

There were a considerable number of misconceptions, such as the mechanism of action of the cholera bacterium (**Question 2(c)(ii)**), the factors that would cause a famine rather than a pandemic (**Question 3(b)(i)**) and the role of turgor in maintaining scapes and stems in an upright position (**Question 4(a)(ii)**).

Some candidates misread questions or did not re-read their answers, leading to errors that are more associated with examination technique rather than their understanding of the syllabus.

Comments on specific questions

Question 1

- (a) (i) Almost all candidates knew that sneezing was a reflex or involuntary action.
- (ii) Most candidates identified and described the functions of at least one of the structures in Fig. 1.1. The most common correct answers included the identification of the trachea and the sensory neurone. Many also understood that a relay neurone transmitted impulses from a sensory neurone to a motor neurone. Fewer candidates correctly identified the spinal cord or its function as being one of control or coordination. A common misconception was that the diaphragm was directly involved in respiration, rather than ventilation.
- (b) (i) Some candidates realised that the neurone in Fig. 1.2 contained a nucleus, cytoplasm, and cell membrane, but it was also common to see labels to parts of the neurone such as the cell body, axon, and dendrites, even though there is no expectation in the syllabus that candidates know these terms. Those candidates who chose to draw arrowheads on their label lines, rather than a line that directly touched the named structure, were sometimes not awarded credit as the structure labelled was not made clear.

- (ii) Fewer candidates marked the correct location of receptor molecules on the diagram, with many putting a cross along the axon, in the nucleus or at the wrong end of the neurone.
- (iii) The most common adaptation given was the long length of the neurone allowing the transmission of impulses over long distances or for faster transmission. Candidates also gained credit for insulation allowing faster transmission or for mitochondria providing the energy for transmission of impulses. Many candidates knew the names of the components of the neurone but were not able to describe their functions. It was also common to see answers about synapses rather than about the cell.
- (c) There were many comprehensive answers comparing nervous and hormonal communication. Most candidates made comparisons about the duration and method of transmission. Some candidates suggested nervous communication was fast without making a comparative statement with hormonal communication. There were also a number of answers that included contradictory statements, such as a correct description of multiple target organs for hormones in one sentence but following this by stating only one target organ for hormones in another sentence. This highlights the importance of reading an answer before moving on to the next question.

Question 2

- (a) (i) Almost all candidates named at least one substance secreted into the alimentary canal. The most common answers were (hydrochloric) acid, pancreatic juice and bile. Other answers seen included saliva and water. A significant number of candidates gave the names of digestive enzymes which suggests that they had not read the question carefully.
- (ii) Many candidates knew the different digestive enzymes and were able to complete most rows of the table. The final row revealed the highest number of incorrectly named enzymes, many of which were beyond the scope of the syllabus, such as erepsin. There were also many examples where one product was correct, but another incorrect product was also included, implying that both products were formed as a result of the reaction.
- (b) There were many excellent responses to this prose question about the effect of temperature on the activity of pepsin. Some answers were vague and did not make use of specific terminology. Some candidates also quoted data but did not use the relevant units. A small minority of candidates only described the graph and did not include an explanation for the effect of increasing temperature on the activity of the enzyme.
- (c) (i) Many candidates knew that lactose is found in milk and most also went on to describe that lactase is an enzyme that breaks down lactose. Few candidates correctly expressed the fact that babies rely on milk for their main source of nutrition. Some candidates incorrectly thought that lactase was involved in the digestion of protein or calcium, or the production of antibodies from mother's milk.
- (ii) Almost all candidates described the symptoms of diarrhoea correctly, but a few candidates confused egestion of faeces with the excretion of urine.
- (iii) Some candidates were very familiar with the actions of the cholera bacterium and some very detailed and accurate answers were seen, including explanations of the water potential gradient. Some candidates recalled that chloride ions were involved but stated incorrectly that the chloride ions were produced by the toxins or by the cholera bacterium itself. The direction of the concentration gradient and the water movement in the gut were also regularly confused.

Question 3

- (a) (i) Most candidates used the correct y-axis and stated the estimated size of the human population in 2010 from the graph.
- (ii) Although many candidates knew how to round their answers to one significant figure, fewer identified the appropriate data from the graph and carried out the correct calculation to determine the percentage affected by famine.
- (b) (i) Many comprehensive answers describing the full range of reasons that could cause a famine were seen. The most common suggestions included war, drought, flooding, and poverty. A significant number of candidates confused famine with an infectious disease and suggested measures used in a pandemic, such as social distancing and vaccinations to prevent the spread of the disease.

