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BIOLOGY

Paper 0610/11
Multiple Choice (Core)

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

General comments

There was good understanding of: the characteristics of living things; white blood cells being the component of blood that produces antibodies; what is a transmissible disease; the role of testosterone; the sequence of events when a woman gives birth; the process that produces carbon dioxide from factories and cars, and the water cycle.

There was some uncertainty about: the characteristics of myriapods; levels of organisation; the features of osmosis; the stages of human nutrition; the features of a vein; the retina being the part of the eye that contains cells that are sensitive to light, and the features of mitosis.

It is important for candidates to work methodically through the information provided in the question, particularly those containing diagrams, such as **Questions 8, 10** and **22**.

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Comments on specific questions

Question 3

The majority of candidates appreciated that the arthropod in the diagram was a myriapod. Option C, insect, was the commonest incorrect response.

Question 4

Many candidates appreciated that the presence of a cell wall and chloroplasts meant that the cell was a plant cell. Some candidates incorrectly opted for the chloroplasts and cell membrane but the cell membrane would be found in both plant and animal cells.

Question 5

This proved to be a demanding question with few candidates appreciating the level of organisation of an ovum and an ovary. The ovum is a cell and the ovary is an organ.

Question 6

Many candidates understood the correct method for working out the actual diameter of the cell. Candidates would benefit from being able to recall and apply the formula for calculating magnification.

Question 7

Most candidates appreciated that in osmosis, diffusion is involved and a partially permeable membrane is required. Some candidates incorrectly believed that cell walls are required for osmosis to occur.

Question 8

This proved to be a very demanding question. Osmosis would cause water to pass through the partially permeable membrane of both pieces of apparatus and so the liquid level in both tubes would rise.

Question 9

Most candidates knew that cellulose, glycogen and starch are the substances made by linking glucose molecules together. Some candidates incorrectly opted for starch, fats and oils.

Question 10

This proved to be a very demanding question. To select the correct option, candidates were required to work through the information on the graph and determine which statement was correct. A methodical approach allowed successful candidates to select option **D**.

Question 11

Many candidates correctly recalled that enzymes are proteins. Some candidates incorrectly believed that enzymes are made of glucose.

Question 12

There was some uncertainty as to whether the answer was photosynthesis or respiration. Photosynthesis in the spiral-shaped chloroplasts releases oxygen and that oxygen attracts the bacteria.

Question 13

Some candidates found this question challenging with few correctly identifying the spongy mesophyll and the upper epidermis.

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Question 14

This proved to be a demanding question. Many candidates did not know that assimilation is the stage of nutrition taking place when food molecules become part of a body cell.

Question 15

Only a small proportion of candidates identified the definition of chemical digestion, that is, large insoluble molecules are changed into smaller soluble molecules.

Question 17

While most candidates understood that water first enters root hair cells, many candidates were uncertain as to whether water then progresses to the xylem or to the mesophyll.

Question 18

Many candidates were uncertain of the name and function of the tissue labelled X. The tissue was the xylem and therefore the function is the transport of water and mineral ions.

Question 19

The features of a vein do not appear to be well known.

Question 22

Many candidates correctly identified where the carbon dioxide concentration was the highest.

Question 23

It was not widely known which processes in the human body require energy from respiration.

Question 24

There was some uncertainty by candidates as to whether the amount of urea in the blood increases as it passes through the liver or the kidney. The liver is responsible for producing urea from excess amino acids whereas the kidneys are responsible for removing urea from the blood.

Question 26

Only a minority of candidates correctly identified the retina as containing cells that are sensitive to light.

Question 31

Many candidates appreciated that both the condom and the diaphragm are barrier methods of birth control. However, some candidates were not aware that the diaphragm is also a barrier method and therefore selected option **C**.

Question 32

Some candidates did not appreciate that the probability of a couple's next child being a girl is always 50% regardless of the sex of other children.

Question 34

Many candidates understood that height in humans is best described as continuous variation resulting in a range of phenotypes. However, other candidates were uncertain showing that they did not fully understand the meaning of continuous and discontinuous variation.

Question 39

Many candidates correctly selected option **C**, but a minority believed that carbon dioxide is used in the making of biofuel and ethanol is used in bread making.

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BIOLOGY

Paper 0610/12
Multiple Choice (Core)

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

General comments

There was good understanding of: the characteristics of living things; the type of organisms that cause tooth decay; what a transmissible disease is, and the effects of deforestation.

There was some uncertainty about: the functions of phloem; the stages of human nutrition; where urea is produced in the body; the structure that receives the pollen nucleus during fertilisation; what are barrier methods of birth control, and the features of mitosis.

It is important for candidates to work methodically through information provided in questions, such as **Questions 8**, **10**, **12**, **22**, **37** and **40**.

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Comments on specific questions

Question 6

Many candidates understood the correct method for working out the actual diameter of the cell. Candidates would benefit from being able to recall and apply the formula for calculating magnification.

Question 7

Most candidates knew that diffusion is involved and that a partially permeable membrane is required for osmosis to occur. Some candidates incorrectly thought that cell walls were required for osmosis to occur.

Question 8

This proved to be a very demanding question. Osmosis would cause water to pass through the partially permeable membrane of both pieces of apparatus and so the liquid level in both tubes would rise.

Question 10

This proved to be a very demanding question. To select the correct option, candidates were required to work through the information on the graph and determine which statement was correct. A methodical approach allowed successful candidates to select option **D**.

Question 12

There was some uncertainty as to whether the answer was photosynthesis or respiration. Photosynthesis in the spiral-shaped chloroplasts releases oxygen and that oxygen attracts the bacteria.

Question 13

Many candidates appreciated that nitrates are required to make amino acids which can then be used to make proteins. Starch was a common incorrect response.

Question 14

Many candidates did not know that assimilation is the stage of nutrition taking place when food molecules become part of a body cell. The most common incorrect answer was **A**, absorption.

Question 15

This was a demanding question with successful candidates being able to identify absorption and digestion as the two processes represented by the experiment.

Question 17

Whilst most candidates understood that water first enters root hair cells, many candidates were uncertain whether water then progresses to the xylem or to the mesophyll. The correct route was root hair to xylem to mesophyll.

Question 18

Most candidates incorrectly believed that a function of phloem is to transport minerals to the roots.

Question 22

Many candidates correctly identified where the carbon dioxide concentration was the highest.

Question 24

Many candidates incorrectly thought that the amount of urea in the blood increases as it passes through the kidneys. The liver is responsible for producing urea from excess amino acids whereas the kidneys are responsible for removing urea from the blood.

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Question 25

There was some uncertainty in the location of relay neurones. Few candidates could recall that relay neurones are located in the spinal cord.

Question 27

Many candidates successfully selected option **D**. Candidates were uncertain as to the effect of adrenaline on the size of the pupils and therefore option **C** was frequently selected. Adrenaline increases the size of the pupils.

Question 29

There was uncertainty by many candidates about the part of the flower that receives the pollen nucleus during fertilisation. The pollen nucleus is received by the ovule.

Question 31

Many candidates were unaware that the diaphragm is a barrier method of birth control.

Question 32

Many candidates were not aware of the features of mitosis. Perhaps some candidates confused mitosis with meiosis.

Question 36

Interpreting the food web proved to be demanding for some candidates. Successful candidates appreciated that organism L was a decomposer.

Question 37

To be successful, candidates needed to work through the diagram methodically, applying their knowledge of the carbon cycle to the diagram. Plants give out carbon dioxide during respiration and animals ingest plants when feeding.

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BIOLOGY

Paper 0610/13
Multiple Choice (Core)

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

General comments

There was good understanding of: the characteristics of living things; the definition of a drug; the parts of a flower; knowing that the condom is a method of birth control that also helps to protect against HIV; the carbon cycle; food webs, and what is involved in genetic engineering.

There was some uncertainty about: the stages of human nutrition; where urea is produced, and the difference between a ureter and the urethra.

It is important for candidates to work methodically through information provided in questions, such as in **Questions 8**, **10**, **12**, **22**, **33** and **35**.

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Comments on specific questions

Question 3

Many candidates appreciated that chloroplasts are a feature of plant cells.

Question 7

Most candidates appreciated that in osmosis, diffusion is involved and a partially permeable membrane is required. Some candidates incorrectly believed that cell walls are required for osmosis to occur.

Question 8

This proved to be a very demanding question. Osmosis would cause water to pass through the partially permeable membrane of both pieces of apparatus and so the liquid level in both tubes would rise.

Question 12

There was some uncertainty as to whether the answer was photosynthesis or respiration. Photosynthesis in the spiral-shaped chloroplasts releases oxygen and that oxygen attracts the bacteria.

Question 14

This proved to be a demanding question. Many candidates did not know that assimilation is the stage of nutrition taking place when food molecules become part of a body cell. The most common incorrect answer was absorption.

Question 15

Many candidates knew that the gall bladder stores bile and could identify the gall bladder on the diagram. Some candidates incorrectly selected option **B**, the pancreas.

Question 17

While most candidates understood that water first enters root hair cells, many candidates were uncertain whether water then progresses to the xylem or to the mesophyll. The correct route was root hair to xylem to mesophyll.

Question 18

While many candidates appreciated that a decrease in humidity normally causes the transpiration rate to increase, some candidates incorrectly opted for a decrease in temperature.

Question 22

Many candidates correctly identified where the carbon dioxide concentration was the highest.

Question 23

Many candidates correctly selected option **B**, alcohol and carbon dioxide only, as the products of anaerobic respiration in yeast. Option **A** was the commonest incorrect response.

Question 24

There was some uncertainty by candidates whether the amount of urea in the blood increases as it passes through the liver or the kidney. The liver is responsible for producing urea from excess amino acids whereas the kidneys are responsible for removing urea from the blood.

Question 25

Most candidates gave the correct response. Some confused sensory neurones with motor neurones and therefore incorrectly selected option **A**, the brain and spinal cord to muscles.

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Question 26

This proved to be a demanding question with uncertainty as to the function of the cornea. The function of the cornea is to refract light.

Question 27

Many candidates correctly selected option **C** but some candidates incorrectly believed that roots grow away from the stimulus of gravity and towards the stimulus of light.

Question 30

Many candidates correctly identified the names of the specified parts of the human male reproductive system. Some candidates confused the urethra and the ureter.

Question 32

Many candidates appreciated that nuclear division to produce genetically identical cells is mitosis. Some candidates selected option **C**, meiosis, highlighting the importance of understanding the differences between mitosis and meiosis.

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BIOLOGY

Paper 0610/21
Multiple Choice (Extended)

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

General comments

There was good understanding of: the characteristics of living things; the role of adrenaline; the features of asexual reproduction and the terms used to describe the phases of growth in a population.

There was some uncertainty about: the leaf structure of dicotyledonous plants; the stages of human digestion; identifying xylem in a cross-section through a plant stem; the features of a vein and the reasons why bacteria are often useful in biotechnology.

It is important for candidates to work methodically through the information provided, such as in **Questions 4**, **6**, **20**, **30**, **35** and **39**.

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Comments on specific questions

Question 2

There was some uncertainty as to whether dicotyledons have broad leaves and parallel veins. Dicotyledons have broad leaves and branched veins, not parallel.

Question 4

Candidates would benefit from being able to recall and apply the formula for calculating magnification. Candidates need to work carefully when converting units.

Question 5

Most candidates appreciated that in osmosis, diffusion is involved and a partially permeable membrane is required. Some candidates incorrectly believed that cell walls are required for osmosis to occur.

Question 6

This proved to be a demanding question. Osmosis would cause water to pass through the partially permeable membrane of both pieces of apparatus and so the liquid level in both tubes would rise. Some candidates incorrectly believed that the liquid level in tube 1 would fall.

Question 10

Many candidates correctly selected option **D**, the substrate is less likely to fit into the active site. A number incorrectly believed that the heat had killed the enzyme. Heat can denature enzymes but it cannot kill them.

Question 11

Many candidates appreciated that carbon dioxide was the limiting factor, but some incorrectly believed that light intensity was limiting.

Question 13

This proved to be a demanding question. Many candidates did not know that assimilation is the stage of nutrition taking place when food molecules become part of a body cell.

Question 14

Many candidates appreciated that during chemical digestion, large insoluble molecules are changed into smaller soluble molecules. Some candidates incorrectly thought that large soluble molecules are changed into smaller soluble molecules, perhaps reading too quickly and missing the importance of the terms insoluble and soluble.

Question 15

While most candidates understood that water first enters root hair cells, some candidates were uncertain whether water then progresses to the xylem or to the mesophyll.

Question 16

Many candidates correctly identified the xylem and were aware that the xylem transports water and minerals. Some candidates though incorrectly believed that the tissue was the phloem.

