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BIOLOGY

Paper 0610/11
Multiple Choice

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

General comments

The overall ability of the candidates and the difficulty of the paper were very well-matched. Only one question presented serious problems for the majority of candidates. Where common errors occurred, they appeared often to be the result of failing to think carefully about exactly what the question was asking, before selecting an answer.

Comments on Specific Questions

Question 19

There was no doubt in candidates' minds that smoking increases the risk of lung infection, but several (just over 1/3) perhaps linked mucus production with cilia, thus reasoning that fewer cilia might lead to less mucus being produced.

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Question 21

The statistics for this question strongly suggest that less able candidates are less likely to read the question carefully and then also less likely to think for a moment before committing themselves. Knowing that carbon dioxide turns lime-water cloudy was not the information required, which a second reading of the first sentence should have indicated, as carbon dioxide is unlikely to have been 'put into a test-tube' along with yeast and warm water.

Question 24

This proved to be a difficult question, and this may be due to the fact that it required two items of knowledge to achieve success. Almost 40% fell at the first hurdle, by identifying the neurone as sensory. If correctly identified, then only the more able candidates were able to link that knowledge with the conduction of impulses away from the spinal cord.

Question 27

Unfortunately, this question engendered considerable confusion and it exposed the fact that candidates were, apparently, not familiar with the fact that sperms can remain viable within the female reproductive system for up to 4 days. Candidates of all abilities, and in large numbers, felt that fertilization could not take place if sperms were released before ovulation has occurred. It must, however, be conceded that the fact that the question was phrased in the negative may have contributed towards the confusion.

Question 34

As with **Question 24**, there appears to have been a trend to seize upon a statement that is perceived as correct without checking carefully that it is the information required to answer the question. Yes, all living organisms respire and thus lose energy, but it was the *result* of this energy loss that was being sought in the question. Able candidates did not make the mistake.

Question 36

This proved to be the easiest question on the paper. Although there was a considerable amount of information to absorb before answering, candidates did very well to do so with such success.

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BIOLOGY

Paper 0610/12
Multiple Choice

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

General comments

The overall ability of the candidates and the difficulty of the paper were very well-matched. Only one question presented serious problems for the majority of candidates. Where common errors occurred, they appeared often to be the result of failing to think carefully about exactly what the question was asking, before selecting an answer

Comments on Specific Questions

Question 11

This question proved to be the easiest on the paper and, with so many candidates being successful (93%) its overall contribution was somewhat limited. Candidates were not required to identify the molar tooth by name, though it would, perhaps, have helped, but they showed commendable skill in matching appearance with function.

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Question 22

There was no doubt in candidates' minds that smoking increases the risk of lung infection, but several (up to 1/3) perhaps linked mucus production with cilia, thus reasoning that fewer cilia might lead to less mucus being produced.

Question 24

The statistics for this question strongly suggest that less able candidates are less likely to read the question carefully and then also less likely to think for a moment before committing themselves. Knowing that carbon dioxide turns lime-water cloudy was not the information required, which a second reading of the first sentence should have indicated, as carbon dioxide is unlikely to have been 'put into a test-tube' along with yeast and warm water.

Question 25

This proved to be a difficult question, and this may be due to the fact that it required two items of knowledge to achieve success. Almost 40% fell at the first hurdle, by identifying the neurone as sensory. If correctly identified, then only the more able candidates were able to link that knowledge with the conduction of impulses away from the spinal cord.

Question 29

Unfortunately, this question engendered almost total confusion and it exposed the fact that candidates were, apparently, not familiar with the fact that sperms can remain viable within the female reproductive system for up to 4 days. Candidates of all abilities, and in large numbers, felt that fertilization could not take place if sperms were released before ovulation has taken place. It must, however, be conceded that the fact that the question was phrased in the negative may have contributed towards the confusion.

Question 40

As with **Question 24**, there appears to have been a trend to seize upon a statement that is perceived as correct without checking carefully that it is the information required to answer the question. Yes, all living organisms respire and thus lose energy, but it was the *result* of this energy loss that was being sought in the question. Able candidates did not make the mistake.

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BIOLOGY

Paper 0610/13
Multiple Choice

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

General comments

The overall ability of the candidates and the difficulty of the paper were very well-matched. Only one question presented serious problems for the majority of candidates, and two questions became, effectively, three-choice questions as one option in each attracted no takers (**Questions 19** and **32**). Where common errors occurred, they appeared often to be the result of a failing to think carefully about exactly what the question was asking, before selecting an answer.

Comments on Specific Questions

Question 15

This question proved to be one of the easiest on the paper and, with so many candidates being successful (94%) its overall contribution was somewhat limited. Candidates were not required to identify the molar tooth by name, though it would, perhaps, have helped, but they showed commendable skill in matching appearance with function.

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Question 17

The statistics for this question strongly suggest that less able candidates are less likely to read the question carefully and then also less likely to think for a moment before committing themselves. Knowing that carbon dioxide turns lime-water cloudy was not the information required, which a second reading of the first sentence should have indicated, as carbon dioxide is unlikely to have been 'put into a test-tube' along with yeast and warm water.

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This proved to be a difficult question, and this may be due to the fact that it required two items of knowledge to achieve success. Just over 1/3 fell at the first hurdle, by identifying the neurone as sensory. If correctly identified, then only the more able candidates were able to link that knowledge with the conduction of impulses away from the spinal cord.

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Question 35

As with **Question 24**, there appears to have been a trend to seize upon a statement that is perceived as correct without checking carefully that it is the information required to answer the question. Yes, all living organisms respire and thus lose energy, but it was the *result* of this energy loss that was being sought in the question. Able candidates did not make the mistake.

Question 39

This proved to be the easiest question on the paper. Although there was quite an amount of information to assimilate, candidates are to be praised for doing so successfully.

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BIOLOGY

Paper 0610/21
Core Theory

General comments

Most candidates attempted all parts of most questions. Parts of **Question 9** sometimes had no response at all but it was unclear if this was due to lack of time or to the demands of the question.

Examiners expressed considerable concern about the standard of handwriting on some scripts. Candidates should be made aware that work that cannot be read cannot gain credit. Sometimes the illegibility was due to multiple alterations and writing one word on top of another. Candidates should be encouraged to read each section of a question with care before beginning their response and to think hard if they find themselves giving identical responses to two sections of a question. Questions are carefully designed to guide candidates as to the type of response required and ignoring part of the wording of the question may lead to a response which, while on the topic, fails to answer the question and thus to gain credit. They should also use the number of marks allocated to a section as a guide to the depth of their response. Candidates should be reminded of the need to use correct biological terminology especially when describing human anatomy.

Comments on Specific Questions

Question 1

(a) Most candidates identified fur or hair as one external feature that did not occur in other vertebrates. Whiskers or vibrissae were accepted as an alternative to hairs. The other common response was the presence of mammary glands or nipples. Most candidates had greater difficulty suggesting a second external feature as the presence of four limbs or a tail is not exclusive to mammals. Some suggested giving birth to live young or being warm blooded, but these are not considered external features. The pinnae were rarely commented upon.

(b) Most candidates identified at least one correct feature, frequently the presence of jointed legs or a segmented body. Some candidates quoted features that are found in insects, such as division of the body into three regions, which are not common to all arthropods. The exoskeleton was often overlooked or incorrectly referred to as a shell.

Question 2

(a)

(i) The stationary phase was usually identified correctly but not the lag phase.

(ii) Only a few candidates realised that some of the population would die during each of the four stages. The mark allocation should have suggested that more than one phase was involved.

(b)

(i) Candidates understood that a range of differing factors could affect population numbers.

(ii) Many had difficulty in explaining how changes in a particular factor would affect the population and the concept of the **rate** of population growth, as opposed to just numbers, was not understood.

Question 3

(a)

(i) The thickness of the wall of chamber **D** allowed most candidates to identify this as the left ventricle.

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(ii) Most identified **A** and **B** although some candidates failed to note that the question referred to chambers not just a chamber of the heart. Thus they often gave an inadequate rather than an incorrect response.

(b) The table was sometimes only partially completed. Candidates should realise that terms such as 'thinner' or 'thicker' must refer to the muscular wall of the vessels, not appear as isolated words. Some candidates tried to make two points of the direction of blood flow in the two vessels (towards / away from the heart, towards / away from the lungs) but credit can only be given for the direction of blood flow once.

(c)

(i) The role of valves in ensuring a one way flow of blood was well known.

(ii) Candidates often described what happened when the tricuspid valve opened rather than what caused it to open.

(iii) Responses were often only a repeat of the response to **(i)** with no further explanation.

Question 4

(a) Knowledge of leaf structure was good with most candidates identifying the cuticle and a stoma. The labelling of the vascular bundle was often too vague.

(b)

(i) Some candidates thought that the transparency of the upper layers of the leaf enabled them to trap or absorb sunlight rather than allow the light to reach the chloroplasts in the deeper layers.

(ii) Many used the word 'protect' but failed to go on explain the nature of the protection.

(iii) There was some confusion between the transport roles of the xylem and phloem. A number of candidates used terms such as absorption, storage and transpiration to describe the role of xylem rather than transport of water or mineral ions.

(c)

(i) Many candidates revealed confusion between photosynthesis and respiration, with oxygen and sometimes glucose being listed as materials needed for photosynthesis. Light and the presence of chlorophyll were also frequently thought to be materials.

(ii) A few candidates appeared to misunderstand the question and gave a description of the process of photosynthesis. Most realised that it provides the substrate for the release of energy during respiration and many also mentioned that glucose is converted into starch for storage but few suggested any other uses. Candidates should be aware that energy can be released, provided or used but not created and should avoid phases such as "energy is produced" which can imply that it is created.

Question 5

(a)

(i) Some candidates ignored the need for a word equation and attempted to produce a formulaic one and frequently got this wrong. Full credit was allowed for a correct, balanced equation, but this was not expected and candidates who chose to give formulae made unnecessary difficulties for themselves. Confusion was caused by those candidates who wrote so much in the box provided, that some of their 'products' appeared on a second line under their reactants on the left hand side of the equation. In word equations all reactants should appear to the left of the equals sign and all products to its right. There was some confusion regarding oxygen, whether it was used or produced.

(ii) Most candidates knew that anaerobic respiration did not require the presence of oxygen and many also stated that it released less energy than the aerobic process. There was some confusion about the products of anaerobic respiration in humans as some candidates suggested that alcohol or carbon dioxide were by-products.

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(b)

(i) The role of yeast in bread making was poorly understood and although most candidates realised that it caused bread to rise they could give no further details.

(ii) The role of yeast in the production of alcohol when used in brewing was known to about half of candidates, with many others suggesting that yeast just added flavour to the liquid.

Question 6

This question produced good responses from candidates with many gaining partial credit. The commonest errors were to confuse the terms 'gene and allele' and 'genotype and phenotype'. There was less confusion of mitosis for meiosis than on previous occasions when understanding of these terms has been examined. There was no evidence of candidates ignoring the instruction to only use terms from the list provided.

Question 7

Most candidates were familiar with the topic of pollution and often made valid biological comments. Unfortunately, some did not notice that the question was about air pollution and thus details of eutrophication and oil spills were irrelevant. Others limited their credit by not naming the pollutant involved in each of their examples although this was required in the question.

Some examples were too vague, including references to global warming, with no explanation and candidates should realise that it is the processes resulting from chopping down trees, such as burning the scrub and vegetation that affect the atmosphere and not deforestation itself that causes air pollution.

Question 8

(a) The ovule, **A** was rarely precisely identified, with many suggesting it was the ovary but most candidates recognised the sepal, **B**.

(b)

(i) Most candidates realised that pollination involved the movement of pollen, although there was confusion about the origin and exact destination of the pollen grain. A number confused pollination with fertilisation.

(ii) Response here revealed understanding of insect pollination and most commented on the importance of petals to attract the insect. The sticky nature of the stigma was also well known.

(c) Most gained partial credit although there was lack of clarity about which structures were elongated when anther or stigmas appeared outside the petals.

(d) The responses here showed understanding of the need for oxygen for respiration and some candidates also noted the need for a suitable temperature for reactions controlled by enzymes to occur. Responses explaining the need for water for germination were far too vague or were related to photosynthesis which does not begin until germination has been completed,

Question 9

(a) There were good responses here that identified the lungs and skin as other excretory organs. Candidates who chose these organs usually also named carbon dioxide and water as excretory products. A significant number of candidates appeared to overlook the need to name organs other than the kidney or tried to name other parts of the urinary system.

(b) Candidates commonly misinterpreted this part of the question and only commented on the data in the table without suggesting how the changes in the data were brought about. Those who did refer to filtration and reabsorption then often did not link this to the changes shown by the data and very few recognised that the kidney being composed of living cells required oxygen and glucose for respiration.

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BIOLOGY

Paper 0610/22
Core Theory

General comments

There was no evidence that candidates had insufficient time to complete the paper and few responses were left blank. The exception to this was that a number of candidates did not label drawings as requested in **Questions 1**, **3** and **9**. This could be because they were unsure of the labelling or that they did not read the question carefully enough. Some candidates showed very limited knowledge and understanding of some topics from the syllabus, especially the eye and genetics and there were very few candidates who did not find the paper demanding in at least some of its aspects. Responses to various sections of questions revealed again this year certain misconceptions and misunderstandings. Some candidates appeared to have considerable difficulty in expressing themselves clearly in English and this was very evident where explanations were required. There was also evidence that some candidates had not read the questions carefully or thoroughly enough and thus their responses were inadequate or did not fully address the question. Candidates should be made aware of the need to read the questions carefully and to take note of each question's demands before they begin their response. The legibility of responses presented by some candidates was such that Examiners had difficulty in ascertaining what the candidate intended as an answer and thus no credit could be given

Comments on Specific Questions

Question 1

(a) The labelling of Fig. 1.1 showed that many candidates were unfamiliar with the region of the digestive system that was illustrated. A significant number labelled the bile duct as the oesophagus and occasionally the stomach as the gall bladder. Virtually all who labelled the diagram identified the pancreas correctly. There were a surprising number who made no attempt to place any labels on Fig. 1.1 despite the instruction to do this being given effectively twice.

(b)

(i) It was clear that many candidates were familiar with enzymes acting as catalysts and some completed the definition by referring to their protein nature.

(ii) It was expected that candidates would be aware that the stomach contents have a low pH and that this would allow them to suggest the relevant enzyme to be **X**. Although many did name enzyme **X** they did not offer a suitable explanation for their choice. There were significant numbers who selected the other two enzymes and stated that the reason was that either pH 5 or 9 were very acidic or that the stomach contents were alkaline. There was also confusion in a number of answers between high and low pH and responses suggested that these terms were being used in the reverse way to normal usage.

(iii) It was unfortunate that most candidates did not link the enzyme amylase with the digestion of starch and that the end product is maltose.

