BIOLOGY

Paper 0610/11
Multiple Choice (Core)

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

General comments

The use of dichotomous keys was well understood, as was the correct definition of the term *enzyme*, the differences between plant and animal cells and the stages that occur during labour and birth.

There was some uncertainty about the classification of organisms, the approximate percentage of gases in expired air and the role of respiration in maintaining a constant body temperature.

Candidates need to work methodically through information given, such as pie charts or experimental data.

Comments on specific questions

Question 2

The majority of candidates appreciated that *Panthera* is a genus, only a small minority identified it as a species.

Question 3

A significant proportion of candidates incorrectly believed that crustaceans have 6 or 8 legs which led these candidates to choose the incorrect distractor, 98.

Question 6

While many candidates correctly identified a root as an organ, there was some uncertainty about the different levels of organisation in a plant.

Question 8

This question proved challenging. Candidates would benefit from knowing the chemical elements that are found in proteins.

Question 10

Many candidates correctly recognised that photosynthesis and respiration both occur in the light, but that the rate of photosynthesis is higher. A significant number of candidates incorrectly believed that photosynthesis occurs in the light, but respiration does not, or that respiration can only occur when photosynthesis is not taking place.

Question 12

Carbohydrates, fats and oils all provide energy. Response **B** was chosen by candidates that applied their knowledge and worked methodically through the information in the pie charts.

Question 14

This question proved challenging. Many candidates did not appreciate that only small molecules like simple sugars and amino acids can cross the membrane. Proteins are too large to cross the membrane.

Question 16

Many candidates were able to identify the right atrium and the left ventricle. Some candidates were not able to distinguish between the left and right side of the heart and therefore incorrectly chose response **A**.

Question 19

Candidates would benefit from being able to recall the approximate percentage of gases in expired air or be able to apply knowledge of the percentages in inspired air.

Question 20

Most candidates did not appreciate that respiration must occur continuously to maintain a constant body temperature.

Question 21

Many candidates correctly identified aerobic respiration as the process that releases the most energy from one molecule of glucose.

Question 25

Candidates would benefit from being able to recall the structure of the excretory system. It is important to be able to distinguish between the ureters and the urethra.

Question 26

This question was well answered and candidates appreciated that the antibiotic that most bacteria are resistant to is the one with no clear circle around it.

Question 28

The majority of candidates appreciated that during pollination, pollen is transferred to the stigma. A small proportion of candidates incorrectly believed that pollen is transferred to the anther.

Question 31

Many candidates appreciated that the sex chromosome from gamete P must be X, since it comes from the mother and the male offspring is XY. Some candidates incorrectly believed that the sex chromosome from gamete P (a female gamete) must be Y.

Question 32

Most candidates were able to deduce that the parents had to be heterozygous and homozygous recessive. It is important to pay close attention to the terms used and distinguish carefully between dominant and recessive.

Question 34

This was a challenging question. Candidates would benefit from understanding the distinction between natural selection and selective breeding.

Question 36

The majority of candidates appreciated that producers remove carbon dioxide from the atmosphere, some incorrectly thought that decomposers remove carbon dioxide from the atmosphere.

Question 38

Many candidates appreciated that the process which makes use of a genetically engineered organism is the use of bacteria to produce insulin.

Question 39

This was a challenging question for many candidates. Candidates would benefit from understanding that deforestation commonly causes the loss of soil and increases the risk of flooding.

BIOLOGY

Paper 0610/12
Multiple Choice (Core)

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

General comments

The use of dichotomous keys was well understood, as was the understanding of factors that increase the risk of developing coronary heart disease.

There was some uncertainty about the characteristics of arachnids and the chemical elements found in proteins.

Candidates need to work methodically through information given, such as pie charts or inheritance problems.

Comments on specific questions

Question 1

The experimental evidence led successful candidates to realise that the microorganisms were demonstrating movement, nutrition and sensitivity.

Question 3

Four pairs of jointed legs, an exoskeleton and a body divided into two sections allowed the arthropod to be classified as an arachnid.

Question 6

While many candidates correctly identified a root as an organ, there was some uncertainty about the different levels of organisation in a plant.

Question 7

Many candidates appreciated the direction of movement of water into and out of potato tissue by osmosis. Some candidates, though, did not understand the process of osmosis adequately in order to work out whether the pieces of potato would increase or decrease in mass.

Question 8

This question proved challenging. Candidates would benefit from knowing the chemical elements that are found in proteins.

Question 12

Carbohydrates, fats and oils all provide energy. Response **B** was chosen by candidates that applied their knowledge and worked methodically through the information in the pie charts.

Question 14

This question was well answered by many candidates and they understood that only small molecules like simple sugars and amino acids can cross the membrane. Proteins are too large to cross the membrane.

Question 15

Candidates would benefit from being more methodical when working through practical problems. Some candidates did not appreciate that the uncovered plant would lose water to its surroundings and therefore lose mass.

Question 19

Interpreting the diagram proved problematic for many candidates. The most common error was candidates incorrectly identifying P as the alveolus wall. The alveolus wall was represented by Q.

Question 20

Many candidates did not appreciate that respiration occurs continuously in all cells.

Question 21

Many candidates correctly identified aerobic respiration as the process that releases the most energy from one molecule of glucose.

Question 23

Many candidates correctly determined the correct answer by applying their knowledge of the pupil reflex. A minority of candidates incorrectly believed that distance P increases and distance Q decreases.

Question 25

Candidates would benefit from being able to recall the structure of the excretory system. It is important to be able to distinguish between the ureters and the urethra.

Question 26

Many candidates correctly identified the pancreas as the organ that secretes amylase. Some candidates incorrectly opted for the stomach, possibly by confusing amylase with protease.

Question 28

This proved to be a challenging question. Candidates would benefit from understanding where fertilisation occurs in the female reproductive system.

Question 30

Some candidates found this probability question challenging. It must be remembered that regardless of the sex of any existing children, the chance of the next child being a daughter is always 50%.

Question 31

Candidates would benefit from understanding that meiosis produces gamete cells that are genetically different. It is important to not confuse meiosis with mitosis.

Question 32

While many candidates opted for the correct answer, some did not work methodically through the question to derive the correct answer. If a homozygous dominant plant is crossed with a homozygous recessive plant all the offspring must be heterozygous and have the dominant phenotype, which in this case is red flowers.

Question 33

Some candidates appreciated that adaptive features make the plant more likely to reproduce. A minority of candidates thought that longer filaments would attract more insects to this flower. This was a wind-pollinated flower so longer filaments to attract more insects would not be an advantage.

Question 36

Many candidates correctly identified the fox as the secondary consumer in the food chain. Some candidates incorrectly believed that the rabbit was the secondary consumer, rather than the primary consumer.

Question 39

This was a challenging question for many candidates. Candidates would benefit from understanding that deforestation commonly causes the loss of soil and increases the risk of flooding.

Question 40

This question was well answered by many candidates. Some candidates opted incorrectly for response **B**, mainly due to the fact that they did not appreciate that **A** is the least polluted part of the river.

BIOLOGY

Paper 0610/13
Multiple Choice (Core)

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

General comments

The features of plant and animal cells were well understood, as was the use of dichotomous keys.

There was some uncertainty about how carbon atoms leave consumers in the carbon cycle, that meiosis forms genetically different gametes and that water is used up in photosynthesis.

Candidates need to work methodically through information given, such as pie charts, genetics problems and experimental data.

Comments on specific questions

Question 2

Many candidates appreciated that Zedonks are not fertile and therefore are not classified as a distinct species.

Question 3

Although many candidates correctly identified the features of birds, some candidates incorrectly believed that birds lay soft-shelled eggs.

Question 6

While many candidates correctly identified a root as an organ, there was some uncertainty about the different levels of organisation in a plant.

Question 8

This question proved challenging. Candidates would benefit from knowing the chemical elements that are found in proteins.

Question 10

This proved to be a difficult question. Many candidates did not appreciate that water is used up in photosynthesis.

Question 12

Carbohydrates, fats and oils all provide energy. Response **B** was chosen by candidates that applied their knowledge and worked methodically through the information in the pie charts.

Question 14

This question proved challenging. Many candidates did not appreciate that only small molecules like simple sugars and amino acids can cross the membrane. Proteins are too large to cross the membrane.

Question 15

While many candidates knew that the xylem and phloem tissues would be found in the cross-section of a plant root, some candidates did not know which tissue was found in which location.

Question 16

Many candidates were able to identify the right atrium and the left ventricle. Some candidates were not able to distinguish between the left and right side of the heart and therefore incorrectly chose response **A**.

Question 17

This question was well answered by many candidates. Some candidates did not take into account both the number of red blood cells and the number of platelets.

Question 18

Candidates would benefit from being able to recall that a disease-causing organism is a pathogen.

Question 19

Many candidates correctly applied their knowledge of gas exchange to determine the correct sequence. A minority of candidates incorrectly believed that oxygen passes from the larynx to a capillary.

Question 20

Many candidates appreciated that respiration is the process that releases heat to maintain a constant body temperature. A minority of candidates incorrectly opted for excretion.

Question 21

Many candidates correctly identified aerobic respiration as the process that releases the most energy from one molecule of glucose.

Question 23

The response to shining bright light into the eye was correctly identified by many candidates as a simple reflex. A few candidates incorrectly identified the response as refraction.

Question 25

Candidates would benefit from being able to recall the structure of the excretory system. It is important to be able to distinguish between the ureters and the urethra.

Question 30

The majority of candidates appreciated that chromosomes are found in the nucleus of a plant cell. A few candidates incorrectly believed that chromosomes are found in the cytoplasm.

Question 31

Candidates would benefit from understanding that meiosis produces gamete cells that are genetically different. It is important to not confuse meiosis with mitosis.

Question 32

Candidates would benefit from working methodically through genetics problems. In this question, crossing heterozygous pea plants would produce a phenotypic ratio of 3 tall to 1 short.

Question 33

Many candidates appreciated that the graph showed continuous variation. Only a minority of candidates incorrectly identified the graph as showing discontinuous variation.

Question 35

This proved to be a challenging question with many candidates not appreciating that carbon atoms leave the consumers through egestion, excretion and decomposition.

BIOLOGY

Paper 0610/21
Multiple Choice (Extended)

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

General comments

The structure of the leaf was well understood, as was the effects of adrenaline on the body and the correct definition of the term *enzyme*.

There was some uncertainty about the classification of organisms, the movement of substances across membranes, the sequence of events that result from the release of cholera toxin and the features of passive immunity.

Candidates need to work methodically through the information given in the question. For instance, when working through the magnification problem in **Question 5**, care needs to be taken with the position of the decimal point.

Comments on specific questions

Question 3

A significant proportion of candidates incorrectly believed that crustaceans have 6 or 8 legs which led these candidates to choose the incorrect distractor, 98.

Question 7

This question proved challenging. The movement of glucose and nitrate ions, in the examples given in the question, involve active transport. Active transport requires energy from respiration and therefore oxygen is required.

Question 8

This question proved challenging. Candidates would benefit from knowing the chemical elements that are found in proteins. Some candidates were unaware that nitrogen is present in all proteins.

Question 10

Many candidates correctly recognised that photosynthesis and respiration both occur in the light, but the rate of photosynthesis is higher. A small proportion of candidates incorrectly believed that photosynthesis occurs in the light, but respiration does not.

