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BIOLOGY

Paper 0610/11
Multiple Choice

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

General comments

All questions were accessible giving an indication that the subject matter had been well learnt and correctly applied.

Comments on Specific Questions

Question 5

The properties of xylem were not widely known, with a proportion of candidates confusing it with phloem. Those who did know that xylem is a dead tissue were clearly the better candidates in the test as a whole.

Question 6

Many good candidates realised that the DNA strand in a bacterial cell is not a true nucleus.

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Question 9

To arrive at the correct answer, candidates had to recognise the cell from the drawing, and then know its function.

Question 12

Candidates found it challenging to link separate pieces of knowledge. First they had to understand that DNA codes for a protein, then know that lipase is an enzyme and enzymes are made of protein.

Question 18

While a photomicrograph of this magnification may not be entirely familiar to all candidates, the majority of candidates managed to deduce that cell Y was a white blood cell and that it produces antibodies.

Question 21

There are certain areas of biology where candidates often exhibit confusion. One of those is exactly when, during 24 hours, a plant photosynthesises and when it respires. On the evidence of this question, a large number believe that plants respire only at night. Knowing that humans, as living organisms, respire all the time, should offer a way of learning that plants, also living organisms, do the same.

Question 23

For those who knew that urea is a breakdown product of protein, this question linked excretion with liver function and diet. The most common mistake was to believe that urea is derived from mineral salts.

Question 30

This was a genetics question presented in a manner that was not familiar to candidates and thus required careful reading, and thought, before answering. The question did not ask for what *could be* the case, but what **must** be the case. This was not recognised by the majority of candidates, making it one of the more difficult questions on the paper.

Question 35

Many candidates confused a pyramid of biomass with a pyramid of numbers.

Question 38

The topic of food chains is one that is traditionally well understood. This question soundly supported that fact making it the easiest question on the paper.

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BIOLOGY

Paper 0610/12
Multiple Choice

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

General comments

All questions were able to discriminate satisfactorily between candidates of differing abilities.

Comments on individual questions

Question 2

Many candidates missed the significance of an organism suckling its young and felt that having a backbone, swimming and breathing air were enough features to classify the animal as an amphibian.

Question 4

This was one of the easiest questions on the paper, with the ability to follow a simple key traditionally a straightforward exercise. Only those who did less well on the paper as a whole failed to navigate to the correct response.

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Question 18

Several candidates correctly sequenced the chambers of the heart as blood passes through it after arrival from the **body**, instead of from the **lungs**, as asked. Careful reading of the questions is advised.

Question 20

There are certain areas of biology where candidates often exhibit confusion. One of those is exactly when, during 24 hours, a plant photosynthesises and when it respires. On the evidence of this question, a large number believe that plants respire only at night. Knowing that humans, as living organisms, respire all the time, should offer a way of learning that plants, also living organisms, do the same.

Question 21

For candidates not necessarily familiar with 'smoker's cough', there was a degree of reasoned deduction required here. That tobacco smoke paralyses cilia, leading to a build-up of mucus was missed by many candidates.

Question 23

For those who knew that urea is a breakdown product of protein, this question linked excretion with liver function and diet. The most common mistake was to believe that urea is derived from mineral salts.

Question 34

This was one of the easier questions on the paper, requiring relatively simple mathematics applied to biology.

Question 40

Candidates were told that only **some** of the fertiliser washed into the lake, but many overlooked this and did not allow for the fact that the fertiliser would increase the growth of the crop plants as well as the plants in the lake.

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BIOLOGY

Paper 0610/13
Multiple Choice

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

General comments

There were no questions that proved generally too difficult for the candidates taking this paper, and marks ranged from around what might be expected to be complete guesswork (10) up to a maximum of 40. One or two traditional confusions were seen (**Question 22**) as well as some common misunderstandings (**Question 24**).

Comments on Specific Questions.

Question 6

Most candidates recognised that xylem does not convert light energy to chemical energy but many candidates confused xylem with phloem and suggested that it carries sucrose.

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Question 7

A small percentage of otherwise very successful candidates did not appear to believe that xylem is a tissue present in leaves, or, that muscle is found in the intestine.

Question 13

Candidates found it challenging to link separate pieces of knowledge. First they had to understand that DNA codes for a protein, then know that lipase is an enzyme and enzymes are made of protein.

Question 17

While a photomicrograph of this magnification may not be entirely familiar to all candidates, the majority of candidates managed to deduce that cell Y was a white blood cell and that it produces antibodies.

Question 22

There is an often-seen mistake amongst candidates at this level that urea is produced *in* the kidneys rather than removed from the blood *by* the kidneys. Over half the candidates made that mistake in this question.

Question 24

For those who knew that urea is a breakdown product of protein, this question linked excretion with liver function and diet. The most common mistake was to believe that urea is derived from mineral salts.

Question 32

This was a genetics question presented in a manner that was not familiar to candidates and thus required careful reading, and thought, before answering. The question did not ask for what *could be* the case, but what **must** be the case. This was not recognised by the majority of candidates, making it one of the more difficult questions on the paper.

Question 33

Many candidates confused a pyramid of biomass with a pyramid of numbers.

Question 37

The topic of food chains is one that is traditionally well understood. This question soundly supported that fact making it the easiest question on the paper.

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BIOLOGY

Paper 0610/21
Core Theory

Key Comments

Candidates should be made aware of the need to read the questions thoroughly and to take note of each question's demands.

General comments

There were a significant number of candidates who did not attempt all parts of all questions but this did not appear to be linked to a lack of time to complete the paper. There were some candidates who showed very limited knowledge and understanding of some topics from the syllabus. There was virtually no evidence that there were candidates who did not find the paper demanding in at least some of its aspects. Responses to various sections of questions revealed certain misconceptions and misunderstandings. There was evidence in a number of places that candidates had not read the questions carefully or thoroughly enough. Unfortunately there were more examples this year of candidates whose written work was difficult for Examiners to interpret as its legibility was poor.

Comments on specific questions

Question 1

Very few candidates offered definitions of either of the named terms, both of which are clearly stated in the syllabus. Many either described a balanced diet or gave statements that were really related to eating and this was clearly discounted by the wording of the question. Respiration was clearly confused with either gaseous exchange within the lungs or with breathing which again was the contrasting term in the question. This question rarely resulted in candidates gaining more than half the available marks.

Question 2

Candidates often seemed to alter correct responses for wrong ones as if they could not accept that all the additions to the table were identical. In particular, many suggested that alcohol does not cause damage to the liver or that it did not act as a depressant. In **(b),** many of the responses were non-specific e.g. it damages your health or it affects the lungs. The effect of carbon monoxide was least well known and the addictive effect of nicotine the best known. Candidates were expected to state a logical site for a cancer caused by tobacco tar and not simply quote "cancer" unqualified.

Question 3

Candidates overall, seemed unfamiliar with the parts of the alimentary canal that carry out particular functions. The commonest correct response was in **(iii)** and the most erroneous responses were in **(iv)**. Responses in **(b)** suggested that many candidates did not know the role of digestive enzymes and those who did understand their role often linked lipase to the breakdown of proteins. A number of answers suggested that the role of this enzyme was to digest lipase itself. Some candidates concentrated on the role of enzymes in general. In **(c)**, the internal structure of the tooth was poorly known with both **S** and **T** being identified as enamel, although many identified calcium, phosphate and fluoride as essential minerals needed for healthy teeth. In part **(iii)**, many candidates linked the cause of dental decay to bacteria in the mouth but often went no further than this in their answer. Some however did link the bacteria to the production of acid from sugary food remains and the erosion of the enamel by this acid. Far too many responses stated that sugar itself, or eating sugary foods, was the direct cause of the decay. Many candidates did realise that poor dental hygiene also plays a role in the processes leading to dental decay.

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Question 4

Most candidates were able to identify parts **A** and **B** of the flower but far fewer recognised **C** as a sepal, often misnamed as a stigma, or **D** as the ovule or ovary. In **(b)** the definitions of pollination were poorly expressed with very few relating the transfer of pollen to movement between the anther and stigma. Many candidates commented on shape, and colour of insect pollinated flowers as well as the possession of nectar and a scent. However, there was evidence in the responses that a significant number of candidates treat the term 'flower' as if it is synonymous with plant and thus their responses gained little credit. Among the responses, there were some that listed features of wind pollinated flowers and simply stated that insect-pollinated flowers did not have these. This unfortunately, did not answer the question. In **(c)** most candidates realised that the lightness of the pollen allowed it to be carried further by even light winds but far fewer recognised that the large amounts produced increased the chances of pollination occurring. In both **(b)(i)** and **(c)** there were a significant numbers of responses that muddled fertilisation with pollination with many candidates using the two terms as if they were interchangeable.

Question 5

Very few candidates were able to link the rise in the human population in the last two centuries to improvements in medical care, improvements in water supply and sewage or improvements in the production and supply of food. Many answers simply suggested that more reproduction took place. Answers dealing with the social implications of the population rise were far stronger with most dealing with the problems of increased demand for raw materials, energy and fuels, food supply and increasing pollution. In both parts of **(b)** responses were often very vague and showed little knowledge or understanding of the topics. Although a significant number of candidates realised the risk of mutations and cancers from the radiation only a very small number recognised that radioactive materials can enter food chains or that their radioactive properties decline slowly over many centuries. Candidates recognised the disease causing potential of untreated sewage but often did not develop their responses any further.

Question 6

In both parts **(a)** and **(b),** the majority of candidates gained credit. In **(c)**, candidates often made one of two errors, either having one level of the pyramid larger than the one below it or muddling the labelling of the middle two layers, insects and insect-eating birds. Those who drew their pyramid as a simple triangle eliminated the first of these potential errors. There were some pyramids that were inverted compared to the conventional version; it is normal to have the producers at the base of the pyramid. In **(d),** there were significant numbers of responses where the name of the method of nutrition was given as 'producer or even 'oak tree'. In describing photosynthesis, candidates should realise that simply stating that the plant uses various chemicals is inadequate. The carbon dioxide and water are involved in a chemical reaction whose products are glucose and oxygen and that the energy for this to happen is light.

