BIOLOGY

Paper 0610/11
Multiple Choice (Core)

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

General comments

There was good understanding of: sources of vitamin C; the definition of a drug and sexual reproduction.

There was some uncertainty about: the circulation of blood; the location of ciliated cells; the position of the xylem and the ureters and urethra.

It is important for candidates to work carefully and methodically through information provided in the question, such as in **Questions 3** and **18**.

Comments on specific questions

Question 2

A large number of candidates correctly selected option **B**. However, some candidates confused the species name with the genus name. In a binomial name, the genus name is the first part of the name.

Question 3

Many candidates were able to use the dichotomous key correctly to identify the organism.

Question 5

This proved to be a demanding question with some candidates incorrectly selecting option **D**, plant roots, confusing the cilia with root hairs, or option **A**, alimentary canal, confusing the cilia with villi or microvilli.

Question 7

This question was well-answered by many candidates. Some candidates were uncertain about the direction of particle movement in diffusion and selected option **A** rather than option **B**.

Question 8

Many candidates did not appreciate that since cyanide is a poison that stops respiration, it must also decrease active transport. Active transport requires energy from respiration.

Question 9

Many candidates understood that the outer, green region of the leaf turns blue-black. Some candidates incorrectly opted for the central white area also turning blue-black.

Question 11

Many candidates correctly identified the best conditions for the digestion of starch. Some candidates incorrectly believed that boiled amylase should be used. Candidates should be aware that boiling an enzyme denatures it.

Question 15

While many candidates understood that the process shown in the diagram is chemical digestion, a small number incorrectly opted for chewing. This shows that some candidates are unclear of the differences between chemical and physical digestion.

Question 17

Some candidates were unable to identify the position of the xylem, particularly in the section of the root.

Question 18

Some candidates correctly selected option **C**, appreciating that as humidity increases, the rate of transpiration decreases. Many candidates incorrectly selected option **A** as they thought that transpiration rate increases with an increase in humidity.

Question 19

This question highlights the necessity to read each question carefully. The question asked: Which part carries blood directly from the lungs? The word ‘from’ is key here and it gives the correct option as **D**.

Question 21

Many candidates understood that skin, mucus and stomach acid prevent pathogens from entering body tissues.

Question 25

This question was well-answered, although some candidates confused ureter with urethra.

Question 28

This was a demanding question. While some candidates understood that the rotating motion would cause the shoot to grow horizontally, many candidates incorrectly believed that the shoot would grow upwards.

Question 31

Many candidates were able to correctly identify the structures that manufacture sperm and the fluid the sperm are transported in. Some candidates incorrectly believed that the sperm duct is one of these structures.

Question 32

From the birth control methods given, only a vasectomy will stop sperm from entering the vagina.

Question 33

While many candidates understood that an allele is a version of a gene, some candidates incorrectly believed that an allele is a version of a chromosome.

Question 34

Most candidates understood the functions of mitosis. Some candidates incorrectly believed that only mitosis is used in the production of gametes.

Question 39

There was confusion amongst some candidates who incorrectly believed that pectinase is used to make biofuel.

BIOLOGY

Paper 0610/12
Multiple Choice (Core)

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

General comments

There was good understanding of: excretion; features of mammals; the role of antibiotics and the water cycle.

There was some uncertainty about: dichotomous keys; chemical digestion and the location of the xylem.

It is important for candidates to work carefully and methodically through information provided in the question, such as in **Questions 3**, **18** and **28**.

Comments on specific questions

Question 3

Many candidates selected an incorrect option. It is important that candidates work through each stage of the dichotomous key in order to identify a specimen.

Question 5

This proved to be a demanding question with some candidates incorrectly selecting option **D**, plant roots, confusing the cilia with root hairs, or option **A**, alimentary canal, confusing the cilia with villi or microvilli.

Question 7

Many candidates did not understand that diffusion involves the random movement of particles.

Question 8

Many candidates appreciated that since the plant root has a higher concentration of magnesium ions than the surrounding soil, the process moving magnesium ions into the root must be active transport.

Question 9

Many candidates understood that the outer, green region of the leaf turns blue-black. Some candidates incorrectly thought that the central white area would also turn blue-black.

Question 10

Many candidates appreciated that the rate of reaction should go on the *y*-axis and pH on the *x*-axis. Some candidates reversed the labelling of the axes.

Question 11

Many candidates correctly identified the best conditions for the digestion of starch. Some candidates incorrectly believed that boiled amylase should be used. Candidates should be aware that boiling an enzyme denatures it.

Question 13

Most candidates incorrectly selected option **B**, indicating that there are three guard cells in the diagram. There are in fact six; two guard cells around each stoma.

Question 15

While many candidates understood that the process shown in the diagram is chemical digestion, a small number incorrectly opted for chewing. This shows that some candidates are unclear of the differences between chemical and physical digestion.

Question 16

Most candidates opted for an incorrect distractor, in particular the large intestine. Most water absorption takes place in the small intestine.

Question 17

Few candidates understood that there are xylem vessels in the roots, stem and leaves of a young plant.

Question 18

Some candidates correctly selected option **C**, appreciating that as humidity increases, the rate of transpiration decreases. Many candidates incorrectly selected option **A** as they thought that transpiration rate increases with an increase in humidity.

Question 19

This question highlights the necessity to read each question carefully. The question asked: Which part carries blood directly from the lungs? The word ‘from’ is key here and it gives the correct option as **D**.

Question 21

Many candidates understood that skin, mucus and stomach acid prevent pathogens from entering body tissues.

Question 22

While many candidates selected the correct option, some candidates incorrectly believe that bronchioles come before bronchi.

Question 23

Many candidates understood that oxygen and glucose are needed to release energy in aerobic respiration. Carbon dioxide and glucose were the commonest incorrect response.

Question 24

Many candidates understood that yeast respires anaerobically to produce carbon dioxide and ethanol (biofuel). Some candidates incorrectly selected option **B**, missing the fact that yeast respiration must be anaerobic if it is to produce ethanol.

Question 25

This question was well-answered, although some candidates confused ureter with urethra.

Question 28

This was a demanding question. While some candidates understood that the rotating motion would cause the shoot to grow horizontally, many candidates incorrectly believed that the shoot would grow upwards.

Question 30

Many candidates understood that fertilisation is the fusion of nuclei to form a zygote. Some candidates incorrectly believed that fertilisation is the fusion of alleles to form a zygote.

Question 31

Many candidates appreciated that pollination occurs when pollen grains are transferred from the anther to the stigma. Some candidates incorrectly believed that pollination occurs when pollen grains are transferred from the anther to the ovary.

Question 34

This question was well-answered by many candidates, although some candidates incorrectly believed that new cells for growth are formed by meiosis.

Question 38

Few candidates appreciated that decomposition releases carbon dioxide into the atmosphere.

Question 39

Few candidates appreciated that carbon dioxide is the useful product of anaerobic respiration in the manufacture of bread.

BIOLOGY

Paper 0610/13
Multiple Choice (Core)

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

General comments

There was good understanding of: dichotomous keys; the role of water pressure in supporting plants; temperature regulation and the definition of a drug.

There was some uncertainty about: the location of the vacuole; the location of ciliated cells; the coronary artery; nitrogen as the element in all amino acids and the order of structures in which sperm must pass in order to fertilise an egg cell.

It is important for candidates to work carefully and methodically through information provided in the question, such as in **Questions 3**, **18**, **28** and **34**.

Comments on specific questions

Question 3

Many candidates were able to use the dichotomous key correctly to identify the organism.

Question 4

Some candidates were unable to identify option **C**, the vacuole, as the correct label on the diagram of a guard cell.

Question 5

This proved to be a demanding question with some candidates incorrectly selecting option **D**, plant roots, confusing the cilia with root hairs, or option **A**, alimentary canal, confusing the cilia with villi or microvilli.

Question 8

Many candidates correctly selected option **C**, although some candidates incorrectly believed that the pressure of water outside the cells presses inwards on the cell wall.

Question 11

Many candidates correctly identified the best conditions for the digestion of starch. Some candidates incorrectly believed that boiled amylase should be used. Candidates should be aware that boiling an enzyme denatures it.

Question 12

While many candidates correctly selected option **B**, some candidates were unable to distinguish between the xylem and the phloem.

Question 13

Few candidates appreciated that nitrogen is present in all amino acids.

Question 15

While many candidates understood that the process shown in the diagram is chemical digestion, a small number incorrectly opted for chewing. This shows that some candidates are unclear of the differences between chemical and physical digestion.

Question 16

Many candidates understood that the stomach is the part of the alimentary canal that produces an enzyme that digests proteins. Some candidates incorrectly opted for the mouth.

Question 17

Many candidates understood that root hair cells absorb water by osmosis. Some candidates incorrectly believed that water is absorbed by active transport.

Question 18

Some candidates correctly selected option **C**, appreciating that as humidity increases, the rate of transpiration decreases. Many candidates incorrectly selected option **A** as they thought that transpiration rate increases with an increase in humidity.

Question 19

This question highlights the necessity to read each question carefully. The question asked: Which part carries blood directly from the lungs? The word ‘from’ is key here and it gives the correct option as **D**.

Question 20

Many candidates could not identify blood vessel **D** as the coronary artery.

Question 21

Many candidates understood that skin, mucus and stomach acid prevent pathogens from entering body tissues.

Question 24

Many candidates correctly identified option **A** as the word equation for anaerobic respiration in yeast cells. Some candidates incorrectly opted for option **B**, the word equation for aerobic respiration.

Question 25

This question was well-answered, although some candidates confused ureter with urethra.

Question 28

This was a demanding question. While some candidates understood that the rotating motion would cause the shoot to grow horizontally, many candidates incorrectly believed that the shoot would grow upwards.

Question 30

There was some uncertainty about which description was a structural adaptation of wind-pollinated flowers. Wind-pollinated flowers have long filaments so that the anthers hang outside of the flower.

Question 31

There was some confusion regarding the correct order of structures through which human sperm must pass in order to fertilise an egg cell. There was particular uncertainty about where in the sequence the urethra and cervix should be placed.

Question 32

This proved to be a demanding question with many candidates not appreciating that both the IUD and IUS are birth control methods that use chemical methods of preventing pregnancy.

Question 33

Candidates were frequently uncertain about which process, mitosis or meiosis, is involved in asexual reproduction.

Question 36

Many candidates could not identify light as the initial source of energy input into most biological systems.

Question 40

A sustainable resource is a resource that is produced as rapidly as it is removed from the environment. Many candidates were unsure of this meaning.

BIOLOGY

Paper 0610/21
Multiple Choice (Extended)

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

General comments

There was good understanding of: sources of vitamin C; voluntary actions; the role of glucagon; natural selection and growth curves.

There was some uncertainty about: the location of ciliated cells; the colour changes of hydrogencarbonate indicator; transpiration pull; changes in pressure during breathing; the function of the kidney tubule; the role of restriction enzymes and the transfer of genetic information.

It is important for candidates to work carefully and methodically through information provided in the question, such as in **Question 32**.

Comments on specific questions

Question 5

This proved to be a demanding question with some candidates incorrectly selecting option **D**, plant roots, confusing the cilia with root hairs, or option **A**, alimentary canal, confusing the cilia with villi or microvilli.