Question 12

Carbohydrates, fats and oils all provide energy. Response **B** was chosen by candidates that applied their knowledge and worked methodically through the information in the pie charts.

Question 13

Candidates would benefit from being able to recall the events that follow the release of cholera toxin.

Question 14

This question proved challenging. Many candidates did not appreciate that only small molecules like simple sugars and amino acids can cross the membrane. Proteins are too large to cross the membrane.

Question 16

This question was successfully answered by the majority of candidates. Some candidates incorrectly believed that starch is transported by translocation, not appreciating that starch is an insoluble substance.

Question 18

This question proved challenging. Candidates would benefit from being able to recall the features of passive immunity.

Question 19

Candidates would benefit from being able to recall the approximate percentage of gases in expired air or be able to apply knowledge of the percentages in inspired air.

Question 21

Many candidates appreciated that during the recovery from vigorous activity aerobic respiration of lactic acid takes place in the liver. Some candidates incorrectly believed that anaerobic respiration of lactic acid in the muscles takes place.

Question 26

This question proved challenging for many candidates. Antibiotics, such as penicillin, kill bacteria through their effect on the cell wall. Viruses are unharmed because they do not have a cell wall.

Question 28

This question proved challenging for many candidates. FSH stimulates the maturation of follicles.

Question 30

This question proved challenging with many candidates incorrectly choosing response **D**. Mature red blood cells do not have a nucleus and therefore have no chromosomes.

Question 31

This question was successfully answered by many candidates. Mitosis produces daughter cells that are identical to the parent cell. The parent cell was diploid and homozygous and therefore the daughter cells must be the same.

Question 33

Many candidates correctly recognised that hydrophytes have large air spaces in the spongy mesophyll of their leaves. This feature helps the leaves to float on water.

Question 39

This was a challenging question for some candidates. Candidates would benefit from understanding that deforestation commonly causes the loss of soil and increases the risk of flooding.

BIOLOGY

Paper 0610/22
Multiple Choice (Extended)

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

General comments

The structure of the leaf was well understood, as was the description of translocation and the process that causes antibiotic resistance in bacteria.

There was some uncertainty about the characteristics of arachnids, the effects of auxin on plant shoots and the fact that the cells produced shortly after fertilisation are stem cells produced by mitosis.

Candidates need to work methodically through information given, such as pie charts or experimental data.

Comments on specific questions

Question 1

Most candidates appreciated that the microorganisms exhibited movement, nutrition and sensitivity.

Question 3

Many candidates correctly appreciated that the arthropod shown was an arachnid. A small proportion of candidates incorrectly thought it was a crustacean.

Question 7

Many candidates appreciated that the reabsorption of glucose by kidney tubules depends on active transport. A minority of candidates incorrectly believed that the uptake of water by plant roots depends on active transport.

Question 12

Carbohydrates, fats and oils all provide energy. Response **B** was chosen by candidates that applied their knowledge and worked methodically through the information in the pie charts.

Question 13

This question proved challenging. Candidates would benefit from recalling that chloride ions are secreted into the lumen of the small intestine as a result of the toxin produced by cholera bacteria.

Question 15

Candidates would benefit from being more methodical when working through practical problems. Some candidates did not appreciate that the uncovered plant would lose water to its surroundings and therefore lose mass.

Question 16

This question was well answered by the majority of candidates. A small proportion of candidates incorrectly thought that the transported sugar in plants is glucose.

Question 19

Interpreting the diagram proved problematic for many candidates. The most common error was candidates incorrectly identifying P as the alveolus wall. The alveolus wall was represented by Q.

Question 21

Many candidates appreciated that during the recovery from vigorous activity aerobic respiration of lactic acid takes place in the liver. Some candidates incorrectly believed that anaerobic respiration of lactic acid in the muscles takes place.

Question 22

Many candidates appreciated that the process that transmits an impulse across a synapse is diffusion. A small proportion of candidates incorrectly thought that the process was active transport.

Question 26

Many candidates were able to correctly identify the factors that contribute to the development of antibiotic resistance. Some candidates incorrectly believed that artificial selection was one such factor.

Question 30

This proved to be a challenging question. Many candidates did not appreciate that the cells produced shortly after fertilisation are stem cells and they are produced by mitosis.

Question 33

Many candidates appreciated that some xerophytes have leaves that are rolled up and are covered with hairs.

Question 36

Many candidates were able to correctly identify where denitrification occurs in the nitrogen cycle.

Question 38

Candidates would benefit from recalling the chemical reaction catalysed by maltase. When a maltose molecule is hydrolysed by maltase, two glucose molecules are released.

BIOLOGY

Paper 0610/23
Multiple Choice (Extended)

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

General comments

The structure of the leaf was well understood, as was the pupil reflex and the role of bacterial plasmids in genetic engineering.

There was some uncertainty about the sequence of events that result from the release of cholera toxin, the features of passive immunity and how lactic acid is removed following vigorous activity.

Candidates need to work methodically through information given, such as pie charts and experimental data.

Comments on specific questions

Question 2

Many candidates appreciated that Zedonks are not fertile and therefore are not classified as a distinct species.

Question 12

Carbohydrates, fats and oils all provide energy. Response **B** was chosen by candidates that applied their knowledge and worked methodically through the information in the pie charts.

Question 13

This question proved challenging. Candidates would benefit from recalling that chloride ions are secreted into the lumen of the small intestine as a result of the toxin produced by cholera bacteria.

Question 18

This question proved challenging. Candidates would benefit from being able to recall the features of passive immunity.

Question 21

Many candidates appreciated that during the recovery from vigorous activity aerobic respiration of lactic acid takes place in the liver. Some candidates incorrectly believed that anaerobic respiration of lactic acid in the muscles takes place.

Question 23

Most candidates had a good understanding of how the muscles of the iris make the pupil smaller. Some candidates incorrectly opted for the reverse muscle action.

Question 28

Many candidates correctly used the concentrations of LH and oestrogen to work out when ovulation occurs. The time when LH peaks is a good indicator of when ovulation occurs since LH stimulates ovulation.

Question 31

This question was successfully answered by many candidates. Mitosis produces daughter cells that are identical to the parent cell. The parent cell was diploid and homozygous and therefore the daughter cells must be the same.

Question 34

Many candidates appreciated that lightning brings about the conversion of nitrogen in the atmosphere to nitrates in the soil. A minority of candidates incorrectly believed this to be the role of nitrifying bacteria.

Question 37

Many candidates appreciated that bacterial plasmids are used in genetic engineering.

Question 38

Many candidates correctly identified fungus as the type of organism used in the production of penicillin.

BIOLOGY

Paper 0610/31
Theory (Core)

Key messages

Candidates would benefit from reading the question carefully, as it often contains specific information that must be used in the answer. For example, the question may ask for a definition rather than a discussion and that indicates the level of detail required in the answer.

General comments

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

Command words such as 'describe', 'explain', 'suggest' and 'compare' require different types of response. If a description of data is required, the response should contain appropriate data quoted from the question. Many candidates can do this effectively. An explanation requires more detail than a description and candidates should be encouraged to understand the difference between 'explain' and 'describe'.

Comments on specific questions

Question 1

(a) (i) This question proved to be challenging. Many candidates incorrectly stated compounds or fatty acids rather than chemical elements.

(ii) Many candidates knew that fats are made from fatty acids and glycerol. Common incorrect answers included lipids, amino acids, hydrogen and other named elements.

(b) This question was well answered by many candidates. Some candidates did not read the question carefully and stated fat, which was given in the stem of the question.

(c) (i) Almost all candidates successfully completed the calculation.

(ii) Some candidates attempted to explain the results rather than describe them. Candidates would benefit from using terms precisely when describing results. For example, when comparing different animals, the term percentage of fat should be used rather than fat unqualified.

(iii) Some candidates wrote about retaining energy or burning energy in vague terms. Stronger answers stated that Alaska is colder than Virginia and therefore more fat is required for insulation and to maintain body temperature.

Question 2

(a) Very few candidates knew that an adaptive feature is an inherited feature.

(b) (i) The majority of candidates selected the correct range.

(ii) The majority of candidates correctly read a frequency value off the histogram.

(iii) Very few candidates realised that the histogram described continuous variation.

(c) This question was well answered and most candidates deduced that a longer flagellum would allow the sperm to swim faster.

(d) Most candidates knew that the testes produce sperm.

Question 3

(a) A very common misconception was that light was needed for germination.

(b) Most candidates correctly determined the ratio of 1:2.

(c) Some candidates knew that nitrate ions are needed for proteins, but very few knew that magnesium ions are needed for chlorophyll.

Question 4

(a) (i) Candidates would benefit from giving precise data quotes when describing graphical data. For example, 'the uterus lining increases in thickness between day 6 and day 15' rather than 'the uterus lining increases in thickness after day 6'. Some candidates read data from the graph incorrectly. Only the strongest responses stated that the uterus lining remained constant between day 15 and day 28.

(ii) The most common error was to state day 6, rather than days 0–6.

(iii) This question proved to be challenging with many indicating day 6 as the day of ovulation.

(b) (i) The fact that hormones are chemical substances was not well known.

(ii) Candidates were often unclear as to the specific physiological effects of adrenaline, often describing how you would feel rather then what would happen to the body.

(iii) The 'adrenaline gland' was a common error as was liver, pancreas, brain and kidney. Candidates should always take care when spelling scientific terms such as the adrenal gland.

Question 5

(a) Candidates found this question challenging and many did not understand the similarities and differences between these processes. Many candidates could state that aerobic respiration uses oxygen whereas anaerobic respiration does not. Candidates were less familiar with the products of both processes. Some incorrectly thought that carbon dioxide was produced during anaerobic respiration in muscles, perhaps confusing it with anaerobic respiration in yeast.

(b) The most common correct answer was active transport. Protein synthesis was less well known.

(c) Many candidates knew that alcohol is addictive and is a depressant but it was less well known that it increases reaction time.

(d) Almost all candidates could state an organ that would be damaged by long-term alcohol abuse.

Question 6

(a) (i) This question was well answered. 'Muscle' was given by some candidates but was not credited as it is a tissue, whereas the question required a structure.

(ii) This was a demanding question. Candidates would benefit from answering more precisely. For example, many stated that 'veins are thinner' without stating that 'the walls of veins are thinner'. A significant number of candidates compared the functions rather than the structures.

(iii) Many candidates knew that the function of arteries is to take blood away from the heart.

(b) (i) Some candidates drew a line that did not touch the red blood cell, so in effect were labelling the plasma. Label lines must clearly touch the structure being labelled.

(ii) This question was well answered by the majority of candidates with most naming white blood cells or specific types of white blood cells.

(iii) Many candidates named plasma but fewer could name a second component. Many named haemoglobin, oxygen or water, but these are constituents of red blood cells and plasma rather than a component of blood.

(c) (i) Many candidates discussed heart attacks and blocked vessels indicating they had not understood the term risk factor.

(ii) Some candidates successfully named the coronary artery but a few incorrectly stated 'artery' which was not specific enough.

Question 7

(a) Many candidates were aware of the problems of nutrient depletion and susceptibility to pests, together with the need for fertilisers and pesticides. The consequences of their large-scale use were less well known.

