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BIOLOGY

Paper 0610/11
Multiple Choice (Core)

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

General comments

There was good understanding of: sexual reproduction; the definition of inheritance; the water cycle.

There was some uncertainty about: the definition of the term species; the smaller basic units of starch and glycogen molecules; the effect of consuming alcohol on reaction times.

It is important for candidates to work methodically through information provided in questions, such as in **Question 40**.

Comments on specific questions

Question 1

Many candidates appreciated that the release of energy from nutrient molecules is respiration. Some candidates incorrectly selected nutrition.

Question 2

Many candidates understood that the horse and the donkey belong to the same genus. A few candidates incorrectly believed that the mule would be fertile.

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Question 4

Many candidates correctly identified the labelled structures that would also be found in an animal cell, namely W (the nucleus) and X (the cell membrane). Some candidates incorrectly selected Z (the cell wall).

Question 5

Candidates could not easily distinguish which label indicated a tissue. C, the spongy mesophyll, is the correct option. A tissue is defined as a group of cells with similar structures, working together to perform a shared function.

Question 8

Some candidates correctly selected option **B**, the cell membrane. Others opted for the cell wall, chloroplast, or vacuole.

Question 9

Very few candidates appreciated that both starch and glycogen are made of glucose molecules.

Question 10

Many candidates correctly selected option **A**, appreciating that an enzyme is a protein and a catalyst. Some candidates incorrectly believed that an enzyme is a substrate.

Question 11

Few candidates understood that the food tests indicated that protein and sugar were present.

Question 12

Few candidates understood that oxygen is the product of photosynthesis that moves out of a green leaf through its stomata.

Question 13

Many candidates appreciated that phloem and xylem tissues are found in vascular bundles. Some candidates incorrectly selected option **B**, palisade mesophyll and spongy mesophyll.

Question 14

Many understood that the dietary importance of fibre in humans is to help food move through the alimentary canal. Some candidates incorrectly believed that dietary fibre is used for growth and repair of cells.

Question 15

Many candidates appreciated that ingestion takes place in the mouth. Some candidates incorrectly believed that it takes place in the stomach.

Question 16

Many candidates were able to both identify and correctly measure the small intestine from the diagram. Some candidates incorrectly included the large intestine.

Question 17

There was some uncertainty about which tissue transports the red dye through the stem, with a minority correctly selection option **D**, the xylem.

Question 18

Few candidates appreciated that most water evaporation during transpiration occurs from the spongy mesophyll cells.

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Question 19

While many candidates opted for the correct answer, some were confused as to which side of the heart was the right and which was the left.

Question 23

Many candidates appreciated that glucose and oxygen are used in aerobic respiration. Some candidates incorrectly believed that carbon dioxide and oxygen are used.

Question 25

A few candidates understood that on a hot day, the volume of urine decreases and the concentration of urine increases.

Question 27

Few candidates understood that the organ that detects and coordinates the response to changes in internal body temperature is the brain. A significant number of candidates incorrectly opted for the skin.

Question 28

Many candidates appreciated that in phototropism plant shoots grow towards light. Some candidates incorrectly selected option **A**, all parts of a plant grow towards light.

Question 29

Drinking alcohol increases reaction times. Most candidates incorrectly believed that alcohol decreases reaction times.

Question 34

Many candidates understood that all egg cells have an X chromosome, and with sperm cells, half have an X chromosome and half have a Y chromosome.

Question 36

Many candidates understood that photosynthesis is the process that uses the principal source of energy input to biological systems. Some candidates incorrectly opted for respiration.

Question 38

Many candidates were unfamiliar with the definition of a population and could not apply it to the context in the question.

Question 40

Many candidates correctly selected option **A**. However, some candidates could not use the food web to determine the effect of chaffinches dying.

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BIOLOGY

Paper 0610/12
Multiple Choice (Core)

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

General comments

There was good understanding of: magnification; respiration; the components of a balanced diet.

There was some uncertainty about: the smaller basic units of starch and glycogen molecules; identification of xylem and phloem; blood vessels of the heart; the role of evaporation and diffusion in transpiration.

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

Comments on specific questions

Question 1

Many candidates appreciated that the release of energy from nutrient molecules is respiration. Some candidates incorrectly selected nutrition.

Question 4

Many candidates correctly identified the labelled structures that would also be found in an animal cell, namely W (the nucleus) and X (the cell membrane). Some candidates incorrectly selected Z (the cell wall).

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Question 5

Many candidates correctly identified the correct levels of organisation of the circulatory system. Some candidates incorrectly believed that the heart (an organ) is simpler than heart muscle (a tissue).

Question 7

Many candidates understood that oxygen moves from a region of higher concentration in the alveoli to a region of lower concentration in the blood by diffusion. Some candidates incorrectly selected active transport or osmosis.

Question 8

Only the strongest candidates correctly selected option **B**, the cell membrane. Other candidates opted for the cell wall, chloroplast, or vacuole.

Question 9

Very few candidates appreciated that both starch and glycogen are made of glucose molecules.

Question 11

Few candidates understood that the food tests indicated that protein and sugar were present.

Question 12

Few candidates understood that oxygen is the product of photosynthesis that moves out of a green leaf through its stomata. Some candidates incorrectly believed that carbon dioxide is a product of photosynthesis.

Question 13

Only a minority of candidates appreciated that water moves from the surface of a mesophyll cell by evaporation and then out of the leaf into the atmosphere by diffusion.

Question 16

Many candidates were able to both identify and correctly measure the small intestine from the diagram. Some candidates incorrectly included the large intestine.

Question 17

Identifying both the part of the plant shown (the root) and the tissue labelled H (the phloem) proved difficult for most candidates.

Question 18

Many candidates did not understand which set of conditions would give the highest rate of transpiration and the greatest decrease in mass. The best conditions for this are a warm temperature with low humidity. Some candidates incorrectly believed that humidity should be high.

Question 19

Candidates found it difficult to name the correct blood vessels that go to and from the heart.

Question 20

Many candidates understood that blood clotting is slower than normal in a person with very few platelets. Some candidates incorrectly believed that antibody formation would be slower than normal.

Question 21

While many candidates understood that cholera is caused by a pathogen, some candidates incorrectly selected coronary heart disease.

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Question 23

Many candidates correctly identified the correct word equation for anaerobic respiration in yeast. Some candidates incorrectly believed that lactic acid is a product of anaerobic respiration in yeast.

Question 24

Many candidates correctly deduced that the coloured liquid moves towards the test-tube because the woodlice are using oxygen. Some candidates incorrectly believed that woodlice are using carbon dioxide.

Question 25

While many candidates appreciated that the kidneys excrete urea, some candidates incorrectly believed that the liver excretes urea.

Question 26

Only a minority of candidates understood that label P is a motor neurone and therefore passes impulses to the effector (the muscle).

Question 27

Many candidates correctly identified the pancreas as the endocrine gland that produces insulin. Some candidates incorrectly opted for the adrenal gland.

Question 28

Only a minority of candidates correctly opted for the brain as the site of blood temperature receptors. Many candidates incorrectly believed that the site is the skin.

Question 30

Many candidates understood the characteristics of sexual reproduction and selected option **B**. Some candidates incorrectly believed that in sexual reproduction, offspring are genetically identical to the parent.

Question 33

It was not appreciated by many candidates that to have offspring with white fur, the parent with dark fur must be heterozygous (Rr).

Question 34

Only a minority of candidates understood that it is continuous variation that has a range with intermediate phenotypes.

Question 36

Many candidates understood that photosynthesis is the process that uses the principal source of energy input to biological systems. Some candidates incorrectly opted for respiration.

Question 37

Many correctly identified X as respiration although some incorrectly selected combustion.

Question 38

Many candidates were unfamiliar with the definition of a population and could not apply it to the context in the question.

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BIOLOGY

Paper 0610/13
Multiple Choice (Core)

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

General comments

There was good understanding of: magnification; respiration; methods of birth control.

There was some uncertainty about: the smaller basic units of starch and glycogen molecules; the percentage composition of oxygen and carbon dioxide in expired air; the part of the eye that focuses light onto the retina.

It is important for candidates to work methodically through information provided in questions, such as in **Question 3**, **15** and **22**.

Comments on specific questions

Question 1

Many candidates appreciated that the release of energy from nutrient molecules is respiration. Some candidates incorrectly selected nutrition.

Question 2

Many candidates understood that in the binomial system the first name is the genus. Some candidates incorrectly believed that it is the second name that represents the genus.

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Question 3

Many candidates were able to use the key to identify the organism as a crustacean. Some candidates incorrectly identified it as a myriapod. It is important that candidates methodically work through the key to determine the correct answer.

Question 4

A few candidates selected the correct option. The labelled structures that would also be found in an animal cell are W (the nucleus) and X (the cell membrane). Some candidates incorrectly opted for Z (the cell wall).

Question 6

Many candidates demonstrated an understanding of the magnification formula. Not all were able to convert cm to mm, with some multiplying by 1000 instead of 10.

Question 7

Most candidates appreciated that chemicals spread through the air by diffusion. Some candidates opted for active transport and transpiration.

Question 8

Some candidates correctly selected option **B**, the cell membrane. Other candidates opted for the cell wall, chloroplast, or vacuole.

Question 9

Very few candidates appreciated that both starch and glycogen are made of glucose molecules.

Question 11

Few candidates understood that the food tests indicated that protein and sugar were present.

Question 12

Few candidates understood that oxygen is the product of photosynthesis that moves out of a green leaf through its stomata.

Question 13

While many candidates appreciated that the factor the student investigated was light, a significant number of candidates incorrectly opted for chlorophyll.

Question 14

There was some uncertainty about this question with only a minority of candidates knowing that the nutrient required to prevent scurvy is vitamin C.

Question 15

Only a small proportion of candidates understood that diagram **B** represents the action of lipase.

Question 16

Many candidates were able to both identify and correctly measure the small intestine from the diagram. Some candidates incorrectly included the large intestine.

Question 17

Many candidates were able to identify the xylem in the cross-section of part of a leaf. Some candidates incorrectly opted for the palisade mesophyll cells.

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Question 18

Only a minority of candidates understood which cells water must pass through to reach the xylem. Some candidates incorrectly believed that water must enter the phloem before reaching the xylem.

Question 20

Many candidates understood that blood clotting is slower than normal in a person with very few platelets. Some candidates incorrectly believed that antibody formation would be slower than normal.

Question 24

Very few candidates appeared familiar with the percentage composition of oxygen (16%) and carbon dioxide (4%) in expired air.

Question 25

Few candidates were able to correctly identify the ureter and the bladder from the diagram.

Question 26

Many candidates were able to correctly identify the conditions that will result in the largest volume of urine being produced by the kidneys. Some candidates did not appreciate that at higher temperatures, perspiration increases which decreases the volume of urine.

Question 28

Many candidates incorrectly believed that the pupil focuses light onto the retina.

Question 34

Only a small proportion of candidates understood that both the egg cell and the sperm must have an X chromosome to produce a female child.

Question 35

While many candidates appreciated that selective breeding involves parents that possess desirable features, some candidates incorrectly believed that it involves a struggle for survival.

Question 36

Many candidates understood that photosynthesis is the process that uses the principal source of energy input to biological systems. Some candidates incorrectly opted for respiration.

Question 38

Many candidates were unfamiliar with the definition of a population and could not apply it to the context in the question.

Question 40

Many candidates correctly selected option **A**. However, some candidates could not use the food web to determine the effect of chaffinches dying.

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BIOLOGY

Paper 0610/21
Multiple Choice (Extended)

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

General comments

There was good understanding of: diffusion; enzymes; ingestion; menstrual cycle; water cycle.

There was some uncertainty about: osmosis; how auxin works; the fact that all kingdoms share the same genetic code.

It is important for candidates to work methodically through information provided in questions, such as in **Questions 17** and **21**.

Comments on specific questions

Question 2

Many candidates correctly selected the monocotyledon, option **D**. Monocotyledons can be identified because their flower parts are in multiples of three.

Question 4

While many candidates were able to identify the tissue as structure **C**, some candidates incorrectly believed that **B**, the cuticle, was the tissue.

