BIOLOGY

Paper 0610/11
Multiple Choice (Core)

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

General comments

There was good understanding of: the characteristics of living things; teeth; the pathway of water uptake and the definition of transpiration.

There was some uncertainty about: arthropod features; the Benedict's test; the colour changes of hydrogencarbonate indicator; direction of impulses and the role of the retina.

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

Comments on specific questions

Question 1

Many candidates understood that excretion, reproduction, and respiration are characteristics of all living organisms. Some candidates incorrectly believed that egestion is also a characteristic of all living organisms.

Question 3

Few candidates appreciated that insects have antennae, three body parts and six legs.

Cambridge Assessment
International Education

Question 4

While many candidates responded correctly, some candidates incorrectly believed that chloroplasts are found between the cell wall and the cell membrane.

Question 6

Many candidates appreciated that the change in the appearance of the cell was due to water entering the cell by osmosis. Some candidates incorrectly believed that the appearance of the cell was due to dissolved salts entering the cell by diffusion.

Question 7

This proved to be a demanding question with many candidates appearing to guess. Diffusion is caused by the movement of molecules.

Question 8

Few candidates knew the colour change shown by Benedict's solution when heated with a reducing sugar is blue to red.

Question 9

Many candidates selected the correct response, **D**, the small intestine. Many incorrectly selected the stomach or the large intestine.

Question 11

Only a minority of candidates could recall the colour changes of hydrogencarbonate indicator.

Question 12

Few candidates understood that the enzyme lipase acts on fat to produce fatty acids and glycerol.

Question 18

Some candidates knew the structures in the circulatory system that have valves to ensure the one-way flow of blood.

Question 22

While many candidates appreciated that the site of gas exchange in humans are the alveoli, some candidates incorrectly selected the nose.

Question 24

Many candidates were aware that the organ that produces insulin is the pancreas. Some candidates incorrectly selected the liver.

Question 25

The urethra was correctly identified by many candidates. Some candidates incorrectly selected the ureter. This is a common mistake.

Question 26

Only a minority of candidates were able to identify the sequence of neurones that shows the direction that impulses will travel during a reflex action.

Question 27

The fact that the part of the eye that detects light is the retina was not widely known.

Question 28

Many candidates correctly identified the acrosome as the structure that digests the egg cell membrane. Some candidates incorrectly selected the nucleus, option **B**.

Question 37

The calculation of how many units of energy will reach the quaternary consumers in the food chain was only correctly completed by a minority of candidates.

BIOLOGY

Paper 0610/12
Multiple Choice (Core)

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

General comments

There was good understanding of: the human breathing system; aerobic respiration and the definition of a drug.

There was some uncertainty about: the fact that during transpiration water evaporates from the spongy mesophyll cells; motor neurones in a reflex arc; the colour changes of hydrogencarbonate indicator; the direction of impulses and the role of the retina.

It is important for candidates to work methodically through information provided in questions, such as in **Questions 12**, **27**, **33** and **38**.

Comments on specific questions

Question 5

While many candidates selected correctly, some candidates appeared to make a mistake with the position of the decimal point.

Question 6

Some candidates did not use the features of osmosis to work out that the volume of water decreases and the volume of sugar solution increases.

Cambridge Assessment
International Education

Question 7

Many candidates understood that diffusion is the process that causes oxygen to pass from an alveolus in the lung to a blood capillary. Some candidates incorrectly selected assimilation.

Question 8

A minority of candidates were able to correctly identify the chemical elements in proteins.

Question 9

While many candidates selected correctly, some candidates did not know that cellulose is a large biological molecule that is made up of glucose molecules.

Question 10

Many candidates were aware that a change in pH and a change in temperature could cause an enzyme to denature. Some candidates incorrectly believed that a change in substrate concentration could also cause an enzyme to denature.

Question 11

Many candidates understood that many stomata and a thin leaf allow more diffusion of carbon dioxide into the palisade cells for photosynthesis. Some candidates incorrectly believed that thick leaves would allow more diffusion of carbon dioxide.

Question 12

This proved to be a demanding question with most candidates selecting incorrectly. The bacteria move to areas of high oxygen concentration. The oxygen is produced by photosynthesis.

Question 13

While many candidates correctly identified the premolar tooth, molar was a common incorrect response.

Question 14

A minority of candidates appreciated what is produced when amylase acts on starch. Amylase digests starch into simple sugars.

Question 16

Few candidates understood that during transpiration most water evaporates from the spongy mesophyll cells.

Question 17

Only a minority of candidates identified the tissue as xylem and the function as the transport of mineral ions.

Question 19

Few candidates selected the correct response. Some candidates incorrectly believed that platelets carry out phagocytosis.

Question 20

Most candidates knew the description of a transmissible disease. Some candidates incorrectly believed that it is a disease caused when a pathogen passes to the host's body only by direct contact.

Question 21

Most candidates understood that in expired air, the concentration of carbon dioxide increases and the concentration of oxygen decreases. However, there was some uncertainty about what happens to the concentration of water vapour. This also increases.

Question 24

A large volume of carbon dioxide will only be produced if sugar is also present with the yeast and water, hence the correct option is **A**.

Question 25

Very few candidates selected correctly. The use of the term ions appears to have caused some confusion.

Question 26

Most candidates were unable to identify the motor neurone in a reflex arc.

Question 27

Responding correctly relied on candidates knowing that both the pupil diameter and the heart rate would increase with an increase in adrenaline.

Question 33

Some candidates gave the correct response, but many found this challenging. It is important that candidates work methodically through this type of genetics question.

Question 35

While many candidates selected the correct option, **B**, some candidates incorrectly believed that blood groups are an example of continuous variation.

Question 37

Many candidates were unable to translate the information into a pyramid of numbers.

Question 38

Many candidates gave the correct response. A common error was not deducting the 5 kg per hectare at 30 days, to find the difference.

Question 39

Candidates needed to understand that carbon dioxide causes limewater to become cloudy and only the limewater in tube Y becomes cloudy because it receives expired air.

BIOLOGY

Paper 0610/13
Multiple Choice (Core)

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

General comments

There was good understanding of: the fact that chloroplasts contain chlorophyll; the definition of pathogens; simple genetic crosses and asexual reproduction.

There was some uncertainty about: the features of crustaceans; the fact that glycogen is made from glucose; the features of arteries; the composition of expired air; the description of a population; the description of drugs; the role of vitamin D and variation.

It is important for candidates to work methodically through information provided in questions, such as in **Questions 12**, **31** and **38**.

Comments on specific questions

Question 1

Many candidates selected correctly for reproduction, respiration and sensitivity being characteristics of living organisms. Some candidates incorrectly believed that breathing is also a characteristic of living organisms.

Questions 3

The features that would place organisms into the crustacean group of arthropods were not well known. Crustaceans have two pairs of antennae.

Question 6

Only a minority of candidates identified the appearance of a plant cell after it is placed in pure water. The plant cell will take up water by osmosis, swelling in size.

Question 8

Only a minority of candidates were aware of the chemical elements contained in fats.

Question 9

Only a minority of candidates appreciated that glycogen is made from glucose.

Question 11

This proved to be a demanding question. Carbohydrates made by photosynthesis are used to produce sucrose for transport in the phloem.

Question 14

Many candidates understood that the organ that produces hydrochloric acid is the stomach, option **A**. Some candidates incorrectly selected the pancreas, option **B**.

Question 15

It was not well known that a lack of vitamin D in a balanced diet results in a person developing rickets.

Question 16

Only a minority of candidates understood that diffusion is the process by which water vapour is lost from a leaf.

Question 17

A number of candidates incorrectly believed that when water leaves the root cortex cells, it enters the palisade cells. The correct pathway is root hair cells → root cortex cells → xylem → mesophyll cells.

Question 19

Few candidates knew the features of arteries.

Question 21

The composition of expired air from a healthy person was not widely known.

Question 22

Only a minority of candidates selected the correct path that carbon dioxide takes as it leaves the lungs, which is: alveolus → bronchiole → bronchus → trachea.

Question 23

Most candidates selected an incorrect distractor.

Question 24

There was some uncertainty amongst candidates as to whether a ball of cells that implants into the lining of the uterus is an embryo (correct response) or a zygote (incorrect response).

Question 25

While many candidates selected correctly, there was some confusion as to which structure is the urethra and which is the ureter.

Question 28

The description of a population was not widely known. A population is a group of organisms of one species, living in the same area, at the same time.

Question 29

Few candidates knew that antibiotics are drugs.

Question 31

Many candidates correctly identified the graph that shows the effect of temperature on the rate of respiration in yeast. Some candidates incorrectly selected the linear relationship, option **B**.

Question 33

Most candidates incorrectly believed that fertilisation occurs in the uterus or ovaries. Some candidates correctly selected the oviducts, option **A**.

Question 35

Some uncertainty exists regarding the difference between continuous and discontinuous variation.

Question 37

It was not widely known that ingestion is the process that transfers energy between the first and second trophic levels of a food chain.

Question 38

Few candidates appreciated that **B** in the diagram represented respiration.

BIOLOGY

Paper 0610/21
Multiple Choice (Extended)

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

General comments

There was good understanding of: enzymes; teeth; chemical digestion; transpiration and populations.

There was some uncertainty about: the features of prokaryotes; calculations using magnification; absorption in a villus; immunity and pedigree diagrams.

It is important for candidates to work methodically through information provided in questions, such as in **Questions 22** and **32**.

Comments on specific questions

Question 3

The features of prokaryotic cells were not widely known. Prokaryotes do not have nuclei or mitochondria.

Question 5

Only a minority of candidates correctly selected option **D**. It appears that some candidates did not convert the mm to μm.

Question 6

While many candidates correctly selected option **C**, that is water enters by osmosis, some candidates incorrectly believed that dissolved salts enter the cell by diffusion.

Question 7

Only a minority of candidates appreciated that since the uptake of nitrates is by active transport, mitochondria, oxygen, and membrane proteins are required.

Question 8

A large minority of candidates did not know the colour change shown by Benedict's solution when heated with a reducing sugar.

Question 9

Only a minority of candidates appreciated that the small intestine absorbs the most water. Some candidates incorrectly selected the large intestine.

Question 12

Many candidates understood that the enzyme lipase acts on fat to produce fatty acids and glycerol. Some candidates incorrectly identified the enzyme as amylase and the substrate as glucose.

Question 15

Only a minority of candidates appreciated that X is the lacteal, and it absorbs fatty acids.

Question 20

Only a minority of candidates appeared to understand active and passive immunity.

Question 22

It is important that candidates work methodically through this type of question, to avoid mistakes.

Question 26

Only a minority of candidates were able to identify the sequence of neurones that shows the direction that impulses will travel during a reflex action.

Question 32

Only a minority of candidates were able to work out that the allele for polydactyly is dominant.

Question 34

Many candidates correctly selected option **D** but some candidates incorrectly believed that a random change in the amino acid sequence in DNA causes gene mutation.

Question 37

Only a minority of candidates selected the correct answer, option **C**.

Question 39

While many candidates understood that lactose-free milk is produced using enzymes, some candidates incorrectly believed that enzymes can be used to produce insulin.

Question 40

Only a minority of candidates appreciated that from the examples given, only using bacteria to produce human substances is an example of genetic modification.

BIOLOGY

Paper 0610/22
Multiple Choice (Extended)

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

General comments

There was good understanding of: the binomial system; respiration; the definition of a drug and the genetic modification of a bacterium.

There was some uncertainty about: blood flow through a villus; the fact that during transpiration most water evaporates from the spongy mesophyll cells and the excretion of ions.

It is important for candidates to work methodically through information provided in questions, such as in **Questions 30** and **38**.

Comments on specific questions

Question 4

Most candidates incorrectly believed that all plant cells possess both a cell wall and chloroplasts. The word 'all' in the question is particularly important here. Root hair cells, for instance, do not contain chloroplasts.

Question 5

Many candidates deduced the correct answer for the size of the bacterium. Some candidates appeared to have been confused by having to convert units from mm to μm.

Cambridge Assessment International Education

Question 7

While many candidates correctly selected option **B**, some candidates incorrectly believed that active transport always transports particles into cells.

Question 12

This proved to be a demanding question with most candidates selecting an incorrect option. The bacteria move to areas of high oxygen concentration. The oxygen is produced by photosynthesis.

Question 15

There was some uncertainty about this question. Vessel **D** is the capillary that carries blood to the hepatic portal vein which goes to the liver. Some candidates incorrectly opted for the lymphatic vessel, option **C**.

Question 16

Only a minority of candidates knew that during transpiration most water evaporates from the spongy mesophyll cells.

Question 17

While many candidates appreciated that the tissue was the xylem and that it transports mineral ions, some incorrectly identified the tissue as the phloem.