Question 17

The features of a vein do not appear to be well known.

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Question 18

Many candidates correctly identified the heart and veins as the sites where valves are found. Some candidates incorrectly identified capillaries as having valves.

Question 19

Many candidates appreciated that the sequence of amino acids in antibodies enables them to bind to a specific antigen. Some candidates though, incorrectly believed that it allowed them to bind to all pathogens.

Question 20

Many candidates correctly identified where the carbon dioxide concentration was the highest.

Question 21

The processes in the human body that require energy from respiration were well known.

Question 22

Many candidates did not appreciate the relationship between the concentration of urea in the blood and the effect the liver and kidneys have on this concentration. The liver is responsible for producing urea from excess amino acids so blood entering the liver will have a lowest concentration of urea. The kidneys are responsible for removing urea from the blood so blood entering the kidneys will have the highest concentration of urea.

Question 24

Only a minority of candidates correctly identified the retina as containing cells that are sensitive to light.

Question 26

Many candidates correctly selected option **A**, arterioles dilate and hair erector muscles relax. Some candidates incorrectly believed that when the environment is hot, the hair erector muscles contract.

Question 28

Some candidates did not appreciate that pollen transferred from the anther to the stigma of a different flower on the same plant is self-pollination.

Question 29

Many candidates correctly selected option **A**, although some candidates incorrectly believed that male gametes have a jelly coat.

Question 31

Many candidates could recall that during meiosis a diploid cell divides to form haploid cells. A few candidates confused the terms haploid and diploid and therefore thought that during meiosis a haploid cell divides to form diploid cells.

Question 32

Many candidates did not appreciate that red-green colour blindness is a sex-linked characteristic.

Question 33

Many candidates understood that the allele for sickle-cell anaemia is commonly found in human populations in certain parts of the world because it protects people against malaria. Some candidates incorrectly believed that the allele is transmitted by mosquitoes.

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Question 35

This was a demanding question and required candidates to work methodically through the information given in the question. Firstly, candidates were required to identify squirrels and shrews as the primary consumers. Secondly, the number of each organism had to be multiplied by the average mass for that organism to calculate the biomass for that organism. Finally, the biomass of squirrels and shrews had to be added together.

Question 36

Many candidates correctly selected option **A**, but some confused the processes of denitrification and nitrogen fixation.

Question 38

The reasons why bacteria are often useful in biotechnology were not well understood. Bacteria do not have a nucleus so statement three had to be incorrect, and therefore, only option **A** could be correct.

Question 40

Many candidates appreciated that the method that would make the biggest improvement in the conservation of tuna fish stocks is the introduction of fishing quotas.

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BIOLOGY

Paper 0610/22
Multiple Choice (Extended)

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

General comments

There was good understanding of: the function of valves in the circulatory system; the product of anaerobic respiration in muscles; how the concentrations of glucose and urea in urine compare to their concentrations in blood plasma and the fact that a person's blood group is not affected by the environment.

There was some uncertainty about: which component of the blood produces antibodies; the distinction between active and passive immunity; the fact that the hormone progesterone is used in contraceptive pills, and the role of nitrifying bacteria.

It is important for candidates to work methodically through information provided, such as in **Questions 4**, **6**, **9**, **20**, **32**, **33** and **37**.

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Comments on specific questions

Question 2

There was some uncertainty as to whether dicotyledons have broad leaves and parallel veins. Dicotyledons have broad leaves and branched veins, not parallel.

Question 4

Candidates would benefit from being able to recall and apply the formula for calculating magnification. Candidates need to work carefully when converting units.

Question 6

This proved to be a demanding question. Osmosis would cause water to pass through the partially permeable membrane of both pieces of apparatus and so the liquid level in both tubes would rise. Some candidates incorrectly believed that the liquid level in tube 1 would fall.

Question 10

Many candidates correctly selected option **D**, the substrate is less likely to fit into the active site. A number incorrectly believed that the heat had killed the enzyme. Enzymes are not living things and therefore cannot be killed. Heat can denature enzymes but it cannot kill them.

Question 13

This proved to be a demanding question. Many candidates did not know that assimilation is the stage of nutrition taking place when food molecules become part of a body cell.

Question 16

There was some uncertainty about the function of the phloem, with some candidates incorrectly believing that it transports starch to the roots. Starch is insoluble and therefore is not transported.

Question 18

Many candidates were uncertain about which component of the blood produces antibodies. Most candidates incorrectly selected option **A**, the phagocyte. Successful candidates selected option **B**, the lymphocyte.

Question 19

The distinction between active and passive immunity was not well understood. Candidates would benefit from having a clear understanding of the two terms.

Question 23

Most candidates correctly identified the spinal cord as containing relay neurones, some candidates incorrectly opted for the synapse.

Question 28

There was uncertainty about which hormone is used in contraceptive pills. Candidates would benefit from being able to recall the roles of the hormones named in the syllabus.

Question 29

Many candidates appreciated that oestrogen causes the lining of the uterus to become thick and glandular before ovulation. Some candidates incorrectly opted for progesterone. Progesterone helps to maintain the lining of the uterus in preparation for implantation.

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Question 30

Many candidates correctly identified the diagram that represents nuclear division of skin cells for growth and repair. Some candidates incorrectly selected option **A**, which shows a diploid cell dividing to produce haploid cells. Candidates would benefit from having a clear understanding of mitosis and meiosis.

Question 32

Many candidates appreciated that the expected result of the test cross, if the black guinea pig was heterozygous, would be 50% black and 50% white. Some candidates incorrectly believed that the expected result would be 100% black. Maybe they did not recall that in a test cross, one parent is always homozygous recessive.

Question 36

There was some uncertainty about the role of nitrifying bacteria. Nitrifying bacteria convert ammonia to nitrates.

Question 40

There was some uncertainty about the possible effect of female hormones as a pollutant of water courses. Some candidates incorrectly believed that the hormones decreased the amount of oxygen for fish.

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BIOLOGY

Paper 0610/23
Multiple Choice (Extended)

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

General comments

There was good understanding of: the characteristics of living things; osmosis; base pairing in DNA; the role of valves in the circulatory system; passive immunity; the features of meiosis; how bacteria are used to make insulin, and the process of eutrophication.

There was some uncertainty about: the effects of vasodilation, and what a length of DNA codes for.

It is important for candidates to work methodically through information provided, such as in **Questions 1**, **4**, **6**, **9**, **36** and **40**.

Comments on specific questions

Question 2

There was some uncertainty as to whether dicotyledons have broad leaves and parallel veins. Dicotyledons have broad leaves and branched veins, not parallel.

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Question 4

Candidates would benefit from being able to recall and apply the formula for calculating magnification. Candidates need to work carefully when converting units.

Question 10

Many candidates correctly selected option **D**, the substrate is less likely to fit into the active site. A number incorrectly believed that the heat had killed the enzyme. Enzymes are not living things and therefore cannot be killed. Heat can denature enzymes but it cannot kill them.

Question 13

Some candidates did not know that assimilation is the stage of nutrition taking place when food molecules become part of a body cell. Some candidates incorrectly selected option **A**, absorption.

Question 15

Whilst most candidates understood that water first enters root hair cells, many candidates were uncertain whether water then progresses to the xylem or to the mesophyll.

Question 22

Many candidates appreciated that urea is produced following deamination of amino acids but some candidates incorrectly thought that deamination is the conversion of amino acids to proteins.

Question 24

Many candidates knew that the function of the cornea is to refract light. Some candidates incorrectly thought that the cornea contains light-sensitive receptors or controls how much light enters the eye.

Question 25

This question proved to be demanding and many candidates did not understand the effects of vasodilation. If the blood vessel at position X dilates the blood flow at position Y and Z must increase.

Question 26

While many candidates correctly selected option **D**, some candidates did not appreciate that both anabolic steroids and testosterone can be misused to improve athletic performance.

Question 29

Many candidates appreciated that FSH stimulates the production of a large number of eggs for use during *in vitro* fertilisation (IVF).

Question 30

This was a demanding question. Many candidates did not appreciate that a length of DNA codes for a protein and that lipase is an enzyme and must therefore be a protein.

Question 32

The inheritance of red-green colour blindness was not well understood. Many candidates did not appreciate that the gene for red-green colour blindness is located on the X chromosome.

Question 33

Many candidates determined the correct answer and selected option **A**. It is important that candidates work methodically through this kind of problem. Drawing a Punnett square would be an ideal approach.

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Question 34

Many candidates correctly selected option **C**, although some candidates were uncertain about how artificial selection differs from natural selection.

Question 37

Many candidates appreciated that the function of X was to maintain an even temperature inside the fermenter, but some candidates incorrectly believed that the role of X was to sterilise the contents of the fermenter.

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BIOLOGY

Paper 0610/31
Theory (Core)

Key messages

Candidates would benefit from reading the questions carefully, as they often contain specific information that must be used in the answer. In addition, the question may give instructions, such as 'state **two**' or draw **three** lines', and these instructions must be followed if full marks are to be awarded.

The number of marks available often indicates the number of separate points that a candidate needs to make if they are to be awarded full marks.

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 data should be used in the description given. Many candidates can do this effectively. An explanation requires more than just a description. Candidates should be encouraged to practise the difference between 'explain' and 'describe'.

Comments on specific questions

Question 1

(a) Many candidates labelled three structures correctly. Some candidates drew a line that did not touch the nucleus, so in effect were labelling the cytoplasm. Label lines must clearly touch the structure being labelled. Some labelled the cell membrane as the cell wall.

(b) This question was generally well answered. Some candidates stated mitochondria and chlorophyll which could not be credited.

Question 2

(a) Most candidates were awarded one mark. Some stated the number of legs but omitted to state that the legs were jointed.

(b) Candidates who knew the term genus gave the correct answer of *Homarus*. Incorrect answers included lobster, crustacean and americanus.

(c) Candidates incorrectly gave common names of arthropods instead of the scientific group names. Arachnids, insects and myriapods were the required groups.

(d) Most candidates were awarded marks with the most common correct answers being about pollution, overfishing and disease. Stronger responses included climate change and its effects on seas and oceans.

Question 3

(a) (i) Almost all candidates correctly identified country A as having the greatest number of adults infected with HIV/AIDS.

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(ii) Many candidates correctly calculated the percentage. Some candidates put the decimal point in the wrong place but could still be awarded partial credit for showing their working.

(iii) This question proved challenging. Many candidates did not know that antibiotics affect bacteria, not viruses, and that HIV is caused by a virus.

(b) This question was well answered and candidates clearly understood how pathogens are transmitted.

(c) Linking examples of body defences and types of defence proved challenging for many candidates. The fact that antibody production and phagocytosis are responses by cells proved to be the most demanding aspect of the question.

(d) (i) Most candidates correctly ticked scurvy and obesity but cholera was a common incorrect answer.

(ii) Some candidates did not read the question carefully enough and stated symptoms of coronary heart disease rather than risk factors.

Question 4

(a) (i) Most candidates clearly described the results as the shoot growing towards the light.

(ii) Very few candidates knew that the response to light was phototropism.

(iii) The idea of getting more light was stated by many candidates but the question asked for an explanation and very few went on to explain that the light was used for photosynthesis.

(b) (i) Few candidates provided a detailed definition of active transport. Stronger responses defined active transport as the movement of substances through a membrane, against a concentration gradient, using the energy released by respiration.

(ii) Many candidates found this question challenging. For magnesium ions, candidates frequently wrote growth rather than specifying that it is needed to make chlorophyll. Generic answers, such as growth, are rarely specific enough to be awarded a mark.

(c) Many candidates gave generic answers rather than stating specific uses of water, such as photosynthesis, support, transport or to act as a solvent.

Question 5

(a) This question was well answered. Candidates clearly understood the data and could interpret the information on the graph.

(b) Many candidates successfully read the data from the graph and calculated the increase in percentage of glass recycled.

Question 6

(a) (i) Most candidates gave the correct pH but not all could give a reason for choosing this pH.

(ii) Many candidates understood that pectinase is an enzyme and therefore any factor that affects enzymes would also affect pectinase. Concentration and temperature were common correct answers.

(b) Candidates were asked to draw three lines. Some did not follow the instructions and drew four lines, consequently one was wrong and they could not be awarded maximum marks.

(c) This was a demanding question and few candidates could name a correct use of enzymes in biotechnology.

(d) Most candidates could name at least one digestive enzyme, not all could name two.

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Question 7

(a) (i) Most candidates were aware of which structure attracts insects but the structures that produce and receive pollen were often confused.

(ii) Successful candidates drew and labelled a line to the ovule.

(iii) Structure **E**, the sepal, was known by most candidates.