Question 6

Only a small proportion of candidates understood that turgor pressure is the pressure that helps to provide support for plants.

Question 9

Many candidates understood that the outer, green region of the leaf turns blue-black. Some candidates incorrectly thought that the central white area also turned blue-black.

Question 11

Many candidates correctly identified the best conditions for the digestion of starch. Some candidates incorrectly believed that boiled amylase should be used. Candidates should be aware that boiling an enzyme denatures it.

Question 12

Only a minority of candidates understood the colour changes of hydrogencarbonate indicator solution at different concentrations of carbon dioxide.

Question 15

While many candidates understood that the process shown in the diagram is chemical digestion, a small number incorrectly opted for chewing. This shows that some candidates are unclear of the differences between chemical and physical digestion.

Question 16

Some candidates were unable to identify the position of the xylem, particularly in the section of the root.

Question 17

There was uncertainty whether cohesion or turgor pressure holds water molecules together during the transpiration pull in the xylem. Option **B**, cohesion, was the correct choice.

Question 20

There was some uncertainty about what causes the pressure in the lungs to decrease during breathing in. The contraction of the external intercostal muscles and diaphragm combine to cause an increase in thorax volume and therefore a decrease in pressure.

Question 21

Many candidates understood that skin, mucus and stomach acid prevent pathogens from entering body tissues.

Question 22

The majority of candidates correctly identified the products of aerobic respiration as option **D**, $6CO_2$ and $6H_2O$.

Question 23

Only a small proportion of candidates understood that both glucose and urea would be present at X in the kidney tubule.

Question 25

Many candidates were uncertain about the changes that occur when eyes accommodate to view near objects. The correct changes are that the ciliary muscles contract, suspensory ligaments become slack thereby allowing the lens to become thicker.

Question 26

Many candidates understood that the body increases blood glucose concentration by stimulating the pancreas to release glucagon. This triggers the liver to release glucose.

Question 29

Many candidates appeared uncertain of the correct response. It is LH that stimulates the release of an egg from the ovary during the menstrual cycle.

Question 30

Many candidates understood that the nucleus of a human gamete is haploid and contains one set of unpaired chromosomes. Some candidates incorrectly believed that the nucleus of a human gamete is diploid and contains 46 chromosomes.

Question 32

This proved to be a demanding question for many candidates. It is important that candidates read the question carefully and work through the problem methodically. The question asked for the chance of the child having the same blood group (phenotype) as one of the parents. Many candidates selected 1 in 2, option **C**, as they worked out the chance of a child having the same genotype rather than the phenotype.

Question 37

Only a small proportion of candidates understood that restriction enzymes are used to create sticky ends in human DNA.

Question 38

This proved to be a demanding question with few able to recall the order of transfer of genetic information to bacteria in genetic engineering.

BIOLOGY

Paper 0610/22
Multiple Choice (Extended)

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

General comments

There was good understanding of: excretion; DNA base sequences; asexual reproduction and natural selection.

There was some uncertainty about: the location of ciliated cells; the colour changes of hydrogencarbonate indicator; shunt vessels; negative feedback; the pupil reflex; application of genetic crosses and the meaning of diploid.

It is important for candidates to work carefully and methodically through information provided in the question, such as in **Questions 20** and **32**.

Comments on specific questions

Question 5

This proved to be a demanding question with some candidates incorrectly selecting option **D**, plant roots, confusing the cilia with root hairs, or option **A**, alimentary canal, confusing the cilia with villi or microvilli.

Question 6

While many candidates appreciated that the process of diffusion involves the random movement of particles, some candidates incorrectly believed that it is the net movement of particles up a concentration gradient.

Question 7

Many candidates correctly recognised molecule **X** as a protein. Some candidates incorrectly identified the molecule as glucose.

Question 12

Only a minority of candidates understood the colour changes of hydrogencarbonate indicator solution at different concentrations of carbon dioxide.

Question 13

Most candidates incorrectly selected option **B**, indicating that there are three guard cells in the diagram. There are in fact six; two guard cells around each stoma.

Question 14

Many candidates appreciated that most water absorption takes place in the small intestine. Some candidates incorrectly opted for the large intestine.

Question 15

While many candidates understood that the process shown in the diagram is chemical digestion, a small number incorrectly opted for chewing. This shows that some candidates are unclear of the differences between chemical and physical digestion.

Question 19

Only a small proportion of candidates appreciated that shunt vessels connect arterioles to venules.

Question 20

This proved to be a very demanding question for most candidates. When breathing in, the pressure in the lungs decreases as the volume of the thorax increases, this causes air to be forced into the lungs and hence the pressure increases. Option **B**, correctly shows these pressure changes.

Question 21

Many candidates understood that skin, mucus and stomach acid prevent pathogens from entering body tissues.

Question 22

Many candidates correctly determined that the bubble moves more quickly towards the seeds at 40 °C than at 20 °C. A similar number of candidates incorrectly believed that the bubble moves more quickly away from the seeds at 40 °C than at 20 °C.

Question 26

Many candidates were unable to recognise that the synthesis of glycogen in response to an increase in blood glucose concentration is part of a negative feedback process.

Question 27

Many candidates understood the changes that occur during the pupil reflex. Some candidates were uncertain whether the circular and radial muscles should be relaxing or contracting to decrease the size of the pupil.

Question 31

Only a small proportion of candidates appreciated that a diploid human cell has 22 pairs of chromosomes and two sex chromosomes.

Question 32

Although it appears that most candidates understood how to complete the genetic cross, some opted incorrectly because they did not consider the probability of only males having haemophilia.

Question 37

Many candidates understood that a characteristic of bacteria that makes them useful in genetic engineering is that plasmids can be transferred between cells. Some candidates incorrectly selected option **B**, their nucleus contains DNA. Bacteria do not have nuclei.

Question 38

While many candidates understood that carbon dioxide is the useful product of anaerobic respiration in bread-making, some incorrectly opted for ethanol.

Question 40

This question was generally well-answered. Some candidates did not appreciate that an increase in decomposition has to precede a reduction in dissolved oxygen.

BIOLOGY

Paper 0610/23
Multiple Choice (Extended)

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

General comments

There was good understanding of: characteristics of living things; structures in a guard cell; magnification; DNA base sequences; the human gas exchange system; antibiotic resistance and natural selection.

There was some uncertainty about: the location of ciliated cells; the colour changes of hydrogencarbonate indicator; transpiration pull; changes in pressure during breathing; the function of the kidney tubule; the role of restriction enzymes and the transfer of genetic information.

It is important for candidates to work carefully and methodically through information provided in the question, such as in **Question 39**.

Comments on specific questions

Question 5

This proved to be a demanding question with some candidates incorrectly selecting option **D**, plant roots, confusing the cilia with root hairs, or option **A**, alimentary canal, confusing the cilia with villi or microvilli.

Question 12

While many candidates understood the colour changes of hydrogencarbonate indicator solution at different concentrations of carbon dioxide, some candidates opted for the opposite results.

Question 15

While many candidates understood that the process shown in the diagram is chemical digestion, a small number incorrectly opted for chewing. This shows that some candidates are unclear of the differences between chemical and physical digestion.

Question 19

Many candidates could not identify blood vessel **D** as the coronary artery.

Question 21

Many candidates understood that skin, mucus and stomach acid prevent pathogens from entering body tissues.

Question 25

Most candidates responded correctly but a minority got the contraction and relaxation of the circular and radial muscles the wrong way round.

Question 26

Only a small proportion of candidates understood that glucose is released from the liver when someone has a low blood glucose concentration.

Question 29

Many candidates understood that a structural adaptation of wind-pollinated flowers is the presence of long filaments so that the anthers hang outside of the flower. Some candidates incorrectly believed that they have feathery stamens. It is the stigmas that are feathery in wind-pollinated flowers.

Question 30

While the majority of candidates gave the correct response, some incorrectly believed that a consequence of HIV infection is reduced passive immunity.

Question 33

It is important that candidates read the question carefully and work through the problem methodically. To answer any genetic question requiring a percentage chance or a probability, candidates should draw a Punnett square and deduce the genotypes and phenotypes of the offspring. This approach reduces the chances of mistakes being made. In this question, the correct percentage would be 50% A and 50% B, option **A**.

Question 37

Many candidates understood that all bacteria are not harmless and therefore eliminated options **A** and **C**. The lack of ethical concerns about using bacteria was also well-known.

Question 38

Many candidates identified DNA ligase; option **C**, as the enzyme used to join a human gene and a plasmid together. Some candidates selected option **D**, restriction enzyme, showing confusion over the roles of restriction enzymes and DNA ligase.

BIOLOGY

Paper 0610/31
Theory (Core)

Key messages

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

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

General comments

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

Comments on specific questions

Question 1

(a) (i) Most candidates correctly labelled the septum and the valve. Many confused the left ventricle and the right atrium.

(ii) Many candidates correctly completed the diagram although some did include the renal artery and vein despite the kidney not being included in the diagram.

(b) Most candidates were awarded three marks for this question. Some did not read the question carefully and included aspects of diet so were only awarded two marks. Several gave ways of reducing risk rather than risk factors.

Question 2

(a) (i) The vast majority of candidates were awarded three or four marks. Transpiration was not well known.

(ii) Most candidates only gained one mark for stating that water is absorbed. Often candidates used general terms, such as root instead of root hair. Few mentioned osmosis across the cell membrane.

(b) (i) Almost all candidates correctly identified location 3.

(ii) Almost all candidates correctly identified mayfly, although many went on to suggest reasons rather than using evidence that they were presented with.

(iii) Most correctly stated sludge worm or bloodworm. A few gave mayfly which was incorrect.

(iv) Very few gained all three marks for the calculation. Most were awarded one mark for identifying the correct population sizes but were uncertain of how to calculate the percentage change. Many

incorrectly rounded their calculation. Many showed no working and could not be awarded marks if their final answer was incorrect as the examiner was unable to see how they had arrived at the incorrect value.

Question 3

(a) Few drew more than two lines and many were awarded both marks. Enzymes were usually identified as being proteins, although some identified them as lipids.

(b) Almost all candidates identified substrate **S** as the most likely substrate for the enzyme.

(c) Many did not read the question carefully and wrote about digestion by chemicals rather than defining chemical digestion.

(d) (i) Most candidates interpreted the graph correctly and were awarded full marks.

(ii) This topic was well-known. Common incorrect answers were stomach, duodenum and small intestine.

(e) (i) Many candidates thought the acid helped with the breakdown of food. The acid helps to kill pathogens.

(ii) Most candidates correctly stated hydrochloric acid, but wrong answers included hyaluronic, lactic, stomach and gastric acid.

(f) Most candidates correctly completed the table. The most popular wrong answer was to give the liver as the organ that secretes enzymes.

Question 4

(a) Many candidates scored all four marks. Of the ones that did not, some did not tick four boxes.

(b) Most candidates correctly stated lactic acid. Incorrect answers included hydrochloric, stomach glucose and sweat. A number of candidates omitted this question.

(c) Many candidates described three different movements but failed to mention muscle contraction. Common answers that were too vague to be credited were heartbeat, breathing, and digestion.