Question 18

Many candidates understood that P (a lymphocyte) produces antibodies. Some candidates incorrectly believed that it carries oxygen.

Question 22

Many candidates understood that receptors in the brain detect increased carbon dioxide concentrations in the blood. Some candidates incorrectly believed that the receptors are in the lungs.

Question 25

Only a small minority of candidates selected correctly. The use of the term ions appears to have caused some confusion.

Question 27

There was confusion over which hormones increase blood glucose concentration. Adrenaline and glucagon increase blood glucose concentration.

Question 29

Many candidates understood that a disadvantage of sexual reproduction for a population in the wild is a reduction in reproduction if individuals are isolated. Some candidates incorrectly believed that a disadvantage is an increased likelihood of a disease affecting all individuals; this is a disadvantage of asexual reproduction.

Question 30

It was important that candidates worked through the information carefully and methodically to derive the correct answer.

Question 32

While many candidates understood that the gene for insulin is only expressed by cells in the pancreas, some candidates incorrectly believed that other body cells do not have the gene for insulin.
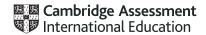
Question 34

Many candidates correctly selected option **A**. However, some candidates did not realise that meiosis is a source of genetic variation in populations.

Question 37

Many candidates understood that denitrification is the process that releases nitrogen gas into the air. Some candidates incorrectly believed that the process is nitrification.

Question 38

This was a demanding question. Only a minority of candidates were able to carry out the sex-linked cross to determine the correct answer.

BIOLOGY

Paper 0610/23
Multiple Choice (Extended)

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

General comments

There was good understanding of: the characteristics of living organisms; the binomial system; rate of reaction; photosynthesis; the pathway of water through a plant; circulatory systems; the excretory system; reflex actions and pollination.

There was some uncertainty about: sinks and sources; the excretion of urea; the thickness of the right ventricle wall; the process of mitosis; the description of biodiversity and protein synthesis.

It is important for candidates to work methodically through information provided in questions, such as in **Questions 29**, **33** and **34**.

Comments on specific questions

Question 11

Only a minority of candidates were able to correctly identify the parts of a plant as sinks or sources.

Question 15

Many candidates were able to correctly identify where nutrients are absorbed into the blood. Some candidates incorrectly selected the lacteal, option **A**.

Cambridge Assessment
International Education

© 2023

Question 18

Many candidates identified the right ventricle correctly as option **B**. A significant number of candidates incorrectly selected one of the other three options suggesting they were unsure of the answer.

Question 22

This proved to be a demanding question for many candidates. Candidates needed to recall that urea is produced in the liver and is filtered out in the kidneys.

Question 28

Some care was needed in answering this question. While many candidates selected correctly, some candidates incorrectly believed that antibiotics can become resistant to bacteria.

Question 32

Many candidates correctly identified the hormone as progesterone, option **D**. Some candidates incorrectly selected oestrogen, option **C**.

Question 34

This proved to be a demanding question. It is important that candidates work methodically through the question to deduce the correct answer. When cells replicate the DNA is doubled and then halved again by the end of mitosis.

Question 36

Many candidates appreciated that nitrogen fixation is the process in the nitrogen cycle that microorganisms use to take nitrogen from the air and convert it into nitrogen compounds. Some candidates incorrectly selected nitrification.

Question 38

Only a minority of candidates knew the description of biodiversity.

Question 40

Only a minority of candidates correctly determined that only statements 4 and 5 were correct. Some candidates incorrectly believed that the first three statements were also correct.

BIOLOGY

Paper 0610/31
Theory (Core)

Key messages

Candidates need to read the question carefully, as it often contains specific information that must be used in the answer. Candidates often see one or two 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

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

Some candidates score well on the objective questions but are unsure how to express themselves clearly in the longer prose questions.

Comments on specific questions

Question 1

(a) Most candidates were able to name one factor affecting the rate of diffusion, usually temperature. Very few candidates wrote surface area or distance. More candidates were able to identify semi (or partially) permeable membrane, respiration, and active transport.

(b) While most identified **C** as the correct answer, explaining why they had selected **C** proved more challenging. Few were able to give a clear explanation. Many wrote about the movement of salt rather than water. Those awarded two marks generally got the second mark for the description of its appearance. Some did identify that the water moved out of the cell or that the salt solution was more concentrated, but these marks were not awarded very often.

(c) Few gained full marks on this question. Digestion was the most common correct response.

Question 2

(a) Very few candidates were awarded full marks on this question. Most were able to identify the stomach as the site of hydrochloric acid production and that physical digestion occurs in the mouth, but few identified the stomach as a site of physical digestion or protein digestion. Many thought that physical digestion occurs in the small intestine. Where chemical digestion of proteins begins was the answer that most candidates got wrong, and candidates seemed to think they had to use different letters for each response.

(b) Most candidates were awarded at least one mark. Common errors included naming the section of the small intestine or stating rectus which seemed to be a combination of anus and rectum.

(c) This question was well answered. The most common mistake was to confuse absorption with assimilation. Sometimes digestion was incorrectly linked to the movement of nutrients from the intestines to the blood. The most common correct answers were for describing egestion and ingestion.

Question 3

(a) This question was well answered. A common mistake was to start with root hair cells. If only one mark was awarded, it was usually for stomata.

(b)(i) The most common error was to state 4.1 g rather than 4.0 g.

(ii) A range of marks was seen for this question, but few were awarded three marks. Most obtained the correct data and were awarded one mark. When two marks were given, it was generally for the data mark and then a correct rounding. Calculating percentage increase proved demanding. Some candidates showed no working and gave an incorrect answer, thereby gaining no marks, or gave an answer that did not have any connection to the shown calculation.

(iii) Those candidates that attempted the question, mostly gained two marks. Generally, when only one mark was awarded, it was because the line did not sit between the two lines already drawn on the lower part of the graph.

(c) Most correctly gave temperature or humidity. Some just stated water without linking to availability so were not awarded the mark. Others gave light, sun, or sunlight, rather than light intensity.

Question 4

(a) Some responses were very thorough and were awarded full marks. Most focused on general cleaning and personal hygiene and did not include food preparation and storage.

(b) There was some confusion over direct and indirect transmission.

(c) A good range of responses were seen. Some were not awarded marks because they simply stated hair, or they named two or more types of white blood cell. Some candidates incorrectly gave vaccination or antibiotics.

Question 5

(a)(i) The most common incorrect response was **E** and **F** and sometimes **D** and **E**.

(ii) Most candidates were awarded the mark for **D**. Common incorrect responses were **A** or **F**.

(iii) The most common response was large or colourful to attract insects, gaining two marks. Some thought petals were for protection rather than attraction.

(b)(i) Candidates were unsure about pollination. Few correctly named the anthers and stigma.

(ii) Candidates found this demanding, and some did not read the question carefully enough. These candidates wrote about the differences in flowers rather than pollen grains. Some answers were not comparative, or they attributed the feature to the wrong type of pollination, e.g., insect-pollinated pollen is smaller. The most common correct answers were sticky, heavier and larger.

Question 6

(a) Few candidates knew the definition of community, but most knew population. A few candidates drew multiple lines from each term. Often the correct descriptions were selected but they were attached to the wrong term.

(b)(i) Most candidates were awarded at least one mark. Death was usually correct, as was exponential. Phase **A** was often incorrectly identified as stationary and a few just had them all the wrong way round so started with death, then stationary, then exponential and then lag.

(ii) Most candidates scored well on this question, but some did not read the data from the graph correctly. If the second answer was incorrect – it was usually 2.4 or 2.6, 3.5 or 4.

Question 7

(a)(i) Most candidates were unsure what the letters HIV represent.

(ii) A full range of answers were seen but they were often lacking in detail, e.g., be careful, don't have any partners, use protection, so there were few high scoring answers. The most common errors included thinking that all contraceptives prevent transmission and thinking that touching someone would result in transmission. Candidates often stated that people with HIV should be prevented from giving blood, rather than focusing on testing blood. General comments about getting checked were also seen.

(b)(i) Generally well answered. If only one mark was awarded, it was usually for incorrect identification of the second conclusion, or three ticks (usually the second box) given.

(ii) Many candidates correctly named bacteria. Common incorrect responses were virus and pathogen.

Question 8

(a) Many candidates did not know the function of herbicides. Most answered about insecticides rather than herbicides by thinking that they kill insects or bacteria or animals in general. Answers explaining why fertilisers are used were often too general. Few candidates made any reference to mineral ions and instead gave vague comments.

(b) Few candidates were awarded more than two marks on this question and often answers were poorly expressed and had a focus on the cost of production, e.g., feed etc. The most common correct answers were animal welfare, e.g., not enough space or the spread of disease.

(c) Some candidates correctly stated enzymes. Incorrect responses included amylase, amino acids, pectin, and protease.

(d)(i) Many candidates gave a correct answer but some suggested that 30 °C is a high temperature and would kill bacteria.

(ii) Many knew that amylase would break down starch. Some incorrectly thought that amylase breaks down glucose.

(iii) Many candidates incorrectly described killing enzymes or enzymes dying. However, many did recognise that pathogens would be killed, and enzymes would be denatured.

(e) Few candidates were awarded two marks. When one mark was awarded, bread-making was seen more often than biofuels. The most popular incorrect answer was lactic acid.

BIOLOGY

> **Paper 0610/32**
> **Theory (Core)**

Key messages

Candidates need to read the question carefully, as it often contains specific information that must be used in the answer. Candidates often see one or two 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

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

Some candidates score well on the objective questions but are unsure how to express themselves clearly in the longer prose questions.

Comments on specific questions

Question 1

(a) (i) Few candidates knew that protease enzymes act in the small intestine. Most candidates recognised the main parts of the digestive system, particularly where salivary amylase is produced.

(ii) Many candidates stated that the acidic conditions will kill bacteria or pathogens present in food. However, some candidates thought that the acidic conditions were present to break down food without appreciating that the enzymes catalyse the breakdown, and the low pH is there to provide optimum conditions. Many thought that the acid neutralised the juices. The word 'germs' was not an acceptable alternative for bacteria and was not credited.

(b) (i) Most candidates recognised amylase as an enzyme and appreciated that it breaks down a food but less stated that this was starch. If they stated starch, most went on to add simple sugars. Maltase was given instead of maltose in a few cases. Some candidates simply identified carbohydrate or food/substances as the substrate and could not be credited as it was not specific enough.

(ii) Most candidates were able to state that enzymes are biological catalysts and that they increase the rate of a reaction. Few stated that enzymes are proteins. Some candidates stated amylase is a cell, it should be emphasised that the name of an enzyme can often be recognised as it ends in 'ase'.

Question 2

(a) Many answers stated chlorophyll rather than chloroplasts. Some also included reference to plant organs like the leaf, suggesting the question had not been read carefully.

(b) Candidates found this question demanding. The question asked for an explanation of the results for the white part of the leaf. Many candidates wrote about the green part which did not answer the

question. Many candidates recalled that iodine solution is the test for starch, but many thought that it tested for chlorophyll or ethanol. Fewer candidates made the correct reference to the lack of photosynthesis in their explanation. Some candidates stated that the yellow-brown colouration was due to that part of the leaf being dead after being boiled in ethanol. Many answers also described the results in terms of chlorophyll rather than starch.

(c) Most candidates stated the correct answer at least once. Many candidates stated that the green area would turn blue-black suggesting they were focused on the presence of chlorophyll and had not appreciated the absence of carbon dioxide. Some confused the colours with those from other tests, such as Benedict's and biuret.

(d) (i) Most candidates correctly identified the use of nectar and cellulose. Many did not recall the use of sucrose. Some candidates drew more than one line from or to a box.

(ii) Very few candidates could state the elements, with most stating a molecule. Those that did state individual elements often added nitrogen into the list. It is useful to recall that carbohydrate elements spell 'CHO' and protein elements spell 'CHON'.

Question 3

(a) (i) Many candidates confused the atrium with the ventricle. A few candidates mixed up the right and left side of the heart.

(ii) Most candidates were able to label a valve, although the names of the valves varied greatly. Incorrect labels often pointed to the blood vessels.

(iii) Many answers stated the two vessels on one side of the heart, either the right or left side rather than two arteries.

(iv) Most candidates were able to state the septum as the part that separates the left and right sides of the heart.

(v) Many candidates correctly stated muscle.

(b) (i) Responses were not always clear. Occasionally candidates just listed all the figures from the graph but without any further development. Some candidates did not follow the key supplied and interpreted the data for the wrong sexes. Most candidates were able to gain credit for the trend that males had higher incidences of CHD but many also spent time describing possible reasons why male data is higher. Some figures were read incorrectly from the graph. Very few candidates stated that the greatest difference was at 75 – 84. Candidates should always comment on significant differences when comparing two sets of data.