- (ii) There were some excellent responses to how chemicals used in farming methods could negatively affect the environment. Many candidates identified pesticides or herbicides and realised they could harm non-target species with some recognising the effect this could have on pollinators. Disruption of food chains, loss of biodiversity and pollution of habitats, such as rivers, were also correctly described by many candidates. However, a significant minority of candidates did not read the question carefully and wrote general answers about a range of pollutants such as acid rain or contraceptives in waterways. Some wrote about fertilisers even though the question specifically stated that they should not do so. Others focused their answers on the impact on farmers or on humans in general rather than on the natural environment.
- (iii) Almost all candidates described a monoculture correctly, but a number of misconceptions were revealed including descriptions of monocotyledonous plants and asexual reproduction.
- (vi) Almost all candidates gave genetic engineering or genetic modification. Biotechnology was considered too vague to be credited because it also includes many other processes such as the industrial use of enzymes.

Question 4

- (a) (i) Most candidates knew that the growth response was phototropism. A number stated geotropism suggesting that the question was not read carefully.
- (ii) Many excellent explanations of how cells keep plants upright were seen. All four marking points were frequently awarded. A few candidates incorrectly discussed turgor in terms of xylem vessels. This highlighted a misconception as candidates should realise that turgor can only occur in cells that have a cell membrane as well as a cell wall.
- (b) Most candidates identified and labelled the xylem tissue in the cross section, but a minority labelled the cortex or phloem.
- (c) Many candidates knew that sucrose and amino acids are transported in the phloem, but fewer went on to name the process as translocation. It was quite common to see the sources and sinks confused, but many candidates stated that transport can occur in both directions.
- (d) Although some candidates did not identify the correct strip cut from the scape, there were many good explanations about the movement of water out of the scape down a water potential gradient. This meant that almost all candidates gained some credit for their response to this question. The best answers included comparative statements to explain why **B** was chosen over the others.

Question 5

- (a) (i) Many candidates realised that these microorganisms were likely to be algae or protoctists. The most common incorrect answers were chloroplasts or plants, suggesting that the question had been misread.
- (ii) Many candidates calculated the total mass of chlorophyll as 15, but fewer candidates determined that the units would be milligrams. The most common incorrect units were dm^3 and mg per dm^3 , but units of distance and time were also seen. The few candidates who converted the values to grams usually gave the correct mass in grams.
- (iii) Many candidates gave excellent suggestions for the determination of chlorophyll rather than using a count of the number of microorganisms. The reasons given included greater accuracy, the fact that some microorganisms do not contain chlorophyll and the length of time taken to count the microorganisms.
- (iv) Many candidates read the question and the graph axes carefully and concluded that the water was most transparent on day 8. However, others either misread the y-axis and chose day 3, or did not pay enough attention to the key so used the wrong line and stated either day 2 or day 10.
- (v) Almost all candidates explained why the transparency of water is important to organisms that contain chlorophyll.

- (b)(i) Many candidates named one of the ions that would cause an increase in plants in the lake with nitrate and magnesium being the most common correct answers. Nitrogen was a common incorrect answer.
- (ii) Most candidates described the consequence of the death of the plants in the lake ecosystem with some excellent descriptions of the relevant stages of eutrophication although very few candidates stated this term in their answers. Many also recognised that decomposers were involved but did not state that there was an increase in their numbers. Many incorrectly stated that there would be less oxygen because of the lack of photosynthesis but still managed to gain a mark for the idea that the reduced level of oxygen led to the death of aquatic animals. Those who realised that because the organisms were producers there would be less food for consumers also received credit. Only a small number incorrectly related the activity of decomposers to increased carbon dioxide concentration rather than a reduction in oxygen.
- (c) Some very detailed outlines of how sewage treatment would ensure that the water was safe to put into the lake were seen. Many candidates gained credit for the idea of filtering of large pieces of rubbish and for chlorination. Better answers included the idea of sedimentation and treatment using microorganisms. Often the roles of aerobic respiration and anaerobic respiration were not given clearly. The use of distillation was rarely seen although some suggested the use of charcoal filters.

Question 6

- (a)(i) Most candidates correctly identified the species from the key. The most common errors were to switch species **E** with **F** and species **B** with **D**. This suggests that those candidates did not identify the carpel or the stigma in the sections of the flowers in Fig. 6.1.
- (ii) Almost all candidates correctly stated at least one structural adaptation of insect-pollinated flowers. Most candidates stated colour, nectary, sticky pollen, or sticky stigma. Some also stated that the stigma and stamens were inside the flower. Some restated features given in the key, even though none of these are unique to insect pollination.
- (b) The most commonly seen correct difference between flowering plants and ferns was the presence of seeds rather than spores. Quite a few candidates described distinguishing features of monocotyledonous or dicotyledonous plants instead.
- (c) Some candidates were able to identify the enzyme used to increase the volume of fruit juice as pectinase. A few stated pectin instead of pectinase.