(b) Most candidates understood that suitable parents have to be identified at the start of the process and that selective breeding takes many generations. The middle part of the process was less well known.

Question 8

(a) (i) Most candidates successfully named the whooping crane as the most at risk species.

(ii) This was a challenging question. Most candidates selected the correct numbers from the table, but were then unable to convert to a percentage increase.

(b) (i) The reasons for species extinction were well known by the majority of candidates.

(ii) Many candidates correctly gave detailed answers referring to seed banks and protected areas. The question specified plant conservation but this was missed by some candidates.

Question 9

(a) Most candidates realised that the water would become undrinkable. Often the terms used were general with terms such as pathogens and bacteria only seen in the strongest answers.

(b) This question proved challenging to the majority of candidates. Chlorination and settlement were occasionally stated.

(c) (i) This question proved challenging and only a few candidates could state 'bacteria' or 'microorganism'.

(ii) Very few candidates stated that the organisms are responsible for the decomposition of sewage.

BIOLOGY

Paper 0610/32
Theory (Core)

Key messages

Candidates would benefit from reading questions carefully, as they often contain specific information that must be used in the answer.

Candidates would benefit from planning their time more effectively to ensure they have sufficient time to check their answers.

General comments

Candidates should make sure labels are drawn clearly and that they touch the structure being labelled.

Candidates would benefit from showing their working in calculations as they may be awarded marks for their method even if the final answer is incorrect.

Comments on specific questions

Question 1

This question was well answered. The most frequent errors were fat instead of water and antibodies instead of enzymes.

Question 2

Most candidates knew that mitotic division is used for growth and replacing damaged cells. Many candidates did not realise that both types of cell division involve nuclear division. Some candidates appeared to have confused mitosis and meiosis.

Question 3

(a) (i) Candidates were able to identify features but not always describe them, e.g. many said that the vein had a lumen but didn't refer to the size. Few candidates recognised the presence of valves. Some candidates referred to the wall as one cell thick, confusing the vein with a capillary.

(ii) The majority of candidates correctly identified the direction of blood flow. Some candidates drew arrows going in both directions or very small arrows drawn within the wall. Candidates should make sure labels are drawn clearly. Some compared the two figures apparently not realising they were different views of the same structure. Candidates would benefit from understanding the difference between a cross-section and longitudinal section.

(b) (i) Candidates found it difficult to express the idea of fingers pressing near an artery in the wrist or neck, instead stating the hand or contradicting themselves by finding the pulse in a vein. Candidates often missed the idea of a time element, just stating count the pulse rate.

(ii) The majority of candidates correctly calculated the average pulse rate when at rest. A few candidates incorrectly calculated the rate after running which did not answer the question. Candidates would benefit from showing their working as they may be awarded marks for their method even if the final answer is incorrect.

(iii) Some candidates gave very detailed answers but missed the fact that running causes an increase in the pulse rate.

(iv) This question proved challenging for some candidates. Many candidates chose **B2** because it had the highest pulse rate but the question asked for the greatest change so **B1** was the correct choice. Candidates would benefit from taking measurements to check their choice.

(v) Many candidates gave clear, comparative statements showing that they were able to use the data to identify the differences. Candidates must always use data quotes in context. In this question, comparisons were essential, as was stating the context of running or resting.

(c) Few candidates were able to identify the changes in breathing that would take place. The strongest responses explained that breathing would be deeper and the breathing rate would increase.

Question 4

This question was well answered by most candidates. The nucleus controlling cell activities was the most well-known function. Many candidates incorrectly thought that the cell wall controls the movement of chemical into and out of cells.

Question 5

(a) (i) This question proved challenging to many candidates. Many candidates thought that the roots and shoots would continue to grow horizontally.

(ii) The term gravitropism was not widely known. Common incorrect answers included gravity, phototropism and sensitivity.

(b) (i) Most candidates gave a correct word equation. A few candidates attempted to write formulae with superscript numbers rather than subscripts.

(ii) Many candidates gave magnesium as the correct answer.

(iii) Many candidates successfully named the palisade cell as an example of a photosynthetic cell. A common incorrect answer was chloroplast.

(c) (i) Many candidates correctly stated that the shorter the distance between the light and the plant, the greater the rate of photosynthesis. Stronger responses included the fact that the relationship is non-linear or that the maximum rate is reached when the plant is within 10 cm of the light source.

(ii) The most common correct response was temperature, followed by carbon dioxide concentration. A few candidates knew that water is a limiting factor in terrestrial plants but that response would not be appropriate in this question as the plant was aquatic.

(d) This question was well answered with most candidates stating that glucose is used in respiration or is converted into starch and cellulose. Responses such as ‘growth’ or ‘for food’ lacked sufficient detail.

Question 6

(a) (i) Most candidates correctly labelled the diagram. The most common mistake was transposing the trachea and the larynx.

(ii) Many candidates missed the word ‘system’ and answered heart. Care should be taken when reading questions to ensure the full wording has been understood.

(b) This was a challenging question. Only some candidates knew that efficient gas exchange surfaces are thin, moist and have a large surface area.

(c) Many candidates could name the harmful components of smoke and knew about lung cancer and addiction. Some confused the harmful effects of smoking with those of alcohol.

Question 7

(a) The definitions for chromosome and inheritance were the most well-known, with gene and phenotype being less well-known.

(b) (i) The number 23, rather than 46, was the most common response. Some candidates correctly stated 23 pairs.

(ii) There were many accurate descriptions stating that the photomicrograph contained two X chromosomes and was therefore from a female individual. Some candidates could not express themselves clearly and used incorrect terminology. A number of candidates gave imprecise answers, such as, only females have the X chromosome or that females are X and males are Y.

(iii) Many candidates stated that Down's Syndrome was due to too many or too few chromosomes or having extra chromosomes (implying more than one extra). The strongest responses referred to the diagram which had been provided and stated that the individual had 47 chromosomes due to an extra copy of chromosome 21.

Question 8

(a) Candidates would benefit from a better understanding of the terms used to describe the nervous system. Many confused stimulus with impulse and sensory with motor.

(b) Many candidates named sense organs rather than stimuli. Temperature was the commonest correct answer, with pain also being well-known.

(c) Most candidates described a scenario that would cause a reflex arc, e.g. touching a hot object but did not give details of the neurones involved, the path of the impulse or the sequence of events.

Question 9

(a) (i) Many candidates stated root, not appreciating that the question asked for a type of cell.

(ii) Many candidates correctly stated xylem tissue but some confused the two types of transport tissue and stated phloem tissue.

(iii) This question was well answered. A few incorrectly stated stomata, clearly thinking of where water is lost, but without referring to the organ as asked in the question.

(b) Most candidates successfully named three ways, with the most common answers being sweat, urine, tears and diarrhoea. Some candidates stated activities that would increase water loss, e.g. exercise or running. A few candidates stated urea rather than urine.

Question 10

(a) (i), (ii) and **(iii)** Candidates were able to accurately use the data presented in the graph.

(b) Candidates often linked both temperature and humidity together rather than explaining each as a separate factor.

(c) The majority of candidates knew that transpiration results in water loss from plants.

BIOLOGY

Paper 0610/33
Theory (Core)

Key messages

Candidates would benefit from reading the question carefully, particularly noting how many answers they need to give. For example, if the question asks for chromosomes or Petri dishes and is for more than one mark, then more than one answer is required.

General comments

Candidates should make sure labels are drawn clearly and that they touch the structure being labelled.

There was continued improvement in classifying information into categories.

Comments on specific questions

Question 1

(a) (i) All candidates were able to select the jelly coating for the egg cell. Many candidates, because they were looking for 'is very small', chose 'is very thin' instead.

(ii) This question was well answered, with most candidates correctly labelling the parts. Candidates should ensure that label lines touch the parts being labelled.

(b) (i) Most candidates were aware that the nucleus is the largest of the three structures. It was less well known that the gene is the smallest.

(ii) Some candidates gave the correct response, but a common misconception was to name protein as the molecule.

(c) Many candidates gave the answer as a specialised tissue, rather than cells. A common error was to write cilia rather than ciliated cell.

Question 2

(a) This question was well answered and most candidates were able to identify the structure as a sensory neurone.

(b) (i) Most candidates could recall that the synapse is a junction between two neurones.

(ii) Many candidates knew that a nerve impulse is an electrical signal. A number of candidates gave the parts of the 'stimulus–response' chain itself, rather than the impulse.

(c) This question was well answered and candidates clearly understood the structure and role of the human nervous system.

(d) This question asked for chemical elements to be named, but many candidates incorrectly gave amino acids.

(e) This question was well answered, although some were confused by having to draw two lines to the box labelled glucose.

Question 3

(a) Most candidates were able to relate cell structures to functions. A few candidates thought that photosynthesis, rather than respiration, releases energy.

(b) (i) This question compared meiosis and mitosis. Those candidates that correctly identified meiosis as producing gametes were able to correctly tick more boxes.

(ii) Although most candidates understood the role of X and Y chromosomes, many did not give the pairs of chromosomes in the boxes. Candidates would benefit from carefully reading the headings in tables.

Question 4

(a) This question asked for a definition of variation. Many candidates gave causes and examples of differences rather than a clear definition.

(b) (i) The majority of candidates correctly read a frequency value off the histogram.

(ii) The majority of candidates selected the correct hand span range.

(c) Candidates were required to state the type of variation and then give evidence. It is important in data handling questions to refer to the data given in the question.

Question 5

(a) (i) The majority of candidates correctly labelled the testes.

(ii) Many candidates knew that oestrogen controls the development of secondary sexual characteristics in girls.

(iii) Most candidates were able to sort the characteristics correctly, but some incorrectly placed pubic hair and underarm hair in both columns.

(b) Candidates gave quite detailed answers for the effect of adrenaline, but many of them were not biological.

Question 6

(a) (i) A 'define' question requires a precise answer rather than a discussion. Some candidates were confused about the role of energy in respiration. Energy is released but is not produced in respiration.

(ii) It is important to read the whole question carefully. Some candidates quoted the products of anaerobic respiration in muscle and yeast.

(iii) Many candidates were able to give at least one difference between anaerobic respiration in yeast and muscle cells.

(b) (i) Nearly all candidates calculated correctly, with just a few forgetting to round to a whole number.

(ii) While many candidates understood that aerobic respiration releases more energy, answers often contained errors in the description of energy. Many were aware of the problems of lactic acid build up in muscles.

(c) This was a challenging question**.** Most candidates were able to work out the increase, but some were unable to convert it to a percentage.

(d) This question was generally well answered, although a small number of candidates thought they had to give the corrected sentences, rather than the incorrect words.

Question 7

(a) (i) Most candidates were able to describe the growth of the tomato seedlings.

(ii) Many candidates correctly identified phototropism.

(iii) This question was well answered with excellent explanations of why seedlings need light, showing the connections between light, photosynthesis and growth.

(iv) Few candidates understood that roots respond to light by growing away from it.

(b) The question specifies conditions for the germination of seeds, not the growth of seedlings. Most candidates incorrectly gave light as an essential condition.

(c) This was a challenging question. Most answers described the role of xylem and root hair cells, rather than turgid cells.

Question 8

(a) Candidates confidently identified the parts of the eye and completed the table.

(b) This question was generally well answered and the pupil reflex was well understood.