(ii) Most candidates correctly recalled the risk factors, particularly smoking and stress. Many candidates misread the question and often referred to the consequences of CHD rather than the risk factors for it. Many also used the risk factors stated in the previous question.

Question 4

(a) (i) Nearly all candidates achieved a mark, either for line one or two, and those achieving two marks did so for both. Far fewer put two ticks in the last line as they assumed that only one tick per row thus missing out on marking point three.

(ii) Most candidates were awarded both marks. Very few forgot the arrows, and just used a hyphen or had the arrows in the wrong direction. Some candidates did not understand the instructions and made a food chain from an alternative web.

(iii) Candidates typically suggested shark, implying that they do not fully understand the concept of trophic levels. Other incorrect answers included octopus or animals outside the web.

(b) Many candidates knew the word decomposer, though some incorrectly stated scavenger or algae.

(c) Most candidates stated the Sun or sunlight and were awarded the mark. Plants or producers were common incorrect responses.

(d)   Some candidates did not read the question carefully enough and responded to other questions, such as 'humans and the ecosystem/biosphere' or 'how humans can improve ecosystems'. Some candidates were awarded full marks on this question through clear and explained answers.

Question 5

(a)   Most candidates connected antibiotics with killing bacteria although a few also stated they killed viruses.

(b)(i)   This question was well answered with most achieving both marks. A common error was multiplying the answer by 1000 suggesting the question stem of 'per 1000 people per day' was not understood. The second mark could be scored from workings if the calculation was correct, but the values chosen were incorrect.

   (ii)   This was well answered with most candidates achieving this mark. The bar chart was often marked to show candidates had accurately read each of the bars.

Question 6

(a)(i)   Very few candidates were awarded this mark. Common incorrect answers included palisade and vacuole.

   (ii)   Many candidates correctly stated root hair cell but some missed out the hair and just stated root cell which is insufficient. Describing the adaptation proved difficult and most candidates stated the function of the cell, not how it is adapted.

   (iii)   Osmosis and diffusion were credited. There were many incorrect answers, the most common being absorption.

(b)   The uses of water in plants were well known.

(c)   The environmental factors that affect the rate of water loss were well known with many candidates being awarded both marks.

Question 7

(a)   The oviduct was generally identified correctly but the ovary was frequently identified as the ovule. The function of the ovary was generally known with many candidates able to list a function.

(b)   This question was well answered with many candidates scoring full marks. Incorrect answers included ciliated cells as a specialised plant cell.

(c)   A wide range of suggestions were given. Cell division was the required answer, but mitosis and meiosis were also credited.

(d)(i)   Many candidates simply added label lines to the terms already on the diagram. Some label lines did not touch the structure that was being identified.

   (ii)   The vast majority of candidates correctly identified the sperm cell.

Question 8

(a)(i)   Nearly all candidates were awarded one mark. The last two answers were mostly correct.

   (ii)   Most candidates selected the correct term (nutrition) but sexual reproduction and egestion were commonly circled. Transpiration was rarely chosen as candidates recognised it as a plant process. A few candidates circled more than one term.

(b)(i)   Most candidates correctly performed the calculation.

   (ii)   Most candidates identified the correct range.

(iii) Discontinuous was an incorrect answer but was seen quite often.

(c) The majority of candidate selected the correct description of variation.

BIOLOGY

> **Paper 0610/33**
> **Theory (Core)**

Key messages

Candidates need to read the question carefully, as it often contains specific information that must be used in the answer. Candidates often see one or two 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

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

Some candidates score well on the objective questions but are unsure how to express themselves clearly in the longer prose questions.

Comments on specific questions

Question 1

(a)   This question asked for structural features of arteries. Some responses did not relate to arteries, gave general comments on blood vessels, or described their function.

(b)   Few candidates correctly stated a function of capillaries. Exchange or transport of substances were the required responses.

(c)   Many candidates correctly named valves.

(d)(i)   Very few candidates drew the required arrows on the diagram.

(ii)   Most candidates gave the heart as the correct organ, but some confused the names of the arteries.

(e)   This was a demanding question. Many candidates were unsure of the correct blood vessel. Candidates should associate renal with kidney and oxygenated with artery.

Question 2

(a)   Candidates often misread the question and stated structures in vascular tissue rather than cells.

(b)(i)   Many candidates correctly calculated the percentage change in mass and their working was shown so that there was evidence of correct rounding.

(ii)   Some candidates described the change in mass rather than the appearance of the potato cylinder.

Cambridge Assessment
International Education

© 2023

(iii) Candidates should be reminded to check that their responses directly answer the question. In this question, responses should clearly refer to the concentration of sucrose and the percentage change in mass.

Question 3

(a) Many candidates knew that light is needed for photosynthesis, and some understood that a large surface area would allow more light to be absorbed.

(b) This question was well answered and most correctly stated the equation for photosynthesis.

(c)(i) Many candidates correctly identified tissue **R** as the tissue with the highest density of chloroplasts.

(ii) Many candidates correctly identified the xylem and phloem as tissues in the vascular bundle.

(iii) Most candidates were able to identify the cells that control gas exchange, but many were unable to name the cells involved.

(iv) It is important to read the description of the diagram, as some candidates referred to skin. Few candidates identified the cuticle with many incorrectly giving epidermis.

Question 4

(a) This question was well answered with many giving the correct order. The position of alveoli was the most common error.

(b) There were some excellent answers to this question. It was important to read the question carefully as it asked for the composition of inspired and expired air. There were some detailed answers on how the body inhales and exhales, but these could not be credited.

(c)(i) Most candidates were able to name the gas identified by limewater as carbon dioxide.

(ii) Some candidates found this question demanding as they were unfamiliar with the practical apparatus as a model of the lungs and so were unable to decide which test-tube would detect carbon dioxide.

(d) Most candidates correctly identified that the rate of breathing would increase, but few mentioned an increased depth of breathing. There were also references to anaerobic respiration, which was not required as the question specified breathing.

Question 5

(a)(i) Most candidates were familiar with the definition of asexual reproduction involving one parent. Although they understood that offspring would be identical, they did not emphasise that they would be genetically identical.

(ii) Few candidates were familiar with asexual structures for reproduction in plants.

(b) Many candidates correctly labelled a flower as a structure involved in sexual reproduction. It was important to read the instruction under the diagram, as the question is no longer about asexual reproduction, and some candidates labelled the bluebell bulb.

(c)(i) Most candidates correctly interpreted the graph.

(ii) Most candidates correctly interpreted the graph.

(d)(i) Candidates gave many excellent answers to the reasons for deforestation.

(ii) There were some excellent answers about the undesirable effects of deforestation. Some candidates added global effects leading to climate change, but responses should focus on the direct effects of removing forests.

Question 6

(a)   Few candidates were able to correctly answer the sentence about discontinuous variation. Most recorded the correct data from the diagram.

(b)   The selection of features for discontinuous variation shows that few candidates were clear about the difference between continuous and discontinuous. Many selected both a continuous and discontinuous feature.

(c) (i)   Most candidates were unfamiliar with the term mutation and many incorrect terms were given.

(ii)   Few candidates were able to answer this question fully and those giving radiation often did not specify ionising.

(d) (i)   There were some good answers to this question, with most suggesting that production would be increased if they were not eaten.

(ii)   Candidates need to give more detail when naming examples of genetically modified crop plants. Answers that are too vague cannot be credited.

Question 7

(a)   Most candidates correctly identified the genus.

(b)   This question does not specify the number of ticks to be used in the table. Many candidates only used one tick for the internal skeleton row, rather than the two they should have used. Many candidates did not understand that the insect compound eye is unlike that of the bird or fisheye, so ticked too many boxes.

(c)   Good attempts were made to describe the harmful consequences of introducing a new species. Some candidates did not realise that the lionfish is a predator and that it is the foreign species causing problems for the existing residents of the habitat.

(d)   There were some excellent lists describing methods of conservation.

Question 8

(a)   Many candidates were able to correctly name all four processes.

(b)   Candidates were unclear on what constitutes a biological molecule, with some giving elements.

(c)   Few candidates were able to suggest an alternative to carbon dioxide as a greenhouse gas.

BIOLOGY

```
Paper 0610/41
Theory (Extended)
```

Key messages

Some of the questions on this paper, such as **Question 2(a)(iv)** and **Question 3(c)(ii)** required a description and an explanation. The best responses recognised the important points and linked them together to give a clear logical account. Many, however, only answered half the question by giving a description, but no explanation.

Candidates should read the question carefully to ensure they do not misinterpret the question. Candidates should be reminded of the meaning of the command words used in these papers, the need to follow the instructions given and the use of correct scientific terminology when describing or explaining biological phenomena.

Questions often require the meaning of biological terms. Candidates should give answers that are very close to those stated in the syllabus. Learning these also improves the precision of responses that candidates make in the longer prose questions.

General comments

A good standard of biological knowledge and understanding was displayed by some of the candidates, and they should be congratulated for their clear, articulate, and accurate responses. Some candidates showed good factual knowledge though they 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 chances of success. Some parts of the syllabus were better known than others.

Comments on specific questions

Question 1

(a) (i) The majority of candidates knew the abbreviations FSH and LH, but frequently placed them in the wrong order. Many thought the lines represented oestrogen and progesterone.

(ii) Many candidates did not know how to display this answer graphically, with many candidates not attempting to draw a line. The strongest responses had a line that stayed low until day 14, then increased to a peak at around day 21.

(iii) This question was generally well answered. Some candidates gave a range between 13–15 days and this was credited.

(iv) Some candidates identified the placenta as the source of progesterone during pregnancy. The alternative correct answers of corpus luteum or yellow body were seen less frequently. The most common misconception was ovary.

(b) This question allowed candidates to demonstrate three basic mathematical skills: unit conversion, a percentage change calculation, and the application of significant figures. Many gained three marks, but few gained all four marks. Common errors included the incorrect conversion from micrometres to millimetres, omitting to calculate the difference between the initial and final diameter, using the wrong denominator or not giving the answer to three significant figures.

(c)   This question was generally well answered with many candidates gaining full credit. Most candidates knew the adaptive features, but some missed marks by using incorrect terminology, such as tail for flagellum, or imprecise descriptions, such as 'has enzymes' instead of 'enzymes in the head of the sperm cell' as a description of the acrosome. Reference to size or shape was not credited. Candidates should take care to use the correct biological terms.

Question 2

(a) (i)   Few candidates recognised the lacteal. Many incorrect answers for **N** were seen, commonly villus, blood vessel, and microvillus.

(ii)   Very few candidates stated the name of cell **M** as a goblet cell.

(iii)   This question was generally well answered with many candidates correctly stating one other place in the body where mucus secreting cells are found. Most candidates suggested the nose or trachea, but many alternative answers for this question were credited as mucus-secreting cells are widely distributed.

(iv)   Candidates often referred to villi having a large surface area and good blood supply for rapid absorption. However, this question required descriptions with linked explanations, so the large surface area should have been linked to the presence of microvilli and the good blood supply should have been linked to the steep concentration gradient it provides. The epithelium was rarely mentioned, so the linked mark for diffusion across the thin epithelium was rarely awarded. Relatively few candidates appreciated the structure and function of microvilli. The lacteal was also thought to be involved in diffusion.

(b)   Some candidates correctly gave hepatic portal vein as the answer. A substantial proportion of responses involved arteries and capillaries which were all incorrect, as was hepatic vein.

(c)   Candidates seemed to know the concept of a stem cell, but many had difficulty expressing their answer using appropriate terms. Few responses used specialised or unspecialised and only a few candidates realised that stem cells divide by mitosis.

(d)   This long response question was often answered very well, but some candidates became confused in their responses. Candidates who attempted to explain the differences between the three parts of the body referred to the release of energy from mitochondria and the uses of energy in heart cells and epithelial cells. Quite a few candidates recognised that mature red blood cells had no, or very little, need for energy, but didn't always go on to write that the cells moved in the blood and the lack of organelles provided more space for oxygen transport by haemoglobin. Some responses referred to active transport in epithelial cells, but most just referred to absorption. Many candidates ignored the instruction to explain the differences in average number of mitochondria and simply described the bar chart. Very few candidates stated that the function of mitochondria was aerobic respiration; many candidates stated that the function was to produce energy which did not gain credit.

Question 3

(a) (i)   The best responses usually mentioned that amphibians have moist skin and a two-stage life cycle. Others referred to their ability to breathe through skin although no marks were awarded for respiring through skin. Candidates expressed the two-stage life cycle in a variety of different ways, but often the responses were lacking in detail and did not gain credit. Such an example was 'live in water and on land'. Candidates should not state an absence of a feature in their responses. Answers such as 'no scales' or 'no feathers' were not credited.

(ii)   Most candidates identified one of the structures required, but many were unable to identify a second structure. Common answers were the pupil, iris, and retina, none of which gained credit.