BIOLOGY

Paper 0610/51 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. Candidates should also consider which variables need to be kept constant and include them in their plan.

Candidates are advised to show their working in calculations, as partial credit may 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 skills of most candidates were good, with suitable detail 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 able to draw an appropriate table. In some cases, candidates did not include suitable headings or units. It is important that candidates do not include units in the body of the table.
- (ii) Many candidates were able to give a suitable suggestion as to why the starch solution was added. The most common correct response was so that the iodine would change colour. Any suggestion that it acted as an indicator was also accepted. Simply stating that it was a test for starch was insufficient for the mark to be awarded.
- (iii) Many candidates identified the drink with the highest amount of vitamin C and explained that it had the highest number of drops, and this was an indication of the amount of vitamin C it contained.
- (iv) Some candidates found it difficult to name the dependent variable or the variable that was measured. Without stating number of drops of iodine solution, candidates were not able to gain this marking point. Drops unqualified was not accepted.
- (v) Most candidates recognised that using the same syringe would lead to contamination of the solutions.
- (vi) Many candidates explained that drop size was inconsistent and therefore an improvement would be to measure the volume with a syringe.

- (b)(i) Candidates were asked to explain what is meant by an anomalous result. Many incorrectly stated that it was a wrong result or an erroneous result. An anomalous result is a result that does not fit the pattern or trend in the other data points.
- (ii) Most candidates were awarded the mark for this question. Any description that the anomalous result would not be included in the average was accepted.
- (iii) Many candidates were able to draw a suitable graph although some did not include suitable units for the axes. Candidates are reminded that the scale for each axis must be linear and plotted data should cover at least half of the grid. It is important that lines do not extend beyond the plotted point and that they represent the trend in the data correctly.
- (iv) Some candidates found this question demanding. In order to gain both marks, they needed to show how their value was obtained using the line on their graph. Many made errors in reading the values from their graph.
- (v) Most candidates correctly stated reducing sugars. The only substances accepted for giving a positive Benedict's reagent test was either reducing sugar or a named reducing sugar. Sucrose is not a reducing sugar.
- (vi) Some candidates realised that the Benedict's test needs to be heated, whereas the Biuret test does not. Responses that referred to differences in colour change were ignored as the question was directly referring to the method.

Question 2

- (a)(i) Most candidates were able to correctly measure the length of line **EF** on the butterfly and calculate the actual wingspan using the formula provided. Some omitted to give their answer to two significant figures.
- (ii) Many candidates produced a diagram using a sharp pencil that had clear and continuous lines and did not include shading. Diagrams were required to be no less than 70 mm (the size of the photographed specimen) and needed to show sufficient detail, i.e. 8–10 segments. The best diagrams showed the veins at the top of the wing being thicker than those at the bottom.
- (b) The vast majority of candidates were able to achieve full marks on this question. The most common differences between the two caterpillars were stripes and spikes.
- (c)(i) Candidates displayed a good understanding of the variables that were kept constant. Many were able to correctly name two suitable variables. It's important to note that time unqualified, without referencing the number of days, did not gain credit.
- (ii) Many candidates correctly calculated the percentage change. Some did not read the question carefully and gave their final answer to an incorrect number of decimal places.
- (iii) Most candidates correctly identified the optimum temperature. The most common incorrect response was 15°C.

Question 3

Some candidates had a clear understanding of how to plan a valid and reliable investigation that would measure the effect of temperature on the rate of photosynthesis. There were some detailed descriptions of the investigation that achieved full marks. Most candidates were able to state that light intensity, carbon dioxide concentration and plant species should be controlled. Most candidates also recognised that a low and a higher temperature would need to be investigated with many suggesting a suitable range of temperatures. Very few candidates went on to state how the temperatures of these trials would be maintained; such as using a thermostatically controlled water-bath. Candidates should be encouraged to clearly identify both the independent and dependent variables.

BIOLOGY

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. Candidates should also consider which variables need to be kept constant and include them in their plan.