(c) There seemed to be considerable confusion among candidates about the liquid produced by the liver that aids digestion with glycogen, lactic acid, glycerol, urea and urine appearing frequently among the responses. Also despite the question stating that the liquid contained no enzymes, candidates still gave details of enzymes, such as lipase, that were thought to be in the bile. It was noticeable how few candidates gave any explanation of the role of the bile. There were some responses in which emulsification was muddled with digestion as candidates thought that bile broke up large fat droplets into fatty acids and glycerol.

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Question 2

(a) Candidates frequently identified either feathers or a beak or both as external features of birds. They should be aware however that there are other vertebrates with wings, such as the bats.

(b) The correct responses such as three body regions, three pairs of legs or the presence of wings were frequently stated. Candidates should be aware that other arthropods have antennae and compound eyes. Candidates' responses that stated that insects had more than two pairs of legs were considered too vague for credit. For both animals a few candidates offered internal features or actions of the relevant animals and none of these were given credit.

Question 3

(a) It was common for the suspensory ligaments to be labelled as the ciliary muscles amongst other errors. Many candidates placed the end of their label lines at the junction of two structures suggesting either carelessness in labelling or uncertainty as to the real identity of the structure they were expected to label. This was a particular problem when labels for the optic nerve terminated clearly at the blind spot rather than on the nerve itself.

(b) Very many candidates linked the retina to either controlling the amount of light entering the eye or reflecting light that had already entered. The retina was rarely recognised as the layer of light sensitive cells that generated nerve impulses.

(c) The majority of candidates understood that in the transition from dim to bright light the pupil was reduced in size. This was often thought to be an action brought about by the pupil itself rather than because of the action of the iris. Those candidates who linked the action to muscle activity regularly ascribed this to the ciliary muscles. Many candidates simply referred to circular muscles in their responses and this is inadequate as there is more than one set of such muscles in the eye. Candidates should be aware that the iris reflex does not control the entry of light into the eye as the light has already entered before it reaches the pupil.

Question 4

In this question candidates were given freedom to introduce examples they had studied of human influences on ocean ecosystems. Unfortunately many devoted all or part of their answers to effects on other ecosystems such as rain forests, rivers and the atmosphere without any reference to the oceans. Although many did make reference to human activities they did not then offer an explanation of the undesirable effects these could have. Candidates with an appreciation of this topic dealt with activities such as oil spillages, the release into the oceans of various chemicals that could be toxic to marine life, over-fishing, dumping of litter and industrial activities such as the extraction of sand and other minerals. Candidates should avoid the use of rather vague terms such as rubbish and waste unless they make it clear what they mean by such terms.

Question 5

(a)

(i) Overall there was a high standard of plotting of the data for males on the existing graph. It was unfortunate that a number of candidates did not recognise that the first two sets of data for males were identical to those already plotted for females. In this sort of graph candidates would do well to match the style of graph line with any already drawn and should not produce freehand versions as a few candidates did. Also the added line should be labelled.

(ii) Candidates were expected to recognise that the steepest gradient would be the period of fastest growth, between 0 and 2 years. Candidates frequently suggested the ages to be 15 to 20.

(iii) Too many responses suggested careless reading of the ages at which the two lines crossed indicating the same heights, on correctly plotted graphs at 8.5 and 16.5 years. Despite the statement in **(iii)** "after the age of 2 years", there were a significant number of response that quoted ages lower than 2 years.

(iv) The age when females were 144 cm in height was again often incorrectly read from the graph.

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(b)

(i) Many different hormones were named as controlling the changes in puberty although more than half the candidates identified the hormone involved as oestrogen, which was offered in a wide variety of formats.

(ii) Simple statements, such as hips, breasts and pubic hair, in themselves do not indicate a change and candidates should state what change is occurring, e.g. hips widen, pubic hair or breasts develop.

Question 6

(a)

(i) Few candidates recognised that process **A** was combustion.

(ii) Very many did identify bacteria or fungi as a correct response.

A significant number of candidates offered the same letter as representing both respiration in **(iii)** and photosynthesis in **(iv)**. This either indicates a misunderstanding of these two processes or of careless reading of the questions.

(b) Candidates were asked to give a word equation for photosynthesis but many chose to try to respond with a chemical equation and made unnecessary difficulties for themselves. To gain full credit for the latter it had to be a balanced equation and this was achieved by very few. Confusion was also caused by those candidates who wrote so much in the box provided, that some of their 'products' appeared on a second line under their reactants on the left hand side of the equation. In word equations all reactants should appear to the left of the equals sign and all products to its right.

(c) Reasons for the increase in carbon dioxide concentration in the atmosphere over the last 100 years should refer to increases in various actions either releasing carbon dioxide into or no longer removing it from the atmosphere. Many candidates' responses suggested that many events had only started in the last 100 years rather than that they were continuing at higher rates. The mark allocation should indicate to candidates that more than a single action reason was needed to gain full credit.

Question 7

(a)

(i) The initial calculation seemed straightforward for the vast majority of candidates who also realised that as the table column was headed with units there was no need to insert these in the empty box.

(ii) A limited number of candidates recognised that this was a division calculation. The correct response was accepted as 4 although a number quoted the value to three places of decimals as 4.002. The majority mistakenly calculated the additional cardiac output after exercise. There were some who although they had identified the correct manipulation of the values, gave a result that was quite different to 4 but because they showed their working, as requested, gained some credit. Candidates should be discouraged from stating an answer without showing how they reached this value in case they make an arithmetic mistake.

(iii) Most candidates did not realise that the body requires additional energy for the exercise over and above that needed for the general body demands. They did not comment on the need for extra respiration in the muscles and thus missed the need for the blood to deliver additional oxygen and glucose to the cells involved as well as to remove the extra carbon dioxide released. A significant number of responses described the additional breathing and gaseous exchange involved as if these processes describe cardiac output.

(b)

(i) Candidates showed some confusion regarding the chamber pumping blood to the lungs.

(ii) There was also confusion over which component of the blood carries oxygen. This was often responded to in terms of structures that are part of the vascular system.

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(iii) Many candidates seemed unaware of the features of gaseous exchange surfaces and described breathing or structures within the thorax.

Question 8

This question posed particular difficulty for many candidates, with individuals leaving some parts unanswered. Few were able to give clear explanations of either allele or recessive.

(a)

(i)

(ii)

(b) Candidates should be made aware that the sample of individuals in this family tree is too small for a statistical analysis to reveal that polydactyly is caused by a dominant allele and thus this is inadequate as a response here. The clue is that parents **3** and **4** produce a child who has a phenotype unlike that of either parent and thus this condition is caused by the recessive allele. This child has the normal number of digits and thus the polydactyly allele must be dominant and "hiding" the recessive allele in both parents.

(c) Although there was a clear instruction to use **F** and **f** as symbols, there were a significant number of candidates who used alternatives of their own choosing.

(d) The two members of the family who had to be heterozygous were the parents **3** and **4**. Very many selected grandparent **1** and child **6**.

(e) Many candidates did understand that a mutation involves a change in the structure of DNA, a gene or a chromosome or even in the number of chromosomes and thus defined the term successfully. Some responses just referred to a change but did not develop this any further. There were a number of candidates who seemed to think that they had to explain a cause of a mutation and gave responses about ionising radiation or mutagenic chemicals.

Question 9

(a)

(b) The positions of the phloem and xylem tissue were commonly reversed and in some cases the label lines were directed to other regions of the section and not the vascular bundles at all. A number of label lines simply indicated the dividing line between the two tissues as either xylem or phloem and this did not gain any credit.

(c) The roles of the phloem and xylem in transporting materials were commonly muddled up and even occasionally candidates stated that the phloem gave support to parts of the plant. Many responses were generalised and thus inadequate. Candidates should understand that the xylem carries water and mineral ions from the roots to the stem and leaves while the phloem carries dissolved materials such as sucrose and amino acids, it does not carry starch grains. The phloem transports these materials from a region of the plant with a supply to a region that needs some, commonly the leaves to the stem and roots but this is not always the case.

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BIOLOGY

Paper 0610/23
Core Theory

General comments

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(i) It was clear that many candidates were familiar with enzymes acting as catalysts and some completed the definition by referring to their protein nature.

(ii) It was expected that candidates would be aware that the stomach contents have a low pH and that this would allow them to suggest the relevant enzyme to be **X**. Although many did name enzyme **X** they did not offer a suitable explanation for their choice. There were significant numbers who selected the other two enzymes and stated that the reason was that either pH 5 or 9 were very acidic or that the stomach contents were alkaline. There was also confusion in a number of answers between high and low pH and responses suggested that these terms were being used in the reverse way to normal usage.

(iii) It was unfortunate that most candidates did not link the enzyme amylase with the digestion of starch and that the end product is maltose.

(c) There seemed to be considerable confusion among candidates about the liquid produced by the liver that aids digestion with glycogen, lactic acid, glycerol, urea and urine appearing frequently among the responses. Also despite the question stating that the liquid contained no enzymes, candidates still gave details of enzymes, such as lipase, that were thought to be in the bile. It was noticeable how few candidates gave any explanation of the role of the bile. There were some responses in which emulsification was muddled with digestion as candidates thought that bile broke up large fat droplets into fatty acids and glycerol.

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Question 2

(a) Candidates frequently identified either feathers or a beak or both as external features of birds. They should be aware however that there are other vertebrates with wings, such as the bats.

(b) The correct responses such as three body regions, three pairs of legs or the presence of wings were frequently stated. Candidates should be aware that other arthropods have antennae and compound eyes. Candidates' responses that stated that insects had more than two pairs of legs were considered too vague for credit. For both animals a few candidates offered internal features or actions of the relevant animals and none of these were given credit.

Question 3

(a) It was common for the suspensory ligaments to be labelled as the ciliary muscles amongst other errors. Many candidates placed the end of their label lines at the junction of two structures suggesting either carelessness in labelling or uncertainty as to the real identity of the structure they were expected to label. This was a particular problem when labels for the optic nerve terminated clearly at the blind spot rather than on the nerve itself.

(b) Very many candidates linked the retina to either controlling the amount of light entering the eye or reflecting light that had already entered. The retina was rarely recognised as the layer of light sensitive cells that generated nerve impulses.

(c) The majority of candidates understood that in the transition from dim to bright light the pupil was reduced in size. This was often thought to be an action brought about by the pupil itself rather than because of the action of the iris. Those candidates who linked the action to muscle activity regularly ascribed this to the ciliary muscles. Many candidates simply referred to circular muscles in their responses and this is inadequate as there is more than one set of such muscles in the eye. Candidates should be aware that the iris reflex does not control the entry of light into the eye as the light has already entered before it reaches the pupil.

Question 4

In this question candidates were given freedom to introduce examples they had studied of human influences on ocean ecosystems. Unfortunately many devoted all or part of their answers to effects on other ecosystems such as rain forests, rivers and the atmosphere without any reference to the oceans. Although many did make reference to human activities they did not then offer an explanation of the undesirable effects these could have. Candidates with an appreciation of this topic dealt with activities such as oil spillages, the release into the oceans of various chemicals that could be toxic to marine life, over-fishing, dumping of litter and industrial activities such as the extraction of sand and other minerals. Candidates should avoid the use of rather vague terms such as rubbish and waste unless they make it clear what they mean by such terms.

Question 5

(a)

(i) Overall there was a high standard of plotting of the data for males on the existing graph. It was unfortunate that a number of candidates did not recognise that the first two sets of data for males were identical to those already plotted for females. In this sort of graph candidates would do well to match the style of graph line with any already drawn and should not produce freehand versions as a few candidates did. Also the added line should be labelled.

(ii) Candidates were expected to recognise that the steepest gradient would be the period of fastest growth, between 0 and 2 years. Candidates frequently suggested the ages to be 15 to 20.

(iii) Too many responses suggested careless reading of the ages at which the two lines crossed indicating the same heights, on correctly plotted graphs at 8.5 and 16.5 years. Despite the statement in **(iii)** "after the age of 2 years", there were a significant number of response that quoted ages lower than 2 years.

(iv) The age when females were 144 cm in height was again often incorrectly read from the graph.

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(b)

(i) Many different hormones were named as controlling the changes in puberty although more than half the candidates identified the hormone involved as oestrogen, which was offered in a wide variety of formats.

(ii) Simple statements, such as hips, breasts and pubic hair, in themselves do not indicate a change and candidates should state what change is occurring, e.g. hips widen, pubic hair or breasts develop.

Question 6

(a)

(i) Few candidates recognised that process **A** was combustion.

(ii) Very many did identify bacteria or fungi as a correct response.

A significant number of candidates offered the same letter as representing both respiration in **(iii)** and photosynthesis in **(iv)**. This either indicates a misunderstanding of these two processes or of careless reading of the questions.

(b) Candidates were asked to give a word equation for photosynthesis but many chose to try to respond with a chemical equation and made unnecessary difficulties for themselves. To gain full credit for the latter it had to be a balanced equation and this was achieved by very few. Confusion was also caused by those candidates who wrote so much in the box provided, that some of their 'products' appeared on a second line under their reactants on the left hand side of the equation. In word equations all reactants should appear to the left of the equals sign and all products to its right.

(c) Reasons for the increase in carbon dioxide concentration in the atmosphere over the last 100 years should refer to increases in various actions either releasing carbon dioxide into or no longer removing it from the atmosphere. Many candidates' responses suggested that many events had only started in the last 100 years rather than that they were continuing at higher rates. The mark allocation should indicate to candidates that more than a single action reason was needed to gain full credit.

Question 7

(a)

(i) The initial calculation seemed straightforward for the vast majority of candidates who also realised that as the table column was headed with units there was no need to insert these in the empty box.

(ii) A limited number of candidates recognised that this was a division calculation. The correct response was accepted as 4 although a number quoted the value to three places of decimals as 4.002. The majority mistakenly calculated the additional cardiac output after exercise. There were some who although they had identified the correct manipulation of the values, gave a result that was quite different to 4 but because they showed their working, as requested, gained some credit. Candidates should be discouraged from stating an answer without showing how they reached this value in case they make an arithmetic mistake.

(iii) Most candidates did not realise that the body requires additional energy for the exercise over and above that needed for the general body demands. They did not comment on the need for extra respiration in the muscles and thus missed the need for the blood to deliver additional oxygen and glucose to the cells involved as well as to remove the extra carbon dioxide released. A significant number of responses described the additional breathing and gaseous exchange involved as if these processes describe cardiac output.

(b)

(i) Candidates showed some confusion regarding the chamber pumping blood to the lungs.

(ii) There was also confusion over which component of the blood carries oxygen. This was often responded to in terms of structures that are part of the vascular system.

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(iii) Many candidates seemed unaware of the features of gaseous exchange surfaces and described breathing or structures within the thorax.

Question 8

This question posed particular difficulty for many candidates, with individuals leaving some parts unanswered. Few were able to give clear explanations of either allele or recessive.

(a)

(i) and **(ii)**

Candidates should be encouraged to learn common definitions, such as allele and recessive, to ensure that these simple marks are gained.