(b) (i)   Many candidates recognised the cells as animal cells and identified membrane, cytoplasm, and nucleus. A few candidates suggested the cell wall as one of the structures.

(ii)   Many candidates named the brain and spinal cord as the two parts of the mammalian nervous system. Occasionally, central and peripheral were given in a response and did not gain credit.

(c) (i)   Almost all candidates correctly identified the location of the blind spot and the fovea.

(ii) Some very good responses were seen with some candidates describing and explaining the distribution of rod and cone cells across the retina. Weaker responses described the distributions of rods and cones, while stronger responses went on to explain the differences. The idea of the rods and cones detecting different types of light was well understood by good candidates, who went into detailed descriptions of the roles of the two types of cells. A minority of candidates were not confident about the different functions of rods and cones, particularly the differences in detecting different light intensities. Some candidates simply described the way in which the lines moved across the graph rather than following the instruction given in the question.

(iii) Candidates often stated incorrectly that the nocturnal mammal would need more cones to help them see in colour. Many candidates gave a response that suggested the situation would be the opposite of the human eye without explaining the difference. Successful candidates recognised that the number of rods would increase while the number of cones would decrease. The strongest candidates stated that there would be rods in the fovea.

Question 4

(a) Many candidates achieved four or five marks and several achieved full marks for this question which required the candidates to complete the sentences about mitosis and meiosis. The most frequent errors were made in the first (repair) and third (separate) gaps.

(b)(i) Only a small number of candidates gave a clear definition of gene mutation. A common misconception was the suggestion that organisms can mutate genes to adapt or benefit from the change. As stated earlier, candidates should give answers to this type of question that follow the definition given in the syllabus closely.

(ii) There were some clear responses that identified two ways in which mutation rate can be increased, but there were also some confused responses. A common error suggested rapid breeding or inbreeding leading to increased homozygosity exposing harmful recessive alleles. Ionising radiation was well known as a cause of mutation, certain chemicals less so.

Question 5

(a)(i) This question was generally very well answered with many candidates stating that 66% of fish stocks were sustainable in 2020. Candidates must take care when reading graphs, several candidates misread the graph and quoted 34%.

(ii) Candidates suggested many ranges of years, not all of which were a five-year period which was specified in the question. Candidates should read questions carefully and follow the instructions given.

(b) This was generally well answered. Some candidates gained two of the available three marks and many gained full credit. Some candidates did not read the question carefully and instead of answering about the effect of reduced population size on the species, they discussed the effect of a reduced population on a food chain. Candidates who followed the instructions generally gained marks for describing the difficulty in finding mates and extinction. The effects of inbreeding were mentioned less often. Only a few responses referred to the effect on genetic variation and its consequences.

(c) There were some very good responses to this question. Many candidates gave good accounts of the methods that could be used to manage fish stocks sustainably. The majority recognised the ideas of laws, quotas, and protected areas and many acknowledged the requirement for education. Some candidates wrote too much about one form of conservation, instead of suggesting sufficient options to gain full credit. Some responses confused the conservation of fish with their preservation.

Question 6

(a)(i) Few candidates were awarded full marks for this question. The question clearly indicated that candidates should state a number or numbers from Fig. 6.1 to identify processes. Both 3 and 1 are processes that take place in yeast cells and both numbers were required to gain credit. Some candidates did not put numbers in their response but used the words from Fig. 6.1, this did not gain credit.

(ii) Candidates are advised to learn the chemical equations outlined in the syllabus. Few candidates were awarded both marks.

(iii) This question was well answered, and most candidates gave at least one of the two enzymes. Amylase was often suggested and maltase slightly less often. Candidates should take care with their handwriting to ensure that there is a clear difference between an 'a' and an 'o', so that maltase is distinctly different and is not confused with maltose.

(iv) Almost all candidates knew that the main use of cellulose in a plant is for making the cell wall.

(v) Some candidates gained some credit for this question, generally for the process of translocation and the phloem as the tissue. A common error was to give nitrogen as the ion instead of nitrate.

(b)(i) The majority of candidates identified muscle as the tissue that produces the most lactic acid during vigorous exercise.

(ii) This was another question that required candidates to read the question carefully. The question referred to the actions of the breathing and circulatory systems after exercise, so the breathing and heart rates would already be high and would continue to be high. Candidates who stated that the rates would increase did not gain any credit. Several candidates referred to the importance of the transport or the breakdown of lactic acid and so gained credit.

(iii) Most candidates identified the liver as the organ responsible for breaking down lactic acid.

BIOLOGY

```
Paper 0610/42
Theory (Extended)
```

Key messages

Answers to some questions suggested that candidates did not always understand the command words used in the paper. In **Questions 1(c)(ii)** and **4(b)**, candidates missed marks for giving descriptions of data rather than explanations. Descriptions of the command words can be found in the syllabus.

Care should be taken when writing responses. Some candidates left out a key word; for example, stating that 'at high temperatures substrate molecules can fit into the active site of an enzyme', instead of writing that '… molecules cannot fit into …'. When asked to compare, candidates should use comparative words, such as larger, longer, higher, etc.

Candidates should be advised to check their answers thoroughly. Often candidates wrote about the water potential of the salt solution and/or the red blood cells in **Question 2(c)(ii)**, but thereafter referred to a water concentration gradient instead of a water potential gradient.

General comments

There were many well written responses to all the questions on the paper with some candidates showing impressive knowledge of topics from across the syllabus.

Many candidates used 'it' in their answers without making it clear what this meant. In **Question 2(c)(i)**, for example, it was not clear whether 'it' referred to the tomato plant or to the water lily plant. Candidates often used incorrect terminology. Examples in **Question 4** on photosynthesis were 'production of food in photosynthesis', 'chlorophyll trapping energy' rather than light energy and the use of the simplistic term 'fair test' to explain why carbon dioxide is provided to plants in excess.

When candidates are asked to describe data, they should describe patterns or trends using some of the data to illustrate the pattern. Candidates should also take care to answer the exact question being asked. For instance, **Question 2(b)(ii)** specifically asked about the large air spaces in the spongy mesophyll and not about other adaptations of water lily plants, such as very broad leaves. **Question 4(c)** asked why carbon dioxide was supplied in excess, not why was carbon dioxide was supplied.

Some responses revealed misconceptions. In **Question 2**, many candidates stated that stomata are for taking in water and/or nutrients. Many candidates thought that antibodies have receptors or active sites rather than antigen-binding sites. Protein carriers were often thought to be molecules that carry proteins.

Care should be taken when spelling biological terms. Platelets, haemoglobin, oestrogen, and enzyme-substrate complex were often misspelt. Some candidates confused the identities of antibodies and antigens and wrote antibiotics instead of antibodies.

Comments on specific questions

Question 1

(a) The majority of candidates identified the substance in red blood cells that combines with oxygen as haemoglobin.

(b) Platelets was the most popular answer for the component of blood that promotes blood clotting. Fibrinogen and fibrin were also accepted.

(c) (i)   A large proportion of the candidates calculated the percentage increase in the mean diameter of red blood cells that were immersed in the 0.8% salt solution. A common error was to round the results of the calculation to 9.33% rather than to 9.3%. Some candidates confused two significant figures with two decimal places. Other candidates used the mean final diameter after two minutes as the denominator in their calculation or chose to use the percentage concentration (0.8%) as the denominator. The error carried forward rule was applied to these calculations so candidates could gain some credit for correct rounding to two significant figures.

(ii)   There were many excellent answers that explained the change in mean diameter of the red blood cells in the 1.8% salt solution. Candidates compared the water potential in the cells with the water potential in the salt solution and then explained that water would have moved down a water potential gradient from the cells by osmosis, often adding that the water passes through the partially permeable cell membrane. Many described the results rather than explain them. Many candidates wrote that the water potential of the red blood cells was higher than the water potential of the salt solution and then said that water moved out of the cells down a concentration gradient or a 'water concentration gradient'. Many also stated that water moved from a high water potential to a low water potential without mentioning which part of the system - red blood cell or salt solution - had the higher water potential. Some thought the decrease in size of the red blood cells was due to loss of oxygen from the cells.

(iii)   Candidates who referred to water potential in **1(c)(ii)** often stated that there would not have been a water potential gradient between the red blood cells and the salt solution with a concentration of 0.9%. Incorrect answers included the salt solution and the red blood cells having the same 'water concentration'. Candidates should be discouraged from using the term 'water concentration'. A few candidates stated that no osmosis took place, rather than explaining that there was no net movement of water molecules.

(d)   There were many correct answers that identified the lack of a cell wall as the reason why the red blood cells burst in pure water. The presence of a cell wall around plant cells was accepted as an alternative. Many gave the impression that red blood cells have cell membranes, but plant cells have a cell wall instead of writing that plant cells have both a cell membrane and a cell wall. Some candidates stated that plant cells have cell walls but said that they are a barrier to movement of water. Some also stated that vacuoles in plant cells prevent them from bursting by taking up the extra water.

(e)   Transport, solvent, photosynthesis and turgidity or support were the most common correct responses for this question on the uses of water in plants. Many candidates wrote growth, but this answer required more detail, such as stating that water is required for the elongation of cells.

Question 2

(a)   Most candidates stated that an adaptive feature helps an organism survive in its environment, but many did not state that it is an inherited feature. In fact, many answers suggested that adaptive features are gained by an organism during its lifetime in response to changes in its environment. Candidates should be aware that they will not gain credit if they use the term that they are explaining in their answer, in this case 'adapt'.

(b) (i)   Palisade mesophyll, spongy mesophyll and air space were the expected answers for the labels on Fig. 2.2. Many candidates identified the part labelled **C** as a vacuole or as stomata rather than an air space. Xylem and phloem were also given. Mesophyll was sometimes written for both **A** and **B** which was insufficient to gain credit. Candidates who thought that **A** was the upper epidermis then often identified **B** as palisade mesophyll and **C** as spongy mesophyll which did not gain any marks.

(ii)   Many wrote about the air providing buoyancy for the leaves, but very few stated that the leaves had a reduced density or even that the air spaces were large. Few stated that the air spaces help the leaves float on the surface of the water. Common answers did not address the question about adaptation of the hydrophyte and wrote about the role of air spaces in the leaves of all plants in providing interconnecting spaces for gases to circulate throughout the leaf and providing surfaces for diffusion of gases into and out of the mesophyll cells. A few candidates wrote about other adaptations of hydrophytes, such as their broad leaves and features of roots and stems.

(c) (i)   Many answers simply stated the values from Table 2.1 without any comparison. Better responses stated that tomato plants have more stomata on the lower epidermis of their leaves than on their

upper epidermis and that water lily leaves have many more stomata on the upper epidermis than the tomato. Few made the obvious statement that water lilies have more stomata than tomato plants. Some candidates manipulated the figures given in the table to qualify their qualitative descriptions. For example, some stated that the water lily leaf has 47.5 times as many stomata on the upper epidermis compared with tomato.

Explanations were often not expressed very well. Strong responses explained the distribution of stomata on tomato leaves in terms of reducing the loss of water by transpiration and the distribution on water lily leaves as an adaptation to living on the surface of water with gas exchange for photosynthesis only possible on the upper surface facing the air. Many candidates thought that the water lily has such a high stomatal density on the upper epidermis as it needs to lose water by transpiration.

(ii) Most candidates gave guard cells as their answer. Incorrect answers included stomata cells, goblet cells and epiglottis.

Question 3

(a) Many candidates identified the vesicles and the synapse correctly in Fig. 3.2. Candidates often wrote neurotransmitters in vesicles for structure **X** which was accepted. Synaptic gap and synaptic cleft were accepted as alternatives to synapse for **Y**.

(b) Candidates who read the information in the question and looked carefully at the diagrams of the junctions between the neurones wrote good answers to this question as they followed the instruction to use what they could see. Most candidates described how the events shown at the junction in the person with Parkinson's disease differ from those in the person who does not have the disease. A smaller number described what happens in Fig. 3.1 and then said that this does not happen in Fig. 3.2. It was often possible to give credit when the comparison with Fig. 3.2 was made clear. Weaker responses did not deal with the stages in transmission of an impulse across a synapse. Most candidates stated that movement in people with Parkinson's is slow and reaction time to stimuli is longer. Reducing reaction time was an incorrect answer that was seen occasionally. Also, a number of candidates stated that the transmission of impulses in the post-synaptic neurone would be slower rather than less frequent.

(c) There were many good answers to this question. Candidates identified a variety of differences between nervous control and hormonal control. The use of nerve impulses, their speed and their length of effect were the features most commonly seen. Some candidates also gave the equivalent points for hormonal control. Features of hormonal control without any comparison to the nervous system, if appropriate, were also credited. Candidates should know that hormones control more features than reproduction and/or blood glucose concentration. They should also know that neurones control features other than movement.