Candidates are advised to show their working in calculations, as partial credit may 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 was good, with suitable detail 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 able to do the investigation and record the temperatures in an appropriate table. The most common error was the inclusion of an extra column in which time was recorded for test-tube **A** and then again for test-tube **B**. This effectively gave two tables with repeated columns for time. Units for time and temperature also appeared quite frequently in the body of the table. Another common error was to omit the temperature recording at zero minutes (the initial temperature). It is important that candidates read the instructions carefully.
- (ii) Most candidates could calculate the maximum temperature change correctly, but several forgot that the temperature started to decrease before the end of the experiment and so used the final temperature rather than the highest temperature.
- (iii) Candidates were asked to state a conclusion for the results. Instead, many gave a description of the results and referred to the temperature increase rather than to the activity of the catalase enzyme. It should be remembered that a conclusion must include both the independent variable and the dependent variable.
- (iv) Most candidates successfully identified temperature as the dependent variable in this investigation. A common error was to give the independent variable instead of the dependent variable.

- (b)(i) Candidates were asked to predict and explain the effect of not covering the test-tubes in foil. Some candidates found this challenging, but many realised that the foil was acting as an insulator, so the temperatures would have been lower if foil had not been used. A large number of candidates referred to a change in temperature, rather than stating the direction of change.
- (ii) This was generally done very well, with the most common response being time and volume of yeast. Some referred to temperature but failed to specify starting temperature or 20°C. The most common incorrect responses stated volume or concentration of hydrogen peroxide.
- (c)(i) Candidates were asked to suggest two measurements needed to be able to calculate the rate of a reaction. Many gained two marks, but some gave suggestions of the equipment used rather than what was actually being measured, for example stating the use of a clock rather than saying that time needed to be recorded.
- (ii) Many candidates were able to state what was meant by an anomalous result, but some referred to anomalies being results that differed from expected results rather than those results that differed from the results already obtained.
- (iii) Most candidates could state how the average was calculated but many seemed to think that trials 1 and 2 were used rather than trials 1 and 3.
- (iv) Very few errors were seen in the plotting of the points, but many candidates were unable to select a suitable scale that covered at least half of the grid. One common error was to extrapolate the line.
- (v) When asked to describe the data, most candidates were able to give an overall trend but fewer were able to describe the optimum values or supply data to support their description.
- (vi) This question asked for a method that could be used to identify the optimum value for pH and oxygen production. Although some candidates identified the need to use smaller intervals of pH, fewer were able to suggest where those values should be taken.

Question 2

- (a)(i) Candidates were asked to draw a section of celery, and overall, the drawings were of an appropriate standard with most being of an adequate size. The outlines were usually well drawn and neat with good representation of the vascular bundles. The most common errors were the inclusion of cells in the central region and shading of the vascular bundles.
- (ii) Most candidates correctly measured line **PQ** and calculated the magnification correctly. A few candidates included a unit, while others did not read the question carefully and gave a value that was not a whole number.
- (b) Most candidates were able to identify the dependent and independent variables and also state which variables should remain constant. The experimental plans were well thought-out but many candidates omitted to mention the need to repeat the procedure to get three results. The dependent and independent variables were identified in many cases, but methods of maintaining temperature were often vague, or referred to a water-bath which was not entirely appropriate for this investigation.
- (c) The description of a food test for reducing sugars was well answered and many referred to the preparation of the plant material.

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Paper 0610/53 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. Candidates should also consider which variables need to be kept constant and include them in their plan.

Candidates are advised to show their working in calculations, as partial credit may 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 was good, with suitable detail 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) Candidates found this calculation of concentration challenging, with only a few obtaining the correct value. Common errors included candidates forgetting that the total volume was 5 cm³ and not 4 cm³.
- (ii) Nearly all candidates were able to use the thermometer to record both the starting temperature and the final temperature of the water in the water-bath.
- (iii) Most candidates were able to carry out the investigation and get results in line with what was expected. Suitable tables were constructed, and the results were suitably recorded. Some candidates repeated the headings in the cells of the table, for example by adding 'test-tube' or 'bubbles' in every cell of the column. Almost all candidates recorded the correct trend for the investigation, with fewer bubbles recorded at lower concentrations of glucose.
- (iv) This question asked candidates to calculate the rate of bubble production, which most could do well. Some candidates rounded their answer either up or down to the nearest whole bubble, which was acceptable in this case.
- (v) Many candidates gave a description of the results instead of stating a valid conclusion. In this case simply stating that more bubbles are produced by higher glucose concentrations is not enough. The conclusion needs to be linked back to the original aim of the investigation, namely the effect of

glucose concentration on the rate of respiration. Another common error was to state volume of glucose rather than concentration of glucose.