Question 7

In **(a),** candidates found it very difficult to state clearly the meaning of the terms, allele and gene. The former being an alternative form of a gene and the latter a length of DNA. In **(b)**, although many candidates were able to identify the genotypes for individuals 2 and 5, in part **(ii)**, and individual 3, in part **(iii)** they seemed unable to offer an adequate explanation as to why the allele for tasting PTC was dominant. In family trees the clue lies in the appearance in one generation of the recessive phenotype when it is not present in the generation before it. In this case, individual 5 cannot taste PTC while both of his parents can. Thus both parents must have the allele for not-tasting PTC in order to pass it to their son but this allele is not expressed in their phenotype so it must be hidden by the dominant allele, for tasting PTC.

Question 8

Many candidates simply stated whether **F**, **G** and **H** were arteries or veins, with varying degrees of accuracy, when they should have named them as the question demands. In **(b)**, candidates were expected to state differences between the blood entering and leaving leg muscles, not state which vessels the blood is flowing in. Differences should make it clear what the state of the blood is in both, at entry and departure, including factors such as the blood pressure, oxygen concentration, carbon dioxide concentration, glucose content or temperature. Stating that blood entering the leg muscle is at high pressure is inadequate unless there is a comment on the pressure on leaving, or the use of a comparative such as 'higher'. In **(c)**, the answers showed very little knowledge or understanding of the advantages of the double circulation. There were many responses that suggested that if one circulation failed the other could take over or that it could assist in times of high demand. Candidates seemed unaware of the delicate nature of lung tissue and the value of a

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lower circulation pressure in the pulmonary circuit and also the need for a much higher pressure to distribute the oxygenated blood to all parts of the body where a greater resistance to flow occurs.

Question 9

The definitions of excretion often seemed to confuse excretion with egestion and included references to faeces. Faeces are not normally considered to be an excretory material unless it is made clear that it is the excretory substances within the faeces, such as bile pigments, that are being considered. Also, many definitions did not make it clear that it is the removal of materials from an organism. Unfortunately errors and misconceptions in **(a)** often had an effect on the answers in **(b)** with the anus, rectum or small intestine being quoted as excretory organs. Many substances given as examples were rather vague and should have been much more specific e.g. urea, water, carbon dioxide or mineral salts rather than exhaled air, urine or sweat. In **(c)**, most candidates named an excretory substance of plants with many recognising both oxygen and carbon dioxide as correct examples. However , some candidates naming oxygen as an excretory substance in humans.

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BIOLOGY

Paper 0610/22
Core Theory

Key Messages

Candidates should be reminded of the need to read the questions thoroughly and to take note of each question's demands. The best answers suggested that candidates had read the whole of a question before beginning their response to any section, thus avoiding repetition.

The amount of credit available for each question part should be noted as this is an indication of how much information is expected in a response.

Candidates should be careful not to repeat information that has been provided as part of the question, as so often this type of response proves to be inadequate for credit. For examples "mucus can block many passages in the respiratory tract" or "non-renewable material is material which is non-renewable".

General comments

A significant number of candidates did not attempt all parts of all questions. This did not appear to be linked to a lack of time to complete the paper, but rather to inadequate preparation or knowledge of the subject matter.

Almost all candidates found at least some aspects of this paper demanding. The best answers showed that candidates had clearly understood the command words such as 'discuss', 'explain' and 'suggest'.

There were excellent answers to all of the questions, although areas of the syllabus that were found to be the most challenging included the role of the kidney, structure of the stem and asexual reproduction.

Comments on specific questions

Question 1

Many candidates proved confident in identifying arthropods/crustaceans and fish, but less so annelids. A surprising number of candidates confused amphibians and reptiles, and rather few scored full marks on this question.

Question 2

Most candidates answered the calculation part **2(b)(ii)** of this question well. Many were rather unsure about the terms' homeostasis' and 'respiration; similarly, few were able to provide three valid uses of water in the body or three *other* functions of the kidney (too many repeated the information given in the question stem i.e. excretion of excess water).

Question 3

Many candidates scored full marks on part **(c)** of this question, although a significant number gave gametes with two alleles in each – a major misunderstanding of the basic biology. Part **(a)** proved more challenging as too many candidates simply repeated the information supplied in the question stem. A few realised that infections must involve bacteria but most just suggested that a lack of oxygen/air caused the infections. The better answers included reference to the difficulties of expelling mucus and the optimum conditions for bacterial multiplication in the warm, moist environment of the lungs.

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Question 4

There was some confusion in answers to this question. Many candidates confused 'renewable' with 'recyclable', and so did not gain all of the marks available. Regarding sewage – very, very few realised it is *liquid* waste or if they did they failed to state this. There were too may references to garbage and rubbish with examples being quoted in terms of plastic, for example.

Question 5

A key to answering this question well is to consider each of the answers alongside one another – it is very unlikely that the repetition of one response will gain any credit. The correct sequence was B, F, C and D. C and D were often reversed, and it was rare to see the cervix correctly identified.

Question 6

Many answers showed a good understanding of the pathway of water movement from the soil to the leaf (although the required detail is 'root hairs' rather than 'root'). Answers to part **(a)** suggested that candidates had either not read the question carefully, or did not appreciate the difference between root and stem. As a result a significant number of answers gained no credit as they offered diagrams showing the positions of phloem and xylem in the *root*.

Question 7

Parts **(a)(i)**, **(b)** and **(c)** were often well answered, although the muscle names were commonly reversed. This may have been because biceps / triceps is the common order of referring to them and thus candidates assumed that C / D were in that order. It is important to study diagrams carefully. Part **(a)(ii)**, however, elicited answers which suggested that candidates had not fully understood what was meant by 'features'; too often, candidates simply offered an *example* of a reflex action.

Question 8

Most candidates correctly identified carbon dioxide and water as products of aerobic respiration. It was clear that many candidates were able to interpret the graphical data and so were able to provide the correct numerical answers (0.2 and 150) to this question. In **(c)(i)** the responses varied from the best, concise, well-explained answers to those which linked pulse rate to breathing. Interpretation for **(ii)** was good and very many offered sensible suggestions for **(d)**.

Question 9

Few candidates seemed to appreciate the principles of asexual reproduction. Even those who identified mitosis seemed to have difficulty in using their knowledge of this to suggest all three plants would be of the same genotype or that asexual reproduction was involved. In **(b)(i)** most candidates missed the point that sexual reproduction was involved and that this can lead to varied genotypes by means other than cross-pollination. Many candidates gained some marks for **(b)(ii)**, but few gave sufficient detail of the process of artificial selection to gain more than 1 or 2. There were very few answers containing reference to flower structure (removal of stamens or stigmas, for example) and even fewer commenting on the need to continue the selection process through several generations.

Many candidates had at least a basic appreciation of genetic manipulation/modification, although once again this was rarely sufficiently detailed to gain more than 1 mark.

Question 10

Very few answers included a good definition of the term 'ecosystem' (as is required by the syllabus). In **(b)** most identified heather plants but far fewer identified photosynthesis. Too often heather plants were given as both answers. Food chains were normally correct but there were the inevitable ones without any arrows or with arrows running from top carnivore to producer. There were also a small number with organisms not in the food web (e.g. Man, lion) despite the instructions in the question. There were some very well-reasoned answers to part **(d)**, with candidates showing a good understanding of the interrelated effects that can arise in food webs.

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BIOLOGY

Paper 0610/23
Core Theory

Key Messages

Candidates need to be aware that unintelligible writing cannot gain credit.

Candidates should be encouraged to read the whole question with care before beginning their response.

General Comments

There were a significant number of candidates who failed to attempt all parts of all questions but this did not appear to be linked to a lack of time to complete the paper. A number of candidates showed very limited knowledge of major parts of the syllabus including the processes of fat digestion and excretion. There was evidence of careless reading of the question, especially in **Questions 4, 7** and **9**. In some cases the standard of English and the handwriting of the candidate made it almost impossible for the Examiner to make logical sense of the response.

Comments on Specific Questions

Question 1

Many candidates appeared not to know the classification of the two classes of flowering plants. Even the term monocotyledon did not seem to suggest the presence of one cotyledon. Some may have been confused by the term eudicotyledon that is now used in this syllabus. Part **(b)** usually produced at least one correct response. In **(c)**, very few candidates identified the diagram as a section through a root although they very often correctly labelled the xylem and phloem. Many knew that the xylem transported water but few could suggest a second function. A significant number confused the functions of the xylem with those of the phloem.

Question 2

It was expected that candidates would use both their general knowledge and the relevant areas of the syllabus when answering this question. It was set out in two sections to guide candidates but many ignored this. The use of agricultural machinery allows many agricultural processes such as ploughing, sowing and harvesting of crops, irrigation and drainage to be carried out more rapidly and efficiently thus increasing crop yields. The second section was about the use of fertilisers, not insecticides or herbicides, which many chose to write about. There was clearly confusion by candidates between these terms. More careful reading of the question might help candidates to produce creditworthy responses.

Question 3

Knowledge of the female reproductive system, and especially the placenta, was very poor. In **(a)(i)**, of those who recognised the term zygote most knew it was formed from the ovum and the sperm but many talked of the gametes meeting without mentioning fusion. Some appeared to think that the sperm entered the ovary and fused with the whole organ. There were also a significant number of candidates who described the human female gamete as the ovule, a term only used in reference to a structure in the ovaries of plants. In **(ii)**, very few candidates mentioned division of the zygote to form a mass of cells or implantation in the lining of the uterine wall. In **(b)(i)**, there were some sensible suggestions given for the two blood systems being separated such as incompatible blood groups or the risk of transferring pathogens. The risk of blood loss at birth was not an acceptable response. Part **(ii)**, was clearly not understood by many candidates. Those who did realise that they were expected to compare the roles of the placenta with those of the small intestine, lungs and kidneys in the adult, showed very limited knowledge of the placenta. The placenta transfers the products of digestion and oxygen from the maternal blood to the fetal blood and transfers carbon dioxide and

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waste nitrogenous material in the reverse direction down a concentration gradient. Thus it is a surface at which absorption and diffusion occur. It does not digest food or breathe for the fetus. Most candidates did make sensible suggestions in **(c)**. The commonest were avoiding smoking, drinking alcohol, taking non-prescription drugs and dietary modifications.