Question 5

(a) Many candidates scored all five marks. Gamete was generally well-known. Mitosis was often confused with meiosis and divide was often stated for fuse. Zygote was the least-known term.

(b) Most candidates scored at least one mark but many thought that insect-pollination was an example of asexual reproduction.

(c) Most correctly stated that a female would have XX chromosomes, but few referred to the diagram.

(d) This question was generally answered well. Some described how insects are adapted for pollination rather than how flowers are adapted.

Question 6

(a) (i) The word equation for photosynthesis was well-known. Some candidates confused the photosynthesis equation with the respiration equation. Others wrote a list of substances with '+' in between and no means of separating the reactants and the products.

(ii) Most candidates correctly stated sunlight.

(iii) Chloroplast was well-known. Incorrect answers included other cell structures and tissue layers e.g. palisade.

(b) (i) Most candidates correctly read the value from the graph.

(ii) Most were awarded one mark for stating that the rate remained constant but few could explain that 0.10 arbitrary units was the lowest concentration that produced the maximum number of bubbles per minute.

(iii) Most were awarded one mark for stating that the number of bubbles would decrease, but explanations often lacked detail. Many simply stated that there is less heat or that the temperature is important rather than explaining that enzyme-controlled reactions are temperature dependent.

(c) Methane was well-known by many candidates.

Question 7

(a) Many candidates did not answer this question, those who answered were usually correct. There were many different spellings of homeostasis.

(b) Some candidates were awarded all five marks. Several candidates missed out one of the word choices e.g. the air / oil / sweat option. Some candidates gave receptors and effectors the wrong way round.

(c) Heroin and alcohol were well-known depressants.

BIOLOGY

Paper 0610/32
Theory (Core)

Key messages

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

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

General comments

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

Comments on specific questions

Question 1

(a) (i) Many candidates were awarded full marks. Some candidates were confused about structures **A** and **B**, often reversing their functions.

(ii) Very few candidates were able to correctly indicate the position of the blind spot. The fovea was often incorrectly indicated.

(b) This question was generally well-answered, with most candidates linking the size of the pupil to the amount of light. Some candidates used the word dilate but were unsure if this meant getting larger or smaller.

(c) Candidates sometimes gave the response rather than the stimulus itself. Heat and cold are the same stimulus as temperature.

Question 2

(a) (i) and (ii) The majority of candidates correctly identified the camel, sheep and cat.

(iii) Most candidates correctly identified the buffalo. The most common incorrect answers were goat, elephant and chicken.

(b) Most candidates scored one mark for correctly identifying that the breathing rate increases. Very few candidates were awarded the second mark for stating that the depth of breathing also increases. Some incorrectly referred to this as breathing heavily or harder. Many candidates incorrectly talked about the effect of exercise on heart rate.

(c) (i) Few candidates were awarded full marks for this question. In questions requiring a comparison, candidates should always ensure that they give comparative statements, such as; inspired air

contains more oxygen than expired air. Many candidates stated the exhaled air contained no oxygen, rather than less oxygen. Very few discussed the water content.

(ii) Some candidates were unfamiliar with a chemical test for carbon dioxide. Limewater was the best known although any suitable indicator was accepted.

(d) The most common correct answer was trachea. Intercostal muscle was the answer least likely to be correct and was most frequently mistaken for the ribs. The alveoli were occasional confused with the bronchioles.

Question 3

(a) (i) Candidates found this to be a demanding question as they had to distinguish between the terms dominant and recessive, and phenotype and genotype.

(ii) Most candidates were able to complete the genetic diagram correctly and give the correct ratio.

(b) (i) Most candidates successfully interpreted the pedigree diagram.

(ii) Many identified a heterozygous individual, but some did not recognise that **U** and **V** could have been heterozygous or homozygous.

(iii) This question was not well answered as candidates did not use the information given at the start of the question. 50% was a common incorrect answer.

Question 4

(a) This was generally well-known though answers were often vague and could not receive full credit. A diet containing all the nutrients was the most common correct answer. The idea of the correct proportions was infrequently given, or incorrectly stated as equal proportions. Very few answers referred to the energy content of the food.

(b) The most common combination was milk, rice, tuna fish and grapefruit. Water was often stated as the main source of calcium and olive oil was often written as the main source of carbohydrate or protein.

(c) This was well-known with many correct answers, although the spelling of fibre varied. Some correctly stated roughage or water. Common errors were vitamins and carbohydrates.

(d) Many candidates gave a correct response of obesity. Many also related the fat to the heart and various heart conditions. Some answers just referred to heart disease without stating coronary or the consequences of a heart problem e.g. heart attack. A few candidates interpreted the ‘too much energy’ aspect of the question as people being malnourished, fatigued and not having enough energy to function. Candidates interpreted this aspect as people using too much energy rather than consuming too many calories.

(e) Many candidates who knew the answer were not awarded the mark because of the way in which they expressed themselves. Most answers referred to food or nutrients for the baby. Most answers referred to a baby rather than the correct term of fetus. Answers such as the mother eats for two or the baby eats the mother’s food were too vague to be credited.

(f) The most common characteristics were respiration, reproduction and growth.

Question 5

(a) Very few candidates were awarded full marks. Evaporation and stomata were the most frequently given correct responses. Very few candidates knew water diffuses through the stoma or stomata.

(b) Most candidates gained one mark for either identifying species **B** losing more water than species **A** or for a data comparison. Many candidates went on to score two marks by explaining that both species lost more water in hot temperatures. Some candidates were confused by the experiment and stated that the plants were given hot or cold water. Candidates did not always make their statements comparative.

(c) This question proved to be demanding for candidates. The most frequent incorrect response was to plot the bar at 6.8 cm^3 rather than less than 4.8 cm^3.

(d) Most candidates correctly named the xylem.

Question 6

(a) A few answers gave a range or referred to a 28 day cycle. This shows that candidates did not recognise the importance of the question stating 'use Fig. 6.1'.

(b) Candidates had a good understanding of the changes that occur during puberty. Some candidates did not state that girls would have pubic hair.

(c) Many correctly named oestrogen. Errors included naming testosterone or progesterone or an amalgamation of oestrogen and testosterone e.g. oestrosterone.

(d) Many candidates stated testosterone, showing candidates were either still thinking of the previous question or just focused on the word hormone in the question.

Question 7

(a) (i) The majority of candidates were awarded this mark with most of the correct answers being within a 6.0 cm^3 to 6.9 cm^3 range.

(ii) Many candidates correctly selected 4.4 cm^3 and 5.4 cm^3 but then did not know how to calculate the percentage increase. There were a significant number that incorrectly included 5.0 cm^3 in their selection of values.

(b) Human involvement was generally correctly selected but '…over many generations.' was less well-known. '…caused by the environment.' was a popular incorrect answer.

(c) The most common error was to answer 2 and 5, rather than 1 and 5. There were a significant number that answered 3 and 4 as they had missed the need to select incorrect statements.

(d) Adaptive feature was not well-known. The most common incorrect answers included inheritance, natural selection, genetic engineering, gene and DNA.

Question 8

(a) Most candidates correctly stated species and time. A few of the answers stated area or place, many answers stating environment or habitat instead of area.

(b) (i) Most candidates stated 88 with a few 89 and 90 answers. Some candidates incorrectly stated 88 000, 000 as they missed the million stated on the answer line. Few candidates showed their calculations.

(ii) This question was very well-answered with most correctly stating 1970.

(c) Most correct answers referred to an increase in birth rate, although this was answered in different ways, including no use of contraception, polygamy and teenage pregnancies. These were often given as separate answers but candidates should appreciate that they would be the same mark point. Many answers referred to migration without making it clear that it is into a country/area. Some answers were incomplete, for example, birth rate stated but no reference to an increase.

(d) Many candidates missed the fact that the question asked about the impact of increasing human population on the environment, with many just focussing on the effects of an increasing human population. Most candidates stated pollution followed by lack of resources and deforestation. Some answers focused on the increase in humans in terms of their lifestyle, for example, fewer jobs available, and did not refer to the effect on the environment.

BIOLOGY

Paper 0610/33
Theory (Core)

Key messages

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

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

General comments

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

Comments on specific questions

Question 1

(a) (i) Candidates gave varied responses to this question. Many correctly answered chemical for the first gap but fewer gave nutrient for the last gap.

(ii) Many candidates described two types of movement but did not specify muscle contraction. Active transport, transmission of nerve impulses and cell division are excellent examples of the uses of the energy released during respiration.

(iii) Many candidates correctly named water as a product of aerobic respiration.

(b) (i) Most candidates were able to select the correct values to use in the calculation, but many inverted the calculation. Some candidates did not round their final answer to one decimal place or rounded incorrectly. Candidates should always show their working.

(ii) Most candidates correctly named water or oxygen. When describing temperature, it's important that it is qualified as a 'suitable temperature' as seeds have different temperature requirements for germination.

Question 2

(a) Most candidates correctly gave bacteria as the organism causing cholera, with very few giving virus.

(b) (i) Most candidates were able to give filtration as a method of sewage treatment and some were able to indicate the separation of large and smaller solids. For this three mark question, it's important to make three separate points if full marks are to be awarded.

(ii) Candidates showed a good understanding of disease control.

(c) (i) Many candidates did not answer the question being asked. The question asked about the entry of pathogens into the body, not defences inside the body. The skin and hairs in the nose are good examples of mechanical barriers.

(ii) Many candidates did not read the question carefully enough and gave examples of white blood cells rather than their products. 'Antibodies' was the required answer.

Question 3

(a) (i) Many candidates correctly identified palisade and spongy mesophyll.

(ii) Few candidates were able to identify structure **F** as a chloroplast, with chlorophyll often given.

(b) Most candidates gave a correct word equation for photosynthesis.

(c) (i) Most candidates correctly calculated the rate of photosynthesis.

(ii) and **(iii)** Many candidates successfully identified the distances from the table.

(iv) While most candidates made the link between light and photosynthesis, many thought that photosynthesis would just slow down. Without light, photosynthesis would stop.

Question 4

(a) Many candidates correctly identified the oviduct and the ovary. Many were uncertain about the functions of the cervix and the uterus wall.

(b) Most candidates could name a barrier method of birth control but there was confusion over the meanings of natural birth control and contraceptive implant.

Question 5

(a) (i) Most candidates used the graph to successfully determine the number of students in the investigation.

(ii) Most candidates successfully selected the most frequent wrist circumference.

(iii) This was a demanding question. Most candidates were unable to clearly explain continuous variation. Continuous data shows a range of values between two extremes or are data that cannot be put into distinct categories.

(b) Many candidates did not read the question carefully and gave examples of continuous variation instead of discontinuous variation.

(c) Candidates found this question demanding and full marks were rarely awarded.

Question 6

(a) (i) Many candidates correctly stated photosynthesis. Some confused the carbon cycle with the water cycle.

(ii) As with part **(i)**, there was some confusion over the cycle and few named respiration as process **B**.

(iii) Many candidates correctly stated animals or consumers. A significant proportion of candidates named gases indicating that they had incorrectly interpreted the diagram.

(iv) The diagram shows that **D** contains carbon compounds which can be combusted. Therefore, **D** is a fossil fuel such as coal, oil or gas.