- (vi) Although a good number of candidates could identify the independent variable in this investigation, many stated that volume was changed, when in fact the final volume was the same for both test-tubes. A few candidates confused the dependent and independent variables.
 - (vii) Candidates were asked to identify an error with the water-bath temperature and suggest a possible improvement. Most were able to identify the reduction in temperature with most also suggesting a method of maintaining the temperature. Simply stating that temperature would be kept the same is insufficient and a method needs to be described, such as the use of a thermostatically controlled water-bath or the addition of insulation.
 - (viii) Some very good answers were seen to explain why the yeast suspension was stirred before adding it to the glucose solution. A number of candidates appeared to forget that it was stirred before it was added to the glucose solution and incorrectly described mixing the two solutions together. A few candidates incorrectly described stirring as a method of activating the yeast.
 - (ix) Some candidates found this question demanding although a few candidates gave excellent descriptions of equilibration of temperature.
- (b) The answers to this question were often excellent, with some extremely well drawn apparatus which was correctly labelled. The use of gas syringes and up-turned measuring cylinders were commonly seen. A few candidates simply repeated the drawing in Fig. 1.1, which was not suitable to collect or to measure the volume of gas.

Question 2

- (a) (i) The quality of the drawing was in some cases excellent, with the lines drawn being clear and distinct and of a suitable size. The detail of the surface of the inkcap mushroom was often of a high standard. As a result, the majority of candidates scored very well on this task. A few candidates either omitted the stem of the mushroom or did not include any surface detail.
 - (ii) Most candidates were able to measure line **AB** and from this value could calculate the actual width of the mushroom cap. A few candidates confused significant figures with decimal places, while others included the wrong units.
- (b) (i) The graph was generally plotted well and axis labels were appropriate. The most common error was to use an inappropriate scale that did not cover at least half of the grid. Lines of best fit were generally very well drawn and in a suitable position, although point to point graphs were also acceptable. Graphs that include both point to point and a line of best fit should be avoided.
- (ii) Candidates were asked to use the graph to describe the results of the study. Most clearly described both the plateau and the slope of the line.
 - (iii) The majority of candidates were able to use the colour key to estimate the value of the temperature from the graph. A few candidates missed a mark for not clearly showing their line on the graph.
 - (iv) Few candidates described the subjective nature of estimating a colour using a key. A few candidates gained a mark for stating that the estimated value was somewhere between two measured values, but overall candidates found this explanation challenging.
 - (v) Many candidates found this question challenging, with few explaining that different mushrooms would behave in different ways. Vague references to fair tests and reliability were not sufficient.
 - (vi) Most candidates could suggest one variable that needed to be kept constant during the investigation. A common error was to suggest temperature, which was the independent variable. Others suggested that the species of mushroom should be the same, even though this was excluded in the stem of the question.
- (c) The majority of candidates described the vitamin C test using DCPIP and many candidates also described how the mushroom tissue could be prepared for testing.

Question 3

The planning exercise was particularly well done with most candidates gaining the majority of the marks available. Most were able to identify the dependent and independent variables and also state which variables should remain constant. The experimental plans were well thought-out and included several alternative methods for measuring the rate of germination. Candidates should clearly state that they would repeat the procedure to get at least three sets of results.

BIOLOGY

Paper 0610/61 Alternative to Practical

Key messages

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. Candidates should also consider which variables need to be kept constant and include them in their plan.

Candidates are advised to show their working in calculations, as partial credit may 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 skills of most candidates were good, with suitable detail 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 able to produce a table that was suitable for recording both raw data and averages. However, many candidates used inappropriate headings, e.g. they did not refer to the number of iodine drops in their heading. Candidates should refer directly to the method to ensure that the data is described using the precise terms given in the question.
- (ii) Only the best responses clearly explained why starch suspension was added. The most common correct response was so that the iodine would change colour. Any suggestion that it acted as an indicator was also accepted. Simply stating that it was a test for starch was insufficient for a mark to be awarded.
- (iii) Most candidates correctly identified **B** as the drink containing the most vitamin C. However, many did not go on to justify this by stating that **B** had the highest number of drops added, rather they explained their choice by restating the question stem about the link between iodine drops and vitamin C concentration, or using a direct quote of the average drop number for **B**.
- (iv) Few candidates correctly identified the dependent variable as the number of drops of iodine solution. Many incorrectly stated the concentration of vitamin C.
- (v) This question was well answered by most candidates. Weaker responses suggested incorrect solutions, pathogens or dirt as potential contaminants or merely stated that the results would be affected.
- (vi) Candidates found this question demanding. Many could not clearly express what the error was or suggest a suitable improvement. Stronger responses identified the subjectivity of the endpoint in the experiment or the inconsistency of the drop sizes and were able to suggest a relevant improvement. Several candidates suggested operator error and spillages, but candidates should assume that the

experiment is being carried out competently and that the errors are ones that are inherent in the method.

