BIOLOGY

Paper 0610/11
Multiple Choice

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

General Comments

There was a good spread of marks on this paper, with no question proving so easy that it failed to make a significant contribution to the process of discriminating between candidates of differing ability. There were a few questions, however, at the other end of the facility range that posed problems, particularly so for the weaker candidates.

Comments on Specific Questions

Question 3

No candidate believed that the animal was not spotted in appearance. In making that judgement, they showed that they were fully competent when using an identification key.

Question 5

It is unlikely that a significant number of the candidates really believe that all cells in the roots of plants contain chloroplasts, as the results suggest. It is much more likely that they did not read the question carefully and failed to appreciate the significance of the word 'all' being emboldened.

Question 6

In theory papers, candidates regularly offer suggestions on the functions of root hairs that are wide of the mark. Some of those suggestions were included in this question but, when presented alongside the correct function, the majority of candidates were able to ignore these distractors.

Question 7

The spread of responses seen to this question indicates that candidates were unaware that xylem vessels are hollow tubes with their cytoplasm removed.

Question 13

Candidates had a sound grasp of the structure of food molecules.

Question 17

This was a testing question as it required candidates first to know the individual functions of xylem and phloem and then apply that knowledge to the described scenario.

Question 22

With a significant proportion of the candidates selecting option **C**, it would appear that many candidates did not appreciate the fact that the question was asking about liver function. The liver is the site of deamination of amino acids, and thus urea will be leaving the liver. Glucose will be removed from the blood for storage.

Question 30

A large proportion of candidates failed to realise that human sperm cells contain only one sex chromosome and thus selected **A** rather than **B** as their answer.

Question 35

Curiously, by far the majority felt that the loss of water to the atmosphere by animals is the result of transpiration. Much in the same way that the term 'excretion' is often used in a way that is biologically inaccurate, so, too, may be the word 'transpiration'. Examination questions test the *biological* knowledge that is required by the syllabus.

BIOLOGY

Paper 0610/12
Multiple Choice

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

General Comments

A wide range of marks was seen for candidates sitting this paper. No question proved so difficult that no candidates were able to determine the correct answer, with sufficient questions of easier facility for the weaker candidates to experience a degree of achievement.

Comments on Specific Questions

Question 5

In theory papers, candidates regularly offer suggestions on the functions of root hairs that are wide of the mark. Some of those suggestions were included in this question but, when presented alongside the correct function, the majority of candidates were able to ignore these distractors.

Question 6

It is unlikely that a majority of candidates really believe that all cells in the roots of plants contain chloroplasts, as the results suggest. It is much more likely that they did not read the question carefully and failed to appreciate the significance of the word 'all' being emboldened.

Question 8

The spread of responses seen to this question indicates that candidates were unaware that xylem vessels are hollow tubes with their cytoplasm removed.

Question 11

When asked what happens to enzymes when heated above 60 ^{o}C, many candidates inaccurately believe that they are 'killed'. However, when presented with the correct word, few had any problem selecting it.

Question 15

It might have been predicted that there would be some confusion between excretion and egestion, and indeed many candidates opted for the former answer.

Question 16

This was a testing question as it required candidates first to know the individual functions of xylem and phloem and then apply that knowledge to the described scenario.

Question 23

With the majority of candidates selecting option C, it would appear that many candidates did not appreciate the fact that the question was asking about liver function. The liver is the site of deamination of amino acids, and thus urea will be leaving the liver. Glucose will be removed from the blood for storage.

Question 28

A large proportion of candidates failed to realise that human sperm cells contain only one sex chromosome and thus selected A rather than B as their answer.

Question 30

A failure to understand that inheriting particular features is a matter of probability rather than of exact whole-number ratios was probably the cause of so many candidates failing to opt for 50% as the likely probability.

BIOLOGY

Paper 0610/13
Multiple Choice

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

General Comments

For the most part, candidates acquitted themselves extremely well on this paper, with a strong showing by candidates on a number of questions.

Comments on Specific Questions

Question 4

This question served to reveal the possession of a sound knowledge of how oxygen moves into the blood, with the vast majority of candidates avoiding the distractors.

Question 5

Candidates may have found this question a little surprising since they might not have expected any cell to possess more than one nucleus. Nevertheless they remained true to their convictions and a large number were able to successfully choose **D** as the correct answer.

Question 7

This was a searching question. If not immediately familiar with the answer, a candidate was asked to realise that an artery is part of an organ system (the circulatory system) and, thus, *is* an organ, though a few of the otherwise successful candidates did not arrive at this conclusion, and opted for artery as the answer. The more direct method, however, was to know that xylem (and phloem) are both tissues within a vascular bundle.

Question 10

When asked what happens to enzymes when heated above 60 °C, many candidates inaccurately believe that they are 'killed'. However, when presented with the correct word, few had any problem selecting it.

Question 23

Perhaps the term 'target organ' is not fully understood, but it is more likely that a significant number of candidates immediately linked the hormone adrenaline with the adrenal gland without the necessary careful thought that is always advisable before committing to an answer.

Question 26

In this question, a large number of candidates missed the significance of the label 'DNA strand', and thus failed to realise that it was a bacterium that was undergoing division, leading them to believe that the process shown was mitosis in a root.

Question 30

There were two requirements in this question: to register that the sex chromosomes did not match, and also to notice the additional chromosome 21. Significant numbers of candidates failed in one, the other, or both of these requirements.

Question 39

Answers were roughly equally divided between options **B** and **C**. The more able candidates chose **B**, the correct answer, while the rest either made a guess that the organisms in the graph would be in the same order as in the food chain, or they did not read the question carefully enough or devote enough thought to their answer.

BIOLOGY

Paper 0610/21

Core Theory

Key Messages

There are some areas of the syllabus that candidates find difficult. Some of these, such as the role of bile in fat digestion and the determination of sex and eutrophication, appeared on this paper. Understanding of these areas needs to be reinforced.

It is important that candidates read instructions carefully and study any diagrams fully before writing their answers. Candidates would also find it helpful to look at the credit allowance for each part of a question as this can be a guide to the number of distinct points required.

General Comments

There were some excellent scripts seen. The paper contained some rigorous elements which served to differentiate between the more able candidates. There was no evidence that candidates were short of time. Some answers were left blank, but this appeared to be through lack of knowledge rather than lack of time.

Comments on Specific Questions

Question 1

(a) Most candidates gave the two characteristics of life correctly, but the definition of reproduction caused more problems.

(b) Those candidates who described structural differences mostly did so correctly and were awarded credit. However, those who attempted to differentiate in terms of habitat or the ability to swim were less successful.

Question 2

(a) The palisade / mesophyll layer and the xylem were both identified correctly by many candidates, but the cuticle was known to relatively few. The most commonly given answer was “epidermis”.

(b) (i) The majority of candidates were able to interpret the graph and state the differences for the two selected months. It would have been helpful if they had also used the figures in a constructive way, for example, “in May, there is four times as much carbohydrate in the leaves as in the tubers”. An explanation for the differences proved difficult for candidates of all abilities. Few mentioned the fact that leaves would be photosynthesising to produce the carbohydrate, or that the carbohydrate would later be stored in the tubers. Many weaker candidates thought that the tubers would start photosynthesising to account for their increased carbohydrate level in September.

(ii) The fact that carbohydrate was stored as starch was well known by able candidates, but less well known by others. Many candidates gave no response at all or gave glucose as the answer.

(iii) The most commonly given responses were respiration, energy release and growth. A considerable number gave respiration and energy release as two separate uses, but this could only gain credit once. Few referred to the possible uses of the released energy such as active transport, translocation or the synthesis of new chemicals.

Question 3

(a) This was well answered by candidates of all abilities.

(b) (i) The more able candidates answered this correctly, giving receptor and effector. Many less able candidates appeared not to have read the information in the central box and gave answers using the names of different neurones involved in a reflex action.

(ii) Most candidates gained credit here, with the most common answers centred round the need to keep the eye surface moist or to remove dust particles.

(c) (i) The definition of *drug* was not well known. Those who attempted to explain in their own words gave muddled and inaccurate statements.

(ii) Although many candidates knew that heroin is a depressant drug, credit was often lost for giving statements such as “reaction times are lower”.

(iii) A wide variety of problems are caused by the use of heroin, and so most candidates managed to gain at least partial credit for this section.

(d) The function of an antibiotic drug needs more emphasis. Many candidates thought that an antibiotic could be used to kill any type of micro-organism. Phrases such as “fight bacteria” or “defend the body” are unscientific and should be avoided. Many weaker candidates thought that antibiotics induced the white blood cells to release antibodies, or that they reduced pain.

Question 4

(a) (i) There were two common incorrect answers seen. One was to place a Y chromosome in the ovum and an X chromosome in the sperm. The other was to make both gametes diploid, each with two sex chromosomes.

(ii) The majority of candidates responded with embryo or fetus. Zygote appeared infrequently.

(b) This question was the least well answered on the paper. Most candidates gave a circular argument such as “equal numbers of male and female babies are born as there is a 50% chance of a boy and a 50% chance of a girl”. Very few candidates referred to the sex chromosomes or attempted to explain random fertilisation. Those who drew a Punnett square scored the most credit.

(c) (i) This was fairly well answered. A few stated that the alleles would be “equal”, which was not precise enough to be awarded credit.

(ii) Almost all correctly stated blood group, and slightly fewer also gave sex.

Question 5

(a) This was answered well by most. There was some confusion between the site where pollen landed and the site of fertilisation.

(b) (i) Many candidates gained partial credit, but very few were awarded full credit. This is possibly because they had not realised that a word from the list could be used more than once.

(ii) This posed no problem for able candidates. Those less able either did not understand the instructions or answered with a ratio that they had met previously in genetics.

Question 6

(a)(i) and (ii) Many knew that bile is produced by the liver and stored in the gall bladder. Some candidates thought that the functions of these organs were reversed.

(iii) The role of bile in emulsifying fats is an area in which candidates of all abilities struggle. Common misconceptions are that bile contains enzymes to digest fat, that blockage of the bile duct means that fats are not digested and that people then become obese, and that fat causes an intestinal blockage leading to constipation. It should be noted that it is insufficient for a candidate to say “bile

breaks down fats" as this could infer that a chemical breakdown occurs. It is important for candidates to realise that the action of bile on fats is a physical one.

(b) (i) Most correctly identified the stomach and the small intestine.

(ii) This was a challenging question for all candidates. There was a tendency to give answers that were too vague for credit such as "the pH is not right" rather than "the pH is too low / too acidic".

(c) (i) Very few candidates understood the function of the colon in the absorption of water. The function of the colon needs to be reinforced.

(ii) and (iii) The majority correctly named fibre or roughage as being the necessary component. Few could state a disorder that might arise from the lack of fibre. Those who were awarded credit all gave constipation as the disorder. None referred to cancer or diverticulitis.

Question 7

(a) (i) Almost all answered this correctly.

(ii) Most candidates completed the boxes correctly, although some weaker candidates reversed the order of the food chain.

(b) Answers for which credit was not awarded referred to stopping the crops being eaten by animals rather than by insects. Most of the rest gave an acceptable reason, although in some cases the wording was muddled.

(c) (i) Many were credited for stating that the trout had eaten insects affected by insecticide. The majority thought that the algae would be covered in insecticide and that the insects ate the algae. A few lost credit by referring to the trout eating water fleas; as water fleas are crustaceans, they would be unaffected by the insecticide. A large number of responses centred around the gills of the trout becoming "clogged with insecticide" or stated that the trout were directly poisoned by the presence of insecticide in the water.

(ii) Able candidates gave well reasoned answers here. Many less able appeared to have misread the question and simply explained why the number of kingfishers decreased.

(d) There was a wide range of answers here including some perfect descriptions of eutrophication. Many were awarded credit for describing the excessive growth of algae and for trout dying as they lacked oxygen. What happened in between these two events was not generally known.

Question 8

(a) (i) Weaker candidates struggled to answer this correctly, with many giving cattle, some type of arthropod or a detritivore as being responsible for the decay. Decomposer was the most frequently given correct answer, followed by bacteria and fungi.

(ii) Many candidates stated water and temperature, with relatively few referring to the surrounding pH or the oxygen concentration. Less able candidates incorrectly stated that wind, the amount of light or the amount of dead grass present would affect the rate of decay.

(b) (i) The calculation posed little problem for the more able candidates, although many others were confused and used the available figures in a variety of ways. Those who just wrote down an answer with no calculation shown may have missed gaining credit for a procedure that was correct.

(ii) Many candidates stated one use of the energy, but struggled to find a second. The answer most commonly given was "growth", but responses involving maintenance of the body temperature, movement, or an example of movement were infrequent. Some weaker candidates seemed to think that the energy would be recycled and could be used in photosynthesis.

(c) There were many imprecise and incorrect answers given here by candidates of all abilities. Good candidates were able to state global warming (or give a description). Imprecise answers gave "pollution" or "it smells", whilst inaccurate ones said that methane destroys the ozone layer or that it causes acid rain.

(d) Most candidates managed to give at least one harmful effect of deforestation, and many gave two. The less able candidates described what occurs in deforestation rather than its effects.

Question 9

(a) Almost all candidates knew that cell **D** transports oxygen, and most could identify cell **B** as being phagocytic. The fact that urea is transported in the plasma needs to be emphasised, as does the role of the platelets in blood clotting.

(b) This was fairly well answered, but a few candidates muddled the pulmonary artery with the pulmonary vein.

(c) This was well answered, with calcium being the most frequently suggested mineral. Weaker candidates suggested iron or vitamin D.

BIOLOGY

Paper 0610/22

Core Theory

Key Messages

Many candidates had clearly used or referred to past papers when preparing for this examination; it is always useful to practise past papers. Some candidates showed a good knowledge of biology but were unsure of how to express themselves clearly.