(d)(i) Few candidates gained credit for this question as they misunderstand the word 'determine'. Rather than referring to sequences of amino acids and base sequences of DNA and/or mRNA they stated that receptor proteins have a specific shape that is complementary to that of the neurotransmitter. Candidates who understood the question often stated that the sequence of amino acids is determined by DNA, or by mRNA, without stating that it is the base sequence on these molecules that is the determining factor. 'The base sequence of amino acids' was seen occasionally, rather than 'the sequence of amino acids' determining the shape of the protein receptors.

(ii) Many candidates did not recognise the term protein carrier and thought that they transport proteins. Some candidates correctly wrote about active transport and transferring molecules or ions across membranes, into or out of cells.

Question 4

(a) Many candidates first wrote 37 and then crossed it out and wrote 40. Some did not realise their error and left 37 as their answer. 37 arbitrary units is the rate of photosynthesis at 40 °C, so these candidates must have taken their answer from the wrong axis in Fig. 4.1.

(b) Most responses described the pattern shown on the graph and gave little or no explanation. The effect of temperature on the rate of photosynthesis can be explained in terms of the activity of enzymes in green plant cells. Few candidates realised this and they did not apply their knowledge of

enzyme activity to the question. Strong responses referred to the increase in kinetic energy as the temperature increases to 40°C and its effect on the frequency of collisions between enzyme molecules and substrate molecules. Only a minority identified temperature as the limiting factor at these temperatures. Almost all those who attempted an explanation stated that enzyme molecules are progressively denatured as temperature exceeded 40°C. Few explained that this involves changes in shape of the active site so that substrate molecules can no longer fit. A few explained changes in terms of production of oxygen or stated that at high temperatures stomata may close so reducing the uptake of carbon dioxide.

(c) Many candidates answered this question by stating that carbon dioxide is a limiting factor of photosynthesis. Many stated that without enough carbon dioxide the results would be unreliable or inaccurate. This alone was not given credit, it was necessary to say that only one variable, temperature, was investigated. If carbon dioxide was not in excess it would not be possible to interpret the results to understand the effect of temperature alone. Many did not realise that the emphasis of the question was on the word excess and answered that carbon dioxide is a reactant of photosynthesis which is why it was supplied.

(d) Most responses explained that some of the oxygen produced by the leaf is used in aerobic respiration. The mark was awarded for simply stating that it was required for respiration.

(e) There was some confusion between chlorophyll and chloroplasts. Many simply wrote that chlorophyll gives plants their green colour. There were many good answers stating that chlorophyll absorbs light energy and converts it to chemical energy.

Question 5

(a) Candidates could gain marks by referring either to a characteristic of the circulatory system of fish or of mammals. The most common answer was that fish have a single circulation and mammals have a double circulation. Candidates who did not use the terms single and double often described the single circulation as 'blood travels through the heart once' and did not add '… in each circuit of the body'. Another error was to state that fish have two chambers… without adding '… in the heart'. Many candidates gave two separate statements about the same feature, for example writing 'fish have a single circulation' on the first numbered answer line and 'mammals have a double circulation' on the second. Answers about the gas exchange system were common; for example, 'fish breathe through their mouth and mammals through their nose' and 'fish have gills and mammals have lungs'. Answers about mammals had to make it clear that they were about mammals; candidates who wrote 'they' followed by a mammalian feature did not gain credit. Many thought the blood pressure was the same at each point in the circulation of a fish. A few used the terms systemic and pulmonary in their answers about the circulatory system of mammals.

(b) Most candidates stated an advantage of the double circulation as the separation of oxygenated and deoxygenated blood. They often added that pressure of blood pumped to the body is high, but fewer added that blood pumped to the lungs has a lower blood pressure. Good answers referred to the fast removal of waste products from respiring tissues and the efficient filtration of blood as it flows through the kidneys. Vague answers referred to more oxygen gained rather than faster transport. Some candidates stated that there are different pressures for the two circuits but did not explain the advantage of this. Some wrote that the double circulatory system allows all organs to receive blood, but this is a feature of all circulatory systems.

(c) (i) A small number of candidates wrote the names of structures that they identified rather than the letters from Fig. 5.1.

(ii) Many identified blood vessel **X** on Fig. 5.1 as the hepatic portal vein. Common incorrect answers were hepatic vein, aorta, vena cava and renal vein.

(d) There were some good answers to this question giving details about deamination and the production and fate of urea. Candidates were often unsure about the role of deamination, although there were plenty of good answers stating that excess amino acids are broken down to release the nitrogen-containing part of the molecule that is converted to urea. Strong responses explained that urea passes from the liver into the blood plasma so it can be excreted by the kidney. However, some candidates must have misread the question as they gave details about filtration and formation of urine in the kidney. Other candidates concentrated on other excretory functions of the liver such as breaking down lactic acid, alcohol, hormones, dead red blood cells and about the production of bile.

Candidates who wrote about bile also described its functions in digestion. Credit was given to production of bile as it contains the bile pigments which are excretory substances. Descriptions of emulsification were unnecessary and not credited.

Question 6

(a)   Oestrogen and progesterone were seen very often. Common errors were to give one or both of the pituitary hormones, FSH and LH. 'Proestrogen' was seen quite often and not credited.

(b)   Most candidates identified the placenta as the organ that antibodies cross to reach the fetus. The umbilical cord was also accepted. Uterus was a common incorrect answer.

(c) (i)   Many candidates identified 6, lymphocytes, 56 and 3 as the answers needed to complete the passage. The most common incorrect answer was the third answer that simply required an addition. White blood cell was often seen instead of lymphocyte.

(ii)   Some answers were rather vague, stating that breast milk contains antibodies that fight pathogens or fight disease. These answers were not credited. Many also stated that breast milk contains nutrients without making it clear that it contains all the nutrients that are required. To gain a mark for antibodies, candidates had to explain that these are provided at a time before the baby has made enough of its own to provide immunity to the diseases it may encounter. Many answers made it clear that the type of immunity provided by maternal antibodies is passive immunity. Another feature that was mentioned was the forging of bonds between mothers and their babies. Breast milk is not free from bacteria as stated by some candidates.

(iii)   Many candidates stated that babies can gain antibodies in formula milk. Candidates should know that antibodies, being protein, will be digested in a baby's digestive system before they can be absorbed and provide passive immunity. Stronger responses described injections of antibodies which put these molecules into the blood system (artificial passive immunity). Many stated that active immunity would be provided with memory cells but did not say that this would occur following an infection. Some candidates wrote antibiotics when they clearly meant antibodies.

(d)   There were many good explanations of the importance of the shape of an antibody. Candidates wrote about the antigens on the surface of pathogens and the need for antibodies to have a complementary shape to these antigens. This is so that they can bind together to form antigen-antibody complexes that lead to the destruction of pathogens, often by phagocytes. The term 'specific' was used very often in a correct context. A number of candidates confused antibody-antigen binding with substrates binding to active sites. A common error was writing about the antibodies killing the antigens.

(e)   Carbon, hydrogen, and oxygen were the three elements required here. Some candidates used the chemical symbols, C, H and O, and these were credited. Candidates often added nitrogen to the list or gave nitrogen as an alternative to one of the three elements common to proteins, carbohydrates, and fats.

BIOLOGY

```
Paper 0610/43
Theory (Extended)
```

Key messages

Command words such as 'describe', 'explain', 'suggest' and 'compare' require different responses. Candidates should be encouraged to identify the differences in the requirements for each command word and in particular the difference between 'explain' and 'describe'.

When giving calculated numerical values from tables, charts and graphs, candidates should check their answers to make sure that they are feasible. In **Question 3(c)(i)** an answer of 3000 breaths per minute is not feasible so an error must have been made in the calculation.

Candidates should use the mark allocation and the number of answer lines as a guide to how much information to include in their response. If bullet points are used on long answer questions, candidates should ensure that each point is sufficiently detailed to gain the marks. An answer of one or several words is unlikely to be awarded credit.

General comments

There was a good understanding of the structure of a flower in **Question 1(a)**; thermoregulation in **Question 4(b)(ii)** and adaptive features and conservation of xerophytes in **Questions 6(b) and (d)**. Candidates also demonstrated that they knew how to scale up the number of stomata per unit area, but many did not convert the units in **Question 6(c)(i)** correctly. Similarly, most candidates read the relevant values from Fig. 3.2 and Fig. 3.3 but did not complete the calculations required in **Questions 3(c)(i)** and **(ii)**.

Some candidates had not read the information in the question thoroughly enough. For example, some described how the rate and depth of breathing would be affected after exercise, rather than while a person was exercising (**Question 3(c)(ii)**) or described the changes in the bacterial population from 0 to 50 hours, rather than just the last 26 hours (**Question 5(c)(iv)**). In **Question (6)(b)** some described features of xerophytes that were not visible in the photograph.

Comments on specific questions

Question 1

(a) (i) Most candidates identified the petals and described their function correctly. Many candidates also identified the stigma and its function correctly, but some candidates stated it was when pollen was absorbed or gave a vague answer, such as where pollination occurs. Fewer candidates knew the function of the sepals, which were often identified as leaves, stating they were used to support the flower. Some answers were not specific enough, for example sepals were said to protect the flower rather than to protect the flower bud.

(ii) Many candidates knew that the filament and anther form the stamen. The spelling of anther was sometimes confused with other words, such as antler, which was not credited.

(b) (i) Some candidates gave very detailed descriptions of the stages in the reproduction of a flowering plant that follow self-pollination. The best responses used the term pollen grain but very few candidates mentioned that the male nucleus moves down the pollen tube. A common misconception was that fertilisation involves the fusion between male and female gametes rather than male and female nuclei. It was common for candidates to confuse plant reproduction with animal reproduction,

with enzymes digesting a jelly layer around an egg, rather than the idea that enzymes are used to create a pathway for the pollen tube. Many used the term ovum when describing the ovule.

(ii) The advantages and disadvantages of self-pollination compared with cross-pollination were not well understood with many candidates describing the advantages and disadvantages of asexual reproduction instead. Many candidates identified that advantages included the need for only one plant and that pollinators were not required. A few stated that self-pollination was more likely to be successful and some also stated that less pollen was wasted. The most common misunderstanding was that self-pollination results in no genetic variation. Candidates who correctly stated that there would be less variation often did not explain how this could also result in a limited ability to adapt to changes in the environment with fewer plants surviving an outbreak of an infectious disease. Instead, many discussed how all the offspring would be wiped out by a disease. Others incorrectly thought that self-pollination would cause the spread in infectious diseases.

Question 2

(a) Many candidates identified **J** as the upper epidermis. Many also went on the explain how it was adapted for photosynthesis. However, a few suggested that it was to absorb light, rather than allow light through to reach the palisade mesophyll cells. Slightly fewer candidates correctly identified **K** as the xylem. Many answers stated that **K** was the vascular bundle, which was too vague given that the label line was specifically to the xylem and not the whole vascular bundle. Although the function was understood, many candidates did not explain how this related to its structure.

(b) Almost all candidates completed at least one of the sentences in the passage. The most common correct term added was that carbon dioxide was a limiting factor or reactant for photosynthesis. Many candidates only stated water instead of water vapour and chloroplasts instead of chlorophyll. Most candidates used the word source to complete the fourth sentence as that is the usual function of leaves.

Question 3

(a) (i) Some candidates knew the percentages of carbon dioxide and oxygen in inspired and expired air. A few stated the values for carbon dioxide and oxygen the wrong way round.

(ii) Many gave vague responses to suggest why there were fewer dust particles in expired air. Many candidates included incorrect references to cilia trapping the dust rather than the mucus trapping the dust that would be moved by the cilia. Other candidates suggested that the air would be filtered but did not give any further detail.

(b)(i) The most stated feature of a capillary was the thin walls. However, many stated that they are one cell thick but did not add that it is the capillary wall that is one cell thick. This was an important qualification since across a capillary there are two cells and often a red or white blood cell. It is therefore important that candidates distinguish the wall from the lumen in their responses. Responses that mentioned that the capillaries are small did not gain the mark for capillaries having a small lumen. However, many candidates stated that there is a short diffusion distance.

(ii) Almost all candidates knew that red blood cells are the component of blood that transports oxygen. Haemoglobin was also accepted.

(iii) Many candidates knew that the pulmonary artery transports blood from the heart to the lungs. The most common errors were to name it as the aorta or pulmonary vein.

(iv) Most candidates stated the location of cartilage in the breathing system as the trachea. However, many other correct locations were seen. The function of the cartilage was also generally well described but a few candidates wrote answer that were too vague, such as 'for support' or 'for protection'.

(c) (i) Many candidates correctly calculated the rate of breathing at rest. However, some did not recognise that the graph was a trace for 30 seconds, rather than for one minute.