(b) Candidates should be made aware that the sample of individuals in this family tree is too small for a statistical analysis to reveal that polydactyly is caused by a dominant allele and thus this is inadequate as a response here. The clue is that parents **3** and **4** produce a child who has a phenotype unlike that of either parent and thus this condition is caused by the recessive allele. This child has the normal number of digits and thus the polydactyly allele must be dominant and "hiding" the recessive allele in both parents.

(c) Although there was a clear instruction to use **F** and **f** as symbols, there were a significant number of candidates who used alternatives of their own choosing.

(d) The two members of the family who had to be heterozygous were the parents **3** and **4**. Very many selected grandparent **1** and child **6**.

(e) Many candidates did understand that a mutation involves a change in the structure of DNA, a gene or a chromosome or even in the number of chromosomes and thus defined the term successfully. Some responses just referred to a change but did not develop this any further. There were a number of candidates who seemed to think that they had to explain a cause of a mutation and gave responses about ionising radiation or mutagenic chemicals.

Question 9

(a) Many candidates answered this correctly.

(b) The positions of the phloem and xylem tissue were commonly reversed and in some cases the label lines were directed to other regions of the section and not the vascular bundles at all. A number of label lines simply indicated the dividing line between the two tissues as either xylem or phloem and this did not gain any credit.

(c) The roles of the phloem and xylem in transporting materials were commonly muddled up and even occasionally candidates stated that the phloem gave support to parts of the plant. Many responses were generalised and thus inadequate. Candidates should understand that the xylem carries water and mineral ions from the roots to the stem and leaves while the phloem carries dissolved materials such as sucrose and amino acids, it does not carry starch grains. The phloem transports these materials from a region of the plant with a supply to a region that needs some, commonly the leaves to the stem and roots but this is not always the case.

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BIOLOGY

Paper 0610/31
Extended Theory

General Comments

There was evidence that some candidates had prepared well for this paper as they gave concise and detailed answers. The detail expected in some of the answers was clearly very challenging for many candidates, who were limited by lack of knowledge and poor understanding of what was required from them in each question.

All the questions were attempted and there were relatively few questions that were left blank. There was little evidence that the candidates had any problems completing the paper in the time available. Scripts were generally legible and answers were confined to the spaces allocated; there were very few examples of candidates writing continuation answers or using additional sheets of paper. The standard of handwriting and spelling was poor in many cases and the Examiners often spent some time deciphering answers. Although there were some very good, fluent answers with ideas clearly expressed, it did appear that some candidates were hampered by language difficulties when interpreting the demands of questions and then expressing their answers in clear English.

Questions 1(b)(ii), **2(a)**, **(b)** and **(c)**, **3(d)**, **4(c)**, **(d)** and **(e)**, **5(a)**, **(b)** and **(c)**, **6(a)**, **7(a)**, **(b)** and **(c)** were often answered well.

Questions 1(a)(i), **(ii)**, **3(a)**, **(b)** and **(c)**, **4(a)** and **(b)**, **6(c)** and **7(d)** and **(e)** proved more challenging.

Comments on Specific Questions

Question 1

(a)

(i) Most candidates named **A** as the pollen tube, but there was some confusion with the naming of **B** and **C**; the most common error was to suggest that **B** was the ovary and **C** was the ovule.

(ii) The more able candidates described clearly the development and growth of the pollen tube and subsequent fertilisation. Some candidates referred to the 'pollen grain travelling down the tube' and being involved in fertilisation and a common error was to describe the pollen grain fusing with the ovule. Some went on to describe the changes in the ovary and ovule after fertilisation, which was not required. Answers should have stopped at the formation of the diploid zygote. Surprisingly few candidates took the opportunity to refer to the letters provided on the diagram and so make their answers more concise.

(iii) Better responses gained maximum credit for describing the advantages and disadvantages of self pollination. Some referred to insects fertilising flowers rather than pollinating them. Many candidates failed to distinguish between self-pollination and asexual reproduction. This led them to suggest that there would be no variation or they stated that all the plants produced would be identical or would form clones. They failed to appreciate that self-pollination is a method of sexual reproduction in which meiosis is involved. This means that there is some variation amongst the gametes and as fertilisation is a random process there will be some variation amongst the offspring, even though it is more limited than amongst the offspring following cross-pollination. Some candidates suggested as a disadvantage, that the new plants will always be very close to the parent plant and compete for water, nutrients and light. This again suggests that they were confusing self-pollination with asexual reproduction or vegetative reproduction. Candidates should appreciate that the degree of variation is greatest with cross-pollination between unrelated plants and then less with cross-

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pollination between related plants, even less with self-pollination and least with vegetative reproduction (asexual reproduction). Even in the latter there will be some genetic variation between the offspring as a result of mutation. There may be even more phenotypic variation if the plants are grown under different conditions.

(b)

(i) Although this was a relatively straightforward question as the answer had to be selected from information on the examination paper, many gave the full species name of the soybean rather than just the generic name, *Glycine*. Some simply called it a dicotyledon.

(ii) Most candidates identified two features of dicotyledons, although a frequent error was to refer to leaves as simply 'large' or describe the parallel venation seen in monocotyledons rather than state that there is a network of veins or something equivalent.

Question 2

(a)

(i) Many named the hormones correctly, although FSH and oestrogen were sometimes given the wrong way round.

(ii) The organ, **Z**, was named correctly by many, although some candidates named it incorrectly as the brain.

(b) Many candidates gained at least partial credit as the function of progesterone was understood. The usual mistake was to state that progesterone 'maintained the wall of the uterus' rather than its lining. The Examiners did not credit answers that referred simply to the 'wall of the uterus' and only credited references to the endometrium or to the lining of the uterus. Some candidates stated that progesterone prepared the uterus for fertilisation rather than for implantation. There were also some vague statements such as 'preparing for the baby' which were not credited.

(c) In most cases this question on the advantages and a disadvantage of breast feeding was answered well with many candidates referring to the transfer of antibodies and the emotional bond that develops between mother and baby. Many referred to the cost of milk as a disadvantage rather than an advantage suggesting that they had not read the question carefully. The point about the suitability of breast milk for human development was expressed in a great variety of ways such as 'the milk contains all the nutrients that the baby needs in the right proportions'; however, some candidates thought that formula milk would be better as it had 'everything added'. Candidates using vague statements such as 'breast milk is better because it is natural' were not awarded credit.

Question 3

(a) The definitions of the term *aerobic respiration* were generally very good although candidates need to take care with expression as many stated that 'energy is made' or 'energy is produced' – these statements were not awarded any credit.

(b) There were some good answers linking the raising of the ribcage to increase the volume of the thorax and decrease the air pressure which easily gained maximum credit. Some concentrated only on the role of the diaphragm during inspiration and so could only be awarded partial credit. Many did not specify that it is contraction of the *external* intercostal muscles which causes the ribcage to move upwards; they often suggested that the diaphragm is responsible for pushing the ribs out. Others stated that it was the expansion of the lungs which forced the ribcage up and the diaphragm down.

(c) Some candidates gained full credit here, although many simply repeated the question stem and stated that the ribcage returns to its resting position without explaining how this is achieved. Others simply described the movement of the diaphragm and lungs during expiration. Few discussed the return of the ribcage to its resting position in terms of the internal and external intercostal muscles. During expiration the external intercostal muscles relax and the internal intercostal muscles may contract if breathing is vigorous.

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(d)

(i) The calculation was almost always correct.

(ii) In most cases there were some good answers to this part with many candidates showing understanding of the need for anaerobic respiration to take place in the muscles. They stated that lactic acid is produced and has to be broken down when the exercise stops. The most common error was to describe the need for a high ventilation rate during the exercise, rather than after it, and also that the athlete would need to 'replace the oxygen he used during the exercise'.

Question 4

More able candidates gave clear descriptions of fat absorption and its subsequent transport pathway, but there was evidence of confusion between the roles of blood and lymph in many answers.

(a) Many candidates repeated the question stem and stated that lymph was moved in a similar way to the movement of blood in the veins. Some stated that valves prevent backflow, but only the more able candidates went on to describe the role of skeletal muscle in squeezing the vessels so that lymph is moved. The Examiners accepted 'muscle' or 'surrounding tissues' as alternatives to skeletal muscle. Some candidates used Fig. 4.1 and attempted to describe the route that the lymph would take before it entered the blood.

(b) Answers here were very imprecise with many candidates simply describing fat digestion. Several stated that fat was harmful and that excess needed to be eliminated via the lymph. Many described the products of fat digestion being absorbed into the lymphatic system, but did not identify the lacteal as the route. The Examiners accepted any sensible suggestion as to why fat travels in the lymph rather than in the blood. Several of these are included in the mark scheme as examples.

(c)

(i) Mitosis was usually identified as the type of nuclear division shown in Fig. 4.2. The main error was to give 'binary fission'.

(ii) Most candidates named antibodies with some giving 'antibiotics' or 'antigens' instead.

(iii) Most candidates gained full credit for identifying cell **R** as a phagocyte and then describing phagocytosis. The common error was to state that bacteria were 'destroyed' after being engulfed without explaining how.

(d) Many candidates gained credit for correctly identifying the trend in Fig. 4.3 and then going on to use appropriate data in support. Some credit was given to candidates who misinterpreted the graph but gave figures to support their argument. Some candidates were imprecise with their data quotes and consequently could not be awarded credit. All data quotes had to have figures taken from both axes. Good candidates noted the variation in antibiotic resistance within countries (marking point 3).

(e) In most cases, candidates gained at least partial credit here as they discussed the problems of antibiotic resistance as a result of overuse. Many also appreciated the specificity of some antibiotics and possible harmful side effects were also given. Common errors were to describe bacteria becoming 'immune' to antibiotics and people becoming 'resistant' to them.

Question 5

(a) Most candidates gained full credit here. A common error was to give 'carnivore' rather than 'secondary consumer'.

(b) More able candidates explained the 10% loss of energy between the trophic levels and gave examples of ways in which energy is lost. There were many imprecise answers here with candidates not actually making the point about energy loss between trophic levels. Many tended to say that the herbivorous fish had more energy than the tuna without saying anything about energy loss; weaker answers simply described the quality of the nutrients available at each trophic level.

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(c) In most cases there were some good answers to this question and most understood the need to conserve tuna and dolphin and linked their loss to possible consequences for the food web.

(d) More able candidates identified the specific problems for marine animals of eating or becoming trapped in plastic materials. This question was not well understood and many candidates wrote in general about the effect of pollution on the sea, without writing specifically about the problems posed by non-biodegradable plastics.

Question 6

(a) Almost all candidates gained full credit here and credit was given even if the lines were sketchy. The main error was to start the line at 0. Some candidates drew the increase to 100 000 at the end of July rather than at the beginning. There were four marking points available so it was possible to earn full credit even with one mistake.

(b) Many candidates identified that the fish would have eaten *Daphnia*, although some described *Daphnia* eating the fish. Others used imprecise statements such as 'the climate was not suitable for them' and so were not awarded credit.

(c) More able candidates realised that the data could be interpreted as a standard growth curve and recognised the different phases making reference to the months during which they occurred. Good answers included reference to limiting factors, such as the temperature, and went on to explain that the population remained stable after September as the lake had reached its carrying capacity. Others simply described the curve and repeated the data already given in the question stem rather than trying to *explain* why there were changes in number. Some candidates began their answer with a description of exponential growth without mentioning or explaining the constant number in March, April and May prior to this. This period, between March and May, represents the lag phase in this example. Another common error was to explain the lag phase in terms of the fish eating the *Daphnia* rather than realising that the fish had been removed in 2006 as stated in the question stem. Very few candidates made reference to increase or decrease in the rate of reproduction in their answers, and again, imprecise statements such as 'resources were running out' were not credited. The birth (or reproduction) rates and death rates of *Daphnia* were rarely mentioned.

Question 7

(a) Most candidates named the response correctly as a geotropism.

(b) Most candidates understood that the seedlings were kept in the dark to eliminate the stimulus of light.

(c) Almost all candidates explained that it was essential that the shoots grew to reach the light and that the roots grew to reach water and minerals. The main error was to describe the roots' sole function as providing anchorage.

(d) The action of auxin was often not understood or expressed well. Few candidates stated that auxins are made in the shoot tip and that their effect is on cell expansion, although many candidates described how auxin causes the shoot to bend.

(e) Good responses discussed absorption and translocation via the phloem so that the weedkiller could then diffuse from cell to cell. Often candidates concentrated on the adverse effects that the weedkiller would have on the weed in terms of unsustainable growth, rather than how the weedkiller travelled through the plant. Another error was to have the weedkiller absorbed through the roots by osmosis and then to be transported in the xylem *and* phloem.

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BIOLOGY

Paper 0610/32
Extended Theory

General comments

This paper ranged widely over the syllabus material highlighting several areas from the supplement sections of the syllabus, particularly codominance (**Question 6**), the effect of exercise on the body (**Question 3**), and some aspects of core biology in novel contexts, such as the role of bacteria in digesting complex food compounds in sewage treatment (**Question 5**) and diffusion in kidney dialysis (**Question 2**).

The Examiners saw some excellent scripts that were well worded with impressive knowledge of the subject matter and good use of appropriate terminology. Many of these candidates often found one question, or several part questions, more challenging so did not perform uniformly well throughout the paper. The paper proved quite difficult for many candidates and the Examiners felt that as these candidates performed well on the more straightforward questions that they would have performed better on Paper 2. The interpretation of questions was often difficult for them.

The most straightforward questions proved to be **Questions 1(a)**, **(b)** and **(d)**, **2(a)**, **3(b)** and **5(a)(i)** to **(iii)**. The Examiners were impressed with the way in which most candidates answered the purely descriptive questions, such as **Question 5(a)(i)**. Many responded to the instruction to use the data provided. Describing the changes in urea concentration in Fig. 2.2 proved to be more difficult, where some did not use the data at all and others quoted every single peak and trough. Candidates obviously need to practice the skills of summarising patterns shown in graphs and using data effectively to illustrate trends and patterns.

The most difficult questions were **Questions 1(c)**, **2(b)(ii)**, **2(c)(iii)** and **(iv)**, **3(a)**, **(c)** and **(d)**, **4(a)**, **5(a)(iv)** and **6(d)**. Candidates found it particularly hard to offer concise explanations with the correct degree of detail. Many candidates did not appear to understand the difference between questions asking for a description of data and those needing an explanation of data. For example, in **Question 2(c)** they tended to repeat their description of the changes in urea concentration rather than explain them in terms of dialysis and urea production. Sometimes, unfortunately, the descriptions in **(c)(iv)** were better than those given in **(c)(iii)**, but Examiners are not permitted to transfer credit from one question to another.

Very few candidates needed more space for their answers than was provided on the examination paper. This was an encouraging sign. Candidates should always be reminded that if they rewrite or continue an answer on white space or blank pages, then they should indicate clearly at the end of the answer lines that they have done this and state where the Examiner will find the rewritten or continuation answer.