(b) Candidates were confident in their descriptions of the undesirable effects of deforestation and many were awarded full marks. Candidates would benefit from always writing specific descriptions. For example, organisms are killed is too vague and would be better expressed as plants are killed and this disrupts food chains as plants are producers.

(c) (i) Many candidates gave general sources of pollution rather than the actual sources of methane, such as decay.

(ii) Many candidates correctly gave global warming or climate change as the answer and a few referred to the enhanced greenhouse effect.

Question 7

(a) This highlights the importance of reading the question carefully as candidates often gave the name of the structure rather than its function.

(b) This question was well-answered with many candidates being awarded full marks.

Question 8

(a) (i) Many candidates correctly stated bacteria.

(ii) Although many candidates recognised that AIDS is caused by a virus, very few knew its name.

(b) (i) Candidates found it difficult to explain the meaning of antibiotic resistance. Answers were often too vague or a repeat of words in the stem of the question.

(ii) This was a demanding question. When describing patterns, it is sensible to describe the general trend, then specific changes and illustrate the trends with a suitable data quote. Candidates should remember to include the units when quoting data.

(c) (i) Some candidates correctly named the pancreas, although a range of glands and organs were also seen.

(ii) Candidates were unclear of the actual role of insulin and few specified that it reduces the concentration of glucose in the blood.

(d) (i) Careful reading of the question was needed. Most candidates gave uses of bacteria, rather than why they are useful. Bacteria are useful because they reproduce rapidly and have the ability to produce complex molecules.

(ii) This question required an answer linking the properties of yeast to its role in the production of biofuels or bread. Few candidates specified anaerobic respiration or fermentation in their answers.

Question 9

(a) While candidates were able to write about inheritance, few were able to give a clear definition. Inheritance is the transmission of genetic information from generation to generation.

(b) Many candidates found this question demanding and seemed unable to use the information in the stem to determine the genotypes. A heterozygous genotype must contain a dominant and a recessive allele, in this case **Rr**. A homozygous recessive genotype must contain two recessive alleles, in this case **rr**.

(c) Some candidates answered correctly and knew that a gene is a length of DNA that codes for a protein.

BIOLOGY

Paper 0610/41
Theory (Extended)

Key messages

Candidates should always look carefully at the command word in each question, and should understand the different requirements for each command word. In particular, some candidates did not understand the difference between 'describe' and 'explain'.

Data quotes to support observations should be given as a value with a unit. When data quotes are used to support a descriptive comment about a difference, they should be comparative.

Candidates must use the correct scientific terminology when describing or explaining phenomena. Careful use of key terminology is required, especially where there may be confusion with similar words. Examples on this paper were pathogen and antigen, atrium and aorta, artery and arteriole and gene and allele.

General comments

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

Many candidates showed good factual knowledge though should be reminded that they need to carefully read the stimulus material provided for each question and complete all the instructions contained within each question part to help maximise their chance of success.

Comments on specific questions

Question 1

(a) (i) Nearly all candidates correctly stated reptiles and amphibians as the other two groups of vertebrates. A number of groups of invertebrates were suggested, such as arthropods, crustaceans and arachnids.

(ii) The choice between double and single circulation seemed to cause candidates the most difficulty in completing Table 1.1. Many used the term 'simple' for the circulatory system of fish. Other common errors were to give birds fur and external ears.

(b) (i) When asked to define a term, the response should be the definition as quoted in the syllabus. Very few candidates could provide the complete definition to gain full credit. Diffusion was generally well known as the movement of particles, from a region of their higher concentration to a region of their lower concentration. Few candidates referred to the random movement of particles.

(ii) The majority of candidates correctly referred to the large surface area of the fish gills and a few suggested that being thin was an adaptation for gas exchange by diffusion.

(c) (i) Many candidates read the question carefully and noted that the death of fish pointed towards eutrophication. These candidates correctly stated sewage and nitrate ions from fertilisers.

(ii) This question was generally well-answered with many candidates gaining full credit. A few candidates failed to read the correct values from the graphs, but subsequent marks remained available as the error caried forward rule was applied.

Question 2

(a) Some candidates gained full credit. Many candidates did not construct a correct genetic diagram. Errors included not using the same letter for the two alleles and giving a single letter for the parental genotypes. Only a few candidates stated that the parental genotypes were heterozygous (Rr). Gametes were often assigned two alleles which gave incorrect offspring genotypes.

(b) Candidates found this to be a demanding question with few answers making any reference to a test cross.

(c) (i) Many candidates linked chlorophyll to photosynthesis and some stated that chlorophyll is used to trap light energy. 'Light' without any reference to energy was insufficient. Production of carbohydrates was rarely seen.

(ii) Some candidates correctly stated that magnesium was required for the synthesis of chlorophyll. Many responses identified glucose or water which are not mineral ions.

(iii) Candidates who restricted themselves to data quotes from Table 2.1 gained little credit as a comparison was required between the unripe fruit and the ripe fruit. Most candidates described the changes in chlorophyll and lycopene in red fruit or in yellow fruit, but rarely in both as required by the question. Credit was given for comparative data quotes with units.

(d) (i) Many candidates correctly identified DNA as the biological molecule where genes are located.

(ii) Candidates found it challenging to describe the disadvantages of genetically modifying crops. Some candidates referred to advantages instead of disadvantages. The most common response stated the expense of genetic modification of crops. Several candidates gave reference to reduced vitamins or taste which did not gain credit.

Question 3

(a) (i) The majority of candidates recognised that enzymes digest the protein and produce amino acids. Many candidates did not identify the enzyme as a protease. It was rare to see responses that referred to digestion being the change from insoluble to soluble molecules.

(ii) Most candidates explained that 50 ºC was the temperature at which the enzymes begin to denature. Fewer identified 30 ºC as the optimum temperature. Denaturation was often explained in terms of the whole enzyme changing shape without recognising the importance of the shape of the active site for enzyme activity.

(b) This majority of candidates were able to outline the roles of bile in emulsification of lipids and neutralisation of stomach acid. Several candidates described emulsification instead of using the term, but many referred to the change in size of lipid molecules instead of droplets. Few candidates described the role of bile in the denaturation of stomach enzymes.

Question 4

(a) Many candidates stated that the cause of cholera is a bacterium and some named *Vibrio cholerae*. Some candidates incorrectly stated that cholera is caused by a virus.

(b) (i) Some candidates correctly suggested that a vaccine must contain a dead pathogen for it to be effective. The most common misconception was that a small amount of the cholera pathogen was used, rather than a weakened or harmless form of the bacterium.

(ii) Most of the explanations as to why people were not protected from cholera immediately after receiving the vaccine were not very thorough. Almost all of the candidates stated that time was needed, but often this was not linked to the production of antibodies and memory cells. The best responses explained that lymphocytes secrete antibodies specific to the antigens in the vaccine. Reference to long-term immunity was rarely seen.

(iii) Many candidates gave a suitable response for this question. Most stated that it was important that the people did not have any immunity to the disease.

(iv) This question required discussion of the effectiveness of the vaccine using the information in Fig. 4.1. Many good discussions were seen with good responses referencing fewer symptoms among those who were vaccinated and the best responses explained that the vaccine was not 100% effective as vaccinated people still had symptoms. Candidates did not always give data quotes that were comparative.

(c) (i) This was generally well-answered and many gained full credit. Almost all candidates explained that diarrhoea is the loss of watery faeces. The best responses explained that the pathogen releases a toxin that triggers chloride ion release. Candidates were expected to answer in terms of chloride ions lowering the water potential, but there were several that described the movement of ions as changing the concentration or diffusion gradient. Many gained credit for describing how water left cells by osmosis.

(ii) A full range of treatments for cholera were described. Most candidates described the need for water and ions. However, fewer mentioned the need for glucose or sugar.

Question 5

(a) Most candidates identified valves as the means of ensuring one-way flow of blood. Many named the valves correctly, making reference to their opening and closing. Some included the contraction of the heart in their explanations.

(b) This question proved demanding with many candidates not recognising the blood vessels that transport blood to and from the skin. Both columns in Table 5.1 had to be completed correctly to gain credit and some candidates only filled in one column. Some candidates identified the artery, capillary and vein and a minority recognised the arteriole or the venule. However, it was extremely rare to see shunt vessel and the letter L in the last row.

(c) This question proved demanding for most candidates, with many incorrectly suggesting that veins carry blood to organs. The renal artery was often identified as the hepatic artery.

(d) The responses to this question were very variable. Some wrote very descriptions of the surgical methods, but many described surgery where the artery was opened and the blockage scraped out. Candidates were often too vague in their explanation of the named surgical option. For example, when describing bypass surgery, they rarely explained that the new vessel is a replacement. A number of candidates suggested using a capillary to replace the artery or stated that it is the aorta that has to be replaced rather than the coronary artery. A number of candidates knew the idea of opening or widening the artery, but failed to name stents as the correct method of doing so.

Question 6

(a) Many responses stated a definition of monoculture which was not required. The most common negative impacts of monocultures given were soil erosion and the depletion of nutrients from the soil. Many good responses also included reference to monocultures reducing biodiversity and destroying habitats. Some responses discussed the effects of pesticides, herbicides and fertilisers on crop production rather than their impact on ecosystems. Some responses focused on human effects, such as food shortages and famine, which did not gain credit.

(b) The diagram for this question identified the cob and the fruit, so vague references to ‘size’ did not gain credit unless qualified by cob or fruit.

(c) (i) Some candidates recognised the need to avoid subsequent pollination of the flowers. Other responses were confused and described pollen being lost from the flower.

(ii) Very few candidates identified the need of oxygen for aerobic respiration. However, most candidates stated that oxygen was needed for growth. Common errors were to state that oxygen was needed for photosynthesis and that respiration produced energy.

(iii) A small number of candidates suggested that the parents were heterozygous. Fewer explained that recessive alleles only showed in the phenotype when homozygous. Weaker responses referred to recessive genes instead of alleles.

(iv) The majority of responses to this question were too vague. Candidates would have benefited from referring back to Fig. 6.3 to help them. Only a few responses suggested that selective breeding for many generations would lead to homozygosity and reduced variation in the population.

(v) Most candidates suggested mutation as a reason for the appearance of new features in a crop plant.

BIOLOGY

Paper 0610/42
Theory (Extended)

Key messages

Candidates should always look carefully at the command word in each question, and should understand the different requirements for each command word. In particular, some candidates did not understand the difference between 'describe' and 'explain'.

Data quotes to support observations should be given as a value with a unit. When data quotes are used to support a descriptive comment about a difference, they should be comparative.

Candidates must use the correct scientific terminology when describing or explaining phenomena. Careful use of key terminology is required, especially where there may be confusion with similar words. Examples on this paper were lipase and ligase, ovum and ovule, mitosis and meiosis and nitrification and nitrogen fixation. Care should be taken when writing about genes and alleles. Many candidates stated in **Question 2** that the plants inherited 'different genes' when what they meant was 'different alleles'. All organisms of the same species have the same genes.

General comments

There were some excellent answers to the questions on this paper. Particularly good were the responses to **Question 1(b)(i)** on active transport, **Question 4(b)** on synaptic transmission and **Question 2(b)(i)** that required candidates to work out the genotypes of a cross involving codominance.