BIOLOGY

Paper 0610/41
Theory (Extended)

Key messages

Candidates need to appreciate that when quoting data, answers must include units. In **Question 3 (d)(ii)** many candidates did not specify the unit as g per day per g and simply wrote answers such as 1.8 instead of 1.8 g per day per g.

Where candidates are asked to explain or describe, maximum marks can be obtained by identifying relevant points and giving a detailed and logical account. Responses that are presented as bullet points often lack sufficient detail.

Candidates should use source information when prompted to do so. For example, candidates should have made good use of the information and data in **Question 5** when answering **part (b)(ii)**.

It is important that candidates read the questions carefully and be aware of the differences between command words, particularly describe and explain.

Candidates would benefit from drawing label lines that are drawn with a ruler and terminate on the structures to be identified.

There are many definitions given in the syllabus. Candidates should be encouraged to learn definitions as it is important to phrase answers close to those given in the syllabus.

General comments

There were some excellent answers to the questions on this paper. Some candidates did not always show a good understanding of the command words and therefore did not address the questions directly and wrote material that was not relevant.

Strong responses were provided by candidates that had read the whole question, including the stimulus material provided. Reading all the material provided is an important exam skill.

Question 7 was based on aspects of the nitrogen cycle. Candidates would benefit from a greater understanding of this topic as many found it challenging.

Comments on specific questions

Question 1

(a) Few candidates named the distinguishing features of myriapods. Many candidates did not qualify the presence of a segmented body with the term ‘many’ and the same error was made for legs. The most common incorrect features were antennae and eyes. Responses which included the presence of head and body segments or elongated bodies were rarely seen.

(b) This question was well answered by candidates. Responses which included spiders instead of arachnids did not gain credit as they are not a group.

(c) The majority of candidates gained two marks for correctly identifying the arthropods **J**, **L** and **M** using the key provided. Many candidates didn’t identify species **K**, **N** and **O** for class 4, commonly just putting one letter when all three letters were required.

(d) (i) Many candidates identified the genus as *Apheloria*. Fewer correctly gave the kingdom as Animalia. The most common incorrect kingdom was insects.

(ii) Most candidates knew that mitochondria are involved with energy as many described them as the powerhouses of the cell in their responses, although this expression did not gain credit. Candidates often used the appropriate scientific terminology and stated that mitochondria are involved in the release of energy. A common misconception was that mitochondria produce energy or store energy. Few candidates stated that no aerobic respiration would take place in the absence of functioning mitochondria. Others described mitochondria as being essential for the release of energy for respiration, rather than the release of energy by respiration.

Question 2

(a) Few candidates gained full marks for this question. A common error was to write about carbohydrates and amino acids together, instead of giving their individual uses in plants. The points most frequently credited linked carbohydrates to energy or respiration and amino acids to proteins and growth. Responses which included the use of carbohydrates to attract insects were seen occasionally. A common misconception was that carbohydrates are used in photosynthesis.

(b) Most candidates correctly identified the location of the phloem in the stem and the root. Locating phloem in the leaf proved more of a challenge. A few candidates placed label lines right on the boundary between the xylem and phloem and could not be credited.

(c) (i) Candidates found this question extremely challenging with most gaining credit only for recognising that the highest concentration of sucrose was in the stem. A few candidates realised that the darkness would stop photosynthesis, but responses that went on to explore the consequences of this were seen rarely. Some candidates knew the terms source and sink and used these words without stating that the root was the source and the leaf and stem were the sinks. Translocation was occasionally seen, often stating that the sucrose moves down the plant which gained no credit. One misconception was to suggest that the sucrose came from the soil.

(ii) Most candidates suggested insecticides as a modern technology, often describing them as a pesticide that kills insects so gaining credit. Stronger responses went on to state that insecticides are applied by spraying them onto crops. Frequently there was confusion between insecticides, pesticides and herbicides. Genetic modification was often seen though few candidates gave a creditworthy description of how genetic modification would be used for crop protection.

(iii) This question was generally answered well with many candidates gaining credit for pollination. A few responses incorrectly referred to spiders or worms, rather than insects.

Question 3

(a) The majority of candidates gave a correct explanation of the purpose of excretion. Some candidates did not make it clear that waste substances are removed from the organism.

(b) Most candidates attempted to sketch a kidney and the majority went on to label their drawing. There were many excellent sketches. A common error was to label the cortex as medulla and vice versa. Some candidates found this question challenging.

(c) (i) Candidates found it a challenge to differentiate between the structure of a glomerulus and its role. Many candidates described the structure as a network, but with few referring to capillaries in their answers. Weaker responses described the glomerulus as round rather than spherical.

(ii) Only the most able candidates answered this question well. Some candidates recalled that filtration is a role of the glomerulus. Many candidates named a correct substance that is filtered, but the majority missed the fact that these substances are filtered out of the blood.

(d) (i) Some candidates described accurately how salts are reabsorbed against a concentration gradient. Most candidates identified the process involved as active transport, but there were few references to this occurring across membranes. Few candidates referred to the involvement of proteins. When proteins were mentioned candidates tended to state that proteins moved across the membranes rather than salts. Stronger responses described the role of membrane proteins in active transport.

A few responses stated incorrectly that the protein molecules provide energy rather than use energy to move the salts. Some were unclear when using the term concentration gradient, for example, stating that the movement of salts against a concentration gradient was from a region of high concentration to a region of low concentration.

(ii) The majority of candidates identified the correct values required (salt reabsorption and kidney mass). Fewer were confident about the calculation (salt reabsorption divided by mass). The mark for the conclusion was frequently not credited, as candidates stated that very different values, for example, 500 and 0.500 were the same, even though they differed by orders of magnitude. Credit was given for a conclusion that matched incorrectly calculated values. Some candidates performed calculations and left the result unclear so that the conclusion mark could not be credited. Many candidates did not state the units when presenting the results of their calculations.

(iii) Only a few candidates knew that osmosis is the name of the process that mammals use to reabsorb water. The most common incorrect suggestion was reabsorption.

(iv) Some candidates knew that glucose is also reabsorbed in kidney tubules.

Question 4

(a) Candidates familiar with the mechanical and chemical barriers that prevent pathogens from entering the human body gave very detailed responses. Some candidates focused too much on one aspect to gain full credit; for example, some gave numerous examples of mechanical or chemical barriers with no mention of the blood defence mechanisms. A common misconception was for candidates to refer to cilia in the nose rather than nasal hairs as a mechanical defence. The differences between the terms antibodies, antigens and pathogens were not clearly understood. Many responses described antibodies as white blood cells that destroy pathogens. Some responses 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 and mark them for phagocytosis. Generally, the role of phagocytes was less well explained than other defences. A number of candidates described antibodies engulfing pathogens, which was not credited. Reference to long-term immunity was rarely seen.

(b) The majority of candidates stated that antibiotics are used to treat bacterial infections or gave a suitable named example, such as penicillin. Occasionally, *Penicillium* was seen for penicillin which did not gain credit.

Question 5

(a) (i) Some candidates correctly identified the coronary artery. Many incorrect responses referring to an artery were seen.

(ii) This question required a description of how a blood clot forms. Candidates found it a challenge to distinguish between the mechanism of blood clotting (how) and the reasons for blood clotting (why). The majority of candidates described the formation of plaques due to cholesterol and the effect of poor diets. A few candidates gained credit for mentioning platelets or the conversion of fibrinogen to fibrin. The best responses gave very thorough descriptions of the process.

(iii) Most candidates who gained credit gave aspirin as their answer.

(b) (i) Many candidates found it difficult to read the correct values from the graph, although most gave values close to the correct ones, they did not gain credit for this. Subsequent marks remained available to candidates regardless of the values given, though many candidates seemed unsure how to calculate the percentage decrease, or did not provide sufficient detail to allow marks to be awarded for correct working. One of the more common errors was to use the wrong denominator or to not give the answer to the nearest whole number.

(b) (ii) The majority of candidates achieved several marks for this question, though few gained full credit due to a lack of detail. Most recognised that only women and only certain age groups were included in the study. They also stated that the women may not have been truthful about the amount of exercise they had carried out. Almost all candidates identified that there was a benefit in doing exercise to reduce the chance of suffering from CHD. Some named other examples of risk factors for CHD. Common misconceptions included stating that the amount of exercise affected

deaths from CHD, worrying about how people would feel if told they had to do exercise and the risk of excessive exercise for older people.

(c) Candidates generally recognised the need for energy and thus for glucose or oxygen, leading to an increase in blood flowing to muscles. In some responses the idea of 'more', or 'an increase' was missing, which meant marks could not be credited.

Question 6

(a) Some candidates confused a deficiency of vitamin D with a deficiency of vitamin C or a deficiency of iron. The most common correct answers were rickets and weak bones or teeth.

(b) There were some very good responses to this question. In some cases, candidates tried to explain the three statements rather than writing descriptions of the reasons, risks and methods. Other candidates concentrated on only one part, such as the stages of eutrophication. The most common responses for why fish become endangered were eutrophication and pollution. The majority of candidates recognised that fish species could become extinct when their population size decreases. Many candidates gave good accounts of the methods that could be used to maintain fish stocks.

Question 7

(a) (i) Some candidates did not answer this question. Candidates who attempted the question often gained full credit. Some candidates were aware of the association of nitrogen fixation with storms, though wrote rain or thunder rather than lightning. The most common correct answer was bacteria.

(ii) Only a few candidates identified process **A** as denitrification and process **B** as nitrification. The most common incorrect answer was decomposition for process **B**.

(iii) Few correctly named compound **X** as ammonia or ammonium.

(iv) A minority of candidates wrote an excellent definition of the term deamination. Many candidates wrote about the removal or breakdown of proteins instead of amino acids and there was some confusion between urea and urine.

(b) Many candidates correctly stated ribosomes as the structure in the cell where protein synthesis occurs.

(c) Protease, pepsin and trypsin were correctly named in candidate responses. A few incorrectly suggested amylase or pectinase.

BIOLOGY

Paper 0610/42
Theory (Extended)

Key messages

Candidates need to appreciate that when quoting data, answers must include units. In **Question 4 (d)(ii)** many candidates did not use the correct unit for the death rates. Many candidates used the same scale to take figures for percentage smoking and death rates so gave the latter as percentages rather than as deaths per 100 000.

Where candidates are asked to explain or describe, maximum marks can best be obtained by identifying relevant points and giving a detailed and logical account. Responses that are presented as bullet points often lack sufficient detail.

It is important that candidates read each question and any accompanying stimulus material carefully and complete all the instructions contained within the question. This was particularly important in **Question 2 (a)** and **Question 3 (e)**.

There are many definitions given in the syllabus. Candidates should be encouraged to learn definitions as it is important to phrase answers close to those given in the syllabus.

General comments

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

Some candidates misinterpreted the command words. Candidates would benefit from understanding the type of response that is expected from each command word, particularly describe and explain.

Comments on specific questions

Question 1

(a) (i) Many candidates gave two suitable features common to all arthropods, such as segmented bodies, jointed legs and an exoskeleton. Not all arthropods have antennae.

(ii) Candidates had to give two features to complete the key to the arthropods shown in Fig. 1.1. Typical answers for box 2 included the insect features of three pairs of legs and wings. Candidates often gave incorrect features in box 3 such as compound eyes. Many, however, correctly stated that arthropod **A** has claws of different sizes.