Candidates should be aware that command words such as “describe”, “explain”, “suggest” and “compare” require different responses. If a description is required, including a reference to a graph or table, then it will be expected that data will be used in the description given. Many candidates were able to do this effectively. An explanation requires more than just a description and candidates should be encouraged to practise the difference between “explain” and “describe”. A “suggest” question encourages the candidate to display biological knowledge linked to the learning outcome being tested.

General Comments

A wide range of abilities was shown by the candidates.

Comments on Specific Questions

Question 1

This question was about using biological keys, with candidates required to use a key to identify five different invertebrates. Candidates knew how to use the key and many scored full credit.

Question 2

(a) (i) Many candidates were awarded full credit for correctly extracting the information from the chart to complete the table.

(ii) Not all candidates realised that the data only included those whose height was between 1.4 m and 1.85 m and whose mass was between 30 kg and 130 kg.

(b) (i) Carbohydrates and fats (lipids) are the two classes of food that need to be reduced in order to lose weight. Some gave an example of one of these classes which was credited, and many scored full credit.

(ii) Explaining how exercising would help obese people to lose weight was not answered well. Candidates did not appreciate that exercise uses muscles, so (more) muscle contraction, hence (more) energy needed which requires (more) respiration and therefore (more stored) fat is used and less fat put into storage, or there is less conversion of carbohydrate to fat. Exercise also increases metabolic rate. Incorrect answers, even from higher scoring candidates, included statements that fats inside the body are burned by the heat, that exercise reduces the risk of diseases, and that weight is lost by sweating and vasodilation.

(iii) Most candidates could correctly name a disease that is linked to obesity.

(c) This was poorly answered. Any (named) fruit, vegetable or cereal was accepted. A few candidates knew that fibre helps with peristalsis and to prevent constipation. Few realised that fibre cannot be digested and simply provides bulk for the muscles of the alimentary canal to grip. The majority gave answers such as that it breaks down calories, provides energy or provides proteins.

Question 3

(a) This was a straightforward recall question but candidates did not answer it well. Some included terms from plant reproduction and transpiration in their answers.

(b) Candidates who had learned this part of the syllabus often scored full credit, but the majority struggled, often scoring no credit. In order to answer the question correctly it was important to know that females have XX chromosomes and males have XY chromosomes. In each case it is the X chromosome that is passed to a female baby. During the formation of gametes meiosis occurs and once fertilisation has taken place it is mitosis that takes place.

Question 4

(a) Candidates were given a diagram of a section through an insect pollinated flower and asked to state which part carried out certain functions. This was more difficult as they were not given the names and had to first identify each structure. However, it was a standard diagram and many were awarded credit.

(b) Despite having an example to guide them, many candidates did not answer the question asked, and wrote instead about insect-pollinated flowers. Many candidates did not know this part of the syllabus. The ideas required were that the stamens (filaments) are longer, the anthers hang outside the flower and are loosely attached so that the wind can shake them and dislodge the pollen and that the pollen is small, light, smooth and produced in large quantities so that it can be carried by the wind.

Question 5

This question about the water cycle was answered reasonably well with the most common incorrect answers being respiration and excretion.

Question 6

(a) This proved to be a difficult task for many candidates. They needed to know exactly what the terms meant in order to apply their knowledge to the task given. In food chain **A**, the terms linked to the llama should have been herbivore and primary consumer, and those linked to the human should have been carnivore and secondary consumer. The terms linked to the human in food chain **B** should have been herbivore and primary consumer.

(b) The syllabus definition of *trophic level* was required but few candidates were able to gain full credit. Some alternative wording was accepted.

(c) This proved very difficult for most candidates. They were given the small box (bush) and the larger box (aphids). A smaller box, labelled beetles, should have been drawn above the aphids box and above that a larger box labelled parasites.

Question 7

(a) In this question, candidates were asked to complete a table of similarities/differences between aerobic and anaerobic respiration by ticking correct statements. Most candidates did not realise that both aerobic and anaerobic respiration use glucose.

(b) The majority of candidates answered this correctly.

(c) Most candidates gave correct conclusions about the energy release related to the distance of the race. Some candidates, however, gave irrelevant conclusions which could not be drawn from the data.

Question 8

This whole question was not answered well.

(a) (i) Relatively few candidates gave the correct answer, carbon dioxide + water → glucose + oxygen.

(ii) A number of incorrect answers were given, such as that chloroplasts distribute starch to the rest of the plant or that they keep the structure of the leaf. Correct answers included statements that the chloroplasts absorb light energy and convert light energy into chemical energy.

(iii) Very few candidates were awarded full credit for this part. More chloroplasts are found in the palisade mesophyll as this layer receives more light.

(b) (i) Credit was not given for the movement of water vapour. Most candidates knew that it was involved in gaseous exchange but many described the gases going the wrong way.

(ii) Few candidates were able to correctly explain the function of the cuticle. It is a waterproof layer, transparent to let light through, and the idea of protection was only creditworthy if it was qualified.

(c) The link should have been made between nitrate ions containing nitrogen which is needed to make amino acids and hence proteins. Proteins are used by the plant for growth or to repair damaged cells.

Question 9

This question was well answered with most candidates scoring the majority of the available credit. The most common incorrect answer was linking the formation of urea to the kidney instead of the liver.

BIOLOGY

Paper 0610/23

Core Theory

Key Messages

There are some areas of the syllabus that need reinforcing. These are translocation, transpiration, decomposition and the role of technology in increased food production.

It is important that candidates read instructions carefully and study any diagrams fully before writing their answers. Candidates would also find it helpful to look at the credit allowance for each part of a question as this can be a guide to the number of distinct points required.

The definitions that appear in the syllabus should be thoroughly learned.

General Comments

There were some excellent scripts seen. The paper contained some rigorous elements which served to differentiate between the more able candidates. There was no evidence that candidates were short of time. Some answers were left blank, but this appeared to be through lack of knowledge rather than lack of time.

Comments on Specific Questions

Question 1

Candidates of all abilities answered this question accurately. Only a few candidates appeared to be unsure of how to use a key. A small minority attempted to give the common names for the animals.

Question 2

(a) (i) The word equation for aerobic respiration was fairly well known. Some candidates tried to give the chemical equation which was only awarded credit if completely correct; frequently the notations were inaccurate or the equation was not balanced. Other candidates wrote the word equation for photosynthesis.

(ii) In this question the more able candidates performed only slightly better than those less able. The majority gave two examples for the use of the energy released from respiration. The answers given were often growth and an example of movement. Few candidates gave three correct uses. Many possible answers were not given by any candidates.

(b) (i) Most candidates correctly extracted the information required from the graph. Less able candidates frequently stated that the time taken for the expiration was six seconds, indicating that they had not fully understood the graph.

(ii) The difference in the results for the male and female students was correctly identified by most. More difficulty was experienced when trying to state the similarity, as many candidates said that both exhaled for six seconds.

(iii) Most suggested either that the volume of exhaled air would be reduced for the smoker, or that it would take a longer time for the smoker to exhale. A few thought that smoking would have beneficial effects on the results.

(c) This was well answered with tar, nicotine and smoke particles the most common responses.

(d) (i) The less able candidates struggled to answer this adequately and even the able candidates could often only identify two differences between the types of respiration. Frequent errors were the ideas that anaerobic respiration released no energy at all, or that anaerobic respiration required less oxygen than aerobic respiration. Some candidates may have misread the question, as they referred to the release of carbon dioxide from anaerobic respiration, which would not happen in animal cells.

(ii) This was generally answered well.

Question 3

Many candidates gave perfect answers. There were two main errors of uncertainty; embryo was often given instead of zygote and gametes were frequently described as being diploid.

Question 4

Almost all candidates found this question difficult, indicating that this area of the syllabus needs reinforcing. Many candidates stated that fossil fuels are non-renewable, but few then went on to explain why the continued use of fossil fuels would be harmful to the environment. Knowledge of the water cycle was not evident as a large number of candidates thought that water supplies were non-renewable.

Question 5

(a) The majority of candidates could explain the role of haemoglobin in the red blood cell. There were some excellent explanations for the absence of a nucleus, but most candidates made statements such as “red blood cells do not need a nucleus as they have a short life”. The explanation for the tiny size of a red blood cell was rarely answered accurately; many left this blank. Others stated that the red blood cell could pass through blood vessels (in general) and did not realise the importance of being able to pass through capillaries.

(b) Some excellent answers were given, with candidates differentiating between the two main types of white blood cells, with accurate functions being described. Many of the weaker candidates could name white blood cells and platelets but then gave muddled or superficial explanations for the functions. Statements such as “fight bacteria” or “defend the body” are unscientific and were not awarded credit.

Question 6

Translocation and transpiration are syllabus areas that need reinforcement. Translocation was better understood than transpiration, but even able candidates struggled to score well on this question. Candidates need to realise that transpiration is the evaporation of water from the surface of the mesophyll cells followed by the diffusion of water vapour out of the stomata. The transpiration stream is the result of transpiration. Many candidates answered the direction requirement by stating “down” for phloem and “up” for xylem. These answers gave insufficient detail and did not gain credit.

Question 7

The ecological terms and their definitions were well understood and candidates of all abilities scored well.

Question 8

(a) Some weaker candidates were unable to relate to the diagram, possibly because it was unfamiliar. In these cases arrows were drawn apparently at random. The main area of weakness for other candidates was the failure to realise that decomposition of faeces results in carbon dioxide which then returns to the atmosphere.

(b) Answers on the water cycle diagram were slightly better than those for the carbon cycle.

Question 9

(a) This was well answered with many candidates gaining full credit. Some candidates had not read the question with sufficient care and included a mineral such as iron in their list.

(b) Many candidates gave the answer that fibre prevented constipation, but few explained why it had this effect. Some candidates mentioned that it also helped to prevent colon cancer.

(c) The majority of candidates stated ways in which technology had increased food production but then neglected to explain how the method had achieved its effect. Some candidates gave four or more methods with no explanations, so could gain only partial credit. It should be noted that the question is about increasing the amount of food produced. Topics such as improving the appearance of crops, addition of colorants to food, packaging or the testing of food were all irrelevant.

Question 10

(a) Most candidates knew how the anthers differed in wind- and insect-pollinated flowers. Some candidates thought that the entire anther was blown away from flowers that were wind-pollinated. Differences between the filaments and stigmas were less well known. Some candidates confused the question with seed dispersal, referring to stigmas being sticky so that they would adhere to the fur of passing animals.

(b), (c) These were both well answered by most candidates.

Question 11

(a) Many candidates did not know the definitions of the genetic terms. The majority gave imprecise and muddled statements when trying to express the terms in their own words. Those who knew the definitions gained full credit.

(b) Many candidates of all abilities gave excellent answers here. Those who understood the topic mostly gained full credit, whereas those with little understanding of genetics tended to perform poorly.

BIOLOGY

Paper 0610/31

Extended Theory

Key Messages

- Candidates should be encouraged to answer all the questions and to use the credit allocation as a guide to the number of points required. Ideally the paper should be finished with sufficient time to check answers for clarity or to add points that may have been omitted. Candidates should also be encouraged to use this time to look for any careless errors such as giving the labels for a diagram in the wrong order or misspelling a key term.

- Candidates should make sure that the points that they make are sufficiently different from each other. Some candidates gave very similar points that were likely to be accepted by the Examiners as alternatives rather than as separate creditworthy points.

- The command terms 'describe' and 'explain' are often confused. When questions ask for descriptions of data in the form of tables or graphs, any explanations of the data, however accurate, are not awarded any credit. Occasionally it is necessary to describe some or all of the data before offering interpretations in response to the command word 'explain'. However, most of such an answer should deal with the relevant biological principle(s), not a description of the data.

- Candidates should use information in graphs and tables to support their answers where appropriate. Data must always be quoted with the relevant units.

- Candidates need to be encouraged to use the correct scientific vocabulary. Vague terms rarely gain credit and hence words such as 'affect', 'change' and 'differ' without any further detail should be avoided. Better answers that gain credit use words such as stimulate, increase and decrease.

- Candidates should be encouraged to write their extended responses in continuous prose. Lists and phrases that show no links to appropriate scientific concepts rarely gain credit.

- Answers that are continued or rewritten in blank spaces or on additional paper must be clearly numbered. If an answer is crossed out and rewritten, candidates should always indicate where the rewritten answer is to be found.

- Candidates should avoid writing initial answers in pencil and then overwriting in pen. Any pencil markings that were missed during this process are unlikely to be sufficiently clear to gain credit. Candidates should also not use thick felt tip pens as the ink can affect the clarity of the answer overleaf. Incorrect answers must be clearly crossed out and the correct answer should be written alongside or just above the first answer.

General Comments

The best answered questions on the paper were **Questions 3(c)(i)**, **4(a)(i)**, **4(d)** and **5(c)**. Candidates found the last four parts of **Question 6** on decomposition, enzyme activity and the nitrogen cycle much more challenging than the rest of the paper.

There were several questions in this paper that required knowledge of biological processes. It was clear from the answers that many candidates were unsure of the stages of these processes and the sequence in which they occur. Processes from this paper are the entry and conduction of water in a plant (**Question 4**) and the nitrogen cycle (**Question 6**).

There was evidence that some candidates had not checked their answers carefully. For example, in **Question 5(d)** some wrote 'binary fusion', which is more likely to have been a slip rather than a genuine error.

On many scripts the last few parts of **Question 6** were left unanswered. It was not clear whether this indicated that candidates were short of time or whether they did not have the knowledge to answer these questions.

Comments on Specific Questions

Question 1

(a) Most candidates showed a good understanding of the functions of the nucleus and the cell membrane. Answers referring to the nucleus as 'the brain of the cell' that 'tells the cell what to do' were not awarded credit as they were considered too superficial for this level. These answers missed the central idea of control. Answers suggesting that the nucleus is 'where reactions happen' were not given credit either as reactions also occur in the cytoplasm. Answers describing the cell membrane functions as providing protection, shape and support were not credited, but answers involving keeping the cell contents inside or keeping the cytoplasm intact were awarded credit.