- (b)(i)** Candidates were asked to explain what is meant by an anomalous result. Many incorrectly stated that it was a wrong result or an erroneous result. An anomalous result is a result that does not fit the pattern or trend in the other data points.
- (ii)** Many candidates were able to correctly explain that the anomalous result should be discarded from calculation.
- (iii)** Many candidates were able to produce a suitable line graph. However, some incorrectly labelled the dependent variable, with candidates missing out key words such as average or drops. Candidates should be encouraged to look carefully at the experimental method and data table headings to be certain of what the variable is actually called. The scale on the percentage vitamin C axis was often incorrect. A common error was to leave equal distance between 0, 0.025, 0.5 and 1.0, then compress the remaining scale onto the rest of the axis. Plotting was generally good, but candidates should be encouraged to use crosses for points to avoid dot points becoming too big. Some candidates incorrectly plotted a bar chart instead of a line graph.
- (iv)** Many candidates gave a correct estimate from their graph but did not show on the graph the point at which they read the value.
- (v)** Some candidates did not realise that this question required a difference in the method, rather than a difference in reagents, purpose of test or results. The Benedict's test needs to be heated, whereas the Biuret test does not.

Question 2

- (a)(i)** Most candidates gave a correct measurement, and the calculation was often correct. However, many candidates made rounding errors, or failed to round altogether. Very few gave their answer to two significant figures.
- (ii)** Many candidates produced a diagram using a sharp pencil that had clear and continuous lines and did not include shading. Diagrams were required to be no less than 70 mm (the size of the photographed specimen) and needed to show sufficient detail, i.e. 8–10 segments. The best diagrams showed the veins at the top of the wing being thicker than those at the bottom.
- (b)** Many candidates correctly identified two differences, although some were not always able to express themselves clearly. Some candidates gave correct differences but could not be awarded credit as it was unclear as to which caterpillar they were referring to (e.g. one has antennae, one has spikes over its body).
- (c)(i)** Most candidates could state two correct variables, although some gave incomplete answers such as food or time. Weaker responses suggested that temperature should be kept constant despite both the text and the table indicated that this was being varied.
- (ii)** Most candidates were able to identify 25 and 26 from the table but did not then go on to correctly calculate the percentage change or give their answer to one decimal place. Candidates should be encouraged to always show their working.
- (iii)** Many candidates correctly identified the optimum temperature. The most common incorrect response was 15°C.

Question 3

Some candidates had a clear understanding of how to plan a valid and reliable investigation that would measure the effect of temperature on the rate of photosynthesis. There were some detailed descriptions of the investigation that achieved full marks. Most candidates were able to state that light intensity, carbon dioxide concentration and plant species should be controlled. Most candidates also recognised that a low and a higher temperature would need to be investigated with many suggesting a suitable range of temperatures. Very few candidates went on to state how the temperatures of these trials would be maintained; such as using a thermostatically controlled water-bath. Candidates should be encouraged to clearly identify both the independent and dependent variables.

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Key messages

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. Candidates should also consider which variables need to be kept constant and include them in their plan. When planning an investigation, candidates do not need to describe the expected results or include any theory on the subject being investigated.

When drawing graphs, candidates should be careful to choose a scale so that their data fills at least half of the grid in both directions.

Candidates are advised to show their working in calculations, as partial credit may be awarded even if a mistake is made during the calculation.

General comments

Many candidates demonstrated good skills throughout the paper, including table drawing and graph drawing. 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 skills of most candidates were good, with suitable detail 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) The mark for constructing the table was sometimes missed because candidates repeated the time column creating contiguous tables. Tables should be designed so that columns are not repeated.

Common mistakes were to include units in the body of the table or give the unit for time (minutes) as 'm'. Candidates should remember that most headings require units. For example, some gave time, but not minutes and some gave minutes but not time.

Some candidates omitted the starting temperature for test-tube **A**. Candidates had to read through the method to find this piece of information. The rest of the data was recorded correctly in nearly all cases. Occasionally, candidates only included the data for one of the test-tubes.

- (ii) The majority of candidates correctly calculated the maximum temperature change in test-tube **B**. However, fewer gave the correct answer for test-tube **A**. This was most likely because they had not considered the starting temperature of test-tube **A**. Some candidates added up all the data and others gave the highest temperature, rather than the temperature change.
- (iii) Few candidates were able to give a correct conclusion that linked the independent variable (hydrogen peroxide concentration) to the activity of catalase. Many restated the results, describing which test-tube had the greater temperature change. This was insufficient for the mark to be awarded. Candidates should refer back to the aim of the investigation when writing their conclusions.