(b) Some candidates found this question challenging and many wrote about the differences between wind and insect pollinated flowers, rather than the differences in their pollen.

(c) Many candidates knew that the answer was zygote.

(d) The fact that both sexual and asexual reproduction result in more of the same kind of organism was not well understood.

Question 8

(a) Many candidates successfully completed the Punnett square and were awarded full marks.

(b) Many candidates knew that the chance of the baby being male was 50%.

(c) Few candidates could name the nucleus as the structure in a gamete that contains chromosomes.

(d) (i) Most candidates correctly read 28 °C from the graph.

(ii) Candidates found this question challenging. Many candidates wrote general statements that could not be awarded marks. Stronger responses included the trend, noted specific points such as the steep increase at 29 °C and provided a comparative data quote with appropriate units. Some candidates attempted to explain the data but the question asked for a description, not an explanation.

Question 9

(a) Most candidates described some negative impacts of intensive livestock production with pollution, disease and animal welfare being the commonest answers. Stronger responses described the spread of pathogens, disturbance of food chains and a reduction in biodiversity.

(b) The term sustainable resource was not well understood by many candidates. A sustainable resource is one which is produced as rapidly as it is used, so that it does not run out for future generations.

(c) In order to gain this mark, two correct answers had to be circled. Many candidates circled one correct answer but few circled two. This highlights the importance of reading the question carefully and following the instructions.

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BIOLOGY

Paper 0610/32
Theory (Core)

Key messages

Candidates would benefit from reading the questions carefully, as they often contain specific information that must be used in the answer. In addition, the question may give instructions, such as 'state **two**' or draw **three** lines', and these instructions must be followed if full marks are to be awarded.

The number of marks available often indicates the number of separate points that a candidate needs to make if they are to be awarded full marks.

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 data should be used in the description given. Many candidates can do this effectively. An explanation requires more than just a description. Candidates should be encouraged to practise the difference between 'explain' and 'describe'.

Comments on specific questions

Question 1

(a) Many candidates were awarded maximum marks with reproduction and respiration being the commonest answers. Some candidates did not carefully read the question and included movement and/or nutrition in their list. Another common error was to refer to breathing instead of respiration.

(b) Some candidates incorrectly named the group as gorilla or vertebrate, rather than the scientific group, mammals. A few candidates stated external ears as a correct feature but many named features that were not visible, such as warm blooded, give birth to live young and produce milk. Some candidates had used the figure to see a visible feature and stated that they walked on all four limbs but did not appreciate that this is not a characteristic feature of the group.

(c) Most candidates could state at least one other group of vertebrates with reptiles being the most frequently seen. Some candidates stated invertebrates, such as arthropods and crustaceans. Some candidates did not read the question properly and stated mammals.

Question 2

(a) The majority of the candidates were able to correctly label the structures. Some candidates confused the nucleus and the vacuole. Candidates should be reminded that label lines should finish exactly on the structure being labelled.

(b) (i) Most candidates were able to identify one way in which the cell had changed. Candidates would benefit from using precise explanations, such as the cytoplasm increasing in volume rather than size.

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(ii) The majority of candidates clearly explained that water had entered the cell by osmosis. Few referred to the partially permeable membrane or were able to explain why osmosis had occurred in terms of concentrations inside and outside the cell.

Question 3

(a) There was some uncertainty in linking the components of the diet with their functions. A common error was to link vitamin D with insulation or growth of muscles. The function of calcium ions was the most well-known.

(b) (i) Most candidates identified meat as the type of food with the most fat.

(ii) Most candidates identified white fish as the type of food with no fibre.

(c) Most candidates were aware that fibre can help to prevent constipation. A few candidates mentioned movement through the alimentary canal but often answers were too vague to be credited. Several candidates referred to fibre being needed for muscle/bone development suggesting confusion between muscle fibre and dietary fibre.

(d) (i) Most candidates stated a suitable fruit or vegetable with citrus fruits being the most common. Some candidates incorrectly stated wholemeal bread.

(ii) Scurvy was the correct answer written by most candidates. The most common incorrect answers were kwashiorkor and rickets.

(e) (i) Most candidates successfully added up the energy used, although some omitted the energy used while sleeping.

(ii) Most candidates correctly calculated the percentage of energy used. A common error was to give 24% which suggests candidates divided the energy used while sleeping by 100.

(iii) Some candidates correctly stated respiration but some stated homeostasis, suggesting they did not appreciate the 'release energy' aspect of the question.

Question 4

(a) This question was well answered and candidates clearly understood about human influences on ecosystems. The commonest error was to pick livestock instead of monoculture.

(b) Many candidates successfully named carbon dioxide and methane. Nitrogen was a common incorrect choice.

Question 5

(a) (i) This was a demanding question and candidates found it difficult to work their way through the diagram and count up. Most candidates were able to gain a mark for the herbivores but the primary consumers and carnivores were less well answered. Some candidates just looked at the number of animals on the same printed level rather than at the same feeding level.

(ii) Most candidates correctly identified the bird or the snake. A few gave generic answers, such as primary consumer, and could not be awarded the mark.

(b) Most candidates understood how a change in the population of snakes could affect the populations of other species in the food web.

(c) Candidates found this question challenging. Energy and organic were the required terms.

(d) (i) Most candidates correctly calculated the width of the bar as 8 mm, realising that each organism is represented by a bar of 4 mm.

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(ii) There was some uncertainty about how to draw a pyramid of numbers. Some candidates incorrectly added numerical axes or drew pyramids that were pyramid shaped rather than a series of horizontal bars. Some candidates did not label the organisms on the pyramid.

Question 6

(a) Many candidates were awarded a mark for stating that a drug modifies or changes something but few stated that drugs modify chemical reactions. Many answers focused on the negative effects of misused drugs or the positive effects of medicines, rather than providing a definition.

(b) Most candidates stated that antibiotics are used to treat bacterial infections. Some candidates named a disease, often viral in origin, rather than state bacterial infections.

(c) Candidates found this question demanding and were uncertain of the term bacterial resistance. Many candidates correctly manipulated the data to provide a relevant data quote and some realised that the time to develop resistance was different for each antibiotic. Very few compared the data further by actually describing the differences.

(d) The question asked candidates to name body defences that prevent pathogens from entering the body. Some answers stated the body's second line of defence, e.g. the role of lymphocytes, phagocytes and antibodies, and therefore could not be credited. Some candidates stated hair, but could not be awarded a mark as they did not qualify it by stating hair in the nose. Blood clotting was rarely seen.

Question 7

(a) The oviduct was well known and the cervix the least well known.

(b) Most candidates only drew three lines, indicating they had clearly read the instructions. Most knew that oestrogen is a hormone and that it is produced by the ovaries. Some candidates were not aware that oestrogen causes breasts to grow.

(c) (i) There was a great deal of uncertainty about the events in the menstrual cycle with many not being able to state the days of the events. The date of ovulation was best known. Candidates would benefit from a greater understanding of the menstrual cycle.

(ii) This question proved challenging with few candidates correctly describing the release of hormones. The majority stated changes that occur in the uterus rather than in the ovary.

Question 8

(a) The vast majority of candidates successfully named two products of photosynthesis. Oxygen was the most common correct answer with the most common incorrect answer being carbon dioxide. This suggests candidates focused on the gases involved in photosynthesis rather than the products.

(b) (i) Most candidates clearly explained that an increase in carbon dioxide concentration would increase the rate of photosynthesis. Some candidates were confused by the constant temperature statement in the question and they incorrectly stated that the rate would not increase further.

(ii) Many answers were too vague to be awarded the mark. Light intensity was required, rather than just Sun or light.

(c) Most candidates correctly identified where photosynthesis was occurring, showing their knowledge of chlorophyll and its requirement for photosynthesis. Very few candidates appreciated that respiration occurs in all areas of the leaf. Most incorrect answers thought respiration only occurred in the green area.

(d) Most candidates correctly stated epidermis and palisade with a few stating cuticle. Some candidates incorrectly stated cell structures, such as the cell membrane, chloroplasts and guard cells, rather than cell types or the cuticle. Candidates should take care with spelling, particularly in terms such as palisade and mesophyll. Spelling does not have to be perfect but it does have to be unambiguous.

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(e) (i) Most candidates gained the mark for xylem. A number of incorrect answers included roots and root hair cells.

(ii) There was some confusion over which mineral ion is used to make chlorophyll. Many candidates incorrectly stated a molecule, such as nitrogen, and a few candidates stated chloroplast.

(iii) There was some confusion over which mineral ion is used to make amino acids with few correctly stating nitrate ions. Incorrect answers included protein, protease and nitrogen.

(f) This question was well answered and candidates displayed a good understanding of the carbon and water cycles. With questions requiring a longer answer, candidates should be encouraged to plan their response to ensure their answers are focused on the specific question being asked. Candidates sometimes provide detailed scientific answers which do not answer the question and therefore gain little credit. In this question, some candidates described the water cycle in terms of water run-off and prevention of soil erosion rather than describing plants taking in water via their roots and then losing water to the atmosphere through transpiration.

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BIOLOGY

Paper 0610/33
Theory (Core)

Key messages

Candidates would benefit from reading the questions carefully, as they often contain specific information that must be used in the answer. In addition, the question may give instructions, such as 'state **two**' or draw **three** lines', and these instructions must be followed if full marks are to be awarded.

The number of marks available often indicates the number of separate points that a candidate needs to make if they are to be awarded full marks.

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 data should be used in the description given. Many candidates can do this effectively. An explanation requires more than just a description. Candidates should be encouraged to practise the difference between 'explain' and 'describe'.

Comments on specific questions

Question 1

(a) (i) Many candidates correctly stated both products of photosynthesis although a few confused products with reactants.

(ii) Many candidates correctly named the chloroplasts. Some candidates did not read the question carefully and named a tissue containing chlorophyll, such as the palisade mesophyll.

(b) (i) Most candidates successfully described the change in rate of photosynthesis and many were also able to describe the plateau where a maximum rate is reached.

(ii) Most candidates drew a correct line on the graph, carefully showing a steeper gradient and a higher maximum rate.

(iii) Many candidates realised that for maximum photosynthesis plants would require magnesium ions, water and a warm temperature. Some candidates ticked very low light intensity, possibly realising that light is important but missing the fact that the question stated very low light intensity.

(c) Many candidates had an excellent understanding of the water cycle, with very few confusing transpiration and evaporation.

Question 2

(a) This question was well answered with most candidates closely following the instructions. Candidates that were unable to identify all parts of the diagram were often able to link the parts to the correct functions.

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(b) Although correct methods of birth control were given by most candidates, few noticed that the question asked for barrier methods. This highlights the importance of reading the question very carefully.

Question 3

(a) Most candidates stated that the butterfly was an insect and could name a characteristic feature of the insect group.

(b) (i) Most candidates were able to interpret the information on the graph and identify the red admiral or the clouded yellow.

(ii) Many candidates identified the high brown fritillary as the most vulnerable species; few identified the significance of its habitat having the smallest area.

(iii) There were many comprehensive answers indicating that candidates had a good understanding of conservation techniques. Some candidates found it difficult to apply general conservation ideas to the conservation of butterflies.

Question 4

(a) Many candidates gave clear definitions, stating that homeostasis is the maintenance of a constant internal environment. Some candidates gave vague responses and could not be awarded full credit.

(b) (i) Many candidates found this question challenging and there was a great deal of uncertainty in naming the structures in mammalian skin.

(ii) A common misconception about reducing heat loss was that flattened hair would trap heat, rather than erect hairs trapping a layer of air. Few candidates stated that fatty tissue insulates the body and therefore reduces heat loss.

(iii) This question was well answered and candidates displayed a clear understanding of the maintenance of body temperature.

Question 5

(a) (i) There was a good understanding of the structure and function of blood vessels with only a few confusing artery and vein structures.

(ii) The question asked candidates for one other way in which the structure of a vein is different from an artery. Most candidates repeated structures from the table or referred to blood flow. The presence of valves was the required answer.

(b) (i) Most candidates realised that the process using oxygen and releasing carbon dioxide was respiration.

(ii) Candidates found this question challenging, possibly because they were not familiar with the diagram. Few candidates linked the direction of movement with the number of molecules on each side of the cell membrane.

Question 6

(a) (i) Candidates followed the instructions and most successfully linked excretion to box three and four.

(ii) Most candidates stated at least two substances that are found in urine with water, urea and salts being the most common answers.

(b) Most candidates identified the bladder but the renal artery and the ureter were less well known.

(c) Many candidates correctly gave the changes in urine after an increase in water consumption but there was uncertainty about the effect of an increase in temperature and exercise. Both of these conditions cause a decrease in urine volume and therefore an increase in concentration.