(b) Any definition of the term *tissue* should include the ideas of a group of cells in the same place doing the *same* function or being of the *same* type. The word 'similar' instead of 'same' is not precise enough for this definition.

(c) Confusion frequently occurred between the functions of cilia and mucus; for example, many candidates stated that cilia trap particles in the air that enters the trachea. Some candidates referred to cilia 'filtering' particles presumably confusing them with the much larger nasal hairs. Mucus was often described as aiding the passage of food, even though the question specifically referred to the trachea. Few candidates described the motion of the cilia by referring to the wave motion or saying that cilia beat or waft mucus.

Question 2

Candidates often showed a good understanding of how to construct genetic diagrams, but found it more difficult to explain the ideas involved in **(a)** and **(b)(ii)**. Credit was awarded for answers to these parts that conveyed the right ideas, even if the use of terminology was not precise.

(a) Candidates usually gave good definitions of the dominant allele. References to the allele being more 'powerful' were ignored. The most common error was that dominant alleles are more likely to be expressed when they are always expressed if present. Candidates often used the word 'dominant' in their definition; the word or phrase being defined should not be used in the definition.

(b) (i) Many candidates gave good, complete genetic diagrams showing the inheritance of flecks on tulip petals. It is important that the letters used for the dominant and recessive alleles are written in a different way for upper and lower case rather than just written larger or smaller. This helps to avoid any confusion. Credit was sometimes lost by candidates who did not use a suitable way of showing the fusion of gametes. Using a Punnett square is the best way to do this as it is much less prone to errors than drawing criss-cross lines. Some candidates lost credit by omitting 'Ff' in the offspring genotypes.

(ii) Most candidates gave correct genotypes, but sometimes did not add a suitable explanation about the parents. The question was asking about how to obtain all fleckless offspring, but answers explaining how to get fleckless offspring at all (with flecked siblings) were accepted.

Question 3

(a) Most candidates gave the correct directions of movement between fetal and maternal circulations for each of the four substances. The reasons given for the movement were less accurate. 'Breathing' was sometimes given for oxygen instead of 'respiration', showing a lack of understanding of the two different processes, despite the clue in the second row for carbon dioxide. 'Waste' was sometimes written instead of 'for excretion' or 'metabolic waste', and was not credited; 'waste from deamination' was accepted.

(b) While there were many correct answers for both iron and vitamin D, there were many superficial responses that failed to gain credit. For example, credit was not given for 'iron for strong blood' and 'iron is needed for blood cells'.

(c) (i) Most candidates named the cells that produce antibodies as lymphocytes. White blood cells and leucocytes were also accepted, but 'white cells' was not. 'Phagocytes' was a common error.

(ii) Many candidates did not take full advantage of the credit available for this question; most made no mention of the provision of immunity or of a function of antibodies. However, most candidates referred to defence against infection or protection from infection. 'Fighting against infection' was credited, but not 'against disease' without further qualification or elaboration.

(iii) Many candidates gained partial credit for their answers about the advantages of breast-feeding. However, most did not give the four advantages that were necessary to gain full credit. Many wrote about the idea that breast milk is 'free' or 'cheap' expressed in a variety of ways. Similarly, they wrote about mother and infant forming a closer bond than might happen if formula milk was used. Some candidates did not develop the nutrient point adequately, suggesting that formula milk may have essential components that are actually missing. Better answers stated that breast milk has the nutrients in the exact proportions that the baby requires, and that the proportions of these components change to meet the changing requirements as the baby develops.

Question 4

(a) (i) Most candidates identified xylem as the water-conducting tissue.

(ii) Many candidates gave a correct feature of xylem vessels within xylem tissue, such as long, hollow and with no end walls. However, few candidates stated how the structure they had described was adapted for the function of water transport.

(b) Candidates frequently provided unnecessary detail about how water gets into plant roots by osmosis. Many did not develop their answers beyond a description of transpiration and many who mentioned the words cohesion and adhesion did not go on to give any further details. The idea of root pressure was credited despite its negligible contribution in large plants. This is a topic where candidates should be able to describe and explain the full sequence of events from the soil to the outside air, and then decide which parts of the sequence are relevant to different potential questions.

(c) (i) There were many successful descriptions of the data shown in Fig. 4.2, but candidates who omitted units from their data quotes did not gain credit. Key points from the results for tree **A**, such as the two peaks, the slow increase in rate of water conduction in the period after 4 hours and the maximum rate, went unnoticed by some. The question tested the skill of understanding and using data taken from a graph. This involved reading the points accurately and transcribing the units correctly. Many candidates did not read the rates of conduction from the graph correctly.

(ii) This part was poorly answered. Candidates confused volumes with rates of water conduction. There are two ways to calculate the total volume of water used by a tree in 24 hours: adding together the volumes for each hour, and calculating the area under the curve.

(iii) This part was rarely answered correctly. Most candidates restated the differences between tall, medium and short trees, but made no mention of the factors affecting the differences. There were several ways in which candidates could gain credit: they could identify differences in exposure to environmental factors, such as humidity, light intensity, wind speed and temperature that all vary with height in a forest. Other potential responses included differences in the surface areas of the leaves giving rise to different rates of transpiration. The information given about the trees was limited to their different heights; the trees could be different species.

(d) This question on the consequences of cutting down trees was generally well answered. Some candidates wrote about the loss of animals' 'homes' or 'places to live' rather than about habitat loss. They also wrote about organisms dying rather than dying out as happens when a species becomes locally extinct. The use of these technical terms demonstrates a firm grasp of the issues involved in deforestation. References to global warming, the greenhouse effect and desertification were ignored, being beyond the scope of the question.

Question 5

(a) Few candidates identified two features that distinguish bacteria from other groups of organisms. A common error was to say what processes the bacteria could or could not do rather than giving distinguishing features. Many gave features that are shared with other organisms, such as being microscopic or unicellular.

(b) (i) The population stages in Fig. 5.2 were usually named correctly. Some candidates described what happens in each stage rather than giving the name of each stage. It was sometimes not clear whether candidates had written 'lag' or 'log' for the first two stages. It may be better to learn the second stage as the exponential stage to avoid this confusion.

(ii) The best way to explain why the population of *Lactobacillus bulgaricus* does not continue to increase is to refer to the action of limiting factors. An explanation that was sometimes seen, but did not go far enough, was that there was 'no or less food'. The Examiners did not accept 'food' in this context and were looking for nutrients, or better, certain named nutrients. A common explanation that was not accepted was that the reaction had finished. Better answers included the idea that the pH had *changed* to be unsuitable for the growth of *L. bulgaricus*. Similarly, the idea of the bacteria dying was not enough; candidates gained credit if they stated that the death rate is equivalent to the 'birth' rate or that reproduction had stopped.

(c) Definitions of growth were very often correct. Candidates who stated that growth involves an increase in dry mass gained full credit. References to reproduction and development did not gain any credit. Few candidates stated that the increase in a parameter, such as dry mass, is permanent.

(d) This part was answered correctly on the whole, but a significant number of candidates gave 'mitosis', which is incorrect. Asexual reproduction or binary fission were the only acceptable answers. 'Binary fusion' was also seen.

(e) More correct advantages were given than disadvantages. A common error was to say that extra nutrients are added. Food additives are not nutrients. Disadvantages that did not gain credit included 'not natural' and 'cause illness'; these ideas should have been developed further. It was surprising that the disadvantages of additives were not as well known as the advantages.

Question 6

This question covered topics from ***Sections II*** and ***IV*** of the syllabus. The action of enzymes was explored in the context of decomposition. The final parts, about the nitrogen cycle, proved very challenging and some candidates did not offer any answers to **(d)**, **(e)(i)** and **(e)(ii)**.

(a) Many candidates wrote about the properties of enzymes, such as 'speeding up the reaction', and their peak activity at an optimum pH and an optimum temperature. In this question, candidates should have considered a diagram showing how a substrate with a shape complementary to the active site fits into the enzyme, breaks and is then released as two product molecules. At least one candidate answered this question with such a diagram, but added no text. The candidates who described this mechanism as the lock and key mechanism were credited and they usually gained more credit because they described how it works.

(b) Many candidates wrote that cellulase digests cellulose instead of the (cellulose) cell wall. The question asked for the *part* of the dead leaf cells, which implies a structure. This shows the importance of reading the question carefully.

(c) (i) Credit was available for general statements that applied to both types of enzyme and for specific statements about the activity of each enzyme. Units were required for any data quotes that were given. Explanations were not needed in this part, just observations, so references to the effects of pH and the soil water content on the activity of the enzymes were not relevant.

(ii) Explanations for the differences in the enzyme activity at the two locations were required in this part. Candidates often appeared unsure about how to respond to this question and did not always make best use of the information in Table 6.1. Successful answers centred on the effect of pH to the exclusion of ideas about the presence of water and the type and composition of the leaves.

Several candidates speculated about the effects of different temperatures, despite there being no data about this aspect.

(d) This part was not well answered. Many candidates gained only partial credit for identifying the involvement of decomposers or types of decomposers. Many candidates were unsure of the sequence of events so did not make the connection from decomposition to ammonia so that they could write about nitrification to form nitrate ions. There were references to nitrogen fixing and denitrifying bacteria, showing the extent of confusion with this topic. Some candidates thought that proteins are liberated into the soil from dead organisms for direct re-use by plants. Many candidates did not answer this part.

(e) (i) The only answer to this question was nitrogen fixation, although nitrogen fixing was also credited. A common error was 'nitrification'. In questions on the nitrogen cycle, there is often confusion between nitrogen fixing, nitrification and denitrifying.

(ii) This part was poorly answered as a result of the poor answers to **(e)(i)**. Candidates were expected to write about nitrogen-fixing bacteria in the root nodule of legumes, but any appropriate comments about free living nitrogen-fixing bacteria were accepted.

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Extended Theory

Key Messages

- Candidates need to ensure that they pay careful attention to the command words in each question. The command terms 'describe' and 'explain' require different responses. Several questions on this paper required descriptions of information provided either in a graph or on a diagram. When questions ask for descriptions of data in the form of tables or graphs, any explanations of the data, however accurate, are not awarded any credit. Occasionally it is necessary to describe some or all of the data before offering interpretations in response to the command word 'explain'. However, most of such an answer should deal with the relevant biological principle(s), not a description of the data.

- Candidates should use information in graphs and tables to support their answers where appropriate. Data must always be quoted with the relevant units.

- Candidates should be encouraged to read through their answers carefully and look for any careless errors such as giving the labels for a diagram in the wrong order.

- Candidates need to be encouraged to use the correct scientific vocabulary. Vague terms rarely gain credit and hence words such as 'affect', 'change' and 'differ' without any further detail should be avoided. Better answers that gain credit use words such as 'stimulate', 'increase' and 'decrease'.

- Candidates should be encouraged to give their extended responses in continuous prose. Lists and phrases that show no links to appropriate scientific concepts rarely gain any credit.

- Answers that are continued or rewritten in blank spaces or on additional paper must be clearly numbered. If an answer is crossed out and rewritten, candidates should always indicate where the rewritten answer is to be found.

- Candidates should avoid writing initial answers in pencil and then overwriting in pen. Any pencil markings that were missed during this process are unlikely to be sufficiently clear to gain credit. Candidates should also not use thick felt tip pens; the ink can affect the clarity of the answer overleaf. Incorrect answers must be clearly crossed out and the correct answer should be written alongside or just above the first answer.

General comments

Questions 1(c)(i), **2** and **4(b)(i)** were answered particularly well. **Questions 1(c)(ii)**, **3(a)**, **4(b)(ii)**, **5(b)(iv)** **6(a)(ii)** and **6(b)** were generally not answered well.

This paper had four questions that required candidates to analyse and interpret data. **Questions 1(c)(i)**, **4(b)(ii)**, **5(b)(i)** and **6(a)(i)** tested these skills in a variety of ways. Of these, **4(b)(ii)** was answered least well. Candidates sometimes lost credit because interpretations were not taken far enough as in **Question 4(b)(ii)** where only the first part of the description was given. Weaker candidates tended to give lots of figures rather than trends when asked to describe.

Candidates should be able to read information from graphs and take accurate data quotes to illustrate their answers. In this paper three graphs had gridlines which means that candidates could use rulers to take their data quotes and read accurately from both axes.

There was confusion between describing results and suggesting explanations for them. Some candidates lost credit because of this, even though it was clear from their answers that the biological principles involved were known and understood. **Question 6(a)(i)** and **(ii)** and **Question 1(c)(i)** and **(ii)** were at risk of this.

Candidates did not seem to appreciate that enzymes are involved in almost all metabolic processes, not just in digestion. This was revealed by answers to **Question 1(c)(ii)** in which enzymes were almost always involved in breakdown reactions and not any involving synthesis.

Comments on specific questions

Question 1

This proved to be a good opening question for most candidates. Some, however, misinterpreted the instruction for **(c)(ii)** and wrote a description of the results from Fig. 1.3 instead of an explanation of enzyme action.

(a) Many candidates identified four or five of the features of the leaf in Fig. 1.1. Common errors were to label **A** as the upper epidermis rather than the cuticle, and to label **E** as the spongy mesophyll rather than an air space. If spongy mesophyll had been the answer then a bracket would have been used to label the tissue.

(b) Candidates found it difficult to match all the functions given in the table with the features of the plant cell. The functions of the cell membrane, **G**, chloroplast, **L**, and the nucleus, **F** were those matched successfully on most scripts. The most common answers were **G**, **J**, **L**, **K** and **F**, as the functions of structures **J** and **K** were frequently confused with each other.

(c) (i) The descriptions of the results were generally good, although many candidates gave explanations as well as or instead of descriptions. Many pointed out that the volume of oxygen collected increased more rapidly at the beginning than after 20 s. Some thought that the graph showed the rate of collection and stated that 6.2 cm^3 of oxygen was being collected at each of the last four readings on the graph. Many candidates made good use of the data and their data quotes were accurate and included units; however, some gave the units as minutes instead of seconds.