- (iv) Temperature was correctly identified as the dependent variable by the majority of candidates. A common mistake was to state the concentration of hydrogen peroxide, which was the independent variable, or time, which was monitored, but did not change as a result of the independent variable changing.

- (b)(i) Many candidates understood that the foil acted as an insulator for the test-tube and that without the foil heat would be lost. However, fewer predicted that the result of this would be that the temperature change would be lower. Many stated that the temperature would be different or inaccurate, which was too vague to be awarded a mark.

Some candidates confused temperature and heat. For example, they described temperature being lost rather than heat.

- (ii) At least one constant variable in the investigation was correctly identified by many candidates. The most common answer was time and volume of yeast. Some gave unqualified answers such as yeast or temperature but did not give enough detail to be awarded the mark. Common incorrect responses included volume of catalase, pH, size of test-tube and volume of hydrogen peroxide solution.

- (c)(i) Many candidates recognised that the volume of oxygen and the time were the two measurements needed for calculating the rate of oxygen production. A common incorrect answer was counting bubbles of oxygen. Many gave pieces of equipment used to measure volume and time rather than naming the quantities.

- (ii) Many candidates were familiar with the term anomalous. Correct responses compared the anomalous result to the other results, stating that it is a result that does not fit the pattern or trend of the collected data. A common incorrect answer was to describe an anomalous result as a result that was different from expected, or an inaccurate or abnormal result.

- (iii) Many candidates correctly described how to calculate the average by excluding the anomalous result. However, some described how to calculate an average using all three results and some thought that the anomaly would be replaced by an estimated result and then all three results used. Some candidates discarded the result for trial 3 rather than trial 2, which was not correct.

- (iv) Most candidates gave the correct axes labels for their graph. The most common mistake was to omit 'average' or the units from 'average rate of oxygen production'.

Many candidates did not use a scale where their data covered at least half of the grid in both directions. This was especially true for the pH axis which needed to start at five rather than zero. Some that started at five put zero at the origin, which meant their scale was not linear. Candidates should use easily divisible scales, to avoid making errors in plotting. Those that did not use an appropriate scale often extrapolated their line to the origin. Candidates should use a ruler to join the data points from one plot to the next, without extrapolation.

Most candidates were able to plot the points accurately, although some made a mistake plotting the point at pH 5.

- (v) Generally, candidates were able to describe the overall trend shown by the data. Some found it difficult to identify the pH with the greatest rate. A significant number thought this was pH 7, rather than pH 8. Few candidates quoted data, including correct units, in their answer.

- (vi) A significant number of candidates could not suggest further investigative work to obtain a more accurate value for the pH with the greatest rate. Common incorrect answers centred on repeating the investigation, controlling variables, and extending the range of pH values.

Question 2

- (a)(i) Many high-quality drawings of the celery stalk were seen. Most drawings were a good size, with a clear, continuous outline. Many accurately showed the vascular bundles and the indent at the top. Some omitted the label for the vascular bundle or labelled it as xylem or phloem. Some included shading or had drawn individual cells.

- (ii) The line **PQ** was generally measured accurately. The units were given on the line (mm) and most measured in millimetres rather than centimetres. Some candidates gave units for their final

magnification. Most divided their measurement by 27, but some rounded incorrectly e.g. $78 \div 27$ as 2.8 rather than 2.9. A significant number did not give their final answer as a whole number.

- (b) Candidates were asked to plan an investigation to determine the effect of air temperature on the movement of dye up a celery stalk. Most candidates described an investigation where the celery was left for a set time at different temperatures. Fewer candidates were able to describe a method to keep the air temperature constant. They were more likely to describe use of a thermostatically controlled water-bath, which would be acceptable for controlling water temperature, but not air temperature. Very few candidates seemed familiar with the method to measure the dependent variable: cutting sections of celery to determine how far the dye has travelled in a set time.

Most candidates were able to name some relevant variables that should be kept constant, although some gave irrelevant variables such as pH.

Many candidates were familiar with the need to repeat an investigation multiple times and to take safety into consideration. Candidates should decide which aspects of an investigation need safety considerations. In this case, the use of a knife to cut sections and the use of a staining dye both had risk.

Some candidates did not describe an experimental method, but instead described the expected result and in some cases described the theory to explain the expected results. Expected results and theory are not required.

- (c) The Benedict's test was well known. However, candidates should remember that the sample should be prepared before the test is conducted, e.g. by grinding the plant tissue. Some referred to the use of a water-bath but did not specify that it contained hot water.