Question 7

Few candidates appreciated that both starch and glycogen are made of glucose molecules.

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Question 16

Few candidates appreciated that most water evaporation during transpiration occurs from the spongy mesophyll cells. Some candidates incorrectly believed that most water evaporation occurs from the palisade mesophyll cells.

Question 17

Many candidates correctly worked out that the oxygen concentration is lowest at X, just before the blood passes through the gills. Some candidates incorrectly believed that it would be lowest at Y, just after the blood has been oxygenated in the gills.

Question 18

Many candidates understood that a function of the lymphatic system is the circulation of body fluids. Some incorrectly believed that the lymphatic system is responsible for blood clotting.

Question 20

Most candidates correctly selected option **B**, but some incorrectly thought that ciliated cells produce mucus.

Question 23

Many candidates selected the correction option. Some incorrectly believed that glucose moves out of the kidney tubule by osmosis. Only water moves across partially permeable membranes by osmosis.

Question 26

Most candidates selected an incorrect option. Some candidates did not appreciate that if the shoot tip is covered, the auxin diffusing downwards will be equally distributed.

Question 29

While many candidates understood that the progesterone level will be highest in the zone around day 21, some candidates incorrectly opted for the zone around day 14.

Question 37

Few candidates understood that all the kingdoms share the same genetic code.

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Paper 0610/22
Multiple Choice (Extended)

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

General comments

There was good understanding of: diffusion; enzymes; balanced diets; selective breeding.

There was some uncertainty about: identifying the phloem; fibrinogen and fibrin; the fact that all kingdoms share the same genetic code.

It is important for candidates to work methodically through information provided in questions, such as in **Question 40**.

Comments on specific questions

Question 1

Many candidates appreciated that the release of energy from nutrient molecules is respiration. Some candidates incorrectly selected nutrition.

Question 2

Many candidates correctly selected the monocotyledon, option **D**. Monocotyledons can be identified because their flower parts are in multiples of three.

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Question 7

Few candidates appreciated that both starch and glycogen are made of glucose molecules.

Question 15

Identifying both the part of the plant shown (the root) and the tissue labelled H (the phloem) proved difficult for most candidates.

Question 18

Many candidates correctly identified component X as fibrinogen. Some incorrectly selected fibrin. This shows some uncertainty about which substance is converted into the other.

Question 20

Many candidates were able to deduce the correct answer as option **C**. Some candidates though were uncertain whether the internal and external intercostal muscles contract or relax at the start of inspiration.

Question 22

It was well understood that aerobic respiration breaks down lactic acid in the liver. Some candidates incorrectly believed that the lactic acid is broken down in the muscles.

Question 25

While many candidates gave the correct response, some candidates incorrectly believed that glucagon is produced by the liver.

Question 26

Many candidates understood that auxin becomes concentrated in the lower part of the shoot and the shoot grows towards the light. Some candidates incorrectly believed that auxin becomes concentrated in the upper part of the shoot.

Question 27

Many candidates understood that an adaptive feature of sperm is the presence of enzymes in the acrosome. Some candidates incorrectly believed that sperm cells have large stores of energy.

Question 30

Many candidates understood that cells produced by meiosis would contain half the number of chromosomes (12). Some candidates incorrectly believed that the cells would contain twice the number of chromosomes (48).

Question 32

Candidates needed to carefully assess which of the features would be an adaptation for hydrophytes. Large air spaces inside the leaves would allow the leaves to float on the surface of the water.

Question 37

Only a minority of candidates understood that all kingdoms share the same genetic code.

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BIOLOGY

Paper 0610/23
Multiple Choice (Extended)

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

General comments

There was good understanding of: asexual reproduction; selective breeding; decomposers.

There was some uncertainty about: how an oxygen debt is removed; the smaller basic units of starch and glycogen molecules; the mechanism of inspiration; the structure of DNA; yields of carbon dioxide; identifying blood cells.

It is important for candidates to work methodically through information provided in questions, such as in **Questions 30** and **32**.

Comments on specific questions

Question 1

Many candidates appreciated that the release of energy from nutrient molecules is respiration. Some candidates incorrectly selected nutrition.

Question 2

Many candidates correctly selected the monocotyledon, option **D**. Monocotyledons can be identified because their flower parts are in multiples of three.

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Question 3

Many candidates correctly identified the labelled structures that would also be found in an animal cell, namely W (the nucleus) and X (the cell membrane). Some candidates incorrectly selected Z (the cell wall).

Question 6

Many candidates correctly identified the cell membrane as the partially permeable membrane. Some candidates incorrectly opted for the cell wall.

Question 7

Few candidates appreciated that both starch and glycogen are made of glucose molecules.

Question 8

Few candidates understood the structure of DNA and correctly selected option **B**.

Question 13

A significant proportion of candidates did not know that the nutrient required to prevent scurvy is vitamin C.

Question 14

Few candidates correctly selected option **B** as the diagram that represents the action of lipase.

Question 15

Many candidates were able to identify the xylem in the cross-section of part of a leaf. Some candidates incorrectly opted for the palisade mesophyll cells.

Question 16

Only a minority of candidates understood which cells water must pass through to reach the xylem. Some candidates incorrectly believed that water must enter the phloem before reaching the xylem.

Question 17

While most candidates appreciated that the right side of the heart receives deoxygenated blood from the body, some candidates incorrectly believed that the right side of the heart pumps oxygenated blood to the lungs.

Question 18

Most candidates did not recognise the cell as a phagocyte that engulfs pathogens.

Question 20

Only a minority of candidates were able to identify the correct action of muscles during inspiration.

Question 21

This proved to be a challenging question for most candidates. Candidates could have derived the answer from their knowledge of the chemical equation of respiration. Since one molecule of glucose yields six molecules of carbon dioxide, then three molecules of glucose yield eighteen molecules of carbon dioxide.

Question 23

Many candidates understood that urea travels from the liver cells to the kidneys where it is filtered out of the blood. Some candidates incorrectly believed that urea is made in the kidneys.

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Question 25

Many candidates correctly selected option **A**, the fovea. However, a significant number incorrectly selected option **B**, the blind spot.

Question 26

Only a minority of candidates understood that the plant hormone 2,4-D is used for killing weeds.

Question 29

Few candidates understood that FSH and LH are required for the development and release of an egg cell.

Question 30

Only a minority of candidates were able to deduce that the allele for orange eyes is recessive.

Question 32

Candidates needed to read the question carefully as it asked for the chance of a male child being colour-blind. For male children, there is a 50% chance.

Question 33

Few candidates appreciated that heterozygous individuals are more resistant to malaria.

Question 36

Many candidates were unfamiliar with the definition of a population and could not apply it to the context in the question.

Question 37

Only a minority of candidates understood that all kingdoms share the same genetic code.

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BIOLOGY

Paper 0610/31
Theory (Core)

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 five lines to be drawn, it is important that only five 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.

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 enables candidates to express themselves clearly.

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 is 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. Correct spelling of certain words is also expected e.g., uterus, ureter, and urethra. Also, meiosis and mitosis.

Comments on specific questions

Question 1

(a) This was answered well by most candidates. The most common error was confusing the role of the cell wall, cell membrane and the vacuole.

(b) Most candidates were able to gain at least one marking point here, with many accessing all the marks available. Those who did not, either misread or did not understand the question and named cell organelles, rather than actual cells. Another error was to write prokaryotes and eukaryotes or simply stem or leaf cell.

(c) (i) Most candidates understood how to do this calculation. A common error was not including the negative sign to show that the mass decreased.

(ii) Most candidates were able to correctly select appropriate data and score one mark even if they gave an incorrect final answer. Candidates are reminded to show all workings so that partial marks can be awarded even if the final answer is incorrect.

(d) Many candidates accurately named osmosis as the process that causes water to enter and leave cells.

(e) This was a challenging question for candidates. Some did not read the question carefully enough and discussed the potato and potato cylinder, rather than the potato cell.

Question 2

(a) (i) Candidates were able to interpret the pie chart to see that female sterilisation had the largest percentage and therefore was the most commonly used form of birth control.

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(ii) Not all candidates could recognise the surgical methods of birth control (female sterilisation and vasectomy) in Fig. 2.1. Some answers stated all of the methods, i.e., 100%. As a result, there was a range of figures offered e.g., 63. Clear definitions of contraceptive options are needed.

(iii) While a substantial proportion of candidates gave good answers here, some could not distinguish natural forms of birth control from other methods. Marks could not be awarded for repetition of abstinence in different forms. Many answers stated monitoring temperature and did not specify that it must be the body temperature that is monitored.

(iv) Most candidates correctly stated condom. Some candidates incorrectly thought that birth control methods such as IUDs, the contraceptive pill, female sterilisation, and contraceptive injections, would protect a person from STIs.

(b) (i) A range of answers were seen here, with many candidates thinking that the pathogen responsible for HIV infection is bacterial. Many also stated AIDS as the pathogen.

(ii) Many answers suggested ways of spreading HIV which have no relationship with a sexually transmitted disease, e.g., airborne, through sharing food, touching, coughs and sneezes. Some candidates gave three good, clear descriptions. Answers that did relate to an STI often stated sexual transmission but did add any further detail such as stating without protection/use of a condom. Many responses stated that blood can transmit the virus but did not state that the blood has to mix with other blood for transmission. Most candidates knew that the virus was present in blood/body fluids but did not always link this to how it would be transmitted from person to person and did not state that body fluids were exchanged. Sharing needles was a common answer although some candidates stated sharing injections, not appreciating the need to mention the component of the injecting syringe that leads to the transmission.

Question 3

(a) Some candidates had a clear understanding of the term gene. Others were confused by what represents a gene or what its function is and wrote answers that were too vague to be credited. Very few candidates stated that genes code for proteins, some answers stated that the gene itself was made of protein.

(b) (i) Most candidates identified that only one guinea pig has a smooth coat, but many stated three as they had misinterpreted the pedigree diagram.

(ii) The majority correctly selected **D** and were able to follow the key and understand the terminology used. The most common incorrect answer was **F**, where candidates had recognised that it was homozygous but had not appreciated it being recessive.

(iii) Most were able to recognise that there were three male guinea pigs in the pedigree diagram.

(c) Many candidates were awarded full marks on this question. Some candidates did not separate the alleles for the gametes so had not understood that meiosis leads to haploid gametes and the importance of gametes having only one allele of a gene. Practice of genetic crosses in a range of unfamiliar contexts would aid understanding. Where problems arose, it was mainly because candidates put the parental genotypes in the male and female gamete boxes. Some did not recognise the genotype of offspring having a smooth coat (rr).

(d) Very few stated the correct answer, pure-breeding. The most common incorrect responses were 'natural' or 'selective'.

Question 4

(a) (i) Many candidates were able to access marking points for this question. The most common error was confusing the oviduct with the uterus. Many did not circle the ovary carefully enough as they circled more than just the ovary, often including a large amount of the oviduct.

(ii) Most candidates found this question challenging. Candidates confused the process of releasing egg cells (ovulation) with the expected answer of meiosis, which produces egg cells.

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(iii) This question was well-answered. The most common error was including the ovary, which is not correct.

(b) (i) This question proved to be challenging. Using the data from the graph, the expected answer was 7 days. However, some candidates stated a range of days, which was not accepted. A few also incorrectly named day 14, or more commonly 16.

(ii) Few candidates answered this question correctly. Often, candidates thought the lining continued to thicken or that it decreased in thickness again. The expectation was that the line would continue horizontally.

(iii) Egg cells were released on day 14. A wider range of values was accepted. The most common incorrect response was 16, which was out of the acceptable range. Other incorrect answers were 1, 7 and 28.

(c) It was clear that many candidates understood the question being asked. Answers such as hair unqualified were not given credit. Candidates should use biologically correct terminology when answering questions about reproduction rather than colloquialisms.

Question 5

(a) The majority labelled the diagram of the human gas exchange system correctly. Where errors arose, it was mainly through mistaking the alveolus and bronchi for other structures.

(b) Most candidates incorrectly stated the lungs as the point of entry of air, even though they had a diagram in the previous question that clearly showed the nose and mouth prior to the structures that make up the lungs.

