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BIOLOGY

Paper 0610/11
Multiple Choice (Core)

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

General comments

The paper provided a balance of questions and sufficient challenge for candidates working at this level. Common misconceptions included the idea that breathing and respiration are the same and there was a lack of clarity regarding the differences between osmosis and diffusion in some cases. The differences between plant and animal cells and the effect of temperature on enzymes were not always clearly understood. Candidates showed a good understanding of the use of dichotomous keys, the functions of teeth, what is meant by a transmissible disease and sex determination.

Comments on specific questions

Question 1

While most candidates gave the correct response, a large number believed that breathing is a characteristic of all living organisms.

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Question 2

Many candidates opted for the correct response but some identified the structure as a cell wall instead of a membrane. Some candidates did not appreciate that having two adjacent cells would mean that two cell membranes are present.

Question 3

The majority of candidates have a good understanding of the use of dichotomous keys.

Question 4

While many candidates selected the correct option, some did not, suggesting a less secure knowledge of the levels of organisation in plants.

Question 5

This proved to be a challenging question. Many candidates did not appreciate that although the process of osmosis requires a partially permeable membrane, diffusion does not.

Question 7

While some candidates understood that boiling denatures an enzyme and lowering the temperature merely slows it down, the majority of candidates found this question challenging.

Question 8

Some candidates selected the correct option. It was not appreciated by most candidates, that in the dark, both the snail and the aquatic plant will produce carbon dioxide.

Question 9

Most candidates recalled the structure of a leaf but some were uncertain of the difference between the spongy mesophyll and the palisade mesophyll.

Question 12

While many candidates appeared to know that the liver is responsible for storage and assimilation, some did not and opted for the pancreas and rectum.

Question 14

Although most candidates answered this well, some were uncertain about which enzyme acts on starch and what the products of starch digestion are.

Question 17

Many candidates selected the correct option but some were also uncertain about which blood vessels are arteries and which are veins.

Question 18

The vast majority selected the correct option. There was a good understanding of what a transmissible disease is.

Question 22

While many candidates correctly identified where urea is produced in the body, they were uncertain about where it is broken down and therefore did not selected the correct option.

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Questions 23, 24, and 25

Candidates showed a good understanding of the topics covered in these questions, with the majority of candidates selecting the correct options.

Question 26

While many candidates selected the correct option, a large number thought that both bacterial and viral infections can be treated with antibiotics.

Question 27

While some candidates selected the correct option, the majority seemed uncertain as to which type of reproduction involves pollination.

Question 32

The majority of candidates seemed unclear about the functions of mitosis.

Questions 33

This question required the interpretation of graphical data. While some candidates identified the correct option, many found it difficult to apply their knowledge of variation to the context used in this question.

Question 34

Many candidates were uncertain about the definition of a population.

Question 40

Most candidates found it difficult to apply their knowledge to graphical data. The bacteria use up dissolved oxygen to digest the sewage and release mineral ions in the process. The sewage must enter the river before the oxygen begins to decline and the level of mineral ions in water begins to increase.

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BIOLOGY

Paper 0610/12
Multiple Choice (Core)

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

General comments

The paper provided a balance of questions and sufficient challenge for candidates working at this level. One misconception was that breathing and respiration are the same. Some topics proved to be challenging for some candidates. These included the role of the different digestive enzymes, interpreting information on levels of organisation, how water is lost from stomata and the differences between osmosis and diffusion. Candidates also found the interpretation of graphical data challenging. Candidates showed a good understanding of the structure of leaves, the catalytic nature of enzymes, the production of antibodies by white blood cells, the site of gaseous exchange in the lungs and aerobic respiration.

Comments on specific questions

Question 1

While most candidates gave the correct response, a large number believed that breathing is a characteristic of all living organisms.

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Question 2

Many candidates opted for the correct response but some identified the structure as a cell wall instead of a membrane. Some candidates did not appreciate that having two adjacent cells would mean that two cell membranes are present.

Question 4

While many candidates selected the correct option, some did not, suggesting a less secure knowledge of the levels of organisation in plants.

Question 5

This proved to be a challenging question. Many candidates did not appreciate that although the process of osmosis requires a partially permeable membrane, diffusion does not.

Question 7

The majority of candidates appreciating the catalytic nature of enzymes and were able to select the correct option.

Question 8

Some candidates selected the correct option. It was not appreciated by most candidates, that in the dark, both the snail and the aquatic plant will produce carbon dioxide.

Question 9

Most candidates knew the structure of a leaf and were able to correctly identify the palisade mesophyll.

Question 11

While some candidates correctly identified that amylase is used in the conversion of starch to simple sugars, many seemed uncertain.

Question 12

This proved to be a challenging question, with similar numbers of candidates choosing each option. Most candidates were not aware that water is lost from stomata by diffusion.

Question 13

Most candidates correctly identified the tooth as a molar, while some candidates opted for premolar. This suggests that some candidates are uncertain about which way round the molars and premolars are arranged in the mouth.

Question 14

Similar numbers of candidates were choosing each of the first three options, suggesting uncertainty. Many candidates appeared to be unsure of how the processes of digestion and absorption differ from assimilation.

Question 17

Although many candidates responded correctly, some were less secure in their knowledge of the structures of the heart.

Question 18

The vast majority of candidates selected the correct option.

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Question 22

While many candidates correctly identified where urea is produced in the body, they were uncertain about where it is broken down and therefore did not selected the correct option.

Question 23

Many candidates were able to identify a receptor, a similar number were not able to distinguish the receptor from a neurone, an effector, or a synapse.

Questions 24

Some candidates did correctly identify the location of the fatty tissue, but many found this challenging.

Question 25

The majority of candidates selected the correct option.

Question 26

While many candidates selected the correct option, a minority thought that cholera is caused by smoking tobacco.

Question 31

Many candidates understood the purpose of mitosis, although some candidates were uncertain as to the number of cells that result from this type of cell division and whether the cells produced were identical or different from each other.

Questions 33

This question required the interpretation of graphical data. While some candidates identified the correct option, many found it difficult to apply their knowledge of variation to the context used in this question.

Question 34

This question proved challenging for some candidates. It was important for candidates to work methodically through the various stages of the problem.

Question 38

Many candidates showed an understanding of a possible disadvantage of having genetically modified crop plants, but some showed a lack of understanding of what the question was asking.

Question 40

Most candidates found it difficult to apply their knowledge to graphical data. The bacteria use up dissolved oxygen to digest the sewage and release mineral ions in the process. The sewage must enter the river before the oxygen begins to decline and the level of mineral ions in water begins to increase.

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BIOLOGY

Paper 0610/13
Multiple Choice (Core)

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

General comments

The paper provided a balance of questions and sufficient challenge for candidates working at this level. One misconception was that breathing and respiration are the same. Some topics proved to be challenging for some candidates. These included the differences between osmosis and diffusion, the differences between plant and animal cells, the distribution of phloem in leaves and roots, the identification of the coronary artery, the structure of a flower and the uses of meiosis and mitosis. Candidates showed a good understanding of the use of dichotomous keys, the water cycle and what is involved in genetic engineering.

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Comments on specific questions

Question 1

While most candidates gave the correct response, a large number believed that breathing is a characteristic of all living organisms.

Question 2

Many candidates opted for the correct response but some identified the structure as a cell wall instead of a membrane. Some candidates did not appreciate that having two adjacent cells would mean that two cell membranes are present.

Question 4

While many candidates selected the correct option, some did not, suggesting a less secure knowledge of the levels of organisation in plants.

Question 5

This proved to be a challenging question. Many candidates did not appreciate that although the process of osmosis requires a partially permeable membrane, diffusion does not.

Question 7

While many candidates correctly identified the enzyme, some incorrectly identified the substrate as the enzyme.

Question 8

Some candidates selected the correct option. It was not appreciated by most candidates, that in the dark, both the snail and the aquatic plant will produce carbon dioxide.

Question 9

Some candidates were able to identify the guard cell but many were not.

Question 10

Many candidates were not aware that it is nitrates that are used in the production of proteins.

Question 12

Most candidates selected the correct option, but some thought that meat products are the main source of fibre in a human diet.

Question 14

Although many candidates answered this well, some candidates seemed unaware that hydrochloric acid kills bacteria.

Question 15

Only some candidates correctly identified the phloem in both the root and the leaf.

Question 17

Similar numbers of candidates chose each option, suggesting that the location of the coronary artery was not well known.

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Question 18

Although many candidates identified which blood vessel was an artery, a similar number opted for the blood vessel which transported 'oxygen from the lungs to the left atrium,' not appreciating that since this blood vessel is transporting blood towards one of the chambers of the heart, it must be a vein.

Question 19

Many candidates wrongly identified antibody production as a chemical barrier, although some correctly realised that it is the mucus lining in the airways that is the chemical barrier.

Question 21

Few candidates selected the correct option. There appeared to be some confusion regarding the differences between aerobic and anaerobic respiration in humans.

Question 22

While many candidates correctly identified where urea is produced in the body, they were uncertain about where it is broken down and therefore did not selected the correct option.

Question 23

Although many candidates correctly identified the retina as the light sensitive part of the eye, some opted for the iris.

Questions 24, 29 and 38

Candidates showed a good understanding of the topics covered in these questions, with the majority of candidates selecting the correct options.

Question 28

A few candidates demonstrated a secure knowledge of the structure of a flower.

Question 30

While many candidates selected the correct option, some thought that abstinence from sex is a barrier method of birth control.

Question 32

The majority of candidates seemed unclear about the functions of meiosis and mitosis.

Questions 33

This question required the interpretation of graphical data. While some candidates identified the correct option, many found it difficult to apply their knowledge of variation to the context used in this question.

Question 34

Many candidates were aware that cutting down large areas of forest increases the concentration of carbon dioxide in the atmosphere. A small number of candidates believed that it had the opposite effect.

Question 37

Most candidates answered well, although a few used the wrong curve (the prey curve) to answer the question.

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Question 39

Only a few candidates were aware that yeast is used in bread-making because produces carbon dioxide.

Question 40

Most candidates found it difficult to apply their knowledge to graphical data. The bacteria use up dissolved oxygen to digest the sewage and release mineral ions in the process. The sewage must enter the river before the oxygen begins to decline and the level of mineral ions in water begins to increase.

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BIOLOGY

Paper 0610/21
Multiple Choice (Extended)

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

General comments

The paper provided a balance of questions and sufficient challenge for candidates working at this level. There was a lack of clarity regarding the differences between osmosis and diffusion in some cases and what stem cells are. The effect of temperature on enzymes was not always clearly understood. Candidates showed a good understanding of DNA structure, the use of nitrates in plants, the role of vitamin D in the body, the development of cholera, the functions of teeth and the role of adrenaline.

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Comments on specific questions

Question 1, **2** and **4**

Candidates showed a good understanding of the topics covered in these questions, with the majority of candidates selecting the correct options.

Question 5

While the majority of candidates selected the correct option, some did not appreciate that although the process of osmosis requires a partially permeable membrane, diffusion does not.