(ii) A common error in this part was to give a definition of the term *enzyme* or write at length about the properties of enzymes rather than explain the action of an enzyme during a reaction, such as that involving catalase and hydrogen peroxide. Many candidates also included descriptions of the optimum conditions for enzyme action which did not gain any credit. Others misread the question and described the results from Fig. 1.3 in much the same way as they had in **(i)**. However, there were many answers that showed a very good understanding of enzyme action and candidates referred to substrates, active sites, the lock and key idea and the complementary shapes of substrate and enzyme molecules. Candidates should be reminded that not all enzymes are catabolic; all wrote about enzymes 'breaking down' larger molecules to smaller ones. Some candidates explained the results in Fig. 1.3 by saying that the volume of oxygen remained constant after 90 s because the catalase in the lettuce leaves was denatured.

Question 2

This proved to be a high scoring question for most candidates.

(a) Candidates gave good definitions of the term *excretion*. Problems often arose when candidates went beyond the definition that they had learnt to give some examples. In so doing, they revealed a confusion between excretion and egestion. Candidates often did not make clear that substances were being removed from the body or from a cell.

(b) Most candidates identified the substances as protein in **(i)**, glucose in **(ii)** and urea and salts in **(iii)**.

(c) Answers to this question were also often correct. Four structures were accepted: pelvis, ureter, bladder and urethra. Phonetic spellings of ureter and urethra, were accepted but no credit was given where the spelling was ambiguous. Some candidates listed parts of the nephron, such as the proximal convoluted tubule and the collecting duct, which were not credited.

(d) Homeostasis was the only answer accepted.

Question 3

Part **(a)** of this question required candidates to write about the action of bacteria in breaking down wastes in sewage works. Many candidates did not make any reference to the enzymes released by bacteria and the reactions that they catalyse. Instead, they described what they thought happens in each of the stages shown in Fig. 3.1.

(a) Candidates were expected to give three aspects in their answers: the breakdown of insoluble compounds to soluble compounds, respiration and some stages of the nitrogen cycle. Well-prepared candidates gave information about the digestion of complex compounds, such as proteins, fats and carbohydrates. Credit was available for the detail involved. Some candidates gave some details of respiration in their answers often including the word or chemical equation for aerobic respiration. These equations gained credit as did any reference to products of bacteria action as substrates for respiration. Very few stated that the bacteria produce or release ammonia. Many scored no credit for lengthy answers that dealt with the sewage treatment process rather than concentrating on the role of bacteria. Some referred to 'breakdown into soluble substances', but omitted to say that the substances broken down are insoluble. A common error was to say that bacteria were added to 'get rid of bacteria'.

(b) Most candidates knew that chlorine is used in sewage treatment works to kill any bacteria that are left in the effluent at the end of the process. Fewer qualified this by stating that it is important to kill any disease-causing or pathogenic bacteria; most just described these as 'harmful' without being more specific. Candidates should be reminded that 'germs' is not an acceptable term for disease-causing microorganisms at this level. Very few explained that the treatment was necessary so that water was not harmful to the environment or did not kill organisms.

Question 4

This question dealt with the mammalian circulatory system. The photograph of the artery showed some features of arteries, although the lumen might have appeared wider than in diagrams. In **(b)(ii)**, many candidates did not mention the cross-sectional area in their answers and therefore gained no credit.

(a) Explanations of the relationship between the structure and function of arteries were rarely more than simple descriptions of the structure. Candidates gained partial credit if they simply listed some of the structural features without giving any explanation. The feature mentioned most often was the thick wall, although some candidates referred to it as the 'cell wall'. Some candidates gave good detail about the different layers in the artery wall often referring to muscle, elastic tissue and fibrous tissue. However, it was only the very best who were good at linking more than one feature to its function. Many stated that muscle tissue contracts to force blood on its way and that elastic tissue increases the blood pressure; both are incorrect statements.

(b) (i) Almost all candidates identified 13 kPa as the maximum blood pressure. Some did not give the units correctly, although 13 / kPa was given credit.

(ii) Candidates found it more difficult to describe how the mean blood pressure and the speed of the blood change with cross-sectional area of blood vessels as shown by the graphs in Fig. 4.2. Many candidates wrote about the blood pressure and the speed in a specific type of blood vessel rather than describing the *changes* in these two features as the cross-sectional area changes. For full credit, candidates had to state that the blood pressure continues to decrease or remains constant as the cross-sectional area decreases in the veins and the vena cava. When describing the change in the second part of the graph for velocity, candidates often did not state that it increases as cross-sectional area decreases in the veins and/or vena cava. Many candidates simply quoted figures from the graph without describing how the pressure and velocity of blood change in the circulatory system.

(c) Descriptions of the movement of substances from the blood into the tissue fluid were not always very good. Those who realised that diffusion is involved often gave several relevant points and gained full credit. Fewer used their knowledge of filtration in the kidney to talk about the effect of blood pressure in forcing water and solutes from the blood. Some thought that active transport was involved and descriptions of diffusion often read as if substances were diffusing into cells, rather than into tissue fluid. Many referred to capillaries as if they are tubes surrounded by cell surface membranes.

(d) The role of arterioles in controlling blood flow through skin capillaries was described well by most candidates who knew that vasoconstriction is involved. Many used the term vasoconstriction, but the rest of their answers showed that they did not understand what it meant. A common error was to state that capillaries 'move away from the skin surface'. Good answers stated that it is the blood that is diverted away from the skin to take a deeper route so that it does not lose heat. Reducing heat loss was given quite often, but methods of heat loss were not. There were quite a few answers that dealt with shivering and some that stated that vasodilation occurs to allow blood to the skin to 'warm up the person'.

Question 5

This question dealt with structural differences between viruses and bacteria and then with HIV/AIDS. Candidates who did not perform well on the rest of the paper often did well in part **(b)**.

(a) (i) Many candidates identified the protein coat and the nucleic acid in the diagram of the virus. Various alternatives were accepted for the nucleic acid, such as DNA, RNA and genetic material. Correct answers for the nucleic acid were given more often than for the protein coat. Occasionally the answers were given in reverse order, suggesting a lack of care by candidates. Structure **X** was commonly identified as the cell wall or cell membrane.

(ii) The majority of candidates responded with most giving features found only in bacteria. As it was not necessary to state anything about viral features these answers gained credit. Cell walls, loops of DNA, cell membranes and cytoplasm were common correct answers. Nucleus was a common error. One error seen was to state that viruses have RNA or DNA, but bacteria only have DNA.

(b) (i) Many candidates summarised the changes in the two graphs, noting the fact that the numbers of people living with HIV remained constant from the period 2000-2002 and that there was an increase followed by a decrease in numbers of newly infected people since 1997-1998. Data quotes used in illustration were generally accurate. A significant minority of candidates used the wrong dates or values as a result of misreading the graphs. Some gave data quotes outside the range accepted. Care needs to be taken over reading figures from graphs.

(ii) A variety of answers were seen including a greater awareness of ways to prevent infection and also to the drug regimes that are extending the life expectancy of people living with HIV. It was not always possible to tell to which group of people the answers referred, but in the case of the most common answers it was obvious. Some candidates stated that the number of people living with HIV increased because they gave birth to babies infected with the virus. They also stated that more people were being recognised, diagnosed or admitted to having HIV.

(iii) Candidates identified the methods of transmission of HIV. Credit was only given for sexual intercourse if it was stated that this is unprotected or that barrier contraceptives are not used. Similarly, 'using needles' even if 'contaminated' or 'unsterilised', was not credited unless it was clear that they are shared between people. To gain credit for transmission through blood, candidates had to make it clear that blood to blood contact is involved not simply by touching blood. Some candidates thought that HIV can be transmitted through kissing, sharing utensils or even inhaling the virus.

(iv) The answers to this question on the effect of HIV on the immune system were often not very clear. Candidates gained credit for the simple statement that HIV 'weakens the immune system'. Gaining credit for further details often proved difficult as many answers continued in the same way by referring to difficulties in 'fighting disease'. The Examiners looked for answers that dealt with the decrease in the number of lymphocytes and the reduction in antibody production. Good answers dealt with the decrease in the number of lymphocytes and the effects that this has, notably on the ability to make antibodies. Most often, answers did not include this level of detail. Some candidates gave very detailed answers on lymphocytes and antibodies and some made references to the central role of T lymphocytes.

Question 6

(a) (i) Candidates often stated that the concentration of PCBs increases up the food chain, although they rarely made much of the data from Fig. 6.1 other than quoting it. They could have stated that the biggest increase in concentration is between trophic Levels 3 and 4 or that the figures were given as ranges for the larger organisms. Many candidates made use of the concentrations to support their qualitative statements.

(ii) Explanations of the different concentrations in the organisms in the food chain were not so successful. Many answers included the information that the animals at the top of the food chain eat much larger quantities of food. They stated that as PCBs are persistent, they are not broken down in the bodies of the animals and are therefore stored. They could also have said that PCBs are not excreted. Few stated that animals at higher trophic levels live longer. The term biomagnification was given by some to the increase in concentration of PCBs in body tissues in the food chain.

(b) (i) This question on selection proved more difficult. Candidates who began their answers with a mutation in the gene for the protein AHR often gave a good explanation for both the origin and the spread of the resistance to the effects of PCBs. Care was necessary to gain credit for the points about selection, so it was clear which type of tomcod fish survived and reproduced and which did not. Some thought PCBs were used in some way by resistant fish. A common error was the suggestion that PCB induced the mutation. Few candidates offered possible causes for the mutation or explained how the mutation could result in a different type of protein. Candidates should know about the importance of shapes of proteins so could have applied their knowledge to this new context. A common error was to explain the resistance as an immune response.

(ii) Explaining the reverse selection proved more difficult especially for those who had not answered part **(i)** very well. It was very rare to see candidates scoring maximum credit for this section. Many simply rewrote the question. Most did not appreciate that as the concentration of the PCBs decreases there would be no selective advantage for PCB resistance and that fish with the mutation would be at a disadvantage and not compete well. More commonly offered was the suggestion that the fish would not be able to readapt to the decreased concentration or they would be subject to predation. A common misconception was that the fish with the altered protein 'required the PCBs'.

(c) There was a wide variety of answers to this question about non-biodegradable plastics including the effects on animals that eat it and those that get entangled in plastic netting and other forms of marine and freshwater debris. Responses were often too general. Examples are that non-biodegradable plastics cause pollution or would kill organisms. Few actually stated that the plastics take up space in landfill sites or rubbish dumps. Credit was given to answers that referred to toxins being released by burning. Credit was also given for the prevention of photosynthesis by blocking light, blocking drains and visual pollution.

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Extended Theory

Key Messages

- Candidates must ensure that they read the questions very carefully. In this paper, many candidates made the error of not reading the introduction to Fig. 3.1 and gave fertilisation as one of the answers to **Question 3(b)(ii)**, even though the diagram showed the events that follow fertilisation.
- The command terms 'describe' and 'explain' are often confused. When questions ask for descriptions of data in the form of tables or graphs, any explanations of the data, however accurate, are not awarded any credit. Occasionally it is necessary to describe some or all of the data before offering interpretations in response to the command word 'explain'. However, most of such an answer should deal with the relevant biological principle(s), not a description of the data.
- Candidates should use information in graphs and tables to support their answers where appropriate. Data must always be given with the relevant units.
- Candidates need to be encouraged to use the correct scientific vocabulary. Vague terms rarely gain credit and hence words such as 'affect', 'change' and 'differ' without any further detail should be avoided. Better answers that gain credit use words such as 'stimulate', 'increase' and 'decrease'.
- Candidates should be encouraged to write their extended responses in continuous prose. Lists and phrases that show no links to appropriate scientific concepts rarely gain any credit.
- Answers that are continued or rewritten in blank spaces or on additional paper must be clearly numbered. If an answer is crossed out and rewritten, candidates should always indicate where the rewritten answer is to be found.
- Candidates should avoid writing initial answers in pencil and then overwriting in pen. Any pencil markings that were missed during this process are unlikely to be sufficiently clear to gain credit. Candidates should also not use thick felt tip pens. The ink can affect the clarity of the answer overleaf. Incorrect answer must be clearly crossed out and the correct answer should be written alongside or just above the first answer.

General comments

The vast majority of candidates were well prepared and showed a detailed knowledge and understanding of the theory examined. A few able candidates were unable to answer some of the straightforward theory questions suggesting that some sections of syllabus had not been sufficiently well covered, for example **Question 2(a)(ii)** on the relationship between sickle cell anaemia and malaria. This question also highlighted common misconceptions about key scientific terms such as 'resistant' and 'immune'. Many candidates were unfamiliar with key definitions of terms outlined in the syllabus, for example, 'limiting factor' in **Question 5(a)(ii)**. Very few questions were omitted and there was no evidence that shortage of time was an issue.

Comments on specific questions

Question 1

(a) Most candidates obtained full credit for this question. A small minority repeated 'cell wall', highlighting the importance of reading questions carefully. Occasionally candidates gave chlorophyll instead of chloroplast as a structural feature.

(b) This question on the movement of water into cells was answered well by most candidates. Surprisingly few gave a detailed description of osmosis. Many candidates referred to 'water concentration', a term that is in the core material of the syllabus. To gain credit in an extension examination, candidates must demonstrate an understanding of water potential, outlined in the supplement material. The term 'turgid' seemed to be misunderstood by many candidates who suggested that animal cells would become turgid before bursting.

(c) (i) Most candidates knew that phloem transports sugars in plants. Only a small minority wrote xylem. Although phonetic spellings of phloem were accepted, a few candidates gave 'phylum' which could not be credited.

(ii) Most candidates understood the experiment on magnesium deficiency in plants and were able to use the data to describe the effects. Some answers were not supported with data, and were thus not able to gain full credit. A very large number of candidates attempted to *explain* the differences shown rather than simply *describe* them as asked. A number of candidates referred only to the plants grown with all nutrients (group **A**) in their answer when the question was about magnesium deficiency (group **B**).