Candidates did not often check their answers. In **Question 1(b)(i)** some candidates wrote that diffusion is the 'movement from a higher concentration to a higher concentration'. In some cases, candidates described the direction correctly, then stated that active transport occurs down a concentration gradient or described the same directional movement in diffusion.

Some candidates did not take care when transcribing information from the paper. In **Question 1(f)(i)** some candidates wrote about proteins and not pectins. There were also a number of candidates that recognised that the fungal extract contained amylase but also stated that it contained pectin rather than pectinase.

Candidate should take care over their choice of words. Produce is a word that is often misused. Throughout **Questions 3(b)** and **(d)** candidates wrote about the production of follicles and eggs during the menstrual cycle rather than their development or maturation.

Comments on specific questions

Question 1

(a) Many candidates gave the duodenum as the other region of the small intestine. A few candidates did not read the question carefully enough and gave the ileum. Colon, stomach, lacteal, capillaries and goblet cells were some of the incorrect answers seen.

(b) (i) There were many good answers to this question on active transport that referred to the energy required, often stating that it was provided by respiration. Some answers stated that active transport occurs through proteins in membranes; rarely did candidates add that diffusion does not require the presence of a membrane.

(ii) Most candidates stated that microvilli increase the surface area or microvilli provide a large surface area. Stronger responses stated that this increases the rate at which nutrients can be absorbed by diffusion across the cell membrane. Many stated incorrectly that microvilli protect the epithelial cells or that they are a barrier to harmful substances. Some said that the increased surface area is for more absorption rather than for faster absorption.

(c) (i) Many candidates correctly gave mucus as the protective substance produced by goblet cells.

(ii) Most candidates gave one reason why a protective substance is needed in the intestines. Some correctly described the effect of stomach acid and others the protection against the damage enzymes might do to the intestinal epithelium. Some answered in terms of the gas exchange system rather than the digestive system. Lubrication and the easy movement of food through the intestines were seen quite often and did not gain credit. However, candidates who stated that the mucus provides protection against the physical damage or friction of food on the walls of the intestine did gain a mark.

(d) Few candidates knew the functions of lacteals. Common incorrect answers were to absorb all nutrients and to increase the surface area for absorption. Few candidates gave the absorption of fat (or fatty acids and glycerol) and the transport of fat into the lymphatic system. Quite a few thought that the lacteals provide support to the villi or stored the digested food. A significant number thought that lacteals are involved in the digestion of lactose.

(e) Few candidates gained all four marks for completing Table 1.1 correctly. Common errors were to identify endoplasmic reticulum as a cell or a tissue; intestinal epithelium as a cell and the ileum as a tissue.

(f) (i) Some candidates gave excellent answers to this question, giving at least three conclusions with supporting evidence. However, some candidates did not read the information carefully and simply described what could be seen in the diagrams with no attempt at interpretation. Some candidates thought that the fungal extract was the source of the starch and the pectin. Some described pectin and starch as enzymes rather than substrates. Very few candidates referred to the enzymes diffusing through the agar.

(ii) The question asked for a prediction about the results. Most gave explanations in terms of enzymes working slowly, or not at all, at 5 °C or the enzymes being denatured at that temperature. The expected prediction was smaller or no clear zones.

Question 2

(a) (i) Many candidates gave the definition of the term chromosome that is given in the syllabus. The vast majority of candidates knew that chromosomes were made of DNA.

(ii) Many answers stated correctly that the bag over the flowers prevents pollen from other flowers landing on the stigma. This idea was expressed in a variety of ways, often including references to pollinators. There were many incorrect answers that suggested the bag would prevent the loss of pollen and even pollen falling out from the anthers, even though the anthers had been removed. A number of candidates referred to the use of the bag in terms of transpiration or controlling conditions, such as humidity, in order to facilitate pollination or germination of pollen.

(iii) Most candidates were very unsure about the cause of the variation in the offspring. The strongest responses explained that variation is caused by meiosis in gamete production and in the random fertilisation of gametes with different genotypes. Many thought that variation was introduced by meiosis or mitosis occurring after fertilisation and the formation of a zygote. Some candidates referred to cross-pollination as being sexual and self-pollination as being asexual. Many candidates stated that variation was a result of mixing characteristics from both parents or the inheritance of different genes rather than different alleles.

(iv) A large proportion of candidates used the terms haploid and diploid in the correct context. Gametes are the products of meiosis, they do not divide by meiosis. Almost all candidates assumed that the species in the question, in fact all species, have a diploid number of 46. If candidates are going to do this, they need to preface their answer by stating that this is the case in humans.

(b) (i) Successful candidates gave the genotypes as P^RP^R, P^RP^W and P^WP^W. Some candidates incorrectly gave P^R for P^RP^R and P^W for P^WP^W and P^{RW} for P^RP^W. Many candidates wrote out the phenotypes instead of the genotypes.

(ii) Many identified the type of inheritance as codominance. Common alternatives that were not accepted included genetic, heterozygous and monohybrid.

Question 3

(a) (i) Most candidates correctly named the ovary as the target organ for FSH. Common errors were uterus, follicle and ovule.

(ii) Many stated correctly that FSH reaches its target organ in the blood. Some gave diffusion which was not accepted. Others stated that FSH is secreted by the pituitary gland, but not how it reaches the ovary.

(iii) There were several ways of approaching this question about the relationship between FSH and LH during the menstrual cycle. Many correctly stated that the concentrations of the two hormones follow a similar pattern, increasing to a peak at day 14 and then decreasing. Others stated that the pattern was the same, but described the differences between the relative concentrations at the beginning of the cycle, at the peak and after the peak. Few quoted data to illustrate their description, but when they did, they often omitted the units, arbitrary units or a.u.. Many misread the scale on the horizontal axis of Fig. 3.1, identifying the day of the highest concentrations of FSH and LH as day 13 not day 14. Vague references to time such as ‘in the beginning’ and ‘later’ were insufficient to allow credit to be awarded.

(b) Many candidates were unsure about the roles of FSH and LH in the menstrual cycle using terms like ovary, follicle, egg, corpus luteum, oestrogen and progesterone indiscriminately. Many who knew that the hormones act on the ovary, rather than the uterus, stated that FSH stimulates the production of eggs rather than their development or maturation. Candidates should know that potential eggs are produced by mitosis before birth and only begin to develop after puberty. Many stated that LH stimulates ovulation and many thought that FSH and LH have a direct role on the changes that occur to the uterus lining.

(c) Descriptions of the changes that occur to the lining of the uterus during one menstrual cycle generally lacked detail. Strong responses began by stating that thinning of the lining occurs over the first five days of the cycle and that this is followed by regrowth over the next seven days. Many also stated incorrectly that the thinning of the uterus begins immediately after ovulation. Many candidates misinterpreted the question and wrote about what happens to the uterus and ovary if the egg is fertilised. Others wrote about the roles of oestrogen and progesterone in controlling the thickness of the uterine lining.

(d) Strong responses described the role of progesterone in contraceptive pills in preventing the release of FSH so that eggs do not develop within follicles. Many correctly stated that ovulation does not occur, although some thought that ovulation is delayed rather than inhibited. Some thought that the pills contain FSH and LH, which would have the opposite effect of that intended. Many thought that the contraceptive pill kills sperm or a developing fetus.

Question 4

(a) The parts of the reflex arc shown in Fig. 4.1 were named and identified correctly by many. Common errors were to confuse the three neurones and state that the receptor and effector conduct impulses.

(b) There were some excellent accounts of impulse transmission across synapses, with many using the appropriate terminology for synaptic transmission. Weaker responses did not make it clear how neurotransmitters are released from the pre-synaptic neurone and did not state clearly that they diffuse across the synaptic cleft.

(c) Almost all candidates named a suitable reflex that occurs in the eye or gave a description. The most common answer was the pupil reflex. Fewer candidates stated accommodation as a reflex and even fewer attempted to describe it.

Question 5

(a) There were many good ideas given in answer to this question. The most common factors that affect the volume of urine produced in the human body included the volume of fluid ingested, the temperature, exercise, sweating and the concentration of solutes in the blood. Some candidates also identified drugs that influence urine production and some gave medical conditions, such as diabetes.

(b) There were many very confused accounts of the relevant part of the nitrogen cycle. Candidates often knew something about the roles of bacteria in decomposition and nitrification, but the sequence of events was rarely described correctly. Many candidates incorrectly referred to nitrogen throughout their answer, for example nitrogen is denitrified to nitrate. Many candidates referred to nitrification, then described the process of nitrogen fixation, which was not relevant in this question. Strong responses started with protein in the animal waste and described its break down to amino acids. Ammonification, where amino acids are broken down to release ammonia or ammonium ions, was often missing from even the strongest responses. Many candidates gained marks by describing nitrification and the change from ammonia to nitrite and then to nitrate. Almost all candidates who attempted this question stated that plants absorb nitrate ions.

(c) Candidates recognised that this was a question about eutrophication and many wrote a good account of the sequence of events following the pollution of a water course. Some began with organic waste and others with fertilisers, but both groups described the growth of algae and plants, competition for light, death and decomposition of producers, population increase in decomposers and reduction in oxygen concentration of the water leading to suffocation of fish and/or death of other aquatic animals. Some candidates misread the question and wrote about plastic pollution. Some thought that the biodiversity would be reduced because the livestock would drink the water, get sick and die. Some wrote about the effect of the pollution on the human population living near a water supply and stated that their deaths would reduce biodiversity. There was some confusion over the reason for the decrease in the oxygen concentration of water. Some thought that the lack of plants is the cause of the lack of oxygen and others that algal blooms prevent oxygen getting into the water.

Question 6

(a) (i) Most candidates gained full marks by defining the term catalyst successfully. Many defined the term enzyme instead but these answers often gained full marks. A common error was to state that the catalyst does not take part in the reaction, instead of stating that it remains unchanged or is not used up in the reaction.

(b)(i) Almost all correctly stated substrate **T**, although a few chose **Q**, **U** or **R**.

(ii) Explanations for choosing substrate **T** were variable. The strongest responses explained that **T** was the only substrate that could fit into (or bind with) enzyme 1 because its shape was complementary to the shape of the enzyme's active site. Some candidates wrote about the lock and key mechanism without clearly stating these two points in their answers. Many could not be awarded the mark because they stated that the enzyme and substrate were complementary, rather than the enzyme's active site and the substrate.

(c) Many candidates gained full credit for completing Table 6.1. Common errors included sucrose, fructose and simple sugars in row one, fatty acids and glycogen in row three, lipase in row five and omitting to name ligase in the penultimate row. Many did not make it clear in the last row that restriction enzymes cut DNA. Some candidates thought that restriction enzymes stick ends of DNA together.

BIOLOGY

Paper 0610/43
Theory (Extended)

Key messages

Candidates should always look carefully at the command word in each question. **Question 2(a)(i)** required candidates to describe results shown on a graph, not to give any explanations. The command word evaluate was used in **Question 4(d)(iii)**. This requires more than a restatement of the data shown in Table 4.2.

Data quotes to support observations should always be given as a value with a unit. When data quotes are used to support a descriptive comment about a difference, they should be comparative.

Candidates must use the correct scientific terminology when describing or explaining phenomena. Careful use of key terminology is required, especially where there may be confusion with similar words. Examples on this paper were lipase and ligase, atria and aorta and septum and spectrum.