Question 4

Knowledge of the effects of sulfur dioxide was very vague. Some candidates mentioned acid rain and its effects and a few candidates mentioned smog. There were some who tried to link this with global warming or the destruction of the ozone layer. In **(b)**, it was surprising how many candidates could not interpret the data shown by the graph correctly and many were unable to extract the relevant data and complete the calculation correctly. Most seemed unable to link the presence or absence of lichen **M** to the possible concentration of sulfur dioxide that would decrease with distance from the industrial site in part **(iii)**. There were a significant number of responses to **(iv)** in which the total number of lichens, calculated by the candidates, was divided by 20, as if the answer required was to be presented per metre squared rather than for the whole 20 m^2 area. This suggests candidates did not read the question carefully enough.

Question 5

Most candidates could not name the enzyme involved in fat digestion or the products of this process. Most did not realise that the fatty acids produced in digestion would lower the pH of the mixture. In **(b)**, most completed the graph. In **(c)** the responses suggested that few had understood the role of bile in aiding the more rapid digestion of fats. Some candidates recognised that in the second investigation the colour of the indicator would change more rapidly but the optimum temperature would remain the same.

Question 6

This question was very poorly answered. Some candidates realised that reactions are speeded up by the presence of enzymes or by an increase in temperature, but knowledge of anaerobic respiration in yeast and human muscle cells was almost non-existent as was the use humans make of anaerobic respiration of yeast. Many of the responses given did not make any sense within the wording of the paragraph.

Question 7

Throughout part **(a)**, a significant number of candidates referred to pollination although the question was about fruit and seed dispersal. Those who read the question carefully usually gained most of the available credit in this section. In **(i)**, a number of candidates thought fruits developed from the seed or gave vague responses such as 'the flower'. In **(ii)**, many referred to hooks, or to the edible (juicy) outer regions but other features such as a conspicuous colour or smell were mentioned less frequently. In **(iii)**, many suggested the presence of wings as another mechanism of dispersal. Suitable agents such as the wind, water or explosive mechanisms were also creditworthy responses. In **(b)**, pollination was the most common correct response. Candidates should be aware that insects are not normally agents for seed dispersal.

Question 8

This was the highest scoring question for many candidates. In spite of the instruction, a few candidates tried to name species at each trophic level and a few reversed the positions of the producer and the carnivore, but most gained full marks. A number of candidates could not manage the basic calculation. Most recognised photosynthesis as the process used by organism **A**. A number of candidates failed to identify ways in which energy is lost at each tropic level. The method could have included respiration, excretion, egestion and, for some organisms, loss of heat energy to the environment. Various processes involving movement such as hunting, walking etc. were also considered adequate. Vague suggestions such as 'keeping alive' were not considered adequate for credit.

Question 9

Many responses to this question showed insufficient understanding about the processes that go on in the kidney. Many candidates did not understand the graph which showed how the relative concentrations of four substances changed as blood passes through the kidney. Candidates should know that blood passes from the renal artery to the renal vein, but a significant minority read the graph back to front. 'Explain the difference', means that the difference must be clearly stated, and then in each case the reason or reasons for the difference given. In **(a)**, it was expected that responses would describe the drop in concentration of urea in the blood as it passed from the renal artery to the renal vein and relate this to the filtration of

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substances in the kidney. Part **(b)**, required a description of the changes in the relative concentrations of oxygen and carbon dioxide and these changes to be related to respiration within the kidney. Part **(c)**, required candidates to note the fall in the concentration of glucose as blood entered the capillaries and its subsequent rise as glucose is reabsorbed. Many candidates failed to refer to the graph or to make use of the information it contained. It is recognised that the kidney is a difficult subject for many candidates, but they should have been able to interpret the graph and thus gain a creditable score.

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BIOLOGY

Paper 0610/31
Extended Theory

Key messages

- Candidates should always take time to read the questions carefully. All the information and data provided should also be studied carefully as candidates are often asked to interpret the information provided to gain full credit.
- Candidates should always give the specified number of responses requested in a list and no more. Where more than the stated number of responses is given, any incorrect responses are penalised as being contradictory. This rule also applies to questions where only one answer is required.
- Candidates should avoid repeating the information given in the questions in their answers as this is a waste of time and space.
- Candidates need to be encouraged to use the correct scientific terminology. Vague terms rarely gain credit. For example words such as 'affect' and 'change' often need further explanations.
- Examiners accept phonetic spelling where words are recognisable and unambiguous. However, candidates should show careful attention to words that can be confused; for example, trophic and tropic, mitosis and meiosis, ovum and ovule.
- Candidates should be encouraged to write their answers to the longer questions in continuous prose. Lists and phrases that do not link together the appropriate scientific concepts are unlikely to gain much credit. Some candidates write answers in the form of bullet points. If these are full sentences then there is rarely a problem, but often they are not and the information given is not sufficient for the award of credit.
- Incorrect answers must be clearly crossed out and the correct answer should be written alongside or just above the first answer. Where an answer is a single letter or number, it is particularly important that candidates do not write on top of an original answer. Where it is not possible to confirm what letter or number is written no credit can be awarded.
- Answers that are continued in blank spaces or on additional paper must be clearly numbered. At the end of the answer space provided, candidates should state where to find the rest of the answer.
- Candidates should avoid writing initial answers in pencil and then overwriting in pen. Any feint 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 on one page can make it difficult to read answers on the back.

General Comments

This was an accessible paper allowing candidates across the full range of ability to demonstrate what they knew. There were some more challenging and stretching questions for the most able. The Examiners were pleased to see that most candidates had attempted all the questions. Almost all completed the paper within the time available. Some handwriting, however, was difficult to read.

There were some excellent well written and coherent responses to the longer answers.

Candidates did not seem well prepared to use data to support a description of a trend or pattern from a graph or a table. Often, candidates who quoted figures did not read them accurately from the graph and often omitted to include the units after each figure.

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Comments on specific questions

Question 1

This question asked candidates to identify the structures of the gas exchange system shown in Fig. 1.1. This proved a good start for most candidates. Almost all candidates calculated the mean volume of air correctly in part **(b)(i)**. Describing and explaining the differences between oxygen and carbon dioxide in the air samples collected from the girl before and after exercise provided more of a challenge.

(a) Many candidates gave the correct answers in Table 1.1. Common errors were to give **F** and **J** as the bronchus, **K** and **B** as the trachea. Sometimes it was difficult to distinguish between the letters **E** and **F** when **F** was written on the line. It was rare to find more than one letter given in each box. If more than one answer was given, then no credit was awarded.

(b) (i) Most candidates calculated the mean volume of air per breath correctly and wrote the answer in Table 1.2. If candidates gave the answer in the space for working, but did not rewrite it in the table, then credit was given. 375 and 37500 were common incorrect answers. A few candidates did not attempt this question and some tried something far more complicated than adding up and dividing by 4.

(ii) The Examiners expected candidates to recognise that the rate of breathing had increased after exercise. Some candidates lost a mark here by giving a change shown in Table 1.1. Depth of breathing was ignored by the Examiners so if they wrote 'depth and rate of breathing' they were given credit. There were many references to heart rate which did not answer the question.

(iii) The most common gases given were argon, hydrogen and water vapour. The Examiners accepted the names of all the rare gases and any air pollutants, such as carbon monoxide and sulfur dioxide. Nitrogen, sulfur, carbon dioxide, oxygen and any 'inert' gases were not given credit.

(iv) There were many good answers to this question. Partial credit was awarded for a description of the differences in the air samples. Candidates often did not use the data to illustrate the differences in the composition of the two samples. Some candidates compared oxygen with carbon dioxide within one sample. The explanations were often poorly expressed. Candidates tended to write about the reasons why oxygen is always required in the body and why carbon dioxide is always removed, rather than addressing the requirements of exercise. Answers often explained that oxygen is needed for respiration and the release of energy, instead of stating that more oxygen is needed after exercise to repay the oxygen debt or because the rate of respiration has increased as more energy is required. In questions on exercise it is often important to use the word 'more'. The concept of oxygen debt was known by many candidates, although rarely explained well. Many candidates did not distinguish between air and oxygen. The Examiners occasionally read that during exercise more air is required, or that muscles require air for respiration.

Many candidates wrote that carbon dioxide is a product of anaerobic respiration in muscle. They should be reminded of the word (and balanced chemical) equations for anaerobic respiration to see that it is not.

Question 2

Energy flow through ecosystems from Section IV of the syllabus was tested in this question. Part **(b)** proved to be a very easy question for most candidates.

(a) (i) Many candidates were successful in identifying **L** and **N** from the energy flow diagram in Fig. 2.1. The Examiners ignored 'plants' and 'carnivores' so that answers such as 'plants, producers' or 'producers (plants)' gained the mark for **L**; similarly, 'carnivores = secondary consumers' and 'secondary consumers (carnivores)' also gained credit. 'Plants' and 'carnivores' unqualified by the names of the correct trophic levels did not gain any credit.

(ii) There was some confusion over the concept shown by the relative sizes of the boxes, **L** to **O**, in Fig. 2.1. Many realised that the boxes represented the energy within each trophic level. Some stated that they showed the decrease in energy from trophic level to trophic level. Both answers were credited. Incorrect answers were: 'biomass', 'number of organisms', 'pyramid of numbers',

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'size of the population' and 'amount of energy transferred'. The latter is shown in the diagram by the arrows between trophic levels.