Question 7

While many candidates understood that raising the temperature denatures enzymes, a common misconception was that enzymes can be killed by heat.

Question 8

While the majority of candidates selected the correct option, it was not appreciated by some candidates, that in the dark, both the snail and the aquatic plant will produce carbon dioxide.

Question 10, **12**, **13**, **16**, **19**, **20**, **21**, **23**, **26**, **33** and **36**

Candidates showed a good understanding of the topics covered in these questions, with the majority of candidates selecting the correct options.

Question 18

While many candidates correctly identified the cell as a phagocyte which carries out phagocytosis, some opted for antibody production.

Question 28

While most candidates answered this question well, some did not appreciate that both the zygote and the nose cells are diploid and therefore have the same number of chromosomes.

Question 32

There was some uncertainty as to what a stem cell was.

Question 34

Many candidates were uncertain about the definition of a population. Some candidates did not realise that the insects in a rainforest are going to be made up of different species and therefore many different populations.

Question 40

While many candidates answered correctly, some found it difficult to apply their knowledge to graphical data.

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BIOLOGY

Paper 0610/22
Multiple Choice (Extended)

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

General comments

The paper provided a good breadth of questions and provided sufficient challenge for candidates working at this level. Common misconceptions included the idea that breathing and respiration are the same and there was a lack of clarity regarding the number of cells produced by meiosis and what constitutes the genetic code. Some candidates found the interpretation of graphical data, as in **Question 40**, challenging. Candidates showed a good understanding of which cells in the body are diploid and which are haploid. They showed ability in interpreting information on the different levels of organisation and in carrying out co-dominant genetic crosses.

Comments on specific questions

Question 1

While most candidates gave the correct response, a large number believed that breathing is a characteristic of all living organisms.

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Question 2

This topic was well understood with the majority of candidates selecting the correct option

Question 3, 7 and 21

Candidates showed a good understanding of the topics covered in these questions, with the majority of candidates selecting the correct options.

Question 5

While the majority of candidates selected the correct option, some did not appreciate that although the process of osmosis requires a partially permeable membrane, diffusion does not.

Question 8

While the majority of candidates selected the correct option, it was not appreciated by some candidates, that in the dark, both the snail and the aquatic plant will produce carbon dioxide.

Question 9

Most candidates knew the structure of a leaf and were able to correctly identify the palisade mesophyll.

Question 10, 11 and 12

Candidates showed a good understanding of the topics covered in these questions, with the majority of candidates selecting the correct options.

Question 13

Most candidates correctly identified the tooth as a molar, whilst some candidates opted for premolar. This suggests that some candidates are uncertain about which way round the molars and premolars are arranged in the mouth.

Question 15

Many candidates knew the meaning of assimilation. Some were less clear as to the differences between digestion, absorption and assimilation.

Question 18

Many candidates were able to apply their knowledge to select the correct option, some found this more challenging. Careful reading of the information provided was essential in this question.

Questions 24

Many candidates selected the correct option, although some candidates opted for the distractor which gave the opposing action of the circular and radial muscles.

Question 25, 26 and 29

Candidates showed a good understanding of the topics covered in these questions, with the majority of candidates selecting the correct options.

Question 30

Many candidates understood that it is oestrogen that causes the effects described and selected the correct option. The most common wrong answer was progesterone.

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Question 31

Many candidates understood that it is lymphocytes that are destroyed in people who are HIV positive, although some opted for phagocytes.

Question 32

This proved to be challenging for some with few candidates showing a secure understanding of what the genetic code is.

Questions 33

Some candidates were able to select the correct option. Many were less secure in their understanding of cell division and thought that meiosis results two cells, each with 23 single chromosomes.

Question 34

This proved to be a challenging question for some candidates who were unsure of the characteristics of sex-linked conditions.

Question 37

Most candidates answered well, although a few used the wrong curve (the prey curve) to answer the question.

Question 40

Most candidates found it difficult to apply their knowledge to graphical data. The bacteria use up dissolved oxygen to digest the sewage and release mineral ions in the process. The sewage must enter the river before the oxygen begins to decline and the level of mineral ions in water begins to increase.

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BIOLOGY

Paper 0610/23
Multiple Choice (Extended)

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

General comments

The paper provided a balance of questions and sufficient challenge for candidates working at this level. Common misconceptions included the idea that breathing and respiration are the same and there was a lack of clarity regarding the differences between osmosis and diffusion in some cases. The interpretation of graphical data also proved to be challenging in some cases. Candidates showed a good understanding of photosynthesis, the effect of temperature on enzymes, the use of nitrate ions, the stages in the development of cholera, the meaning of phototropism and protein production.

Comments on specific questions

Question 1

While most candidates answered correctly, a large number believed that breathing is a characteristic of living organisms.

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Question 2

Many candidates opted for the correct response but some identified the structure as a cell wall instead of a membrane. Some candidates did not appreciate that having two adjacent cells would mean that two cell membranes are present.

Question 3

While many candidates realised that metabolism was associated with mitochondria, some candidates opted for ribosomes being present in large numbers in cells with high rates of metabolism, instead of mitochondria.

Question 4

While many candidates selected the correct option, some did not, suggesting a less secure knowledge of the levels of organisation in plants.

Question 5

This proved to be a challenging question. Many candidates did not appreciate that although the process of osmosis requires a partially permeable membrane, diffusion does not.

Question 8

Some candidates selected the correct option. It was not appreciated by most candidates, that in the dark, both the snail and the aquatic plant will produce carbon dioxide.

Question 9

While many candidates were able to recognise a guard cell, a similar number of candidates could not.

Question 13

The majority of candidates showed a good understanding of the functions of teeth.

Question 14

This question required the interpretation of graphical data. While some candidates identified the correct option, many found it difficult to apply their knowledge of enzymes to the context used in this question.

Question 15

While some candidates answered correctly, this proved to be a challenging question with many candidates unable to relate the structures of a villus to their functions.

Question 16

Only some candidates appreciated that amino acids move out of the leaves to the rest of the plant in the phloem.

Question 17

Many candidates were aware that the pulmonary vein carries oxygenated blood to the heart, although some were less certain of what is carried and in which direction.

Question 19

Many candidates were aware that an injection of antibodies will provide passive immunity against some pathogens. However, some candidates were less clear about the differences between passive and active immunity.

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Question 20

Although many candidates selected the correct option, some were unable to relate the pressure in the thorax to the actions of the internal and external intercostal muscles and that of the diaphragm.

Question 24

While many candidates selected the correct option, some thought that the light sensitive part of the eye is the iris.

Questions 25, 26, 35, 36 and 38

Candidates showed a good understanding of the topics covered in these questions, with the majority of candidates selecting the correct options.

Question 30

While many candidates answered well, some thought that inserting sperm into the vagina of a woman from a donor was *in vitro* fertilisation (IVF) rather than artificial insemination (AI).

Question 31

Many candidates were aware that it is the lymphocytes that are destroyed in people who are HIV positive, although some opted for phagocytes.

Question 34

While many candidates were aware that blood groups show discontinuous variation, some candidates thought that they show continuous variation.

Question 37

Most candidates answered well, although a few used the wrong curve (the prey curve) to answer the question.

Question 39

While many candidates knew that yeast is used in bread-making because produces carbon dioxide, some believed that it is used because it uses up oxygen or sugar, or because it produces alcohol.

Question 40

While some candidates identified the correct answer, many found it difficult to apply knowledge to graphical data.

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BIOLOGY

Paper 0610/31
Theory (Core)

Key messages

It is essential that candidates consider each question carefully before starting to write their answers. Candidates should ensure that they are answering the question asked.

General comments

There were some excellent scripts produced and the overall standard of expression was sound. There are some areas of the syllabus that candidates perennially find difficult and which need reinforcing. Some of these areas appeared in this paper: the link between energy and activity, the role of sweating, and the calculation of percentages.

Comments on specific questions

Question 1

(a) (i) Most identified the iris and the pupil correctly. A significant number of candidates knew these names but applied them to the wrong structures.

(b) (i) The reduction in pupil size was known by nearly all candidates. Many candidates also explained how the iris changed in order to produce this effect which although correct, was not required.

(b) (ii) A large number of candidates gave an incomplete answer as they did not state that the amount of light entering the eye would be reduced. Only the some candidates identified the retinal cells as the components that would be damaged by too much light.

Question 2

(a) This was well answered by nearly every candidate.

(b) Many candidates knew that hormones are transported round the body in the blood. Common misconceptions were that hormones travelled along the nerves or that they were transported by the red blood cells.

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Question 3

(a) This was answered well by the majority of candidates, although a few omitted the units from their data references.

(b) Most candidates could name two other organs in the body that were not shown on the graph. The most common error made was to state a component of the alimentary canal as one of the organs.

(c) (i) The correct calculation of a percentage change proved challenging for many candidates. It is a skill that needs to be emphasised.

(c) (ii) Many responses mistakenly gave the products of respiration rather than the reactants, which suggested that the question has been misread in some cases.

(c) (iii) The best responses explained why the heart muscle needed an increased blood flow during exercise. Less confident responses had difficulty in making the link between increased cardiac activity and the need for more energy to support this.

(d) (i) The majority of candidates identified that the correct trend in blood flow. Relatively few candidates quoted figures from the graphs in support of their answers. A significant number of candidates included information in **(d)(i)** that was required in parts **(ii)** and **(iii)** and then left these last two parts blank. It must be noted that credit for correct information can only be given when it is written in the required section.

(d) (ii) Some found it challenging to express their ideas clearly.

(d) (iii) There was one mark allotted to the answer to part **(ii)** and three marks allotted to the answer for part **(iii)**. Candidates did not appear to appreciate that their answer to part **(iii)** needed to contain more information than that for part **(ii)**. Overall, this proved to be a challenging question. A general misconception was that the skin needed more blood flow as it needed more water in order to produce more sweat. The fact that sweating was connected with reduction in body temperature was not well understood by many.

Question 4

Some candidates showed a secure knowledge of this topic and provided accurate answers. Others were less confident in their understanding. The most known fact was that yeast produces alcohol when it respires anaerobically.

Question 5

(a) Most candidates could select an adaptive feature for each animal and explain how it helped the animal survive. The most frequent error was to select features that were not visible in the diagrams.

(b) Most candidates showed a good understanding of natural selection and provided the correct sequence for the order of statements.

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Question 6

(a) (i) Most candidates produced accurate responses.

(a) (ii) This was a more demanding question and was challenging for some candidates. A few gave information about the cause of the differences which did not answer the question.

(b) Many candidates did not make the connection between bacteria and infections. The fact that the bacteria are trapped by the mucus and that the mucus is normally moved by the cilia was not well understood. This area of the syllabus needs to be reinforced.

(c) Most candidates could state two harmful components of tobacco smoke.

Question 7

Candidates of all abilities knew how to use a key. The most common error was to transpose specimens **J** and **K**, but the majority correctly identified the other four specimens. Only a few candidates appeared to have no knowledge of how to use a key for identification.