(c) This question was generally well-answered, with 'vapour' being the least known missing word. Some candidates tried to use percentages for the gases named in the sentences.

(d) Most candidates correctly stated limewater, some even stating the change when carbon dioxide passes through. Common errors were stating hydrogencarbonate without saying indicator and a few candidates stated calcium carbonate, the correct cation but incorrect anion.

Question 6

(a) (i) Most candidates scored the last two points.
A – a common error was anther or stamen.
C – corolla was accepted for petal. A few candidates wrote leaves.
E – the ovary was more challenging with some candidates stating ovule or ovum.

(ii) Most candidates gave an acceptable answer although some incorrectly said the anther transferred the pollen or caught the pollen.

(iii) Many candidates incorrectly selected **F**, rather than **D**.

(b) The main error was to give a feature that was not visible in the photograph. Many candidates wrote about just petals or colourful or scented petals but did not state large petals. Few mentioned that the anther and stigma were inside the flower.

(c) Some candidates wasted time describing insect-pollinated flowers thinking they had to make a comparison. Other candidates referred to leaves or sepals rather than petals and described pollen as feathery rather than the stigma as feathery. Long filaments were mentioned but then the significance of the anthers being outside the flower was not stated. Several just said it is light or smooth with no reference to whether this referred to the flower or the pollen.

(d) Most gave an appropriate response, most common was animal/animalia. Incorrect answers included mammals, insects, and vertebrates.

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Question 7

(a) (i) Most candidates were able to score two marks. Incorrect answers were usually 7.2 rather than 7.4, and 320 rather than 300.

(ii) This question proved to be challenging for a significant number of candidates. They did not connect boiling as a temperature that would stop metabolic activity and predicted that the higher temperature would speed up the reaction due to increased kinetic energy or evaporation of carbon dioxide.

Where candidates scored the first mark, they often did not go on to explain why the mass of carbon dioxide would be zero and described yeast itself being denatured. The enzymes in yeast are denatured and the yeast is killed.

(iii) Many candidates knew that ethanol is produced by anaerobic respiration in yeast. Common incorrect answers included lactic acid, glucose, and oxygen.

(b) Many candidates were awarded two marks. A common incorrect answer was to select, always produces carbon dioxide.

(c) The majority correctly stated oxygen, although carbon dioxide or glucose were common incorrect answers.

(d) Many candidates were awarded two marks and most selected growth even if they did not select excretion.

Question 8

(a) (i) This was challenging for many candidates, and many omitted to draw an arrow anywhere on the diagram. If there was an arrow on the diagram, then it was usually between the correct boxes, but a small proportion drew the arrowheads pointing in the wrong direction.

(ii) Some good answers were seen here.
J – combustion was well-known.
L – some did not look carefully enough at the descriptors and wrote digestion or predation.
M – most candidates recognised the process, but some could not offer a spelling of decomposition that could be recognised as such.

(b) Most gained one mark for oxygen, but a significant number said carbon dioxide and/or water. Fewer correctly stated glucose.

(c) There was a huge variety of answers here and many candidates displayed a misunderstanding of the impact of deforestation. Quite a few described changing oxygen levels as a reason for changes in carbon dioxide levels rather than photosynthesis itself. Many candidates described the increase in carbon dioxide correctly and talked about loss of trees resulting in lower uptake of carbon dioxide but failed to mention the decrease in photosynthesis.

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BIOLOGY

Paper 0610/32
Theory (Core)

Key messages

Candidates should ensure that they read each question carefully and answer the question being asked. Candidates sometimes see one or two key words and write everything they know about that topic, much of which does not answer the question and cannot be credited.

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.

It is important that all instructions in a question are followed. Diagrams given in the question supply information needed to answer the questions that follow. This was particularly important in **Questions 1(d)** and **7(a)(i).**

General comments

There was evidence that candidates had used past papers when preparing for the exam. This is useful as some candidates have a good knowledge of biology but are unsure how to express themselves clearly.

Comments on specific questions

Question 1

(a) (i) Most candidates drew an arrow showing water moving out of the surface of the leaf and a second arrow showing water moving into the root. A few drew an arrow up the stem rather than into and out of the plant.

(ii) Many candidates correctly named the xylem, although phloem was seen occasionally.

(b) (i) Few candidates could define transpiration using appropriate terms. Some candidates recalled that evaporation occurs at the surface of mesophyll cells.

(ii) This question required two conclusions to be made using data on the effect of temperature on transpiration rates. Some candidates described how temperature changed rather than the effect of temperature on transpiration rates.

(c) Candidates needed to consider the concentration of water vapour in the air and relate that to the rate of transpiration. Increasing humidity decreases the rate of transpiration. Some candidates looked at the graph and confused temperature and humidity. The graph was not needed for this question.

(d) The arrows on the diagram indicated the flow of water from sea to cloud to land. The question asked for the processes at X and Y to be named, but many candidates described what was happening at the arrows instead.

Question 2

(a) Many candidates misread the question and gave a detailed description of the mechanism of homeostasis instead of a definition.

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(b) Most candidates knew that the brain detects the temperature of the blood and that it coordinates body functions. Few realised that it receives impulses from the optic nerve.

(c) Candidates were unfamiliar with the structures in mammalian skin, and few were awarded full marks.

(d) Candidates were unable to describe how the structures in the body reduce heat loss, although they understood which structures are involved. The main misconception was the idea that hair prevents cold air getting in, rather than prevents heat loss.

Question 3

(a) (i) A well-answered question. Most candidates followed the instructions and drew six lines. A common error was to match assimilation with the ileum.

(ii) Most candidates identified the liver, but few could describe an appropriate function, such as formation of urea.

(b) Most candidates gave detailed answers and described liver damage, increased reaction times and addiction.

(c) Candidates found this question demanding with lipase least known as the enzyme that breaks down fats and oils to form fatty acids and glycerol.

Question 4

(a) (i) Almost all candidates could name one producer.

(ii) Almost all candidates could name one herbivore.

(iii) Most candidates gave the correct number of carnivores. It was important to read the question carefully as some gave named examples of carnivores instead of the number of carnivores.

(iv) A well-answered question with most able to successfully complete the food chain.

(v) Candidates needed to refer to the food web before answering this question, so that they were clear about which were predators and prey. Overhunting of golden lion tamarins means that their population decreases so there is less prey for anacondas, but more food for sloths.

(vi) Few candidates gave the Sun as the principal source of energy.

(b) (i) Almost all candidates gave the correct response for the calculation.

(ii) Some candidates did not understand how the given numbers could be drawn as blocks on the grid and were unaware of the expected shape of a pyramid of numbers.

(c) Most candidates understood the link between the increase in atmospheric carbon dioxide concentration and deforestation. Few went on to list soil erosion or the increased risk of flooding.

Question 5

(a) (i) Most candidates could interpret the graph to correctly complete the sentences.

(ii) Candidates frequently identified the type of variation as discontinuous, but few were able to explain it using scientific terminology.

(b) Most candidates correctly identified decreases as the incorrect word.

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Question 6

(a) This question was well-answered by most candidates. Both sugar and salt should be included in the water needed for rehydration, or candidates should refer to Oral Rehydration Therapy. It is important to use the correct terms to describe the processes. Some candidates referred to excretion instead of egestion.

(b) Candidates often gave detailed descriptions of ways of preventing disease spread. However, for a four-mark question, four separate points need to be made if full marks are to be awarded.

Question 7

(a) (i) A description of the arrangement of the seedling and lamp was given at the beginning of the question. This needed to be read before answering the question, so candidates were aware that the root and shoot were growing horizontally at the start. After seven days the root would have grown downwards and the shoot upwards.

(ii) A few candidates gave phototropism as the correct response. Geotropism was frequently seen.

(iii) Few candidates could state that mitosis is required for growth. Meiosis was frequently seen.

(b) Water and a suitable temperature were well-known as factors required for germination. Many candidates did not recognise that germinating seeds require oxygen.

(c) Many candidates correctly completed the sentences. Fewer candidates could recall the elements found in proteins.

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BIOLOGY

Paper 0610/33
Theory (Core)

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.

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.

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. Correct spelling of certain words is expected e.g., uterus, ureter, and urethra. Also, meiosis and mitosis.

Comments on specific questions

Question 1

(a) Some candidates found this question challenging with several linking the pulmonary vein to the lungs. A significant number of candidates drew only three lines, one to each box on the right despite the instructions telling them to draw four lines.

(b) The presence or absence of valves was straightforward. The thickness of the walls was more challenging, but both are thinner than the artery walls. Some candidates put not thick, rather than thin.

Question 2

(a) (i) This question was well-answered by those candidates who followed the instructions and wrote a word equation. However, those who tried to write a symbol equation often gave symbols for the substances that were incorrect and could not be credited.

(ii) A well-answered question but the emphasis was on the type of energy not the source, so 'Sun' was not accepted.

(b) (i) Most candidates correctly identified a palisade cell although some included the epidermis. Few identified the xylem with many indicating a guard cell or the stoma as the cell conducting water.

(ii) The question asked for a cell structure, but many candidates wrote chlorophyll rather than chloroplast.

(c) (i) The majority of candidates answered correctly. The commonest error was to give the highest temperature (40 °C) rather than the temperature at which the rate of photosynthesis was highest.

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(ii) Most candidates only gained one mark for correctly selecting the correct data from the table (42 and 77) which is the rate at 20 °C and 30 °C. The question asked for three significant figures which some candidates found challenging.

Question 3

(a) (i) Generally well-answered but some candidates stated oviduct instead of ovaries.

(ii) Well-answered; those that did not gain full marks mostly omitted to tick both columns for changes in body shape.

(b) The most common error was incorrectly identifying the umbilical cord.

(c) The answers to this question were often too vague and mostly colloquial. Some described fertilisation rather than labour. Typical answers included waters break, contractions start, baby is born, umbilical cord is cut. More detail was needed to score the marks. Candidates mentioned dilation but not in relation to the cervix. References to the vagina were rare although nearly every candidate referred to the presence of a doctor. Several candidates referred to the baby being in the mother's stomach.

(d) (i) Candidates answered this well. A common error was to state a single weight rather than a range.

(ii) Most candidates were able to select the correct data from the table.

(iii) Few candidates gave the correct answer 'continuous', most gave 'birthweight'.

Question 4

(a) (i) Candidates knowledge of this part of the syllabus varied. Those who scored marks usually wrote about filtering and settlement.

(ii) Answers to this question could be general or specific. Candidates usually gave specific answers such as oil or garbage.

(b) (i) Few candidates could name the molecule that was broken down to make urea.

(ii) Most candidates thought this process took place in the kidney rather than the liver.

(c) Many candidates wrote about plants rather than animals. Pollution was not credited unless qualified by the pollutant.

Question 5

(a) Mostly well-answered except for the final missing word 'ventilation' which was not widely known.

(b) (i) Several candidates wrote lung or membrane rather than alveolus, possibly due to incorrect reading of the question.

(ii) Although some candidates correctly answered the question, a significant number got the answers the wrong way round.

(iii) Many candidates wrote osmosis which was incorrect as the question asked about molecules so it must be diffusion.

Question 6

(a) Most candidates were awarded two marks on this question. Those candidates that did not score tended to get confused between the number of smokers or sufferers of chronic bronchitis and the percentage. Some just listed what data was collected rather that what it showed e.g., the percentage of smokers and non-smokers, if they have chronic bronchitis and their age. Few gained a third mark for a correct data quote.

(b) (i) Candidates usually named one of the cancers and sometimes CHD. A few mentioned COPD.

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(c) (i) The toxic components of tobacco smoke were well-known. Carbon monoxide was often missed, or carbon dioxide was written instead.

Question 7

(a) Few candidates correctly stated mitosis. There were a wide range of incorrect answers suggesting candidates were unfamiliar with mitosis.

(b) Very few candidates deduced the correct answer from the data. The DNA took 8 hours to double in mass.

(c) (i) Most candidates identified some of the different structures, almost all identified the nucleus and cell membrane. Few identified the jelly coat or flagellum, often putting tail instead.

(ii) Possible molecules that are energy stores in an egg cell were not well-known. The most common incorrect answer was glucose.