(iii) There was plenty of scope for candidates to gain full credit for this question if they looked carefully at the figures. Few quoted the figures to state that all the energy obtained by the tertiary consumers at level **O** is accounted for by the energy loss from this trophic level. Many stated that energy is lost in the food chain with answers often illustrated by statements that 10% of the energy entering a trophic level is passed to the next or by the statement that 90% is lost. Many mentioned that animals in trophic level **O** would be too big and fierce and therefore would not have any predators. Some used examples such as lions, tigers, vultures and large snakes that have no predators. Many just stated 'it was at the top of the pyramid' so could not have any predators without offering any explanation The question was often answered as what trophic level **O** received rather than what could be passed on to any potential predators. Few pursued the argument to say that this would mean a population of predators would be small or struggle to survive. Some candidates simply stated that energy stops at the tertiary consumer level.

(iv) Many candidates gained full credit for stating that **P** represents loss of energy by respiration to the surroundings or to the atmosphere. Answers that gained full credit often stated that this is energy lost as heat. A number of candidates stated that this represented energy *used* in respiration. There were also incorrect references to plants, decomposers and to the nitrogen cycle.

(b) This was probably the easiest question on the paper. Candidates explained that the loss of animals from trophic level **M** would have effects on the populations of all the other trophic levels. Answers were often well written. The few candidates who did not gain credit here read the food chain the wrong way round, thinking that **L** fed on **M**. Of those candidates who did not achieve full credit for this question, many showed poor expression. For example, they wrote 'a decrease in the numbers of **N** would affect **O**', rather than, 'a decrease in the numbers of **N** will lead to a decrease in the numbers of **O**'. Many mentioned **N** and **O** becoming extinct which was accepted.

Question 3

There were many full and accurate descriptions in part **(c)(i)** of the graph in Fig. 3.2. However, many candidates did not follow the advice given in the question to give the results from the graph in their answers. Many of those that quoted figures often misread them from the graph and/or did not include units. Some of the answers to part **(d)** contained some impressive detail of the events of fertilisation.

(a) Many candidates gained full credit for identifying the organs described in Table 3.1 and shown in Fig. 3.1 Common errors were to identify the ovary as **S** rather than **T** and to confuse the uterus and the oviduct. Some candidates wrote 'ovule' or 'ovum' for ovary. The Examiners accepted uterus lining and uterus endometrium but rejected uterus wall, since the site of implantation is in the lining not in the wall. There were many different spellings of Fallopian – many of these were accepted by the Examiners if they were phonetic. The Fallopian tube or oviduct was often referred to as the ovary duct which was not accepted.

(b) (i) The target organ for FSH was given as the ovary or ovaries on many scripts. Common errors were to give the follicle, which is not an organ, and the uterus. Also quite a few gave the pituitary gland, which is the source of FSH, possibly because they did not understand the term *target organ*.

(ii) Candidates who misidentified the organ in part **(i)** usually lost another mark by giving an incorrect function for FSH. In this case the error carried forward rule was not applied to answers such as these. Successful answers gave the effect of FSH as stimulating the growth of a follicle or of an ovum and stimulating the secretion of oestrogen. Many candidates stated that FSH stimulates ovulation which was not accepted. Some did not gain any credit because they stated that FSH stimulates the secretion of oestrogen *and* progesterone. Also quite a few said that FSH causes menstrual bleeding, or gave general statements such as 'it increases fertility'.

(c) (i) Candidates who gained full credit often did this with three descriptive comments and one data quote or with two comments and two data quotes. Many candidates did not give any figures from the graph. The Examiners did not award any marks for use of figures unless 'arbitrary units', or simply 'units', were used at least once. Credit was only given to descriptive comments and figures if the relevant days were identified. Some candidates expressed answers poorly giving descriptions in terms of concentrations 'at' specific days rather than describing changes in concentrations between certain days. Some candidates gave an explanation in terms of the events

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of the menstrual cycle, rather than a description of the changes in oestrogen levels shown in Fig. 3.2.

(ii) Most answers gave good definitions of the term *ovulation*. Unfortunately, some candidates stated that this is the release of an *ovule* rather than an *ovum*. This error often appeared in part **(d)** as well. Some referred to the production or maturation of an ovum rather than its release.

(d) Many candidates did not gain many marks for their descriptions of fertilisation. In many cases, this was because they described events that occur *after* fertilisation and if they gained any credit, it was for using the term zygote. A common error was to state that a zygote forms after the fertilised egg has divided several times. Many answers started with an embryo and described the events of implantation and beyond. Candidates who read the question carefully easily gained full credit often giving impressive detail. Some candidates gave details of the process of *in vitro* fertilisation which were not required.

(e) (i) The syllabus gives a suitable definition of the term *chromosome*. It was surprising that few answers quoted this definition. Some candidates gave the syllabus definition of the gene and others wrote about the importance of chromosomes or the numbers of chromosomes in different cells. Some stated that chromosomes are cells.

(ii) Many candidates gave 46 or 23 pairs as the correct number of chromosomes in a cell of a human embryo. 2, 23, 24, 32, 34, 42, 47, 48, 64 and 92 were all seen.

Question 4

Part **(a)** was a question typical of Papers 5 and 6. It was surprising that candidates were not better prepared to make a drawing of a photograph of a specimen. Very few candidates could transfer information from the photograph to their own drawing. If drawn correctly, candidates often had the labels the wrong way round. Part **(c)** proved one of the most challenging questions on the paper. It tests the second bullet point in the Supplement section of learning outcome 7.1.3.

(a) Many candidates drew the distribution of vascular tissue in a cross section of a root or stem from memory rather than following the instructions. Of those that attempted to make a drawing of the position of the xylem and phloem, few identified the xylem and phloem correctly. There were some excellent drawings of the cell detail of the xylem although marks were awarded if the areas occupied by the two tissues were shown by dividing the shape of the vascular bundle into two or drawing outlines to show the position of the xylem to the right of the phloem. Even well drawn responses labelled the xylem to the left of the phloem.

(b) Sucrose was often identified as the carbohydrate transported in the phloem. Glucose, sugar, starch, glycogen and amino acids were often given instead. Some candidates gave two responses, one right and one wrong. In this case no credit was awarded.

(c) This question on transport in the phloem proved difficult. Some candidates were confused between the roles of xylem and phloem. They often wrote about the movement of water and minerals at different times of the year. These answers also stated that water and nutrients move both upwards and *downwards* within the plant. Candidates who wrote about the movement of sucrose stated that it moves up and down the stem but omitted to give the destinations, such as roots, flowers, fruits and seeds. Some candidates stated that substances moved in the phloem are sent *to* leaves so that they can carry out photosynthesis. The terms *source* and *sink* were used by many candidates with the best making good use of these terms applying them to leaves, storage organs, flowers and growth regions. Answers revealed many misunderstandings about plant biology, such as fruits growing underground. Many stated that sucrose moves downwards in winter. Many did not state the conditions relevant to winter and summer or related movement to photosynthesis or the stage of growth. Some included good descriptions of movement in phloem after seeds have germinated. Some stated that carbohydrates were absorbed from the soil. The most common misconception was that sucrose was moving down in the winter to feed the roots and back up in the spring / summer to 'feed' the leaves or to provide sugars for photosynthesis.

(d) Definitions of transpiration often gained full credit. Candidates referred to evaporation and the loss of water through stomata in leaves. Only the best candidates stated that water evaporates from the surfaces of mesophyll cells and that water loss occurs by the diffusion of water vapour through stomata. Common errors were to answer part **(e)** here and describe the movement of water in the

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transpiration stream. Omitting vapour from their explanation a common error. This definition is given in the syllabus so it was surprising that more candidates did not gain full credit here. Many confused transpiration with translocation.

(e) The most successful answers to this question on movement of water through plants began by stating that transpiration is responsible. Candidates explained that transpiration pull involving the cohesion between water molecules within xylem vessels is responsible for the movement of water up tall plants, such as the rattan palm. The Examiners decided to award credit for cohesion and adhesion if these terms were also explained. Many gave the terms and either they did not say what they meant or got them the wrong way round. Many answers began by describing the movement of water from the soil, through roots hairs and the cortex into the xylem in the root. No credit was given for this. Movement of water up the root and stem was often explained in terms of a water potential gradient. Some candidates, unfortunately, went on to say that this involved osmosis across partially permeable membranes, which is incorrect. Candidates appeared to confuse movement from soil to root hair with movement in the transpiration stream.

Question 5

Many candidates appeared not to have read the information provided about the experiment on the digestion of fat very closely. Many answers to parts **(b)(i)** and **(ii)** showed that candidates had not used the information before **(a)(i)** and applied it to the description of the experiment. Neither had they used it in interpreting the results shown in Table 5.1. The roles of bile salts in emulsifying fats and lipase in digesting fat are in ***sections 6.3.4*** and ***6.3.5*** of the Core syllabus.

Colours given in Table 5.1 often led to confusion with other tests. For some, blue meant the iodine test and orange meant the test for reducing sugars. It was good to see in **(a)(ii)** almost all candidates reading the question carefully and only giving the pancreas once.

(a) (i) Very few answers to this question gained full credit. Many candidates wrote about the features of enzymes without picking out the facts that enzymes are catalysts that speed up reactions. This means that reactions can occur within organisms at low temperatures instead of the high temperatures required for uncatalysed reactions to occur. A few candidates stated that enzymes lower activation energy. Many answered this question by drawing on their knowledge of digestion without making two or three general points about the importance of enzymes.

(ii) Many candidates selected pancreas, stomach and salivary glands from the list to identify the organs that secrete the three enzymes. Common errors were to select the gall bladder and the liver for lipase and protease. Most candidates linked amylase to the salivary glands. All three are secreted by the pancreas; most candidates followed the instructions and only gave the pancreas once. Lipase was the one they were most likely to get wrong.

(b) (i) Many candidates identified tube **D** as the control. The Examiners did not accept 'control variable' given by some candidates. The control variables are the temperature (40 °C), the time at which substances were added to the test-tubes and the time for the reaction to occur (5 minutes). Presumably the volumes and concentrations were also standardised although the information does not give these details. The control tube is used to see if the differences in colour or pH of the tubes are due to the action of the lipase and bile. (Tube **D** is missing both lipase and bile. Other tubes had one or the other.) Many candidates stated that the tube would be used to compare with the other tubes, but they did not state what aspect would be compared. Suitable answers were the colours of the indicator or the pH of the contents.