Question 8

(a) It should be noted that when definitions are asked for, the syllabus definition is taken as the standard. Relatively few responses gave definitions that covered the three points stated in the syllabus. Many responses defined mechanical digestion, whilst others described ingestion, digestion, absorption and egestion.

(b) This question was answered accurately by candidates of all abilities.

(c) Many candidates could state a function of the liver, but fewer could state a function of the small intestine.

(d) This question was well answered by some candidates. However, there were many responses that only referred to mechanical digestion, digestion of carbohydrates and fats or gave only descriptions of the properties of enzymes in general. A common misconception was that proteins are digested with the sole purpose of producing urea.

(e) The treatment of cholera was not well understood by many. Common misconceptions for the treatment of cholera included drinking less water, eating more fibre and taking more vitamin tablets.

Question 9

(a) (i) The majority of candidates were able to identify the epidermis, but the palisade mesophyll layer was frequently identified as the spongy mesophyll, or just mesophyll which was too ambiguous.

(a) (ii) Some candidates knew that the epidermal cells were transparent so that light could pass through them.

(b) (i) Many candidates were able to identify the structure **Z**.

(b) (ii) This question proved to be challenging for many candidates, although some were able to identify the correct process.

(b) (iii) This question was well answered by the majority of candidates.

(c) (i) The majority of candidates could state the products of photosynthesis.

(c) (ii) Many candidates knew that the green pigment was called chlorophyll. Some could not differentiate between chlorophyll and a chloroplast.

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BIOLOGY

Paper 0610/32
Theory (Core)

Key messages

It is essential that candidates consider each question carefully before starting to write their answers. Candidates should ensure that they are answering the question asked.

General comments

Some excellent scripts were seen.

Comments on specific questions

Question 1

Most candidates were able to use the key to correctly identify the leaves.

Question 2

(a) While most candidates were familiar with ingestion and mechanical digestion, fewer were able to correctly identify where protease is produced or where nutrients are absorbed.

(b)(i) Most candidates were able to define what an enzyme is.

(ii) Nearly all candidates could recall one product of fat digestion, fewer knew the second product.

(iii) Careful reading of the question was required as many candidates gave components of fats rather than the required elements.

(iv) Most candidates were able to identify the foods that are good sources of dietary fat.

(v) A good understanding of diet was shown by the majority of candidates.

(vi) Most candidates were able to give one use of fat in the body.

Question 3

(a) A good understanding of hormones and the glands producing them was shown.

(b) While most candidates understood that insulin is used to control glucose, fewer were able to explain its role in reducing blood glucose concentration.

(c) All parts of this question were well-answered by the majority of candidates.

(d)(i) Many candidates described how adrenaline makes a person feel, rather than how it affects the body.

(ii) The majority of candidates selected the correct activities.

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Question 4

(b) (ii) The majority of candidates were able to provide two correct responses. A common error was to state two reactants.

(iii) Many good responses were seen. Errors include giving uses of oxygen rather than uses of energy.

(c) Most candidates were able to give a suitable difference.

(d) This was well-answered by the majority of candidates.

Question 5

Some candidates found this question challenging.

(a) Some candidates were able to label the diagram correctly, others found this more challenging.

(b) Many candidates were able to describe two structural differences. Some candidates misread the question and gave differences in the functions of the blood vessels.

(c) Generally, a good understanding of the functions of the components of blood was shown.

Question 6

(a) The majority of candidates were able to answer with a tropism; fewer were able to say which one was involved.

(b) An excellent understanding of the conditions required for germination enabled most candidates to provide detailed and correct responses.

(c) (i) Very few candidates were able to give the immediate function of nitrate and magnesium ions, although most understood the requirement for growth and photosynthesis.

(ii) An excellent understanding of the absorption of ions was shown. A few candidates gave responses that explained where the ions travelled once inside the plant rather than how they entered the plant, which was not required.

Question 7

(a) An excellent understanding of adaptations was shown, with most candidates limiting answers to visible adaptations, as expected.

(b) Candidates found this question challenging and many were unable to describe the process of natural selection. Although there was some were able to explain that some animals would live and some would die, the link to adaptations was not made. A common error was to give a description of selective breeding rather than natural selection.

(c) Overall the majority of candidates provided good responses. For a minority of candidates, there was some confusion over the word 'endangered', with some descriptions of why polar bears are dangerous being given rather than why they are an endangered species.

Question 8

(a) Careful reading was required here. While all candidates could correctly read from the bar chart, some did not reference gender in their responses to both parts of this question.

(b) Candidates showed a very good understanding of the risks of smoking, but could not always distinguish which component caused which effect.

(c) Many candidates gave more effects of smoking, while the question asked for risk factors for coronary heart disease, other than smoking.

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BIOLOGY

Paper 0610/33
Theory (Core)

Key Messages

Candidates should ensure that they understand the type of response required for command words such as state, describe and explain.

General Comments

A good level of knowledge and understanding was seen for many syllabus topics.

Learning the definitions of key terms remains an important skill.

Comments on Specific Questions

Question 1

(a) (i) The majority of candidates were able to name the correct process.

(ii) Many candidates found completing the word equation for photosynthesis challenging. A common error was to give the word equation for respiration.

(iii) Some candidates found this question challenging. Some responses provided specific adaptations such as having a large surface area; others lacked detail, for example, stating that leaves were big which was insufficient.

(b) (i) Most candidates were able to use the key successfully.

(ii) Many candidates were able to produce a suitable sentence for the key. A common error was to create a question which gave the answer the wrong way round, e.g. they asked a question to which the answer was yes for leaf *Fraxinus excelsior.*

Question 2

(a) (i) This was well answered by the majority of candidates.

(ii) While many candidates gave the correct response, some found this challenging.

(iii) Many candidates were able to give suitable responses for this question.

(b) (i) Few responses correctly identified the coronary artery.

(ii) There are many factors that can increase the risk of developing a blockage and most candidates provided good examples.

(iii) A common error was to give the name of a specific blood vessel, such as those quoted in question **2(b)(i),** rather than the particular type of blood vessel.

(c) (i) Some candidates were able to identify the structure correctly.

(ii) While some candidates were able to state the function of valves many found this question challenging.

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(iii) A few candidates were able to name the structure.

Question 3

This proved to be a challenging question for some candidates.

(a) (i) Some candidates were able to name the group correctly.

(ii) Few candidates knew the sources of all three hormones.

(iii) Some candidates were able to identify the relevant glands.

(iv) Some candidates were able to state the functions of both hormones.

(b) Some candidates were able to provide two effects.

Question 4

(a)(i) Some candidates could recall the definition specified in the syllabus.

(b) (i) and (ii) Many candidates found this challenging. A few could recall the enzyme involved and the product of starch digestion.

(c) (i) The majority of candidates correctly identified the structures. A common wrong answer was **E**.

(ii) Some candidates correctly identified the structure. A common misconception was that absorption of food molecules occurs in the large intestine.

(d) While some candidates gave correct responses. A number of responses did not answer the question asked and instead provided a description of ingestion. A common error was to state enzymes that are not active in the stomach.

Question 5

Many candidates were able to extract information and use graphical data accurately and this question was answered well by the majority of candidates.

(a) (i) The majority of candidates were able to accurately extract data from the graph.

(ii) The majority of candidates were able to calculate the time correctly.

(iii) This was well-answered by the most candidates.

(b) (i) Many candidates were able to recall part of the definition. Some responses were also able to make the link between the breakdown of nutrients and the release of energy.

(ii) While many were able to state a useful product. Many stated alcohol which was in the question and was therefore not accepted.

(iii) Some candidates were able to give two differences.

Question 6

(a) (i) While some candidates gave a correct response many responses did not answer the question and it was possible that some had not read the introductory sentence that described the conditions in which the plant had been grown, i.e. in the dark.

(b) (i) This proved challenging for many candidates, a few were able to give the correct stimulus.

(ii) Some candidates knew the correct response.

(c) (i) Again some candidates knew the correct response.

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(ii) While some candidates were able to provide a good response to this question, many found it challenging. A common error was to repeat the description given in the question and to omit the explanation as to why the shoots bent towards the light.

Question 7

(a) It was pleasing to see that many candidates answered this question well.

(b) Candidates found this question challenging. A few candidates were able to successfully describe the stages involved in selective breeding. The best responses realised that sexual reproduction would be used in selective breeding, asexual reproduction. Some responses were less successful in applying their knowledge to a novel context.

(c) This question proved to be challenging for most candidates. A few responses gave valid examples and successfully explained what genetic engineering is.

(d) The majority of candidates were able to give suitable examples.

Question 8

(a) (i) Some candidates were able to put all of the statements into the correct sequence in the flow chart. Many found this challenging.

(ii) A few candidates were able to state how new alleles are formed.

(iii) A few candidates knew a factor that increases the rate of new allele formation.

(b) (i) The majority of candidates were able to define the term successfully.

(ii) Many candidates were able to give two visible features. A common error was to give features that were not visible in Fig. 8.1.

(iii) Many were able to give features of mammals that are not visible. A common error was to give a feature that is common to all vertebrates rather than just mammals.

Question 9

(a) This question was answered well by nearly all candidates.

(b) (i) Many candidates gave correct structural differences. A common error was to give differences in function rather than structure.

(ii) Nearly all candidates knew the purpose of a blood clot.

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BIOLOGY

Paper 0610/41
Theory (Extended)

Key Messages

Candidates who find that they do not have enough space to complete their responses should always indicate clearly where they have continued their responses.

Candidates should always read the stimulus material provided for each question very carefully. They should also know how to respond to the different command words, particularly describe, explain and suggest.

Candidates should use the mark allocation to help them plan their answers.

The syllabus includes definitions of key biological terms, such as gene and population, learning definitions is an important skill.

General Comments

Some questions required careful use of terminology. For example, in **Question 1** many candidates wrote about the supply of oxygen and nutrients "to the heart" rather than to heart muscle. Often their descriptions of coronary arteries were not clear enough for this reason.

Some candidates analysed the data provided in **Questions 5** and **6** very well. They had obviously read the introductory text and spent some time looking critically at the tables of data. Their answers were lucid and well-illustrated with comparative data.

Comments on Specific Questions

Question 1

(a) Most candidates gave two or three correct responses to this question on the role of fat in the body. Common errors were "fat is used to produce energy" and "fat is a store of carbohydrate".

(b) (i) Almost all candidates identified the correct enzyme. The most common incorrect response was amylase.

(ii) Many listed the correct products. Some gave either glycerol or fatty acids but not both. A common incorrect response was amino acids. Glucose and glycogen were occasionally given instead of glycerol.

(iii) The majority of candidates gave the correct response.

(iv) The majority of candidates gave the correct response.

(c) Most responses used the term emulsification correctly and explained what it meant. Some candidates wrote about the action of lipase in chemical digestion. A common error was to give a description of chemical digestion or ingestion. Some wrote about other things that happen in the duodenum, such as peristalsis or the production of pancreatic juice.

(d) Some candidates wrote only about the absorption of fat into the blood system. Good responses described the movement of fat into lacteals in the villi and movement into the lymphatic system.