(b) (i) Most candidates gave four pairs of legs as the feature shown by the happy-faced spider that identifies it as an arachnid. Some stated that the head and thorax are fused together or used the term cephalothorax. A few gave pedipalps as the feature.

(ii) Some candidates gave good accounts of adaptive features as applied to the happy-face spider. These candidates clearly knew the definition of the term from the syllabus. However, many candidates described features other than the pattern on the bodies of the spiders in their explanation. Those that did write about the face pattern often referred to camouflage, warning to predators and lures for prey.

(c) Some candidates simply explained where to find DNA either in cells or on the spider webs. Others explained how to cut particular lengths of DNA from the samples collected from the spider webs thinking that this was a question about genetic engineering. Strong responses started with the base sequences in DNA from unknown sources should be compared to known sequences. Many candidates had the idea that the base sequence in DNA is unique to each species. Some candidates quoted the syllabus statement that organisms which are more closely related have base sequences that are more similar than those that share only a distant ancestor. An occasional error was to confuse DNA with protein structure and to state that DNA is composed of a sequence of amino acids. Some candidates referred to base pairs instead of base sequences.

(d) Many candidates gave three different reasons why species become endangered. Some candidates focused entirely on spiders and gave three variants on the hunting-collecting idea. Common acceptable answers were the use of pesticides, habitat loss, increases in predators and increase in competition for food. Some candidates thought that the large-scale removal of spiders from their environment for sale to tourists or for research work in laboratories were responsible.

Question 2

(a) Most candidates answered this question, although some only completed one of the two tasks. Many circled a complete vascular bundle enclosing the xylem, phloem and outer area of sclerenchyma (fibres). Circles that did not include the fibrous area were accepted, but they had to enclose the whole of the xylem and phloem.

(b) Candidates who realised that the cells in area **Y** of the stem are living cells that absorb water by osmosis and are turgid tended to gain maximum marks. Many candidates thought that **Y** was pointing to the xylem or phloem and described the movement of substances within those tissues, or they thought that the cell walls of the cells were lignified to provide support.

(c) Most candidates gave good descriptions of the data in Fig. 2.3 and Table 2.1 explaining that removal of the phloem prevented translocation of the labelled sucrose or that sucrose was only translocated when phloem was left intact. Very few answers referred to the leaf as the source of the sucrose or the shoot tips and roots as the sinks. Weaker answers stated that the movement of minerals occurred in the phloem from roots to shoots and made little reference to the information about sucrose given in the question. Only the strongest answers stated that sucrose moves in both directions in the stem.

Question 3

(a) (i) Many candidates identified the correct roles of hydrochloric acid. A few candidates thought that the acid was responsible for chemical digestion.

(ii) Most candidates stated that pepsin is the enzyme that breaks down protein in the stomach. The products of the action of pepsin were given as polypeptides, peptides and amino acids. Some stated that pepsin is a protease without any further detail so did not gain credit. Others confused pepsin with lipase or with amylase.

(b) Candidates were less successful with the definition of assimilation. Many confused this with mechanical digestion, chemical digestion or absorption. Those that knew assimilation follows absorption rarely stated that nutrients that were formed by digestion move into cells where they become part of the cells. Examples were not required, but some candidates did support their definition by giving the example of protein synthesis. Some candidates thought that assimilation was the distribution of food molecules through the body in the blood.

(c) Many candidates thought that stem cells provide defence against stomach acid. Few seemed to know the role of stem cells as described in **section 17** of the syllabus. Strong responses referred to stem cells as unspecialised cells that divide by mitosis to produce cells that specialise to replace cells damaged by the acid contents of the stomach. Stem cells do not repair damaged cells as some candidates thought.

(d) The role of the microvilli in increasing the surface area of the villi in the small intestine for absorption was well known. A common misconception was that microvilli help to move food along the intestines.

(e) There were many correct answers, but many candidates rounded up their answers to one decimal place rather than to the nearest whole number. Common errors included:

- misreading the figures from the graph
- using 120 as the denominator in the calculation rather than 78
- dividing 78 by 120 instead of dividing the increase in number (42) by 78.

Question 4

(a) There were many good accounts of the ways in which the human gas exchange system is protected against pathogens. Many answers included the roles of nasal hairs, goblet cells, mucus and cilia. A common misconception was that cilia trap bacteria, rather than move bacteria trapped in mucus. Few candidates classified the protection measures they described as mechanical or chemical barriers. Some candidates described the action of phagocytes in the lungs, although some just referred to them without describing their action in engulfing pathogens.

(b) Well-prepared candidates wrote excellent answers to this question on vaccination. Strong responses explained that vaccines contain dead or weakened forms of the pathogen which stimulates active immunity. Candidates explained that some lymphocytes release antibodies and some develop into memory cells that are responsible for the fast response if the live pathogen enters the body in the future. Some candidates used the terms immune response and antigen correctly in their answers and explained that memory cells are long-lived or are responsible for the long-term nature of active immunity. Weak responses often showed knowledge of the events that follow injection of a vaccine, but did not use the correct terminology or included misconceptions.

(c) Most candidates could not give two appropriate reasons why antibiotics cannot be used to treat viral infections. Only the strongest candidates stated that antibiotics are effective against bacteria, but viruses do not have any of the structures or processes that are targeted by these drugs. Common correct answers were that viruses are not alive and that they do not have cell walls. Some candidates also stated that viruses infect the cells of their hosts so that they are beyond the reach of antibiotics that cannot cross cell membranes.

(d) (i) In this data response question, candidates were asked to describe the differences between the percentages of males and females that smoke in country **A**. Many candidates described the changes in the percentages in the two groups without stating any differences between them. Most of the successful answers stated the percentage of males that smoke is higher than the percentage of females, that the peak for males occurred earlier than for females and that the increase in the percentage of males smoking early in the twentieth century occurred faster and, later in the century, the decrease occurred faster than in females. Many answers included suitable data quotes with year(s) and percentages for both groups. Some candidates did not read the question carefully and also wrote about death rates.

(ii) This proved to be a challenging question as many candidates did not identify any trends in their answers. Good answers agreed with the statement using evidence from country **A** in Fig. 4.1. They identified the increase and decrease in percentage smoking in both groups and the same trend repeated in the deaths from lung cancer. Some also noticed that the peaks occurred some years apart. The same trends are not visible in country **B** as no data is included for the years before 1950. Some candidates noticed that while the percentage of male smokers decreased steeply from that date, the numbers of female smokers did not and fluctuated from year to year. Also, the number of deaths in men increased from 1950 but the number of deaths in females did not. Confusion often occurred as a result of candidates not specifying the country they were referring to, or comparing males from each country rather than the trends within each country and the pattern between male and female. Some candidates just quoted data from different points in the graphs, but did not describe any trends. Many candidates gave the death rates as percentages taking them from the axis on the left rather than the axis on the right. Some used the same scale to make comparisons saying that more men or women die from lung cancer than smoke.

Question 5

(a) (i) Candidates who based their answers simply on their knowledge of wind-pollinated flowers tended to score less well than those who read the question and based their answers on the flower shown in Fig. 5.1. Points about pollen grains, colour, scent and absence of features associated with insect

pollination did not gain any credit. Strong responses referred to the position of anthers and stigma, the feathery structure of the stigma and the small bracts. Some candidates used the letters from Fig. 5.1 in their answers, but some did not identify the structures correctly. For example, the stigma was often identified as pollen.

(ii) Most candidates gave a correct answer. A common incorrect answer was **D**.

(b) Many candidates appeared to assume this question was about asexual reproduction in plants rather than sexual reproduction involving self-pollination. Some made this explicit by stating that the plants split into two. Few candidates gave positive aspects of self-pollination, such as the little wastage of pollen and the independence from pollinators. Some candidates wrote about dispersal of seeds rather than the transfer of pollen grains. Quite a few candidates referred to plants being genetically identical, rather than having little variation, which suggests asexual reproduction. There were quite a few vague references to disease or being unable to survive or adapt to changes in the environment.

(c) Candidates identified most of the factors that have the potential to cause famines.

(d) (i) Many answers simply repeated the steps already outlined in Fig. 5.2 to suggest how the plant breeders made sure that the plants that they used for step 3 were rust-resistant. Stronger responses stated that the plants could be exposed to the rust fungus to see if they become infected. Candidates rarely stated that the plants that were not infected, did not show any symptoms or showed resistance would be the ones chosen for step 3. Perhaps prompted by **Question 1** candidates suggested that the DNA of the plants could be tested for the appropriate gene.

(ii) Candidates often missed the fact that step 3 is repeated for many generations to increase the number of plants that will become available for supply to farmers. Other ideas that candidates suggested included ensuring that all the plants are resistant to stem rust and to make sure that they are all homozygous for the gene concerned.

(e) Candidates gave a variety of features of monocotyledons including one seed leaf or cotyledon, narrow leaves, parallel veins and flower parts in threes. Monocotyledons do not have one seed.

Question 6

(a) Many candidates completed the table correctly. The most common incorrect responses were for **C** and **D**. These were often given as decomposition for both **C** (respiration) and **D** (fossilisation). Some candidates gave formation of fossil fuels for **D** and that was accepted.

(b) Candidates had to complete the passage with six words or phrases. Sources of methane proved difficult for candidates to state accurately. The expected sources were cattle, flooded rice fields, swamps or marshes, rubbish tips and landfill. Many candidates gave combustion or burning which was not accepted. As with sources of methane a variety of answers were accepted for the final gap. The expected answer was non-biodegradable, but micro, single-use and non-recyclable were accepted. These answers showed an awareness of current concerns over the widespread use of plastics and their damage to the environment.

BIOLOGY

Paper 0610/43
Theory (Extended)

Key messages

Candidates need to appreciate that when quoting data, answers must include units. In **Question 3 (d)(iii)** many candidates did not specify the unit as kPa and in **Question 4 (b)(ii)** they did not include the percentage sign. Other candidates started to quote data, but did not use a comparative statement and consequently did not gain the mark.

Where candidates are asked to explain or describe, maximum marks can best be obtained by identifying relevant points and giving a detailed and logical account. Responses that are presented as bullet points often lack sufficient detail.

Candidates should use source information when prompted to do so. For example, the use of data in **Question 4 (b)(ii)** and identifying the structures in **Question 6 (a)**.

It is important that candidates read the questions carefully. Many candidates wrote about the digestion of molecules other than carbohydrates in **Question 3 (a)**.

General comments

There were some excellent answers to the questions in this paper. Some candidates did not always show a good understanding of the command words and therefore did not address the questions directly but wrote material that was not relevant.

Some candidates were unfamiliar with the appropriate vocabulary or used scientific terms in the wrong context.

Question 3 (c)(ii) was based on the excretion of salt. Candidates would benefit from a greater understanding of this topic as many found it challenging.

Comments on specific questions

Question 1

(a) (i) Most candidates determined that the ant-mimic jumping spider was in the third level of the food chain. Many candidates just stated that the spiders were consumers or predators and this was not credited. Some thought that the spiders are primary consumers occupying the second level of the food chain.

(ii) Many candidates used their knowledge of binomial nomenclature to state the genus of the spider as *Myrmarachne*. The most common errors were *formicaria* or arthropods. Some candidates gave both scientific names and therefore could not be credited.