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(d) (i) Most candidates named appropriate elements with few incorrectly giving carbon dioxide or carbohydrate as an element.

(ii) Many candidates correctly stated the liver as the organ that breaks down amino acids. Some candidates named organs that produce enzymes for digestion, rather than the organ that is responsible for the breakdown of amino acids.

(e) Candidates were confident in naming the molecules involved in the enzyme-catalysed reactions.

Question 7

(a) Most candidates correctly calculated the percentage of deaths caused by COPD. Candidates should be encouraged to always show their working so if they make a mistake in their final answer, they may be awarded credit for their method.

(b) (i) Candidates gave rather extreme descriptions of the effects of tar and carbon monoxide rather than scientific effects.

(ii) Almost all candidates correctly stated that nicotine is the addictive substance in tobacco smoke.

(c) Many candidates understood the role of the placenta and the umbilical cord, but did not recognise the mother's blood as the source of the harmful substances.

(d) Candidates confidently named the risk factors associated with coronary heart disease.

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BIOLOGY

Paper 0610/41
Theory (Extended)

Key messages

Candidates should be reminded of the importance of carefully reading each question. Some questions were misread by candidates, who then gave responses that did not answer the question.

Candidates should be reminded of the differences between command words, particularly 'describe' and 'explain'. Often candidates wrote descriptions when explanations were required. Similarly, candidates should also know how to respond to questions that ask 'how' and 'why' certain processes occur.

Candidates should be reminded to take note of the mark allocations as they indicate the number of specific points that need to be made in answers.

Several questions showed the importance of learning the definitions given in the syllabus.

General comments

Question 3 on excretion and **Question 4** on pollination were not answered well by candidates. Some candidates did not provide a response for **Question 3(c)(i)**, possibly because it is a question without answer lines.

Candidates should look carefully at diagrams, identifying the structures indicated by the ends of label lines. Responses to **Question 3(c)** showed that many did not do this.

Data quotes should be given as a value with a unit, e.g. in **Question 2(b)** 145 cases of disease per million people is correct, but '145 cases' is not.

Comments on specific questions

Question 1

(a) Many candidates knew that water moves into and out of cells by osmosis and that water is known as a solvent. Some candidates were unsure of the meaning of the terms: solvent, solution and soluble.

(b) Most candidates sketched the expected appearance of the leaf cell after it had been placed in pure water for three hours and the majority drew an arrow to show the direction of water movement. Some candidates did not realise that immersing a cell in water would lead to a swelling of the cell. Many showed the cell as being plasmolysed, with large gaps between the cell membrane and the cell wall. A common error was to draw the arrow showing water going around the cell wall, this could not be credited as it wasn't clear if the water was going into or out of the cell.

(c) Many candidates knew that the plant would wilt if not watered for one week. Few candidates referred to the lack of turgor pressure in their responses. Most responses were given in terms of the whole plant, instead of the effects of water loss on each cell. The idea that without water, cells are not provided with support, was seen very rarely.

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Question 2

(a) This question was a challenge for many candidates. Candidates familiar with white blood cell involvement in the immune response gave very detailed responses. Some candidates focused too much on one aspect to gain full credit; for example, giving detailed responses about phagocytes but with no mention of lymphocytes. The terms antibodies, antigens and pathogens were often used incorrectly. Many responses described antibodies as white blood cells that destroy pathogens. Some answers described antigens as being made by antibodies. The best responses stated that lymphocytes secrete antibodies that bind to specific antigens on the surface of pathogens marking them for phagocytosis. Reference to long-term immunity was rarely seen. The role of phagocytes was less well explained. A number of candidates described antibodies engulfing pathogens which was not credited. The weaker responses found the diagram hard to interpret, incorrectly referring to letter **T** as the pathogen and **Q** as the antibody.

(b) Many candidates gave incorrect data quotes. In questions of this type, it is essential that data quotes are comparative. Many did not use the correct units - number of cases of disease per million people. Most recognised that there was a general decrease in the number of cases of disease per million people after the vaccination and that there were fluctuations in the number of cases. The best responses clearly identified evidence that was for and against the conclusion.

Question 3

(a) (i) The expected feature that distinguishes *Naegleria fowleri* from prokaryotes was the nucleus. This was given by the majority of candidates. Mitochondria and chloroplasts were also accepted.

(ii) Most candidates identified structure **A** as the cell membrane. The most frequent incorrect answer was the cell wall. Some candidates did not fully understand the function of the cell membrane.

(iii) Many candidates explained how carbon dioxide was produced during respiration, rather than identifying diffusion as the method of excretion.

(b) A minority of candidates wrote excellent descriptions of how and where in the body urea is formed. Many candidates wrote about the removal or break down of proteins instead of amino acids and there was much confusion between the roles of the liver and the kidneys.

(c) (i) Successful candidates gained credit for placing a label line in the space occupied by the cortex. Several candidates placed label lines right on the boundary between the cortex and medulla and could not be awarded credit. It is important that label lines end exactly on the structure being labelled.

(ii) Most candidates gained credit for identifying the names and letters of the structures described in Table 3.1. However, only a minority completed all five rows in the table correctly. Candidates were most confident identifying the bladder and urethra; they found it particularly difficult to distinguish between the renal artery and the renal vein. Candidates should be aware that hybrid spellings of ureter and urethra, such as ‘urether’ and ‘uretra’, cannot be credited. Spelling does not have to be perfect but it does have to be unambiguous.

(d) (i) Most candidates recognised that running would affect sweating, but not that it would increase the amount of sweat produced compared with the amount that is produced when not exercising.

(ii) Most candidates identified the relevant values from Table 3.2 and calculated a percentage decrease of 8.6(44)%. One of the more common errors in the calculation was to use the wrong denominator. Some candidates did not round up their answer to one significant figure which was required for all three marks to be awarded.

(iii) Very few candidates were able to describe accurately how the kidney tubules enable the excretion of salts. A small minority realised that the salts are in the blood and are filtered through the pores in the capillaries of the glomerulus. Despite the following question stating that large plasma proteins are usually prevented from entering the urine, candidates did not realise that only small molecules are filtered. Some candidates described the reabsorption of salts by referring to active transport or diffusion. References to the presence of excess salts in the urine or filtrate were seen very rarely.

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(e) Few candidates could name a protein found in blood plasma. Fibrinogen was the most common correct response.

Question 4

(a) (i) The majority of candidates described pollen grains as sticky, but further correct points were rarely given. Many candidates simply repeated points from the stem of the question, such as colour, scent and nectar.

(ii) Some candidates correctly identified the anther or stamen. A significant proportion of candidates incorrectly suggested that pollen is produced by the stigma.

(iii) Only a few candidates realised that meiosis is the process involved in the production of haploid pollen nuclei.

(iv) Most candidates appeared to have understood what they were asked in this question but rarely gave complete answers. The most frequent correct answer was that the diploid number is restored at fertilisation.

(b) (i) The majority of candidates stated that pollen is transferred to the stigma and that fertilisation results in the formation of a zygote. Very few candidates explained that at fertilisation a male nucleus fuses with a female nucleus to form a zygote and that an embryo is formed by division of the zygote by mitosis.

(ii) Some candidates described two advantages of cross-pollination. The most common advantage given was that cross-pollination allows variation.

(c) (i) Many candidates suggested an appropriate method of preventing cross-pollination between genetically modified plants and wild varieties of plants.

(ii) Some candidates stated that genetic modification can confer resistance to disease and improve yields. Many responses were too vague and could not be credited.

Question 5

(a) Most candidates linked calcium to bone formation, and some also gained a mark for teeth. Candidates found the importance of proteins more of a challenge. A large number incorrectly suggested that protein is an important source of energy. The most common correct response was that protein is important for growth and repair of cells. Increasing muscle strength was often suggested, but was insufficient to gain credit unless linked to the growth of muscles.

(b) Few candidates named two organs, associated with the alimentary canal, that produce enzymes. Incorrect answers included the liver and the mouth.

(c) (i) Most candidates recognised that pathogens would be killed by heating the milk in **step 2**.

(ii) Most candidates stated that heat would denature the enzymes, but did not continue their answer to explain that lactose would therefore not be broken down. Few candidates stated that the shape of the active site would be altered.

(iii) Many candidates stated that lactase is the enzyme used to make lactose-free milk.

(iv) Some candidates found this question challenging. A few candidates suggested that the enzyme could be re-used and that there would be no enzyme left in the milk.

(d) (i) Many candidates explained the advantages of breast milk to new-born mammals. The most common responses included: passive immunity, bonding with the mother and availability. Better responses stated that the composition of breast milk changes with the development of the baby. Some candidates wrote exclusively about one aspect, such as the transfer of antibodies, which did not allow them to gain full credit.

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(ii) Most candidates were aware that water is needed to produce milk and that alcohol could harm the baby. In some cases, responses could not be awarded credit because they referred to the effects of alcohol before birth. This highlights the importance of reading questions carefully.

Question 6

(a) Very few candidates provided a complete definition of sensitivity. Many candidates gave a simple definition and did not include the term stimulus, or stimuli, in their answers. The majority of candidates gained one mark for stating that sensitivity involved a response or reaction by an organism.

(b) (i) Few candidates described a sense organ as having a group of receptor cells or tissues. Many more referred to their ability to detect or respond to a stimulus.

(ii) Many candidates gained credit for the pupil widening but responses that referred to circular muscles relaxing and radial muscles contracting were rarely seen.

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BIOLOGY

Paper 0610/42
Theory (Extended)

Key messages

Candidates should be reminded of the importance of carefully reading each question. Some questions were misread by candidates, who then gave responses that did not answer the question.

Candidates should be reminded to take note of the mark allocations as they indicate the number of specific points that need to be made in answers.

Candidates should be reminded of the differences between command words, particularly between 'describe' and 'explain'. Many answers to **Question 5(b)** were explanations instead of descriptions. Similarly, candidates should also know how to respond to questions that ask 'how' and 'why' certain processes occur.

Candidates should use appropriate specific terminology when phrasing their answers. Inappropriate use of terms hampered candidates in **Question 3(a)**, **Question 1(b)(iii)**, **Question 1(c)**, **Question 5(c)** and **Question 6(c)(iii)**.

General comments

There was evidence of misreading some questions. In **Question 6(b)** many candidates missed the importance of the word 'cell' in the question and wrote about roles of DNA in determining the features of organisms and in inheritance. In **Question 6(c)(i)** there were correct descriptions of the role of meiosis in response to a question about mitosis.

In some questions, candidates did not make links to particular topics from the syllabus. For example, in **Question 3(c)(i)** they often missed ideas about the effect of intensive livestock farming on the environment. They also rarely made any reference to the inefficiency of using crops to feed animals rather than humans from topic 19.2. The conservation of fossil fuels from topic 21.4 of the syllabus was very rarely mentioned in answer to **Question 4(b)(iii)**.

Many candidates gave good answers to **Question 5(c)**. However, some candidates did not plan or structure their answers and described the two processes separately without comparing them directly by identifying similarities and differences.

Comments on specific questions

Question 1

(a) (i) Very few candidates provided a complete definition of sensitivity. Many candidates gave a simple definition and did not include the term stimulus, or stimuli, in their answers. The majority of candidates gained one mark for stating that sensitivity involved a response or reaction by an organism.

(ii) There were good definitions of the term sense organ, although few referred to receptors or receptor cells in their answers, using instead the general definition that applies to all organs.

(b) (i) Many candidates correctly named the fovea or yellow spot. Incorrect answers included blind spot.

(ii) To be awarded full marks, candidates had to show the lens thicker than in Fig. 1.1, light rays refracted in the cornea and/or in the lens and light rays coming to a point on the fovea. Some

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candidates completed the diagram very carefully and were awarded full marks. Common errors were to omit the lens, show the lens as thinner than in Fig. 1.1 and cross the light rays either outside the eye or in the vitreous humour. A few candidates completed the light rays freehand, rather than using a ruler, and so often gave irregular lines.

(iii) The most common correct answers stated that the ciliary muscles relax, the suspensory ligaments become taut or tighten and the lens becomes thinner. Some candidates explained that ciliary muscles and suspensory ligaments have roles in changing the shape of the lens, but did not describe how this happens when light comes from a distant object. Some candidates did not read the question carefully and described what happens when light comes from an object near to the lens. Common errors included stating that the ligaments stretched or that they acted as a muscle antagonistic to the ciliary muscles. Many thought the ciliary muscles control the amount of light entering the eye. Many wrote about contraction of suspensory ligaments.