General comments

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

Many candidates showed good factual knowledge though should be reminded that they need to carefully read the stimulus material provided for each question and complete all the instructions contained within each part question to help maximise their chance of success.

Comments on specific questions

Question 1

(a) Most candidates defined an enzyme as a biological catalyst, with some candidates preferring to give a description of a catalyst instead.

(b) (i) Almost all candidates wrote the correct sequence of complementary bases on the lower strand in step 1 on Fig. 1.1.

(ii) Only the strongest responses identified that the enzyme labelled in the flow diagram was a restriction enzyme. Common incorrect answers included protease and amylase.

(iii) Many candidates used the diagram to state that the DNA molecule was cut. A number of candidates incorrectly stated that the strand was cut as they appeared to confuse the terms molecule and strand. This highlights the importance of being careful with scientific terminology. Some also confused restriction enzymes with digestive enzymes in the alimentary canal and stated that the DNA molecule would be broken down. Many candidates correctly stated that the process resulted in the formation of complementary sticky ends.

(iv) Some candidates applied their knowledge about the role of enzymes to explain how the specific DNA base sequence was the substrate that formed a complex with the restriction enzyme by binding to the active site.

(c) (i) Many candidates knew that bacteria naturally contain plasmids, with a small number stating fungi or prokaryotes.

(ii) Many candidates identified the enzyme in step 2 as ligase. Some candidates repeated restriction enzyme.

(iii) Only some candidates correctly identified the molecule as recombinant DNA or a recombinant plasmid. Recombinant gene was a fairly common incorrect answer that highlighted a misunderstanding about the process of genetic engineering. However, other candidates gave the names of other molecules associated with DNA and protein synthesis, such as RNA, mRNA and amino acid.

(d) Most candidates labelled the axes correctly and drew a curve with a peak. The best responses showed that the gradient of the decrease in enzyme activity after the peak would be considerably steeper than the increase before the peak. Where the difference in the two gradients was not obvious, credit for that aspect could not be given. Those candidates who reversed the axes rarely drew an accurate trend. Some candidates drew a line that reached a plateau rather than reaching a peak at an optimum temperature. Some candidates labelled one of the axes as rate of reaction with no reference to an enzyme so did not gain the mark for labelling correctly.

Question 2

(a) (i) Many thorough descriptions of the figures describing the rate of nitrate uptake along a root were seen. Good responses described that there was no uptake before 2.75 mm, that between 10 mm and 15 mm the uptake levels off at 10 pmol per cm^2 per s and reached a peak at 27 mm because there were more root hairs present. A few candidates stated that the uptake was lowest before 2.75 mm when there was no uptake at all so gained no credit for this statement. Not many stated there were no root hairs below 10 mm or at the root tip or root cap, and only a few candidates linked the rate of uptake of nitrate ions to the presence or absence of root hair cells.

(ii) Almost all candidates knew that nitrate ions moved into roots across a cell membrane or into a root hair cell and many also knew that the process was active transport, although a considerable number thought it was osmosis or diffusion. Stronger responses went on to describe the process of active transport correctly to gain maximum credit. Few candidates stated that the nitrate ions are dissolved in water before moving into the root.

(iii) Some candidates realised that nitrate ions decreased the water potential in the root cells, enabling the uptake of water. Many candidates wrote confidently using the term water potential, with very few using the incorrect phrase – water concentration. Many candidates misread the question and instead explained how nitrate ions are used in plants.

(iv) A wide range of correct uses of nitrate ions were seen, with growth the most common answer. Few candidates went on to explain that nitrate ions are needed to make amino acids for the synthesis of proteins.

(v) Some very detailed and accurate descriptions of the part of the nitrogen cycle that occurs in the soil to form nitrate ions were seen. Good answers often started with nitrogen fixation by lightning or bacteria converting atmospheric nitrogen to ammonium ions which then undergo nitrification into nitrate ions.

(b) (i) Many candidates confused the sequence of events that occurs when high concentrations of nitrate ions flow into lakes.

(ii) Almost all candidates identified the process correctly as eutrophication.

Question 3

(a) Many candidates correctly predicted the phenotypic ratio of the heterozygous cross. Some candidates recognised there were black-bodied fruit flies and yellow-bodied fruit flies, but did not give a phenotypic ratio. Some candidates gave ‘black is 75%’ or ‘black is 3’ without giving the figure for yellow and so were not awarded the mark.

(b) Many candidates also identified that if 124 offspring have black bodies and 121 have yellow bodies, the expected offspring phenotypic ratio would be 1:1. Using this approach, many candidates went on to show the genetic cross that would have resulted in this ratio. However, others started from an incorrect cross and stated the expected ratio from their cross rather than using the figures given.

(c) (i) Many candidates correctly stated that all arthropods have exoskeletons or segmented bodies. Those candidates who chose to describe differences in the number of legs often made vague or inaccurate statements.

(ii) Most gave correct statements about the numbers of legs; there were fewer references to the carapace or to gills.

(d) (i) Many candidates explained that if crabs with the allele for albinism reproduced, this allele will be passed onto the next generation. Many also made vague statements about survival, or did not mention natural selection or how the change over time would be evolution and hence did not gain maximum credit. Better candidates stated that the allele for albinism would give the crabs a selective advantage over others that did not have it. Other candidates became confused with dominant and recessive alleles and consequently did not state clearly that it is the allele for albinism that was passed on to the offspring.

(ii) Most candidates knew that radiation could cause mutations, but fewer identified chemicals or mutagens. Common incorrect answers included vague statements that referred to the environment and to food. Many candidates misread the question and instead described a mutation.

Question 4

(a) A wide variety of mechanisms by which HIV can be transmitted were correctly described, but some common misconceptions were also seen. Many candidates stated that body fluids were the medium of transmission, but omitted to state clearly that only infected body fluids would transmit the virus.

(b) Many candidates stated that viruses have a protein coat. Other correct responses included non-living and pathogen.

(c) (i) Almost all candidates stated that lymphocytes produce antibodies, with the more able candidates going on to mention active immunity, the functions of antibodies and the production of memory cells. In contrast, some candidates seemed familiar with the words associated with the function of lymphocytes, but did not use them accurately.

(ii) Many candidates knew that the number of lymphocytes would decrease if there is an HIV infection, but many candidates suggested that the virus inhibited antibody production or just weakened the lymphocytes.

(d) (i) The importance of vitamin C and iron in the human diet were explained thoroughly by many candidates. Iron was better understood and described by most.

(ii) Almost all candidates calculated the percentage decrease in the average number of copies of HIV RNA in the blood. A small minority used the incorrect denominator or made a calculation error after correctly showing the correct working. These candidates gained a mark for their working, but where no working was shown and the answer was incorrect, no credit was possible.

(iii) Most candidates focused on the change in the average number of lymphocytes in the treatment group, but fewer compared this with the control group in their evaluation of the effect of the dietary supplements. Some candidates did not read the question carefully and focused on the reduction of HIV RNA rather than on the lymphocytes.

Question 5

(a) Some detailed discussions about how governments can regulate fishing to maintain fish stocks were seen. Few candidates explained what is meant by a sustainable resource or sustainable development, but did gain credit for including descriptions of how the use of quotas, protected areas, fishing seasons and fish farming allowed for breeding recovery, prevention of overfishing

and species becoming endangered. Some candidates misread the question and discussed reducing the impact of water pollution.

(b) Many candidates correctly stated that contraceptive hormones were likely to have caused the increase in the number of female and intersex fish downstream of the factory.

(c) Many candidates correctly stated that in humans, sex is inherited from the sex chromosomes, but many simply stated it was from reproduction, gametes, chromosomes or just the Y chromosome. A number of candidates also incorrectly referred to X and Y alleles or genes.

Question 6

(a) Almost all candidates explained that the heart was made of many tissues, but fewer went on to give a complete explanation.

(b) Almost all candidates correctly inserted at least one of the words into the sentences on the circulatory system. Common incorrect responses included respiratory for circulatory, left side for left atrium and aorta for coronary artery.

(c) Most candidates correctly stated that an ECG or a heart rate monitor was another method to monitor heart rate; others did not read the question carefully and repeated the example given in the question paper.

BIOLOGY

Paper 0610/51
Practical Test

Key messages

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

General comments

Many candidates displayed good skills in drawing the flower. High quality diagrams used single, unbroken lines, are in proportion and show sufficient detail. Diagrams should not be shaded, nor should a ruler be used. Label lines should end exactly on the structure being labelled.

Comments on specific questions

Question 1

(a) (i) In general, candidates found drawing this data table quite demanding. There were a large number of data points that needed to be included as well as suitable headings with units. The most common error was to omit the column heading for the testing reagents.

(ii) Most candidates were able to correctly state the food-testing reagents. A small number listed examples of foods for each test, which was not credited.

(iii) This question required candidates to list all the substances found in solution **M**. In order to be awarded the mark, proteins, reducing sugars and starch all had to be given.

(iv) Only a small number of candidates correctly named reducing sugar and gave the evidence that it gave a positive Benedict's test in the solution in the test-tube. The most common error was incorrectly identifying the substance as protein.

(b) Many candidates misinterpreted the reasons for rinsing the dialysis tubing. Many discussed how this would allow the experiment to be carried out or that it was for general cleaning. Rinsing prevents contamination of the solution being tested with solution **M**.

(c) Some candidates had a very clear idea of what constitutes a hazard, whilst others misinterpreted this and described human errors. Stronger responses stated that food testing reagents were harmful and a suitable precaution would be to wear goggles or gloves. Not tying the dialysis tubing correctly is a human error and not a hazard.

(d) Some candidates described a valid and reliable investigation that would measure the effect of pH on enzyme activity. Most candidates were able to discuss the need to keep some variables constant, such as the volume of amylase and the temperature. Many were able to identify the need for repeats, but did not say how many times the investigation should be repeated. It is important that candidates can specify a suitable range for the independent variable being tested, in this case a minimum of two pH values. There were few detailed descriptions of the investigation. Candidates would have been awarded credit for describing key points of the method, such as maintaining a constant temperature using a thermostatically controlled water-bath or sampling at set time intervals.

Question 2

(a) (i) Most candidates were able to identify temperature as the independent variable.

(ii) Many candidates gave the distance of the lamp from the plant as a constant variable. Unqualified answers, such as light, time, sodium hydrogencarbonate or plant, could not be credited. Variables should always be qualified, e.g. intensity of light, colour of light, time to collect the gas or species of plant.

(iii) Many candidates found it difficult to articulate their ideas in this question. Results are repeated so that anomalies can be identified and discarded.

(b) (i) This question proved demanding for some candidates. Many were able to correctly identify the values of 7.8 cm^3 and 12.0 cm^3, but often they calculated the difference rather than the percentage change. Many candidates were unsure of significant figures.

(ii) Many candidates constructed suitable graphs with labelled axes and equidistant scales. Plotting the data proved challenging for candidates that chose an unsuitable scale. Candidates should join their plots with a ruled point-to-point line that does not extend beyond the plots. A small number of candidates plotted the volume of gas collected in 20 minutes rather than the rate of photosynthesis and therefore could only be awarded a maximum of three marks.