(iii) Many candidates knew that a key using paired choices is called a dichotomous key. A few candidates gave incorrect answers such as arthropod key or spider key. Some candidates misinterpreted the question and gave a specific feature that might be used in a dichotomous key, for example, number of legs.

(b) (i) Most candidates gave features common to all arthropods. Most commonly seen correct answers were exoskeleton, segmented body and jointed legs and/or the number of legs. Some candidates

stated too many legs or too many pairs of legs so did not gain credit. Other common incorrect answers included the presence of antennae and compound eyes, features that are not seen in all arthropods.

(ii) The distinguishing features of arachnids were less well known than those of arthropods. Most correctly stated that they have four pairs of legs or eight legs. Other common answers included two body parts. The term cephalothorax was known but was not a frequent response.

(iii) Most candidates successfully selected the four arachnids from the six arthropods. Almost all candidates followed the instruction to list four letters, with only a few giving fewer than four. Some gave **A** or **F** in their list so did not gain full marks.

(c) Fewer candidates named other features used in classification. Some candidates correctly referred to anatomy and to DNA sequences. It was very rare to see sequences of amino acids or behaviour as suggestions. There was a wide range of incorrect answers that suggested that this particular topic on the syllabus was not well known.

Question 2

(a) (i) Almost all candidates knew that glucose is produced in leaves by photosynthesis and many detailed accounts were seen. Some responses were imprecise in their use of terminology; stating that it was the chloroplast, rather than chlorophyll, that traps light. It was common to see a lot of additional information about how plants obtain their water and carbon dioxide even though the mark allocation should have guided the candidates that this was not required. Very few accounts referred to the conversion of light energy to chemical energy. Confusion with respiration, or attempts to explain respiration as a part of photosynthesis, were seen frequently.

(ii) Although many candidates knew that sucrose moved by translocation, many incorrect responses were seen. The most common incorrect responses were transpiration, osmosis and active transport.

(iii) Most candidates discussed the uptake of water and minerals salts from the soil rather than translocation. Although there were many excellent answers that explained why roots sometimes act as a source, it was evident that many candidates were not familiar with the terms, source and sink.

(b) (i) Many candidates applied their understanding of plants to the diagrams of the model in Fig. 2.1 to identify tubes **Q** and **S** as phloem and xylem respectively although some got them the wrong way around. If only one was correctly identified, this was more commonly phloem.

(ii) Many excellent and very thorough explanations of why sucrose would move along tube **Q** were seen. Many candidates had some idea that osmosis and diffusion were involved but used these terms in the wrong context. Common misconceptions included discussing movement by osmosis in terms of solute molecules rather than water molecules or stating that sucrose passed through the membrane. A common starting point for correct answers was that sucrose diffused from a higher concentration to a lower concentration along tube **Q**. This was then followed by explanations of how the increase in water into bag **P** by osmosis, down a water potential gradient, caused an increase in pressure or volume to push the sucrose solution along tube **Q**.

(c) Many candidates realised that the source and sink bags would equilibrate after two hours and this would mean that the net movement of sucrose through tube **Q** would stop. One common misconception is that the equilibration would occur between the inside and the outside of the bags. Other common incorrect responses referred to all the sucrose being used up or having moved to bag **R**.

(d) Well-prepared candidates knew that nitrate is the mineral ion required to make amino acids, but incorrect answers were also seen. These included nitrogen, protein, sodium ions or iron ions.

Question 3

(a) Many very detailed answers describing what happens to carbohydrates between ingestion and assimilation were seen. Many candidates continued to use the more general term carbohydrates instead of starch when referring to specific enzyme reactions and stated that carbohydrates rather than glucose are absorbed in the alimentary canal. Otherwise strong responses, which appreciated

that absorption took place in the small intestine via the villi did not include specific details about the method of absorption. The presence of maltase on the epithelium of the small intestine was not well known. Weaker answers often rewrote the information from the question without any elaboration and, consequently, did not demonstrate any further knowledge or understanding of the subject. Many candidates broadened their answers to the digestion and absorption of proteins and lipids even though this was not asked for in the question.

(b) Almost all candidates knew that calcium ions are required for strong bones and teeth. Some candidates also stated that calcium ions help in blood clotting or had a role in muscle contractions. The function of iron was slightly less well known although many identified its role in production of haemoglobin, transport of oxygen and prevention of anaemia. A common misconception was that iron prevents scurvy.

(c) (i) Many candidates gave two correct factors that affect the risk of developing coronary heart disease (CHD). Vague statements such as lifestyle could not be credited. Quite a few candidates did not read the question carefully and discussed diet and blood pressure in their answer, these did not gain any marks because they were specified in the question.

(ii) The strongest responses provided detailed explanations of excretion and how excess salt is not reabsorbed back into the blood. Weaker responses repeated information given in the question or became confused between the processes of filtration and reabsorption. Often candidates did not make it clear that the salt was excreted or removed from the body. Some answers showed confusion between urea and urine.

(d) (i) A good variety of correct components of the diet were suggested. The few candidates who did not gain credit mostly referred to vitamins, carbohydrates or vegetables, others included factors that are not components of a diet, such as smoking or exercise. This suggested that they had not read the question carefully.

(ii) The vast majority of candidates read from the graph correctly but fewer used the data to calculate the correct percentage increase in blood pressure. The most common errors were not expressing the answer as a whole number, using the incorrect denominator in their calculation, or simply dividing the two blood pressures by each other. Almost all candidates followed the instruction to round their answer to the nearest whole number and so were able to gain some credit, even if they had not performed the correct calculation or had read the wrong numbers from the graph.

(iii) Most candidates gave at least one piece of evidence from Fig. 3.2 to support the conclusion that some diets reduce the risk of CHD. Some candidates did not read the question carefully and went on to explain why various components of the diet would affect the risk. Many simply compared the results from group 1 with group 2 or just quoted data without a valid comparison.

Question 4

(a) (i) Many candidates described reasons why people cut down forests and it was common for candidates to achieve maximum credit for this question. Some candidates gave many very similar examples that were all considered part of the same reason, for example clearing land for houses, factories and cities are all associated with the same idea.

(ii) Candidates displayed a good understanding of how forests can be conserved with many well considered actions described. These answers suggested that candidates had a good awareness of local knowledge of the forested environments in their community. Again, some candidates gave multiple examples of the same concept, such as providing education in schools and using media campaigns and advertisements to raise awareness among the general public to explain the importance of conserving forests. These answers were considered to be alternatives of one another.

(b) (i) Most candidates used the data in Table 4.1 to determine that the house mouse showed almost no preference between small and large areas of forest.

(b) (ii) Many candidates compared the last two columns of data correctly to confirm that the larger areas of forest were best for most mammals. Many answers related the percentage of mammals to the forest size and included the two introduced species as exceptions to the general trend. The better-prepared candidates went on to give examples, expanding their answers to include some evidence

from the size of the mammals and mention that the data for the introduced species did not support the hypothesis. Some very astute candidates made reference to the limitations of using one study in accepting a broad hypothesis. A considerable number of candidates did not read either the question or the data carefully. It was common to see responses that added up the last two columns of data to give a meaningless total, or that attempted to explain the relationship by writing generally about the conservation of mammals without any reference to the study. Occasionally candidates used the data as numbers of a particular species rather than percentage of forest areas containing each species.

Question 5

(a) Many candidates were familiar with the correct terminology associated with genetic engineering and completed the passage with the correct terms. The terms that were least well known were 'genes' or 'alleles' for the fourth response and 'recombinant' for the seventh response. Many candidates suggested using ligase or similar instead of the 'same' restriction enzyme. Others stated that the plasmid should be placed in a fermenter rather than a host vector cell.

(b) Biological washing powders and the production of lactose-free milk were the most common correct examples of biotechnologies that use enzymes. The use of pectinase to produce fruit juice was also well known. The most common incorrect answers were to give examples associated with genetic engineering or products made with yeast, such as bread, penicillin and fermented foods.

Question 6

(a) There were many detailed descriptions of blood clotting that made correct reference to the blood cells and fibrin in the photomicrograph in Fig. 6.1. Common misconceptions were to think that the strands of fibrin were platelets, to mix up fibrinogen and fibrin and state that fibrinogen is insoluble and fibrin is soluble. Some candidates were unfamiliar with the process of blood clotting, but did gain some credit by simply identifying **J** and **M** correctly.

(b) Almost all candidates gave at least one reason for the importance of blood clotting and a significant number were able to give both expected reasons.

(c) (i) Although it was clear that most candidates were familiar with the term phenotype, a significant number were not able to describe it in sufficient detail or correctly use the terms gene, allele and genotype. Answers about the properties of blood were not accepted because examples are not credited for a definition.

(ii) A small minority of candidates knew that the ABO blood group system is an example of co-dominance. Common incorrect answers included monohybrid inheritance, sex-linked inheritance, continuous variation and discontinuous variation.

(iii) Some candidates knew the two possible genotypes for blood group A, but many were unfamiliar with the correct symbols, with many stating the letters AA and AO, without the use of superscripts. A minority of candidates included B as a means to gain the A blood group, for example by writing I^AI^B instead of I^AI^o.

BIOLOGY

Paper 0610/51
Practical Test

Key messages

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

General comments

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

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

Design an experiment that takes into consideration the control variables, how the data is going to be collected and how the data will be analysed.

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

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

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

Comments on specific questions

Question 1

(a) (i) This question proved challenging. Candidates were asked to attach the chromatogram, draw the shape of the pigments and label the pigments and solvent line. Many candidates drew the shape of the pigments but did not complete the other instructions. Candidates would benefit from reading the question carefully.

(ii) Many candidates did not realise that the solvent would dissolve the pigment.

(b) (i) When discussing safety precautions, it is important to apply this to the experiment being carried out. General answers such as wearing goggles or a lab coat are not specific enough. In this experiment, the ethanol should always be kept away from naked flames.

(ii) Candidates were asked to calculate the R_f value of the orange-yellow pigment. This question was well answered by many candidates. A few candidates did not record their measurements in mm or did not give an answer to two decimal places.

(iii) Candidates would benefit from remembering to provide a suitable title and appropriate SI units in the heading of the table. Units should not be written in the body of the table.

(iv) This question required candidates to apply the information in the question to an unfamiliar context. Some candidates were able to successfully identify the colour green and link this with the idea that it was because it moved the least distance.

(c) This was a challenging question. Many candidates described the differences between the two methods, rather than how **1(b)** was an improvement on **1(a)**. Only the strongest responses explained that the solvent was better at separating the pigments because more pigments were shown.

(d) Many candidates correctly gave iodine solution as a test for starch. A few incorrectly gave Benedict's solution.

(e) Candidates would benefit from using a sharp pencil to draw specimens with clear and continuous lines. It is important that candidates do not use shading. Care should be taken when drawing the shape and proportions of the cells.

(f) Planning a suitable method to measure the rate of photosynthesis proved challenging. Many candidates used the chromatography method given in the question, but changed the colour of leaf. Only the strongest responses described a valid method for measuring the rate of photosynthesis, such as measuring the volume of oxygen produced in a set time. Many candidates were able to name a range of suitable controlled variables for the experiment.

Question 2

(a) (i) Many candidates successfully answered this question. The most common error was counting all of the cells in the squares on the bottom right of the grid.