(c) Most candidates stated that the pupil reduces in size in bright light. Many gave good descriptions of the functions of the muscles in the iris in reducing the size of the pupil, although only the strongest candidates went on to mention or describe the antagonistic action of the muscles. Again, some candidates misread the question and described the role of these muscles in dilating the pupil in dim light. There were very few correct comments about the iris in changing the size of the pupil. Some candidates confused the iris with the pupil in their answers stating that the iris decreases in size in bright light. The most common errors included reversing the roles of the circular and radial muscles or referring to ciliary muscles and suspensory ligaments as having a role in controlling the diameter of the pupil. There were many answers that referred to 'circulatory' and 'radical' muscles. Many stated that the pupils contract in bright light.

(d) Almost all candidates gave reflex action or involuntary action as their answers.

Question 2

(a) Many candidates named the parts of the tooth correctly. Spellings of enamel and dentine were not always correct, but credit was given for phonetic spellings. Common errors were to confuse enamel (**A**) and dentine (**B**) and give cement for gum (**D**). The term crown was not accepted for enamel. In a diagram of a tooth, the crown would be shown by a bracket.

(b) A common error was to explain how molar teeth are adapted for chewing rather than describing their role in mechanical digestion in the mouth. Good answers often included the idea that molars crush or grind food to increase the surface area for the action of enzymes. Amylase was often mentioned. Many candidates became confused with chemical digestion as they stated that molars break down pieces of food into smaller molecules or into soluble substances.

(c) There were many good descriptions of the process of tooth decay outlining the role of bacteria in producing acid that erodes enamel, exposing dentine and maybe reaching the nerves in the pulp and causing pain. There were few correct references to dentine in the answers. Weaker answers often stated that bacteria consume the teeth or described the circumstances that might lead to tooth decay.

Question 3

(a) This question was based on a food web for an ecosystem in a forested area in Central America. Most candidates gave correct answers for the first, second and fourth rows of the table. Many were unsure what to call the trophic level described in the third row. Few called it the quaternary consumer, but many knew that it was the fourth consumer level often using words like 'fourthtiary'. Not all candidates identified the great horned owl as the example from Fig. 3.1.

(b) (i) Candidates were often unsuccessful at identifying the group of organisms as decomposers. Many gave omnivores or the fifth trophic level. Acceptable alternatives included detritivores and named groups, such as bacteria, fungi and microorganisms.

(ii) Most answers to this question identified the loss of energy from one trophic level to another as the reason for the limited number of trophic levels. Respiration and inedible material were given as common reasons for the energy loss at each trophic level. Most ended their answers by stating that there is very little energy available to top predators and certainly not enough for another trophic level. A few candidates began at the base of the food web and explained that plants make use of

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only a small proportion of the light energy available, so accounting for the limited energy available to support an extra trophic level.

(c) (i) Many candidates misinterpreted this question and wrote about the effect of intensive livestock systems on the welfare and health of the animals concerned. They wrote about the limited variation in flocks of chickens and the likelihood that disease will spread easily from chicken to chicken. Good answers referred instead to the effects of faeces and urine on waterways, the effect of clearing land on the local wildlife and its biodiversity, and the release of greenhouse gases, especially methane. A minority discussed the spread of disease from livestock to wild animals or dealt with the wasteful use of energy in livestock production compared with providing food from crops. There were some good answers that explained that livestock systems need large supplies of food and the effect that monocultures of feed crops, such as maize, can have on ecosystems.

(ii) Candidates tended to concentrate on one aspect of the impact of soil erosion. For example, some concentrated on the effects on the physical environment, mentioning flooding, landslides and desertification. Others dealt with the loss of mineral ions leading to a decrease in soil fertility and reductions in plant growth. A smaller number dealt with the effects on the water cycle. Most candidates could gain credit by explaining that soil erosion leads to a loss of habitat. Some candidates developed this idea by referring to all the organisms that make up the community in soils. Many extended their answer too far, linking soil erosion to deforestation leading to climate change.

Question 4

(a) (i) Many candidates identified both parts of the yeast cell correctly. Ribosome(s), endoplasmic reticulum, rough endoplasmic reticulum and the abbreviations ER and RER were accepted for **A**. Vacuole was the expected answer for **D**, but vesicle was also accepted.

(ii) Most candidates correctly identified the function of the nucleus (**B**) and the mitochondrion (**C**). Common incorrect answers for the mitochondrion included produce energy for the cell, anaerobic respiration and provides energy for respiration. A few misread the question and named the organelles.

(iii) Almost all candidates identified the chloroplast as the structure found in plant cells, but absent in yeast cells. Some gave cell wall even though it was labelled in the diagram of the yeast cell.

(b) (i) The two enzymes given in Fig. 4.2 are amylase (**S**) and maltase (**T**). Some candidates gave maltase as **S** and amylase as **T**. Other candidates struggled with their spelling, but unambiguous spellings were accepted.

(ii) The majority of correct answers to this question gave the formula for glucose, inserted a 2 before the formula for ethanol and added $2CO_2$ to complete the equation. Some candidates put a 3 before glucose and balanced their equation correctly so were given credit. Incorrect answers were not balanced correctly, often by omitting the 2 before CO_2.

(iii) Most candidates realised that this question was asking them to contrast renewable fuels with non-renewable fuels. A few candidates expressed the misconception that renewable was the ability to reuse the biofuels. Many candidates incorrectly thought that biofuels have less of an environmental impact than fossil fuels because when burnt they do not emit carbon dioxide or that they do not need to be burnt or that they are biodegradable. There were many references to biofuels being 'eco-friendly' without any explanation of what this much-used term actually means. The very best answers explained that the carbon dioxide emitted by using biofuels is offset by the uptake of carbon dioxide by the plants, such as maize, grown for the production of biofuels. Few candidates stated that the use of biofuels will help to conserve fossil fuels as they are a finite resource. Many wrote that biofuels are cheaper and easier to produce than fossil fuels that have to be mined. These answers did not gain any credit. Also, many wrote about biofuels being natural and fossil fuels being artificial or similar.

(iv) Carbon dioxide uptake for use in photosynthesis was the first point made by good answers to this question. Many candidates stated that carbon dioxide is a requirement of the process so adding it to the atmosphere in glasshouses increases the rate of photosynthesis, assuming other factors are not limiting. Some correctly used the term limiting factor in their answers. Some candidates thought that this question was about the greenhouse effect, explaining that the carbon dioxide will help to

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keep heat in the glasshouse. This could not be credited. Many suggested that plants carried out photosynthesis in order to produce oxygen as if this was an advantage to the plant or to the owner of the glasshouse. Few stated that carbon dioxide enrichment increases yields of glasshouse crops. Fewer still linked the increase in photosynthesis to an increase in biomass by referring to the production of sugars, starch or protein.

Question 5

(a) Many candidates completed the table showing the sites of production of the hormones and their roles correctly. However, others found it more of a challenge. Common errors were:
- FSH causes the production of eggs and/or follicles, rather than stimulating their development
- FSH causes ovulation.

(b) The points that were credited were descriptions of the change in the thickness of the lining of the uterus. Many candidates gave explanations for the changing thickness in terms of shedding of the lining and its subsequent growth accompanied, occasionally, by the ways in which these changes are controlled by hormones or the reasons for the changes in terms of implantation. The question asked for a description so simple statements that the thickness decreases between days 0 and 7 and increases between days 7 and 28, with some detail for one or both of the phases, was all that was required.

(c) Many candidates used the information given in Fig. 5.2 to good effect when comparing the two methods of assisted reproduction. Many answers were carefully structured so that similarities and differences were separated and described clearly. Some correct points that were seen infrequently were:
- intercourse does not occur
- fertility drugs are used
- implantation of the embryo occurs so that the lining of the uterus must thicken in preparation
- embryo selection and embryo biopsy is possible with IVF but not with AI.

A common omission was to say that fertilisation occurs in both methods. Many candidates incorrectly stated that in AI, fertilisation occurs in the vagina or the uterus. Candidates often wrote that sperm and eggs are mixed in IVF without stating that this allows fertilisation to occur. Some candidates did not read the question carefully as they wrote about the reasons for infertility.

Question 6

(a) (i) Most candidates gave **T** as the base that pairs with **A**. The letters **B** and **D** were seen in some responses.

(ii) Most gave **C** and **G** as the other two bases in DNA.

(b) Many candidates stated that the genetic material in cells is in the form of DNA. Better responses stated that DNA codes for proteins. Fewer candidates explained that the sequence of bases in DNA determines the sequence of amino acids in proteins. Many candidates misread the question and wrote about the role of DNA in determining people's characteristics and its role in inheritance.

(c) (i) There were some good answers here explaining that chromosomes are copied or duplicated before mitosis occurs so that the daughter cells have the same number of chromosomes and are genetically identical. Candidates often stated that chromosomes thickened or split in two instead of saying that they are copied, duplicated or replicated. Some candidates wrote about meiosis and halving the chromosome number even though the question was about mitosis. Some candidates referred to identical or similar offspring rather than to daughter cells.

(ii) Many candidates gave cell membrane and cell wall as the structures that form between the two nuclei in a cell that divides into two. Incorrect answers included nuclear membrane and cytoplasm.

(iii) Candidates were often imprecise with their definitions of diploid. 'A full set of chromosomes' was a common answer that could not be awarded credit whereas 'A full set of paired chromosomes' was accepted. A diploid cell has two copies of each type of chromosome.

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BIOLOGY

Paper 0610/43
Theory (Extended)

Key messages

Candidates should be reminded of the importance of carefully reading each question. Some questions were misread by candidates, who then gave responses that did not answer the question.

Candidates should be reminded of the differences between command words, particularly 'describe' and 'explain'. Often candidates wrote descriptions when explanations were required. Similarly, candidates should also know how to respond to questions that ask 'how' and 'why' certain processes occur.

Candidates should be reminded to take note of the mark allocations as they indicate the number of specific points that need to be made in answers.

Candidates should use appropriate specific terminology in their answers and avoid vague phraseology.

Candidates should look carefully at column headings on tables and axes labels on graphs and use any units given in their answers.

General comments

Almost all candidates performed well on the data-response questions, although some could not recall the conversion from millimetres to micrometres in **Question 4(a)**.

Comments on specific questions

Question 1

(a) Most candidates correctly drew seedling **A** bending towards the light. For seedling **B**, many drew either a seedling of identical length to the first or a withered seedling. This suggested that candidates incorrectly thought that after a week without light, but with water, seedlings would show no growth response, be wilted or be dead.

(b) (i) Very few candidates provided a complete definition of sensitivity. Many candidates gave a simple definition and did not include the term stimulus, or stimuli, in their answers. The majority of candidates gained one mark for stating that sensitivity involved a response or reaction by an organism.

(ii) Most candidates knew that auxin was the plant hormone involved in gravitropism, but fewer were able to describe its role. Many discussed that auxin was found at the tips of roots or shoots but did not go on to mention that it was made in the tips or that it moved by diffusion. Accumulation or the unequal distribution of auxin, leading to differences in cell elongation was not clearly described. Candidates often discussed elongation of roots or stems without stating explicitly that it was the cells that were elongating. However, most candidates understood that roots grow downwards and shoots grow upwards. There were a number of candidates that didn't read the question carefully and described phototropism rather than gravitropism.

(iii) Many good explanations as to how gravitropism enables plant survival were seen. Many candidates appreciated the need for water, anchorage and light with many going on to detailed explanations of photosynthesis even though this was not required.

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(c) (i) Many candidates stated that reflexes involve the nervous system, whereas sensitivity in plants does not. A minority incorrectly stated that animals did not use chemicals.

(ii) Few candidates described a sense organ as having a group of receptor cells or tissues. Many more referred to their ability to detect or respond to a stimulus.

Question 2

(a) (i) Most candidates were able to place the first two events, **T** and **S**, in the correct order, but fewer knew that assimilation would happen after absorption and consequently placed the last two events in the wrong order.

(b) (i) Some candidates named organs, rather than cell structures, suggesting that they had not read the question carefully.

(ii) This was generally well answered and many candidates gained full credit. Hydrochloric acid was seen slightly more frequently than pepsin or protease. The most common misconceptions were that gastric juice contained bile and that acid provided the optimum temperature for enzyme activity.

(iii) Secretion of mucus by goblet cells was well known. Protein was the most common incorrect answer.

(c) (i) Many candidates knew that bile was involved in the emulsification of fats and most went on to explain that large fat globules were broken down into smaller fat globules that increased the surface area. However, a large number of candidates incorrectly thought that emulsification involved the breakdown of fats to fatty acids and glycerol.

(ii) Many candidates understood that emulsification occurred in the small intestine but the liver was a common incorrect answer. This suggested that candidates knew the association of bile with the liver but were uncertain about the role of the liver, or where bile acted.

(iii) Well-prepared candidates knew that fats are absorbed into the lacteals of the villi. The small intestine and microvilli were common incorrect answers.