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Less well-executed responses did not refer to absorption and transport in blood or lymph, but instead described the movement of gut contents further down the alimentary canal by peristalsis. Some wrote about the absorption of fat by active transport, which is incorrect. The method of absorption was not required.

(e) Many candidates described the accumulation of fat in the arteries and described the consequences. Some incorrectly stated that fat accumulates in "blood vessels" or in veins or in capillaries. Many wrote their answers in the context of the coronary arteries as anticipated. There was some confusion as to where fat is deposited with some stating that it accumulates in the lumen rather than in the wall. Some also stated that it "forms around the arteries" which is not correct. A few candidates gave answers about what accumulates in the arteries, referring to plaque, cholesterol, fatty acids, and so on, while others did not make it sufficiently clear in their explanations that it is heart muscle that is starved of blood, rather than the whole heart.

(f) There were many extremely detailed responses describing the treatment of coronary heart disease. Descriptions of the surgical methods were often described in some detail. The procedure for inserting stents and details of angioplasty were often confused with each other. Many candidates referred to the use of drugs such as aspirin. Some candidates wrote at some length about lifestyle changes but did not cover the marking points expected.

Question 2

(a) Many candidates gave the definition of a gene from the syllabus. A common error was to refer to amino acids coding for proteins rather than DNA. Some referred to strands of DNA, which was not accepted as that term is used to describe a single polynucleotide of DNA that extends for the whole length of a chromosome.

(b) This question on antibodies revealed many misconceptions. Examples were:

antibodies are cells
antibodies have enzymes that break down the pathogens
antibodies make memory cells
antibodies carry out phagocytosis
antibodies are antigens or carry antigens or have antigens
antibodies are antigens that destroy pathogens.

It was evident that some thought that antibodies are phagocytes.

Many candidates described the correct relationship between antigens and pathogens and many also knew that pathogens are covered in antigens. There were good descriptions of antibodies binding to antigens, although some candidates referred to them being the same shape as antigens rather than being a complementary shape. Antibodies were also described as marking pathogens for phagocytes and killing pathogens directly. Some candidates wrote about the roles of lymphocytes rather than the roles of antibodies. Some candidates wrote about roles of antibiotics rather than antibodies.

(c) Few candidates identified all four structures correctly in **Table 2.1**. Most could identify the nucleus. The most common error was identifying cytoplasm rather than vesicles as being responsible for the transport of antibody molecules for release into the blood. "Bubbles" was also a relatively common incorrect substitute for vesicles. Many candidates gave structures that are not found within animal cells, such as stomata, plasmids, red blood cells, white blood cells, lymph vessels and capillaries. Others referred to molecules such as proteins and fats. Many candidates knew the appropriate letters, but not the names of the cellular structures.

(d) Most candidates gave phagocyte. Incorrect responses included white blood cell, which is not a specific enough. Some response lacked sufficient detail when describing the role. For example, 'attacks' or 'eats'. Candidates should use the appropriate scientific terminology.

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Question 3

(a) Many were able to correctly define the term drug. The idea that the drug must be taken into the body was not really appreciated, although the effect on a chemical reaction of some kind was relatively well known. Many candidates wrote only about illegal or harmful drugs forgetting that many drugs are medicinal. Others wrote only about medicinal drugs without realising that there are many non-medicinal drugs. There were many descriptions of the effects of specific drugs and the problems with addiction. These were not appropriate answers to this question.

(b) A number of candidates wrote detailed descriptions of the transmission of an impulse across a synapse. They referred to the role of synaptic vesicles, neurotransmitters and receptors often referring to pre-synaptic and post-synaptic membranes in their responses. Some candidates stated that a nerve impulse stimulates the vesicles to produce neurotransmitters rather than to release them. Candidates often said that there are receptors for neurotransmitters they also needed to state that the neurotransmitters bind to these receptors. Many referred to the components of a reflex arc, but omitted detail about synapses between neurones.

(c) Many good responses were seen for this question. These answers referred to vesicles at the end of the pre-synaptic neurone and receptors only on the post-synaptic neurone. Some responses stated that synapses are like valves without giving the required detail. Many stated that the one-way flow is caused solely by a diffusion gradient and did not refer to vesicles or receptors. Many referred to the shape of the synapse or the small size of the gap without any further detail.

(d) Some candidates stated that heroin is metabolised into morphine and also that heroin or morphine stimulates the release of dopamine in the brain. Others used the information given in the stem of the question to suggest how heroin may interfere with the transmission of impulses across the synapse shown in **Fig. 3.1**. There were a few excellent answers that referred to endorphins and the role of heroin or morphine in pain relief. Many gave lengthy descriptions of the harm heroin causes to the user and sometimes their society, which did not answer the question.

(e) The majority of candidates were able to name stimuli other than pain. Light, temperature (often written as hot and cold), sound and chemicals were the most common. Candidates need to know what is meant by the term stimulus and not confuse it with the senses, such as sight and hearing.

Question 4

(a) Many candidates gave good definitions of the term. Common errors were to give only part of the marking point.

(b) Many candidates identified **D** as the blood vessel with the highest blood pressure. **C** and **A** were common errors. A small number of candidates wrote the name of a vessel rather than indicating a letter as requested in the question.

(c) Many correct features of gas exchange systems were identified with most stating a large surface area and a thin wall. Some candidates named gas exchange systems or explained what is meant by gas exchange. Some chose inappropriate structures that contribute to a large surface area; for example, villi and microvilli. A number of the scripts described the direction of gas exchange rather than features of the surfaces.

Question 5

(a) (i) Almost all candidates stated that the genus of the quiver trees correctly.

(a) (ii) There were many very thorough correct responses. It was sometimes unclear as to whether candidates considered a population to consist of members of one or more than one species. Others did not make it clear that the population consists of more than one individual.

(b) Many candidates used the information in the question to suggest why the quiver trees are endangered. They referred to different aspects of the harsh environment even though that is their natural habitat. Better responses referred to deforestation, climate change, changes in land use, the presence of invasive animals and plants and plant hunters. Many missed the key element of change in the environment. Many described animals eating them or referred to diseases, without

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emphasis on an increase in the number of predators or the arrival of a new disease or strain of a disease.

(c) The risks to plant species of having a small population were discussed well by some candidates. They referred to little variation, the difficulty of successful reproduction by cross-pollination and the likelihood of extinction. Many candidates wrote about the consequences for the ecosystem of the extinction of a plant species. For example, they discussed the effects on food chains and food webs and the decrease in biodiversity.

(d) (i) A common error seen was 56%, derived by calculating 5 as a percentage of 9. Many did not round to the nearest whole number.

(d) (ii) Many candidates referred correctly to the decrease in the population with time. There was often a correct comparative data quote involving loss of trees from site A. Candidates also recognised that site D had the highest mortality rate. Many candidates understood that the photos had been taken at different times and that the final survey had occurred in 2004. Good responses also quoted figures from the table to illustrate their points. They also stated that while site D had the highest mortality it had lost the fewest trees. A common error was to think that the same site had been surveyed many times (1937, 1953, 1985 and in 2001) and hence draw the conclusion that the number of trees had actually increased between the final two surveys.

Question 6

(a) Many candidates stated that the investigation was a "fair test" or would produce accurate or precise and / or reliable results. These responses lacked sufficient detail. Good responses recognised that using genetically identical plants standardises a variable – the variation between plants. This ensures that any differences in the results are due to environmental factors, such as the mineral deficiencies. Candidates expressed this idea in a variety of ways. A few also stated that comparisons can be made between the groups or even that these comparisons would be valid.

(b) Careful reading of the information in the question was essential. Many answered this question as if it was asking for factors that affect *all* seedlings not the seedlings in the investigation. As a result, many gave water as one of the three environmental factors that could affect the growth of the seedlings even though **Fig. 6.1** shows the roots immersed in water. Many referred to aspects of soil, such as pH. The common correct factors were light (often qualified by intensity), temperature and the concentrations of oxygen and carbon dioxide in the air.

(c) Good responses compared the growth of the seedlings in group 2 with group 1 and compare the mean masses as evidence for their comparisons. Common omissions included not taking into account the difference in the number of plants in the two groups. Some concluded a lack of nitrate ions was somehow responsible for the greater number of plants. Many candidates thought that the numbers in **Table 6.1** referred to the numbers of leaves and roots, rather than to dry mass in milligrams. Most candidates who quoted figures did give units. Some candidates compared group 3 and 4 with groups 1 and 2. Many candidates stated that plants use nitrate ions to make amino acids and then use those to make proteins. They then continued by stating that proteins are needed for growth or gave a specific use of proteins by referring to enzymes. Quite a few candidates stated that nitrate ions are used directly for growth.

(d) Many candidates recalled that magnesium is needed to make chlorophyll. Alternative answers were given in terms of the data in **Table 6.1** which did not answer the question. Some candidates did not differentiate between chloroplasts and chlorophyll.

(e) Candidates found it challenging to apply the information about phosphate ions and DNA to the level of growth shown by the plants in group 4. Many did not make the connection that a deficiency of phosphate ions would mean that DNA would not be made, despite the information being provided in the question. They therefore did not extend their response to explain the effects of a lack of DNA, such as lack of cell division, protein synthesis and growth.

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BIOLOGY

Paper 0610/42
Theory (Extended)

Key Messages

Candidates who find that they do not have enough space to complete their responses should always indicate clearly where they have continued their responses.

Candidates should always read the stimulus material provided for each question very carefully. They should also know how to respond to the different command words, particularly describe, explain and suggest.

The syllabus includes definitions of key biological terms, such as gene and population, learning definitions is an important skill.

General Comments

A relatively common error was not including units with quoted data or not including relevant data from the question. Candidates should be reminded of the importance of using data in their responses.

Comments on Specific Questions

Question 1

(a) (i) Almost all candidates knew that yeast is the organism that makes bread rise. A common error was to think yeast is a bacterium or that bacteria make bread rise.

(ii) Slightly fewer candidates knew that respiration was the process that creates the gas bubbles that cause bread to rise. A number of responses gave carbon dioxide or bicarbonate as the answer.

(b) (i) Candidates gave many suitable examples of natural disasters with the most common being “drought” and “flooding” but there were a number of unqualified “natural disasters” which was insufficient. Common incorrect suggestions were tornadoes and storms because these are very localised events that do not cause widespread crop damage. “Famine” was also seen fairly regularly, suggesting that some candidates did not know that this word means food shortage, but it is a consequence of natural disasters. Several responses referred to causes of food shortages that were not natural events, but man-made ones or even simply stated “the increasing human population”. Candidates should be guided by the stimulus material to draw on their knowledge of the syllabus.

(ii) Although most candidates knew that the increasing human population has meant that land for farming is limited and that there is an increased demand for food, it was less common to see responses that extended beyond these points. The best responses gave a number of different reasons rather elaborating on a single reason. A few responses suggested that greenhouse gases might be involved but the link to global warming and the impact on crops lacked sufficient detail to meet the requirements of the marking point.