(ii) Most candidates were able to calculate the volume of the counting grid using the given data.

(iii) This calculation proved challenging for many candidates. The most common error was to not multiply by the dilution factor.

(b) This question was well answered. Candidates realised that infection would increase the number of white blood cells and anaemia would decrease the number of red blood cells.

(c) (i) This graph question proved challenging to a large number of candidates. Common issues were scales that would not allow the data to be plotted accurately, unnecessarily calculating the average between men and women and drawing a line graph rather than a histogram.

(ii) Most candidates realised that females of age 65-74 had a higher percentage of anaemia than men and then over 74 men had a higher percentage than women. Few candidates stated the general trend that anaemia increases as both men and women get older.

(iii) This was a challenging question and the best responses showed an understanding that more women than men were sampled so actual numbers would not give a fair comparison, and therefore a percentage had to be calculated.

BIOLOGY

Paper 0610/52
Practical Test

Key messages

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

Candidates should try to match the detail they give to the number of marks available. For example, a three-mark question will require the candidate to make three separate points.

Candidates must be familiar with the practical procedures indicated in the syllabus. This means that candidates are expected to carry out these procedures safely, but also that they should be able to work with competence on practical procedures in unfamiliar contexts.

When asked about safety considerations, candidates should identify a risk, but also identify a method of reducing that risk.

General comments

Candidates performed well throughout the paper with some excellent results recorded that reflected careful work being carried out by the candidates. Drawing a data table was done well by the majority of candidates, with underlined headings and results recorded in an appropriate way.

Most candidates performed very well on the planning exercise, producing a detailed, logical investigation.

The drawing of a graph was done well by most candidates but a few still find choosing labels or a suitable scale challenging.

Drawing skills were generally well done, with suitable detail included. Candidates should remember that lines must not be incomplete or feathered. Drawings should be neat, in proportion, and show sufficient detail.

Comments on specific questions

Question 1

In this question candidates were required to incubate starch and amylase in a dialysis tubing bag, and then test for the presence of starch both inside and outside of the bag. This was repeated with a control tube.

(a) Most candidates were able to carry out the investigation and then record suitable observations in an appropriate table. The most common error was the omission of at least one of the headings, in particular the heading for the location of the sample. Despite the relative complexity of having four different sample sites, most candidates produced excellent tables that were simple and unambiguous.

Candidates should remember that the observation of colour requires an actual colour to be recorded. Simply stating that the colour of the iodine remained unchanged is not sufficient.

(b) (i) Most candidates were able to state a sensible reason for rinsing the outside of the dialysis tubing bag.

(ii) In this question, candidates were asked why water was used instead of amylase solution in the second tube. Some candidates found it difficult to explain the idea of a control test in which they were trying to show that the starch did not break down on its own, and required the enzyme to be present.

(iii) In this question candidates were asked for two variables that were kept constant. Most candidates could name at least one variable with temperature and time being the commonest correct answers.

(c) This question asked for a description of the test for reducing sugars with nearly all candidates realising that Benedict's solution was the appropriate test. A few candidates forgot to mention heating the solutions while others confused biuret reagent with Benedict's solution. A small number of candidates gave a test for non-reducing sugars highlighting the need to read the question carefully.

(d) The planning exercise was particularly well done with most candidates gaining the majority of the marks available. Most were able to identify the dependent and independent variables and also state which variables should remain constant. The experimental plans were well thought-out. In a few cases, there was a lack of consideration of safety issues and few references to repeating the procedure. The strongest responses described how Benedict's solution can be used to determine the rate of reaction by measuring sugar production over time, rather than simply starch loss at the end of the investigation.

(e) Nearly all candidates correctly identified biuret reagent as a test for protein and gave a suitable colour change.

Question 2

This question required candidates to measure the width of three leaves and then plot a bar chart of leaf width against light intensity. They then drew and compared cross-sections taken from a root and a stem.

(a) (i) The vast majority of candidates measured the widths of the three leaves with suitable accuracy and recorded their answers with matching units.

(ii) Most candidates were able to calculate the average for one of the three light intensities but a few used the three measured values rather than all eight measurements.

(iii) The values from the table were generally plotted well with a good degree of precision. A significant number of candidates omitted the units from the average leaf width axis while others omitted light intensity and just labelled the bars high, medium or low.

(iv) Most candidates could identify the anomalous result as 12, with most going on to explain why this could be considered anomalous.

(b) (i) Most candidates identified the independent variable but some lacked detail and stated just light rather than light intensity.

(ii) Almost all candidates correctly identified the dependent variable.

(c) (i) A large drawing of the cross-section of the root was required and the quality of most drawings was impressive. A few candidates included cells in their drawing while others failed to identify all of the layers that made up the root.

(ii) In this question candidates were asked to measure a line and then calculate the magnification of the image. Most candidates managed this well with the two main errors being the inclusion of units for magnification, or division by 2.2 instead of 2.0.

(iii) Many candidates found the comparison of the root and the stem quite challenging with some answers too vague or undefined. Some candidates referred to the sizes of tissues without appreciating that the root had a different magnification to the stem.

(d) (i) Most candidates gave a good account of methods for determining leaf surface area.

(ii) Most candidates realised that leaves are of variable length so measuring area is better than width.

BIOLOGY

Paper 0610/53
Practical Test

Key messages

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

Candidates would benefit from practising questions based on percentage change as many found this challenging.

Candidates would benefit from understanding the difference between significant figures and decimal places.

General comments

Candidates performed well on the majority of the paper, showing good preparation and familiarity with the types of question asked.

Most candidates performed very well on the planning exercise, producing a well-designed, logical investigation. Identification of variables, safety and a workable method are key aspects of this task and were all covered in suitable detail by most candidates.

The drawing of a graph was performed particularly well by nearly all candidates. Similarly, drawing of a table for data was done well by the majority of candidates.

Drawing skills were generally well done, with suitable detail included. Candidates should remember that lines must not be incomplete or feathered. Drawings should be neat, in proportion, and show sufficient detail.

Comments on specific questions

Question 1

In this question candidates extracted a suspension of chloroplasts from crushed leaves and then exposed one portion to light while one portion remained in darkness.

(a) (i) Most candidates were able to carry out the investigation and then record their values in an appropriate table. The most common error was the omission of at least one of the headings, in particular the heading for the type of treatment used in each test-tube.

Candidates should remember that the observation of colour requires an actual colour to be recorded. Simply stating that the colour of the iodine remained unchanged is not sufficient.

(ii) Most candidates were able to successfully identify both the independent and the dependent variables. Some answers were too vague, for example, stating ‘the type of test-tube’ is insufficient for naming the independent variable.

(iii) Most candidates correctly identified two variables that remained constant but some answers lacked sufficient detail. Quantities or volumes of reagents are acceptable but simply stating that the filtrate remained constant was not enough.

(iv) In this question candidates were asked for a conclusion for their results. Many candidates wrote a suitable conclusion but some did not state the link between light and photosynthesis. Even if no change was observed, this still needs to be stated in the conclusion.

(b) (i) This question asked why the investigation should be repeated and many recognised that this allows anomalous results to be identified.

(ii) Many candidates identified one source of error but very few were able to identify two. Human error, for example poor timing or incorrect measurement of volumes, are not appropriate sources of error. Candidates would benefit from answering in more detail. Placing the test-tubes in a water-bath is not an error in its own right but not controlling the temperature of the water-bath is an error. The use of syringes for measuring volume is also not a significant source of error.

(iii) Most candidates were able to identify a suitable improvement for the investigation.

(c) The planning exercise was particularly well done with most candidates gaining the majority of the marks available. Most were able to identify the dependent and independent variables and also state which variables should remain constant. The experimental plans were well thought-out and included some safety considerations as well as a suitable reference to repeating the procedure.

Question 2

This question required candidates to draw a large diagram of part of the lower epidermis of a leaf and to calculate the stomatal width.

(a) (i) The quality of the drawing was generally very high with the lines drawn being clear and distinct and of a suitable size. Some candidates still find this task challenging and produce drawings with feathered lines and shading. A few candidates did not draw all of the cells shown and so could not be awarded the mark for detail.

(ii) The vast majority of candidates were able to measure the line on the diagram and calculate the actual width of the stoma. A large number of candidates gave the wrong number of decimal places, often quoting two significant figures instead.

(b) (i) Many candidates found this question challenging, circling processed data or no data at all.

(ii) Nearly all candidates were able to calculate the average of the values given, but a few did not read the question fully and omitted the unit.

(c) (i) In this question candidates were asked to calculate the percentage change in the number of open stomata. Although nearly all candidates could identify the two values that changed, relatively few knew how to manipulate the numbers to calculate a percentage change.

(ii) Almost all candidates plotted a graph that scored full marks. Scales and labels were suitable and all values were plotted accurately. A few candidates plotted a line graph instead of a bar chart.

(iii) The description of the graph was well done by most candidates but several descriptions lacked sufficient detail for full marks. A full description should try to include reference to specific data points or trends between two values.

(d) (i) Almost all candidates successfully identified iodine solution as the substance used to test for starch.

(ii) The Benedict's test for reducing sugars was described in adequate detail by most, although a few forgot to mention heating the mixture or described a protein test using biuret reagent.

BIOLOGY

Paper 0610/61
Alternative to Practical

Key messages

Candidates should be exposed to a wide range of practical activities so that they are able to plan investigations in unfamiliar contexts.

Candidates would benefit from practising graph drawing for different types of data.

All questions should be read carefully to make sure that they are understood and that instructions are followed fully.

Candidates must know the difference between identifying the differences in methodology and how one method is an improvement to another.

General comments

Candidates were not expected to be familiar with the chromatography investigation. Many found **Question 1** challenging, particularly the planning question, due to this unfamiliar context. Candidates should be advised to carefully read all the information in each question before attempting to write a response.

Improvements were seen in designing data tables and in calculation questions, indicating that candidates were now very familiar with these types of question.

Comments on specific questions

Question 1

(a) (i) Most candidates interpreted the chromatogram correctly. A few candidates treated the green line or the solvent line as a fourth pigment.

(ii) Few candidates realised that the pigments in the green line would dissolve into the solvent if placed below the solvent line and therefore would not be able to move up the chromatography paper. Some candidates knew that the uncontrolled mixing of solvent and pigment should be avoided, but expressed this in terms of preventing pigments from mixing with each other.

(iii) Most candidates were confident at identifying variables that should be kept constant. Candidates should be encouraged to avoid unqualified answers. For example, 'depth of solvent' would be awarded a mark, but 'solvent' unqualified would not.

(b) (i) This question specifically asked about safety precautions when evaporating ethanol, which candidates were told is flammable. Most candidates referred to general lab safety, such as the use of goggles or gloves. Candidates must make sure that their answers relate to the question being asked. In this experiment, the ethanol should always be kept away from naked flames.

(ii) Many candidates were awarded full marks for this question. The most common mistake was measuring in centimetres rather than millimetres.

(iii) This question was well answered by most candidates. The commonest errors were units in the data cells or in the R_f heading. Candidates should be reminded that headings are needed for each column.

(iv) This question required candidates to apply the information in the question to an unfamiliar context. Some candidates were able to successfully identify the colour green and link this with the idea that it was because it moved the least distance.