(ii) Many candidates calculated the volume of inspired air correctly. Common incorrect answers included 1.2 or 3.8 dm^3 suggesting that these candidates only read one value from the graph and did not carry out the required calculation.

(iii)   Most candidates understood that more energy was required during exercise, but some did not connect this with the need for more oxygen. Similarly, many candidates knew that the muscles would be 'working harder' during exercise, but only a few mentioned muscle contraction. A few candidates stated that adrenaline was released. A few candidates gave more detailed answers that included the fact that increased aerobic respiration would result in a greater concentration of carbon dioxide in the blood that would lower the pH of the blood and more carbon dioxide would need to be excreted from the lungs.

Question 4

(a)   Most candidates knew that maintaining a constant internal temperature is homeostasis. Fewer candidates knew that negative feedback is the mechanism involved. Some answers stated that thermoregulation was involved which was accepted as an alternative to either homeostasis or negative feedback, but not both.

(b) (i)   Most candidates identified at least one of the labelled structures in the skin with sweat gland as the most common correct answer. Some candidates thought that all three structures were receptors of different types, e.g. chemoreceptors and pain receptors.

(ii)   Almost all candidates described some of mechanisms which humans use to maintain a constant body temperature when the external temperature decreases. Common correct responses included contraction of the erector muscles or hair standing up, sweat glands reducing the production of sweat and the decrease in loss of heat from blood or sweating. Candidates seldom mentioned that hairs standing up trapped air which acted as an insulator. The idea of receptors detecting the changes in the temperature was mentioned by many candidates, but they seldom went on to state that impulses, not messages or signals, travel along sensory neurones to the brain and that impulses from the brain travel along motor neurones. Many candidates knew that there was vasoconstriction of the arterioles, but many confused this with blood capillaries or shunt vessels. Some candidates also confused the terms vasoconstriction and vasodilation in their answers. Candidates should be advised that references to movement of blood vessels towards or away from the skin are incorrect and are not credited.

(c) (i)   Almost all candidates knew that the pancreas secretes glucagon although a minority thought it was the liver. The spelling of pancreas was often incorrectly written as pancrease, which is the name often given to the mixture of enzymes secreted by the pancreas and not to the organ.

(ii)   Many candidates knew that the secretion of glucagon results in an increase in the concentration of glucose in the blood. A few confused the action of glucagon with that of insulin, stating that there would be a decrease in blood glucose concentration. Others incorrectly thought that glucagon, rather than glycogen was broken down to form glucose. Misspellings of these terms could not be accepted where there was ambiguity.

Question 5

(a)   Many candidates stated at least one cell structure found in both animal and bacterial cells. Cytoplasm, cell membrane and ribosomes were all seen regularly, with nucleus and mitochondria being the most common incorrect answers.

(b)   Some candidates wrote very comprehensive responses stating why bacteria are useful in biotechnology. Most candidates stated that bacteria reproduced rapidly, have plasmids and that there are few ethical concerns in using them in biotechnology. Some also stated their ability to make complex molecules. Some candidates seemed to misread the question and gave examples of the uses of biotechnology, such as making insulin. A common misconception was to describe bacteria and other organisms as having the same genes, rather than the same genetic code or type of DNA.

(c) (i)   Most candidates drew an **X** on the lag phase on the graph.

(ii)   Almost all candidates drew a **Y** in the correct position on the graph to show where the death rate and birth rate were the same.

(iii)   Many candidates correctly calculated how long it took for the bacteria to reduce by half.

(iv) Almost all candidates described the decrease in the bacterial population in the last part of the graph. The question asked candidates to describe and explain the change. Some explanations were very detailed, but others did not explain why the numbers had decreased. Some candidates successfully quoted the data, but others did not state the exact units in their answers.

(v) Most candidates successfully explained how the optimum temperature was important for enzyme function and the idea that enzyme activity is fastest at optimum temperatures. Almost all candidates mentioned that enzymes are denatured at higher temperatures, but some did not go on to link this to the change in shape of the active site. Some incorrectly stated that enzymes denature at both high and low temperatures and others described the bacteria as denaturing rather than the enzymes. Some stated that there was sufficient kinetic energy but did not go on to mention that the collisions resulted in formation of the enzyme-substrate complexes.

(vi) Although there were some very comprehensive explanations about why amino acids are given to bacteria grown in liquid culture, there were also many responses that repeated the information given in the question; the idea that amino acids are required for growth. These vague responses were not credited.

Question 6

(a) The meaning of the term adaptation was not well explained. Many candidates described that the population would be better suited to the environment in a variety of ways, but often did not include any reference to the process of natural selection. Equally the idea that adaptation would occur over many generations was seldom seen. Many candidates incorrectly assumed adaptation was something that can be acquired during the life span of an organism.

(b) Almost all candidates described the presence of thorns as an adaptive feature visible in the photograph of the cactus, although a few described the leaves as thin, possibility forgetting that almost all leaves are thin in cross-section. Some explanations about how this feature was beneficial to desert plants were too vague to be credited. The most common omission was the reduced surface area in the explanations about minimising transpiration. Many candidates also described the wide stem and its role in storing water, though some did not state which structure was wide in their answers and were unable to score the mark. Fewer candidates mentioned the corrugations on the stem, but those that did often gave very comprehensive explanations about how they benefited desert plants. A significant number of candidates described features of the roots and stomata, or of xerophytes other than the cactus in the photograph, suggesting that they had not read the question carefully.

(c) (i) Although most candidates calculated the number of stomata correctly, it was common that the answer was given to the wrong order of magnitude. This was usually because candidates did not notice that the area was given in square centimetres and the data in the table was given in square millimetres, or that they had known the correct unit conversion but had not carried this out correctly.

(ii) A few very comprehensive explanations about the differences in the stomatal density in the plants in the data table were seen. However, many candidates only described the data rather than giving explanations for the differences. Those candidates who considered the differences between the upper and lower surfaces as well as between the xerophytes and the oak tree often gained maximum credit.

(d) There was an impressive range of reasons given about why it is important to conserve xerophytic ecosystems. The most common answers included maintaining biodiversity, loss of habitats and preventing extinction.

BIOLOGY

<div style="border:1px solid black">

Paper 0610/51
Practical Test

</div>

Key messages

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

Candidates should try to match the answers they give with the number of marks available for each part of a question; for example, a three-mark question is likely to require three separate marking points.

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

Candidates should practise drawing accurate representations of biological specimens using appropriate conventions. Lines should be clear and continuous, using a sharp pencil. Candidates should note the appropriate detail of the specimen, including the shape and proportion of the structures.

General comments

Candidates performed well on this paper with some clear and thoughtful answers. Most candidates appeared to perform well on the practical itself with some excellent results that were clearly presented. Time management appeared to be good.

It is important that candidates check their work thoroughly before moving on to the next question. This is particularly true for the calculations where unnecessary errors were sometimes seen.

Comments on specific questions

Question 1

(a) (i) Many candidates were able to successfully construct a table, following normal conventions. Candidates are reminded that units should only be in the table headings, not in the body of the table. All data should be recorded, including the starting temperatures.

(ii) Candidates were required to calculate the rate of heat loss in the beaker and the test-tube. Rather than doing a rate calculation, many simply found the change in temperature. A mark was also awarded for correct units.

(iii) Candidates found this question demanding. To gain the mark, candidates needed to make direct reference to body size and rate or time.

(b) (i) Some candidates correctly identified the independent variable, which was the size of the container. Many incorrectly identified time as the independent variable.

(ii) When identifying constant variables, vague statements of time or temperature were not accepted. It's important that candidates qualify this by either saying the total time of the experiment or the starting temperature of the water.

(c) (i) Candidates were asked to plan an investigation to determine the effect of temperature on the rate of diffusion in agar blocks. Many candidates found this question particularly demanding. Some

candidates misinterpreted what was being asked of them and a number discussed diffusion theory in great detail, without applying it to the question. These responses could not be credited. Some candidates were able to correctly identify a suitable temperature range in which to complete their investigation. Many were able to identify some controlled variables, such as keeping the volume of acid or size of the agar block the same. It is important when discussing how to control temperature, that they qualify this by using a thermostatically controlled water-bath. A water-bath alone does not keep the temperature constant.

(ii) Many candidates were unfamiliar with this calculation, and few correctly calculated the surface area to volume ratio of the cube.

Question 2

(a) This calculation was attempted by most candidates. The most common error was expressing the answer to an incorrect number of significant figures. Candidates should be reminded to show all their working so that partial credit can be awarded where appropriate if a mistake has been made.

(b)(i) This question was answered well by many candidates. Most were able to correctly identify two differences between the red blood cells of a lizard and a human. The most common differences were that lizard red blood cells are larger than human red blood cells and lizard red blood cells contain a nucleus whereas human red blood cells do not contain a nucleus.

(ii) This question assessed candidates' ability to produce a standard biological drawing, following all necessary conventions. Candidates should be able to produce a drawing using a sharp pencil with clear and continuous lines. It is important that candidates do not use shading or jagged lines. The detail mark was only awarded to those candidates that clearly joined the lower lobe of the nucleus to the top lobe.

(c)(i) Many candidates were able to correctly identify the mean mass of haemoglobin as being the dependent variable.

(ii) Many candidates were able to draw a suitable graph. Some candidates made plotting very difficult by choosing a difficult scale. The most common error was using a scale that did not allow the plotted points to take up at least half of the available space.

(iii) In this question, candidates were asked to use their graph to estimate the mean mass of haemoglobin at 17 days. It is essential that there is some marking on the graph to indicate where this value was read from. Without this, two marks could not be achieved. Using more suitable scales when drawing the graph would facilitate easier reading of these values.

(d)(i) Most candidates were able to correctly provide a conclusion of the more carbohydrate consumed, the longer they could exercise until exhaustion. The most common error was to link the carbohydrate consumption to exercise rather than to the increased time exercise.

(ii) Many candidates were able to identify two suitable variables that needed to be considered when selecting participants. Age and sex were the most common correct responses.

(e)(i) It was clear that the Benedict's test for reducing sugars was very well known. For those that did not gain both marks, it was most likely that they omitted to heat the solution.

(ii) Most candidates correctly named iodine solution as the reagent used to test for starch.

BIOLOGY

| Paper 0610/52 |
| Practical Test |

Key messages

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

Candidates should be familiar with the practical procedures indicated by the syllabus. This means that candidates are expected to be able to carry out these procedures safely or describe methods of changing variables in a novel context.

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

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

General comments

Most candidates performed very well on this paper with some clear and thoughtful answers. Knowledge was required of the technique for regular sampling of an enzyme-controlled reaction and testing for the presence of starch using drops of iodine solution on a white tile. It was clear that although most candidates had some experience of this technique, a few were less sure of the meaning of the different colours obtained with the iodine solution.

The planning question was reasonably done but some candidates ignored important information in the stem of the question.

Comments on specific questions

Question 1

(a) (i) Candidates were required to mix amylase with starch and then take samples every 30 seconds to test for the presence of starch using drops of iodine solution on a white tile. Most candidates did this well, demonstrating a good level of understanding of the technique. Tables were generally good but tended to have headings that were not entirely clear. Candidates tested two different test-tubes (cold and hot) with spots on 12 different dimples on a white tile. It was not always clear if the candidate was referring to test-tubes or dimples.

(ii) Most candidates were able to state the positive test result when testing for starch with iodine solution.

(iii) Many candidates correctly stated a conclusion for the investigation. However, some simply described the results or did not specifically mention the effect of temperature on enzyme activity.

(iv) Although most candidates were able to identify the independent variable, a few incorrectly gave time or the colour of the iodine solution.

(v) When asked to identify variables that were kept constant, it is important for candidates to read the method carefully, selecting volumes and concentration that have been controlled. Lack of detail can

result in missed marks. For example, simply stating that time is kept constant, it is not clear if this is the equilibration time, or total sampling time (which was effectively the dependant variable and therefore not constant for both temperatures).

(b)(i) Candidates were asked to analyse the method with regard to determining an accurate time for the breakdown of starch. The accuracy is limited by the fact that a colour change could occur anytime during the 30 second sampling time, so shorter intervals were required. Generally, this was answered extremely well. The most common incorrect answer was to state that it should be repeated (which would not solve the issue) or to use longer sampling times, which would decrease the accuracy.

(ii) Most candidates were able to describe a method for maintaining the temperature of the water in the beaker. Simply stating that a thermometer would be used to record the temperature is insufficient.

Question 2

(a) This question involved candidates planning an investigation to find out the effect of lipase concentration on the breakdown of fats in milk. They were told that the production of fatty acids would change the pH of the milk. Candidates should be aware that any information given in the stem of the question will be relevant to the answer. In this case, many candidates did identify that testing the change in pH with an indicator was a suitable dependent variable as this was related to the production of fatty acids. A large proportion of candidates chose to test for fats using the emulsion method. As the emulsion test produces a white emulsion, using this on a sample of milk is impractical. Controlled variables, repeats and safety were well described by most candidates.