(iii) Most candidates described a suitable trend for the effect of temperature on the rate of photosynthesis. Candidates should be encouraged to give a data quote to illustrate the pattern being described.

(iv) Some candidates were able to identify the rate of photosynthesis at 17 °C, but many did not draw a line on their graph or accurately read off the value from the graph.

(c) (i) Many candidates were able to accurately draw an outline of the flower. A small number could not be awarded the outline mark because they had shaded their diagram. Diagrams needed to include five anthers and seven petals. The most common error was to draw diagrams too small. A large drawing should usually be larger than the original image and fill the space provided. However, drawings should not extend into the text around the space provided.

(ii) Most candidates correctly measured and recorded the length of line **XY** as 90 mm. Candidates were then expected to divide this value by 6 and give the correct units. Many made the error of multiplying by 6.

BIOLOGY

Paper 0610/52
Practical Test

Key messages

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

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

General comments

Most candidates performed very well on the planning exercise, producing a 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 data table and the graph were drawn well by most candidates. The drawing skills of most candidates was seen to be good, with suitable detail included.

Comments on specific questions

Question 1

(a) (i) Most candidates were able to construct a table that was suitable for the data collected. Generally, the table headings and table structure were good, although some candidates put units in the body of the table. The results collected indicated that the practical procedure was carried out with a good degree of confidence and ability.

(ii) This question asked for a conclusion based on the results of the investigation recorded in 1**(a)(i)**. Although this was done well by most candidates, a significant number simply described the results of the investigation rather than giving a conclusion. Answers that simply stated that one balloon had a larger diameter than the other could not be credited.

(iii) Candidates were asked why the yeast suspension was stirred before using it. Many candidates did not give sufficient detail when answering the question. The idea of an even distribution of the yeast cells between the two test-tubes was well communicated by a few candidates.

(iv) Most candidates were able to identify at least one variable that was kept constant during the investigation, but a lack of detail in the answers often prevented a second mark being awarded. Simply referring to temperature being kept constant was insufficient, as temperature was the independent variable. Instead, candidates needed to refer to the maintenance of temperature in each individual water-bath.

(b) (i) Many candidates were able to suggest a piece of apparatus suitable for collecting and measuring the volume of gas produced. Those who did not choose a gas syringe often found it difficult to describe the collection of gas by a displacement method.

(ii) Most candidates were able to identify a correct indicator for carbon dioxide and give the correct result of a positive test.

(c) (i) Most candidates were able to record the temperatures of the two water-baths, but a small number then went on to incorrectly calculate the change in temperature.

(ii) In this question candidates were asked how the temperature of the water-baths could be maintained. Although some good answers were seen, with insulation being the most common, many candidates gave insufficient detail of monitoring the temperature as the water-baths were heated.

Question 2

(a) (i) The quality of the drawing was generally very high. Lines were clear and distinct and the drawings were of a suitable size. Some candidates drew sketchy lines and included shading. A few candidates did not draw all of the visible structures and so could not be awarded the marks for detail.

(ii) The measurement of the image was done well, but care needs to be taken not to confuse mm with cm. Nearly all candidates went on to correctly divide by the magnification, but the most common error was not giving an answer to two decimal places. Candidates must ensure that they read the question fully and understand the difference between significant figures and decimal places.

(b) (i) The percentage decrease in the average distance travelled was generally done well with nearly all candidates able to select the correct values from the table. Fewer were able to manipulate the values correctly and some candidates appeared to miss the fact that the answer needed to be expressed to two significant figures. An understanding of how to calculate a percentage change is an important skill for all candidates.

(ii) Most candidates scored very well on this question. It is important that a suitable scale is chosen. A scale that allows easy plotting of all points helps prevent candidates from making errors when determining where plotted points should be placed. A few candidates chose to plot the dependent variable on the *x*-axis, which made plotting of the points quite challenging.

(iii) In this question, candidates were asked to determine a distance using the line drawn on their graph in **2(b)(ii)**. Many were able to do this with a good level of precision, but a significant number chose the wrong line or did not show on their graph how they had obtained their estimate.

(iv) Most candidates were able to state the positive test for proteins. A very small number incorrectly stated Benedict's solution.

(c) (i) The planning exercise was generally done well. The use of potometers was rarely seen, as was suspending leaves and measuring their change in mass over a period of time. Many candidates gained marks for identifying the variables, but far fewer gained marks for the actual method.

(ii) Although some very good descriptions were seen, many candidates could not suggest how the humidity of the air surrounding a sample of leaves could have been changed. A bowl of hot water will increase the humidity whereas a dehumidifier will reduce the humidity.

BIOLOGY

Paper 0610/53
Practical Test

Key messages

Candidates would benefit from showing all of their working when performing a calculation. If working is shown, then even an incorrect answer can be awarded marks for the correct selection of data or manipulation of formulae.

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

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

General comments

Most candidates performed very well on the planning exercise, producing a 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 data table and the graph were drawn well by most candidates. The drawing skills of most candidates was seen to be good, with suitable detail included.

Comments on specific questions

Question 1

(a) (i) Tables of results were generally well constructed and reflected the data that needed to be collected. The observations themselves were close to the expected values and indicated a good standard of practical work was carried out by the candidates. Occasionally units were placed in the body of the table.

(ii) This question asked for a conclusion based on the results shown in the table in **1(a)(i)**. Although many candidates did this well, referring to the enzyme catalase, a significant number simply described the difference between the two sets of results.

(iii) Many candidates correctly identified a potential error in the method. The most common being the difference in mass or surface area of the three different tissue samples. Other errors, such as the difficulty in measuring the uneven surface of the foam were also accepted, but human errors (including parallax error) did not receive credit.

(iv) This question asked why the experiment should have been performed three times, rather than twice. Answers that described taking averages were not accepted, as an average was calculated using two sets of results. Similarly, ‘to make it more reliable/accurate’ were too vague to answer the question. Performing an experiment three times allows anomalous results to be identified and discounted.

(v) Some very good answers were seen. The most frequent correct answers were the mass or surface area of the plant tissue and temperature. Care needs to be taken when using the word ‘amount’ as this could refer to either the volume or the concentration of a substance.

(vi) This question on safety was answered well with some sensible suggestions of how to reduce risk. Candidates should always try to describe the risk (cutting using a knife) and also specify the precaution (cut on a white tile and always cut away from the hand).

(b) This question proved demanding for many candidates. A method of collecting a volume of gas was required (gas syringe or displacement method) and some reference to the rate being calculated as a function of time.

(c) (i) Most candidates were able to accurately record the colour changes of the three types of tissues and correctly state conclusions for their observations. When a negative result is obtained, the colour still needs to be recorded, rather than simply writing 'no change' or putting a dash in the box. Similarly, the conclusion must refer to the nutrient being tested for, even if the test is negative. This means that 'starch not present' would gain a mark, but just writing 'negative result' would not.

(ii) Nearly all candidates correctly identified the reagent for testing for proteins, although Benedict's was occasionally seen.

(d) The planning exercise was extremely 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. Some candidates forgot the need to repeat the procedure twice to get three sets of results.

Candidates must be careful to be precise when referring to measured variables, and avoid phrases such as 'leave it for about ten minutes' or 'cut them to approximately the same length'.

Question 2

(a) The drawings were generally of a very high standard. The most common errors were:

- outlines that were feathery or drawn using a pair of compasses
- poor observation in terms of size, proportion or detail of structures within the specimen.

(b) (i) Many candidates appear to be confused between significant figures and decimal places, or are unaware of how significant figures are determined.

(ii) In this question, candidates were asked to identify two similarities and one difference between two species of moth. Nearly all candidates could identify two similarities but fewer were able to make comparative statements about the differences. Close observation of the drawings was required, and any statement had to be comparative, rather than just referring to one of the moths. The most obvious difference was that the bird-cherry ermine moth had more spots than the apple ermine moth.

(c) (i) The graph drawing was very good, with very few errors in plotting. Most scales were suitable and both axes were clearly labelled. Common errors included:

- extrapolation beyond the last point
- plotting of particularly large points.

(ii) Almost all candidates correctly estimated the number of moths using their graph.

BIOLOGY

Paper 0610/61
Alternative to Practical

Key messages

Candidates should be familiar with the practicals outlined in the syllabus. They should be familiar with the methods for the practicals, and be able to identify the independent, dependent and constant variables. Candidates should understand the hazards in each investigation and the reason why investigations are repeated twice to obtain three sets of data.

Candidates should be familiar with the mathematical requirements specified in the syllabus, including calculating a percentage change and a magnification. Working should always be shown for calculations as often marks can be given, even if the final answer is incorrect.

General comments

Many candidates displayed good skills in drawing the flower. High quality diagrams used single, unbroken lines, are in proportion and show sufficient detail. Diagrams should not be shaded, nor should a ruler be used. Label lines should end exactly on the structure being labelled.

Comments on specific questions

Question 1

(a) (i) The majority of candidates drew a suitable table to display the results of the investigation. The results were recorded accurately in most instances. Some interpreted the results to record whether the solution contained reducing sugar, protein or starch. This was accepted in place of the colour of the testing reagent. The most common mistake was to not give complete column headings. Frequently a heading for the test was not given.

(ii) Most candidates were able to correctly state the food-testing reagents. A small number listed examples of foods for each test, which was not credited.

(iii) Candidates were required to interpret the results for all three food-testing reagents. Most candidates correctly stated that solution **M** contained reducing sugars, proteins and starch. The most common error was to misinterpret the result for reducing sugars.

(iv) Few candidates correctly named reducing sugar and gave the evidence that it gave a positive Benedict's test in the solution in the test-tube. The most common error was incorrectly identifying the substance as protein.

(b) Many candidates misinterpreted the reasons for rinsing the dialysis tubing. Many discussed how this would allow the experiment to be carried out or that it was for general cleaning. Rinsing prevents contamination of the solution being tested with solution **M**.

(c) Some candidates had a very clear idea of what constitutes a hazard, while others misinterpreted this and described human errors. Stronger responses stated that food testing reagents were harmful and a suitable precaution would be to wear goggles or gloves. Not tying the dialysis tubing correctly is a human error and not a hazard.

(d) Some candidates described a valid and reliable investigation that would measure the effect of pH on enzyme activity. Most candidates were able to discuss the need to keep some variables

constant, such as the volume of amylase and the temperature. Many were able to identify the need for repeats, but did not say how many times the investigation should be repeated. It is important that candidates can specify a suitable range for the independent variable being tested, in this case a minimum of two pH values. There were few detailed descriptions of the investigation. Candidates would have been awarded credit for describing key points of the method, such as maintaining a constant temperature using a thermostatically controlled water-bath or sampling at set time intervals.

Question 2

(a) (i) Most candidates were able to identify temperature as the independent variable.

(ii) Many candidates gave the distance of the lamp from the plant as a constant variable. Unqualified answers, such as light, time, sodium hydrogencarbonate or plant, could not be credited. Variables should always be qualified, e.g. intensity of light, colour of light, time to collect the gas or species of plant.

(iii) Many candidates found it difficult to articulate their ideas in this question. Results are repeated so that anomalies can be identified and discarded.