Question 8

(a) Many candidates were awarded two marks. Biological was an incorrect answer for mechanical and antigens was often confused with antibodies.

(b) This question gave candidates the opportunity to give a wide range of answers. As the question asked about individuals in their homes, answers included personal hygiene, ways of preparing food and waste disposal.

Question 9

(a) Very few candidates were able to correctly define a sense organ. Most did not mention receptor cells and simply defined an organ or gave examples of sense organs.

(b) Most candidates knew the structure of the eye and the function of the parts of the eye.

(c) The majority of candidates correctly drew the pupil with a smaller diameter.

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BIOLOGY

Paper 0610/41
Theory (Extended)

Key messages

It is important for candidates to read all the stimulus material carefully and complete all the instructions contained within the question. There were occasions where candidates could not access the full marks available or gave irrelevant responses due to not reading the question thoroughly or answering a question of their own devising. The mark allocation for each question provides a guide as to how many relevant points a candidate needs to make to be awarded full credit.

Understanding the differences in the responses required by different command words is key in enabling candidates to access the available marking points for each question. In particular, the command words of describe and explain require different responses. Candidates often provide descriptions of data when an explanation of the data is required.

General comments

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

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

Data analysis skills are good for candidates to practise. It is important for candidates to be able to manipulate data and information that is unfamiliar to them. Using the information provided in the stimulus material such as graph axes and diagrams will enable candidates to successfully answer questions set in unfamiliar contexts. These skills were particularly beneficial for **Questions 1(c)**, **2(a)(ii)**, **3(c)** and **3(e)(i)**.

Candidates should be reminded to carefully read the questions and apply their knowledge to the context of the question. There were several instances when candidates showed impressive knowledge about a topic, but this was irrelevant to the question being asked. This was particularly relevant to **Questions 5(b)**, **5(c)** and **5(d)**.

Occasionally candidates are required to draw, shade, or annotate diagrams, as was the case for **Question 2(b)(i)**. For these types of questions, it is important that candidates use a sharp pencil to produce accurate shading or annotation.

Comments on specific questions

Question 1

(a) (i) There was some confusion between the different orders of classification. The correct response of Fungi was commonly seen. However, a variety of alternative answers were given including genus and species names and names of alternative kingdoms.

(ii) The correct response was aerobic respiration. Some candidates were vague in their responses and simply gave the name of the process as respiration. A few gave the incorrect response of anaerobic respiration.

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(b) Some candidates did not appreciate that the sucrase molecule was the enzyme, which resulted in some confused responses. However, most candidates were generally able to describe the importance of shape with reference being made to the complementary shape of the active site and substrate enabling an enzyme-substrate complex to be formed. Answers referring to the specificity of the enzyme, or that sucrase only binds with sucrose were also seen. Candidates should be reminded to take care when describing the shape of the active site and refer to the shape using language specified in the syllabus. References to the active site being the same shape as the substrate could not be awarded credit.

(c) This question was generally well-answered with many candidates providing excellent descriptions and explanations of the graph. Some candidates misinterpreted the question and only gave a description, limiting the marks that could be achieved. Candidates should be reminded to look carefully at the command words in the questions and to know what responses are expected of them when a question asks for a description and/or an explanation. A few candidates that tried to answer this question in terms of temperature, rather than pH. Candidates should check all stimulus material carefully, paying particular attention to the axes labels on graphs. Most candidates recognised that pH 6 resulted in 100% activity, or the optimum, but very few made it clear that the enzyme was active over the whole pH range. A high level of correct scientific terminology was evidenced in candidate's explanations with correct references explaining the effect of denaturation on enzyme activity. Fewer candidates were able to explain why an increasing pH value (from pH 2 to pH 6) increased enzyme activity in terms of more enzyme-substrate complexes being formed.

Question 2

(a) (i) The correct response of left ventricle was commonly seen. It was rare that candidates gave the incorrect side of the heart or stated the chamber was the atrium.

(ii) Some candidates were able to state the correct name of the vein. The pulmonary vein was a common incorrect response. Candidates were still able to achieve marks for descriptions of the structure of a vein, such as presence of valves and thin walls. It was clear that some candidates misinterpreted the question as functions of the blood vessel were often given instead of descriptions of the structure. Many candidates stated that veins have a wide lumen, but it was rare to see reference to the muscle and elastic fibres in the wall.

(iii) The function of valves was very well-known. Few candidates could identify the semi-lunar valves with atrioventricular valve and unqualified references to valves often seen.

(b) (i) Inaccuracies in candidates shading prevented some candidates being awarded the mark. The question asked for the blood vessel to be shaded. A number of candidates included the atrium of the heart or simply shaded the capillaries. A few candidates shaded the incorrect blood vessel. Responses where more than one blood vessel was shaded could not be credited.

(ii) This question required evidence that could be seen in Fig. 2.2. Evidence that was not visible on the diagram was not credited. There were also some vague responses referring to the pathway of blood going to the lungs and going to the body, without successfully referring to the two separate circuits (pulmonary and systemic). A detailed explanation of a complete circuit was accepted. Some candidates could deduce that the blood would flow through the heart twice but needed to specify this as happening in one complete circulation. The simpler response of the heart having a left side and right side was less frequently seen.

(iii) This question proved demanding for many candidates. Many could describe the double circulatory system as enabling different pressures in different circulations in the pulmonary and systemic circuit, fewer were able to explain the benefit of this. Responses could be improved by explaining why it is important for the pulmonary circuit to have blood at a lower pressure in terms of preventing damage to the delicate capillaries of the lungs, in addition to the high pressure of blood in the systemic circuit allowing efficient transfer of blood, oxygen and nutrients. However, a number of candidates were able to identify that deoxygenated and oxygenated blood were able to be kept separate and that a double circulation enabled the maintenance of high rates of respiration.

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Question 3

(a) The names of the labelled organs in the alimentary canal were generally well-known. The gall bladder proved the most problematic for candidates to identify, with bile duct and kidney often given in its place. The duodenum was frequently incorrectly identified as the ileum; however, the general answer of the small intestine was accepted.

(b) The enzymes secreted by the pancreas were generally better known than the hormones secreted. Insulin was more commonly seen than glucagon. A number of candidates confused pepsin and trypsin, pepsin being secreted in the stomach and not the pancreas. The commonest incorrect hormone given was adrenaline. Candidates should be reminded to take care when spelling keywords. Glucagon is easily confused with glycogen, so accurate spelling is particularly important.

(c) It was important for candidates to read the stimulus material carefully and pay close attention to the diagram. Some candidates did not appreciate that the chloride ions would be moved against their concentration gradient as shown in the diagram, leading them to describe diffusion as the way the chloride ions were transported. Candidates that did identify active transport, generally scored highly, giving detailed descriptions of the active transport process, including reference to carrier proteins and the use of energy. A relatively common omission was not to name the process as active transport.

(d) The process of osmosis was generally described well, with candidates correctly referring to differences in water potential. The best responses described the effect of the chloride ions lowering the water potential of the inside the pancreatic duct. Often, the process was described as movement of water down the concentration gradient, rather than down the water potential gradient. Some candidates thought that the water molecules moved with the chloride ions through the protein carriers.

(e) (i) Some candidates struggled to articulate their responses clearly. In addition, this question required evidence from Fig. 3.3. To gain full credit candidates were expected to refer to the information given in the figure to support their answer. The best responses included explanations in relation to person 2 and 3 in Fig. 3.3. This question required candidates to describe and explain their answer. Candidates tended to either describe that the parents of 5 and 7 did not have cystic fibrosis or explain that parents 2 and 3 were heterozygous. Fewer candidates provided an adequate description and explanation. A common misconception was that cystic fibrosis was an infection. Candidates should know the difference between inherited diseases and infectious diseases.

(ii) There were some excellent, well laid out responses to this question. Common difficulties included the suggestion that cystic fibrosis was a sex-linked characteristic. Some candidates misinterpreted the meaning of the term phenotype and gave descriptions of the genotype such as carrier or heterozygous rather than the correct response of without / no cystic fibrosis and with cystic fibrosis. If candidates confused the parental genotypes generally by identifying the genotype of person 7 as something other than homozygous recessive, the principle of error carried forward was applied to the rest of their answers. Occasionally the sex chromosomes of X and Y were given in place of gametes and some candidates shaded in the gamete circles to resemble the pedigree diagram. Although drawing Punnett squares is a useful way to predict the genotypes of offspring produced in a cross, candidates must be careful to transfer the outcomes of any rough working to the appropriate place on the page in their response. It would be useful for candidates to practise setting out of genetic crosses and revising the key terms of inheritance to help answer questions such as these.

Question 4

(a) There were some excellent descriptions seen that used correct terminology appropriately. Many candidates could provide the different stages of the breakdown of protein. The most common misconception was the attempt to include nitrogen-fixing bacteria into the processes, which was irrelevant in this instance. Some candidates did not access all the available marks by omitting the initial breakdown of protein into amino acids. Alongside many excellent answers, there were several vague and inaccurate responses, with some candidates attempting to refer to digestion within cattle and some candidates describing the uptake of ions by plants. There were several instances where candidates missed part of the journey and attempted to describe the breakdown of protein directly to nitrates. There were occasions where candidates read ahead in the question paper and described the processes occurring in the root nodules. These were irrelevant to this question.

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(b) (i) The question required an advantage to the farmer rather than the plant itself. Common correct answers included faster growth or better yield and the need to use less fertiliser. General responses suggesting that more nitrogen was fixed could not be credited.

(ii) Many candidates showed mathematical skills of a high standard. A number of candidates attempted to calculate a percentage decrease rather than a percentage increase by dividing by 156 instead of 96. Readings from the graph were generally accurate. Some candidates did not express their answers to the correct number of significant figures.

(iii) The stages involved in eutrophication were well-known by many candidates with some detailed and accurate responses. Common misconceptions included attributing the lack of oxygen in water bodies to the lack of photosynthesis of producers and manure covering the surface blocking light for producers. The first stages of the process were better known than the role of decomposing bacteria, although few candidates related eutrophication to the initial breakdown of manure. Some responses referred to the involvement of bacteria but did not explain that it was aerobic respiration of these bacteria that caused a decrease in dissolved oxygen content of the water.

Question 5

(a) The species name and common name were frequently given rather than the correct genus name.

(b) This question specified the effects of deforestation on habitats. Many candidates listed general undesirable effects of deforestation. Candidates should be reminded to read questions carefully and apply their knowledge to the context of the question. Responses regarding the effect of deforestation on global climate were not credited. The best responses related deforestation to the effects on the soil such as soil erosion, increased runoff, and the leaching of minerals.

(c) Many candidates were not precise enough in their responses. There were many well written but irrelevant responses detailing the general benefits of habitat conservation. This question specified the benefit to other organisms of conserving the forest. Vague references to helping climate change and biodiversity were irrelevant. The best responses referred specifically to how the forest would provide benefit to organisms in terms of food, shelter, and breeding sites.

(d) This question proved challenging to some candidates. Many candidates misinterpreted the question and answered why it is important to collect seeds from many different species rather than many individual trees of each species. Careful reading of the question was required to answer this question successfully. Candidates that recognised the importance of this in terms of genetic diversity were generally able to suggest reasons why genetic diversity would be important. A common omission was to suggest increasing variation rather than specifying genetic variety. Vague references to increasing biodiversity were not credited.

Question 6

(a) Most candidates were able to interpret the flow diagram to give the names of the correct cells, organs, or processes. Testis was commonly given for **P** but occasionally penis was incorrectly given. Weaker responses often gave the names of gametes or fertilised egg instead of zygote for **S**. Processes **Q** and **T**, meiosis and mitosis, were occasionally confused. Spelling of the terms meiosis and mitosis was also an issue for some candidates. It was common to see 'meitosis' for mitosis and 'meosis' for meiosis. Fertilisation was frequently named for process **R**, although some candidates attempted to describe the process as fusion of gametes. The name of the process was the required answer. Process **U** proved to be the most problematic with few candidates naming the process of implantation. A number of candidates give the name of the process as implementation. Some alternative correct answers, such as the development of the placenta, were also credited.