(iii) Most candidates knew the basic symptoms of a magnesium deficiency (yellowing of the leaves and stunted growth). Fewer explained the symptoms, although many had given the relevant information about magnesium and chlorophyll in their answers to part **(ii)**.

Question 2

This question covered various aspects of genetics from ***Section III*** of the syllabus with particular emphasis on sickle cell anaemia. Most candidates were confident with the genetics of this disease and with the cause of Down's syndrome, but few were familiar with the reasons behind the global distribution of malaria and sickle cell anaemia.

(a) (i) A well answered question with the majority of the candidates able to extract the relevant information from the passage. The weakest area was being unable to identify the phenotype; common incorrect answers included various genotypes and 'carrier' rather than fatigue, extreme pain or mild symptoms.

(ii) This was a challenging question for many candidates as it required an extended written argument. Those candidates who did not write in continuous prose were seldom able to give sufficient information for their responses to be creditworthy. There was a general lack of logical clarity and planning. A common misconception was that malaria is a genetic disease. One point that was often missed by weaker candidates was that in general only carriers pass the sickle cell anaemia allele on to their offspring. With improvements in the management of the condition, people with sickle cell anaemia can have children, although men are more likely to be infertile. Many candidates lost credit due to poor terminology, for example giving 'immune' instead of 'resistance'. Another frequent misconception or error of logic was that the two diseases occur together because sickle cell anaemia leads to a greater susceptibility to malaria.

(b) Many candidates correctly stated that Down's syndrome is caused by an extra chromosome, with a significant minority going on to also include information beyond the syllabus, such as giving the term trisomy 21. Unfortunately, many candidates indicated that Down's syndrome was caused by 'one more or one less' chromosome. This question highlights the need for more care when writing answers.

(c) Many candidates found it challenging to distinguish clearly between discontinuous and continuous variation. Many muddled and contradictory answers were seen. It was often not clear that discontinuous variation depended on genes *alone.* Some candidates attempted to use examples, such as hitchhikers thumb and human height, but these answers rarely gained credit as they tended to describe the specific features rather than explain why they are examples of these two types of variation. Other candidates seemed unfamiliar with the correct meanings of these two key terms. Nevertheless, a significant minority were able to give comprehensive comparisons.

Question 3

This question focused on the female human reproductive system and the events following fertilisation. This topic was generally well understood and described by most candidates.

(a) Most candidates gave a good definition of growth and were able to obtain full credit. Those who were less well prepared confused growth with development.

(b) (i) Most candidates identified the structures of the female reproductive system. The cervix was the least well known. 'Urethra', 'ureter' and 'womb' were commonly given for **A** instead of the correct answer, 'uterus'.

(ii) A considerable number of candidates thought that the process at **D** was fertilisation, even though it was clearly stated in the question that the diagram showed the events that *follow* fertilisation. This illustrated the importance of reading the question carefully. Even so, many candidates did identify this process correctly as mitosis or cell division. Most candidates knew that the process at **E** was implantation.

(iii) Ciliary action along the oviduct was well known. A number of candidates referred to cilia incorrectly as 'villi' and a few confused them with 'ciliary muscles'. Peristalsis was slightly less well known.

Question 4

Fermentation of yeast was the common thread through this question. Although most candidates were well versed in functions of commercial fermenters, some found it challenging to apply their knowledge to the small scale example shown in Fig. 4.1.

(a) Only a minority of candidates were able to distinguish yeast from bacteria. The most common correct answer was the presence of the nucleus in yeast, but not in bacteria. A number of other distinguishing features were also seen. The most common incorrect answers included spores and hyphae.

(b) The chemical equation for anaerobic respiration in yeast was fairly well known with those candidates who knew the chemical formulae also able to balance the equation.

(c) (i) Most candidates realised that the water jacket was needed to maintain a constant temperature, but few expanded on this to give another reason by referring to denaturation of enzymes, optimum temperature for enzymes, or yeast being killed by high temperatures. However, there were some candidates who realised that the yeast respiration releases heat.

(ii) Very few candidates understood that the nitrogen source was used to make amino acids or proteins. Many answers were too vague or referred to decomposition producing ammonia.

(iii) Although an air lock would have been unfamiliar to those candidates who had studied industrial fermenters, many were able to transfer their knowledge well. Many responses were too vague and referred to prevention of the entry of air rather than specifically to preventing the entry of oxygen. Nevertheless, many referred to the maintenance of an anaerobic environment. Only a few mentioned the reduced contamination by other microorganisms.

(d) (i) Most candidates recognised the phases of the growth curve and were able to obtain full credit. Those who did not score well were usually attempting to explain, rather than describe the results. A small number of candidates lost credit for not including the correct units when quoting data.

(ii) This question was more challenging than part **(i)** as it asked candidates for an explanation. Those candidates who were not familiar with this command term often resorted to a description of the two plots on Fig. 4.2. More able candidates realised that the yeast was following a growth curve and they suggested reasons for the curve. However, credit was often lost for vague terminology, such as 'food' or 'resources' rather than the details of the nutrients that yeast requires. Additionally, many candidates did not realise that since the growth of the yeast population was measured in mass, during the stationary phase, the dead yeast would still be included in the final mass and thus the yeast must have stopped reproducing. Many candidates stated incorrectly that the birth rate would equal the death rate, rather than applying their knowledge specifically to the growth curve in

the question. A number of candidates also thought that the increase in alcohol was responsible for the increase in yeast.

(e) Most candidates were able to name industrial processes that exploit the anaerobic respiration of yeast. The most common error was to be too vague and offer 'baking' rather than the making of *bread* as an answer.

Question 5

(a) (i) Most candidates were not confident in answering this question, and many seemed to have problems interpreting the plots on Fig. 5.1 in terms of limiting factors. Few candidates obtained full credit and many gave the same response for all three experiments. The more able candidates were able to confirm that temperature was the limiting factor in experiment **B**, but often lost the credit for experiment **C** if their response did not qualify that it was the *concentration* of carbon dioxide that was limiting.

(ii) Those candidates who had learnt the definition for limiting factors in the syllabus were able to answer this question confidently. However, many candidates struggled to communicate the key aspects of the definition without simply repeating the terms 'limited' and 'factor'. Others used vague terminology such as 'change' and 'affect', but these terms were not creditworthy.

(b) (i) Most candidates realised that the grid at the base of the composting units allowed a flow of air, but fewer noted that microorganisms in the compost need oxygen for aerobic respiration.

(ii) Answering this question relied on an understanding of the nitrogen cycle. This is a section of the syllabus that many candidates find particularly challenging. Only the most able and well-prepared candidates gained full credit. A great number thought incorrectly that hydrogen and nitrogen combine to produce ammonia.

(c) (i) This question on experimental design was confidently answered by almost all candidates.

(ii) Most candidates were able to give a full description of both plots from the experiment. Credit was lost by a minority for not describing the plot for 'no composting units'. Some candidates here did not include any data quotes in their description of the two trend lines and others lost credit because the wrong units were used for the data or units were omitted altogether. Some candidates stated that the units were minutes rather than days. This is another example of candidates not reading the question carefully.

(d) This question enabled candidates to draw together evidence from a number of experiments to show that the carbon dioxide produced from the composting units in the greenhouse caused an increase in yield. Most candidates were able to gain some credit, with a number of well-constructed answers that gave a complete summary of the data. Weaker candidates were unable to make the link with the production of carbon dioxide in the composting units. Credit was commonly lost for not including any data or not giving comparative data with the relevant units.

Question 6

The final question considered ventilation in humans and the effect of strenuous physical exercise on the pH of the blood. This physiology was understood by most candidates.

(a) While there were many candidates who gave correct descriptions of the actions of the diaphragm, ribcage and external intercostal muscles, there were many answers that were too vague to gain full credit. For example, the majority of candidates did not link contraction of the diaphragm muscles with the flattening of the diaphragm.

(b) Most candidates were familiar with the consequences of strenuous exercise. The majority of answers were given in terms of anaerobic respiration and lactic acid, but others also correctly described the increase of carbon dioxide and carbonic acid. A common misunderstanding due to a lack a familiarisation with the pH scale, was that increased acidity is associated with an increase in pH.

BIOLOGY

Paper 0610/04

Coursework

Key Messages

Teachers should ensure that they are fully informed about the requirements for Paper 4 before attempting to assess their candidates. Full guidance is given in the Coursework Training Handbook (Part 1): Guidance, available on the Teacher Support website.

General Comments

The coursework submitted from some Centres was of a high standard, with all documentation clearly presented and work fully and very carefully marked. These Centres had chosen the tasks carefully, and had written very full and detailed mark schemes that closely reflected the criteria for each skill, ensuring that their marking of the candidates' work was both valid and reliable.

Some Centres were less successful in carrying out assessment. Choice of tasks is crucial; tasks should be chosen to ensure that candidates can show their ability to meet all the criteria for the skill or skills being assessed. Centres are reminded that it is not possible to assess C1 and C4 on the same task. Tasks for C2 must be sufficiently challenging for an IGCSE candidate; this will normally involve the need to measure and record quite complex data or observations. A simple table with just three entries cannot justifiably be given a mark of 5 or 6. Several suitable tasks are included in the Coursework Training Handbook.

Similarly, C3 tasks should also involve a reasonable quantity of data to process; graphs with just three points or three bars are not suitable, and in any case cannot really be used to draw a sound conclusion. In general, the task should generate enough data for there to be at least five plots on the graph.

Graph drawing skills were very varied. It was apparent from the work samples that candidates who were provided with full-size sheets of good quality graph paper tended to draw better quality graphs than those given small pieces of graph paper which were then pasted into their written work. Advice on constructing graphs is included in the Coursework Training Handbook.

Skill C4 is time-consuming, and most Centres use only two, or sometimes three, assessments for this. It is important that the task is genuinely novel for the candidates, although it is of course acceptable for them to use techniques that they have experienced in previous practical work. Candidates must work individually for this assessment, with no opportunity provided for discussion.

It can be difficult to appreciate the standard of work required for a mark of 6 if no candidates are producing work of that standard. There are many examples of marked work, with commentaries, in the Coursework Training Handbook, and it would be beneficial for all teachers to study these.

Teachers are reminded that the Moderators expect to see original, marked work. It is not acceptable to submit fair copies, rewritten after the teacher has marked them. Moderators also want to see teacher comments written on the work itself, next to particular parts of the work, rather than a simple summary at the end or on a separate sheet of paper.

BIOLOGY

Paper 0610/51

Practical Test

Key Messages

It is essential that candidates experience as much practical work as possible during their programme of study in order to practise the skills required.

Candidates should:

- read questions carefully before starting to answer and give only the number of responses required for questions that ask for a specific number. Incorrect additional responses may cancel a correct response.
- know which SI units to use for measurements, in particular time and distance and the correct abbreviations.
- know how to draw tables that display data clearly using suitable column and row headings, and appropriate units.
- be able to plot the most appropriate type of graph for a set of data using a workable scale, axes clearly labelled with the variable being plotted, and appropriate units.
- know the difference between reliability and accuracy.

General comments

There were many examples of clear well-presented answers, showing thorough preparation and careful thought. In questions that require use of data, such as **Questions 1(d)(iii)** and **2(c)(ii)**, the data extracted and quoted must be accurate and include any units. There were some excellent examples of tables drawn carefully with a ruler and with units in the table headings. Poorer tables were drawn with irregular lines, without column headings and with units often in the body of the table. There were also some excellent examples of graphs with scales that fitted all of the grid space provided and could be plotted accurately. Poorer graphs had irregular scales and plot points that were so large they occupied more than a small square on the grid. Graphs should be plotted with most of the grid area used, so the data should be carefully considered when choosing a scale that fits the available space. Plotted points need to be small and accurately placed at the plot point. The correct choice of graph to represent the data accurately is important. In this paper a line graph was most suitable as the independent variable was a sequence of quantitative values and the dependent variable was also quantitative.

Drawings were variable in quality, with some showing clear outlines in pencil and occupying most of the space provided and others drawn in ink with crossed out lines and occupying less than half of the space. Candidates should use sharp pencils for drawings so that any errors can be erased. Careful observation is essential so that the drawing has the correct proportions and shows the main visible features. Labelling lines should touch the feature being identified.

The Supervisor's report is very important in ensuring that candidates are credited appropriately when materials have to be substituted for those specified in the Confidential Instructions. Supervisors should trial practical materials as required in the Confidential Instructions some time in advance of the actual examination. This gives time if any difficulties arise to seek advice about alternative materials, using the contact information on the Confidential Instructions. In cases, where a substitution is made the Supervisor's Report should include as much detail as possible to allow Examiners to assess the candidates' answers appropriately.

Comments on specific questions

Question 1

This question was a practical activity that involved measuring the increase in volume of yeast, sugar and flour mixture. The practical skills tested were accurate measurement using SI units, preparation of a table and recording results, calculating increase in volume, modifying an experimental procedure to test the effect of a different variable, plotting a graph and interpreting results.

(a) Most candidates were able to construct some type of table. Better tables showed a first column with a heading time / min and a second column with an overall heading for volume / cm^3 with sub-columns for each of the three syringes. Poorer tables showed three separate syringe columns, often omitting the headings for time and volume, and with the units in the table. Other candidates did not appear to know how to present three sets of data collected from one independent variable in a single table. These candidates effectively drew three tables, one for each syringe, and joined them together. Records of the readings from the syringes were mostly appropriate, but some candidates tried to record to subdivisions of 1 cm^3, for example 9.2 and 15.8. This level of accuracy is not possible with the scale of a syringe calibrated at 1 cm^3 intervals. Readings to 0.5 cm^3 were accepted. Candidates need to be aware of the degree of accuracy that can be obtained using the scale of a calibrated measuring device. Some candidates used ml as the unit, which is not the expected SI unit or the unit specified in the question. Other candidates used an incorrect abbreviation of 'm' (metres) for minutes.