Whilst most followed the rubrics to the questions, a significant number did not; candidates should be reminded of the need to follow the rubric and the importance of taking note of embolden phrases or words. An example of this is **Question 1(a)** where candidates were expected to refer only to features visible in Fig. 1.1.

Comments on Specific Questions

Question 1

(a) Most candidates gave one or two features of dicotyledonous plants as shown in the drawing of *Ranunculus cymbalaria*. Most gave broad leaves and branched veins, although some stated the features associated with monocotyledonous plants explaining that these were not shown by *R. cymbalaria* and these answers were accepted. Some candidates stated that flower parts are in fives not in threes as could be seen in Fig. 1.1 B. Most candidates followed the rubric and gave features visible in the drawings. Very few included two cotyledons in their answers and if they did, the Examiners ignored this point and looked for the features mentioned. Some candidates gave other features of dicotyledons and/or monocotyledons that were not shown in the drawings. A

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number of candidates wrote about tap roots and leaves being divided into parts, points which were not appropriate.

(b) The photomicrographs in Fig. 1.2 showed the difference between the number of starch grains in roots of *Ranunculus* at the end of winter (**W**) and at the end of summer (**S**). Candidates either explained the reasons for the few grains present in **W** or the reasons for the large number in **S** or they discussed both. Common answers explained that as the winter does not provide suitable conditions for photosynthesis, starch is used up to provide energy. An answer with these three points gained full credit. The reverse argument was also common: in the summer conditions favour photosynthesis and starch is stored. Some candidates referred to the number of leaves likely to be on the plant in summer and/or winter and some referred to the limiting factors for photosynthesis. There were some very well expressed answers and also some that included information on enzymes that was appropriate for **(c)**. Some candidates thought that starch was absorbed from the soil or that the roots carried out photosynthesis.

(c) A very large majority of candidates did not recognise this question. It was set on Topic 6.1 from ***Section II*** of the syllabus:

describe the synthesis of large molecules from smaller basic units, i.e.
- simple sugars to starch and glycogen

Many candidates did not understand the meaning of the term *synthesise* as used in the question and thought that it referred to breakdown. Most answers explained that amylase breaks down starch to provide glucose, which is then used by the plant. The answer expected was that sucrose is translocated from the leaves to the roots where enzymes convert glucose into starch by adding glucose molecules together to form a long chain molecule. Some candidates described the structure of starch even though they often described its breakdown rather than its synthesis. Some also gave features of enzymes and both these approaches gained some credit. Four marking points were available to those who wrote about the structure of starch and about enzymes even if in the context of breakdown. ***Section 6.1*** also includes the synthesis of proteins from amino acids and fats from fatty acids and glycerol. Past papers have shown that candidates are more knowledgeable about breakdown than they are about synthesising these large molecules.

(d) Answers to this question on the effect of temperature on enzyme activity were generally good. Some candidates repeated the information in the question, but also stated that they work best at an optimum temperature after which they are denatured. Some explained the increase in activity in terms of an increase in kinetic energy and more collisions between enzymes and substrate molecules, although this latter idea tended to be expressed in a variety of different ways often without the appropriate terminology. Denatured was a term that was not used by all candidates and some stated that enzymes are 'killed' or 'die' at these higher temperatures. Some candidates gave the optimum temperature as between two extremes of a range and some stated that enzymes only work at the optimum temperature rather than working *best* at this temperature. Many candidates expressed the idea that all enzymes have their optimum temperature at 37 ^{o}C, which is far from the case as implied by the question.

Question 2

(a) The Examiners were pleased to see that most candidates knew all or part of the definition of excretion given in the syllabus. Some gained partial credit by stating that excretion is the removal of waste products of metabolism, toxic compounds and substances in excess of requirements. Further credit was available for stating that these substances are removed *from the body* – a point that was not always made very clearly as candidates tended to write about 'removal of wastes' without further clarification. Some candidates described egestion rather than excretion. Candidates did not always make clear the point about removal of substances in excess of requirements. Often candidates wrote about 'excess of products which can be toxic' which would gain credit for 'toxic', but not for 'substances in excess of requirements'.

A number of good answers gave the definition and then also gave specific examples; 'excess salts are removed from the body in sweat form the skin'. It was not necessary to give examples to gain credit.

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(b)

(i) Many candidates did not seem to appreciate what prevents the loss of plasma proteins and red blood cells from the blood as it flows through a dialysis machine. Candidates thought of a wide range of unlikely explanations including having the appropriate concentration of proteins and red blood cells in the dialysate. Very few candidates stated that plasma proteins and red blood cells are too large to pass through the dialysis membrane or that the pores in the membrane are too small. Some candidates stated or implied that red blood cells are molecules and the Examiners decided to ignore this in order to credit the right idea. Describing the dialysis membrane as 'too small' was not precise enough to gain credit. There were many incorrect references to permeability or semi-permeability of membranes preventing the passage of red blood cells and plasma proteins.

(ii) Some candidates used the information in the question to explain that the glucose concentration in the dialysate is at the 'correct' concentration or within the normal range. If they did this they gained full credit. Full answers were seen on a few scripts which then explained that glucose diffuses into or out of the blood to achieve the 'correct' concentration in the blood after several hours on dialysis. Some also stated that having glucose in the dialysate meant glucose did not diffuse out of the blood leaving the patient without any. Some candidates explained the feedback control of blood glucose with insulin and/or glucagon. This approach did not answer the question. Many candidates seemed to be under the impression that glucose diffuses from the blood into the dialysis fluid to keep its concentration at an appropriate 'level' and there were a surprising number of candidates who thought glucose did not move at all.

(c)

(i) Identifying the number of times dialysis treatment occurred proved to be quite a challenge for candidates. Common answers were 8, 9 and 17. Nine is the correct answer.

(ii) Many candidates carried out the calculation correctly giving 200 mg per dm^3 as their answer. The Examiners insisted on the unit being included and accepted mg / dm^3 and mg dm^{-3}. Some candidates did not take sufficient care and wrote 'g per dm^3', or just 'mg' or 'dm^3' and so could not be awarded credit for this.

(iii) The Examiners saw some very good descriptions of the changes in the urea concentration and the instruction to use the data was followed by most. The data quotes were not always read accurately and the table below shows the figures for the peaks and troughs from Fig. 2.2.

day	concentration of urea / mg per dm^3	
	peak	trough
1	240	90
3	215	85
5	200	80
7	180	75
9	165	65
11	125	55
13	100	45
15	85	45
17	75	40

Candidates identified all the points given on the mark scheme although they tended not to notice that the increase after dialysis became less steep after day 9 (marking point 6). Many were awarded full credit if they referred to the decrease in urea concentration 'during' or 'after' dialysis. Most gained partial credit for a data quote even if they repeated the wording of **(c)(ii)** and its answer. Whilst some good answers were seen, the majority failed to identify clearly the day and the concentration in their data quotes which were often too vague. Good candidates tended to use the figures extensively and often calculated all the differences between the peaks and troughs.

(iv) This question asked candidates to explain the changes described as shown in Fig. 2.2 and therefore described in **(c)(iii)**. Many candidates did not explain the changes; instead they often repeated the description already given. Candidates who attempted an explanation

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tended to concentrate on the *decreases* in the urea concentration rather than the *increases*. Some candidates explained that urea diffuses from the blood to the dialysate although few went on to explain that as the dialysate does not contain any urea there is a concentration gradient between blood and dialysate. The urea concentration increases because excess amino acids are deaminated in the liver. The restatement of answers to **(c)(iii)** was probably because candidates thought that the advice 'you will gain credit for using the data from Fig. 2.2 in your answer' also applied to this question.

Question 3

(a) There were quite a few chemical equations for anaerobic respiration in muscle that were correctly balanced. Errors seen often here were: giving oxygen on the left hand side of their equation, giving the formula for ethanol rather than lactic acid and including water and/or carbon dioxide on the right hand side of the equation. The Examiners ignored any word equations that were given in addition to chemical equations and they also ignored any references to energy or ATP. This question was left blank by a high proportion of candidates. Amongst the better answers some candidates gave the correct formula for lactic acid, but failed to balance the equation. Many gave word equations and did not attempt to give chemical equations at all. This revealed a lack of confidence in the supplement material in the syllabus.

(b) Some candidates completed Table 3.1 correctly taking the information from Fig. 3.1 and Fig. 3.2. Some misread the figure for the rate of breathing so the Examiners allowed an error carried forward for those that multiplied their incorrect answer by 2 to give the volume of air taken in per minute.

(c) This question asked candidates to explain the effect of exercise on the candidate's breathing. Credit was given to any correct description of the effect of exercise which was either a qualitative statement or used the data to state how the breathing changed. Some candidates wrote at great length describing the effect rather than giving an explanation. Successful candidates began by explaining that muscle respires faster during exercise and requires more energy. Faster and deeper breathing provides more oxygen to support aerobic respiration and removes carbon dioxide at a faster rate. Some confused air intake with oxygen intake. Many candidates included an explanation about paying off the oxygen debt. Answers that did this gained little credit as the data provided in Fig. 3.2 records the candidate's breathing during exercise not after it. Few candidates explained that providing sufficient oxygen during exercise is likely to prevent anaerobic respiration occurring and therefore prevent the build up of an oxygen debt. Candidates tended to understand the demands of this question or not. If they did not, then the Examiners felt that perhaps they thought 'effect on breathing' in the question meant 'effect on the pattern of breathing' which was the wording used to describe graphs on page 10 of the paper. This may explain why whole answers were devoted to comparing the figures from the graphs. In this question it is worth emphasising the need to give comparatives as the Examiners looked for statements that there was 'more respiration' with 'more energy required' and therefore 'more oxygen needed'.

(d) The effect of adrenaline on the pulse rate and the concentration of glucose was described and explained quite well by many candidates. The marking points were not always given in the two sections so the Examiners looked at both sections for the award of full credit. Many explained that the glucose concentration would increase or stay the same to provide the muscles with sufficient energy, although some thought that the concentration would decrease as a result of respiration, forgetting that the question asked for the effect of adrenaline. Most stated that the pulse rate would increase although many explained that this would happen to provide more blood to the body. Candidates should refer to the increase in supply of blood to *muscles* rather than to the body. This was explained in terms of providing more oxygen to the muscles, but rarely removing carbon dioxide, lactic acid or heat. There were many references to energy being produced, made or created which were not credited for marking point 9.

Question 4

(a) Candidates often found it difficult to describe what happens to the viruses that leave white blood cells. The most common correct answer was that they enter other white blood cells. Few thought to add that they must pass through blood, plasma or lymph to do so. Strangely very few stated that the viruses might be transmitted to another person and give a route by which this might happen. This is strange since when the transmission of HIV has been asked most candidates know three or more routes of transmission. Many of the answers that appeared here were more appropriate for

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(b). Very few scored more than partial credit for the invasion of further white blood cells. Many wrote of 'invading' other cells in the blood but failed to identify which these were and some stated that HIV infects red blood cells. There were also many vague answers about HIV 'invading other cells' in the body without specifying which these were. Many discussed what happened inside white blood cells perhaps not spotting the word 'leave' in the question.

(b) Answers to this question were much better, although few candidates differentiated between the different types of white blood cell. A few, however, impressed with information about CD4 T-lymphocytes. Candidates made the obvious points that with time the long-term effects of HIV on the immune system were to weaken it making infected people more likely to contract diseases. Some explained that these are opportunistic diseases such as TB. A few candidates mentioned the increased likelihood that cancers will develop and that AIDS will develop. Some candidates attributed the development of AIDS to another virus rather than to the effects of HIV infection. Most candidates gained partial credit here and many were awarded full credit.

(c)

(i) The term drug covers a great variety of substances and the Examiners looked for a general definition that covers the effects of all of these substances. The definition given by the syllabus is: any substance taken into the body that modifies or affects chemical reactions in the body. The Examiners looked for this general definition but did not insist on the word *chemical*. As the question was asked in the context of disease, many candidates gave a definition that concentrated on medicines, rather than drugs in general. Answers that did not gain credit included: drugs 'speed up actions', 'make the body better', 'kill pathogens', 'cure illness' and 'change behaviour'.

(ii) Many candidates explained why antibiotics are not used to control HIV. Some answered this question in some depth explaining that antibiotics are used to treat bacterial infection not viral since they work on specific targets that do not exist in viruses. Many referred to the effect of antibiotics on the cell walls of bacteria and stated that viruses do not have cell walls. Some went on to write about anti-viral drugs. A common error was to state that viruses become resistant to antibiotics. There was also some confusion with antibodies as some wrote about the virus changing its coat so that antibodies no longer recognise them. Other common errors were to state that viruses can overpower or destroy the antibiotics and that viruses constantly mutate so cannot be affected by antibiotics.

Question 5

(a)

(i) This question was very well answered with many candidates gaining full credit. Most candidates described the changes in oxygen concentration shown in Fig. 5.1. The Examiners insisted on candidates describing the steep decrease after the sewage enters the river and its more gradual increase from just beyond station **D**. Credit was not awarded for those that simply stated that the oxygen concentration decreased and increased. Many gained credit for stating that the concentration falls to zero and many stated that it returns to 100% at station **G**. Many candidates gave data quotes, although they were not very good at reading the oxygen concentration at **B** which they thought was 100%. The Examiners used the following table when awarding credit for data quotes comparing the oxygen concentration at two stations.

sampling station	acceptable oxygen concentration / %
A	100
B	55 – 65
C	10 – 15
D	0
E	30 - 40
F	75 - 80
G	90- 100

Some candidates gave explanations here rather than descriptions, but there were not many of these.

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(ii) Most candidates chose the stonefly nymph as the invertebrate animal that is only found in water with the highest oxygen concentration. Some misread the question and gave a species that tolerates low oxygen concentrations. A number of candidates gave a sampling station letter, e.g. **A** rather than a species.

(iii) Many identified the rat-tailed maggot and tubifex worm as invertebrate animals that tolerate the lowest oxygen concentrations. The Examiners often found midge larva in the answers and decided to ignore it. Answers that included all three species gained credit, but the mark was not awarded unless both rat-tailed maggot and the tubifex worm were given.

(iv) Candidates often described the relationship between the number of different species and the oxygen concentration. The data table only shows the presence or absence of the different species, not the numbers of each species at each sampling station. Some answers referred to the numbers of each species and did not gain any credit. Candidates were less good at explaining the changes they described, although it was only necessary to state that some invertebrates, such as the stonefly nymph, cannot survive where there is little oxygen and some, such as the two species identified in **(a)(iii)**, must be able to respire anaerobically to survive in areas such as **D** with no dissolved oxygen. The Examiners credited other reasons for the distribution pattern shown in Table 5.1, but comments about the availability of food, presence of toxins, changes in temperature or pH as well as migration of species were found very rarely. Some answers dealt with changes to the sewage rather than to the invertebrate species. In the description rarely was the distribution of species related to the oxygen concentration. There was little awareness that some species are able to use both aerobic and anaerobic respiration.