(b) (i) There were many simple descriptions of fusion of gametes making a diploid zygote. The best responses expressed the importance in terms of maintenance of the chromosome number from generation to generation. The idea of preventing the doubling of chromosomes at each generation was also creditworthy.

(ii) This question was generally well answered by most candidates. Some responses vaguely referred to protection of the egg cell and some incorrectly suggested that the jelly coating was an energy store for the egg cell. Most candidates gave the required response of preventing additional sperm from entering the egg after fertilisation.

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(c) The role of the placenta in exchange of oxygen and carbon dioxide gas was well-known. A variety of acceptable dissolved nutrients were seen. Occasionally candidates gave the names of insoluble molecules such as protein and fat. Passive immunity was commonly seen, with the occasional answer of active immunity incorrectly given. It was evident there was some confusion between the terms antigens, antibodies, and alleles. It is important that candidates know the differences between similar sounding biological terms. Pathogens was also infrequently seen, however alternative responses giving named examples of pathogens were accepted.

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BIOLOGY

Paper 0610/42
Theory (Extended)

Key messages

It is important for candidates to read all the stimulus material carefully and complete all the instructions contained within the question. There were occasions where candidates could not access the full marks available or gave irrelevant responses due to not reading the question thoroughly or answering a question of their own devising. The mark allocation for each question provides a guide as to how many relevant points a candidate needs to make to be awarded full credit.

Understanding the differences in the responses required by different command words is key in enabling candidates to access the available marking points for each question. In particular, the command words of describe and explain require different responses. Candidates often provide descriptions of data when an explanation of the data is required.

General comments

Many good descriptions of complex concepts such as accommodation (**Question 3(a)(ii)**) and inspiration (**Question 5(b)**) were seen with some excellent use of mnemonics to help them remember the key details of these processes. However, it was also common to see candidates confuse similar concepts such as the role of insulin with the role of glucagon (**Question 2(c)(ii)**), the roles of rods and cones (**Question 3(b)(i)**) and the roles of antibodies with that of antibiotics (**Question 4(b)(iv)**), sometimes even within the same answer such that they contradicted themselves.

Candidate were more confident with the content in some topics in the syllabus compared with other topics. The checklists in the learner guide, which has been compiled from the learning objectives in the syllabus, are a useful tool to help candidates identify areas that may require more attention during their revision.

Sometimes candidates overlooked key instructions, such as to give an answer to a specific number of significant figures (**Question 4(b)(i)**), or to provide a total number, rather than a list (**Questions 6(b)(i)** and **(iii)**).

Comments on specific questions

Question 1

(a) Most candidates were able to convert 0.01 mm into µm. There was a range of incorrect conversions that were out by multiples of 10.

(b) Most candidates correctly identified the nucleus, vacuole, and cell wall from the diagram, but a number confused the chloroplast with the mitochondrion. This suggests that they did not pay careful attention to the arrows showing the net movement of carbon dioxide in the daylight. The function of the nucleus and chloroplast were well-known, although a few referred to the nucleus as the brain of the cell. Many candidates incorrectly stated that the function of the cell wall was to protect the cell, or to act as a barrier or to control the movement of substances in and out of the cell. This suggested that the cell wall had been confused with the cell membrane.

(c) (i) Almost all candidates knew that diffusion was the process by which carbon dioxide travels into a leaf, but common incorrect answers included respiration, transpiration, and photosynthesis.

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(ii) Many candidates knew that carbon dioxide would enter the leaf via the stomata, with slightly fewer mentioning the intercellular air spaces, in their description of the pathway to the spongy mesophyll cells.

(d) (i) Few candidates were familiar with the term limiting factor to describe something in the environment that is in short supply, restricting life processes.

(ii) The best responses gave examples of a feature in its limited form, such as low light intensity or a lack of water, but simply the name of the feature was sufficient to gain credit. Commonly seen incorrect answers included weather, pollution, climate change, lack of oxygen and vegetation.

(e) Some very detailed and well considered answers were seen to this question on the advantages of artificial photosynthesis to the environment. The most common correct response was the reduction of carbon dioxide in the atmosphere. There were very few references to the enhanced greenhouse effect. A significant number of candidates misinterpreted the question and gave advantages of artificial photosynthesis over the natural process. Numerous candidates incorrectly focused on the benefits of the process for putting more oxygen in the atmosphere or even more food production.

Question 2

(a) (i) The glomerulus was correctly named from the diagram by most candidates. Many phonetic spellings were accepted, but on some occasions the word was too far away from the correct spelling to be credited.

(ii) Many candidates explained that the blood vessel was an artery, or that the high pressure was required for filtration. Although a number of very detailed answers were seen, covering the full range of correct explanations, a considerable number of candidates incorrectly thought that the blood vessel itself pumped the blood, or just stated that it carried oxygenated blood, or waste products.

(iii) Many candidates realised that the microvilli provide a large surface area and were able to apply their knowledge of the small intestine to describe that this would enable more absorption. A common incorrect answer was to confuse the microvilli with cilia and describe their function.

(b) Some very thorough answers were seen that outlined the function of the kidney tubules and appropriately used the data and diagrams. Those candidates who did not refer to the data were not able to gain maximum credit. It was common to see the terms filtration and absorption mixed up, or to use diffusion interchangeably with filtration as if they were synonymous. Another common confusion was between the role of the liver in the formation of urea by deamination and the role of the kidney in terms of excretion of urea. A lack of correct units for concentrations or for not including exactly where a specific reabsorption took place meant that the application marks were not always accessed. However, most candidates were able to use the information to state that urine would contain urea and salts.

(c) (i) Most candidates knew that homeostasis is the term for maintaining a constant internal environment.

(ii) The details of how negative feedback controls the blood glucose concentration were reasonably well understood. Most candidates were confident in their spellings of glucagon and glycogen. Only a few candidates confused the roles of glucagon and insulin.

Question 3

(a) (i) Refraction was commonly confused with reflection, as the term to describe what happens to light as it passes into the cornea. Bending is too vague to be credited.

(ii) Even though it was only necessary for candidates to describe the adjustment in the eye as focusing on a near object occurs, many candidates described the mechanism for both distant and near objects. Many very detailed descriptions were seen with a number of candidates going on to explain the effect of the refraction of light. Common errors included confusing the ciliary muscles for circular muscles, describing the suspensory ligaments as muscles, and getting confused between the impact on the shape of the lens. Some candidates confused focusing with the pupil reflex and instead described the actions of the circular and radial iris muscles.

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(b) (i) Many candidates knew that rods and cones were involved in detecting light and went on to give very detailed descriptions of the functions of each. Some candidates found it difficult to express themselves clearly and it was common to see inaccurate statements such as there being three cones, rather than the idea that there are three types of cones. Other candidates confused the functions of rods and cones, either completely, or partially, mixing the colour / black and white vision with the wrong intensity of light in which the type of photoreceptor work optimally.

(ii) Using their knowledge and the photograph to determine the distribution of rods and cones across the retina was a challenge for many candidates. The most common correct answer was to know that no rods or cones are located at the blind spot.

(c) (i) Many candidates were able to deduce that no females in the pedigree diagram have colour blindness. Some candidates gave detailed explanations using particular examples from the diagram, although misinterpretations were also seen. Others did not refer to the diagram and only restated the information in the question stem.

(ii) Most candidates knew that a female genotype would have two X chromosomes. Many were also able to use the key on the pedigree diagram to determine that person 5 was heterozygous. The vast majority of candidates knew how to write the full genotype correctly.

(iii) Completing the genetic diagram between person 3 and 4 to show the probability of the child having colour blindness was a challenging question. The most common errors were to put alleles for colour blindness on the Y chromosomes or to not use the X and Y chromosomes in the genotypes at all. Examiners applied the error carried forward rule, so candidates were awarded partial credit even if their answer was not fully correct. Some candidates did the correct genetic cross but had difficulty in determining the probability of having a child with colour blindness with many stating 1:3 rather than 1:4.

Question 4

(a) Many candidates correctly identified the two parts of a virus from the diagram.

(b) (i) The percentage change calculation was done correctly by the vast majority of candidates. The most common errors were to give the answer to the incorrect number of significant figures, round the answer incorrectly, or use the wrong denominator.

(ii) The overall decrease in the number of lymphocytes across the 84 months was mentioned by many candidates with detailed descriptions including good use of key features on the graph. Some candidates misread the axes and referred to minutes and years instead of months or forgot to include units when quoting key values from the *y*-axis.

(iii) Many very detailed descriptions of the consequences of the decrease in lymphocytes on a person with HIV were seen. The development of AIDS was rarely seen, even in the most thorough answers.

(iv) Although many candidates understood the reasons why antibiotics are not used to treat viral infections, many common misconceptions about this were also seen. The most common among these was about developing resistance to viral infections, or that viruses were too strong for antibiotics. Another common error was to confuse antibiotics with antibodies and describe either vaccination or lack of development of an immune response.

Question 5

(a) (i) The location of the parts of the gas exchange system were well-known by most candidates. Some candidates used the common terms, such as voice box and windpipe, but these could not be credited. The commonest errors were to give bronchiole instead of bronchus, oesophagus instead of trachea, or pharynx instead of larynx.

(ii) Many candidates knew that cartilage prevents the collapse of the trachea and bronchi during breathing, but a wide range of incorrect answers were also seen.

(b) The process of inspiration was described in detail by a few candidates, often giving detail beyond the maximum number of marking points to gain full credit. However, many answers also lacked sufficient detail or gave confused descriptions, mixing mechanisms associated with expiration.

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Others seemed to have misread the question and described the pathway of oxygen molecules from the atmosphere to the blood. Some incorrect responses suggested that it was air entering that caused the volume of the lungs to increase, or that the increase in the volume of air in the thorax would cause the pressure to decrease.

(c) Alveoli was well-known as the gas exchange surface in the lungs. Many phonetic spellings were seen, but as with many other technical terms, this word could become confused with others, and where the spelling of the word was too ambiguous, credit could not be awarded.

Question 6

(a) The key terms used to describe an ecosystem were not well known, and candidates commonly confused population, species, and habitat.

(b) (i) Almost all candidates correctly determined that there were four secondary consumers in the food web. However, a some misread the question and listed the names of some of the organisms instead.

(ii) Only the reef shark fed at more than one trophic level. The most common incorrect answer was zooplankton.

(iii) As with **Question 6(b)(ii)** only the number 4 was required to answer how many different organisms were in the shortest food chain, but again many candidates named the organisms instead.

(iv) The full range of evidence that could have been used to explain why the phytoplankton were producers was seen. A minority of candidates did not realise that they should have used the food web, and instead gave a definition of a producer.

(v) Many very detailed answers explaining what limits the number of organisms in a food chain were seen. A common misconception was that top predators are always physically large organisms and would need a large volume of food. Candidates also incorrectly named processes such as growth, protein synthesis and reproduction as inefficient in terms of energy transfer, not realising that most of the energy in these processes contribute to biomass and therefore can be consumed at the next trophic level. Very few candidates mentioned that energy would also transfer to decomposers.

(c) A wide variety of threats to aquatic ecosystems were seen with many candidates going on to give a detailed discussion about how that threat would impact the ecosystem. The most commonly seen threats were from non-biodegradable plastics, sewage, fertilisers, and overfishing. Common answers that did not gain credit were bulleted lists of words without any context, and vague mentions of pollution or chemicals. References to damage to the terrestrial environment without any specific link to aquatic ecosystems, e.g., deforestation were often seen.

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BIOLOGY

Paper 0610/43
Theory (Extended)

Key messages

It is important for candidates to read all the stimulus material carefully and complete all the instructions contained within the question. There were occasions where candidates could not access the full marks available or gave irrelevant responses due to not reading the question thoroughly or answering a question of their own devising. The mark allocation of each question provides a useful guide of how many relevant points a candidate needs to make.

Understanding the differences in the responses required by different command words is key in enabling candidates to access the available marking points for each question. In particular, the command words of describe and explain require different responses. Candidates often provide descriptions of data when an explanation of the data is required.

General comments

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

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

The importance of reading the question was apparent in **Question 2(b)** where some candidates gave responses in term of reduced oxygen transport rather than reduced blood flow.