(b) The descriptions of the emulsion test for lipids were often vague or incomplete. This is a standard technique and should be familiar to candidates.

Question 3

(a)(i) The drawing of the seaweed was very well done with some excellent clear drawings. A few candidates added unnecessary shading and texture, but overall, some well-constructed drawings were seen.

(ii) The majority of candidates were able to correctly calculate the magnification of the image. A few candidates gave their answer with units and a few confused significant figures with decimal places.

(iii) When asked to describe differences between the two types of seaweed most candidates gave good answers. Candidates must ensure that the statements are comparative. Stating that one has small bladders is insufficient, whereas stating that the bladders are smaller is comparative and so gains the mark.

(b)(i) Candidates must ensure that sufficient detail is given when describing variables. Simply stating the environment was constant is not enough. This could mean the temperature, light intensity, wind speed or any other environmental factor.

(ii) Most candidates were able to give a good description of an anomalous result.

(iii) Candidates were asked how the students in the investigation calculated the mean value (with reference to omitting the anomalous result). Many candidates gave general answers that described finding a mean of any three values. A look at the calculated mean in table of data would show that the anomalous result had been omitted.

(iv) Most candidates were able to calculate the mean percentage decrease in mass. The most common error is dividing by the wrong value. Most understood the principle of significant figures.

(c) The graph was done well with almost all candidates getting the axes labels correct. A few did not use the labels as shown in the headings on the table, using 'percentage decrease' instead of 'percentage decrease in mass', for example. The most common error was to use an incorrect scale. The values in the table did not go up by the same amount each time, with the first 4 increasing by 30 each interval and the next increasing by 60 each interval. The plotting of points and the line itself were generally good. Unless a line or curve of best fit is specifically asked for, a line joining point to point is advisable.

(d)   Most candidates were able to state the names of the reagents used to test for protein and vitamin C. Care must be taken with the order of the letters when spelling DCPIP.

BIOLOGY

Paper 0610/53
Practical Test

Key messages

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

Candidates should try to match the answers they give with the number of marks available for each part of a question – a three-mark question most likely requiring three separate marking points for example.

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

General comments

Performance on the paper was generally very good with some clear and thoughtful answers. Most candidates managed their time appropriately.

Candidates appeared confident with the practical procedure and obtained results that were broadly similar to those expected. Results were recorded clearly and in a logical manner.

The planning exercise was done well with some good responses seen. Similarly, the drawing of the stomata was done well with some very good drawings of adequate size and quality.

Comments on specific questions

Question 1

(a) (i) The table of results produced by most candidates was of a high standard and they presented their results in a logical and clear order. A few candidates forgot to record the actual temperatures and simply had **C**, **R** and **H** instead. A few candidates put units in the body of the table or omitted them from the headings. The most common mistake was to record the starting height and the final height, but not the difference in height. It's important that all candidates read and follow the instructions carefully.

(ii) The conclusion was generally well constructed, but several simply described the results rather than linking the results to the rate of respiration in the yeast cells. The conclusion should incorporate the information given at the start of the question which states exactly what is being investigated.

(iii) Most candidates were able to identify the independent variable in the investigation. A few candidates stated the dependent variable by mistake.

(iv) This was well answered by candidates who read the question carefully. Candidates were required to suggest a possible source of error linked to the measurement of the height. Some candidates gave general sources of error that were not to do with measurement of the height, such as timing errors or temperature changes. Line of sight errors were also inappropriate in this instance.

(v) This question also referred to a specific measurement in step 10. Although many candidates suggested some sort of mass balance or even just a ruler, many gave equipment that was

inappropriate for measuring or not usually considered as laboratory equipment such as spoons and cups.

(vi) Most candidates were able to suggest why the test-tubes were kept in water-baths for five minutes, but some answers lacked suitable detail. A common example is when candidates state that it was to ensure the water was at the same temperature. This is insufficient as it could mean that the water in **C** was the same temperature as the water in **H**, which is incorrect. To allow the water to warm up is also incorrect as **C** was in fact cooling down.

(vii) This was a very demanding question for many candidates. A few candidates gave excellent answers that fully explained why using different diameter cups was unsuitable. These answers were very impressive in their clarity and understanding of the issue. A common incorrect answer was to simply state that the height would be different in the three cups (which it would be anyway if the temperature was also different). The candidates needed to link the height difference to a unit volume or link the same starting height to differences in starting volumes.

(b)(i) Most candidates could state the colour for a positive test for reducing sugars.

(ii) Although most identified heat as a possible hazard, some candidates also mentioned Benedict's reagent. Simply stating that Benedict's is a hazard is insufficient.

(iii) Most candidates could identify the reagent used to test for carbon dioxide. Limestone and lime juice were occasionally seen.

(iv) Many candidates correctly performed the calculation and gave an answer to one decimal place.

(c) The planning activity asked candidates to plan an investigation to determine if breathing rate was affected by different intensities of exercise. Generally, candidates produced some very well considered plans. The most common error was to confuse breathing rate with heart rate, with some candidates describing in detail how pulse rate could be measured. The types of exercise suggested were generally suitable (such as running at different speeds), but it was not always clear that the intensity was being changed (such as comparing running to swimming).

Controlled variables were described well, but safety considerations were not always appropriate. These should be in place to prevent accidents, not to deal with the aftermath of accidents such as availability of medical care.

Question 2

(a)(i) The quality of the drawings was excellent. Some candidates confused stomata with guard cells and so drew a second pair of guard cells, but this was ignored when marking. The main problem was the size, with many candidates drawing the epidermal cells so large that they overlapped the text of the question. Shading of the nuclei was also seen, this should be avoided.

(ii) The calculation of the actual length of the guard cell was well done, but a few candidates gave an answer to one significant figure (which was two decimal places) rather than two significant figures.

(b)(i) Many of the candidates could identify the dependent variable in this investigation.

(ii) When deciding on variables that have been kept constant, candidates must ensure that this is clear from the given method. For example, the humidity was given as 60%, so this is a suitable variable to name. However, the method states that five different leafy shoots were used, but it does not state that they were from the same plant or even of the same species. They should have been the same, but it is not expressly stated in the method, so this cannot be concluded.

(iii) Many candidates were able to identify the reason for sealing the apparatus with petroleum jelly. Some suggested it prevented air from escaping or water entering which is the wrong way around.

(iv) The graph was drawn very well with some excellent lines and accurate plotting of data points. Candidates must ensure that they study the scale and values carefully. A significant number of candidates did not notice that the values in the table were not sequential with a jump from 30 to 50. This meant that many skipped 40 on the *x*-axis. Candidates must also make sure that plotted points

are not too large. A very small cross or a small dot in a larger circle is recommended for plotting points.

(v) The interpolation of the value from the graph was done well. Candidates must ensure that they read values off the graph carefully and mark the graph to indicate where the value has been taken.

BIOLOGY

General comments

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

Candidates are advised to show their working in calculations. This ensures that partial credit can be awarded even if a mistake is made during the calculation.

General comments

Many candidates performed well on this paper, with many good answers seen. It is essential that all questions are attempted, even if the candidate is unsure of the answer as they may gain partial credit even if full marks are not awarded.

The drawing skills of most candidates were good, with suitable detail included. Lines should not be incomplete or feathered. Drawings should be neat, in proportion and show sufficient detail.

Comments on specific questions

Question 1

(a) (i) Most candidates could draw the basic table outline, but fewer could add correct headings with appropriate units. A significant number of candidates did not include the starting temperatures in their table. Common errors were to include units in the body of the table and not expressing all values to one decimal place.

(ii) With the exception of the incorrect selection of data for the calculation (taking the values at 1 minute and 5 minutes rather than the starting temperature), many candidates were able to calculate the correct answer for both **A** and **B**. However, deriving the appropriate unit was challenging for some. Weaker responses calculated the mean of all readings, or just picked one temperature to use in the calculation.

(iii) As the question asked for the effect of body size on the rate of heat loss, a time element was expected. Some candidates only described losing more or less heat and did not indicate the effect on the rate.

(b) (i) Many candidates found it difficult to identify the independent variable. Time and temperature were frequent incorrect suggestions. Those who suggested the volume or amount of water did not realise that this would vary due to the size of the containers.

(ii) Some candidates gave incomplete answers such as time or temperature, without qualifying their answer. References to temperature needed to be qualified as either the starting temperature of the water or the environmental temperature. Similarly, references to time needed to be qualified as either the total time for the experiment or the time at which the samples were taken. Only stronger responses considered the material from which the containers were made or the height of the mark on each container.

(c) (i) Most candidates could identify that the investigation should be carried out at a range of different temperatures; that the experiment should be carried out multiple times, and that appropriate safety equipment would be required. Some could recognise at least some of the factors that should remain constant. Only stronger responses correctly described how to measure the rate of diffusion. Weaker responses just tried to modify the investigation already described.

(ii) Some candidates could perform both calculations correctly. The volume was correctly calculated more often than the surface area, which was often incorrectly given as 1.

Question 2

(a) Most candidates could measure the line accurately. Examples of incorrect calculations included multiplying by 0.6 rather than dividing by it. The concept of three significant figures was not well understood by a significant proportion of candidates, with many giving the answer to three decimal places or more.

(b) (i) Most candidates could supply at least one correct difference between the lizard blood cells and human blood cells. Weaker responses referred to lizard blood cells not having white blood cells rather than that lizard blood not having white blood cells.

(ii) Some candidates drew good, clear diagrams that correctly represented the cell. However, candidates should be aware that they are expected to draw with clear, continuous lines and should not shade any parts of the drawing.

(c) (i) Most candidates correctly identified the mass of haemoglobin as the dependent variable. Some candidates thought it was the number of days, mixing up the independent and dependent variables.

(ii) Most candidates constructed an appropriate graph. Candidates are advised to draw graphs with a plotted area that occupies at least 50% of the available space in both directions. They should also remember to label and add units to the axes and to use a linear scale that is easy to apply. Candidates should be advised against plotting with dots as they can be too big or, more commonly, not visible when the line is drawn. A few candidates drew bar charts.

(iii) Many candidates correctly read off an appropriate value from their line. Although the question directed candidates towards indicating on their graph how they were obtaining their estimate, a significant proportion did not.

(d) (i) Most candidates described the trend that the greater the amount of carbohydrates in the diet, the longer they could exercise until exhaustion. Weaker candidates just made a statement about high carbohydrate diets rather than describing the trend.

(ii) Most candidates could supply at least one appropriate suggestion of a variable to consider.

(e) (i) Most candidates recognised that Benedict's reagent would be used to test for the presence of reducing sugars, but a significant proportion did not state that heat was required.

(ii) The majority of candidates correctly identified iodine solution as a test for starch.

BIOLOGY

```
Paper 0610/62
Alternative to Practical
```

Key messages

Candidates should practise identifying the independent, dependent and variables that need to be kept constant in an investigation. They should also practise reaching a conclusion from their results that refers to the aim of the investigation.

When drawing graphs, candidates should be careful to use an even scale even if the data points are not evenly spaced. Some candidates drew a non-linear scale by evenly spacing the values and ended up with a straight line.

Candidates are advised to show their working for calculations. This ensures that partial credit can be awarded even if a mistake is made during the calculation.

General comments

Many candidates demonstrated good mathematical and drawing skills. Graphs were generally drawn well.

Many candidates found the table design difficult. Candidates should practise drawing different sorts of tables, choosing the best headings for the data, and including units in the heading of the table.

Candidates should be familiar with all the food test reagents described in the syllabus. Many were unfamiliar with the method for the emulsion test.

Comments on specific questions

Question 1

(a) (i) Most candidates drew a table with at least three columns and a header line. However, many candidates did not design their table so that they could get the mark for the headings. A heading was needed for the dimples 1 to 6, and a heading was needed above the results, usually the iodine colour for test-tubes **W** and **C**. These headings were often omitted or were incorrect, such as dimples labelled as test-tubes. The data in the body of the table must match the headings. Where time was used as a heading, often the heading mark could not be awarded due to the units of 's' being included in the data cells of the table.

The results were recorded in a variety of ways. It was expected that candidates would record the colours: blue-black and yellow-brown, for each dimple. However, some recorded the results as positive or negative (for the starch test) or positive or negative for reducing sugars. If the correct pattern was given for the results in Fig. 1.2, then the mark was awarded. If the candidates added up the number of each colour and recorded these values as their result, a pattern could not be seen so they could not be awarded the final marking point.