Candidates generally misread the question usually identifying the invertebrates present without explaining carefully enough their inability to tolerate anaerobic conditions.

(b) Candidates either knew that this question about bacteria in sewage works involved describing the action of digestive enzymes or they did not. Descriptions of the effects of named enzymes were often very good easily exceeding the maximum requirement for full credit to be awarded. Many who wrote about starch, protein and fat digestion stated that enzymes are secreted by bacteria and often gave more than the maximum number of points. The digestion of cellulose was less well known although good candidates correctly stated that it is broken down into sugars. Sometimes explanations referred to the changes that occur during eutrophication and a surprising number of candidates thought that the bacteria were denitrifying bacteria and that nitrogen was the product of digestion.

(c) Ways in which nitrate ions are removed from sewage effluent that trickles through reed beds were described very well by some candidates. Most candidates gave two ways – the absorption by the reeds and use of nitrate ions in making proteins or other nitrogenous substance. Denitrification was given by many who explained that this is the conversion of nitrate ions to nitrogen. Some candidates were confused in their understanding of which bacteria 'used' the nitrate ions and for what purpose. Many had the nitrate ions being broken down to ammonia and then being absorbed by the reeds or being used by bacteria to provide energy for them to 'build sugar'. A common error was saying that nitrate ions are absorbed by the gravel or by the reed beds. A few misunderstood the question and attempted to explain how the uptake of nitrate ions could be improved, for example by planting more reeds.

(d) Weak candidates tended to explain that methane has effects at ground level by saying that it is toxic to plants and animals and may be breathed in by humans with dire consequences. Better answers explained that methane is a greenhouse gas and went in to some detail about how this gas contributes to the greenhouse effect. Some candidates knew about the enhanced greenhouse effect as a result of the pollution described in the question. Often candidates explained that methane is converted into carbon dioxide and explained the effect of that as a greenhouse gas.

There were, unfortunately, many references to effects on the ozone layer and the formation of acid rain. Candidates often find it difficult to remember the effects of the different atmospheric pollutants and some tended to give all likely possibilities in the hope that one or more might be correct. In this question many stated that methane 'decreases the ozone layer and this leads to global warming'. However, the Examiners were pleased to see that many candidates understood the importance of this issue and gave factually correct answers about the importance of methane as a greenhouse gas.

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Question 6

(a) Definitions of self-pollination often did not make it clear that pollen is transferred from the anthers to the stigma and often did not state that this happens within a flower or between flowers of the same plant. The Examiners did not credit answers which stated that self-pollination occurs within the same plant without reference to flowers. Some answers showed that candidates did not distinguish between pollination and fertilisation.

(b) Some candidates wrote out clear and correct genetic diagrams to show the inheritance of flower colour in snapdragons. A large number left this question blank and many made simple errors, such as giving one allele for one or both of the parents and putting two alleles in the circles provided for the gamete genotypes. Some candidates ignored the alleles given in the question and used R and W. The Examiners expected that this might happen and awarded the credit. Many forgot to include the colours in the phenotypic ratio. The layout of the question was supposed to help the candidates, but often seemed to confuse them. There was only one circle for the gametes from each of the homozygous parents and two for the gametes from heterozygous parents in the hope that candidates would put one allele into each circle. Some put in extra circles (which the Examiners accepted) and others squashed the two gamete letters into one circle which is incorrect. Often Punnett squares were drawn out correctly showing the genotypes of the gametes clearly. Some candidates did not seem to distinguish between the term *genotype* and *phenotype* so gave the correct answers in the wrong places.

(c) Success in this question was often dependent on the answer to **(b)**. Most candidates who completed the genetic diagram in **(b)** correctly gained full credit for the test cross as the Examiners decided to accept the ratio of 1:1 without the colours. In both **(b)** and **(c)** the Examiners did not award credit for the ratios if two or more were given as happened in some scripts. The inclusion of only a single circle to represent the genotype of the gametes produced by the white flower proved confusing to many who drew in a second circle and followed it through for the rest of their answer. This made no difference to the final outcome and they were awarded credit even if they gave the final ratio as 2:2.

(d) The answers to this question on the advantages of sexual reproduction in plants were rather disappointing. Most candidates stated that variation occurs although they rarely explained that in terms of the genes or alleles inherited from parents. Many confused variation in general with variety of colour, often related to attracting insects more successfully. The advantage that this variation gives plants the ability to adapt to new conditions was expressed in a variety of ways and also some stated that sexual reproduction provides the ability to evolve or for natural selection to occur. Often candidates stated that sexual reproduction allows plants to adapt to 'the conditions' without including the words 'new' or 'changing'. Some saw the question in terms of dispersal, colonisation and reducing competition although they rarely made it clear that this is associated with seed production. Most candidates scored only partial credit for reference to variation and there were many incorrect references to new species being formed and to mutations. Only a handful of correct references were seen to meiosis. Many weak candidates thought that new species were formed in sexual reproduction. Answers tended to be hampered by poor use of terminology.

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BIOLOGY

Paper 0610/33
Extended Theory

General comments

The paper generated a complete range of responses and many were of excellent quality, demonstrating a thorough knowledge of the material in the syllabus, as well as the ability to interpret information which was presented in novel ways.

In general, all the questions were attempted and individually there were relatively few questions that were not attempted and left blank. There was little evidence that candidates had any problems completing the paper in the time available. Scripts were generally legible and answers were confined to the spaces allocated; there were very few examples of candidates writing continuation answers or using additional sheets of paper. Candidates should always try to write concisely and should not have to use additional space for their answers.

Low scoring scripts were in the minority although there were several candidates whose performance suggested that they might have performed better in Paper 2 rather than in this one as they struggled with the concepts from the supplement sections of the syllabus.

Most candidates were able to follow the key in **Question 1(a)** to gain full credit and could recall the main digestive enzymes and their action in **Question 3(c)**. The reasons for deforestation and its effects were well known in **Question 4(b)(ii)** and **(c)**. Although many candidates labelled accurately the standard biological diagrams of the skin in **Question 2(a)** and of a plant cell in **Question 5(a)** there were many basic mistakes seen, for example labelling cytoplasm and vacuole the wrong way round in **5(a)**.

At this level candidates should use the information provided in the stems of questions to their best advantage. **Question 1** concerned two different species of cichlid fish. In spite of background information about the distinguishing features of the two types of fish, many chose to answer all of **(b)(ii)** and **(c)** as though only one species existed.

Candidates should also be able to analyse the graphs provided succinctly and include enough numerical data to justify their observations and not simply make generalised statements. The descriptions of the effects of pH on enzyme activity in **Question 3(b)(ii)** often lacked precision; for example, the optimum was given over a very wide pH range and the values for start and end of activity were not quoted. A more careful analysis of the hormone concentrations in the graphs in Fig. 6.1 in **Question 6** would also have resulted in better and more detailed responses for this question.

This lack of precision was evident elsewhere, especially in **Question 2** in writing about temperature control and throughout **Question 6** where vague unsubstantiated answers were common.

Nearly all candidates calculated the percentage correctly in **Question 4(b)(i)** although many did not realise that they should limit their answer to two significant figures (one decimal place) to agree with other data in Table 4.1.

It was encouraging to note that in **Question 4(c)** on the effects of deforestation on the atmosphere that candidates confined themselves to the effects of carbon dioxide and global warming. They did not link the increase in the carbon dioxide concentration in the atmosphere with destruction of the ozone layer and/or the formation of acid rain.

Candidates should avoid the use of terms such as ‘messages’ and ‘signals’ when writing about the nervous system. This was quite common in answers to **Question 2(b)** and **(d)**. They should refer to electrical impulses or just to impulses. It was clear from the answers to **Question 6** that many candidates found these questions on the two sections in 1.2.2 of the syllabus on the roles of hormones in the menstrual cycle and pregnancy very difficult.

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Comments on Specific Questions

Question 1

This question on fish started well for most candidates but proved to be increasingly discriminating in the later sections.

(a) Most candidates worked through the key successfully and gained full credit. The identifications of **A** (*Epinephelus*) and **B** (*Chaetodon*) were sometimes transposed.

(b)

(i) Only the more able candidates gave mutation as the reason for the first appearance of the different body colours in the male cichlid fish. There were frequent references to variation, adaptation, natural selection or the direct effect of the depth or the light itself.

(ii) Many gained partial credit here, usually for stating that mating with the relevant species would occur. Other possible points were rarely expressed with sufficient clarity to gain credit. Some candidates failed to read the question correctly or did not understand the concept of species and thought that all fish could detect both colours, meaning that they could live at any depth or interbreed with any type.

(c) This question generated some good answers with many candidates realising that the lack of blue light adversely affected breeding in blue fish. The effect on the population numbers of the two species was stated correctly and some also included the idea of reduced competition for the red fish. Very few referred to the genetic implications for future generations. Many did not identify the species or type of fish and answered in general terms, which was not sufficient to be awarded credit. A common assumption was that all fish would default to brown, or all die. Others concentrated on the adverse effects of the pollution, including eutrophication and subsequent lack of oxygen or direct damage to the retinas of the fish.

The introductions to **(b)** and **(c)** of this question referred to the penetration of different wavelengths of light. This should have made it clear that the penetration of blue and red light refers to the situation in lakes which are cloudy thanks to the presence of organic matter. There is a good summary of the evolution of cichlid fish and the problems posed by eutrophication in Lake Victoria in the article 'Sex, speciation and fishy physics' at http://evolution.berkeley.edu/evolibrary/news/090301_cichlidspeciation for those who wish to read more about this example of natural selection in action.

Question 2

(a) All four structures in Fig. 2.1 were labelled correctly by many candidates. **A** clearly referred to a hair rather than to a complete follicle; **B** indicated a nerve ending or neurone rather than a complete nerve and **C** pointed to the sweat gland rather than to its duct. Common problems were the naming of **D** as blood vessels or just cells and confusion between nerve endings and blood vessels for **B**, even though capillaries and arterioles were labelled on the diagram.

(b) This question was answered well by candidates who correctly identified the structures in the diagram. The Examiners allowed correct explanations of the roles of structures labelled in Fig. 2.1 if they were incorrectly identified in **(a)**. These 'error carried forward' marks were only awarded if the explanations were sufficiently accurate. Many candidates did not specify the structures and wrote generally on control of body temperature without reference to the diagram.

(c)(i)(ii) Full credit was rarely awarded here. Vasoconstriction was often given but incorrectly linked to capillaries rather than to arterioles. If this happened then the Examiners did not award marking point 1. Candidates often realised that blood should be moved away from near the surface of the skin, but they frequently suggested that the vessels themselves moved away from the surface rather than that blood is diverted away from the capillaries near the surface. Radiation was given as a reason for heat loss, but conduction and convection only very occasionally. The question was marked as a whole but the majority of candidates simply repeated in **(ii)** what they had already written in **(i)**. There were also examples where candidates had misread **(ii)** and described how to increase heat loss rather than reduce it.

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(d) The concept of negative feedback was generally poorly understood and this question was sometimes not attempted at all. The central point of maintaining a constant body temperature was often missed. Common answers referred to a cold external temperature resulting in the erection of hairs without explaining how this brought about internal change. The involvement of the hypothalamus in temperature control was appreciated but this was usually linked to 'messages' going to the skin. References to homeostasis were rare and there were instances where this was explained in terms of the control of the glucose concentration in the blood rather than temperature control.

Question 3

This question generated some excellent answers across the ability range especially with respect to the identification and action of digestive enzymes in **(b)(iii)** and **(c)**; other sections provided good discrimination between the candidates.

(a) The lock and key model of enzyme action was well known as was the active site; it was encouraging to note that very few thought that the enzyme and substrate had the same shape. The Examiners did not expect to find the term *complementary* but they did accept anything that conveyed this idea such as 'the sucrose and sucrase fit together'. Some candidates were confused over the role of water in the process or did not realise that the enzyme was unchanged at the end and could be reused.

(b)

(i) Most candidates explained that 40 ^{o}C was the optimum temperature although simply stating that it was close to body temperature needed further qualification. More able candidates also realised that a constant temperature was important in an investigation into pH and that higher temperatures would denature the enzyme.

(ii) The majority of candidates gained partial credit for identifying the optimum pH but many gave generalised statements that were not supported by the use of figures from the graph. For example, many candidates did not quote the figures for pH accurately when describing the effect of pH on the activity of the enzyme.

(iii) The three enzymes were often identified correctly although some named substrates or gave digestive juices instead of enzymes.

(c) Candidates showed a detailed knowledge of digestive enzymes and their substrates and products; for example, the products of fat digestion were often stated as fatty acids and glycerol, rather than one or the other. A small minority discussed infant digestion in very general terms and why pre-digestion was necessary without referring to specific enzymes. Although carbohydrase was credited as a general term for enzymes acting on carbohydrates, candidates who gave amylase did not always state that this is specific to starch and not to carbohydrates in general.

Question 4

(a) The key to this question was the word *compare*. Those who recognised this were able to describe the population graph for Brazil in terms of the lag and log (exponential) stages and the absence of the stationary and decline phases. Credit was given for accurate comparative description of the phases without necessarily naming them as such. Many simply described the graph or suggested reasons for population size at intervals with no reference to a sigmoid growth curve. There were frequent irrelevant references to the non-smooth nature of the line or that the lag phase was unnaturally long when compared with the lag phase of a 'normal' sigmoid growth curve.

(b)

(i) The calculation was usually correct although some did not convert their answer to two significant figures (one decimal place) to agree with the other values in Table 4.1. A common error was to divide by 478, which is the final rather than the initial forested area.

(ii) This question was very well answered; nearly all candidates provided two valid reasons for deforestation with paper manufacture, building and farming being the most common suggestions.

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(c) The effects of deforestation were well known and many scored highly here with logical, consequential analysis. Some did not realise the possibility of water-logging or loss of nutrients in soils and a few thought that the lack of trees would cause rivers to dry up. The vast majority from across the ability range recognised the likely increase in carbon dioxide and often linked it correctly to global warming. Thankfully there were few references to the ozone layer and acid rain in this context.

(d) Although this question was similar to one in Paper 32 in June 2010 it generated a range of answers. More able candidates could discuss the question by relating to the composition of drinks cartons, referring to limited resources and the need to reduce the extraction or gathering of specific raw materials. Weaker answers relied on general statements about 'saving the planet' or reducing the 'effect' on wildlife without using specific examples to justify the argument.

Question 5

(a) Most candidates named the three structures successfully although **A** (cell wall) was occasionally confused with the cell membrane and cytoplasm and vacuole were often transposed.

(b) The fact that root hair cells provide a larger surface area was well known but this was not always linked with *increased* absorption of water or ions. The majority did not progress further or gave general functions common to all cells, such as cell walls preventing bursting, or they gave incorrect answers, such as the wall being 'one cell thick'. Some very good answers were seen showing a detailed applied knowledge of cell structure and function linked to these particular cells. The roles of mitochondria and carrier proteins in relation to active transport were given by a few candidates. Those using the vacuole as their example often omitted to explain how a water potential gradient between the cell and the soil water is established.