Question 3

(a) (i) Many candidates knew that the monkeys could feed at two different trophic levels, but either miscounted or excluded some organisms when recording the number of secondary consumers and trophic levels.

(ii) Both trophic level 5 and fourth consumer were credited. Many candidates incorrectly thought that the anaconda was a tertiary consumer when eating a jaguar but that wasn't the highest possible trophic level. Apex consumer or predator were seen quite often but these general terms could not be credited as they did not describe the trophic level.

(iii) Reference was commonly made to the inefficient transfer of energy from one level of a food chain to another. Candidates often gave examples of the causes of inefficient energy flow although sometimes these included growth, which is an example of energy that can be transferred to the next trophic level.

(b) (i) Many candidates recognised that scientists would use DNA to classify the giant rat. They stated that scientists would compare base sequences in the DNA with those of known rat species. Few candidates stated that DNA would first have to be extracted from the cells of the giant rat.

(ii) Candidates displayed a good understanding of how monocultures can result in the extinction of some animals. The most commonly seen answer was the loss of habitats through deforestation. This idea was often linked to a lack of food since many species cannot feed on the crop grown as a monoculture.

Question 4

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(a) The calculation of the concentration of yeast cells challenged candidates in a number of ways. The first step required the conversion from micrometres to millimetres. Those candidates who decided to do that step after calculating the volume, tended to perform an incorrect conversion. Some candidates were able to do the final step correctly and were awarded credit, even if the previous steps were incorrect or missing. Candidates should be encouraged to present their working clearly as this ensures they can be awarded marks for their method.

(b) (i) Almost all candidates knew the position of the lag phase on the yeast population graph. The most common incorrect position was a cross on the origin.

(ii) Many candidates correctly drew a curve to show the stationary phase of the yeast population, but only those candidates who had examined the preceding graph of sugar concentration realised that towards the end of the period, the population of live yeast cells must have decreased. A number of candidates realised that the increase would slow down but then showed the line subsequently getting steeper again, which did not gain credit.

(iii) This question was answered well and many candidates accurately described the graph. In some cases, candidates became confused with the terminology and described the sugar concentration with the terms used for a population growth curve. Most were also able to gain marks with explanations linking the yeast population and the sugar concentration.

(c) Many candidates correctly stated that the gas that escapes from the tube in the fermenter is carbon dioxide. Fewer candidates realised that the purpose is to avoid a build-up of pressure that could burst the fermenter. Some incorrectly stated that the tube was required to allow oxygen to enter.

Question 5

(a) (i) Almost all candidates knew that sperm have haploid nuclei.

(ii) Similarly, almost all candidates knew that fertilisation takes place in the oviduct, or Fallopian tube. Incorrect responses included the uterus and the ovaries.

(iii) A number of very detailed descriptions were seen. Often candidates started their answer at the fertilisation stage and missed marks for describing the role of the acrosome. Many candidates did not state that the jelly coat was digested. Others did not use the term jelly coat, but rather identified it incorrectly as a cell wall or a cell membrane. There were some very clear descriptions of fertilisation, but also others that incorrectly described the (whole) sperm entering the egg cell. Confusion was also seen about when a zygote was formed and if the nuclear division following fertilisation was mitosis or meiosis.

(b) Most candidates were familiar with fertility drugs and IVF, but fewer were able to give an accurate description of how they are used. Very few candidates knew when fertility drugs were administered. Many candidates gained marks for the idea of collecting eggs and sperm for fertilisation outside the body. Many thought it was the zygote or egg, rather than the embryo that was inserted into the uterus. In some cases, there was confusion about where the embryo was inserted, with ovary and oviduct regularly suggested. A few candidates gave answers about artificial insemination, contraception and the ethics of IVF.

Question 6

(a) (i) Many candidates were able to determine that insecticide **3** would be the best at removing all three species of insects using the lowest dosage (5). A number of candidates suggested a dosage that was the total of the dosages needed for each insect. Some candidates did not state that it was the lowest dosage of all the insecticides or that it killed all the insects in their explanations.

(ii) Candidates gave a wide range of factors that should be considered to prevent insecticides harming the environment. The ideas of targeting other species, damaging food chains or pollution of the environment were often seen, but these answers were rarely extended further. Many candidates suggested correctly that if it was raining, insecticides may wash into nearby rivers or lakes and kill non-target aquatic organisms. There were some good discussions about the frequency of application and toxicity. However, many candidates did not read the question carefully and repeated that the concentration or dosage were important factors. Others seemed confused about

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the difference between insecticides, herbicides and fertilisers, as their responses explained damage to plants and the process of eutrophication.

(b) (i) The prevention of crop damage and higher crop yields were the most common advantages of using insecticides. Answers that stated insecticides were easy to use or efficient, required more detail to gain credit.

(ii) Herbicides and fertilisers were the most common chemicals that were stated. Candidates need to be aware that fertiliser is a collective term and that it is better to be more precise with terminology. For instance, magnesium ions are required to make chlorophyll and nitrate ions are required to make proteins.

(c) (i) There were some excellent answers to this question with links often made to increased fitness and chances of survival. Weaker answers discussed the differences between natural insecticides and chemical insecticides and the possibility of harm to plants and the environment.

(ii) Almost all candidates knew that smoking tobacco is addictive and that addiction is caused by the drug nicotine. Fewer candidates mentioned withdrawal symptoms as a problem for those that try to stop smoking.

(iii) Most candidates named suitable suggestions, such as lung cancer and chronic obstructive pulmonary disease. A few candidates described symptoms, rather than naming diseases.

(iv) Tar was the best known component of tobacco that damages alveoli. Fewer candidates suggested particulates or smoke particles. The most common incorrect answers were nicotine and carbon monoxide.

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BIOLOGY

Paper 0610/51
Practical Test

Key messages

When planning investigations, candidates should use the same principles each time. They should describe the independent variable, the dependent variable and the variables that are kept constant. Then they should describe the method, including general procedures such as repeating the investigation more than two times and naming suitable safety procedures.

Candidates would benefit from understanding how and why a control is used in an investigation.

Sufficient practise is needed with choosing suitable scales for graphs and accurately plotting data points.

General comments

Many candidates displayed good skills in drawing biological specimens and recording results in a table.

In mathematical questions, it is important that candidates show their working so credit can be awarded for their method even if the final answer is incorrect.

Comments on specific questions

Question 1

(a) (i) Candidates that closely examined Table 1.2, realised that halving the volume of lipase solution halved the percentage concentration of lipase solution and were therefore able to calculate the missing value.

(ii) Most candidates constructed a suitable table with appropriate headings. Any suitable trend, or a trend that matched the centre's data, was accepted. The most common error was writing the units in the body of the table, rather than in the heading.

(iii) Any valid conclusion of the candidate's results was accepted. Most candidates were able to identify and describe a trend in the data they collected.

(b) (i) Many candidates confused the control with the variables that were kept constant. Candidates should be confident with their understanding of the difference between these two terms. Many of those that correctly identified test-tube **L4** as the control found it difficult to explain that this was used to show that lipase was causing the colour change of the indicator.

(ii) The majority of candidates were able to correctly estimate the pH values for test-tubes **L1** and **L4** at the end of the investigation. The most common mistake was to state the colour of the indicator in these test-tubes rather than the pH value.

(iii) This question required candidates to look back at the method and choose two variables that were kept constant. These variables should be qualified, for example, volume of milk rather than milk. Many candidates showed a sound understanding of the variables that were kept constant.

(iv) The vast majority of candidates recognised that the water-bath was used to ensure that all reactants were at the same temperature, i.e. the test-tubes were equilibrated.

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(v) The only suitable error for Step 9 was the idea that determining the colour change was subjective to the observer or that it is difficult to choose a definite end-point. Many candidates named errors in the experiment, such as not controlling temperature or time, rather than the error associated with Step 9.

(c) The vast majority of candidates correctly named the biuret test as the test for proteins and described the colour change from blue to purple or violet. Nearly all could name an appropriate safety precaution for this food test.

(d) Candidates should be familiar with designing investigations and should be able to describe the independent variable, dependent variable and variables that were kept constant. Few were able to accurately describe how to keep variables constant. For example, stating that temperature can be controlled using a water-bath is not specific enough unless it is qualified with a description of how the temperature of the water-bath is maintained, e.g. using a thermostatically-controlled water-bath or adding hot and/or cold water to the water-bath and checking the temperature with a thermometer.

Choosing a suitable temperature range proved challenging. It was important to have at least one temperature above and below 37 °C and one at 37 °C in order to determine if this temperature was indeed the optimum.

It is essential that candidates practice applying their experimental design understanding to novel situations and think critically about how variables can be accurately measured and controlled.

Question 2

(a) Many candidates were able to identify the different structures in Fig. 2.2. There was some confusion over distinguishing the petals from the sepals, so either option was accepted with the correct number, 4.

(b) (i) Drawings of the germinating pollen grain were generally of a high standard. Many provided an accurate drawing of a suitable size and shape using a clear, unbroken line. The most common errors were to omit the structures in the middle or to shade the structures.

(ii) Candidates should be familiar with applying the formula for magnification. It is important that candidates show their working so credit can be awarded for their method even if the final answer is incorrect. Common errors were to omit the unit, give an incorrect unit or multiply the magnification by the length of **XY**.

(c) (i) Many candidates correctly interpreted the results given in Table 2.2 and stated that **S1** germinated faster than **S2**. Some candidates simply stated that one went faster than the other. It is important that candidates identify which one was faster by referring to **S1** and **S2**. Stronger responses stated that both **S1** and **S2** reached the same percentage germination after 60 minutes.

(ii) Most candidates were able to identifying that there were a different number of pollen grains on each slide so calculating a percentage takes this difference into account.

(iii) This question was generally answered well. Most candidates were able to describe how to calculate a percentage. The most common error was to omit the stage of multiplying by 100.

(d) A large number of candidates found this question challenging. The first stage was to work out the correct scale using the result for solution **A** and the bar already drawn. Each small square represented 5 µm. The second stage was to add this scale to the *y*-axis and use it to accurately plot the bars for the results of solutions **B** and **C**. These bars should also have been labelled.

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BIOLOGY

Paper 0610/52
Practical Test

Key messages

When planning investigations, candidates should use the same principles each time. They should describe the independent variable, the dependent variable and the variables that are kept constant. Then they should describe the method, including general procedures such as repeating the investigation more than two times and naming suitable safety procedures.

Sufficient practise is needed with choosing suitable scales for graphs and drawing an appropriate line.

General comments

Many candidates displayed good skills in drawing cells from the photomicrograph. Quality diagrams use single, unbroken lines, are in proportion and show sufficient detail. Diagrams should not be shaded, nor should a ruler be used.

In mathematical questions, it is important that candidates show their working so credit can be awarded for their method even if the final answer is incorrect.

Comments on specific questions

Question 1

(a) (i) Most candidates were able to carry out the investigation and record suitable observations in an appropriate table.

The most common error was the omission of a suitable heading for the temperature, or type of cup used. C and W alone, with no heading, was insufficient.

Units should always be in the headings of the table, not in the body of the table. Measurements should ideally be in millimetres, rather than centimetres. If converting between units, candidates should take care to ensure that the conversion is accurate and the correct unit has been stated.

A few candidates omitted the initial height measurement, or did not state clearly which measurement was which.

(ii) Most candidates managed to calculate the change in heights, but a small number simply stated the final heights.

(iii) Candidates were required to state a conclusion for the results. Many candidates simply described the results instead of stating a conclusion based on the results. A comparative statement needed to be made where the height change at each temperature was referred to. Referring to C and W was insufficient if temperature was not also mentioned.

(iv) Most candidates successfully identified temperature as the independent variable in this investigation.

(v) Most candidates successfully identified the height of the dough as the dependent variable.

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(b) (i) Most candidates realised that in Step 6 the dough would not be split exactly into two equal halves if separated by hand. Strong responses stated that the dough should be weighed to ensure equal masses. A few recommended dividing the dough by volume. This was credited, even though it would be difficult to do in practice. Some candidates thought that using a ruler to measure length and a sharp knife for the cutting would be sufficiently accurate. However, this could not be credited as simply measuring length does not imply an equal volume. Sometimes the error and improvement were not associated with step 6 and so could not be credited.

(ii) This question proved challenging for many candidates. Few identified that the initial heights were different. Using change in height eliminates the fact that the initial heights were different.

(c) The majority of candidates knew that iodine solution was used to test for the presence of starch and stated the positive colour as blue-black or dark blue. It needs to be noted that 'blue' on its own is not an acceptable description of the colour for a positive iodine solution test – the best description is blue-black.