(b) (i) More able candidates referred only to reliability or identifying anomalies. Many candidates' answers were not credited as they referred to accuracy or precision as well as reliability. Candidates need to be certain about the difference between reliability, which indicates the repeatability of results, and accuracy which is a measure of how close the results are to the true value. In most cases accuracy is related to the calibration of the measuring instrument so a scale with few subdivisions is less accurate than a scale with many subdivisions. In this experiment the accuracy of the syringes was 1 cm^3.

(ii) Almost all candidates answered this correctly. Some did not read the question carefully enough and did not round their answer to the nearest whole number. The only common error was to find the mean for each syringe and then find the mean of these means.

(c) Very few candidates were able to give a full description of a method to investigate the effect of mass of sugar on the volume of bread dough. Candidates were expected to modify the method they had just carried out by keeping all the procedure the same, apart from making bread dough with different masses of sugar and measuring the volume. Better answers referred to using three different masses of sugar, commonly 1 g, 5 g and 10 g and measuring the volume over a period of 20 minutes. Poorer answers used only two types of dough, one with sugar and one without sugar, and referred to measuring the volume after 'a time'. Answers such as this did not gain credit as they did not use different masses of sugar and the time was not specified. Candidates should know that when asked to modify an existing method to test another independent variable, all the variables already standardised (controlled) in that method and the method of measuring the dependent variable should be kept the same. It therefore follows that candidates need to be able to identify independent and dependent variables, and which variables should be standardised, which can only be achieved by practice.

(d) (i) Most candidates were able to calculate the volume increase correctly. The most common error was 20, suggesting that candidates had added the two previous figures in the table.

(ii) There were some well-presented graphs that gained maximum credit. Candidates should be encouraged to follow good practice by plotting the independent variable along the *x*-axis and the dependent variable on the *y*-axis. Candidates who plotted the dependent variable on the *x*-axis were not penalised, but often failed to complete the graph line correctly. For this graph the points needed to be connected by ruled lines or a curve passing through all the points. Candidates who clearly understood how to plot graphs often lost credit for omitting the units for the axis labels, or using incorrect abbreviations for the units. Candidates should be encouraged to use the table headings given in questions as their axis labels. Others lost credit for extending the line beyond the plot points. A few candidates plotted the average volume of bread dough after 20 minutes, rather than the average increase in volume. These candidates were allowed credit for correct axis

labelling, scale for the data and a line connecting the plotted points. Poorly plotted graphs, as noted in the general comments, had irregular scales, incomplete axis labelling and inappropriately connected points.

(iii) There were very few good descriptions of the graph, often because candidates omitted the word 'increase' and so answered in terms of average volume of bread dough instead of average increase in volume. Candidates were expected to describe the trend shown by the graph, such that increase in temperature up to 50 °C caused a greater increase in the average increase in volume, after which further increases in temperature caused a decrease in the average increase in volume. Many candidates referred to 'a certain temperature', rather than the specific temperature at which the greatest increase occurred; others quoted figures from 10 °C, 50 °C and 70 °C. Answers such as these were not credited. Some candidates confused 'describe' and 'explain' and so gave very good answers to part **(iv)** of the question.

(iv) The answers given by most candidates were too vague and often repeated the answer given for part **(iii)**, again suggesting confusion of the meaning of 'describe' and 'explain'. The most common correct answer was that the optimum temperature for yeast activity is 50 °C.

Question 2

This question tested the practical skills of observing and drawing from biological specimens, measuring, calculating magnification and interpreting experimental data.

(a) (i) Most candidates were able to draw an outline of the correct leaf. Better drawings had a clear outline, drawn with a sharp pencil, without any gaps or shading and with clearly drawn veins showing their thickness and position on the leaf. Poorer drawings were often heavily shaded or with the veins shown as short sketchy lines. In some cases, drawings were in ink or ball-point pen that had smudged or been crossed out. Candidates should be encouraged to use pencil for drawing and to fill most of the space provided, but not to overlap the printed text. Most candidates were able to gain credit for a label to the main vein on a diagram that showed the main vein as thicker and extending the full length of the leaf. Labels on drawings that did not show the main vein as different from the other veins, were not credited. Poorly placed labelling lines that did not contact the main vein were not credited. Candidates should be encouraged to draw labelling lines in pencil, with a ruler and to make sure that the line touches the feature being identified. Lines should not have arrow heads. The common errors were to label the main vein with the label line ending on the lamina or with the line ending on the petiole.

(ii) Candidates who drew a line on their drawing usually gained maximum credit. Credit was also allowed for candidates who measured the length rather than the width of the leaf. If there was no line shown on the diagram then full credit could not be obtained. Some poorer answers gave the measurements in cm. In these cases credit was allowed for two correct measurements in cm if the unit was clearly stated in the answer. Candidates should be encouraged to use the units that are specified in the question. Some less able candidates seemed to be uncertain about the relationship between mm and cm, having apparently measured in cm and then converted incorrectly to mm, for example 350 or 0.35 instead of 35.

(iii) The majority of candidates knew how to calculate magnification. Error carried forward was allowed for the candidates' measurements in part **(ii)**. Less able candidates failed to round to the nearest whole number and in some cases changed the values of the measurements used. A minority of candidates included a value for a microscope magnification, for example, the value obtained by dividing the size of the specimen into the size of the drawing was multiplied by 100 or in some cases gave units after their answer. Magnification should not have any units.

(b) (i) Most candidates were able to gain some credit for this question. The most common differences were related to the venation of leaves and the shape of the leaf. Supervisor reports, particularly photographs, were essential for this part of the paper to inform Examiners of the appearance of the leaves. Better answers made direct comparisons of the same features, while poorer answers often had a statement about shape in one column and leaf edge in the other. These answers rarely gained credit unless a comparative word was used in the description of the feature. It is essential for candidates to compare like with like.

(ii) Many candidates gave a correct answer. Descriptions of parallel venation, such as 'straight veins', were accepted. In some cases candidates correctly identified **R** but did not give a reason. Some

candidates appeared to be confused about the differences between monocotyledon and dicotyledon leaves as they identified **S** as a monocotyledon.

(c) (i) Most candidates suggested a correct variable. The most common answers were light and wind speed.

(ii) Very few candidates knew how to test for water. More able candidates were able to suggest a way that water lost by leaves could be collected. A few candidates knew about cobalt chloride paper and a few others about anhydrous copper sulfate. Measuring the boiling point or freezing point was also credited. Most candidates assumed that the mass loss was all due to water, so their answers were either related to measuring mass loss or water uptake with a potometer.

(iii) Most candidates were able to identify one similarity and one difference in the pattern of water loss of leaf **V** and leaf **W**. The most common correct similarity was that they both lost mass, and the most common difference was that leaf **V** stopped losing mass after 50 minutes. Better answers used the figures to calculate that both leaves lost approximately the same percentage mass and that leaf **W** lost more absolute mass than leaf **V**. Only the best answers recognised that the rate of water loss decreased over time for both leaves. Many candidates noticed the gain in mass by leaf **V** between 10 and 15 minutes, but surprisingly few stated that this was likely to be anomalous. Some candidates misread the table headings and quoted water loss in terms of increase in temperature Poorer answers were often too vague to be credited, for example ‘at one point leaf **V** increased in mass’ and ‘leaf **W** loses all the time but leaf **V** does not’. If data quotes are required these should be exact.

BIOLOGY

Paper 0610/52

Practical Test

Key Messages

Candidates should have experience in using the practical procedures that are specified in the syllabus so that they develop confidence in applying these skills.

It is important that candidates read questions carefully before starting to answer and give only the number of responses required for questions that ask for a specific number. Incorrect additional responses may cancel a correct response. Also, candidates should be familiar with the appropriate SI units to use for measurements, in particular time (seconds), mass (grams) and diameter (millimetre) and the correct abbreviations.

Candidates need to be able to choose the most appropriate type of graph for a set of data, in this paper a bar chart, using a workable scale, with the axes clearly labelled with the variable being plotted, and appropriate units. This knowledge contributes towards the ability to make correct calculations.

General Comments

The quality of work showed that candidates were well prepared for this paper and there were many examples of clear, well-presented answers.

It is important that a sharp HB pencil is used for drawings so that any errors can be erased. Drawings should have clear, continuous lines and no shading. The guide lines for labels must make contact with the structure intended and there should be no gap. There were some excellent drawings seen, showing clear outlines in pencil and occupying most of the space provided. There were, however, others drawn in ink with crossed out lines and occupying less than half of the space.

The Supervisor's Report is very important in ensuring that candidates are credited appropriately when materials have to be substituted for those specified in the Confidential Instructions. Supervisors should trial practical materials as required in the Confidential Instructions some time in advance of the actual examination. This gives time if any difficulties arise to seek advice about alternative materials, using the contact information on the Confidential Instructions. In cases where a substitution is made the Supervisor's Report should include as much detail as possible to allow Examiners to assess the candidates' answers appropriately.

Comments on Specific Questions

Question 1

(a) (i) Most candidates followed the instructions to record the time taken for the pieces of filter paper to rise to the surface of the dilute hydrogen peroxide solution. The enzyme present in the extracts was catalase which breaks down the substrate to release oxygen. The bubbles released around and under the pieces of filter paper enable the paper to rise. It was important to refer to the Supervisor's Report to compare the candidates' measurements. There were a few problems concerning a few extracts of peppers and the freshness of the hydrogen peroxide solutions as specified in the Confidential Instructions.

Many stop-clocks or other timing methods displayed the time in fractions of a second. A few candidates failed to convert the recorded result to seconds. The opportunity to repeat the procedure showed the trend that one extract responded in a shorter time period compared with the other type of extract, as well as consistency between the two attempts.

(ii) Candidates described the appearance of bubbles as the pieces of filter paper rose to the surface of the hydrogen peroxide solution. Some descriptions referred to observing a fizzing or effervescence being released during this process.

(iii) The results recorded in the table generally showed a trend between the two sources of extract. Credit was awarded based on the candidate's individual results with consideration to those shown for that Centre in the Supervisor's Report. Many candidates gave an appropriate conclusion and expressed a clear link between the shorter time period, the release of oxygen bubbles and the greater quantity of catalase present based on their actual results. Some candidates incorrectly linked the shorter time period to lower catalase content.

(b) The method for safely carrying out a suitable test required a detailed account of the Benedict's test. The sample would first have to be prepared by grinding or chopping. Some candidates described making a solution, although many assumed that an extract would be provided. Most candidates correctly described and applied the Benedict's test, although a few omitted to state the need to heat the mixture in order to bring about a colour change. Gently warming rather than heating will resemble the colour change for the biuret protein test rather than a positive result for the Benedict's test. It is important when describing the expected colour change that the initial blue colour is stated. Several candidates omitted this colour change, describing only the final colour, and so did not gain credit for the colour change. A safety factor was required and most candidates referred to heating the test-tube containing the mixture in a water bath. Other safety factors were also considered.

(c) (i) Candidates were required to plot an appropriate graph to present the data given comparing the sugar content of five fruits. A bar chart was the most suitable format as it shows variation for discrete categories. There were many well-presented graphs that gained maximum credit. Candidates should be encouraged to follow good practice by plotting the independent variable, in this case the types of fruit, along the *x*-axis and the dependent variable, sugar content / g per 100 g on the *y*-axis. Candidates should be encouraged to use the table headings given in questions as their axis labels; the first column was the independent variable. The main error was the choice to use a histogram instead of a bar chart; the columns should not make contact as the type of fruits are discrete categories. Most values were plotted accurately, although some errors were noted in the values for green peppers and lemons. The columns should be evenly spaced or equal width to occupy half or more of the printed grid area, with the label placed underneath.

(ii) Many candidates correctly calculated the number of times greater the sugar content of 100 g of banana was than an equal mass of green pepper. The common errors were either to subtract the two values or ignore the instruction to give the answer to the nearest whole number. Several non-attempted or blank questions were seen.

Question 2

(a) The better drawings had a clear outline, drawn with a sharp pencil, without any gaps or shading and with clearly drawn layers showing their thickness and position on the specimen. Poorer drawings were often heavily shaded or with the layers shown as short sketchy lines. In some cases, drawings were in ink or ball-point pen that had smudged or been crossed out. Candidates should be encouraged to use pencil for drawing and to use most of the space provided. Most candidates were able to gain credit for labelling the site where leaves are attached. Poorly placed label lines that did not contact the area were not credited. Label lines should be in pencil, drawn using a ruler and the line must touch the feature being identified. Lines should not have arrow heads and brackets should not be used.

(b) (i) and **(ii)** Mature carrots only showed stored starch in certain layers. Again the Supervisor's Reports were consulted as there was variation between specimens that were provided. Most candidates recorded the expected colour change for a positive starch presence and described the distribution of the areas. Some specimens used were immature and had not yet stored any starch; such observations were credited. References to xylem/phloem were not really relevant with this magnification.

(c) Many candidates calculated the magnification by dividing the length of **ST** by the corrected recorded widths, giving the answer to the nearest whole number as instructed. Less able candidates did not give the answer to the nearest whole number or confused the method to calculate magnification. Magnification calculations were credited based on the candidates' recorded widths.

Question 3

(a) Many candidates noted the differences, but some struggled to find the appropriate terms to express a feature. A common error was to confuse the thorax and abdomen.

(b) A number of candidates failed to read the question carefully and included features that had already been given in the question. Many candidates correctly identified the presence of wings, but did not know that a characteristic of an insect is to have only one pair of antennae, which distinguishes insects from other arthropod groups.

(c) More able candidates showed that they were familiar with planning investigations and were able to produce a methodical plan to cover the variables, including those to control as well as determine the outcome and handling of data to lead to reliable results. The better answers took account of other variables which had to be controlled in each case, for example the use of coloured cardboard flowers to eliminate other variables of attraction, e.g. scent. Suitable experiments were suggested, set up either in open spaces or in enclosed boxes for both flies and bees. Poor answers only gave a “theoretical” description about nectar and scent without giving much detail of a practical method. Some of the answers were very imaginative involving sealed boxes and traps. Ideas for handling and presenting results, such as tabulation and analysis of results in some way, were discussed by many candidates. A small number correctly identified the need for a safety factor such as protective clothing when working with bees.