(c) Many candidates scored maximum credit here for their knowledge of photosynthesis in the leaves as a source of sugar and its subsequent translocation in the phloem. It was also recognised that sucrose rather than glucose was transported. Conversion from starch storage was rarely mentioned and a substantial number thought that roots absorb sugars from the soil, often by osmosis.

Question 6

This question caused the most problems for the candidates. Answers were characterised by confusion over the role of the different hormones or very general statements which did not receive credit.

(a) Many candidates used the correct terms or gave an accurate description although several confused the two processes, identifying **X** as ovulation and **Y** as menstruation instead of the other way around.

(b) This question rarely was awarded full credit. The role of oestrogen in repairing and/or rebuilding the uterine lining was known although a common error was to refer to the wall of the uterus rather than to its lining or to the endometrium. The Examiners did not credit answers that referred to the wall of the uterus when awarding the first two marking points on the mark scheme. The reason for this thickening was recognised occasionally with regard to implantation, but some candidates suggested that it was only built up so that oestrogen could break it down again. There was some confusion over the effects of oestrogen on the secretion of LH and FSH. Many attributed the maintenance of the lining to oestrogen. They should know that this is the role of progesterone.

(c)

(i) The use of FSH as a fertility drug was muddled. A common mistake was to assume that FSH produced ova rather than maturing those already present in the ovary although some did recognise that follicles containing the ovum were developed. There were occasional correct references to an increased number of maturing ova or follicles. There was only very infrequent mention that FSH could be used in IVF treatment or recognition that a woman might not produce enough FSH naturally. It was often suggested that FSH should be administered at the time of ovulation rather than at the beginning of the cycle.

(ii) The usual correct response here was a reference to multiple births with very occasional mention of cost implications or the fact that FSH might not work. References to identical

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twins were rejected. Many gave 'side effects' of the drug treatment which did not gain credit without some qualification. Several thought that FSH acted as a means of contraception.

(d) Only more able candidates realised that if FSH is secreted during pregnancy then more eggs would develop and possibly be released. This could result in fertilisation with another pregnancy starting some time after the first. The majority of candidates answered in very general terms about 'harming' the baby or triggering menstruation or miscarriage, which did not gain credit.

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BIOLOGY

Paper 0610/04
Coursework

General comments

The assessment of coursework by almost all Centres was judged to be entirely appropriate this year, and very few changes to marks were made.

Most Centres use a range of up to 10 or 12 tasks. These are normally presented as worksheets that have been constructed by the teachers at the Centre, although in a few cases modified versions of worksheets taken from published material are used. Styles vary considerably, but the majority strike a good balance between providing candidates with sufficient guidance to ensure they can be successful in obtaining results in their experiment and leaving sufficient room for them to make individual decisions about aspects of the tasks. Examples of this are whether or not to do repeats, how to record and display results, or how to present their conclusions and evaluate the reliability of their results.

Centres are required to write task-specific mark schemes based on the generic criteria for each task, and these have generally been very well done. The trick is to develop a scheme that makes a valid assessment of each aspect of the skill being assessed, and that also allows different teachers in the Centre to use the scheme to assess each candidate fairly. Some Centres are able to do this adequately right from the start, but most make small changes to their mark schemes year on year, gradually improving them and making them easier to use.

Skill C1 does not generate visible evidence of the candidates' performances, so it is important that Centres make records of these performances to justify their marks to the External Moderators. This is usually done using tick lists, as this is the easiest way to make quick records while candidates are working in the laboratory.

There is a wide range of performance in the work presented for moderation, but it is extremely rare to see a candidate who has not achieved anything worthwhile. The use of this Paper is invaluable in helping candidates to develop their practical skills, as they have clear goals and regular, specific feedback on what they have achieved so far. The best work is truly excellent. Candidates who do well in their IGCSE coursework have a very solid platform from which to approach their experimental work at a higher level.

While some Centres make wide use of IT, others do not, and this should make no difference to the marks awarded. There is no doubt that good IT facilities and skills can help both teachers and candidates, but Centres who do not have access to IT should not feel that their candidates are disadvantaged in any way. For example, graph-drawing skills can only be fully demonstrated if a candidate draws their own graph, making choices about axes, scales and the line to be drawn between points. Graph-drawing programs, unless used with considerable care, tend to take many of these decisions out of the candidates' hands.

Centres should be aware that individual feedback is provided following the external moderation of each coursework submission. If there are no problems with the assessments, this feedback may be very short, but where problems have arisen there will be detailed guidance about the issues that need to be addressed in future years. It is most important that teachers see this feedback and act on it.

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Paper 0610/51
Practical Test

General comments

Candidates from most Centres were able to plan and carry out practical work safely and effectively. Generally the investigation into the effects of pectinase on apple pulp was carried out successfully. Good observations and conclusions were made in the food tests on honey. Detailed comments on the procedures are given in specific questions.

There were some excellent large drawings with clear outlines and recognisable details. Ink lines are not suitable for biological drawings because of the impossibility of correcting mistakes. Candidates are advised to use well sharpened HB pencils and good erasers. They should understand that the main intention of their biological drawing is to communicate their observations. Clear, smooth lines are better than faint marks and shading. Even very small specimens should be drawn large so that details can clearly be seen.

In most cases candidates' meaning was clear although there were examples of confusion of terms and some grammatical errors.

The Examiners were greatly helped by the reports of the preparations for the experiments sent in by Centres. Accounts of the trial runs which Supervisors carried out before the examination were especially useful.

Comments on specific questions

Question 1

(a) Almost all candidates constructed neat tables with ruled lines. They made a column for each of the concentrations of enzyme solution and a row each for the volume and appearance of the juice. Some candidates made three rows for the enzyme concentrations and two columns. Their results were also clear. Units should be entered only in the table headings and not repeated in each part of the table.

(b)

(i) The important point in this question was the *comparison* of the volume and appearance of the juice from the three containers. It was not enough to list the volumes from the table again. They needed to use the figures to show a trend, or work out a percentage. Most candidates seemed to have performed the experiment without any trouble and were able to conclude that the enzymes released a greater volume of juice than the water, and that 3% enzyme released more juice than did the 1% enzyme. Some candidates had more juice from the 1% enzyme than either the water or the 3%. Perhaps they had confused their results.

Fewer candidates were able to describe the differences in the appearance of the juice. Some confused the words 'liquid' or 'water' with 'juice'. Some excellent answers used terms like 'turbid' and 'cloudy'. Most candidates described the juices as 'clear' and 'more clear' or 'less clear' which expressed their meaning well.

(ii) Candidates understood what made a good experiment. They generally knew the value of repeating processes. Fewer actually suggested calculating means. Many were aware that increasing the volume and allowing more time for the reaction and the filtration, would increase accuracy. Not many candidates would have used a larger range of concentrations of the enzyme. More would do the experiment at a fixed temperature and some suggested controlling the pH. No-one suggested how either temperature or pH could be controlled.

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(c)

(i) The aim was to plan an experiment. Theoretical knowledge about the optimum pH for enzymes was not relevant here.

Many candidates understood that they would need to describe a similar experiment to the one they had already done, at a range of different pHs. Few candidates described using buffer solutions although a few planned to add acids, alkalis or water to have different background pH. Candidates generally knew that other variables such as temperature and the quantities of apple pulp and enzyme should be the same for each pH. Some candidates used the vague word 'amount'. The best answers described keeping the same *volume and concentration* of, for example, the enzyme solutions.

Good answers described the outcome they would measure as the volume of juice and its clarity. Repeated tests at each pH would allow for calculating a mean of the results which could be shown as a graph. All these points were mentioned by some candidates.

(ii) Almost all candidates scored full credit here. Some forgot that the value for what they measure must 'go up the side' (the '*y*' axis) and the value for what they set, must 'go along the bottom' (the '*x*' axis) of the graph. Candidates need to label the axes and include the units where they know them e.g. for the volume of the juice using the column headings in the table of results.

Candidates could have used their theoretical knowledge of enzymes here and drawn a curve with a rise and fall.

Question 2

(a) The quality of the drawings of the bee's leg varied. There were some large drawings with clear lines and no shading, showing well observed details. The joints between segments of the leg and the claw at the end were often labelled. Most drawings were left unlabelled. Candidates should try to label their drawings and if they do not know special terms, describe the structures they can see. E.g. 'separate piece of leg' or 'segment of leg'. Many of the drawings were too small.

The outline was generally clear even on the small drawings though some legs were not closed at the end but left open and not complete. Three segments were generally represented though not always in the expected proportions.

A few candidates drew the whole bee. It was still possible to gain partial credit for the part of the drawing which showed a back leg, but a lot of time was lost on work which gained no credit.

(b)

(i) The majority of candidates measured the pollen grain correctly to within plus or minus 1 mm.

(ii) Most were able to calculate the actual size. Some candidates were confused possibly because they were used to calculating the magnification from the actual size. The diameter of the pollen grain was 20 mm and the actual size was 0.04 mm.

A minority of candidates were not able to answer this question.

(c)

(i) This question was usually answered well. Candidates need to remember that the reagent to test for starch is iodine solution, not iodine. It is also necessary when describing the expected results for a positive test to say what the colour is at the start. So iodine solution changes from yellow/brown to blue/black if starch is present. It is not enough to say "It goes blue/black.".

Most candidates remembered that the test tubes for the Benedict's test for reducing sugars, would be heated in a beaker, or similar container, of *hot* water. It is not enough to warm it. It was unusual for reducing sugar tests not to be heated enough. Only rarely were candidates unsure about which test to use.

When a question asks how an experiment could be carried out safely the safety factors should be mentioned. For heating Benedict's reagent with food, eyes should be protected

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from splashes, hands from hot tubes and the hot water to bath prevent hot caustic liquid spurting out of the tube. These are a minimum. Nearly all the candidates mentioned the water bath. Goggles and test tube holders featured less often and overalls and hair ties not at all.

(ii) Clearly the candidates were well practised in performing these tests because most got the expected results and conclusions.

(d) Almost all the candidates correctly named the honey bee's group and described an insect feature to support their answers. Usually they described the three pairs of jointed legs, three body parts or wings. A few candidates recorded 'animal' or 'invertebrate instead of 'insect'. A small number of candidates quoted the Latin name for bees instead of correctly giving the name for the group.

Fewer candidates recognised the bee parasite as an arachnid. Those who did usually saw that it had eight legs or four pairs of legs. Carapace and cephalothorax were occasionally mentioned although not on the syllabus. Candidates who got it wrong wrote 'parasite', 'myriopod', 'bacterium' or 'virus'.

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BIOLOGY

Paper 0610/52
Practical Test

General comments

The standard of English was good and the presentation of answers showed good understanding of the questions. Some candidates had difficulty with the language for example in **Question 1(b)(i)**. The drawings were sometimes well presented but some were not labelled. Candidates do need to use clear outlines and to use an HB pencil. Many candidates presented accurate line graphs in **Question 1(c)(ii)**.

There were examples in all questions of candidates not reading the question carefully such as in **1(b)(ii)** and **(iii)** where observations were asked for separately from the conclusions and the use of units in labelling axes in **1(c)(ii)**.

Candidates attempted all questions and showed that they had adequate time to finish the paper.

Most Centres enclosed a Supervisor's report. These reports provide valuable information and were very helpful to Examiners.

Comments on Specific Questions

Section A

Question 1

(a)

(i) The Supervisor's Reports were helpful in outlining the various types of apple supplied to candidates. Apples were stored for different periods of 3 weeks, one week and freshly purchased.

Most candidates were able to complete the table with appropriate descriptive terms. A few candidates confused the ideas of texture and described the appearance in both rows of the table.

(ii) Many of the samples of apples kept for the longer time period of three weeks had begun to show decay and were soft on the inside or wrinkled on the outer layer, which indicated the correct choice out of the three pieces of apple. It was clear from some of the Supervisor's reports that this was not always the case and so again these details gave valuable information to help Examiners.

(b)

(i) The descriptions of the chemical changes based on food tests for starch and reducing sugar were well described by most candidates. Candidates need to remember that the reagent to test for starch is iodine solution, not iodine. It is also necessary when describing the expected results for a positive test to say what the colour is at the start. So iodine solution changes from yellow/brown to blue/black if starch is present.

Most candidates remembered that the test reagent for reducing sugars is Benedict's solution, which would be heated with the apple sample and water in a test-tube placed in a beaker, or similar container, of **hot** water. The colour change was often included. Only rarely were candidates confused about which test to use.

It was surprising to note that the 'safety' in the rubric was largely ignored. When a question asks how an experiment could be carried out safely, the safety factors should be mentioned.

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For heating Benedict's reagent with food, eyes should be protected from splashes by the use of goggles or safety spectacles / glasses; hands should be protected from hot tubes by the use of tongs or test-tube holders; the hot water bath should be used to prevent the caustic liquid spurting out of the tube when heating directly over a heat source.

(ii) After the candidates had carried out the food tests on samples of apples, most recorded their observations based on colour changes in the appropriate boxes in the printed table, even if all three samples showed the same colour change or often no change at all. Only a few omitted their observations and only gave the deductions which were the basis of the next part of the question.

(iii) If candidates' followed the rubric correctly, it was this section that covered the deductions from the results of the food tests. In many cases the starch was broken down on storage and the reducing sugar content increased. Again it was important that the Supervisor's reports were presented so Examiners could consult the findings of different Centres.

(c)

(i) Most candidates correctly calculated the total loss in mass to complete Table 1.3. A number of candidates incorrectly calculated the loss in mass by subtracting the mass from the previous recorded mass instead of the mass on day zero at the start of the investigation.

(ii) With two continuous variables, it was appropriate to use a line graph to plot the data of the total loss in mass (g) against time in days. Most candidates plotted the line graph correctly, accurately and neatly so scoring full credit.

The measured data for total loss in mass (g) should be plotted on the *y*-axis and the time in days on the x-axis. It was surprising how many candidates omitted the units with the axes labels. Few candidates reversed the axes.

If the calculations were correct in **(c)(i),** the range of mass should extend from 0 to 110 g, so a scale of 2 g to each small square was appropriate for the *y*-axis. There were still a few candidates that used non-linear uneven scales. The values need to be plotted on an evenly spaced linear scale to cover the range of data.

Most points were plotted accurately; some candidates omitted the plot for day 0 and plotted day 2 too high. Plotted points should have been marked clearly as the position of a small dot was difficult to check. As mentioned before in previous reports, it is advised that a small cross, either an addition or a multiplication cross is appropriate. Dots alone to represent the plotted points should not be used. If too small it is difficult to check the point and if too large, where the dots filled a 1 mm square, these obscure the accuracy of the plot. Some candidates omitted the plot for day zero.