(c) Although there was a photograph to provide an example of a monoculture, it seemed that this term was unfamiliar to some candidates. Many responses started with a definition of monoculture which was not required. The most common impact described was the depletion of nutrients from the soil. Many responses also included reference to monocultures reducing biodiversity and destroying habitats. Good responses were able to link the fact that the plants were all genetically similar to their consequent vulnerability to disease. Some responses discussed the effects of pesticides, herbicides and fertilisers on crop production rather than on their impact on the environment. Other responses stated that an advantage was increased photosynthesis leading to a reduction in global warming. This was a misconception as all crop plants photosynthesise and it is not a feature of monocultures.

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Many natural forests are reported to absorb much more carbon dioxide than monocultures and have an effect on atmospheric carbon dioxide concentrations. Some responses focussed on the non-environmental effects such as a decrease in food shortages and the high profit from selling crops grown in monocultures.

Question 2

(a) The definition of a gene was known by many candidates. A common error was to make reference to a "strand" of DNA rather than a "piece" of DNA. This was not accepted because "strand" often implies the entire length of a chromosome rather than a smaller section of DNA. Many responses stated that a gene codes for a characteristic or a trait, rather than stating that a gene codes for a protein.

(b) Good responses gave detailed and accurate descriptions of protein synthesis. Common errors seen included referring to the DNA sequence as being composed of a sequence of amino acids rather bases and incorrect reference to the terms transcription and translation, details of which are not required by the syllabus. A common omission was to refer simply to RNA rather than to mRNA. Many candidates also suggested that mRNA enters the nucleus to copy the gene instead of mRNA being synthesised from DNA in the nucleus. Very few responses mentioned the use of energy in protein synthesis.

(c) (i) Almost all candidates knew that active transport is the process used to move mineral ions into root hair cells. It was rare to see incorrect suggestions such as osmosis and diffusion.

(ii) Fewer candidates were able to describe accurately how proteins in cell membranes are involved in moving ions into a cell. A common misconception was to refer to the proteins, rather than the ions, moving across the membrane. A few responses stated incorrectly that the protein molecules provide energy rather than use energy to move the ions. Many responses gave a definition of active transport without referring to the role of protein. Some were unclear when using the term concentration gradient, for example, stating that movement of ions *against* a concentration gradient was from a region of high concentration to a region of low concentration. Alternatively, the converse was stated i.e. movement of ions *down* a concentration gradient was from a region of low concentration to a region of high concentration. The xylem was sometimes mentioned as transporting ions.

(d) Many correct examples of the proteins that are found in the blood were given. Common wrong examples included amino acids, urea or plasma. The names of familiar digestive enzymes from the human nutrition topic were frequently seen. This suggests that might some candidates thought that digestive enzymes are found in blood as well as in the alimentary canal.

Question 3

(a) Many candidates knew that neurones conduct electrical impulses. A common misconception was that "pacemaker" cells conduct electrical impulses to the heart.

(b) (i) Many candidates found it challenging to apply their knowledge of the action of the heart valves, particularly when completing the final row of the table. A significant number of candidates did not know that the atrioventricular and semilunar valves would not both be open or closed at the same time. Others used the words "contract" and "relax", confusing the action of the valves with those of muscles.

(ii) Almost all candidates knew that the valves prevent backflow. A small minority described the role of the septum in preventing the mixing of oxygenated and deoxygenated blood.

(c) (i) This question required candidates to use an ECG trace to calculate the heart rate. This proved to be challenging for some candidates. This highlighted the importance of showing how an answer is derived. Many determined 1 or 0.8 as the number of beats in a second, but did not multiply this number by 60 to convert to beats per minute. Responses using either of two approaches were accepted:

estimate the average number of beats per minute, or
determine the length of one complete heart beat.

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(ii) Many more candidates successfully described differences. Some responses lacked sufficient detail and did not make use of the information provided in the question. Some responses offered an explanation when the question asked for a description. Some responses described what would happen *after* exercise, rather than the required comparison *before* and *during* exercise.

(iii) A large proportion of the candidates described the effect of exercise on breathing in sufficient detail. The most common response was to describe the faster rate of breathing. An increase in the volume of air breathed in was seen less often. However, many responses were rather general and referred to an increase in ventilation without further clarification. Many gave descriptions of gas exchange and blood flow and linked this to the respiring muscles needing more oxygen, or gave descriptions of the process of ventilation of the lungs; this was not required by the question. It seemed that some thought that the terms ventilation and gas exchange were synonymous.

Question 4

(a) Many candidates were familiar with the term *balanced diet*, however, some were did not explain what was meant in sufficient detail. Some responses described different "healthy" foods, rather than nutrients. References to food pyramids often lacked enough scientific detail.

(b) It was evident that many candidates were familiar with the symptoms of marasmus. Less well-executed responses gave descriptions of low body weight rather than giving different symptoms. Some listed other deficiency diseases, such as rickets, and described these symptoms. Some responses gave symptoms of kwashiorkor. A small minority appeared to have extracted data from the next question to explain symptoms, consequently describing a short-term condition leading to obesity.

(c) Many excellent responses were seen with candidates able to link the data provided with suitable explanations. Many realised the relevance of the information in the data table and were able to describe the role of the specific nutrients in the body. Unfortunately, some quoted data without making comparisons, such as quoting the percentages of each nutrient in fortified milk without making any links to the same nutrient in cow's milk. The best responses included both an analysis of data in the table as well as an analysis of data from the graph. Errors included the omission of units when quoting data or misreading of values from the graph.

(d) Many candidates were familiar with the role of bile in fat digestion. The most common error was the mention of emulsification being the breakdown of fats into smaller molecules. This statement implies that bile is responsible for chemical digestion. Candidates should state that by bile breaks down larger droplets into smaller droplets, an example of mechanical (or physical) digestion not chemical digestion in which bonds are broken. There was some evidence of confusion over the source of the lipase, with candidates describing it as a component of bile.

Question 5

(a) Eutrophication was the most common incorrect example that was described in this question. Of those candidates who described acid rain, many stated that as the acidity increases so does the pH. Some responses included descriptions of the effects on crops and other land-based ecosystems rather than focusing on freshwater ecosystems as the question required. Good responses made reference to specific examples to illustrate the effects of pollutants on plants, animals and other organisms. Suitable examples in this question were fish.

(b) (i) Most candidates realised that the students used sulfuric acid in their investigation because sulfur dioxide is the most common pollutant that causes acid rain. A common error was to refer to sulfur rather than sulfur dioxide.

(ii) Almost all candidates described a suitable technique to measure pH. A few referred to using a "pH scale" without further clarification.

(iii) Although many candidates knew the conditions required for seed germination, many common misconceptions were seen. The most common of these was that seeds need light to germinate. Knowledge of the requirement for light to break the dormancy of some seeds, including pine seeds, is beyond the scope of the syllabus. Correct references were accepted but needed to be explicitly stated.

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(c) (i) The best responses were able to suggest why germinating seeds increase in temperature, linking it with the huge increase in the rate of respiration associated with germination. A common error was to incorrectly describe the effect rather than the cause of a rise in temperature.

(ii) Many candidates provided a correct description. Some wrote about "killing enzymes" or "denaturing seeds" suggesting that they had confused these biological terms.

(iii) Many candidates were able to describe the table of results from the seed germination experiment. In a few responses data from the table was just quoted rather than described which was insufficient. Many responses were able to identifying the relationship, but did not quote data or in many cases did not include the units with the data. Candidates should also be reminded that small differences (of less than 1 °C) over a range of more than 25 °C are insignificant and that these extremely small variations are more likely to suggest a levelling off rather than any meaningful fluctuations.

(d) Candidates who understood how to identify data points that do not match the expected pattern were able to identify Petri dish 2. A significant number selected Petri dish 3. This suggested that many candidates only looked at the single data set in **Table 5.2** and did not refer back to **Table 5.1** to observe whether there was concordance in the trends.

Question 6

(a) (i) Some found this question challenging. Most candidates gave cell membrane and cytoplasm. The most common incorrect response was nucleus.

(ii) A full range of the structural features that differ between white blood cells and prokaryotes were given. Many incorrectly referred to prokaryotic cells being unicellular and lymphocytes being multicellular. A common misconception was that white blood cells have ribosomes but prokaryotes do not. Many candidates did not mention that in addition to the loop of DNA, prokaryotes also have additional DNA molecules called plasmids. Some response just gave a description of the diagram rather than applying their knowledge of classification.

(b) Many candidates used the passage and flow diagram to identify the missing key terms. Occasionally the term **V** was incorrectly given as "antibiotics" rather than "antibodies". It was pleasing to see that the majority of candidates could spell mitosis correctly. Being unable to identify the antigens was the most common error.

(c) (i) Phagocytosis was the process that many candidates recognised from the photograph in **Fig. 6.2**. A common error was to describe rather than name the process.

(ii) Some very good descriptions of phagocytosis were given. Candidates should be encouraged to use the correct biological terms in their responses, for example, 'engulf' rather than 'eat'. Some candidates confused the mode of action of phagocytes with that of lymphocytes.

(d) (i) Most candidates were able to identify the teeth as incisors. The most common incorrect response was molars.

(ii) Some very detailed descriptions of how bacteria cause tooth decay were given. However, a significant number of responses referred to bacteria digesting the enamel. Responses needed to focus on how bacteria dissolve enamel, rather than the detailed dissolving pathway after the enamel layer is damaged. Some mentioned food left on the teeth, but did not specify that it is sugar that is relevant in this context.

(e) Almost all candidates were able to describe methods of preventing tooth decay. A common omission was to mention that cleaning teeth should occur, but not add that this should occur regularly.

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BIOLOGY

Paper 0610/43
Theory (Extended)

Key Messages

Candidates who find that they do not have enough space to complete their responses should always indicate clearly where they have continued their responses.

Candidates should always read the stimulus material provided for each question very carefully. They should also know how to respond to the different command words, particularly describe, explain and suggest. It was evident that not all were of confident of the differences in meaning, particularly in questions **2 (d)(ii)** and **(iii)**.

Responses need to be precise. In question **2 (d)(i)** some wrote about concentration but did not specify that it was the concentration of the substrate. Similarly in question **4(a)** reference was made to eggs rather than hard-shelled eggs.

The syllabus includes definitions of key biological terms, such as gene and population, learning definitions is an important skill.

Candidates should always show the working in their calculations. Marks may be available for correct working if the final answer is incorrect expressed, for example omitting to round a value to the nearest whole number.

General Comments

A relatively common error was not including units with quoted data or not including relevant data from the question. Candidates should be reminded of the importance of using data in their responses.

Comments on Specific Questions

Question 1

(a) (i) Almost all candidates drew an arrow on the correct side of the heart; however, many did not use an arrow showing the complete path from vein to ventricle and some continued their arrow past the ventricle into the artery. Some also annotated the diagram of the heart to help them with the subsequent questions. This showed good use of the source material.

(ii) Many knew both the location and the name of the blood vessel that carries blood at highest pressure. Many knew that it was blood vessel **C**, but were not able to recall the name of the blood vessel. The most common incorrect responses were **D** and the vena cava.