(ii) There were two interpretations of the orange colour in test-tube **A**. Some thought that the contents had an acid pH because lipase and/or bile salts were acidic. The Examiners did not award any credit for this. These candidates did not apply the information given about digestion of fat. Those who realised that lipase had broken down fat to fatty acids and glycerol tended to gain full credit for this question. Quite a few candidates thought that the orange colour was something to do with the Benedict's test for reducing sugars.

(b) (iii) Candidates who had not appreciated the roles of lipase and bile salts in fat digestion usually gained partial credit for saying what colour one of the tubes had gone and/or what this meant in terms of acidity or alkalinity. Candidates who were successful in part **(ii)** often did well here as they explained that there is no breakdown of fat to fatty acids and glycerol in tube **B** since there is no

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lipase present. They explained the yellow colour in tube **C** in terms of lipase digesting only some of the fat since there were no bile salts to increase the surface area of the fat globules.

Question 6

There were many good answers to parts **(a)** and **(b)**. Most candidates identified an arthropod feature shown by the crab in Fig. 6.2. Future candidates using this paper for examination practice might like to know more about the hydrothermal vent crab, *Bythograea thermydron*. If so, there is information available at: http://www.ceoe.udel.edu/deepsea/level-2/creature/crab.html

(a) Many candidates identified two features of bacteria that are not shown by animal cells. Some candidates gave differences between plant and animal cells. Common correct answers were 'no nucleus', 'flagellum' and 'cell wall'. Some candidates gave detailed information about the cell wall more appropriate for A level. References to size, shape and presence and absence of cytoplasm, cell membrane and vacuole were all seen and not awarded any credit.

(b) (i) Stage **A** of Fig. 6.1 was identified as the lag phase on many scripts with stage **B** identified as the log and/or the exponential phase. Incorrect answers were 'start' and 'growth', 'non-growth phase' and 'reproduction phase', 'prophase' and 'metaphase', 'mitosis' and 'meiosis'. The Examiners found it difficult to read the difference between candidates' a's and o's. Sometimes, corrections had been written over the original answer and it was hard to tell what was the final answer, lag or log.

(ii) The explanations for phases **D** and **E** often referred to limiting factors, such as food or nutrients and oxygen. Toxic waste products were also mentioned. Many candidates explained that in the stationary phase the rate of reproduction is equal to the death rate and that in the death phase the death rate is greater than the rate of reproduction. The Examiners accepted the term 'birth rate' instead of reproduction rate. Some had the idea that phagocytes, disease or antibiotics were responsible. A significant number of candidates gave 'generic' answers which included war, drought and flooding, rather than writing an answer that applied to this specific situation.

(c) (i) The features of arthropods visible in the drawing of the deep sea crab are the exoskeleton and the jointed legs. These were identified correctly by the majority of the candidates. Common incorrect answers were 'joined' or segmented legs, hard shell, segmented limbs, antennae and compound eyes despite the last two not being visible in the drawing.

(ii) The Examiners accepted two arguments for the evolution of the deep sea crab. The information provided states that there is no light in the deep sea. Some realised that there is no advantage in having a body that is red, green or brown as predators are not able to see the crabs. They then stated that a mutation may have occurred that stopped the production of any pigments. Not producing pigments saves energy and this might give these albino crabs a slight advantage over the pigmented crabs. There were some very coherent answers which included good links between the idea of mutation, differential survival and selective advantage.

The Examiners accepted an alternative argument that suggested that the bottom of the sea is covered in white sand or white rocks. This argument relies on the ability of crab predators to see their prey – perhaps by bioluminescence although more often candidates suggested that there is sunlight at these great depths so contradicting the information provided. The Examiners overlooked this if the rest of the argument used an understanding of natural selection. The candidates stated that white crabs are camouflaged and less likely to be predated. In this argument albinism provides a more obvious selective advantage. Those that gained full credit for this question mostly followed this argument.

Some candidates explained that albinism in crabs is a recessive trait and that these white crabs originate from mating between heterozygous crabs. However, there was rarely any indication as to why white crabs would increase in numbers. There were plenty who thought that the crabs went white because they did not have any sunlight to produce melanin in their shells.

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BIOLOGY

Paper 0610/32
Extended Theory

Key Messages

- Candidates should always take time to read the questions carefully. All the information and data provided should also be studied carefully as candidates are often asked to interpret the information provided to gain full credit.
- Candidates should always give the specified number of responses requested in a list and no more. Where more than the stated number of responses is given, any incorrect responses are penalised as being contradictory. This rule also applies to questions where only one answer is required.
- Candidates should avoid repeating the information given in the questions in their answers.
- Candidates need to be encouraged to use the correct scientific terminology. Vague terms rarely gain credit and hence words such as affect and change should be avoided.
- Examiners accept phonetic spelling where words are recognisable and unambiguous. However, candidates should show careful attention to words that could be confused; for example fibrin and fibre, and cone and cornea.
- Candidates should be encouraged to write their answers to the longer questions in continuous prose. Lists and phrases that do not link together the appropriate scientific concepts are unlikely to gain much credit.
- Incorrect answers must be clearly crossed out and the correct answer should be written alongside or just above the first answer. Where an answer is a single letter or number, it is particularly important that candidates do not write on top of an original answer. Where it is not possible to confirm what letter or number is written no credit can be awarded.
- Answers that are continued in blank spaces or on additional paper must be clearly numbered. At the end of the answer space provided, candidates should state where to find the rest of the answer.
- Candidates should avoid writing initial answers in pencil and then overwriting in pen. Any feint 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 on one page can make it difficult to read answers on the back.

General comments

The vast majority of candidates were well prepared and showed a detailed knowledge of the theory examined although a few able candidates did not answer correctly some straightforward theory questions, suggesting that their knowledge of some sections of the syllabus was not comprehensive. Few, if any, questions were omitted and there was no evidence that shortage of time was an issue. A limited command of English made it difficult for some candidates to express their understanding. Although the examination assesses their knowledge of Biology, ambiguous or contradictory responses often caused by a lack of understanding of the correct terminology prevented many candidates from gaining full credit. One example is interchanging the terms immunity and resistance as in **Question 2**. Weaker candidates often misunderstood what was being asked, such as the *implications* of self-pollination required in **Question 4 (b)(ii)** and the *consequences* of blocked bile ducts in **Question 5 (c)**.

There was evidence that candidates did not always understand what was required by the common command terms. In **Question 1 (b)**, candidates were asked to describe the functions of two regions of the nephron and in **Question 1 (d)** they were asked to explain why the concentration of urine in the collecting duct is higher than the concentration of filtrate in the proximal convoluted tubule. The command terms were not always followed and explanations in **(d)** were often simple descriptions. Command terms should guide candidates towards the appropriate information required in an answer. A further guide to the detail required in an answer is provided by the mark allocation.

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Comments on specific questions

Question 1

This question examined the structure and function of the kidney, as well as the composition of the blood in people with kidney failure.

(a) (i) Most candidates knew that the liquid part of the blood is plasma. Common wrong answers included water, urine and tissue fluid.

(ii) Slightly fewer candidates recognised the description of excretion. The most common wrong answer was egestion.

(b) Many candidates answered this question confidently, giving a very thorough account of the functions of both ultrafiltration as well as reabsorption. A number of candidates were confused with the direction of flow. Correct answers were: out of the glomerulus or into Bowman's capsule in part A, and back into the blood in **part B**. A common error was to describe the filtration process as occurring by diffusion or to describe reabsorption and filtration occurring in both **parts A** and **B**. It was clear that despite many showing knowledge of this topic, there were others who were confused by both processes. Despite this, many used relevant examples to show the movement of molecules. However, there were candidates who gave the wrong examples of substances that would be filtered or reabsorbed, proteins being the most common mistake.

(c) (i) Most candidates were able to deduce the answer from the data provided. Candidates who did not read the question and gave more than one substance invariably received no marks as one answer was incorrect. The most common incorrect answer was glucose.

(ii) Most candidates deduced from the table that all the glucose was reabsorbed. The common mistake was to suggest protein as an answer.

(iii) Most candidates knew that urea is a metabolic waste product. The most common incorrect answer was sodium ions. It was clear that the candidates who suggested urine had not read the question carefully.

(d) The few candidates who gave confident answers to this question, generally performed well above average across the entire paper. Most were able to say that water had been reabsorbed, but could not take the point any further. A common mistake was to indicate that concentration increases as the urine formed is collected. There were many who thought that the reabsorption of glucose and substances other than water changes the concentration of salts and urea. Another common mistake was to suggest that Y had waste discharge from one nephron and Z was where all the nephrons were excreting the waste leading to an increase in concentration.

(e) (i) Most candidates were able to gain at least one mark for stating a suitable value and many also gave a reasonable explanation for their choice. Answers were split fairly evenly between the two alternatives. A small minority did not attempt this data interpretation question.

(ii) Most candidates were able to give at least one component of blood that is not found in dialysis fluid. Common errors were to include protein, glucose, water, plasma, carbon dioxide and oxygen. A surprising number mentioned alcohol, but the permanent components of blood were required and infrequent components, such as toxins and drugs, were ignored. Those candidates who stated more than the two answers were often penalised because one of them was invariably incorrect.

(f) Many excellent, detailed descriptions of blood clotting were seen with many candidates including information well beyond the syllabus such as clotting factors and enzymes. However, a significant number of candidates showed very little understanding of this topic and referred to heparin or to the mixing of different blood groups leading to clotting. Common mistakes were to confuse fibrinogen with fibrin and fibrin with fibre. Some responses showed confusion between blood clotting as prevention of blood loss and clotting as a threat to one's health. This confusion probably arose due to a misreading of the question or to a misunderstanding of the preamble to the question.