BIOLOGY

Paper 0610/53

Practical Test

Key Messages

Candidates should have experience in using the practical procedures that are specified in the syllabus so that they develop confidence in applying these skills.

It is important that candidates read questions carefully before starting to answer and give only the number of responses required for questions that ask for a specific number. Incorrect additional responses may cancel a correct response. They should know how to draw tables of data clearly using suitable column and row headings and should be able to choose and plot the most appropriate type of graph for a set of data using a workable scale, labelling both axes clearly with the variable being plotted and appropriate units. Also, candidates should be familiar with the appropriate SI units to use for measurements, in particular time (seconds), mass (grams) and diameter (millimetre) and the correct abbreviations.

Candidates should understand the specific terminology of reliability, accuracy or precision variables and should know which ones to change and set for the independent variable, which to measure and record for the dependent variable and which to keep constant as the control variable.

General Comments

The quality of work showed that candidates were well prepared for this paper and there were many examples of clear well-presented answers. Candidates attempted all questions and showed that they had sufficient time to complete the paper. The standard of English was good and the answers were usually legible and well presented.

There were some excellent examples of graphs with scales that fitted all of the grid space provided and were plotted accurately. Graphs should be plotted so that most of the grid area is used, so candidates should look carefully at the data to choose a scale that fits the available space. Plotted points should be small and accurately placed at the plot point. The correct choice of graph to represent the data accurately is important. In this paper a line graph was most suitable as the independent variable was a sequence of quantitative values and the dependent variable was also quantitative.

Drawings were of variable quality; some had clear outlines in pencil and occupied most of the space provided while others were drawn in ink with crossed out lines and occupied less than half of the space.

A sharp pencil should be used for drawings so that any errors can be rubbed out. Careful observation is essential so that the drawing is in the correct proportion and shows the main visible features. Label lines should touch the feature being identified.

The Supervisor's Report is very important in ensuring that candidates are credited appropriately when materials have to be substituted for those specified in the Confidential Instructions. Supervisors should trial practical materials as required in the Confidential Instructions, some time in advance of the actual examination. This gives time if any difficulties arise to seek advice about alternative materials, using the contact information on the Confidential Instructions. In cases where a substitution is made the Supervisor's Report should include as much detail as possible to allow Examiners to assess the candidates' answers appropriately.

Comments on Specific Questions

Question 1

(a) There were some excellent examples of tables, carefully drawn with a ruler and with correct column headings, to record the changes in texture and firmness of the potato tissue before and after the pieces were placed in the three liquids. Some poorer tables had irregular lines, no column headings, or with units in the body of the table and incomplete records of the observations. Some candidates did not record sufficient changes between the potato pieces after treatment to enable identification of the three liquids. It appeared that some candidates confused the three liquids, as the observed changes did not correspond to those expected.

(b) (i) Most candidates correctly identified the three liquids. The majority of candidates identified liquid **B** as distilled water, but the identities of the other two liquids were commonly reversed.

(ii) The explanation for the identification to support the candidates' choices proved more difficult. There were some excellent reasons given for the correct identification of the liquids **A** and **B**, given in terms of water movement into or out of the pieces of potato, many giving details of concentration gradients and often including references to water potentials. The concept of a balanced, or no net movement of water for the identification of liquid **C** was seldom clearly explained. Answers from less able candidates often referred incorrectly to the movement of sugar.

(c) Only better answers referred to reliability or identifying anomalies. Many candidates' answers were referred to accuracy or precision as well as reliability and were not credited. Candidates need to be certain about the difference between reliability, which indicates the repeatability of results, and accuracy which is a measure of how close the results are to the true value.

(d) This question was only answered well by a few candidates. Candidates should know that when asked to change an existing method, some variables need to be kept the same. Extending other variables, such as the time for which the pieces of potato remain in the liquids, extending the range of concentrations, or recording changes in length or mass may lead to greater accuracy.

Question 2

(a) The measurement was carried out accurately by the majority of candidates. The most frequent error was to measure in centimetres instead of millimetres. The magnification proved challenging for the less able candidates, and many inverted formulae were seen. It is worth noting that a formula stated in words will gain some credit, even if the subsequent arithmetic is incorrect.

(b) Most candidates correctly calculated the percentage reduction, but others became confused. Partial credit could be awarded for intermediate stages where shown, even if the final answer was incorrect. Some candidates did not read the question carefully enough and did not round their answer to the nearest whole number.

Question 3

(a) This is an area where improvements could be made as many candidates make a comparison. Good answers stated, for example, presence of wings as compared to no wings, or the absence of spikes as compared to the presence of spikes. The presence of wings compared to the presence of spikes is not a comparison. Some candidates described differences that could not be observed from the photographs, such as texture features, e.g. dry compared to succulent, or tried to compare the sizes even though the paper stated that the two fruits were shown not to scale.

(b) (i) There were some well-presented line graphs that gained maximum credit. Candidates should have plotted the independent variable, the wind speed, along the *x*-axis and the dependent variable, the average distance travelled by each fruit, on the *y*-axis. Candidates who plotted the dependent variable on the *x*-axis were not penalised, but often failed to complete the graph lines correctly. Some candidates lost credit for omitting the units on the axis labels or using incorrect abbreviations. A suitable means to identify each line, such as a key, was required to distinguish between the two sets of data. Candidates should be encouraged to use the table headings given in questions as their axis labels. Other candidates lost credit for extending the line beyond the plot points. A few candidates present the data as a bar chart.

(ii) Many candidates interpreted the graph correctly, stating that fruit **E** was wind dispersed because it travelled further than fruit **F** at all wind speeds. The positive correlation was correctly noted between the greater distances travelled by fruit **E**, with increasing wind speeds. Poorer answers did not relate the distance travelled to wind speed, or to the distance travelled by the fruit **F**.

(c) Better drawings had a clear outline, drawn with a sharp pencil, with no gaps or shading and with the radical and seed correctly proportioned. Poorer drawings were often heavily shaded or had short sketchy lines. In some cases, drawings were in ink or ball point pen that had smudged or been crossed out. Candidates should be encouraged to use pencil for drawing and to use most of the space provided. Most candidates were awarded credit for labelling a named seedling structure. Poorly placed labelling lines that did not contact with the named structure were not credited. Label lines should be drawn in pencil, with a ruler, with the line touching the structure being identified. Lines should not have arrow heads. Often a label was not given, or the labels were incorrect. “Root” and “shoot” were seen quite frequently.

(d) (i) Most candidates stated that the variable to be changed was the temperature.

(ii) The identification of the independent variable to be measured and recorded was poorly answered. The rate of germination, or the number of seeds germinating, was required but many candidates selected the measurement of some aspect, such as the length of the radical or the mass of the seedling.

(iii) For this investigation there were several control variables to be kept the same; the volume of water supplied, the concentration of oxygen or a statement about seed comparability were all accepted. Poorer answers included the intensity of light, or failed to qualify water and oxygen.

(e) (i) Most candidates named the Biuret test. Many answers omitted any reference to preparation of the seed, such as grinding or forming a solution from it. Other named tests were considered.

(ii) Most candidates stated the final colour for a positive protein result with the Biuret test, but often failed to mention that the initial colour was blue.

BIOLOGY

Paper 0610/61

Alternative to Practical

Key Messages

Candidates should be familiar with the practical procedures that are specified in the syllabus so that they develop confidence in using these skills. In particular, understanding how results are collected and measured, so that sources of error can be recognised and ways of improving an experiment can be suggested. In questions that require a specific number of responses, candidates are advised not to exceed the number. The ability to plan an investigation and identify variables is important.

Candidates should read questions carefully before starting to answer. They should know which SI units to use for measurements, including the correct abbreviations, and should show all stages in a calculation. They need to understand the difference between reliability and accuracy/precision. Candidates should be able to choose the correct type of graph to use and should label graph axes clearly, including the units. The scale should be chosen to occupy at least half of the grid.

General Comments

The quality of work showed that candidates were well prepared for this paper; there were many examples of clear, well-presented answers.

Drawings should be made with a sharp HB pencil, using clear, continuous lines, and should have no shading. The guide line for a label must touch the intended structure.

Comments on Specific Questions

Question 1

(a) Most candidates were able to construct a table. Better tables had the heading time / min in the first column and volume / cm^3 in the second column, and an overall heading with three sub-columns for each of the syringes. It was not uncommon for candidates to omit the records for the initial/starting volume. Poorer tables were drawn freehand, showing three separate syringe columns. The headings for time and volume were often omitted, and the units shown in each result box within the table instead of in the headings. Some candidates drew three separate tables, one for each syringe, and joined them vertically. The readings from the syringes were mostly recorded accurately. Some candidates gave the unit as ml, which is not the expected SI unit or the unit specified in the question. A few candidates used an incorrect abbreviation of 'm' (metres) for minutes.

(b) (i) The more able candidates referred only to reliability or identifying anomalies. Many candidates lost credit for referring to accuracy or precision as well as reliability. Candidates need to be clear about the difference between these specific terms; reliability indicates the repeatability of results, whereas accuracy is a measure of how close the results are to the true value. In most cases accuracy is related to the calibration of the measuring instrument. In this experiment the accuracy of the syringes was 1 cm^3. Comments such as 'it is a fair test' were inadequate and were not credited.

(ii) Although many candidates identified syringe **2** results as anomalous, a correct explanation was not always provided. A common error was to suggest that syringe **3** results were anomalous because it had the largest volume.

(iii) Almost all candidates gave a correct answer. Common errors included not rounding to the nearest whole number or giving the total volume of bread dough in all three syringes rather than the average.

(c) (i) Most candidates were able to calculate the volume increase correctly.

(ii) A line graph was the most suitable choice, as the independent variable was a sequence of quantitative values. Some line graphs gained full credit and were drawn with suitable scales which filled the whole space of the grid, accurately labelled axes with correctly abbreviated units and evenly spaced scales. Candidates should plot the independent variable along the *x*-axis and the dependent variable on the *y*-axis. Candidates who plotted the dependent variable on the *x*-axis were not penalised, but often failed to complete the graph line correctly. In some cases the axis labels did not have units or were incorrectly abbreviated. Candidates should be encouraged to use the table headings as the axis labels. Some candidates lost credit for extending the line beyond the plot points. A few candidates plotted the average volume of bread dough after 20 minutes, rather than the average increase in volume. These candidates were allowed credit for correct axis labelling, scale for this data and a line connecting the plotted points. Some less able candidates drew graphs with irregular scales, very large plotted points, freehand lines with irregularities between the points, or lines of best fit that were inappropriate for this type of data.

(iii) There were very few good descriptions of the graph, often because candidates omitted the word 'increase' and so answered in terms of average volume of bread dough instead of average increase in volume. Candidates were expected to describe the trend shown by the graph, i.e. an increase in temperature up to 50 °C caused a greater increase in the average increase in volume, after which further increase in temperature caused a decrease in the average increase in volume. Many candidates referred to 'a certain temperature', rather than the specific temperature at which the greatest increase occurred, others gave figures such as 10 °C, 50 °C and 70 °C. Answers of this sort were not credited.

(iv) The answers given by most candidates were too vague and often repeated the answer given for part **(iii)**, again suggesting confusion of the meanings of 'describe' and 'explain'.

Question 2

(a) (i) Better drawings had a clear outline drawn with a sharp pencil, with no gaps or shading, and with clearly drawn veins showing their thickness and position on the leaf. Poorer drawings were often heavily shaded or with the veins shown as short sketchy lines. In some cases, drawings were in ink or ball point pen that had been crossed out. Candidates should be encouraged to use a sharp HB pencil for drawing and to use most of the space provided. Most candidates were awarded credit for the label to the main vein on their drawing that showed the main vein as thicker and extending the full length of the leaf. Labels on drawings that did not show the main vein as different from the other veins, were not credited. Poorly placed label lines that did not contact the main vein were not credited. Label lines should be drawn in pencil, with a ruler, and the line should touch the feature being identified. Lines should not have arrow heads. The common errors were to label the main vein, with the label line ending on the lamina or on the petiole.

(ii) Some candidates confused width with length on their drawing and measured this. If no line was shown on the diagram then full credit could not be obtained. Some less able candidates gave the measurements in cm. In these cases credit was allowed for two correct measurements in cm if the unit was given correctly.

(iii) Most candidates were able to correctly calculate magnification. Some less able candidates did not follow the instruction to give the answer to the nearest whole number. Units should not be given for magnification. A few candidates gave a value for a microscope magnification, i.e. the value obtained by dividing the size of the drawing by the size of the specimen and then multiplying by 100.

(b) (i) Most candidates were able to gain some credit for this question. The most common differences given related to the venation of leaves and the shape of the leaf. Better answers made direct comparisons of the same features whereas poorer answers often gave a statement about shape in one column and leaf edge in the other. These answers rarely gained credit unless a comparative word was used in the description of the feature. It is essential for candidates to compare like with like.

(ii) Many candidates gave the correct choice with an appropriate reason for leaf **R** being the monocotyledon. Some candidates identified leaf **R** correctly but did not give a reason and so did not gain credit.

(c) (i) Many candidates were able to suggest at least one correct variable. The most common correct answers were light, temperature or wind speed. The best answers gave two correct variables and an appropriate way to standardise each variable. Some less able candidates gave correct variables, but the explanations of how to standardise each variable were too vague, for example for light intensity, 'keeping the light the same' or ' putting the leaves in the same room' was not enough for credit. Some reference to a light at the same distance from each leaf, or a room with only a single light source was expected. Many candidates referred to using an air conditioner to maintain temperature. This was not credited as an air conditioner is a cooling device and also creates an air current which would affect the rate of transpiration.