All points should be joined by ruled lines not free-hand curves and not lines of best fit. The lines need to be clear, straight and visible. The line should not be extrapolated beyond the last data plot.

Fewer bar charts were seen for this paper than in previous papers showing candidates were more able to select the appropriate form of graph.

(iii) The important word in this question was 'process' that would cause loss in mass of the apples. Many candidates were able to refer to one process such as loss of water or a metabolic process e.g. respiration or decomposition.

(iv) Storage of apples after picking is not a practice which is used widely. The idea of storage was not familiar to many candidates. It is usual now to purchase small quantities of apples from retail outlets and use these apples up in a short period. The common idea of storing large quantities of apples for a longer period of time at a low temperature [but not freezing] or under conditions of different gases to slow respiration was mentioned by a number of candidates but not the idea of preventing apples decaying or rotting by careful packaging. This packaging should not be in plastic bags as this would allow the humidity to increase and promote rotting.

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Question 2

(a) The standard of drawings of the two parts of a mollusc shell varied widely. Some candidates obviously spent a considerable time giving excellent drawings of a very high standard. Centres provided a variety of bivalve shells, the range including oysters, cockles, mussels, clams etc.

The outline of the two parts of the shell joined together was required with a clear outline and no shading. Many of the drawings were of a large size - very few minute shell drawings were presented. However, some drawings contained only one half of the bivalve structure though the question requested both parts of the shell should be drawn. Others were heavily shaded obscuring all other details and some were drawn with little regard to the proportions and shape of the shell.

Although many candidates attempted labels there were still a significant number of drawings without any labels.

(b) Many candidates understood this question and suggested correctly the idea of the shell providing protection from predators, the pressure of wave action of the sea or from drying out on exposure. A few candidates unfortunately confused the terms predator and prey.

(c)

(i) The animal group that both shells, specimen **W4** and Fig. 2.1 (gastropod) belonged to is the molluscs. Many candidates were familiar with the varied forms of this group and gave the correct name or one which was spelt phonetically and could not be confused. A common error was to give the invertebrate groups such as crustaceans, nematodes or myriapods.

(ii) Although the first stage of the calculation was to measure the length of the shell in Fig. 2.1 only the able candidates showed a line marking this on Fig. 2.1, where the length had been measured. Units again are important and several candidates measured in centimetres but gave the length in millimetres without converting to the correct unit. Use of the scale instead of giving magnification proved difficult for many candidates though the more able ones continued to gain full credit either by the use of a ratio or using the scale directly to determine the length.

(d) Those candidates who were familiar with the use of this indicator explained these changes correctly. The use of hydrogencarbonate indicator was explained in the introduction to this part of the question.

In the animal tube containing a small animal such as a snail, respiration occurs and carbon dioxide released which is soluble in water to form an acidic solution, carbonic acid. Most candidates followed this reasoning and recorded the indicator as changing colour from red to yellow with the appropriate explanation.

In the plant tube in the light without an animal present, the plant will carry out respiration releasing carbon dioxide and also carry out photosynthesis as there is light present thereby absorbing the carbon dioxide. The solution therefore is less acidic and becomes slightly alkaline and the colour of the indicator changes from red to purple.

Common errors included the idea that oxygen released by plants was alkaline, to mis-understand the colour changes described in the introduction or to be unaware that the carbon dioxide is an acidic gas. The colours reported in the Supervisor's Reports again were important to Examiners in considering the candidates' answers.

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BIOLOGY

Paper 0610/53
Practical Test

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There were examples in all questions of candidates not reading the question carefully such as in **1(b)(ii)** and **(iii)** where observations were asked for separately from the conclusions and the use of units in labelling axes in **1(c)(ii)**.

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(ii) Many of the samples of apples kept for the longer time period of three weeks had begun to show decay and were soft on the inside or wrinkled on the outer layer, which indicated the correct choice out of the three pieces of apple. It was clear from some of the Supervisor's reports that this was not always the case and so again these details gave valuable information to help Examiners.

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Most points were plotted accurately; some candidates omitted the plot for day 0 and plotted day 2 too high. Plotted points should have been marked clearly as the position of a small dot was difficult to check. As mentioned before in previous reports, it is advised that a small cross, either an addition or a multiplication cross is appropriate. Dots alone to represent the plotted points should not be used. If too small it is difficult to check the point and if too large, where the dots filled a 1 mm square, these obscure the accuracy of the plot. Some candidates omitted the plot for day zero.

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(iv) Storage of apples after picking is not a practice which is used widely. The idea of storage was not familiar to many candidates. It is usual now to purchase small quantities of apples from retail outlets and use these apples up in a short period. The common idea of storing large quantities of apples for a longer period of time at a low temperature [but not freezing] or under conditions of different gases to slow respiration was mentioned by a number of candidates but not the idea of preventing apples decaying or rotting by careful packaging. This packaging should not be in plastic bags as this would allow the humidity to increase and promote rotting.

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The outline of the two parts of the shell joined together was required with a clear outline and no shading. Many of the drawings were of a large size - very few minute shell drawings were presented. However, some drawings contained only one half of the bivalve structure though the question requested both parts of the shell should be drawn. Others were heavily shaded obscuring all other details and some were drawn with little regard to the proportions and shape of the shell.

Although many candidates attempted labels there were still a significant number of drawings without any labels.

(b) Many candidates understood this question and suggested correctly the idea of the shell providing protection from predators, the pressure of wave action of the sea or from drying out on exposure. A few candidates unfortunately confused the terms predator and prey.

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(i) The animal group that both shells, specimen **W4** and Fig. 2.1 (gastropod) belonged to is the molluscs. Many candidates were familiar with the varied forms of this group and gave the correct name or one which was spelt phonetically and could not be confused. A common error was to give the invertebrate groups such as crustaceans, nematodes or myriapods.

(ii) Although the first stage of the calculation was to measure the length of the shell in Fig. 2.1 only the able candidates showed a line marking this on Fig. 2.1, where the length had been measured. Units again are important and several candidates measured in centimetres but gave the length in millimetres without converting to the correct unit. Use of the scale instead of giving magnification proved difficult for many candidates though the more able ones continued to gain full credit either by the use of a ratio or using the scale directly to determine the length.

(d) Those candidates who were familiar with the use of this indicator explained these changes correctly. The use of hydrogencarbonate indicator was explained in the introduction to this part of the question.

In the animal tube containing a small animal such as a snail, respiration occurs and carbon dioxide released which is soluble in water to form an acidic solution, carbonic acid. Most candidates followed this reasoning and recorded the indicator as changing colour from red to yellow with the appropriate explanation.

In the plant tube in the light without an animal present, the plant will carry out respiration releasing carbon dioxide and also carry out photosynthesis as there is light present thereby absorbing the carbon dioxide. The solution therefore is less acidic and becomes slightly alkaline and the colour of the indicator changes from red to purple.

Common errors included the idea that oxygen released by plants was alkaline, to mis-understand the colour changes described in the introduction or to be unaware that the carbon dioxide is an acidic gas. The colours reported in the Supervisor's Reports again were important to Examiners in considering the candidates' answers.

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BIOLOGY

Paper 0610/61
Alternative to Practical

General comments

The standard of English was good and the presentation of answers showed a reasonable understanding of the questions. Candidates attempted all questions and most showed that they had adequate time to finish the paper.

Candidates need to read questions carefully in order to gain the maximum credit available. In **1(a)(iii)** they were asked to describe their results. This required a detailed description, including at least two separate points. Many candidates gave a general description and then went on to try and explain their results. This explanation could not be credited.

In **1(b)** candidates were required to methodically set down the necessary practical procedures for a new investigation. They could have used the experimental procedure given in **1(a)(i)** as a basis for their new investigation. Candidates need more guidance in planning investigations and this would result in an improvement in the marks of candidates of all abilities. It was also evident that some candidates did not fully understand the term pH.

Candidates' diagrams were generally good. The use of a single continuous outline and the labelling of the diagram, as instructed, would have improved them further for some candidates.

Comments on Specific Questions

Question 1

(a)

(i) Most candidates gained full credit here.

(ii) As temperature and volume of juice were two continuous variables, then a line graph was the correct graphical form. A number of candidates incorrectly presented bar charts and histograms.

Temperature / ° C, as the independent variable, should be on the *x*-axis and volume of juice collected / cm³, as the dependent variable, should be on the *y*-axis. Most candidates correctly orientated their graph and labelled their axes appropriately. The labels for the axes should be taken directly from the headings on the table of results but T / ° C and V / cm³ were used by many candidates.

Although most candidates did use an even scale, the most common error was to use too small a scale on the *y*-axis.

The majority of candidates plotted the points accurately and only a small number of errors were seen. Plots should be small dots or crosses on the point of intersection. There were a noticeable number of candidates using very large dots, spanning at least one small square of the grid. These are not suitable and can lead to inaccurate graphs.

The majority of candidates did join all the points as expected. Ruled or smooth free hand lines were accepted. A small number drew lines of best fit or extrapolated their lines to zero, these were incorrect.

(iii) The graph showed that the volume of juice produced increased as the temperature increased. This trend was generally seen and the majority of candidates gained at least

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partial credit here. Weaker candidates simply quoted the figures from the table of results and this was not a description. For further credit to be awarded more detail was required, for example, that the largest increase was between 10 °C and 15 °C or that the smallest increase was between 30 °C and 35 °C. A small number of candidates described that the line flattened or the volume did not change after 35 °C. As no results were available for this it was not a valid description. The majority of candidates did not simply describe the results but tried to explain them in terms of enzymes. Even though their answers showed quite a clear understanding, this detail was not required for the description and could not be credited.

(b) Planning an investigation to show the effect of pH on the activity of the enzyme used to extract apple juice gave candidates an opportunity to express their practical organisational skills. Even though they had been given most of the necessary experimental details earlier in the question, only a minority of candidates were able to clearly describe suitable procedures to perform this experiment.

Tubes with a range of different pH should be used, a minimum of three are needed to give meaningful results. Candidates need to state the number they would use or describe all the different tubes in order to achieve credit.

It is necessary to describe the method by which these could be produced, e.g. by using different acids and/or alkalis. Candidates need to understand that pH is a measure of the acidity or alkalinity of a substance and that, in order to use a different pH in their experiment, they would have to add different substances e.g. named acids or alkalis rather than simply adding solutions of pH 4 and pH 8. A small number tried to vary the pH using different fruits and so incorrectly introduced another variable.

All variables need to be controlled except for the pH and candidates need to describe all possible variables in order to gain further credit.

A small number of candidates did state the importance of repeating readings.

In order to see the effect of pH on the production of apple juice the results need to be plotted on a graph so that they can be analysed. Candidates could have gained credit by including this in their plan.

It is also important to include safety features in a plan e.g. wearing goggles or a laboratory coat and few were seen.

It was clear that many candidates, of all abilities, require further guidance and practice in planning investigations. A plan needs to contain sufficient detail so that another investigator might follow the steps to carry out the same investigation.

Question 2

(a) Overall the standard of drawing was good with most of the candidates making an obvious attempt to draw the back leg of the honey bee. A few candidates drew the entire honey bee but were given credit for the drawing of the back leg. The majority of candidates gained full credit for the drawing element of this question.

Most gained credit for drawing a leg, larger than the photograph, with a clear single outline. There were few sketchy lines but the common error was to have an incomplete outline, leaving a gap where it was attached to the body.

The majority of drawings had the segments in the correct proportions and showed details of the hairs, claws and the smaller end segments.

Labels to joints, segments, hairs and claw were all seen. A small number of candidates did not label the drawing of the bee's leg at all.

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(b)

(i) Most candidates accurately measured the diameter of the pollen grain. The most common error was to give the length in cm even though mm was given on the answer line.

(ii) The majority of candidates correctly calculated the actual diameter of the pollen grain. A few candidates failed to place the decimal point correctly. Weaker candidates incorrectly multiplied their measurement by 500.

(c) The tests for starch and reducing sugars were well known. Many candidates gained full credit here. For the starch test the reagent used is iodine in potassium iodide solution. Weaker candidates used the correct reagents but also incorrectly added starch and/or reducing sugar to them as well as or instead of the honey. As there were two substances being tested it was important to link the correct reagents and expected results to the appropriate food substance, a small number did not do this. Some candidates only described one test for starch or reducing sugar. To test the honey safely, it is necessary to include features such as using a water bath for heating, wearing goggles, using tongs etc. Many candidates did not mention these.

(d)

(i) Candidates were not expected to know the meaning of the term parasite but, instead, use the information given to suggest its meaning. The more able candidates obviously did understand what a parasite was. Some were able to give relevant information from the question, usually sucking the blood of a host or bee, or the idea that it was a pest, causing harm and so gained full credit. Others, however, simply gave a general definition of a parasite without referring to the information given and were awarded no credit. Many candidates gained partial credit for a reference to *Varroa* being a pest. A small number of candidates used its name, *Varroa* destructor, to deduce that it caused harm or destroyed organisms.

(ii) Most candidates correctly identified the honey bee as an insect and were able to give a correct feature. A small number incorrectly described a general feature of arthropods e.g. jointed legs or the presence of antennae, not specifying one pair only. Only the more able candidates correctly identified the parasite as an arachnid with eight legs. A common error from candidates, who did know their arthropod groups, was to miscount its limbs and state that it had more than eight legs and so was a myriapod or crustacean. The majority of candidates gave incorrect answers for the parasite. The most common errors were to state that they belong to the group of bacteria or nematodes and that the features for the group were that they suck blood, live on others or are microscopic.

Question 3

(a) Most candidates gained credit for stating that there were more candidates with straight thumbs than 'hitch hiker' thumbs.

The general trend for males and females was that there was very little difference in the overall results and these were independent of gender. It was noticeable that, although the numbers for males and females were very similar, there were always more females in both thumb groups. Credit was available for both of these descriptions and a significant number were awarded this credit.

The general trend for the results given according to different ages was that there was no overall pattern, it varied with age and so the results were independent of age. The majority of candidates only quoted figures for all the different age groups and did not describe the results.

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(b) Only a small number of more able candidates correctly identified the fact that there were only two thumb types, not a range, and that this indicated the shape would be controlled by a single gene. Some of these correctly referred to discontinuous variation.

A small number of candidates did state that the results were not affected by age or linked to gender. This would be true if thumb shape were controlled by a single gene.

Although the results did not give any identifiable ratios, there were many more straight thumbs and a number of candidates correctly stated that straight thumb could be controlled by a dominant allele and 'hitch hiker' by a recessive allele. It is important to note that 'gene' and 'allele' do not have the same meaning and are not interchangeable. An allele is an alternative form of a gene and so in this question 'straight' and 'hitch hiker' are alternative forms of a single gene.

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BIOLOGY

Paper 0610/62
Alternative to Practical

General comments

The standard of English was generally good and the presentation of answers showed good understanding of the questions. Many candidates presented accurate line graphs in **Question 1(c)(ii)**. The drawings in **Question 2(a)** were generally well presented but some were not labelled. Candidates need to use clear outlines, no shading and to use a good eraser as previous lines show on scanning. Some candidates had difficulty with the calculation in **Question 2(c)(ii)**.