Comments on specific questions

Question 1

(a) (i) Most candidates identified the type of pathogen treated by penicillin as bacteria. Many incorrect answers were seen, including virus and fungi.

(ii) Some candidates identified penicillin as an antibiotic, but a wide range of incorrect answers were also seen, including pain medicine and antiviral.

(b) (i) Few candidates were able to name two features of a fungal cell that are not found in prokaryotes. There was some confusion over the presence of a nucleus. A common incorrect answer was the presence of a cell wall which is found in both organisms.

(ii) Only a few candidates could name the genus of organism **A** correctly as *Penicillium*. The most common incorrect answers were fungus and penicillin.

(iii) Few candidates could list two nutrients that are added to the fermenter. There seem to be confusion about what a nutrient is, with candidates often giving oxygen, carbon dioxide or gas as an answer. Many also named elements such as iron and magnesium without stating they would be present as ions.

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(iv) Candidates did not give enough detail about the purpose of sterilising the nutrients before adding them to the fermenter. Vague responses about cleanliness and removing impurities were insufficient to gain credit.

(v) Some candidates were able to explain that a gas outflow pipe prevents the pressure rising inside the fermenter and stops the fermenter exploding. Few candidates could explain that carbon dioxide is produced during fermentation or that carbon dioxide is toxic to the fungus. Many candidates referred to gas instead of waste gas.

(vi) Most candidates gained credit for stating that the product was removed from the fermenter, filtered, and bottled. Many candidates omitted to describe the exponential growth of the fungus and the production of penicillin as a by-product of maximum growth.

Question 2

(a) (i) Candidates were confused between elements and small biological molecules such as amino acids. Other common incorrect answers included carbon dioxide, sulfur, and water.

(ii) Some candidates correctly stated the role of haemoglobin, but many candidates stated it was involved in the production of red blood cells or the immune system.

(b) Many candidates were able to describe how the abnormal red blood cells affect blood flow. Most correctly stated that blood cells becoming stuck, and this increases clotting. Very few commented on the shape being the reason for the cells becoming stuck.

(c) Very few candidates were able to complete the whole genetic cross correctly, but most managed some parts. The most common errors were in the parental phenotypes and genotypes. Candidates were confused about what a phenotype and genotype are and instead wrote one allele on each line. Some candidates used Hb^s as the genotype (thinking that H is one allele and b^s is the other) despite the information being given in the question.

(d) (i) Most candidates were able to simply describe the data shown in Figs. 2.2 and 2.3 and find the evidence that does and does not support the statement. Very few candidates gave a deeper discussion of the evidence such as ideas about population density varying or the differing resolution of the maps.

(ii) Only a few candidates could correctly describe how scientists would identify an allele in a tissue sample. Most candidates simply described looking at blood samples for the presence of sickle cells or doing a DNA test.

(e) The majority of candidates were able to explain why mutations are always inherited in asexual reproduction but most struggled to explain in detail why this does not happen in sexual reproduction. The most common correct response was that sexual reproduction involves two parents but then many candidates incorrectly described dominant and recessive alleles as the reason mutations may not be inherited instead of mutations not being present in the gametes. Few candidates stated that mutations were found in the DNA.

Question 3

(a) Some candidates were able to describe the effect of acid rain as causing damage to leaves or lowering the pH of soil. Very few candidates went further in their description.

(b) Most candidates were able to answer this question well. The most common responses included species extinction, loss of habitat, disruption of food chains and increase in atmospheric carbon dioxide. Some candidates were not able to gain full credit for their response as they did not use scientific language. An example of this is the use of the term home instead of habitat.

(c) Very few candidates were able to answer this question with sufficient detail to gain credit. It was not sufficient to say that amphibians live in water as this information was provided in the question.

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(d) Some candidates gave correct references to scrubbers in power stations or using renewable energy sources. Very few managed to gain full credit by giving three correct descriptions of methods for reducing acid rain.

Question 4

(a) Very few candidates completed more than two rows of **Table 4.1** correctly. Most candidates correctly identified the anus as the place where egestion occurs, and some were able to identify the mouth and all three processes that occur in it. Very few candidates could correctly name the parts of the small and large intestines and so were unable to gain credit even if the processes were correct.

(b) Some candidates were able to give a correct response for this question. However, many could not correctly identify the parts of the villus and link these to their function. Many did not use the letters as asked for in the question. Some gave responses linking the villus to gas exchange rather than to absorption. Some candidates gave a simple description of the function of the villus as to increase the surface area for absorption, but very few could extend this any further. Some could identify the lacteal and its function. Many did not describe the structure of the villus or its role in sufficient depth for credit.

Question 5

(a) (i) Most candidates could state that carbon dioxide is needed for photosynthesis, and some could explain further that glucose is a product of photosynthesis. Far fewer were able to use scientific language and describe carbon dioxide concentration as a limiting factor of photosynthesis.

(ii) There was a wide range of suggestions of how to increase carbon dioxide concentration in a glasshouse. Incorrect responses included keeping the plants in the dark, having more plants, adding fertiliser, and using a filter.

(iii) Many candidates were able to describe the pathway of carbon dioxide into leaves. Some candidates did not describe it fully, for example, stating that carbon dioxide is absorbed rather than diffuses through stomata.

(b) (i) Most candidates could calculate the percentage increase and use significant figures correctly. Some candidates misread the question and so used incorrect data in their calculation. They were able to gain credit for the correct use of significant figures despite this error.

(ii) Almost all candidates could identify sodium lamps as the lamp with the highest intensity output per unit of electrical energy.

(iii) Most candidates were able to correctly describe plants wilting and then dying. Some candidates correctly described the effect on transpiration. Far fewer described the effect of excessive heat on enzymes or stated that enzymes were involved in photosynthesis.

Question 6

(a) Some candidates could give a reason why orange trees are classified as dicotyledonous plants although many candidates incorrectly stated that it is because the trees produce fruit.

(b) Most candidates were able to correctly define enzyme. Some gave partial definitions which omitted that they did not get used up during the reaction.

(c) (i) Many candidates named an enzyme used to extract juice from fruit, but some gave the substrate (e.g., pectin) rather than the enzyme.

(ii) Most candidates could correctly read the optimum length of time for efficient juice extraction from the graph although some incorrectly gave a range of times that gave the maximum volume of juice (45–90 minutes) rather than the shortest time.

(iii) Almost all candidates could state the name of the vitamin found in high concentrations in oranges. Only very few candidates incorrectly stated vitamin D.

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(d) (i) Very few candidates could name the process of changing genes in plants. The commonest incorrect responses were selective breeding or artificial selection.

(ii) Some candidates were able to describe disadvantages of changing genes in a plant. Correct responses include the idea that genetically modified seeds are expensive, there is a reduction in biodiversity or that there are ethical concerns.

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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. Controlled variables must also be considered and included in a plan.

Candidates should also try to match the answers they give with the number of marks available for each part of a question. A three-mark question will require three separate points to be made if full credit is to be awarded.

Candidates must be familiar with the practical procedures indicated in the syllabus. This includes the common food tests and methods for obtaining fair and valid results.

General Comments

Most 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.

Comments on specific questions

Question 1

(a) (i) Most candidates were able to produce a very good table of results, with correct colours for the solutions in the two test-tubes. The most common mistake was to omit the title above the test-tube column.

(ii) Although most candidates could state a conclusion for the results they obtained, some gave vague answers or simply described the results. Answers such as; '*A went green, and W stayed blue*' are insufficient as both variables need to be included in the conclusion. In this case, some mention of the enzyme was required in order to draw a suitable conclusion.

(iii) Most candidates were able to identify one variable that stayed constant. It is important that candidates are specific in their answers. Simply stating rice or water alone is insufficient, mass of rice or volume of water is acceptable.

(iv) Many candidates found this challenging and did not mention that a comparison with the enzyme test-tube was required to be able to draw a conclusion. The idea of the water acting as a control was accepted, but ideally candidates should explain what a control is.

(v) This question was demanding for many candidates. The idea of contamination was given by some, but few went on to predict the results of such contamination. Simply stating the results would be wrong was sufficient.

(vi) Some candidates were able to name a suitable piece of equipment for maintaining temperature.

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(b) Many candidates stated an incorrect test for starch. A number gave the wrong reagent, usually Benedict's. Others gave vague descriptions of the expected colour, such as stating blue or black rather than blue-black.

(c) (i) This question was generally answered well, with many candidates recognising the correct trend in the data and also stating the point at which the maximum value was reached. The most common error was simply to state a series of data points rather than describing the trend in the data. Other candidates described the enzyme denaturing, rather than describing the trend.

(ii) Most could correctly read a value from the graph, but a few divided by the temperature, or calculated the rate in mg per second.

(iii) Many candidates found this question challenging and referred to repeats rather than specifying the temperatures that would allow a more accurate estimation of the optimum. Some candidates understood what was required, but confused time with temperature on the *x*-axis. It is important to look carefully at any graphs or figures provided.

(d) This question involved writing a plan to investigate the effect of pH on enzyme activity. The responses were good, and most candidates scored very well.

Candidates should remember:

- to state the variable that was being changed and explain how this change would take place (reference to a buffer was not often seen)
- to identify what was being measured
- to identify the factors which needed to be kept constant
- to say how many times the experiment was going to be repeated (at least three trials in total is required)
- to state a suitable safety precaution.

Question 2

(a) (i) The quality of the drawings was very good with many candidates gaining full marks. Care should be taken to draw unbroken outlines. Shading of the drawing must be avoided. In this case, the question stated that no cells should be drawn. It is important to read the question as the instructions can vary.

(ii) Most candidates were able to calculate the actual diameter correctly although a small number inverted the values in the equation or used incorrect units and gave an answer in cm rather than mm.

(b) (i) Most candidates were able to identify the dependent and independent variables, but some lost marks due to a lack of detail. Some stated sodium chloride but did not mention concentration. Others referred to the growth of the roots but did not mention length.

(ii) A very well-answered question by the majority of candidates. Some lost a mark as they did not appreciate it was the large number of seeds that was important rather than the number itself.

(c) (i) Although most candidates understand how to calculate a percentage decrease, far fewer appear to appreciate the difference between significant figures and decimal places.

(ii) The graph was very well done, with many candidates scoring full marks.

Some key points for drawing graphs:

- Labels on the axes should be complete and include units where appropriate. These should match the headings and units in the table. Some candidates forgot to include average from the root length and concentration from the sodium chloride axis.
- Plotted points must be small – a small cross or circled dot is ideal.
- A line of best fit can be a straight line or a curved line. In many cases, joining plot points with straight lines (using a ruler) is sufficient (unless the question specifically asked for a line of best fit).
- Lines must not be extrapolated, unless specifically asked for in the question.

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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. Controlled variables must also be considered and included in a plan.

Candidates should also try to match the answers they give with the number of marks available for each part of a question. A three-mark question will require three separate points to be made if full credit is to be awarded.

General comments

Most 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.

Comments on specific questions

Question 1

(a) (i) Most candidates were awarded two marks for this question. The first marking point was for giving two accurate temperatures for hot and cold. The second was for using appropriate units, ºC.

(ii) Many candidates were able to draw a suitable table that accurately represented the data they collected. The most common error was not including units in the heading. Candidates are reminded not to include units in the body of the table.

(iii) The majority of candidates were able to state a valid conclusion based on their results. It was important for them to give a suitable direction to the volume of DCPIP, such as at higher temperatures, a greater volume of DCPIP was used.

(iv) In order to gain the mark, candidates needed to be clear that rinsing was to remove any contamination by vitamin C on the dialysis tubing. Ideas such as cleaning to remove dirt or microbes were not credited.

(v) Most candidates were able to provide appropriate answers. The first error was that as the volumes were not measured, they may contain different volumes of water. To rectify this, they could use a measuring cylinder. More general pieces of equipment, or incorrectly named apparatus, were not accepted. The second error was that the temperature did not remain constant. Simply stating temperature was not credited. To overcome the error, it must be clear the temperature will be maintained and the most effective way to do this is by using a thermostatically controlled water-bath.

(vi) Some candidates find the idea of independent and dependent variables challenging. Most candidates were able to identify temperature as the independent variable. A larger number found it difficult to accurately name the dependent variable.