(d) (i) The majority of candidates knew that limewater turns cloudy, or milky, in the presence of carbon dioxide. The use of hydrogencarbonate indicator as a test for the presence of carbon dioxide was not well known.

(ii) The planning exercise was well done with most candidates gaining the majority of the marks available. Most were able to identify the independent and dependent variables and also to state which variables should remain constant. The experimental plans were well thought-out but many candidates forgot to mention the need to repeat the procedure twice to obtain three results.

Few candidates were able to accurately describe how to keep variables constant. For example, stating that temperature can be controlled using a water-bath is not specific enough unless it is qualified with a description of how the temperature of the water-bath is maintained, e.g. using a thermostatically-controlled water-bath or adding hot and/or cold water to the water-bath and checking the temperature with a thermometer.

The use of a gas syringe to collect the gas was frequently seen. Other methods, such as displacement of water from an inverted measuring cylinder, were equally acceptable. Candidates also needed to state that the volume of gas would be recorded in a set time period, not just that the volume of gas would be recorded.

Candidates should be reminded that an investigation should be carried out at least three times (or repeated twice). The reason for this is that if an investigation is only performed twice and the results are different it is impossible to identify which result is anomalous.

A few candidates sketched and labelled the apparatus they would use. This is a helpful practice which limits the need for complex descriptions of apparatus.

Question 2

(a) (i) A large number of candidates were awarded full marks for their diagram of the plant cell. Nearly all diagrams were sufficiently large and were drawn with smooth, clear and unbroken outlines. Lines should be drawn free-hand and not produced with the help of a ruler.

Some candidates omitted details, such as the two main clusters of chloroplasts or the points where cells join.

A small number of candidates drew a stylised plant cell instead of the cell in the photomicrograph.

(ii) Most candidates correctly measured line **PQ** and calculated the actual length of the cell. A few forgot to include a unit and some converted their mm measurement to cm or μm and introduced unnecessary errors.

(b) (i) Many candidates successfully calculated the average number of bubbles per minute. A few who gave an incorrect answer seemed to have worked out the midpoint between the number of bubbles produced per minute at 100 and 140 cm, rather than using the number of bubbles produced in three minutes and dividing by three.

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(ii) There were some excellent graphs and many were awarded full marks. Candidates should ensure that all data is plotted to within ± half of the smallest square on the graph grid. The most common errors were the absence of units on the axes or the use of non-linear scales. Axes do not need to start at zero, but when a zero is included and there is then a 'jump' in the values, a discontinuity mark must be included. The lines drawn were usually appropriate, but candidates should remember not to extrapolate the line beyond the data points.

(iii) Almost all candidates correctly estimated the rate of bubble production per minute using their graph.

(iv) Candidates were asked to describe the trends shown on the graph they had drawn. This proved to be challenging for many candidates. The majority of candidates described the relationship between the distance from the light and the rate of bubble production, but neglected the portion of the graph where the rate remained constant.

(v) Stronger responses stated that it was necessary to allow the plant time to equilibrate and reach the new temperature before proceeding with the investigation. Some candidates had difficulty in expressing their idea clearly. Many candidates incorrectly referred to the ten minutes as the time taken for measurements to be made.

(vi) Many candidates performed the calculation correctly and were awarded full marks. Candidates should be reminded to show their working so credit can be awarded for their method even if the final answer is incorrect. Some candidates did not give their answer to a whole number, indicating that they had not read the question carefully enough.

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BIOLOGY

Paper 0610/53
Practical Test

Key messages

When planning investigations, candidates should use the same principles each time. They should describe the independent variable, the dependent variable and the variables that are kept constant. Then they should describe the method, including general procedures such as repeating the investigation more than two times and naming suitable safety procedures.

Sufficient practise is needed with choosing suitable scales for graphs, accurately plotting data points and drawing an appropriate line.

It would be helpful to candidates if they used a pencil when constructing a table, drawing a diagram and when drawing a graph. This means that mistakes can easily be erased and clearly corrected.

Candidates should note the number of marks available for each part of a question. A three-mark question will require the candidate to make three separate points if full credit is to be awarded.

General comments

Many candidates displayed good skills in drawing biological specimens, recording results in a table and plotting graphs.

In mathematical questions, it is important that candidates show their working so credit can be awarded for their method even if the final answer is incorrect.

Candidates should be encouraged to read the questions carefully and follow all instructions closely.

Comments on specific questions

Question 1

(a) (i) Candidates that closely examined Table 1.1, realised that halving the volume of amylase solution halved the percentage concentration of amylase solution and were therefore able to calculate the missing value.

(ii) Most candidates were able to carry out the investigation and get results in line with what was expected. Most results were suitably recorded in a table, but units within the body of the table were seen in a large number of cases.

The use of 'm' for minutes is to be discouraged as 'm' is the SI unit for metres. A small number of candidates recorded their results in seconds. This was credited, but forced an unnecessary conversion from minutes to seconds which had the potential to introduce calculation errors or incorrect units in the table heading.

Ideally the amylase concentration should have been recorded in the table, but beaker **A**, **B**, **C**, etc. was sufficient for the mark.

(iii) This was well answered by most, although answers such as '*no change was observed*' were too vague and needed to refer to the colour change.

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(iv) Good answers were seen in the majority of cases, with reference made to a comparison with the solution in beaker **B**.

(v) Many candidates forget to state that heat is required for the Benedict's test. The simplest method is to heat the mixture to 70-80 °C with a Bunsen burner or to use a heated water-bath at that temperature. It must be clear that the water-bath is heated as it could be set at a cold temperature. A few candidates confused Benedict's solution with biuret reagent and gave purple as the colour for a positive test result.

(b) The planning exercise was particularly well done with many candidates being awarded high marks. Most were able to identify the independent and dependent variables and also state which variables should be kept constant.

The experimental plans were well thought-out and some included interesting alternative methods for seed activity, such as the degree of germination.

Candidates should be reminded that an investigation should be carried out at least three times (or repeated twice). The reason for this is that if an investigation is only performed twice and the results are different it is impossible to identify which result is anomalous.

(c) (i) Almost all candidates plotted a graph that scored high marks. Scales and labels were suitable and values were plotted accurately. A line of best fit or points joined by straight lines were acceptable. Extrapolation of the line beyond 18 days was inappropriate and candidates should be reminded not to extrapolate beyond the data points. Some candidates did not plot the values at 0 and 3 minutes. Even if values are zero and the plot is on the *x*-axis, they should still be shown by a plotted point.

(ii) Most candidates carefully described the pattern shown by the data but several descriptions lacked sufficient detail. A full description should have included the period of inactivity for the first three days or a reference to the flattening of the graph between days 9 and 12.

(d) (i) Some candidates found it difficult to express that amylase at its most active would be shown by the peak of the graph, but the peak couldn't be identified because the values at day 9 and 12 were the same.

(ii) Strong responses stated that more data points were required between day 9 and day 12. To state that the range of measurements needed to be increased was insufficient, as this could have meant extending the investigation beyond 18 days, which wouldn't have helped determine the peak activity.

Question 2

(a) (i) The quality of the drawings was very high. Lines were generally single, clear and unbroken. The size was appropriate as were the proportions of the wings and seeds. Shading was rarely seen which was pleasing.

(ii) The majority of candidates correctly calculated the actual seed length, with just a few getting the equation the wrong way round or confusing units. Those candidates who tried to convert to micrometres added an unnecessary level of difficulty.

(b) The similarity of the two seeds was well observed and described. The difference was less well done. Simply stating that the shape was different was insufficient. Candidates needed to state how the seeds were different and identify which seed was which. An answer that stated that Fig. 2.1 had two seeds also needed to state that Fig. 2.2 only had one seed.

(c) (i) Nearly all candidates gained full marks for this question. A few confused 15 for 17 and were only awarded one mark, whereas others forgot to show on the graph how they had obtained their answer.

(ii) The calculation of percentage increase was challenging for some candidates. Many candidates used 10 and 18 instead of the values from the graph, and many did not know how to calculate a percentage increase. Others also forgot to give their answer to two significant figures. It is important that candidates show all of their working so if an error is made, marks can still be awarded.

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(iii) Most candidates were awarded both marks for this question. Vague answers, such as weather, could not be credited, whereas precise descriptions, such as wind speed, were awarded the mark.

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BIOLOGY

Paper 0610/61
Alternative to Practical

Key messages

When planning investigations, candidates should use the same principles each time. They should describe the independent variable, the dependent variable and the variables that are kept constant. Then they should describe the method, including general procedures such as repeating the investigation more than two times and naming suitable safety procedures.

Candidates would benefit from understanding how and why a control is used in an investigation.

Sufficient practise is needed with choosing suitable scales for graphs and accurately plotting data points.

General comments

Many candidates displayed good skills in drawing biological specimens and recording results in a table.

In mathematical questions, it is important that candidates show their working so credit can be awarded for their method even if the final answer is incorrect.

Comments on specific questions

Question 1

(a) (i) Candidates that closely examined Table 1.2, realised that halving the volume of lipase solution halved the percentage concentration of lipase solution and were therefore able to calculate the missing value. A common error was to divide the volume of lipase solution by the volume of distilled water.

(ii) This question was generally answered well, with most candidates drawing a suitable table with appropriate headings. The majority of candidates correctly converted the times to seconds. The most common error was in recording the result for test-tube **L4**. Candidates should have followed the instructions and recorded >300 as the colour had not changed to yellow in five minutes. Candidates should be reminded that units must be given in the heading of the table and not in the body of the table.

(iii) When stating a conclusion for the results, candidates should refer to the table of results and look for a relationship between the independent and dependent variable. In this case, as the percentage concentration of lipase increased, the time taken for the indicator to change colour decreased.

(b) (i) Many candidates confused the control with the variables that were kept constant. Candidates should be confident with their understanding of the difference between these two terms. Many of those that correctly identified test-tube **L4** as the control found it difficult to explain that this was used to show that lipase was causing the colour change of the indicator.

(ii) The majority of candidates were able to correctly estimate the pH values for test-tubes **L1** and **L4** at the end of the investigation. The most common mistake was to state the colour of the indicator in these test-tubes rather than the pH value.

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(iii) Candidates should be familiar with identifying the independent and dependent variables in an investigation. Most identified lipase concentration as the independent variable. The most common error was to state either time or pH change.

(iv) This question required candidates to look back at the method and choose two variables that were kept constant. These variables should be qualified, for example, volume of milk rather than milk. Candidates should be reminded that using the same number of drops does not necessarily mean that the same volume has been used as drops can vary in size.

(v) Many candidates realised that the water-bath was used to ensure that all the reactants were at the same temperature, i.e. the test-tubes were equilibrated. Some candidates mistakenly referred to the water-bath being used to raise the temperature to speed up the rate of reaction or activate enzymes.

(vi) Step 8 referred to observing the colour change of the indicator. The error here is that observing a colour change is subjective and it is difficult to choose a definite end-point. A common mistake was to suggest that there was an error with the way temperature was controlled or time was measured.

(c) The vast majority of candidates correctly named the biuret test as the test for proteins and described the colour change from blue to purple or violet. Nearly all could name an appropriate safety precaution for this food test.

(d) The strongest responses adapted the investigation in the first part of the question, but kept the concentration of lipase the same and changed the temperature.

Candidates should be familiar with designing investigations and should be able to describe the independent variable, dependent variable and variables that were kept constant. Few were able to accurately describe how to keep variables constant. For example, stating that temperature can be controlled using a water-bath is not specific enough unless it is qualified with a description of how the temperature of the water-bath is maintained, e.g. using a thermostatically-controlled water-bath or adding hot and/or cold water to the water-bath and checking the temperature with a thermometer.

A number of candidates used ethanol as a test for fats. This was given credit but use of an indicator such as bromothymol blue would have been a better choice as an indicator can be used to produce quantitative results.

Candidates should be familiar with lab-based investigations involving enzyme-catalysed-reactions, such as the action of lipase on fat. Some candidates incorrectly thought the activity of the enzyme could be measured in a human body, possibly due to a lack of opportunity in designing investigations.

Question 2

(a) There was some confusion over distinguishing the petals from the sepals, so either option was accepted with the correct number, 4. Most candidates correctly named and counted parts **A** and **B**.

(b) (i) Most drawings were of a high quality and closely resembled the germinating pollen grain. Candidates are reminded not to include shading and to draw outlines with a smooth, single line. Diagrams awarded high marks also included details such as the shape of the pollen tube and the three rounded structures inside the pollen grain.

(ii) Nearly all candidates were able to accurately measure the length of the line **XY**. However, fewer then went on to correctly calculate the actual length of the pollen grain. Candidates should be familiar with applying the formula for magnification. It is important that candidates show their working so credit can be awarded for their method even if the final answer is incorrect.