(b) (i) This was a challenging question because candidates were required to think about what *causes* the closing mechanism, not the *function* of the valves. Candidates who did attempt to discuss the mechanism often described what caused the valve to open rather than close.

(ii) The function of the heart valves was well known. The most common error was to suggest that the valves prevented the mixing of oxygenated and deoxygenated blood. Some candidates wrote about this in **(b)(i)**.

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(c) The majority of candidates were able to describe the correct pathway. More candidates could have used the labels on the diagram to help them. Many identified the pulmonary artery, but very few used the term semilunar valve in their answers. Those that did sometimes confused the semilunar valve with the atrioventricular valve. Similarly, a high proportion of the candidates reversed the terms ventricles and atria. Very few described pressure changes in the heart. Some candidates extended their responses to describe what happens after the blood reaches the lung even though this was not required by the question.

(d) Many candidates either identified the structure as the septum or stated its function, but surprisingly few candidates did both. Many gave other scientific terms that begin with an "s" such as sternum, steroid and stent. A common misconception was to suggest that the septum is used to push blood through the heart.

Question 2

(a) Most candidates gave a common feature of dicotyledonous plants. The most common correct response referred to the idea that they have branched leaf venation and two cotyledons in their seeds. The most common errors were to give the wrong number flower parts or to suggest that the plant, rather than the flower, was found in multiples of four or five. Other candidates incorrectly gave features of monocotyledonous plants.

(b) (i) Some excellent definitions of the term *gene* were seen but many seem to draw on their general knowledge rather than the syllabus definition. For example, candidates often discussed the coding of a "trait" or "characteristic" rather than a protein. Some used the terms DNA and protein interchangeably suggesting that they were not confident about the difference between these molecules.

(ii) Almost all candidates gave one difference in the structure of the two proteins in the diagrams, but fewer gave two differences. Most described the overall shape of the proteins, fewer discussed the difference in the specific amino acids or order of the amino acids in each sequence. It was not uncommon for candidates to suggest that the proteins were of different lengths, even though the diagrams show exactly the same number of amino acids. This suggests that perhaps candidates knew that this is a common difference, but were not using the source material as directed by the question.

(c) The role of the ribosome was generally better described than the role of mRNA. This question required a precise explanation and some responses lacked detail. Common misconceptions were to describe DNA as a copy of mRNA or to describe mRNA as a protein. Some responses described the location of mRNA and ribosomes within cells, even though this information was not required.

(d) (i) Temperature was the most common factor given. A common error was to describe factors that affect plant growth rather than enzyme activity. Some responses were not sufficiently detailed, for example, stating 'concentration' rather than enzyme (or substrate) concentration.

(ii) Most candidates gave detailed descriptions of the graph. However, some went further and gave an explanation of denaturing which was not required. A large number of responses referred to temperature rather than pH, even though there was no mention of temperature in the question.

(iii) Candidates found it more challenging to explain the differences in the enzyme activity at pH 4 and pH 7. The majority stated that pH 4 was the optimum pH and that the enzyme was denatured at pH 7, but far fewer gave an explanation as to how denaturation would affect enzyme activity. Nevertheless, some very confident responses were seen, with correct references to active sites, enzyme-substrate complexes and successful collisions. As in the previous question, some referred to temperature rather than pH.

Question 3

(a) Many candidates were able to apply their knowledge and use the information in the flow diagram to describe how red blood cells are produced excellent responses to this question. Almost all candidates described the sequence of events, with the best responses making use of appropriate terminology, such as mitosis and protein synthesis and haemoglobin. The description of the red blood cell shape was often incorrectly given as concave or doughnut-shaped and only a few

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mentioned the breakdown of the mitochondria. Some also realised that only one of the two stem cells had become specialised. Most candidates included an explanation in their response. The most common points included reference to the large surface area and the transport of oxygen.

(b) Most candidates knew that the liquid part of the blood is plasma. Common errors include cytoplasm and haemoglobin.

(c) Some excellent suggestions as to why stem cells are found in the skin were given. Some were less certain of the role of stem cells suggesting protection, acquiring oxygen through the skin or the clotting of blood.

(d) (i) Many candidates knew that iron deficiency causes anaemia. A small minority referred to vitamins or other minerals such as calcium and magnesium.

(ii) Almost all candidates gave at least one symptom of anaemia with fatigue and weakness being the most common. A few gave symptoms of haemophilia or rickets.

(e) The genetic cause of sickle-cell anaemia was generally well known. In some contexts it is acceptable to use the term "gene" or "allele", but in most cases it is advisable to avoid interchanging these terms and choose the correct one. Those candidates who made use of the commonly-used symbols, Hb^S and Hb^A, often provide less ambiguous responses than those who did not. A common misconception was to refer to haemoglobin, rather than the red blood cell, as being sickle-shaped. Some responses discussed the relationship between sickle-cell anaemia and malaria even though this was not required by the question.

Question 4

(a) Almost all candidates could identify the group correctly. Fewer gave two correct features that were relevant only to birds.

(b) The definition of a population was well known. However, some responses did not specify that a population refers to a single species and very few mentioned that it is the group of organisms found at the same time.

(c) A number of candidates made good use of the source information and gave appropriate suggestions. The most astute noticed that the less successful captive breeding programme occurred almost 10 years earlier and suggested that lessons were learnt from that experience that improved the success of the later programme. A common misconception was that the yellow-shouldered Amazon parrots were released in Arizona and that the lack of success was due to that fact that they did not adapt to a very different environment.

(d) Many candidates successfully outlined the disadvantages. Most realised that with small numbers, genetic diversity would be low and explained the consequences of this.

(e) Many candidates show a good understanding of the advantages. A wide variety of answers were seen with many excellent examples of the environmental consequences. Fewer candidates made reference to the impact on economic, educational or ethical reasons.

Question 5

(a) (i) Many candidates calculated the difference in yields. For some there was confusion by some as to which number to use as the denominator - some using the fertiliser plot data and others using an average or the sum of the two. Candidates need to show their working.

(ii) Some responses provided sufficient details of the particular nutrients in the fertiliser. Most explained that nutrients had been added, but very few described the effect of each compound on the plant.

(iii) Almost all candidates stated the correct name of the process. Common incorrect terms given included "run-off", "pollution", and "nitrification".

(b) While many candidates gave confident descriptions, some responses lacked sufficient detail. A common error was to refer to the wrong group when describing the information in the graph.

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(c) Few candidates suggested why some grasslands plants survive better than others in sufficient detail. Many candidates linked their response to the previous parts of the question by relating this answer to fertilisers. For example, they stated that "some plants could use the fertilisers better" or that "some plants were adapted to the fertilisers". A few responses discussed animal survival on the grassland rather than plants.

Question 6

(a) Although it was evident that many candidates knew what is meant by a transmissible disease, few gave a precise definition. The term bacteria was used instead of pathogen in some responses.

(b) Similarly, the definition of a nerve impulse was not sufficiently precise in some cases. Many described a reflex arc instead of a nerve impulse, and others described the transmission of the impulse across a synapse.

(c) (i) Some very good responses were seen. However, the term vaccine was not always accurately described. For example, some referred to a small dose of a pathogen rather than a weakened or dead form of a pathogen. For a minority there was also a lack of clarity regarding the differences between active and passive immunity.

(ii) Insightful explanations as to why vaccinations need to be continued even after a disease, such as meningitis, disappears were given by some candidates. The most common suggestion was the arrival of visitors, such as tourists or migrants, to the country. Many candidates only gave one suggestion even though there were two marks available for this question. Nearly all candidates stated that the pathogen could return, the best responses were able to explain how this might happen.

(d) (i) This proved to be a challenging question for many candidates. The best responses were able to apply their knowledge of digestion to the context given.

(ii) Some good explanations were seen. However, many candidates found this challenging and responses were frequently limited to a simple statement regarding the temporary nature of antibodies with no further explanation given. Some candidates suggested the use of regular injections of antibodies to overcome mutations in the pathogen rather than the value of an active immune response.

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BIOLOGY

Paper 0610/51
Practical Test

Key messages

Candidates must ensure that they follow the instructions in the question paper carefully.
Correct presentation of data is an important skill and the use and inclusion of SI units on graph axes labels and in table headings, rather than in the data cells is essential.
Candidates must be able to recognise the different variables in an experiment and be able to adapt a given method to test a different variable.
The Supervisor's Report is very important and should be completed in as much detail as possible.

General comments

It is important that candidates are able to identify the different variables involved in an investigation. They should also consider how the data is going to be collected and how the data will be analysed when planning an investigation. Candidates should also be able to justify their choice of equipment and evaluate its accuracy and precision.

Drawing an accurate representation of a biological specimen requires practice. It is important to observe and determine the appropriate details of a specimen, including the shape and proportion of the structures seen.

Comments on specific questions

Question 1

(a) (i) Most candidates were able to complete the table correctly and calculate the missing values. Some found these calculations challenging.

(ii) Many candidates produced well-constructed tables. While many responses included the 'concentration of protein' as a column heading, fewer remembered to include 'percentage' or a percentage sign in the column heading. The better responses showed differentiation between the shades of the colours observed. Some responses recorded the colours at the lower concentrations as being just blue. Correctly prepared solutions should have given a distinct gradation from dark to pale purple and a pale blue for the control. Some responses did not use the percentage concentration and instead used the volume of the protein solution for each concentration instead. Most candidates used the intensity scale as expected, but a few invented their own system with additional '+' signs added to the chart. The Supervisor's Report was particularly important during the assessment of this question.

(iii) Most candidates gave a correct response here.

(iv) Many candidates correctly related the intensity score to a suitable concentration. The best responses also showed that there would be a range between which each unknown would fit. A common error was to multiply the percentage values by 100.

(b) (i) Only a few candidates were able to identify the control. The most common incorrect response was 'the volume of the biuret solution', which suggests uncertainty about the difference between a control and a controlled variable. Fewer candidates were able to explain why a control is used.

(ii) Only a few candidates seemed to understand that the method of estimation was qualitative or subjective rather than quantitative. This idea was expressed in a number of ways.

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Question 2

(a) (i) Many candidates did not label Fig. 2.1 as instructed. Some labelled features other than those specified, for example cytoplasm and mitochondria. Some label lines did not touch the intended feature. Candidates should be encouraged to place labels outside of a drawing or photograph.

(ii) Most candidates gave correct responses, although some did not identify which cells had been measured, or the units were omitted.

(iii) The majority of candidates were able to calculate the correct length. A common error was to change the unit of measurement part-way through the calculation, resulting in an incorrect value.

(iv) Almost all candidates drew the expected cells, although a few candidates appeared to misunderstand the instruction and drew all the cells outside of the box on Fig. 2.1. There were some excellent drawings made with clear lines and cells in the correct proportion with well observed internal details, which were not shaded.

Examples of less well-executed drawings included: thick lines with overlapping joins to both internal structures and the outer boundary, drawing with ink, cellular details that were not visible in Fig. 2.1.