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(vii) Many candidates gave vague references to accuracy or to calculating an average. By repeating the procedure, anomalous results can be identified and excluded, but not prevented.

(b) This question required candidates to apply their knowledge of osmosis to a dialysis tubing experiment. This involved using a range of different concentrations of sugar solutions and measuring the volume or mass of water that enters or leaves the tubing. The majority of candidates were able to state that at least two different concentrations of sugar solution would be needed. Some of these were stated as volumes rather than concentrations and this was not accepted. Candidates were awarded a mark for using a suitable piece of apparatus to measure the solutions in the tubes, such as a syringe or a measuring cylinder. The majority of candidates were able to name variables that would have to be kept constant, such as temperature and volume of water. Some candidates qualified this by stating that they would use a thermostatically controlled water-bath to maintain the temperature. Fewer candidates were awarded the mark for correctly describing how to measure the dependent variable. The best responses included measuring the difference between the starting and final volume of sugar solution in the dialysis tubing. Some candidates included how to make the data more reliable by repeating it at least two more times.

Question 2

(a) (i) Most candidates were able to draw a suitable outline that was clear and continuous with no shading. Only a small number of candidates drew a shell that was too small. The most challenging part of the drawing was the final detail mark. The bottom part of the shell needed to be drawn curving up so that it touched the top of the shell.

(ii) Almost all candidates were able to accurately measure the line on the diagram and calculate the magnification. The most common error was measuring in cm rather than mm. Some candidates did not express their answers to two significant figures.

(b) There were a wide variety of responses by candidates. The most common similarity between the shells was the spiral shape. Some responses, such as similar shape, were too vague to be credited. For the differences, the most common response was the idea that Fig. 2.1 had a smooth shell, whilst the Fig. 2.2 had a rough shell. Candidates are encouraged to observe the diagrams carefully to make observations based on what is shown.

(c) (i) Many demonstrated that they could accurately draw a histogram. Plotting was generally accurate. When drawing bars, candidates are reminded that they should be the same width. Some scales were even, but difficult to plot, resulting in errors. Candidates should try and use the most appropriate scale for the data and grid provided

(ii) Most candidates were awarded at least one mark on this question. The most common response was to give the most common shell width as being 121–130 mm or the least common shell width as being 101–110 mm. A smaller number where able to describe the trend in the width of the shells.

(iii) Only a small number of candidates were able to suggest why a large number of shells were measured. This is so that a representative sample of the population can be obtained. Answers referring to increasing accuracy or so that averages can be calculated were not credited.

(iv) Most candidates were able to gain full marks for this calculation. Common sources of error were either selecting incorrect data or using the wrong expression. Candidates are encouraged to use calculators to avoid simple calculation errors.

(d) Almost all candidates could name the biuret test as the test for protein with a positive result of purple or mauve. The most common error was to give Benedict's as the name of the test.

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BIOLOGY

Paper 0610/53
Practical Test 53

Key messages

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

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

Candidates should also try to match the answers they give with the number of marks available for each part of a question. A three-mark question will require three separate points to be made if full credit is to be awarded.

Mathematical calculations form an important part of the practical assessment. It is essential that candidates check all of their working carefully and take time to consider whether the resulting answer is realistic.

General comments

Most 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.

Candidates have a reasonable understanding of the requirements for drawing graphs and drawing specimens. The planning question was also answered well.

Comments on specific questions

Question 1

(a) (i) Nearly all candidates were able to record four temperatures. Some gave unrealistic figures for the water temperature. The display of units was often incomplete with many candidates forgetting to include the C or leaving out the ° symbol. Fahrenheit is not an SI unit and should not be used.

(ii) The results tables generally had a suitable arrangement of columns and rows with adequate numbers of measurements. Units should not be written in the body of the table. Occasionally, the units did not match the values shown. The most common error was to leave off the column heading for the independent variable, with hot and cold stated but no indication of what this referred to. Inches should not be used as they are not SI units.

(iii) Most candidates were able to calculate the change in length, but some attempted to use a combination of units. Candidates should ensure that all values are in the same unit before calculating the difference. Some candidates did not use units at all.

(iv) Although most candidates were able to state a conclusion that related to temperature, many simply described the results without drawing a conclusion.

(b) (i) When asked to describe any variable, it is important that sufficient detail is given. Stating type of raisin or number of raisins is ideal but stating that the raisins were the same could be referring to length, which is incorrect. Similarly, water on its own is insufficient as it could refer to volume of water (correct) or temperature of water (incorrect).

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(ii) Most candidates found this question challenging. A few understood that the measurement of a single raisin would have been too small to be accurate and a few identified that a single raisin may well have behaved in an unpredictable manner. A simple statement that using fifteen raisins would make the investigation more accurate is insufficient.

(c) (i) Most candidates correctly stated that the mass of potato was the dependent variable in the investigation. Many gave incomplete answers such as just potato or size, instead of mass of potato.

(ii) The calculation was done well by many candidates, with the correct selection of values and suitable manipulation to calculate percentage change. It is important to understand the difference between decimal places and significant figures.

(iii) The candidates were first asked to draw a graph of percentage change in mass against concentration of sodium chloride solution. Most graphs were well constructed with accurate plotting of points and well labelled axes. As the zero value of concentration was given, this should have been used when plotting the values. A few candidates found the concept of plotting negative values challenging.

Some key points for drawing graphs:

- Labels on the axes should be complete and include units where appropriate. These should match the headings and units in the table. Some candidates forgot to include average from the root length and concentration from the sodium chloride axes.
- Plotted points must be small – a small cross or circled dot is ideal.
- A line of best fit can be a straight line or a curved line. In many cases, joining points with straight lines is sufficient (unless the question specifically asked for a line of best fit).
- Lines must not be extrapolated, unless specifically asked for in the question.

(iv) Estimates from the graph were generally good, but not all candidates indicated on the graph where the estimate was made. It is important that candidates read the entire question carefully.

(v) This question was challenging for a large number of candidates. A few stated correctly that the initial mass of each potato was different, but many simply stated that the potatoes were of different masses.

(vi) Many candidates did not refer to the water adding mass and simply stated that removing the excess water made the investigation more accurate, or not removing it would produce incorrect results.

Question 2

(a) (i) The drawing of the apple section posed few difficulties for most candidates, with some good clear drawings that were of a suitable size. The most common error was the use of shading when drawing the section. Only clear single lines should be used when drawing – even if sections of the specimen appear shaded on the photograph.

(ii) The calculation of the actual width of the apple was answered well with most candidates able to measure the line indicated and substitute this correctly into the given formula. Candidates must ensure that they read the question carefully as some answers were not given as whole numbers.

(b) (i) Most candidates correctly identified the independent variable for this investigation.

(ii) In this question candidates were asked why one value was not included in the average. Many answered this well although some candidates assumed that the value was not included because it would give an incorrect average rather than focusing on the fact that it was anomalous.

(iii) A few candidates were unaware of the correct food test for reducing sugars and many gave incorrect colours for a positive test.

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(c) The planning question asked candidates to plan an investigation into the effect of temperature on enzyme activity. Some of the plans were well thought out and comprehensive with a good range of marks obtained. Most candidates included a reference to a range of temperatures and were able to identify one or more variables that were kept constant.

Some key points to remember:

- there needs to be at least two repeats (three trials in total)
- a method of maintaining the temperature should be included (a water-bath alone is insufficient; it needs to be a thermostatically controlled water-bath)
- measurements need to include a suitable dependent variable, such as the time taken for a colour change, rather than just a stated colour change
- controlled variables need to be relevant to the investigation being planned
- all values given should be precise and terms such as about and amount should be avoided.

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BIOLOGY

Paper 0610/61
Alternative to Practical

Key messages

Candidates must ensure that they read the questions carefully before starting to answer. This is particularly important for planning questions. Identification of the dependent and independent variables is vital before a plan is completed.

It is important that candidates show their workings in the space provided when asked to do a calculation. At each stage of a calculation, the principle of error carried forward applies. Therefore, a candidate can make a mistake and still gain partial credit.

General comments

Many candidates were well prepared for this exam. The majority of table designs, drawings and graphs were of a high standard, demonstrating that candidates had practised these skills.

Comments on specific questions

Question 1

(a) (i) Candidates were asked to construct a table in which to record results of an investigation. Some candidates produced a more complex table than was required and they recorded all the information available, not just the results of the investigation.

The majority of candidates gained a mark for the correct recording of the two end colours obtained with the Benedict's test. Some candidates were not awarded the mark for table construction and relevant headings. The most common error was to give headings for the results that were too vague. Another common error was to give a heading of colour change and then record the end colour only, or alternatively, have a heading of end colour and recording blue to orange.

(ii) Few candidates gave a suitable conclusion. The majority merely restated the results or stated whether reducing sugars were present or absent.

(iii) Most candidates could state two variables which were kept constant during the investigation.

(iv) Some candidates struggled with the reason for the addition of distilled water. Reasons such as to dissolve the rice, to let diffusion occur or to stop the rice burning when heated were common. Stronger responses identified the need for a control experiment, explained the comparison idea or stated that distilled water would not add impurities to other reactants.

(v) The majority of candidates gave incomplete answers, such as the solution would be contaminated, or the investigation would be inaccurate. The question asked for the effect on the results, and very few candidates referred to the probable colour change in **W10**.

(vi) The use of a thermostatically controlled water-bath was given by a significant number of candidates. The question asked for one piece of equipment that could be used to maintain the temperature during the investigation.

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(b) The test for the presence of starch was well-known and many candidates gained both of the available marks. The most common error was for candidates to state the colour of a positive starch test as blue, which is too vague. The colour of a positive starch test is blue-black.

(c) (i) In this question, candidates were shown a graph of amylase activity against temperature and were asked to describe the effect of temperature. Many candidates interpreted the graph correctly, stating the initial increase in amylase activity with increasing temperatures, followed by a decrease in activity after 35 °C. Two common errors were the omission of °C after the number and failure to pinpoint the optimum temperature. A significant number of candidates stated that temperatures above 35 °C denatured the amylase, which does not describe the gradual decrease in activity as shown on the graph.

(ii) Most candidates correctly read the value off the graph and calculated the rate. Those that did not give the correct answer had usually forgotten to divide by 5 to calculate the mass of reducing sugars produced per minute.

(iii) Candidates found this question very demanding. The majority of answers featured repetition of the investigation, identifying anomalies, and taking an average. Others suggested the use of more accurate equipment and doing the procedure more carefully. These suggestions, however, do not determine the precise optimum temperature for amylase activity. This would require limiting the investigation to a narrow temperature range above and below 35 °C, with tests being done, for example, at one-degree intervals.

(d) There were some excellent plans produced which clearly described how to determine the effect of pH on amylase activity. Some candidates made valid points in excess of the six for which marks were available. The most commonly awarded marks were for: testing with at least two different pH values; keeping two variables constant; using Benedict's solution; running at least three trials and using one piece of safety equipment.

Question 2

(a) (i) The drawing of a section of marram grass leaf was done well by most candidates. The drawings were larger than the original, lines were clear, the proportions correct, and sufficient detail was usually shown. The main error was to ignore the instructions and to draw cells. A significant number omitted the vascular bundles. Candidates should be advised to draw with a sharp, but soft pencil. This means that mistakes can be rectified easily and neatly. Blunt pencils produce very thick lines, and these should be avoided as the drawing becomes imprecise.

(ii) Candidates were asked to calculate the actual dimeter of the marram grass leaf, having measured the diameter on a photomicrograph and being given the formula necessary for the calculation. A few candidates measured the line length inaccurately or gave the measurement in centimetres. Most, but not all, did give their answer to one decimal place as instructed.

(b) (i) The outline of an investigation was described, and candidates were asked to identify the independent and dependent variables. This was answered well by the majority of candidates. The most common error for the independent variable was to give the answer sodium chloride solution and omit the necessary word, concentration. For the dependent variable, the most common error was to refer to the growth of the seeds rather than the length of the roots. Some candidates confused the independent and dependent variables.