(ii) Very few candidates knew how to test for water. Better answers suggested a way in which water lost by leaves could be collected. A few candidates knew about cobalt chloride paper and a few about anhydrous copper sulfate. Measuring the boiling point or freezing point was also credited. Most candidates assumed that the mass loss was entirely due to water, so their answers were either related to measuring mass loss or water uptake with a potometer or included reference to the process of osmosis.

(iii) Most candidates were able to identify one similarity and one difference in the pattern of water loss of leaf **V** and leaf **W**. The most common correct similarity was that they both lost mass and the most common difference was that leaf **V** stopped losing mass after 50 minutes. Better answers used the data to calculate that both leaves lost approximately the same percentage mass, or that leaf **W** lost more overall mass than leaf **V**. Only a few answers stated that the rate of water loss decreased over time for both leaves. Many candidates noticed the gain in mass by leaf **V** between 10 and 15 minutes, but very few stated that this was likely to be anomalous. Some candidates misread the table headings and quoted water loss in terms of increase in temperature. Poorer answers were often too vague for credit. Data quotes were needed to support these differences. A few candidates did not attempt to answer this question.

BIOLOGY

Paper 0610/62

Alternative to Practical

Key Messages

Candidates should be familiar with practical procedures outlined in the syllabus.

It is important that a good HB pencil and eraser are used for drawings and graph construction.

Drawings should be made with clear, continuous lines and have no shading. The guide line for a label must make contact with the structure intended and there should be no gap. Magnifications based on the photographed image require accurate measurement for the calculation.

The starting colour must be recorded for food tests when noting the changes if certain foods type are present.

Graphs should be scaled so that the plots fit and most of the available grid should be used with plots covering at least half the grid in both directions.

General Comments

Overall candidates were well prepared and questions were generally answered in accordance with the instructions given. A wide range of abilities were seen.

The correct choice of graph to represent the data accurately is important and in this paper candidates were required to present the data as a bar chart with clearly labelled axes.

Candidates must read the questions very carefully. There were a number of calculations where the answer was required as a whole number, but many candidates failed to round up the decimal places in their final answers.

Comments on Specific Questions

Question 1

This question involved knowledge and understanding of practical procedures, handling data and drawing conclusions.

(a) Most candidates were able to correctly calculate the mean times. However, despite being asked to give answers to the nearest whole number, many candidates gave the mean times with decimal places.

(b) Most candidates correctly identified that the filter paper soaked in ripe fruit extract took less time or was faster to rise. Many of these candidates were also able to link this to the idea that the shorter time was a consequence of more catalase production. This link had to be made and it was not sufficient to just say that the shorter time supported the statement. The more able candidates gave a further explanation in terms of the faster release of oxygen. Other candidates gained some credit for correctly calculating differences in result times to illustrate their answer. No credit was given for just quoting times, totals or means from the results.

(c) This was answered well and most variables were seen. The most common errors were to suggest pH or for simply stating filter paper or hydrogen peroxide without qualification. Less able candidates appeared not to understand what was happening in the experiment and gave time as the variable to control.

(d) In order to carry out a successful test it is important to prepare the pepper. In many cases simply adding reagents to the fruit would not give a clear result. A number of candidates did suggest breaking up the pepper by grinding or chopping, and others described making it into a solution, but a large number failed to prepare the sample at all.

Most candidates correctly suggested the use of Benedict's solution. A small number did not mention heating the mixture which would lead to a colour change normally expected when testing for protein rather than for reducing sugar. Many candidates correctly stated the use of a water bath, but a small number incorrectly said warm water bath or simply water bath with no reference to heat, which gained credit for safety but not for heating. It is important to state both the original and final colour when describing the expected colour change to show the presence of a reducing sugar. Although many candidates knew all the possible colours for the varying amounts of reducing sugar, they did not refer to the original colour. There were quite a number of references to suitable safety factors, although a number of candidates did not mention any.

(e) (i) Using the data provided, candidates were asked to draw a graph to compare the sugar content of the five fruits. A bar chart was most suitable as it shows variation for discrete categories. Most candidates chose this type of graph and overall the bar charts were well constructed and well presented. A very small number drew line graphs.

Vertical or horizontal bars were accepted. The labels for the axes should have been taken directly from the table of results, i.e. sugar content / g per 100 g and the individual names of the fruits. The axis for the sugar content had to have an even scale, the names of the fruits placed centrally beneath each bar, and the values for data evenly spaced on each axis so that the plotted bars made full use of at least half of the whole printed grid in both directions.

Most candidates chose an appropriate scale and labelled their axes correctly. A small number of weaker candidates took the sugar values from the table and placed them equally along the axis rather than dividing the axis evenly. This was not awarded and it also resulted in meaningless plots and so further credit was lost.

The majority of candidates plotted the bars correctly and few errors were seen.

In this bar chart, the bars for the different fruits should be discrete and not touching, with all bars the same width and same distance apart. Most bar charts were drawn with bars of equal width, but a common error was to draw bars which touched.

(ii) The more able candidates were able to calculate this correctly although, again, credit was lost for not expressing the answer as a whole number. The most common error was to subtract the amount of sugar in 100 g green pepper from that in 100 g banana.

Question 2

(a) Overall, the standard of drawings was good. The lines used to draw the carrot and layers were mainly single and clear. There were very few artistic lines and there was very little shading seen.

Most drawings were of a reasonable size, larger than the photograph. The ideal size used most of the space provided.

Only the more observant candidates represented all the main layers of the carrot, two wider and two inner layers around the central core. The inner layers in the carrot, seen as lighter bands on the photograph, were often represented by single lines rather than double lines; single lines do not represent the complete layer.

Candidates were asked to label where the leaves were attached. This was not well done. It was the point of attachment, an area touching the top of the carrot anywhere between the two leaves, which required the label. The most common error was to label the leaf. A small number incorrectly indicated a part at the bottom of the carrot and some candidates did not label the diagram at all. It is important to note that a valid label line must touch the part which is being identified and should not simply point in the correct direction.

(b) This was answered well. Most candidates were familiar with the use of iodine solution to test for starch. One error was to state iodine instead of iodine solution or drops of iodine, although this was not seen very often. Iodine is a solid but needs to be dissolved in potassium iodide solution for the starch test. It is important to state both the original and final colour. Although many of the candidates knew that it would become blue/black they did not refer to the original colour.

(c) Most candidates measured **ST** accurately. The most common error was to give an answer which may have been correct, if measured in cm, but not in mm, so no credit could be given.

The candidates then had to use a scale rule, shown in **Fig. 2.2**, to measure the actual width of **ST**. Only the better candidates were able to understand and complete this successfully. A variety of measurements were seen but the most common error was to be out by a factor of 10.

Many candidates knew how to calculate the magnification by dividing the length of **ST** by the actual width, and credit was given if the final answer was correct for their measurements. A small number of candidates incorrectly multiplied their two measurements together. As with other questions on this paper, candidates were required to give their answer to the nearest whole number and again a number of candidates did not follow this instruction.

(d) (i) This was answered quite well by the more able candidates. The most common error was to confuse germination and growth, and use knowledge, rather than the results given, to state that light is needed by the seeds. A small number of candidates had not read the question carefully and stated that some of the other conditions listed in the question would be needed for germination or growth.

(ii) This was answered well and many candidates successfully described a correct improvement. The most common errors were to change the experiment completely rather than improve the method given. For example, leaving all the seeds in the same light or moving dishes to a dark room. A number of candidates suggested using more dishes, rather than more seeds, to give the seeds more space.

Question 3

(a) This was well answered. Most candidates were able to identify a number of differences and many gave more than the two required. A common error was to confuse the thorax and abdomen. However, although a small number lost some credit as a result of this, there were many of these candidates who gave enough detail to identify the exact feature they were describing. Weaker candidates did not compare like with like.

(b) This was not well answered. Candidates were not always precise when identifying two visible features that show why a fly and a bee are identified as insects. Many candidates correctly identified wings but did not know that a characteristic feature of an insect is only one pair of antennae. There were many answers simply stating antennae, but crustaceans have two pairs of antennae. Those candidates who incorrectly described the three parts to the body or three pairs of legs had not read the question carefully as these features were given in the question.

(c) It was obvious from the approaches seen to this question that some candidates were familiar with planning investigations and were able to produce a scientific, methodical plan, whereas others just gave a general description of what they might do. The weaker candidates gave no experimental method and simply discussed why bees were attracted to different coloured flowers.

The key to the investigation was to set up different colours; most candidates did this in some way.

Descriptions of suitable experiments set up in open spaces and in enclosed boxes were both seen. The better answers took account of other variables which had to be controlled in each case, for example the use of coloured cardboard flowers to eliminate the variables of attraction, e.g. scent.

A common error was to use vague terms for the numbers of insects or time, phrases such as “about ten flies” or “leave for some time” or “about a day” are not acceptable and would not be suitable instructions for setting up an investigation. For the method it was important to record the number of visits to flowers of each colour. This was generally well done, although some candidates described recording the numbers for only one of the insects, e.g. bees.

Many candidates correctly stated that the experiment should be repeated to get reliable results and often went on to suggest calculating an average.

Those candidates familiar with scientific planning realised the importance of presenting the results effectively and displaying them in a graph or table.

A small number of candidates correctly identified a need for a safety factor such as protective clothing when working with bees. This was given credit.

BIOLOGY

Paper 0610/63
Alternative to Practical

Key Messages

Some questions are structured such that candidates are asked for a description followed by an explanation or asked for a change (to the experimental design) followed by an explanation of the need for this change. Frequently candidates do not limit their answers to the headings given and produce answers with no clear distinctions, which leads to repetition and lack of clarity. Improvements in performance could be made by following the instructions.

General Comments

Candidates attempted all questions and had sufficient time to complete the paper. The standard of English was good and the answers were mostly legible and well presented.

Comments on Specific Questions

Question 1

This question was based on an experiment where candidates investigated the effect of exercise on pulse rate.

(a) (i) Many candidates scored full credit, usually for the position and for counting the beats per minute. Less able candidates described using the thumb, (which has its own pulse), or referred to taking a pulse using a vein. Very few candidates gave a reason why the pulse could be felt at the point chosen.

(ii) This was answered slightly less well than **(i)**. Acceptable answers referred to the need for a comparison between the pulse rate before and after exercise. Many candidates stated “as a control” but gave no further elaboration and could not be awarded credit.

(b) (i) Most candidates were awarded credit for constructing a table with two columns, correct headings, cells for the data and insertion of the correct data. Credit was most frequently lost because of incomplete headings or omission of the data for the resting state.

(ii) Frequently the sections were not treated as distinct entities. The majority of candidates produced sound descriptions and accounted for the rise in pulse rate. Less able candidates often referred to breathing rates. Chemical symbols in the explanation were accepted, but only if correct. Often symbols were inaccurately written and so gained no credit. If candidates are unsure of the correct symbol and notation, it is preferable to use words.

(c) This was a more demanding section. Candidates found it easier to suggest changes than to explain how each change would improve the result. The most commonly given improvements were repeating the experiment, standardising the intensity of exercise and the use of a pulse rate monitor. Few referred to the need to control other variables, extending the period of exercise or standardising the time during which the pulse rate was counted. The reasons for the suggested improvements tended to be imprecise with “increased accuracy” widely cited. Candidates need to be aware of the difference between accuracy and reliability of results.

(d) (i) The measurement required was carried out accurately by the majority of candidates. The most frequent error was to measure in centimetres and not convert to millimetres when writing the answer. The magnification proved challenging for the less able candidates, and many inverted formulae were seen. It is worth noting that a formula stated in words will gain some credit, even if the subsequent arithmetic is incorrect.

(ii) More able candidates stated the answer correctly. Candidates should be reminded that credit can be given for intermediate stages if these appear, even if the final answer is not correct. Although instructed to give the answer to the nearest whole number, a considerable number of candidates gave the answer as a decimal and thus were not awarded full credit.

Question 2

(a) Many candidates did not give a comparison. Good answers stated, for example, presence of wings as compared to no wings, or the absence of spikes as compared to the presence of spikes. The presence of wings compared to the presence of spikes is not a comparison. Less able candidates often gave differences that could not be observed from the photographs, such as dry compared to succulent, or bigger compared to smaller, when it was stated on the paper that the two seeds were not shown to scale.

(b) (i) There were some very good graphs seen. Most gained credit for labelling the axes, using at least half the grid, plotting the points accurately, drawing straight lines point to point, and identifying the lines in some way. The most common errors were not labelling the axes and drawing a bar chart instead of a line graph.

(ii) Many candidates interpreted the graph correctly, stating that **E** travelled further than **F** at all wind speeds. Less able candidates did not relate the distance travelled to wind speed, or to the distance travelled by the other seed.

(c) Candidates of all abilities gained full credit for their drawings. Generally the outlines were clear, unbroken pencil lines, with no shading. The diagrams were large with good detail shown. Those who lost credit did so either because the radical was too short, a label was omitted, or the labels were incorrect. “Root” and “shoot” were used quite frequently. A label line must touch the structure being labelled and not just point towards it.

(d) (i) The majority of candidates correctly stated that the variable to be changed was the temperature.

(ii) Identification of the variable to be measured was poorly answered by candidates of all abilities. The rate of germination or the number of seeds germinating was the required response, but many candidates selected the measurement of some aspect, such as the length of the radical or the mass of the seedling.

(iii) The identification of two variables to keep the same caused some problems, particularly for the less able candidates. The volume of water supplied, the concentration of oxygen and a statement about seed comparability were all acceptable points. Many incorrectly suggested the intensity of light, or failed to qualify water and oxygen.

(e) (i) The majority correctly named the Biuret test, and many quoted the reagents used in this test. Many omitted any reference to preparation of the seed, such as grinding, or forming a solution. A few candidates cited other tests for protein, such as using Millon’s reagent, or the xantho-proteic test.

(ii) Although the majority knew that a positive result with the Biuret test would produce a purple/mauve colour, candidates often failed to mention that the initial colour was blue. It is important to note that in food tests, the colour change is required and not just the end colour.