(ii) At the start of the question, the first sentence reads 'candidates investigated the effect of temperature on the activity of amylase.' Therefore, the conclusion should relate temperature (the independent variable) to the activity of the amylase (the dependent variable). The conclusion should have been given as the greater the temperature, the greater the activity of amylase.

A significant number of candidates misinterpreted the results and thought that the amylase activity was highest at the cold temperature. Many others described the results rather than relating the results

to the aim of the investigation. Some said that starch broke down faster at higher temperatures but did not mention the enzyme.

(iii) The independent variable in the investigation was temperature. Candidates should be able to identify the independent and dependent variables in investigations. Some confused the dependent and independent variables. Others gave variables such as time, volume of amylase or volume of starch.

(iv) Candidates should be able to identify variables that are kept constant in an investigation. These should specifically relate to the investigation described. For example, time unqualified is insufficient for a mark, but time intervals of 30 seconds to collect samples is much more precise. Candidates should be encouraged to use the terms volume and concentration rather than amount. So, volume of amylase and concentration of amylase were both valid answers. Amylase / starch / iodine unqualified could not be credited. A common error was to say that the volume of water was kept constant. However, the method stated that the volume of water was approximate. The size of the test-tubes was not relevant.

(b)(i) This question required the candidates to understand the method and how the results were being obtained. The key part of the investigation is that samples were taken every 30 seconds. So, the investigation would only indicate if starch had been broken down after each 30 second interval, but not the precise time of the breakdown. Therefore, the expected answer should describe the idea that 30 seconds is a long time interval and it is impossible to know exactly when in those 30 seconds the starch was broken down. Very few candidates expressed this idea. Some described the idea that the colour change is subjective, and this was accepted.

Common errors included descriptions of human errors e.g. in using the stop-clock, not repeating the investigation, or comments on other errors such as the temperature not being controlled. Many candidates referred to problems with multitasking affecting accuracy or they misunderstood the method and stated that three minutes was not long enough for the reaction to take place.

(ii) The temperature of the water in the beakers was not controlled in any way. The method could have been improved by controlling the temperature. An answer describing how the temperature was controlled, such as use of a thermostatically controlled water-bath, was required. Very few referred to insulation, which was another alternative answer. Some described using a thermometer to measure the temperature, but not a method of controlling the temperature. A thermometer cannot control the temperature.

(iii) The test-tubes were left for three minutes so that the solutions in the test-tubes would reach the temperature of the water in the beakers. Very few candidates were able to articulate this idea. A range of answers were given including the idea that this was to allow the reaction to happen. Others said that this was to make the temperatures equal, but the temperatures of the contents of each test-tube should have been different. Many incorrectly referred to the enzyme being at its optimum or described the enzyme being adapted to the temperature rather than the starch suspension reaching the correct temperature.

Question 2

(a) Candidates were asked to plan an investigation to determine the effect of lipase concentration on the breakdown of fats in milk. They were told that fatty acids cause the pH of milk to decrease and that fats are broken down into fatty acids (and glycerol).

Overall, this question was answered very well, with many candidates achieving four or more marks, usually for identifying the variables that should be kept constant, repeats and safety. A few were able to describe using a boiled enzyme for a control. A wide range of pH indicators were suggested, the most common being universal indicator or a pH probe/meter. Many candidates referred to having the same pH but did not qualify this by stating initial. A few candidates mentioned the use of a buffer, either to measure pH or to maintain the pH (which would make the experiment invalid). Constant variables were generally described well. The most common given were the volume of milk and temperature.

A common mistake was to confuse concentration with volume. Some candidates said that different concentrations of lipase would be used, but described these as different volumes, e.g. $1\,cm^3$, $2\,cm^3$, $3\,cm^3$. Some candidates did not mention milk and gave a generalised plan using fat, rather than milk. Some candidates used the emulsion test as the dependent variable. However, this would not work

as the student is investigating the breakdown of fats in milk, and milk is already cloudy. Therefore, it would be difficult to see any change caused by an emulsion. Those that read the introduction carefully, would have realised that an indicator could be used to measure the pH after a set time.

(b)   The emulsion test was known by some candidates. However, many knew that ethanol had to be added to the sample but did not say that water should also be added. Fewer candidates stated that the mixture should be shaken to obtain the result. Some candidates referred to adding an emulsion solution. This question asked candidates to describe the method. Candidates were not expected to give the results of the test, although a large number did.

Question 3

(a) (i)   High quality drawings were seen, with clear outlines, seven bladders and a midrib drawn with a double line. Very few lost marks for shading or stippling or making their drawing too small or so large that it covered text on the page. Occasionally, only a single bladder was drawn. This was usually too small and gained no marks. The most common reason for a mark not being awarded was for errors in the outline.

(ii)   Generally, this question was answered well. Line **PQ** was nearly always measured accurately. The most common error was to round to the wrong number of decimal places. Some incorrectly included units in the magnification.

(iii)   Candidates were not expected to know anything about seaweed to answer this question. They simply had to look for differences between the two photographs. Various descriptions of the bladders were accepted, such as eggs, lumps, or balls. There were many valid answers. The most common answer given was that the bladder wrack has more bladders, but that they are smaller than the bladders on the egg wrack. This gained both marks.

Those that missed marks often confused the bladder wrack with the bladders. For example, they said that there were more bladder wracks, rather than more bladders. Some referred to the wracks as being wet or dry, but this cannot be seen from the photographs.

(b) (i)   The method of an investigation was described. Candidates had to suggest two constant variables in the investigation. As previously mentioned, candidates should give detail to the variables described. So, time or seaweed unqualified would be insufficient, but age of seaweed and sampling times would be awarded marks. Many candidates realised this was an investigation about transpiration and gave variables that affect the rate of transpiration: temperature, humidity and windspeed.

As the students recorded the initial and final mass of the seaweed, it was not important that the initial mass was constant. Amount of bladder wrack was not accepted, but length or size of bladder wrack was accepted. The length of the string was not important.

(ii)   Many candidates were able to describe what was meant by an anomalous result: a result that does not fit the pattern or trend. However, many gave answers that were too vague to gain credit. For example, a result that is different, a wrong result, an abnormal result, or an inaccurate result.

(iii)   Many candidates did not take the anomalous result into consideration when describing how to calculate the mean. Many simply described adding all the results and dividing by three. Some identified the wrong anomalous result (usually result three) and so did not get the mark.

(iv)   Many candidates displayed good mathematical skills although some confused significant figures with decimal places. Others divided by 76, rather than 176, so could only get the second mark if they had given their answer as 130. Some divided 76 by 176 but could get one mark if they gave their answer as 43 (two significant figures).

(c)   Most candidates labelled the axes correctly giving suitable labels including units. Some omitted all the labels or gave incorrect units for time such as 'm' for minutes or missed out part of the label for decrease in mass.

More practise needs to be given to drawing even scales when the data is not even. The mass of the egg wrack was measured every 30 minutes for the first two hours and then every hour for a further three hours. The most common mistake was to have even spacing between the sampling times, not considering the different time intervals. 150 minutes was commonly missed out.

Almost all candidates avoided the error of plotting a bar graph instead of a line graph. Most plotted the seven points correctly. The most common plotting error was at 0,0 rather than 30,0. Most candidates joined their plots point-to-point with a ruler. A straight line of best fit was not suitable here as the pattern shows a curve. Extrapolation was not accepted.

(d)   The tests for protein and vitamin C were well known. Candidates should be encouraged to learn the correct spelling of biuret reagent and DCPIP.

BIOLOGY

Paper 0610/63
Alternative to Practical

Key messages

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

Candidates should also try to match the answers they give with the number of marks available for each part of a question. For example, a three-mark question will generally require three separate marking points.

Candidates should be familiar with the practical procedures indicated by the syllabus. This includes the food tests and methods for obtaining valid results. It is essential that candidates are familiar with laboratory apparatus, even when sitting the Alternative to Practical paper.

General comments

Performance on the paper was generally very good with some clear and thoughtful answers. Most candidates managed their time appropriately.

Candidates appeared to fully understand the practical procedure outlined in **Question 1** and were able to record the student's results in a clear and logical manner.

The planning exercise was done well with some good responses. Similarly, the drawing of the stomata was done well with some very good drawings of adequate size and quality. The plotting of the graph was well done but additional consideration needs to be taken when deciding on the scale of the horizontal axis.

It is important that candidates check their work thoroughly before moving on to the next question.

Comments on specific questions

Question 1

(a) (i) Almost all candidates followed the instruction and drew a line on each cup.

(ii) The table of results produced by most candidates was of a high standard and they presented the student's results in a logical and clear order. A few candidates put units such as mm in the body of the table or omitted them from the headings. The most common mistake was to record the starting height and the final height but not the difference in height. It is important that candidates read and follow the instructions carefully.

(iii) The conclusion was well constructed by many candidates, but several simply described the results rather than linking the temperature to the rate of respiration. It may be helpful for candidates to remember that the conclusion should incorporate the information given at the start of the question which states what they are going to investigate.

(iv) Most candidates were able to identify the independent variable in this investigation. A few candidates stated the dependent variable by mistake.

(v) This was well answered by the candidates who read the question carefully. Candidates were required to suggest a possible source of error linked to the measurement of the change in height (the

dependent variable). Many candidates gave more general errors that were not related to the measurement of the height, such as timing errors or temperature changes. Line of sight errors were also inappropriate in this instance.

(vi) This question referred specifically to step 8 in the procedure. Although many candidates suggested some sort of mass balance or even just a ruler, many gave equipment that was inappropriate for measuring or not usually considered as laboratory equipment such as spoons and cups.

(vii) Most candidates were able to suggest why the test-tubes were kept in water-baths for five minutes, but some answers lacked suitable detail. A common example is when candidates state that it was to ensure the water was at the same temperature. This is insufficient as it could mean that the water in **C** was the same temperature as the water in **H**, which is incorrect. To allow the water to warm up is also incorrect as **C** was in fact cooling down.

(viii) This was a very demanding question for many candidates. A few candidates gave excellent answers that fully explained why using different diameter cups was unsuitable. These answers were very impressive in their clarity and understanding of the issue. A common incorrect answer was to simply state that the height would be different in the three cups (which it would be anyway if the temperature was also different). The candidates needed to link the height difference to a unit volume or link the same starting height to differences in starting volumes.

(b)(i) Most candidates could state the colour for a positive test for reducing sugars.

(ii) Although most identified heat as a possible hazard, some candidates also mentioned Benedict's reagent. Simply stating that Benedict's is a hazard is insufficient.

(iii) Most candidates could identify the reagent used to test for carbon dioxide. Limestone and lime juice were occasionally seen.

(iv) Many candidates correctly performed the calculation and gave an answer to one decimal place.

(c) The planning activity asked candidates to plan an investigation to determine if breathing rate was affected by different intensities of exercise. Generally, candidates produced some very well considered plans. The most common error was to confuse breathing rate with heart rate, with some candidates describing in detail how pulse rate could be measured. The types of exercise suggested were generally suitable (such as running at different speeds) but it was not always clear that the intensity was being changed (such as comparing running to swimming).

Controlled variables were described well, but safety considerations were not always appropriate. These should be in place to prevent accidents, not to deal with the aftermath of accidents such as availability of medical care.

Question 2

(a)(i) The quality of the drawings was excellent. Some candidates confused stomata with guard cells and so drew a second pair of guard cells, but this was ignored when marking. The main problem was the size, with many candidates drawing the epidermal cells so large that they overlapped the text of the question. Shading of the nuclei was also seen, this should be avoided.

(ii) The calculation of the actual length of the guard cell was well done, but a few candidates gave an answer to one significant figure (which was two decimal places) rather than two significant figures.

(b)(i) Many of the candidates could identify the dependent variable in this investigation.

(ii) When deciding on variables that have been controlled, candidates must ensure that this is clear from the given method. For example, the humidity was given as 60%, so this is a suitable variable to name. However, the method states that five different leafy shoots were used, but it does not state that they were from the same plant or even of the same species. They should have been the same, but it is not expressly stated in the method, so this cannot be concluded.

(iii) Many candidates were able to identify the reason for sealing the apparatus with petroleum jelly. Some suggested it prevented air from escaping or water entering which is the wrong way around.

(iv)   Many candidates gave a good explanation of why investigations are repeated. A few referred to reliability and accuracy but most correctly stated the need to identify anomalous results.

(v)   The graph was drawn very well with some excellent lines and accurate plotting of data points. Candidates must ensure that they study the scale and values carefully. A significant number of candidates did not notice that the values in the table were not sequential with a jump from 30 to 50. This meant that many skipped 40 on the *x*-axis. Candidates must also make sure that plotted points are not too large. A very small cross or a small dot in a larger circle is recommended for plotting points.

(vi)   The interpolation of the value from the graph was done well. Candidates must ensure that they read values off the graph carefully and mark the graph to indicate where the value has been taken.