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Question 2

This question explored antibiotic resistance in the context of an experiment. The common misconception that resistance and immunity are synonymous cost marks for many candidates. It was of concern that in some cases candidates had not merely interchanged the two words but had described bacteria as having white blood cells to defend themselves - suggesting a more substantial misconception. The question concluded with a section on the genetic engineering of bacteria to produce insulin.

(a) (i) This part was generally well answered with most explanations referring to bacteria being killed. Confusion between resistance and immunity was seen quite regularly here and in **parts (a)(ii)**, **(a)(iii)** and **(b)**. Some candidates were also confused between the actions of antibiotics and those of antibodies.

(ii) Most candidates gained credit for this question. A common error was to attribute resistance to the antibiotic rather than to the bacteria.

(iii) Most candidates gained one mark for stating that only some bacteria were resistant; a few also mentioned the resistance being due to mutation. Fewer mentioned that only the resistant bacteria reproduced. Many candidates omitted to consider the relative proportion of resistant to non-resistant bacteria that was required to gain credit in this data interpretation question. A lot of responses gave more detail than is required by the syllabus, for example by discussing the effect of antibiotics on peptidoglycans in the cell wall. They missed the point that this is a data analysis question.

(b) Explanations were of a variable standard. A considerable number of candidates did not comprehend that the experiment described in Fig. 2.1 compared a range of antibiotics. Instead they discussed other possible experiments with other independent variables, such as dosage or potential side effects. Of those candidates who had understood the test and were able to apply their knowledge, poor English and vague answers were the main reason for losing marks.

(c) This question prompted a range of answers that differed greatly in quality. Many candidates wrote much that was creditworthy, but many repeated themselves giving the same points numerous times. Many answers tended towards the correct suggestions but were too vague to gain credit. Common answers that did not gain credit referred to eating citrus fruit, exercising, herbal supplements, vaccinations and leading a hygienic life – all of which, it was claimed, reduce antibiotic resistance.

(d) (i) This question involved sequencing the stages involved in genetic engineering. This was answered correctly by most candidates.

(ii) Many candidates gained some credit for stating the advantages of providing human insulin. Some candidates appeared to be unfamiliar with the production process for human insulin, despite the source material provided for this question. A few even confused diabetes with bacteria. As in **Question 2 (c)**, some candidates tended to consider only one advantage and repeat it.

Question 3

The physiology of the eye was generally well understood by the majority of candidates, who were also able to use the associated scientific vocabulary confidently.

(a) (i) Most candidates knew what parts of the eye alter the direction of the light rays, with 'cornea' being the most common answer. A few well-prepared candidates gave two or more correct answers. A sizeable minority of candidates were unable to answer this question correctly or made no attempt to give an answer. Common wrong answers were iris, lens or suspensory ligaments.

(ii) More candidates knew where in the eye an image is formed, but a significant number incorrectly gave cornea as the answer. Weaker candidates tended to misread the question interpreting it as 'which part of the eye forms the image' and answered it with 'the lens'.

(b) (i) About half of the candidates were able to interpret the graph and determine the places on the line that indicated when the eye was focusing on distant objects. The Examiners did not award a mark if it was unclear whether the letter had been placed along one of the two lowest horizontal lines.

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Some candidates put their letter just at the very edge where the shape of the lens becomes more convex and did not gain credit. A sizeable minority did not attempt this question.

(ii) Although many candidates stated correctly that the ciliary muscles contract as the lens adjusts to focus on close objects, the majority then made the classic error of stating that the suspensory ligaments would relax, as would be the case for antagonistic muscle pairs. Only the better prepared candidates knew that the ligaments would slacken.

(c) Most candidates identified that cones were responsible for detecting colour, but only the more able candidates were able to develop their answer to include the detail of how a colour image is seen. Very few knew that there are three types of cone cell. Amongst those who knew that cones detect three colours yellow was given quite often instead of green. A common error was to identify rods as being responsible for detecting colour; descriptions of rods detecting the 'colours' black and white were also seen.

Question 4

Pollination, fertilisation and seed formation in sorghum was the thread of this question. Although most candidates were well versed in plant reproduction and energy flow, many of their answers highlighted common misconceptions.

(a) Although many candidates identified the features of monocotyledonous plants, a surprising number gave descriptions of the leaves as long and thin or strap-shaped. Many candidates gave more than the two characteristics required by the question. If one of these was incorrect, then only one mark could be awarded. It is not advisable for candidates to add alternative answers if they are unsure they are correct.

(b) (i) Definitions were of a variable standard; some were very clear while others were poorly described or incorrect. A common error was to omit the anther in the definition of pollination. Fertilisation was better understood with many correct answers seen. Other common errors included a reference to pollen fusing with the egg, and using the word 'meet' instead of 'fuse'. 'Diffuse' was also used instead of fuse by a sizeable minority.

(ii) Answers were generally vague and of a poor standard. Many described flower structure and self-pollination, but did not understand the meaning of 'implication'. A large majority of good answers discussed the lack of variation, but many candidates confused self-pollination with asexual reproduction and gave answers that described the competition between parent and offspring. 'No variation' and 'no mutation' were the most frequent incorrect responses.

(c) This question was commonly misinterpreted and candidates gave descriptions of germination and seed dispersal rather than seed development. Marks were commonly gained for zygote and embryo formation, but many fuller answers just listed structures rather than discussing their formation. The most impressive answers included correct references to the endosperm, but these were rare.

(d) Answers were generally poor with many candidates discussing the nutritional value of sorghum and a preference for eating wheat and rice. Those candidates who answered with respect to energy losses fell into two categories: those who answered confidently and those who lacked correct reference to the appropriate scientific terminology, such as food chains and trophic levels.

Question 5

The structure of the digestive system and the consequence of cholesterol accumulation in the gall bladder and in the coronary arteries provided the framework to this question on human physiology.

(a) Most candidates had a reasonable understanding of digestion and there were many good concise answers. A common omission was to neglect the mention of molecules in chemical digestion, as in converting large insoluble molecules to small soluble molecules. Descriptions of mechanical digestion tended to be vague. A sizeable minority did not answer the question, but resorted to naming examples of each process.

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(b) Many candidates were able to link the correct function and location of the parts of the alimentary canal. The two most common errors were to give rectum instead of anus and small intestine for pancreas.

(c) Descriptions of the action of bile were often good, but rarely related to the effect of gallstones. Weaker candidates repeated the question in their answer and did not seem to have an understanding of the role of bile in lipid digestion. Many suggested that bile *contained* enzymes so there would be no digestion as no lipase would be secreted. Other errors were to suggest that if the fats were not digested the person would become obese and suffer from coronary heart disease.

(d) This was generally well answered. A common error among weaker candidates was to describe a lack of oxygenated blood in the whole circulatory system. Heart tissues or heart muscle was seldom stated, even in better answers. There were few references to anaerobic respiration of cardiac muscle.

Question 6

The final question explored the environmental consequences of carbon dioxide enrichment, eutrophication and the process of treating sewage. Despite the considerable publicity associated with these global concerns, an alarming number of answers suggested that there is a blurring of cause and effect.

(a) Many weaker candidates generally knew that carbon dioxide is a greenhouse gas that contributes to global warming. Most candidates were able to describe the consequences of global warming. However, a number of candidates thought that carbon dioxide caused acid rain or destroyed the ozone layer to let UV light in to cause global warming. Very few described the effects of increasing carbon dioxide concentration on photosynthesis.

(b) Answers were of a variable standard but most gave an accurate and concise account. Vague answers about the need for minerals for good and healthy plant growth without identifying the specific role of nitrate ions or magnesium ions were rare. A common mistake was to suggest that 'nitrates contained proteins'. A number of candidates knew that nitrate ions were needed for growth, but did not link this to proteins and hence forfeited any credit. Some did not differentiate between nitrate ions and magnesium ions although giving information that would have gained credit if they had done so.

(c) (i) Most candidates knew the term was eutrophication, but many also gave wrong answers. Although this term is seldom confused with any other, spelling was generally poor.

(ii) The cause of the low levels of dissolved oxygen following an algal bloom is generally misunderstood and this was highlighted in this question. Although many detailed explanations covered all the marking points, common errors were to suggest that algae or fish used up all the oxygen. A large number of candidates made no reference to the death of plants or their decomposition. Some thought that algae prevent the atmospheric oxygen dissolving in the water. Others referred to the presence of bacteria, but not to their role. 'Bacteria eating' was a commonly seen biological misconception.

(d) The most commonly described stages of sewage treatment were filtration, aeration and chlorination. Weaker candidates gave vague answers, but usually identified that the process starts with filtration and ends with chlorination. Some candidates were confused about the difference between anaerobic and aerobic microorganisms and others were confused about the order of the events and could thus not be given full credit. Some candidates dealt with this as a question on water purification rather than about sewage treatment. A surprising number of candidates referred incorrectly to boiling or heating of the sewage as a primary or even only form of treatment.

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BIOLOGY

Paper 0610/33
Extended Theory

Key messages

- Candidates should always take time to read the questions carefully. All the information and data provided should also be studied carefully as candidates are often asked to interpret the information provided to gain full credit.
- Candidates should always give the specified number of responses requested in a list and no more. Where more than the stated number of responses is given, any incorrect responses are penalised as being contradictory. This rule also applies to questions where only one answer is required.
- Candidates should avoid repeating the information given in the questions in their answers.
- Candidates need to be encouraged to use the correct scientific terminology. Vague terms rarely gain credit. For example words such as 'affect' and 'change' often need further explanations.
- Examiners accept phonetic spelling where words are recognisable and unambiguous. However, candidates should show careful attention to words that can be confused; for example, trophic and tropic, mitosis and meiosis, ovum and ovule.
- Candidates should be encouraged to write their answers to the longer questions in continuous prose. Lists and phrases that do not link together the appropriate scientific concepts are unlikely to gain much credit. Some candidates write answers in the form of bullet points. If these are full sentences then there is rarely a problem, but often they are not and the information given is not sufficient for the award of credit.
- Incorrect answers must be clearly crossed out and the correct answer should be written alongside or just above the first answer. Where an answer is a single letter or number, it is particularly important that candidates do not write on top of an original answer. Where it is not possible to confirm what letter or number is written no credit can be awarded.
- Answers that are continued in blank spaces or on additional paper must be clearly numbered. At the end of the answer space provided, candidates should state where to find the rest of the answer.
- Candidates should avoid writing initial answers in pencil and then overwriting in pen. Any feint 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 on one page can make it difficult to read answers on the back.