There were examples in all questions of candidates not reading the wording carefully and therefore not being awarded credit.

Candidates attempted all questions and showed that they had adequate time to finish the paper.

Comments on Specific Questions

Question 1

(a) Most candidates were able to describe at least two visible changes from the illustration. A few candidates described features which were not visible in the photograph such as texture. Some answers showed misunderstanding of terms such as seeds and seedlings, sepals and leaves etc.

(b) The descriptions of the chemical changes based on food tests for starch and reducing sugar were well described by most candidates. Candidates need to remember that the reagent to test for starch is iodine solution, not iodine. It is also necessary when describing the expected results for a positive test to say what the colour is at the start. So iodine solution changes from yellow/brown to blue/black if starch is present.

Most candidates remembered that the test reagent for reducing sugars is Benedict's solution, which would be heated with the apple sample and water in a test-tube placed in a beaker, or similar container, of *hot* water. Some candidates still used Fehling's solution instead and others described the use of Clinistix strips. The colour change was often included. Only rarely were candidates confused about which test to use.

It was surprising to note that the 'safety' in the rubric was largely ignored. When a question asks how an experiment could be carried out safely, the safety factors should be mentioned. For heating Benedict's reagent with food, eyes should be protected from splashes so the use of goggles or safety spectacles/glasses is required; hands should be protected from hot tubes by the use of tongs or test-tube holders; a hot water bath should be used to prevent the caustic liquid spurting out of the tube if directly heated over a Bunsen flame.

(c)

(i) Most candidates correctly calculated the total loss in mass to complete the table. A surprising number of candidates incorrectly calculated the loss in mass by subtracting the mass from the previous recorded mass instead of the mass on day zero at the start of the investigation.

(ii) With two continuous variables it was appropriate to use a line graph to plot the data of the total loss in mass (g) against time in days. Most candidates plotted the line graph correctly, accurately and neatly so scoring full credit.

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The measured data for total loss in mass (g) should be plotted on the *y*-axis and the time in days on the *x*-axis. It was surprising how many candidates omitted the units with the axes labels. Few candidates reversed the axes.

If the calculation was correct in **(c)(i),** the range of mass should extend from 0 to 110 g so a scale of 2 g to each small square was appropriate for the *y*-axis. There were still a few candidates that used non-linear uneven scales. The values need to be plotted on an evenly spaced linear scale to cover the range of data.

Most points were plotted accurately; some candidates omitted the plot for day 0 and plotted day 2 too high. Plotted points should be marked clearly as the position of a small dot is difficult to check. As mentioned before in previous reports, it is advised that a small cross, either an addition or a multiplication cross is appropriate.

Points should be joined by ruled lines not free-hand curves and not lines of best fit. These lines need to be clear, straight and visible. The line should not be extrapolated beyond the last data plot.

Fewer bar charts were seen for this paper than in previous papers so candidates are more able to select the appropriate form of graph.

(iii) The important word in this question was 'process' that would cause loss in mass of the apples. Many candidates were able to refer to one process such as loss of water or a metabolic process e.g. respiration or decomposition. The more able candidates correctly suggested two processes.

(iv) The idea of storage of apples after picking for a period of time is not a practice that is used widely. It is usual now to purchase small quantities of apples from retail outlets and use these apples up in a short period. The common idea of storing large quantities of apples for a longer period of time at a low temperature [but not freezing] or under conditions to slow respiration was mentioned by a number of candidates but not the idea of preventing apples decaying or rotting by careful packaging. This packaging should not be in plastic bags as this allows the humidity to increase and promotes rotting.

Question 2

(a) The standard of drawings of the two parts of a mollusc shell varied widely. The outline of the two parts of the shell joined together was required with a clear outline and no shading. Many of the drawings were of a high standard and most were of a larger size than the original photograph. However, some drawings contained only one half of the structure shown in Fig. 2.1. Others were heavily shaded obscuring all other details and some were drawn with little regard to the proportions and shape of the shell.

Although many candidates attempted labels there were still a significant number of drawings without a label. A common error was to label the shell as though it was a single cell with nucleus, cell membrane etc. If the candidates had read the introduction carefully it is difficult to understand this error.

(b) Many candidates understood this question and suggested correctly the idea of the shell providing protection from predators, the pressure or wave action of the sea or from drying out on exposure. A few candidates unfortunately confused the terms predator and prey.

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(c)

(i) The animal group that both shells in Fig. 2.1 (bivalve) and Fig. 2.2 (gastropod) belonged to is the molluscs. Many candidates were familiar with the varied forms of this group and gave the correct name or one which was spelt phonetically and could not be confused. However, most other animal groups were also noted in the range of incorrect answers even vertebrates such as mammals, amphibians and reptiles. A common error was to give the invertebrate groups such as crustaceans, nematodes or myriapods.

(ii) Although the first stage of the calculation was to measure the length of the shell in Fig. 2.2, only the able candidates showed this on Fig. 2.2 just where the length had been measured. Units again are important and several candidates measured in centimetres but gave the length in millimetres without converting to the correct unit. Use of the scale instead of giving magnification proved difficult for many candidates though the more able ones continued to gain full credit either by the use of a ratio or using the scale directly to determine the length.

Question 3

(a) The question was based on a comparison of the visible features of the two types of leaf shown on the aquatic plant in Fig. 3.1. The submerged leaves refer to those found below the water level and the floating leaves on the surface. There were many alternative points based on the number of leaves, the shape, the venation or the presence of a leaf stalk. A few candidates incorrectly thought that this illustration was based on two different plants or that the plant was in soil and the divided leaves were roots.

(b)

(i) Most candidates correctly used label lines to identify the two types of mesophyll tissues in the photomicrograph of a section through a floating leaf shown in Fig. 3.2. It was the use of brackets to indicate the division of these types of tissue that caused difficulties as the end often overlapped and incorrectly included the epidermal layers. Unfortunately, a few candidates' label lines indicated the vascular bundle instead of the spongy mesophyll.

(ii) By referring to the two types of tissues (palisade mesophyll linked with photosynthesis situated near the upper exposed surface, and the spongy mesophyll linked with large air spaces and gaseous exchange) it was possible for candidates to gain full credit. However, some did not mention both of these tissues and so restricted their answers.

(c) Those candidates who were familiar with the use of this indicator explained these changes correctly. The use of hydrogencarbonate indicator was explained in the introduction to this part of the question.

In the animal tube the snail (mollusc) respires and releases carbon dioxide which is soluble in water to form an acidic solution, carbonic acid. Most candidates followed this reasoning and recorded the indicator as changing colour from red to yellow.

In the plant tube in the light without an animal present, the plant will respire releasing carbon dioxide and also carry out photosynthesis thereby absorbing the carbon dioxide. The solution therefore is less acidic and becomes slightly alkaline; the colour of the indicator changes from red to purple.

Common errors included the idea that plants release oxygen that was incorrectly thought to be alkaline, to misunderstand the colour changes described in the introduction or to be unaware that carbon dioxide is an acidic gas.

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General comments

The majority of candidates performed very creditably on this paper and scripts of poor quality were a rarity. All appeared to have had sufficient time in which to complete the paper and the majority attempted all the questions. Candidates had been well prepared for the Alternative to Practical Paper

The standard of English was very sound and answers showed that, in general, questions had been understood. Many candidates may have been capable of an improved performance had they considered more carefully the precise wording and requirements of the question before they started to write their answer. Similarly, candidates need to be precise in the wording of their answers.

Some candidates would benefit by taking the mark allocations into consideration when formulating their responses. Where a question carries four possible marks candidates need to be aware that the answer must contain four distinct points to achieve full credit.

The quality of both the drawings and the graphs was generally good and bore witness to the fact that the candidates had followed guidance in these areas. The convention of using an HB pencil, as opposed to ink, in drawing graphs and diagrams, means that candidates can rectify errors easily. In this paper the use of pencil for graphs and diagrams was almost universal.

When answering questions where numerical data has been supplied, candidates need to realise that some manipulation of the numbers is required in their answers to gain credit. Merely quoting numbers directly as supplied is not sufficient to be awarded credit.

Comments on Specific Questions

Question 1

(a)

(i) Candidates were required to read the volumes of dough samples in two measuring cylinders and to enter these values in a table. Hardly any candidates misread the volumes.

(ii) Candidates were not told which type of graph to draw, but line graphs are most appropriate here. The standard of graphs was high with many candidates orientating and labelling the axes correctly. Some candidates need to be aware that the controlled variable (time) is placed on the *x*-axis, and the measured variable (volume of dough) is placed on the *y*-axis, with the labels stating both the name of the variable and the units in which it was measured. Other aspects performed to a high standard by many candidates were the accurate plotting of points, line construction and identification of the two lines. Credit for drawing of the line was awarded where the points had been connected either by a smooth hand-drawn curve or by a ruled line going from point to point. Ruled lines are preferable and are also easier for the candidate to draw with accuracy and without wobbles.

A small proportion of candidates reversed the axes, neglected to quote units, produced very thick or wobbly lines, gave no identity to the lines, extrapolated lines or drew a histogram / bar chart.

Scales used for a graph need to be selected so that half or more than half of the paper is used. In this case the scale chosen by most candidates (1 cm representing 10 cm^3 dough) used less than half the paper. Candidates would benefit by realising that an axis does not have to start at zero, or alternatively, a discontinuity symbol can be used.

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It would aid clarity if, in future, different symbols are used for plotting data when more than one set is to be represented, especially where lines may cross. In this case, for example, plotting dough **A** with a cross for each point and dough **B** with a dot in a circle.

(iii) Most gained partial credit for stating that dough **B** increased more / faster than dough **A**. The link between the greater increase and the presence of the flour improver was not usually stated and few candidates referred to the increase being uniform in dough **A**. Answers that involved the use of numbers often repeated what was in the table instead of using the numbers in a calculation. High achieving candidates gave comparisons of total increases in volume, or compared rates of increase.

(iv) Some excellent answers were; equal starting masses, use of identical apparatus, maintenance of a constant temperature and performance of repeat experiments. Quite often only three ideas rather than four were given. Checking the temperature does not have the same meaning as maintaining a constant temperature.

Few candidates referred to the following points: the need for dough **A** and **B** to have similar and simultaneous preparation, the requirement to use the same type of ingredients, the need to ensure that the initial temperature of the apparatus was at the experimental temperature and possible techniques for handling the dough during the stages of the investigation.

As the question was centred on improving reliability, there was no credit given for statements about safety procedures, for extending the duration of the investigation, for using more accurate timers, or for describing variations such as using different quantities of flour improver.

(b) This was generally very well known, with many candidates giving all four possible marking points in their answers. Some candidates incorrectly ascribed the rise in the dough to continued reproduction of the yeast cells.

(c)

(i) The method by which yeast cells reproduce was also well known with the majority of candidates stating at least one of the acceptable answers. A small number incorrectly gave the answer as binary fusion (instead of binary fission.) Candidates should note that 'asexual' is one word and a response of "a sexual reproduction" indicated uncertainty about the correct answer. Candidates need to be aware that mitosis is not a method of reproduction, but of nuclear division.

(ii) The instruction here was to measure the length of the yeast cell, drawing a line on Fig. 1.2 to indicate where the measurement was made. As this was a measuring skill, a candidate could gain credit for an accurate measurement even though the line drawn was not along the length of the cell. Where no line was indicated, it was assumed that either the length of the mother cell or the length of the cell plus bud had been measured. Most candidates carried out an accurate measurement. A few candidates measured in cm but left the units as mm. A small number of candidates were unprepared for the examination, as they did not have a ruler available. This was made apparent by messages on the exam paper such as, "I do not have a ruler so I will have a good guess".

(iii) Most candidates calculated the actual length of the yeast cell accurately using the number they had given as their answer in **(ii)** and dividing by 5000. Only a few did not understand what was required and multiplied by 5000, subtracted their answer in **(ii)** from 5000 or divided / multiplied by 100.

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Question 2

(a)

(i) The majority of drawings were of a high standard being accurate, large, drawn in pencil with clear unbroken lines and without shading. A few represented the veins inaccurately in terms of distribution and / or width. The minimum requirement for credit to be awarded for detail was two leaflets and one tendril. A minority of candidates incorrectly drew one leaflet only, drew a stylised leaf or drew a section though a leaf to show the internal structure.

Most labelling given was accurate in terminology and had label lines ending on the structure being named. Two accurate labels were required for full labelling credit. Some candidates were confused by the tendrils and identified them variously as roots, stigmas, stamens, buds or developing pea pods. The term petiole was used infrequently. A relatively large number of candidates gave no labels. Labels could only be given credit where the structure was visible. Thus such labels as epidermis, cuticle, xylem and phloem were inappropriate here.

(ii) The usual modification described was an increased surface area to absorb more light for photosynthesis and most candidates were able to gain partial credit for this. Fewer candidates referred to the support and transport functions of the veins and fewer still appreciated the role of the tendrils.

(b)

(i) Many candidates could state accurately the three environmental conditions needed for the germination of seeds: warmth, water and oxygen. An equally large number were not clear about these requirements. The presence of oxygen was commonly omitted and many thought that minerals, darkness or light were necessary for germination to take place.

(ii) Describing the conditions required for germinated pea plants to grow and produce flowers offered the candidates many marking points and most candidates gained full credit, the majority concentrating on the provision of light, water, warmth and minerals. Few covered aspects such as support, provision of space, weeding or protection from pests and diseases. Some candidates could improve by being more precise in their answers. Suggestions such as putting the plant near a window were too vague.

(c) There were some excellent answers where data had been placed into categories using a tally table, a histogram had been constructed and average and modal values calculated. Very few candidates commented on these results.

Many candidates quoted the heights of the smallest and tallest plants and calculated the range of heights. This wide range was usually attributed to environmental differences, but apart from elaborations on this aspect, many candidates produced no further ideas.

Many of those who detected the gap in the heights between 19.0 cm and 36.5 cm again made no effort to provide an explanation.

Some candidates, having grouped the figures into 10 cm categories, stated that there were more short plants than tall ones, rather than expressing this as there being more plants in the 10 – 19 cm range than in any other of the 10 cm groupings.

Few candidates made reference to dominant and recessive genes, continuous or discontinuous variation, or the possible presence of different species / types of pea plant.

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Question 3

The question was generally well answered, with many candidates gaining full credit. Many candidates did not give the group names although they were successful in stating relevant reasons for the groupings. The term reptile / reptilia was better known than annelid / annelida.

The features most commonly selected for classification were presence / absence of segmentation and presence of scales. Many candidates gave more than one correct feature in each case, and many made use of the scale lines provided to comment that the nematode was very small.

This question was testing observational skills, so references to features not visible such as colour, feeding, reproduction and internal organs were not appropriate.

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