(b) (i) The majority of candidates gave two correct responses, commonly temperature and the volume of yeast suspension. Weaker responses stated 'time' without any further qualification. As two different aspects of time were standardised during the experiment, time alone was insufficient.

(ii) This question proved to be challenging for many candidates. Most responses gave examples of human errors rather than errors involving the method. In some cases the improvement given did not match the stated error.

(c) (i) Almost all candidates gave a correct response.

(ii) The majority of candidates are able to plot graphs competently. The majority of points were carefully plotted and the use of a small cross or a dot within a circle made it easy to read the plotted points. The most common error was a poorly placed line of best fit. Less well-executed graphs omitted the units from one or both of the axes or used inappropriate scales which made it difficult to plot points accurately. Lines should be thin and not so thick that the plot points are obscured. A few candidates did not follow the instructions and either plotted all three sets of data or the data for both syringes.

(iii) Only the best responses showed an understanding of the fact that the volumes in the two syringes needed to be compared, rather than the trend shown by syringe 1.

(d) There were many excellent, well-organised, responses to this question. Some candidates found this aspect of the exam challenging and were unable to modify the apparatus shown, to test pH successfully. Less detailed responses tended to limit their answers to only using two pH values as they did not appear to remember that the two syringes in the original experiment were replicates. The better responses added solutions that would change the pH of the yeast suspension, for example, acids or alkalis, found the pH using universal indicator, and then measured the volume of gas using the same method as given in **Question 2(b)**. Most of these candidates used at least three pH values, replicated the experiment and referred to relevant safety equipment. Common errors included: using only two different pH solutions in each of syringes 1 and 2, replacing the water in the test-tube by a pH solution and putting the yeast into a gas syringe.

There were a number of candidates who modified the collection of gas by putting the yeast suspension into test-tubes and then using a gas syringe or delivery tube to collect the gas over water. Others however, did not seem to realise that bubbles of gas from a reaction cannot be counted directly in the reaction mixture, or that counting bubbles from a delivery tube is less accurate than measuring a volume. Weaker responses rarely went further than 'repeat the method using different pH'. Candidates need to practise the practical skills listed in the syllabus throughout the course so they can follow instructions, know what type of apparatus is suitable for different activities and understand why experiments are set up and carried out in a particular way.

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BIOLOGY

Paper 0610/52
Practical Test

Key Messages

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

General Comments

In addition, successful candidates are also able to demonstrate the following skills:

Justify their choice of equipment and evaluate its accuracy.

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

Data is presented in a table using the appropriate SI units. Tables have borders and appropriate headings with SI units. Units are not written in the body of the table.

Graph axes are labelled and have appropriate units.

Drawings of biological specimens have clear and continuous lines, drawn with a sharp pencil. Drawings show an appropriate level of detail and are representative of the shape and proportions observed.

Comments on Specific Questions

Question 1

(a) (i) Most candidates were able to draw a suitable table with appropriate column headings and units.

(ii) Candidates were expected to state a suitable conclusion that was linked to the results they obtained. Most candidates who obtained a trend were able to draw a conclusion.

(iii) Most responses mentioned the production of oxygen and the best responses also made reference to “air spaces” or a change in density or buoyancy.

(iv) This question was answered well by candidates. It is important that candidates understand the difference between the variables, i.e. those that are kept constant and those that are changed (independent) or measured (dependent).

(v) Again, this question was answered well by most candidates. A few responses lacked sufficient detail. For example, candidates needed to qualify their response by stating that the size of the leaf discs or the number of the leaf discs were kept constant, rather than simply stating ‘leaf discs’.

(vi) Many candidates were able to successfully identify two errors and two possible improvements. It is important that the error is paired with the improvement. The most commonly identified errors related to volume measurement, unequal light intensity or the difficulty in timing six test-tubes simultaneously.

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(b) (i) In most cases, calculations were carried out accurately and units were given. Candidates needed to ensure that they expressed their answers in whole numbers.

(ii) Most candidates drew a very suitable graph. The most common error was plotting all the raw data rather than plotting the average rising time. Candidates should ensure that they provide suitable units for the axes.

Question 2

(a) (i) Most candidates successfully stated two visible differences between the leaves. Only one comparison between the palisade mesophyll and the spongy mesophyll was required.

(ii) Many good drawings were seen, that were drawn with clear, continuous lines. A few less successful responses included shading, jagged lines or individual cells, which was not required.

(b) (i) Most candidates were able to calculate the average leaf length. Fewer were able to calculate the percentage difference accurately.

(ii) Most candidates were able to provide appropriate responses for this question. The most common error was not using the data to support their response. The best responses included units in all data quotations. It was encouraging to see so many candidates provide suitable conclusions based on the data provided.

(c) (i) Almost all candidates were able to correctly describe how to boil ethanol safely.

(ii) The best responses made clear reference to the fact that the colour change was easier to observe.

(iii) The quality of responses to this question was varied. Many candidates had a very clear idea of how to plan a valid investigation that would find out if starch was present in both leaves grown in direct sunlight and in the shade. There were many excellent, detailed descriptions of the investigation. Most candidates were able to identify the role of boiling the leaf in ethanol and performing the iodine test. Fewer responses appropriately identified the variables involved.

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BIOLOGY

Paper 0610/53
Practical Test

Key Messages

Candidates must ensure that they read the questions carefully before starting to answer. This is particularly important for the planning exercise. Identification of the key variables in an investigation is vital for a good plan.

Candidates must 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, but also that they should be able to work safely and with competence on practical procedures that derive from learned methods.

When asked about safety considerations, candidates should be able to identify a risk and also a method of reducing that risk.

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

General Comments

The exam paper consisted of two questions testing candidates' skills in a variety of areas. Many of the questions were very well answered and there were examples of excellent responses to all of the questions.

Some candidates continue to find the planning exercises challenging, but the majority were able to produce well thought-out, logical investigations. Identification of variables, safety and a workable method are key aspects of this task.

Graph drawing is a skill that most candidates continue to perform well on. Similarly, drawing of a table for data also posed few problems for the majority of candidates.

The drawing skill remains challenging for a number of candidates. Clear, continuous lines with no shading are expected and details of individual cells should not be included. The instructions need to be read carefully and drawings must be in proportion and show sufficient detail.

Comments on Specific Questions

Question 1

(a) Most candidates and this question well. The best responses included appropriate heading with correct units in the headers rather than in the body of the table. They also recorded a volume rather than the number of drops.

(b) Some candidates understood the purpose of adding starch. A few erroneously thought that starch was an enzyme, or stated that it was a mistake to add it.

(c) Most candidates were able to identify two variables that were kept constant in the investigation. Good responses made a distinction between volume and concentration, rather than just stating 'amount' which was not appropriate in this particular context. In this case the concentration of vitamin C solution did change, but the volume of vitamin C did not change, making "amount" an ambiguous term. Candidates should always identify whether it is volume or concentration.

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(d) Good responses focused on the difficulties associated with identifying the end-point in a titration. Some suggested, incorrectly, that the equipment was imprecise. In this case, the precision of a syringe was adequate for the differences in volumes being measured.

(e) (i) Most candidates were able to perform the correct calculation.

(e) (ii) Most candidates were able to produce and a good graph. Some plotted all the data rather the final vitamin C content stipulated in the question. Most were able to draw an accurate line of best fit. Lines should be thin, not feathered and must come close to where a line of best fit should have occurred. When plotting points, candidates should remember the importance of using small crosses or circled dots.

(e) (iii) Almost all candidates were able to correctly indicate how the vitamin C content could be estimated from their graph. Candidates should think carefully about how to use the scale sensibly to make plotting as easy as possible. Sometimes, the scale chosen by the candidate made an estimation of the value difficult.

(f) Many candidates gave good responses to the planning question. Many were able to correctly identify the relevant variables in this investigation. Only a few varied the type of juice which resulted in them incorrectly, changing several variables rather than one.

Question 2

(a) Most candidates were able to produce an adequate drawing of the specimen. All drawings were drawn to an appropriate size with an appropriate level of detail and suitable shape. Drawings must have a continuous clear outline, without either feathered lines or shading. Candidates should always use a sharp pencil when drawing, and avoid drawing cells inside the structure. Candidates should ensure that they draw the correct specimen, in this case **Fig. 2.1**, a few drew **Fig. 2.2**.

(b) (i) The majority of candidates were able to correctly the magnification of the specimen. Candidates need to ensure that they measure the image correctly and use the correct units.

(c) (i) Almost all candidates were able to correctly calculate the average rate of reaction.

(c) (ii) Similarly nearly all candidates could identify the optimum temperature and give good reasons for their choice. Candidates should use the data when answering the question instead of referring to human body temperature.

(c) (iii) This question asked candidates to identify an anomalous result and to give a reason. Most were able to do this but not all were as confident in the reason as to why the result was anomalous. When stating that a value is high the candidate should also compare it with the other values which are not considered anomalous.

(c) (iv) Nearly all candidates were able to identify the two variables, although some transposed them.

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BIOLOGY

Paper 0610/61
Alternative to Practical

Key Messages

There were many excellent scripts where the responses were accurate, informed, clearly reasoned and well presented. Some candidates require more practice in the following areas: planning an investigation, identification of experimental errors, correct labelling in tables and on graphs, and the appropriate use of units.

General Comments

It is important that candidates are able to identify the different variables involved in an investigation. They should also consider how the data is going to be collected and how the data will be analysed when planning an investigation. Candidates should also be able to justify their choice of equipment and evaluate its accuracy and precision.

Drawing an accurate representation of a biological specimen requires practice. It is important to observe and determine the appropriate details of a specimen, including the shape and proportion of the structures seen.

Comments on Specific Questions

Question 1

(a) (i) The majority of candidates answered this correctly.

(ii) Most candidates knew the correct colour for a positive test with biuret reagent.

(iii) The majority of candidates answered correctly. A few assigned shades of colour instead of a score which did not answer the question.

(iv) Many candidates produced well-constructed tables. While many responses included the 'concentration of protein' as a column heading, fewer remembered to include 'percentage' or a percentage sign in the column heading. Most candidates entered the figures and their intensity scores accurately. A common error was to write the units in the body of the table rather than in the heading.

(v) Most candidates assigned accurate intensity scores to the two solutions they were shown.

(vi) Many candidates were able to provide correct estimates.

(b) (i) Some candidates correctly identified the control for the experiment but others found this challenging. It is important that candidate know the difference between an experimental control and a controlled variable. Some candidates were able to state the definition of a control experiment, but could not apply it to the context they were given.

(ii) Most candidates found it challenging to explain why the method used in the experiment meant that the results could only be an estimate. The most common reason given was that different concentrations of protein had the same intensity score. Few referred to the results being subjective or that the method was qualitative.

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Question 2

(a) (i) Many candidates did not label Fig. 2.1 as instructed. Some labelled features other than those specified, for example cytoplasm and mitochondria. Some label lines did not touch the intended feature. Candidates should be encouraged to place labels outside of a drawing or photograph.

(ii) Most candidates gave correct responses, although some did not identify which cells had been measured, or the units were omitted.

(iii) The majority of candidates were able to calculate the correct length. A few omitted units altogether, or changed the units during the calculation and did not state the new unit.