(c) Most candidates found this question challenging and many just described the differences between the methods rather than how **1(b)** was an improvement on **1(a)**. Few candidates realised that **1(b)** showed 4 pigments instead of 3 and therefore the solvent was better at separating the pigments.

(d) Almost all candidates gave iodine as the substance that would be used to test for starch. A few incorrectly gave Benedict's solution.

(e) Most drawings were of a suitable size, were drawn with clear lines and contained an appropriate level of detail. The most common mistake was not drawing the three cells with the correct shape and proportions. Some candidates did not follow the instructions and labelled more than one chloroplast. Drawings should not be shaded.

(f) Candidates needed to draw on their knowledge of the practicals outlined in the syllabus to answer this question. Many thought they needed to adapt the chromatography investigation using different coloured leaves. Only the best responses described a valid method of measuring the rate of photosynthesis, such as measuring the volume of oxygen produced in a set time. Many described measuring the amount of growth as the dependent variable, which was not appropriate. Testing leaves for starch or glucose was another common suggestion, as was the use of a photometer. These suggestions were not suitable methods for determining the rate of photosynthesis. Most candidates were able to give some variables that should be kept constant and stated that at least two different coloured leaves should be used.

Question 2

(a) (i) Many candidates successfully answered this question. The most common error was counting all of the cells in the squares on the bottom right of the grid.

(ii) Most candidates were able to calculate the volume of the counting grid.

(iii) The most common mistake on this question was to forget to multiply the red cells counted by the dilution factor. Some just divided the red cells counted by the volume of the counting grid.

(b) This question was well answered. Candidates realised that infection would increase the number of white blood cells and anaemia would decrease the number of red blood cells.

(c) (i) This graph question proved challenging to a large number of candidates. Common issues were scales that would not allow the data to be plotted accurately, unnecessarily calculating the average between men and women and drawing a line graph rather than a histogram.

(ii) Most candidates realised that females of age 65-74 had a higher percentage of anaemia than men and then over 74 men had a higher percentage than women. Few candidates stated the general trend that anaemia increases as both men and women get older.

(iii) This was a challenging question. The best responses showed an understanding of the fact that more women than men were sampled so actual numbers would not give a fair comparison, and hence a percentage had to be calculated. Most candidates incorrectly thought the problem lay in the large numbers that would be involved and difficulties in putting this data into a graph.

BIOLOGY

Paper 0610/62
Alternative to Practical

Key messages

Candidates would benefit from knowing the reagents to use in food tests, how to carry out the tests and the colours which denote a positive result.

Candidates should try to match the detail they give to the number of marks available. For example, a three-mark question will require the candidate to make three separate points.

General comments

There were many excellent responses demonstrating that the candidates had sound practical skills and an understanding of the processes involved. The majority of candidates read the questions thoughtfully and attempted to carry out their requirements.

Comments on specific questions

Question 1

In this question, candidates were introduced to a simple investigation involving the action of amylase on starch. The amylase and starch were placed inside a bag made from dialysis tubing and the temperature maintained. A control investigation with water replacing amylase was also described. After ten minutes, tests were carried out for the presence of starch and reducing sugar.

(a) The majority of candidates named iodine solution as the chemical used to detect the presence of starch. A small proportion incorrectly named Benedict's solution.

(b) Candidates were asked to describe a test for reducing sugars. The majority of candidates knew that Benedict's solution should be used but many neglected to state that heating is necessary. Many candidates could not be awarded the heating mark as they put the test-tube in a water-bath; this is insufficient as a water-bath could be cold, so a hot water-bath had to be specified.

(c) Washing the dialysis bag removes any starch suspension or amylase solution which has been spilt whilst the bag is being filled. Vague answers, such as 'to clean the tubing' insufficient as there was no indication of what substance might be removed.

(d) (i) Candidates were required to construct a table and use it to record the results of the investigation. Most candidates could construct an adequate table and record the results accurately. The selection of adequate headings for the table proved more challenging.

(ii) Writing conclusions was challenging for many candidates. Stronger responses stated overall conclusions such as, 'amylase breaks down starch but water does not' or 'reducing sugar can diffuse through dialysis tubing whereas starch cannot as the molecules are too large'. The majority of candidates gave more simplistic answers stating where starch and reducing sugar were present or absent.

(e) Of the many variables that were kept constant during the investigation, most candidates could state two. Weaker responses were often too vague and lacked adequate detail.

(f) Most candidates were awarded the marks for describing two method points from the previous investigation, plus stating that a range of temperatures should be used. Many could state a safety feature, such as the use of gloves or safety glasses. Points that were rarely mentioned were using a thermostatically controlled water-bath, using the same concentrations of starch suspension and amylase solution, timing how long the reactions took, performing each temperature at separate times, maintaining the same pH and equilibrating the temperatures of the solutions prior to starting the investigation.

It should be noted that using known volumes of substances is not the same as using the same volumes of these substances: the volumes may be known, but not necessarily identical.

(g) Many candidates knew that biuret reagent is used to test for the presence of protein and that the positive result is a mauve-purple colour.

Some candidates, having named biuret reagent, went on to state the chemicals involved. This is not required, and in those cases where incorrect chemicals were named, the mark for biuret could not be awarded.

Question 2

(a) (i) The majority of candidates could measure the width of the leaves within the accuracy required. A few candidates gave measurements in centimetres or entered them in an incorrect sequence.

(ii) Most candidates successfully calculated the average. Errors made in the measurements in **(a)(i)** were carried forward, so that a mark was awarded where a correct average was calculated from incorrect figures.

(iii) Some excellent bar charts were produced. Those who did not gain full marks usually gave an incomplete label on the *y*-axis, for instance labelling the axis as width rather than average leaf width in mm. A few candidates drew a line graph or left no gaps between the bars.

(iv) Most candidates could identify the anomalous result as 12, and went on to explain why this could be considered anomalous. Some candidates made the correct selection, but then had difficulty expressing why they had chosen it.

(b) (i) The majority of candidates could state that light intensity was the variable that was changed. Some candidates gave imprecise answers, such as light rather than light intensity.

(ii) The majority of candidates could state that the width of leaves was the variable that was measured. Some candidates gave imprecise answers, such as size of leaf, and could not be credited.

(c) (i) Candidates were asked to make a drawing of a cross-section of a root. Some drawings were excellent. Most candidates drew diagrams that were sufficiently large and many gained at least one of the detail marks. The line quality was generally good except for the large central xylem vessels, which were often drawn randomly. Candidates should draw in pencil and use an eraser where necessary.

(ii) The measurement was usually accurate and the magnification calculated correctly. Common errors were measuring the original line in centimetres, dividing by 2.2 and giving a unit for magnification.

(iii) This question proved to be challenging. Many candidates found it difficult to select, and express clearly, two differences between the structures of the root and stem. A number of candidates drew on their theoretical knowledge and stated differences that were not visible in the photomicrograph.

(d) (i) Candidates appeared to be unfamiliar with the technique of tracing round a leaf on gridded paper to find its area. The commonest method suggested by candidates was to measure the width and length of the leaf and multiply these figures to find the area. As leaves have an irregular shape, this is not appropriate. Of those who described using a grid, many forgot to say that the leaf shape had to be drawn on the grid, or that the occupied squares had to be counted. Alternative methods were given credit, such as, using a transparent grid, or taking a photograph of a leaf and then using an app to find the area.

(ii) Most candidates realised that leaves are of variable length so measuring area is better than width.

BIOLOGY

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Alternative to Practical

Key messages

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

Candidates should try to match the detail they give to the number of marks available. For example, a three-mark question will require the candidate to make three separate points.

General comments

Candidates performed well on the majority of the paper, showing good preparation and familiarity with the types of question asked. It was evident that most candidates had a good understanding of the expectations of the mark scheme.

Most candidates performed very well on the planning exercise, producing a well-designed, logical investigation. Identification of variables, safety and a workable method are key aspects of this task and were all covered in suitable detail by most candidates.

The drawing of a graph was performed well by most candidates. Similarly, drawing of a table for data was done well by the majority of candidates.

Drawing skills were generally well done, with suitable detail included. Candidates should remember that lines must not be incomplete or feathered. Drawings should be neat, in proportion, and show sufficient detail.

Comments on specific questions

Question 1

In this question, candidates were introduced to a simple investigation involving the extraction of a chloroplast suspension from crushed leaves and then exposing one portion to light while one portion remained in darkness.

(a) (i) Most candidates were able to record the values in an appropriate table. The most common error was the omission of at least one of the headings, in particular the heading for the type of treatment used in each test-tube.

Candidates should remember that the observation of colour requires an actual colour to be recorded. Simply stating that the colour of the iodine remained unchanged is not sufficient.

(ii) Most candidates were able to successfully identify both the independent and the dependent variables. Some answers lacked detail, with ‘the type of test-tube’ being insufficient for a mark for the independent variable.

(iii) Most candidates correctly identified two variables that remained constant but some answers lacked sufficient detail. Quantities or volumes of reagents are acceptable but simply stating that the filtrate remained constant was not enough.

(iv) In this question candidates were asked for a conclusion for their results. Many candidates wrote a suitable conclusion but some did not state the link between light and photosynthesis.

(b) Almost all candidates correctly recorded the two temperatures. A few omitted appropriate units.

(c) (i) This question asked why the investigation should be repeated and many recognised that this allows anomalous results to be identified.

(ii) Many candidates identified one source of error but very few were able to identify two. Human error, for example, poor timing or incorrect measurement of volumes, are not appropriate sources of error. Candidates would benefit from answering in more detail. Placing the test-tubes in a water-bath is not an error in its own right but not controlling the temperature of the water-bath is an error. The use of syringes for measuring volume is also not a significant source of error.

(d) The planning exercise was particularly well done with most candidates gaining the majority of the marks available. Most were able to identify the dependent and independent variables and also state which variables should remain constant. The experimental plans were well thought-out and included some safety considerations as well as a suitable reference to repeating the procedure.

Question 2

This question required candidates to draw a large diagram of part of the lower epidermis of a leaf and to calculate the stomatal width.

(a) (i) The quality of the drawing was generally very high with the lines drawn being clear and distinct and of a suitable size. Some candidates still find this task challenging and produce drawings with feathered lines and shading. A few candidates did not draw all of the cells shown and so could not be awarded the mark for detail.

(ii) The vast majority of candidates were able to measure the line on the diagram and calculate the actual width of the stoma. A large number of candidates gave the wrong number of decimal places, often quoting two significant figures instead.

(b) (i) Many candidates found this question challenging, circling processed data or no data at all.

(ii) Nearly all candidates were able to calculate the average of the values given, but a few did not read the question fully and omitted the unit.

(c) (i) In this question candidates were asked to calculate the percentage change in the number of open stomata. Although nearly all candidates could identify the two values that changed, relatively few knew how to manipulate the numbers to calculate a percentage change.

(ii) Almost all candidates plotted a graph that scored full marks. Scales and labels were suitable and all values were plotted accurately. A few candidates plotted a line graph instead of a bar chart.

(iii) The description of the graph was well done by most candidates but several descriptions lacked sufficient detail for full marks. A full description should try to include reference to specific data points or trends between two values.

(d) (i) Almost all candidates successfully identified iodine solution as the substance used to test for starch.

(ii) The Benedict's test for reducing sugars was described in adequate detail by most, although a few forgot to mention heating the mixture or described a protein test using biuret reagent.