General comments

There were some excellent answers to the questions in this paper, but overall many candidates struggled to understand the information provided and were unsure about how to answer. There was no evidence that candidates had difficulty completing the paper in the time available. Some candidates gave answers to questions that were *not* asked. They should always read the questions carefully and then adapt what they know to provide an answer. Many candidates would benefit from using the last five minutes of the examination for reading through answers looking for additional points to make and for checking their wording and spelling. For example, candidates could check the order of the points that they have made in long answers. The word 'and' should not be used in place of 'therefore' as it usually does not link points together adequately.

Candidates should have the confidence to attempt answers to questions that they are unsure about. They may gain credit that would otherwise be lost if they leave a blank space. Candidates are advised to take care when writing numerals. They should write them as they are printed to avoid any confusion between 1 and 7, 4 and 7 or 9, and between 0 and 6.

Candidates should note that the number of marks available for a part usually shows the minimum number of points that they should aim to make when answering that part.

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Comments on Specific Questions

Question 1

This question covered topics from Sections I and III of the syllabus. Candidates appeared not to appreciate that 'draw a food chain' meant write the names of the organisms with arrows between them. Instead they made little drawings of the organisms and in so doing omitted the producers for the estuarine ecosystem.

(a) Candidates were asked to state three features of annelids that are not shown by the nematode *Ascaris lumbricoides* in Fig. 1.1. Bristles, chaetae and hairs were allowed for the projections, but not legs or feet. Several alternatives for segments were given credit. Features that were not shown in the drawings were not given credit.

(b) Candidates were asked to state what is meant by the first part of the name *Nereis diversicolor*. Many gave genus as the answer. The Examiners also accepted 'genus part of species name'. Species, family and kingdom were examples of incorrect responses. At least one candidate tried to translate the word *Nereis* as 'sea nymph' which was certainly not the intention of the question.

(c) (i) Four aspects of the term *ecosystem* were awarded credit. 'Different species' was not considered adequate for 'all the organisms' or 'community'. 'Habitat', but not 'environment', was allowed for the given area.

(ii) Many candidates had difficulties drawing the food chain for the ecosystem when the tide was out. Many omitted the plankton and many did not draw arrowheads. One mark was awarded for putting the organisms in the correct sequence and another for showing that energy flows from food to feeder, e.g. plankton to annelid. It was not necessary to draw little pictures of the organisms, as many candidates did. This is presumably why they omitted the plankton as they did not know how to draw them.

(d) This question was about the mass spawning of palolo worms, annelids that live in tropical reefs. Most candidates missed the points about many gametes being released together increasing the chances of gametes fusing. Many wrote that the number of eggs or zygotes or embryos that could or could not be eaten by predators, rather than the proportion, is an important advantage of mass spawning.

(e) This question on meiosis attracted many good answers. The points that were missed most frequently were the two divisions in meiosis and the cells or nuclei or gametes that are produced. Many referred correctly to variation and explained that meiosis is necessary to halve the number of chromosomes.

Question 2

This was a question on limiting factors and photosynthesis. Candidates should have been familiar with the apparatus shown in Fig. 2.1 and been able to apply the principle of controlling variables to this example. Descriptions of the data shown in Table 2.1 were, on the whole, not well expressed. Describing data from a table or graph is a skill that candidates should practise.

(a) (i) Many candidates wrote about the temperature effect of the lamp, rather than keeping the light intensity constant. They did not seem to realise that the plant is insulated from the heat of the lamp by the beaker of water. The terms 'intensity' (for light), 'constant' or 'control variable' and 'limiting factor' were required to gain credit for this part.

(ii) The point of this question was that carbon dioxide is needed for photosynthesis. Sodium hydrogen carbonate releases carbon dioxide so that a good concentration is maintained. This ensures that carbon dioxide concentration does not become a limiting factor. Not all candidates provided both points needed for full credit.

(b) This part was usually well answered, with the peak rate of photosynthesis identified at 30 ^{o}C. Common errors included giving a range for the peak rate and/or the optimum temperature. They did not use the words increase and decrease to describe the changes in rate; instead, they referred to low rates and high rates either side of 30 ^{o}C.

(c) Most candidates made the points that the rate of photosynthesis increases to a peak as temperature increases and then decreases. They used this evidence to support the argument that

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enzymes must be involved in photosynthesis. No candidate stated the first mark point that if enzymes were not involved it is likely that the rate would continue to increase. Few wrote about destruction of active sites when enzymes are denatured.

(d) This question asked why the alga, *Cabomba caroliniana*, has grown very rapidly in Australia where it has been introduced. Some candidates only made one suggestion although there were two marks available. Many wrote that the temperature is more suitable or nearer to the optimum temperature without saying whether this was higher than in its original habitat or not. Some answers suggested that candidates had overlooked the aquatic habitat of these plants.

Question 3

Hormones, from ***Section II*** of the syllabus, was the thread running through this question.

(a) Some candidates named the parts of the cell shown in Fig. 3.1 instead of giving their functions. Some functions were too vague to be awarded any credit, such as **C** (the cell membrane) 'keeping the cell together'.

(b) Very few candidates gained both marks available for this question. Few stated that glycogen is insoluble and/or that glucose is soluble. Very few stated that much larger quantities can be stored if glucose is converted into glycogen than could be stored simply as glucose. Few also stated that if glucose concentrations in the blood increase then much is not reabsorbed in the kidney and is therefore lost in the urine. Correct mentions of diabetes gained credit. Some candidates stated incorrectly that glucose is a larger molecule than glycogen and therefore being less suitable for storage.

(c) (i) To gain credit, candidates had to state that glucagon stimulates liver cells to convert glycogen into glucose. 'Breakdown of glycogen' and 'make glucose' on their own did not gain any credit.

(ii) This part was generally answered very well. 'Travel in (red) blood cells' was sometimes wrongly suggested.

(d) This was also answered very well. Various spellings of the steroid hormones were accepted so long as they were phonetic.

(e) (i) Most candidates gained credit here by stating, for example, that cattle grow faster so that the animals can be kept for a shorted time. Simply stating that 'more meat was produced' gained no credit as this was given in the question.

(ii) Most candidates gained credit by explaining that cattle produce methane as a waste product. However, few of them made the link between better use of food and less waste or less methane or less carbon dioxide.

(f) Most candidates gained credit here. Some only wrote about the hormone 'affecting humans' or 'affecting cattle' without saying whether this was for the better or worse. Better answers stated that the hormone had a negative effect on the health of the animals and/or humans as consumers.

Question 4

Fig. 4.1 is an electron micrograph of a capillary. Even though the type of blood vessel was not identified in the introduction to the question, there were sufficient clues in the relative scale of the cell and the diameter of the vessel. Some candidates obviously did not read the introduction and part **(a)(i)** properly because in **(a)(iii)** they gave 'artery' or 'vein'. These contain many more cells than just the one shown in Fig. 4.1.

(a) (i) Some candidates ignored the word 'cell' in the question and answered 'nucleus'.

(ii) This part was mostly answered correctly.

(iii) Candidates should have noticed by comparison with cell **X,** that it is a very narrow blood vessel, hence a capillary. Many candidates gave 'artery' or 'vein' as their answer.

(b) This question asked for three substances that cross the wall of the capillary. 'Blood' and 'plasma' were incorrect. The key word in the question is 'substance', i.e. a chemical. The Examiners

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accepted a long list of substances that could be carried in the plasma as well as oxygen and carbon dioxide.

(c) (i) The answer to the calculation should have been written in Table 4.1, but the Examiners also accepted answers written below the table. Clear writing of numerals was important.

(ii) This part was answered well by most candidates. However, many did not gain full credit because they did not use words such as 'more' or 'a lot of'. We respire all the time, so no credit is given for stating that 'oxygen is required for respiration during exercise'.

(iii) This question asked candidates to describe the changes that occur to increase and decrease blood flow. Candidates usually gained some credit for using the terms vasodilation and/or vasoconstriction in the appropriate sections of the answer. However, few mentioned that these processes occur in arterioles or small arteries and that the blood flow into capillaries is decreased as a result of vasoconstriction or is increased when vasodilation occurs. A common error was to say that the capillaries, or blood vessels themselves, move nearer to the skin surface during exercise, rather than that more blood flows nearer to the surface.

Question 5

This question was about reproduction in flowering plants and mammals – the two main topics in ***Section III*** of the syllabus.

(a) Candidates were asked to describe what happens between pollination and fertilisation in flowering plants. A number of candidates confused pollen grains with seeds. Many wrote about the pollen grain instead of the male gamete or the pollen grain gamete or nucleus. The ovule was confused with the female gamete or ovum. Some candidates wrote about events that occur after the formation of the zygote without gaining any credit.

(b) Few candidates scored highly on this question about the functions of the structures labelled in Fig. 5.1. The question was divided with the subheadings: protection, constant temperature, nutrients and excretion of metabolic waste. Most candidates responded well to the sub-headings, but often their answers lacked detailed information some of which should be general knowledge. The protection and constant body temperature aspects rarely attracted the points expected. Rarely did candidates state what dangers the fetus is protected from. Parts of the body that provide protection for the fetus were rarely given. The idea of blood flowing and delivering or removing heat was not given by most candidates. The nutrients and excretion parts frequently implied that maternal and fetal blood systems are united, with blood flowing between them instead of being separated at the placenta. Candidates should appreciate that nutrients and oxygen move across the placenta from maternal blood to fetal blood.

Question 6

This question looked at the relationship between numbers of predator and prey.