Occasionally, candidates described the use of heat and ethanol to remove chlorophyll, rather than the use of heat with Benedict's solution. A few suggested other tests such as use of iodine solution or the biuret test.

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Key messages

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. Candidates should also consider which variables need to be kept constant and include them in their plan.

Candidates are advised to show their working in calculations, as partial credit may 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 skills of most candidates were good, with suitable detail 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) Candidates found this calculation of concentration challenging, with only a few obtaining the correct value. Common errors included candidates forgetting that the total volume was 5 cm³ and not 4 cm³.
- (ii) Nearly all candidates were able to read the starting and final temperature and then calculate the change in temperature.
- (iii) Most candidates were able to interpret the data provided in relation to glucose concentration and the tally charts of bubbles produced. Suitable tables were constructed, and the results were accurately recorded. Some candidates repeated the headings in the cells of the table, for example by adding test-tube or bubbles in every cell of the column.
- (iv) This question asked candidates to calculate the rate of bubble production, which most could do well. Some candidates rounded their answer either up or down to the nearest whole bubble, which was acceptable in this case.
- (v) Many candidates gave a description of the results instead of stating a valid conclusion. In this case simply stating that more bubbles are produced by higher glucose concentrations is not enough. The conclusion needs to be linked back to the original aim of the investigation, namely the effect of glucose concentration on the rate of respiration. Another common error was to state volume of glucose rather than concentration of glucose.
- (vi) Although most candidates could identify the independent variable in this investigation, many stated that volume was changed, when in fact the final volume was the same for both test-tubes. A few candidates confused the dependent and independent variables.

- (vii) Candidates were asked to identify an error with the water-bath temperature and suggest a possible improvement. Most were able to identify the reduction in temperature with most also suggesting a method of maintaining the temperature. Simply stating that temperature would be kept the same is insufficient and a method needs to be described, such as the use of a thermostatically controlled water-bath or the addition of insulation.
- (viii) Some very good answers were seen to explain why the yeast suspension was stirred before adding it to the glucose solution. A number of candidates appeared to forget that it was stirred before it was added to the glucose solution and incorrectly described mixing the two solutions together. A few candidates incorrectly described stirring as a method of activating the yeast.
- (ix) Some candidates found this question demanding although a few candidates gave excellent descriptions of equilibration of temperature.
- (b) The answers to this question were often excellent, with some extremely well drawn apparatus which was correctly labelled. The use of gas syringes and up-turned measuring cylinders were commonly seen. A few candidates simply repeated the drawing in Fig. 1.1, which was not suitable to collect or to measure the volume of gas.

Question 2

The planning exercise was particularly well done with most candidates gaining the majority of the marks available. Most were able to identify the dependent and independent variables and also state which variables should remain constant. The experimental plans were well thought-out and included several alternative methods for measuring the rate of germination. Candidates should clearly state that they would repeat the procedure to get at least three sets of results.

Question 3

- (a) (i) The quality of the drawing was in some cases excellent, with the lines drawn being clear and distinct and of a suitable size. The detail of the surface of the inkcap mushroom was often of a high standard. As a result, the majority of candidates scored very well on this task. A few candidates either omitted the stem of the mushroom or did not include any surface detail.
- (ii) Most candidates were able to measure line **AB** and from this value could calculate the actual width of the mushroom cap. A few candidates confused significant figures with decimal places, while others included the wrong units.
- (b) (i) The graph was generally plotted well, and axis labels were appropriate. The most common error was to use an inappropriate scale that did not cover at least half of the grid. Lines of best fit were generally very well drawn and in a suitable position, although point to point graphs were also acceptable. Graphs that include both point to point and a line of best fit should be avoided.
- (ii) Candidates were asked to use the graph to describe the results of the study. Most clearly described both the plateau and the slope of the line.
- (iii) The majority of candidates were able to use the colour key to estimate the value of the temperature from the graph. A few candidates missed a mark for not clearly showing their line on the graph.
- (iv) Few candidates described the subjective nature of estimating a colour using a key. A few candidates gained a mark for stating that the estimated value was somewhere between two measured values, but overall candidates found this explanation challenging.
- (v) Many candidates found this question challenging, with few explaining that different mushrooms would behave in different ways. Vague references to fair tests and reliability were not sufficient.
- (vi) Most candidates could suggest one variable that needed to be kept constant during the investigation. A common error was to suggest temperature, which was the independent variable. Others suggested that the species of mushroom should be the same, even though this was excluded in the stem of the question.
- (c) The majority of candidates described the vitamin C test using DCPIP and many candidates also described how the mushroom tissue could be prepared for testing.