(b) (i) This question proved demanding for some candidates. Many were able to correctly identify the values of 7.8 cm^3 and 12.0 cm^3, but often they calculated the difference rather than the percentage change. Many candidates were unsure of significant figures.

(ii) Many candidates constructed suitable graphs and accurately plotted the data. Most axes were labelled correctly with equidistant scales. Plotting the data proved challenging for candidates that chose an unsuitable scale. Candidates should join their plots with a ruled point-to-point line that does not extend beyond the plots. A small number of candidates plotted the volume of gas collected in 20 minutes rather than the rate of photosynthesis and therefore could only be awarded a maximum of three marks.

(iii) Most candidates described a suitable trend for the effect of temperature on the rate of photosynthesis. Candidates should be encouraged to give a data quote to illustrate the pattern being described.

(iv) Some candidates were able to identify the rate of photosynthesis at 17 °C, but many did not draw a line on their graph or accurately read off the value from the graph.

(c) (i) Many candidates were able to accurately draw an outline of the flower. A small number could not be awarded the outline mark because they had shaded their diagram. Diagrams needed to include five anthers and seven petals. The most common error was to draw diagrams that were too small. A large drawing should usually be larger than the original image and fill the space provided. However, drawings should not extend into the text around the space provided.

(ii) Most candidates correctly measured and recorded the length of line **XY** as 90 mm. Candidates were then expected to divide this value by 6 and give the correct units. Many made the error of multiplying by 6.

BIOLOGY

Paper 0610/62
Alternative to Practical

Key messages

Candidates must ensure that they read questions carefully before starting to answer. This is particularly important for any planning exercise that is required. Identification of the dependent and independent variables is vital before a plan is completed. Variables that will be kept constant must also be considered and included in a plan. When describing repeats, it is important that two repeats are specified. This means that three sets of data are collected so that any anomalous results can be identified and discarded.

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

It should be noted that an electronic balance is a piece of apparatus used to find the mass of an object. A small number of candidates use the word 'balance' incorrectly: i.e. 'balance the leaves before and after the investigation' when they mean 'find the mass of the leaves before and after the investigation'.

General comments

The data table and the graph were drawn well by most candidates. The drawing skills of most candidates was seen to be good, with suitable detail included.

Comments on specific questions

Question 1

(a) (i) Candidates were asked to construct a table and to record the results of the investigation. The table needed to contain time, the circumference of the balloon and the condition in which the suspension had been kept (hot or cold). Many candidates found this demanding as they seemed unfamiliar with the concept of sub-headings. Most candidates gained the mark for table construction and the majority of tables were neatly drawn with ruled lines and were easy to interpret.

The second marking point was awarded for table headings with appropriate units. Many candidates were not awarded this mark as they either omitted a heading, left out the units or put the units in the body of the table. It should be noted that there is no abbreviation for minutes and while we frequently accept 'min', 'm' cannot be accepted as it is the abbreviation for metre.

The final mark was for correctly recording the results. There were very few instances where a mistake was made. The most common error was for candidates to transpose the results for hot and cold.

(ii) This question asked for a conclusion based on the results of the investigation recorded in 1**(a)(i)**. Although this was done well by most candidates, a significant number simply described the results of the investigation rather than giving a conclusion. Responses that simply stated that one balloon had a larger diameter than the other could not be credited.

(iii) Candidates were asked why the yeast suspension was stirred before using it. Many candidates did not give sufficient detail when answering the question. The idea of an even distribution of the yeast cells between the two test-tubes was well communicated by a few candidates. It was clear that many candidates did not understand the term suspension.

(iv) Most candidates were able to identify at least one variable that was kept constant during the investigation, but a lack of detail in the responses often prevented a second mark being awarded. Simply referring to temperature being kept constant was insufficient, as temperature was the independent variable. Instead, candidates needed to refer to the maintenance of temperature in each individual water-bath.

(b) (i) In this question, candidates were asked to suggest another method of collecting and measuring the gas produced in the investigation. The most commonly given answer was to use a gas syringe. Another acceptable method, though infrequently stated, was to collect the gas using a displacement method. A significant number of candidates suggested counting the number of bubbles produced. This was not acceptable as the gas would not be collected.

(ii) Most candidates were able to identify a correct indicator for carbon dioxide and give the correct result of a positive test. The test using limewater was well-known as was its positive result. The use of hydrogencarbonate indicator and its resultant yellow colour was less well-known. Many candidates used a pH indicator (e.g. universal indicator) and were awarded a mark for the correct colour change but not for the name of the indicator as it is not specific to carbon dioxide.

(c) (i) In this question, candidates had to read and record the temperatures shown on two thermometer diagrams and calculate the changes in temperature over the duration of the investigation. This was answered correctly by nearly all candidates.

(ii) Candidates were asked to suggest a modification to the investigative method that would prevent the temperature of the water-bath changing. The simplest answer was to use thermostatically controlled water-baths, and many candidates answered in this way. Using lagging, insulation or adding lids to the water-baths were also acceptable modifications. Some candidates said that they would heat the water (with a Bunsen burner or by adding hotter water etc.). This was not acceptable on its own, but was accepted if the idea was qualified by using a thermometer to check the temperature was not changing.

Question 2

(a) (i) The quality of the drawing was generally very high. Lines were clear and distinct and the drawings were of a suitable size. Some candidates drew sketchy lines and included shading. A few candidates did not draw all of the visible structures and so could not be awarded the marks for detail. Candidates should draw in pencil rather than ink as ink cannot be erased if a mistake is made.

(ii) The measurement of the image was done well, but care needs to be taken not to confuse mm with cm. A significant number of candidates measured the pollen grain length (62 mm) but wrote the length as either 6.2 mm or 0.062 mm. Nearly all candidates went on to correctly divide by the magnification. The most common error was not giving an answer to two decimal places. Candidates must ensure that they read the question fully and understand the difference between significant figures and decimal places.

(b) (i) The percentage decrease in the average distance travelled was generally done well, with nearly all candidates able to select the correct values from the table. Fewer were able to manipulate the values correctly and some candidates appeared to miss the fact that the answer needed to be expressed to two significant figures. An understanding of how to calculate a percentage change is an important skill for all candidates. As in **2(a)(ii)**, candidates should show their working as partial credit can often be given even if the final answer is incorrect.

(ii) Using both sets of data, candidates were instructed to draw a line graph and to provide a key. The majority of candidates labelled the axes correctly, had even scales and plotted data on more than half the grid. The plotting posed a problem for some as, in order to distinguish between the two lines, different symbols were used for the plot points. Where a large circular dot had been selected, this was frequently so large that it became inaccurate in terms of plotting. Most candidates drew the two lines as dot-to-dot which was appropriate. There were few instances of extrapolation. A few candidates drew bar charts rather than a line graph as instructed.

(iii) In this question, candidates were asked to determine a distance using the line drawn on their graph in **2(b)(ii)**. Many were able to do this with a good level of precision, but a significant number chose the wrong line or did not show on their graph how they had obtained their estimate.

(iv) The Benedict's test for the presence of reducing sugars was well-known. The need to heat the mixture was the most frequently omitted point.

(c) (i) The planning exercise proved demanding for some candidates. The use of potometers was rarely seen, as was suspending leaves and measuring their change in mass over a period of time. Many candidates gained marks for identifying the variables, but far fewer gained marks for the actual method. Having stated that the investigation would be carried out at different temperatures, many candidates were unable to describe how these different conditions could be achieved. Some candidates did not attempt to plan an investigation, but listed generic points applicable to any investigation.

(ii) Although some very good descriptions were seen, many candidates could not suggest how the humidity of the air surrounding a sample of leaves could have been changed. A bowl of hot water will increase the humidity whereas a dehumidifier will reduce the humidity.

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Alternative to Practical

Key messages

Candidates would benefit from showing all of their working when performing a calculation. If working is shown, then even an incorrect answer can often be awarded marks for the correct selection of data or manipulation of formulae.

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

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

General comments

Most candidates performed very well on the planning exercise, producing a 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 data table and the graph were drawn well by most candidates. The drawing skills of most candidates was seen to be good, with suitable detail included. On some drawings, lines were incomplete or feathered and therefore could not be credited.

Comments on specific questions

Question 1

(a) (i) Tables of results were generally well constructed and were suitable for the data that needed to be recorded. Occasionally units were placed in the body of the table. Some candidates forgot to calculate averages, or calculated the average for each trial rather than the average for each tissue type.

(ii) This question asked for a conclusion based on the results shown in the table in **1(a)(i)**. Although many candidates did this well, referring to the enzyme catalase, a significant number simply described the difference between the two sets of results.

(iii) Many candidates correctly identified a potential error in the method. The most common being the difference in mass or surface area of the three different tissue samples. Other errors, such as the difficulty in measuring the uneven surface of the foam were also accepted, but human errors (including parallax error) did not receive credit.

(iv) This question asked why the experiment should have been performed three times, rather than twice. Answers that described taking averages were not accepted, as an average was calculated using two sets of results. Similarly, 'to make it more reliable/accurate' were too vague to answer the question. Performing an experiment three times allows anomalous results to be identified and discounted.

(v) Some very good answers were seen. The most frequent correct answers were the mass or surface area of the plant tissue and temperature. Care needs to be taken when using the word 'amount' as this could refer to either the volume or the concentration of a substance.

(vi) Most candidates were able to identify the dependent variable.

(vii) This question on safety was answered well, with some sensible suggestions of how to reduce risk. Candidates should always try to describe the risk (cutting using a knife) and also specify the precaution (cut on a white tile and always cut away from the hand).

(b) This question proved demanding for many candidates. A method of collecting a volume of gas was required (gas syringe or displacement method) and some reference to the rate being calculated as a function of time.

(c) (i) Most candidates were able to state a valid conclusion for the observations given. When a negative result is obtained, the colour still needs to be recorded, rather than simply writing 'no change' or putting a dash in the box. Similarly, the conclusion must refer to the nutrient being tested for, even if the test is negative. This means that 'starch not present' would gain a mark, but just writing 'negative result' would not.

(ii) Nearly all candidates correctly identified the reagent for testing for proteins, although Benedict's was occasionally seen.

(d) The planning exercise was extremely 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. Some candidates forgot the need to repeat the procedure twice to get three sets of results.

Candidates must be careful to be precise when referring to measured variables, and avoid phrases such as 'leave it for about ten minutes' or 'cut them to approximately the same length'.

Question 2

(a) The drawings were generally of a very high standard. The most common errors were:
- outlines that were feathery, or drawn using a pair of compasses
- poor observation in terms of size, proportion or detail of structures within the specimen.

(b) (i) Many candidates appear to be confused between significant figures and decimal places, or are unaware of how significant figures are determined.

(ii) In this question, candidates were asked to identify two similarities and one difference between two species of moth. Nearly all candidates could identify two similarities but fewer were able to make comparative statements about the differences. Close observation of the photographs was required, and any statement had to be comparative rather than just referring to one of the moths. The most obvious difference was that the bird-cherry ermine moth had more spots than the apple ermine moth.

(c) (i) The graph drawing was very good, with very few errors in plotting. Most scales were suitable and both axes were clearly labelled. Common errors included:
- extrapolation beyond the last plotted point
- plotting of particularly large points.

(ii) Almost all candidates correctly estimated the number of moths using their graph.