(c) (i) Candidates were generally able to interpret the results given in Table 2.2 and reach some appropriate conclusions. Many realised that the pollen grains in solution **S1** germinated faster than those in **S2**, but that they both reached the same percentage germination after 60 minutes.

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(ii) Most candidates realised that there were different numbers of pollen grains on each slide and this is why the results were shown as percentages as this takes the different numbers into account. Answers referring to increasing validity did not gain credit.

(iii) This question was generally answered well. Most candidates were able to describe how to calculate a percentage. The most common error was to omit the stage of multiplying by 100.

(d) A large number of candidates found this question challenging. The first stage was to work out the correct scale using the result for solution **A** and the bar already drawn. Each small square represented 5 µm. The second stage was to add this scale to the *y*-axis and use it to accurately plot the bars for the results of solutions **B** and **C**. These bars should also have been labelled. There were more errors with plotting than with adding the scale.

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BIOLOGY

Paper 0610/62
Alternative to Practical

Key messages

When planning investigations, candidates should use the same principles each time. They should describe the independent variable, the dependent variable and the variables that are kept constant. Then they should describe the method, including general procedures such as repeating the investigation more than two times and naming suitable safety procedures.

Sufficient practise is needed with choosing suitable scales for graphs, accurately plotting data points and drawing an appropriate line.

It would be helpful to candidates if they used a pencil when constructing a table, drawing a diagram and when drawing a graph. This means that mistakes can easily be erased and clearly corrected.

General comments

Many candidates displayed good skills in drawing cells from the photomicrograph.

In mathematical questions, it is important that candidates show their working so credit can be awarded for their method even if the final answer is incorrect.

Comments on specific questions

Question 1

Candidates were given the outline of an investigation involving the preparation of bread dough.

Approximately half the dough was kept at a cool temperature for ten minutes and the other portion kept at a higher temperature for the same period of time. Diagrams of the dough samples at the start and end of the ten minutes were provided for the candidates. Their first task was to measure the maximum height of all four samples and to mark the points on the diagrams at which the heights were measured. Most candidates marked the maximum heights, a few omitted to do so, and some marked points other than the maxima.

(a) (i) A table had to be constructed in which to record the results of the investigation. The majority of candidates constructed a suitable table and recorded the four required heights, most of the heights having been measured accurately.

Some candidates did not state the units in the heading of the table, or repeated them in the body of the table. Frequently, the heading for the different dough samples was left blank. It is important that every column has an appropriate heading, and where appropriate, a unit.

Some candidates mixed up the initial and final heights and recorded their measurements in the incorrect data cells. Measurements should ideally be in millimetres, rather than centimetres. If converting between units, candidates should take care to ensure that the conversion is accurate and the correct unit has been stated.

(ii) Nearly all candidates correctly calculated the change in height of both dough samples. Candidates that measured inaccurately, or recorded incorrectly, received credit if their calculation was correct using their recorded data.

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(iii) Many candidates re-stated the results rather than reaching a conclusion about them. Suitable conclusions stated that at the higher temperature, the height of the dough increased more than in the lower temperature.

(iv) (v) The majority of candidates were able to identify the independent and the dependent variables in the investigation.

(b) (i) Most candidates realised that the dough would not be split exactly into two equal halves if separated by hand. Strong responses stated that the dough should be weighed to ensure equal masses. A few recommended dividing the dough by volume. This was credited, even though it would be difficult to do in practice. Some candidates thought that using a ruler to measure length and a sharp knife for the cutting would be sufficiently accurate. However, this could not be credited as simply measuring length does not imply an equal volume.

(ii) Many candidates clearly understood that the variation in initial dough heights was the key point. Using change in height eliminates the fact that the initial heights were different. Many candidates gave answers that were too vague, often citing greater accuracy or errors being minimised.

(c) The majority of candidates knew that iodine solution was used to test for the presence of starch and stated the positive colour as blue-black or dark blue. It needs to be noted that 'blue' on its own is not an acceptable description of the colour for a positive iodine solution test – the best description is blue-black.

(d) (i) The majority of candidates knew that limewater turns cloudy, or milky, in the presence of carbon dioxide. The use of hydrogencarbonate indicator as a test for the presence of carbon dioxide was not well known. The use of pH indicators which give a colour change in acidic conditions were also accepted. A small number of candidates incorrectly referred to limestone instead of limewater.

(ii) Many candidates described investigations using bread dough rather than a yeast suspension, as instructed in the question. This highlights the importance of reading the question carefully and following instructions closely.

Candidates should be familiar with designing investigations and should be able to describe the dependent variable, independent variable and variables that were kept constant. Few were able to accurately describe how to keep variables constant. For example, stating that temperature can be controlled using a water-bath is not specific enough unless it is qualified with a description of how the temperature of the water-bath is maintained, e.g. using a thermostatically-controlled water-bath or adding hot and/or cold water to the water-bath and checking the temperature with a thermometer.

The use of a gas syringe to collect the gas was frequently seen. Other methods, such as the displacement of water from an inverted measuring cylinder, were equally acceptable. Candidates also needed to state that the volume of gas would be recorded in a set time period, not just that the volume of gas would be recorded.

Candidates should be reminded that an investigation should be carried out at least three times (or repeated twice). The reason for this is that if an investigation is only performed twice and the results are different it is impossible to identify which result is anomalous.

A few candidates sketched the apparatus they would use. This is a helpful practice which limits the need for complex descriptions of apparatus.

Question 2

(a) (i) A large number of candidates were awarded full marks for their diagram of the plant cell. Nearly all diagrams were sufficiently large and were drawn with smooth, clear and unbroken outlines. Lines should be drawn free-hand and not produced with the help of a ruler.

Some candidates omitted details, such as the two main clusters of chloroplasts or the points where cells join.

A small number of candidates drew a stylised plant cell instead of the cell in the photomicrograph.

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(ii) Most candidates successfully measured the length of the magnified cell and then calculated its actual length. A small number of candidates performed the original measurement inaccurately but carried out the calculation correctly and therefore received some credit.

Common errors were to give the first cell measurements in centimetres, to omit the units in the final answer, to carry out an incorrect conversion into micrometres, or to incorrectly use standard notation.

(b) (i) Most candidates successfully calculated the average number of bubbles per minute. A few who gave an incorrect answer seemed to have worked out the midpoint between the number of bubbles produced per minute at 100 and 140 cm, rather than using the number of bubbles produced in three minutes and dividing by three.

(ii) There were some excellent graphs and many were awarded full marks. Candidates should ensure that all data is plotted to within ± half of the smallest square on the graph grid. The most common errors were the absence of units on the axes or the use of non-linear scales. Axes do not need to start at zero, but when a zero is included and there is then a 'jump' in the values, a discontinuity mark must be included. The lines drawn were usually appropriate, but candidates should remember not to extrapolate the line beyond the data points.

(iii) Most candidates could use their graph to read off the correct rate of bubble production per minute.

(iv) Candidates were asked to describe the trends shown on the graph they had drawn. This proved to be challenging for many candidates. The majority of candidates described the relationship between the distance from the light and the rate of bubble production, but neglected the portion of the graph where the rate remained constant.

(v) Stronger responses stated that it was necessary to allow the plant time to equilibrate and reach the new temperature before proceeding with the investigation. Some candidates had difficulty in expressing their ideas clearly.

(vi) Many candidates performed the calculation correctly and were awarded full marks. Candidates should be reminded to show their working so credit can be awarded for their method even if the final answer is incorrect.

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BIOLOGY

Paper 0610/63
Alternative to Practical

Key messages

When planning investigations, candidates should use the same principles each time. They should describe the independent variable, the dependent variable and the variables that are kept constant. Then they should describe the method, including general procedures such as repeating the investigation more than two times and naming suitable safety procedures.

Sufficient practise is needed with choosing suitable scales for graphs, accurately plotting data points and drawing an appropriate line.

It would be helpful to candidates if they used a pencil when constructing a table, drawing a diagram and when drawing a graph. This means that mistakes can easily be erased and clearly corrected.

Candidates should note the number of marks available for each part of a question. A three-mark question will require the candidate to make three separate points if full credit is to be awarded.

General comments

Many candidates displayed good skills in drawing biological specimens and recording results in a table.

In mathematical questions, it is important that candidates show their working so credit can be awarded for their method even if the final answer is incorrect.

Candidates should be encouraged to read the questions carefully and follow all instructions closely.

Comments on specific questions

Question 1

(a) (i) Candidates that closely examined Table 1.1, realised that halving the volume of amylase solution halved the percentage concentration of amylase solution and were therefore able to calculate the missing value.

(ii) Most candidates were able to transfer the data shown in Fig. 1.2 to a tabular form. It was common to see colours recorded, instead of the time taken for the change to take place. This resulted in a table that was simply a different version of Fig. 1.2 rather than a summary of the time taken for starch to be broken down in the different conditions.

The use of ‘m’ for minutes is to be discouraged as ‘m’ is the SI unit for metres. A small number of candidates recorded their results in seconds. This was credited, but forced an unnecessary conversion from minutes to seconds which had the potential to introduce calculation errors or incorrect units in the table heading.

A few candidates did not follow the instructions and did not use the ‘greater than’ symbol, >, when recording the results for beaker **D**.

Ideally the amylase concentration should have been recorded in the table, but beaker **A**, **B**, **C**, etc. was sufficient for the mark.

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(iii) This was well answered by most, although answers such as 'no change was observed' were too vague and needed to refer to the colour change.

(iv) Good answers were seen in the majority of cases, with reference made to a comparison with the solution in beaker **B**.

(v) Most candidates correctly identified a suitable piece of safety equipment, but some stated general safety issues rather than ones relevant to the investigation described in **1(a)**.

(vi) Many candidates forget to state that heat is required for the Benedict's test. The simplest method is to heat the mixture to 70-80 °C with a Bunsen burner or to use a heated water-bath at that temperature. It must be clear that the water-bath is heated as it could be set at a cold temperature. A few candidates confused Benedict's solution with biuret reagent and gave purple as the colour for a positive test result.

(b) The planning exercise was particularly well done with many candidates being awarded high marks. Most were able to identify the independent and dependent variables and also state which variables should be kept constant.

The experimental plans were well thought-out and some included interesting alternative methods for seed activity, such as the degree of germination.

Candidates should be reminded that an investigation should be carried out at least three times (or repeated twice). The reason for this is that if an investigation is only performed twice and the results are different it is impossible to identify which result is anomalous.

(c) (i) Almost all candidates plotted a graph that scored high marks. Scales and labels were suitable and values were plotted accurately. A line of best fit or points joined by straight lines were acceptable. Extrapolation of the line beyond 18 days was inappropriate and candidates should be reminded not to extrapolate beyond the data points. Some candidates did not plot the values at 0 and 3 minutes. Even if values are zero and the plot is on the *x*-axis, they should still be shown by a plotted point.

(ii) Most candidates carefully described the pattern shown by the data but several descriptions lacked sufficient detail. A full description should have included the period of inactivity for the first three days or a reference to the flattening of the graph between days 9 and 12.

(d) (i) Some candidates found it difficult to express that amylase at its most active would be shown by the peak of the graph, but the peak couldn't be identified because the values at day 9 and 12 were the same.

(ii) Strong responses stated that more data points were required between day 9 and day 12. To state that the range of measurements needed to be increased was insufficient, as this could have meant extending the investigation beyond 18 days, which would not have helped to determine the peak activity.

Question 2

(a) (i) The quality of the drawings was very high. Lines were generally single, clear and unbroken. The size was appropriate as were the proportions of the wings and seeds. Shading was rarely seen which was pleasing.

(ii) The majority of candidates correctly calculated the actual seed length, with just a few getting the equation the wrong way round or confusing units. Those candidates who tried to convert to micrometres added an unnecessary level of difficulty.

(b) Although the similarity of the two seeds was well observed and described, the difference was less well done. Simply stating that the shape was different was insufficient. Candidates needed to state how the seeds were different and identify which seed was which. An answer that stated Fig. 2.1 had two seeds also needed to state that Fig. 2.2 only had one seed.

(c) (i) Nearly all candidates gained full marks for this question. A few confused 15 for 17 and were only awarded one mark. Some forgot to show on the graph how they had obtained their answer.

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(ii) The calculation of percentage increase was challenging for some candidates. Many candidates used 10 and 18 instead of the values from the graph, and many did not know how to calculate a percentage increase. Others also forgot to give their answer to two significant figures. It is important that candidates show all of their working so if an error is made, marks can still be awarded.

(iii) Most candidates were awarded both marks for this question. Vague answers, such as weather, could not be credited, whereas precise descriptions, such as wind speed, were awarded the mark.

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