(iv) Most candidates drew large, accurately proportioned diagrams. The main areas for improvement are to make all lines continuous (no gaps and no overlaps) and to avoid shading or cross-hatching to emphasise different areas.

(b) (i) The question was well-answered by the majority of candidates.

(ii) Candidates found this question challenging. Responses needed to be precise and detailed. Often the improvement did not match the identified error. A large number of candidates cited various human errors rather than an error in the method described.

(c) (i) The majority of candidates were able to calculate the average required.

(ii) The majority of candidates are able to plot graphs competently. Some graphs used an awkward scale which made accurate plotting difficult and some utilised less than half the grid provided. Good responses included labelled the axes with units.

(iii) Many candidates answered correctly by comparing the result with that of the other tube at the same time.

(d) There were many excellent, well-organised, responses to this question. Some candidates found this aspect of the exam challenging and were unable to modify the apparatus shown, to test pH successfully. Less detailed responses tended to limit their answers to only using two pH values as they did not appear to remember that the two syringes in the original experiment were replicates. The better responses added solutions that would change the pH of the yeast suspension, for example, acids or alkalis, found the pH using universal indicator, and then measured the volume of gas using the same method as given in **Question 2(b)**. Most of these candidates used at least three pH values, replicated the experiment and referred to relevant safety equipment. Common errors included: using only two different pH solutions in each of syringes 1 and 2, replacing the water in the test-tube by a pH solution and putting the yeast into a gas syringe.

There were a number of candidates who modified the collection of gas by putting the yeast suspension into test-tubes and then using a gas syringe or delivery tube to collect the gas over water. Candidates need to practise the practical skills listed in the syllabus throughout the course so they can follow instructions, know what type of apparatus is suitable for different activities and understand why experiments are set up and carried out in a particular way.

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Paper 0610/62
Alternative to Practical

Key points

It is important that candidates spend enough time reading through the information provided in the questions so that they understand the methodology and data collected before starting to answer the questions.

Candidates should use a sharp pencil for drawings and graphs. Care should be taken when erasing lines so that they are erased completely to avoid any ambiguity.

Candidates should include appropriate units when quoting data, drawing tables and graphs and performing calculations. Decimal points must be drawn clearly to avoid ambiguity.

General comments

Most candidates were well prepared for the exam and answered the questions confidently. The marks awarded covered the whole range of abilities.

Most candidates could confidently draw tables and graphs, as well as plan and evaluate investigations. The drawing proved more challenging for some. It is important that the instructions given are followed. For example **Question 2(a)(ii)** instructed candidates not to draw individual cells, and **Question 2(a)(iii)** instructed candidates to give their answer to two decimal places. These instructions were not followed in all cases.

Comments on specific questions

Question 1

Candidates should be familiar with a range of different photosynthesis investigations such as this.

(a) (i) Many different tables were drawn and most were appropriate.

The most common error was to include units in the data cells rather than in the headings. Many candidates had not converted the minutes to seconds and so wrote the units in the body of the table.

SI units should always be used in a table of data. In this case time, in minutes and seconds, should be converted to seconds.

(ii) A few candidates found this question challenging, particularly if they had not converted minutes to seconds in **Question 1(a)(i)**. Some response treated seconds as decimals of minutes but did not correctly convert them to decimals. The question required candidates to include the units and give their answer as a whole number, most candidates did so.

(iii) Most candidates successfully plotted a bar chart. A few responses erroneously plotted all of the data rather than just the average rising times. Most responses had an even scale and appropriate axes labels, although some used an unusual scale in an attempt to use the whole grid. Provided at least 50% of the grid was used for the time axis the scale was acceptable.

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(iv) The majority of responses identified that oxygen was a product of photosynthesis. However, most did not go on to explain that the oxygen is trapped inside the leaf or air spaces, or how this reduces the density of the leaf disc. Understanding of the methodology was important and those that had understood why the syringe had been used in Step 4 provided good responses to this question.

(v) Candidates used a range of terminology in their responses to this question, most of which was valid. Good responses showed an understanding of identifying anomalous data.

(vi) Most candidates were able to identify the variable that was measured. Identifying the variable that was changed proved more challenging for some. Candidates needed to refer back to the information given at the beginning of the paper. Some thought the measured variable was the type of leaf, rather than the location that the plant was grown in.

(vii) Many good responses were seen for this question. The most commonly credited answers were the size of the leaf disc, the light intensity and the volume or concentration of sodium hydrogen carbonate solution. The most common error was to say that the temperature was kept constant.

(b) There were many good responses to this question. The most common responses were the error and improvement associated with measuring height rather than the volume of sodium hydrogencarbonate solution and the set up of the lamp in relation to the test-tubes meaning that the discs were receiving light of different intensities.

Question 2

(a) (i) Most candidates answered this question well. Most gave a general statement about **Fig. 2.2** being thicker and then went on to compare the size of the different layers or compared the cells. For example, that there are more air spaces between the cells in **Fig. 2.2**.

(ii) Some candidates did not follow the instruction to not draw individual cells. Good drawings followed the standard conventions of drawing clear, continuous lines with a sharp pencil. Drawings should not be shaded and should be freehand, ruled lines are not appropriate. The best responses had five lines, indicating the upper epidermis, palisade mesophyll, spongy mesophyll and lower epidermis. Some responses did not show the correct proportions for the palisade and spongy mesophyll layer. Nearly all drawings were of a suitable size. It is important that candidates practise their drawing skills so that they are familiar with how the drawings are assessed and what is expected.

(iii) Most candidates were able to measure **PQ** accurately and include appropriate units (cm or mm). Most then correctly used the formula to divide their measurement by 130. The most common error was to then give the answer to more than two decimal places, and to omit the units.

(b) (i) Nearly all candidates correctly calculated the difference between the average leaf length of the leaves grown in the sunlight and those in the shade. However, many did not then go on to correctly calculate the percentage difference. The most common error was to divide 35 by 105 rather than by 70.

(ii) This question was generally answered well. Most were able to interpret the data correctly and select the correct pieces of data for their explanation. Candidates must remember to include units when quoting data and to use appropriate language, e.g. some used the word 'larger' rather than 'longer'. Some tried to use their knowledge of photosynthesis to answer the question which was not required.

(c) (i) It was clear that many candidates were familiar with this experiment and were able to describe how ethanol can be safely boiled. A few responses seemed unaware of that dangers of ethanol and naked flames which was concerning.

(ii) This question proved challenging for some. A few candidates were able to suggest that chlorophyll is removed because it is a green pigment and could make it difficult to see the iodine colour change. The most common errors were to suggest that chlorophyll needs to be removed to halt photosynthesis or that it contains starch or glucose.

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(iii) Most candidates were confident in demonstrating this skill. It was clear that many had done a version of the starch test before. However, many made reference to destarching the leaves, which was not relevant to this question. Some responses lacked sufficient detail. For example, the response indicated that the leaf should be boiled, but did not specify if it was boiled in water or ethanol. Most were able to describe the correct test for iodine and the colour change to blue-black if starch was present. A few gave the Benedict's test instead. Some responses correctly stated that the investigation should be repeated with three or more leaves. Only a few mentioned appropriate methods of keeping variables constant, such as keeping the volume of iodine solution the same or heating the leaves for the same amount of time.

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Paper 0610/63
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Key Messages

Candidates must ensure that they read the questions carefully before starting to answer. This is particularly important for the planning exercise. Identification of the key variables in an investigation is vital for a good plan.

Candidates must 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, but also that they should be able to work safely and with competence on practical procedures that derive from learned methods.

When asked about safety considerations, candidates should be able to identify a risk and also a method of reducing that risk.

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

General Comments

The exam paper consisted of two questions testing candidates' skills in a variety of areas. Many of the questions were very well answered and there were examples of excellent responses to all of the questions.

Some candidates continue to find the planning exercises challenging, but the majority were able to produce well thought-out, logical investigations. Identification of variables, safety and a workable method are key aspects of this task.

Graph drawing is a skill that most candidates continue to perform well on. Similarly, drawing of a table for data also posed few problems for the majority of candidates.

The drawing skill remains challenging for a number of candidates. Clear, continuous lines with no shading are expected and details of individual cells should not be included. The instructions need to be read carefully and drawings must be in proportion and show sufficient detail.

Comments on Specific Questions

Question 1

(a) Most candidates and this question well. The best responses included appropriate heading with correct units in the headers rather than in the body of the table. They also recorded a volume rather than the number of drops.

(b) Some candidates understood the purpose of adding starch. A few erroneously thought that starch was an enzyme, or stated that it was a mistake to add it.

(c) Most candidates were able to identify two variables that were kept constant in the investigation. Good responses made a distinction between volume and concentration, rather than just stating 'amount' which was not appropriate in this particular context. In this case the concentration of vitamin C solution did change, but the volume of vitamin C did not change, making "amount" an ambiguous term. Candidates should always identify whether it is volume or concentration.

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(d) Good responses focused on the difficulties associated with identifying the end-point in a titration. Some suggested, incorrectly, that the equipment was imprecise. In this case, the precision of a syringe was adequate for the differences in volumes being measured.

(e) (i) Most candidates were able to perform the correct calculation.

(e) (ii) Most candidates were able to produce and a good graph. Some plotted all the data rather the final vitamin C content stipulated in the question. Most were able to draw an accurate line of best fit. Lines should be thin, not feathered and must come close to where a line of best fit should have occurred. When plotting points, candidates should remember the importance of using small crosses or circled dots.

(e) (iii) Almost all candidates were able to correctly indicate how the vitamin C content could be estimated from their graph. Candidates should think carefully about how to use the scale sensibly to make plotting as easy as possible. Sometimes, the scale chosen by the candidate made an estimation of the value difficult.

(f) Many candidates gave good responses to the planning question. Many were able to correctly identify the relevant variables in this investigation. Only a few varied the type of juice which resulted in them incorrectly, changing several variables rather than one.

Question 2

(a) Most candidates were able to produce an adequate drawing of the specimen. All drawings were drawn to an appropriate size with an appropriate level of detail and suitable shape. Drawings must have a continuous clear outline, without either feathered lines or shading. Candidates should always use a sharp pencil when drawing, and avoid drawing cells inside the structure. Candidates should ensure that they draw the correct specimen, in this case **Fig. 2.1**, a few drew **Fig. 2.2**.

(b) (i) The majority of candidates were able to correctly the magnification of the specimen. Candidates need to ensure that they measure the image correctly and use the correct units.

(c) (i) Almost all candidates were able to correctly calculate the average rate of reaction.

(c) (ii) Similarly nearly all candidates could identify the optimum temperature and give good reasons for their choice. Candidates should use the data when answering the question instead of referring to human body temperature.

(c) (iii) This question asked candidates to identify an anomalous result and to give a reason. Most were able to do this but not all were as confident in the reason as to why the result was anomalous. When stating that a value is high the candidate should also compare it with the other values which are not considered anomalous.

(c) (iv) Nearly all candidates were able to identify the two variables, although some transposed them.

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