(ii) Candidates were asked to state two ways in which the investigation had been designed to produce results which were valid and reliable. Very few candidates mentioned that the same species of seed was used. Some candidates thought that having the same number of seeds (15) in each Petri dish was important for reliability, whereas the importance is in having a large number of seeds. The seeds were left for 20 days before the root lengths were measured and some candidates thought that the importance of this was to give sufficient time for growth, whereas the importance was to give all the seeds the same amount of time for growth. A common incorrect answer was that measuring root length with a ruler improved reliability.

(c) (i) Candidates were given a set of results from the investigation and were asked to calculate the percentage decrease in average root length. Candidates generally calculated the correct value. The instruction to give their answer to three significant figures was often ignored.

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(ii) Candidates were asked to plot a line graph for the results of the investigation. Candidates showed good graph-drawing skills, and many gained full marks. Using blunt pencils is undesirable as plot points become too large and lines too thick to be precise. Candidates should use scales that mean plotted data covers at least half of the grid. For this data, drawing a point-to-point line was appropriate.

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BIOLOGY

Paper 0610/62
Alternative to Practical

Key messages

Candidates must ensure that they read the questions carefully before starting to answer. This is particularly important for planning questions. Identification of the dependent and independent variables is vital before a plan is completed. When planning investigations, candidates do not need to describe expected results.

It is important that candidates show their workings in the space provided when asked to do a calculation. At each stage of a calculation, the principle of error carried forward applies. Therefore, a candidate can make a mistake and still gain partial credit.

Questions relating to reasons for repeating a procedure or collecting a large data set often result in vague responses. Candidates should be familiar with these types of question.

General comments

Many candidates achieved high marks with candidates demonstrating good skills throughout the paper.

Questions involving calculations were answered well and most candidates showed a good degree of skill in drawing graphs. Care should be taken when choosing a suitable scale for the graph, so that data points can be plotted easily.

Comments on specific questions

Question 1

(a) (i) The majority of candidates were able to accurately read from the diagram of the thermometers and correctly state the temperatures of the hot and cold water. A mark was also given for units. Some candidates omitted the units, or gave incomplete units such as º or C. Some candidates used ºF which is inappropriate as it is not an SI unit.

(ii) Most candidates correctly recorded the volumes of DCPIP remaining in both syringes. The most common error was to record the volume of DCPIP used, rather than the volume remaining in the syringes.

(iii) Some good tables were drawn with most candidates also correctly calculating and recording the volumes of DCPIP used in each test-tube. Some candidates did not give suitable headings, omitted headings, or put units in the body of the table. Many did not put a heading for test-tube/temperature, and some gave the heading as volume of DCPIP / cm^3 rather than volume of DCPIP used / cm^3.

(iv) Candidates were asked to state a conclusion for the results, and most were able to do so. Some correctly stated that a greater volume of DCPIP was used at a higher temperature, and some related this to the rate of diffusion and stated that more vitamin C diffuses at a higher temperature. A few misinterpreted the results and thought that more DCPIP was used at the lower temperature.

(v) Rinsing the dialysis tubing was to remove any vitamin C that had spilled while filling the tubing. Ideas of contamination (by vitamin C) were accepted, but not to clean or to remove dirt, bacteria, or impurities. There were many answers that were too vague and could not be credited. Some candidates incorrectly thought that the bag was rinsed to aid diffusion.

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(vi) Many candidates were able to identify the error and suggest suitable equipment to overcome the error. Some correctly realised that the volume of water in the test-tubes was not measured. Some had difficultly naming a suitable piece of equipment for measure volume. Use of a beaker, pipette or measuring cup could not be credited. Using a measuring cylinder, graduated pipette or burette was accepted.

Suggesting that the temperature was not controlled and using a thermostatically controlled water-bath (or insulating the test-tubes) was accepted as an alternative answer. Use of a water-bath unqualified, was insufficient.

(vii) The independent variable was usually correctly identified as temperature. However, many candidates struggled to identify the dependent variable as the volume of DCPIP. The rate of diffusion and volume of vitamin C were incorrect but sometimes seen. Some candidates confused the independent and dependent variables.

(viii) The procedure was repeated so that anomalous results could be identified and then excluded when analysing results. Most candidates were not able to articulate this idea. Answers referring to increasing accuracy, validity, reliability, or to calculate an average were not credited. Answers suggesting that repeating prevents anomalous results were also not credited.

(b) Candidates should be familiar with practicals to investigate the effects of immersing plant tissues (in this case a dialysis tubing bag to represent plant tissues), in different concentrations of sugar solution. Some good methods were described with many candidates correctly describing several appropriate constant variables as well as a suitable investigation to obtain results. Some candidates described using at least two different concentrations of sugar solution, but then proceeded to describe using different volumes of sugar solution instead. For the method marks, the use of a syringe for measuring volume was frequently seen as was a thermostatically controlled water-bath and to a lesser extent, a description of how to make up the sugar concentrations. The dependent variable mark was the least commonly scored as many did not make it clear that volumes/mass should be measured before and after. The majority of candidates knew that an investigation should be repeated numerous times. A few candidates did not describe an investigation but instead gave a theoretical answer about osmosis. Many candidates described general laboratory safety procedures, but credit was not given for these as they were not relevant to the methods outlined.

Question 2

(a) (i) The shell should have been drawn with a clear and continuous outline, with no shading. Use of shading in the stripes or the stripes extending beyond the outline was the most common reason for the first marking point not being awarded. Also, use of a compass meant the mark could not be awarded. Nearly all drawings were a suitable size, i.e., larger than the photograph in Fig. 2.1. Most included stripes as part of the detail. The shell should have been drawn with the bottom part of the shell curving around to meet the top part, to leave a central hole visible. This was less accurately drawn by some, with the bottom section not meeting the top part or the central hole being omitted.

(ii) Nearly all candidates correctly measured the length of line **AB** and used their answer to calculate the magnification, giving their answer to two significant figures. The most common mistake was to give their measurement in centimetres rather than millimetres. Error carried forward (**ecf**) was given subsequently for this error. Some also made mistakes when giving their answer to two significant figures or giving the unit for magnification.

(b) Many different responses were given for this question, but some were too vague to be awarded a mark. The most common correct responses were the similar spiral shape for both shells and that the shell in Fig. 2.1 had a smooth surface compared to the rough surface of the shell in Fig. 2.2. References to both shells having similar shapes/being circular, or different textures were insufficient. Candidates should have the opportunity to familiarise themselves with appropriate biological terminology when describing structures so that they can express their ideas clearly and concisely.

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(c) (i) Most candidates drew histograms, labelling the axes correctly, with even scales and correct plotting. Some scales were even, but difficult to plot, resulting in errors. Candidates should try and use the most appropriate scale for the data and grid provided. In this case, 10 small divisions on the *y*-axis as 20 shells was a sensible choice.

If a zero is placed at the origin, care should be taken if to make it clear if this applies to one axis or both. Those that chose a linear scale for the *x*-axis, rather than categories of width, sometimes did not make their scale linear from the origin or had bars of different widths.

(ii) The most common answer given was to state that the most common shell width was 121–130 mm and/or the least common was 101–110 mm. Few went on to describe any other trends from the results, such as a description of the normal distribution observed. Some did describe the increase and decrease in the number of shells but made no reference to the width of the shells.

(iii) Few candidates were able to suggest why a large number of shells were measured. This is so that a representative sample of the population can be obtained. Answers referring to increasing accuracy or so that averages can be calculated were not credited.

(iv) The majority of candidates were able to select the correct data, calculate a percentage and give their answer to one decimal place. A few either selected incorrect data or used the wrong expression.

(d) Nearly all candidates could name the biuret test as the test for protein with a positive test result of purple or mauve. The most common error was to give Benedict's as the name of the test.

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BIOLOGY

Paper 0610/63
Alternative to Practical

Key messages

Candidates must 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.

Mathematical calculations form an important part of the practical assessment. It is essential that candidates check all of their working carefully and take time to consider whether the resulting answer is realistic.

General comments

Many candidates were well prepared for this exam. The majority of table designs, drawings and graphs were of a high standard, demonstrating that candidates had practiced these skills.

Comments on specific questions

Question 1

(a) (i) Nearly all candidates could read the temperatures from the diagram of two thermometers. The recording of units was not well done with many candidates forgetting to include the C or leaving out the ° symbol. Some candidates used ºF which is inappropriate as it is not an SI unit.

(ii) The results tables were generally very good with suitable arrangement of columns and rows and adequate numbers of measurements. Units should not be written in the body of the table. Occasionally the units did not match the values shown. The most common error was to omit the column heading for the independent variable, with hot and cold stated but no indication of what this referred to. Inches should not be used as they are not SI units.

(iii) Most candidates were able to calculate the change in length, but some attempted to use a combination of units. All values should be in the same units before calculating the change in length.

(iv) Although most candidates were able to state a conclusion that related to temperature, many simply described the results without drawing a conclusion.

(b) (i) When asked to describe any variable, it is important that sufficient detail is given. Stating type of raisin or number of raisins is ideal but stating that the raisins were the same could be referring to length, which is incorrect. Similarly, water on its own is insufficient as it could refer to volume of water (correct) or temperature of water (incorrect).

(ii) Most candidates found this question challenging. A few understood that the measurement of a single raisin would have been too small to be accurate and a few identified that a single raisin may well have behaved in an unpredictable manner. A simple statement that using fifteen raisins would make the investigation more accurate is insufficient.

(c) (i) Most candidates correctly stated that the mass of potato was the dependent variable in the investigation. Many gave incomplete answers such as just potato or size, instead of mass of potato.

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(ii) The calculation was done well by many candidates, with the correct selection of values and suitable manipulation to calculate the percentage change. It is important to understand the difference between decimal places and significant figures.

(iii) The candidates were first asked to draw a graph of percentage change in mass against concentration of sodium chloride solution. Most graphs were well constructed with accurate plotting of points and well labelled axes. As the zero value of concentration was given, this should have been used when plotting the values. A few candidates found the concept of plotting negative values challenging.

Some key points for drawing graphs:

- Labels on the axes should be complete and include units where appropriate. These should match the headings and units in the table. Some candidates forgot to include average from the root length and concentration from the sodium chloride axis.
- Plotted points must be small – a small cross or circled dot is ideal.
- A line of best fit can be a straight line or a curved line. In many cases, joining plotted points with ruled straight lines is sufficient (unless the question specifically asked for a line of best fit).
- Lines must not be extrapolated, unless specifically asked for in the question.

(iv) Estimates from the graph were generally good, but not all candidates indicated on the graph where the estimate was made. It is important that candidates read the entire question carefully.

(v) This question was challenging for some candidates. A few stated correctly that the initial mass of each potato was different, but many simply stated that the potatoes were of different masses.

(vi) Many candidates did not refer to the water adding mass and simply stated that removing the excess water made the investigation more accurate, or not removing it would produce incorrect results.

Question 2

(a) (i) The drawing of the apple section posed few difficulties for most candidates, with some good clear images that were of a suitable size. The most common error was the use of shading when drawing the section. Only clear single lines should be used when drawing – even if sections of the specimen appear shaded on the photograph.

(ii) The calculation of the actual width of the apple was answered well with most candidates able to measure the line indicated and substitute this correctly into the given formula. Candidates must ensure that they read the question carefully as some answers were not given as whole numbers.

(b) (i) Most candidates correctly identified the independent variable for this investigation.

(ii) In this question candidates were asked why one value was not included in the average. Many answered this well although some candidates assumed that the value was not included because it would give an incorrect average rather than focusing on the fact that it was anomalous.

(iii) A few candidates were unaware of the correct food test for reducing sugars and many gave incorrect colours for a positive test.

(c) The planning question asked candidates to plan an investigation into the effect of temperature on enzyme activity. Some of the plans were well thought out and comprehensive with a good range of marks obtained. Most candidates included a reference to a range of temperatures and were able to identify one or more variables that were kept constant.

Some key points to remember:

- there needs to be at least two repeats (three trials in total)
- a method of maintaining the temperature should be included (a water-bath alone is insufficient; it needs to be a thermostatically controlled water-bath)
- measurements need to include a suitable dependent variable, such as the time taken for a colour change, rather than just a stated colour change
- controlled variables need to be relevant to the investigation being planned
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