(a) Full definitions of the term *population* had to include the ideas that it refers to all the organisms of the same species living in the same area or at the same time. The idea of a population being a number of organisms was ignored.

(b) (i) The reasons for the decrease in voles as shown in Fig. 6.1 were usually identified well, although candidates sometimes did not state that there may have been 'more owls'. Climate change was not accepted because the time span is too short for that to have an effect.

(ii) The links between the changes in owl and vole populations were usually identified, although the idea of a slight delay between the change in vole numbers and that of owls was not mentioned by many candidates.

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BIOLOGY

Paper 0610/04
Coursework

General Comments

A wide range of interesting experiments were submitted among the coursework samples. Many of these were well chosen, providing plenty of opportunity for candidates to demonstrate their achievements in each of the four skill areas. Some, however, were less successful. A careful choice is most important, as unsuitable tasks can greatly limit the marks that can be awarded.

The greatest problems tend to occur in C3 and in C4. For C3, it is important that the task involves the generation of quantitative data, as only then can the candidate demonstrate how well they can process these (for example, by carrying out calculations or by constructing a graph) and recognise sources of experimental error. Being able to identify which sources of error are of greatest significance is a feature of a Level 5 or 6 performance. It is important to distinguish between genuine sources of error (for example, inability to control a variable, or limitations in the measuring instruments) and human mistakes (for example, failing to start a stop clock at the right time, or misreading a scale on a thermometer). Mark schemes need to list the most important sources of error, and higher marks should only be awarded if the candidate has commented on these.

For C4, it is good practice for candidates to clearly identify the variable they will change (the independent variable), the variable they will measure (the dependent variable) and all the important variables that they will keep constant, outlining how they will do this. Doing this well is a feature of a Level 5 or 6 performance. A task that does not involve variables cannot, therefore, allow candidates to gain high marks in this task. Teachers need to devise tasks that involve investigating the effect of one variable on another.

Most teachers are aware that providing help on a worksheet with constructing results tables or drawing graphs limits the maximum mark that can be awarded. Some Centres use help sheets that can be handed out with this type of guidance, for candidates who are struggling to construct results tables or graphs on their own. This allows all candidates to complete the task, and only those who have received the help sheet are limited in the maximum mark that can be given.

Graphing skills vary widely. It is important that candidates are provided with graph paper on which to construct their graphs, and are encouraged to do this neatly, using a ruler and sharp pencil. Untidy graphs are difficult for another person to understand; communicating results and trends clearly is an important aspect of writing up an experiment. Results charts should also be clearly presented, with thought given to how easily they can be interpreted by another person.

Centres are advised to look carefully at the new Coursework Training Handbook, if they have not already done so. This can be found at teachers.cie.org.uk, on the IGCSE Biology pages, under the Teaching Resources tab.

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BIOLOGY

Paper 0610/51
Practical Test

Key Comments

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

It is always important that candidates read the questions carefully before starting to answer.

Candidates should use a good HB pencil and eraser for drawings and graphs so that errors can be carefully and thoroughly erased.

General comments

Questions were generally answered within the space provided.

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

Overall, candidates were generally well prepared to answer the questions.

Candidates often lost marks for not giving both the start and finishing colours for food tests.

Drawings should be arranged so the outline does not extend beyond the space available. The outline needs to be larger than the image with an accurate representation of the shape and proportion of the image. If labels are required then these must be shown to gain full marks, and the guide line should make contact with the intended structure, without a gap or an arrow head.

Graphs need to be scaled so these fit and use most of the available grid, not covering less than half in both dimensions. The correct choice of graph to represent the data accurately is important: in this paper candidates were required to construct a bar chart.

There continues to be a lack of understanding of the difference between accuracy and reliability.

Comments on specific questions

Question 1

This question was based on food tests for albumen from a hen's egg. These tests ranged from describing a safe test for reducing sugar; performing the biuret test for protein and stating the expected observation for a positive end result for an emulsion test. Another part of this question covered a test for the effect of acid on albumen with a control, using water.

The full range of marks was seen with all candidates making some attempt.

(a) There were many good answers with most candidates naming the correct reagent, though spellings varied. Very few chose an incorrect indicator such as iodine solution. A significant number of candidates failed to mention the initial colour of Benedict's solution. Candidates had clearly been taught to prepare food samples before testing and adding the reagent. Safety points were well known ranging from the use of a water bath or a beaker of water to heat the mixture to the use of eye protection or laboratory coats.

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(b) Many candidates tended to miss out the complete colour changes and lost the mark for not giving blue as the starting point for the protein test. Conclusions were correct based on the candidates' observations.

(c) Most candidates described a difference between adding the water and acid to two separate samples of albumen. A large number of candidates identified that a reaction was observed between the acid and the albumen when mixed together. Very few correctly linked the reaction to protein denaturation because of the change of pH. Some candidates simply repeated the results for the conclusion. Others confused this with the emulsion test for fats.

(d) This question attracted a variety of responses with less than half of the candidates correctly identifying the purpose of the tube with the water added. A large number of candidates did use the word 'control' or realised that the tube permitted a comparison to be made. Other candidates thought the purpose of the water was to make a dilute solution of albumen. Confusion was made over the incorrect idea that a controlled 'variable' was involved.

(e) This test was familiar and candidates answered in terms of the appearance as turbid, cloudy or white. Some candidates answered incorrectly because they confused this test with the grease mark test.

Question 2

This involved two photographed images of the back legs of a reptile e.g. a lizard (animal A) and an amphibian e.g. frog (animal B).

(a) (i) Most candidates understood the requirements of the question and correctly identified similar limb structure in a number of different ways. Candidates should be encouraged to be specific in their answers as many responses simply stated 'same number of toes' rather than 'both have five toes'.

(ii) Some able candidates gained all the available marks for naming two features shown in the two photographs and the differences for these features. The most common error was to identify features not visible in the photograph or to compare two different features e.g. claws versus scales.

(b) The drawing skills ranged from those candidates using a clear, unbroken pencil line showing an accurate proportion for the five digits in relation to the leg, to poor images with undeveloped observation and drawing skills.

The most common errors included - **O**utline – Double lines or extensive feathering. Inclusion of scales was not involved in the outline.

Size and proportion– All the digits should be shown within the available space. If the drawing extended into the next question space or the five digits were drawn out of proportion or partly shown, this mark was not awarded.

Detail – There were two detail marks for this complicated drawing. These involved drawing the five digits with four having nails clearly shown.

Label – Some candidates did not label at least one feature. The label lines need to make contact to the feature identified. An arrow head at one end is not needed or required.

(c) Most candidates measured line PQ correctly in millimetres. Few used other units e.g. centimetres. A significant minority did not fulfil the question requirement to 'Draw line PQ' and consequently forfeited the measurement mark as this could not then be checked.

The most common calculation error was either to divide 36 by their measurement or to round the final answer for the magnification incorrectly. Some candidates incorrectly included units here.

(d) (i) Most candidates estimated the size of the population of males and females in the year 1992. A common error was failure to follow the instruction in the question to account for males **and** females.

(ii) Candidates generally analysed the data successfully from the graph. Linking the specific year and population number required careful and accurate reading of the paired sets of data from the graph. It was essential for candidates to link the dates accurately with the estimated number of males in the population. A considerable number of incorrectly paired data were noted. The general trends

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and the changes regarding the gradient or slope of the line of population number were recorded. A few candidates did not refer to the year and population number of the peak population. Several candidates referred to 'lag, log or death phase' without clarifying this further or attempted to explain why populations might be changing in size in terms of predation or food supply. This was not required as the question asked for a description and not an explanation.

Question 3

This question was based on the growth of onion seedlings and then extended to compare this with beetroot seedlings. Data handling as well as planning and interpretation of data question parts were involved with plotting the data in the form of a bar chart.

(a) (i) Candidates were asked to explain a straight forward reason for removing the onion seedlings from the tray before measuring. Many candidates incorrectly referred to the idea that it would improve accuracy, precision, reliability or it would make a fair test. Others thought this procedure would stop growth which was obviously the outcome for those seedlings that were measured. However, this is not the reason.

(a) (ii) Many candidates correctly explained that involving ten seedlings improved the reliability of the measuring exercise or identified anomalies. The reason was not to improve accuracy, or to calculate a mean/average or to increase precision. These terms need to be clearly understood and form part of the scientific method covered in planning skills.

(a) (iii) Completion of the total length of ten onion seedlings and the respective mean value, in Table 3.1, were correctly recorded by most candidates. The instructions on the front cover indicate a calculator can be used and this is advised.

(a) (iv) Many candidates correctly recorded the difference in the mean increase in height of the onion seedlings between the data recorded in Table 1.3 for the paired measurements at the start and after three days for both sets of onion seedlings.

(b) (i) The data in Table 3.2 show a second type of seedling, beetroot, to compare with the mean increase in height of another tray of onion seedlings. Candidates correctly presented the data in a bar chart that was generally well constructed using correctly labelled axes, scaled evenly to use most of the printed grid showing four spaced columns.

There were a significant number of histograms without spaces between the four columns.

Common errors were noted in labelling the axes. The axes should be labelled with 'type of seedling' on the 'x' axis and the 'mean increase in height in mm' on the 'y' axis. Many candidates used a key to identify the four types of seedling measurements.

(ii) Many candidates found these last two questions on interpretation of the data difficult. Few commented on the difference in height of the onion seedlings between the tips removed and the tips left on. More candidates were able to correctly describe the effect of removing the tips in the case of the beetroot seedlings where the difference was greater. A common error was to compare the growth rate for the two different types of seedlings.

(iii) Although more candidates correctly identified the tip of the shoot or seedling for the beetroot, many had difficulty in locating the site of growth for the onion seedling. Other areas of the plant or onion bulb were incorrectly given. Mention of an auxin was not required as this question was based on the data given in Table 3.1. Many candidates did not attempt this question.

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BIOLOGY

Paper 0610/52
Practical Test

Key Messages

For this paper it is important that candidates have experience in using the practical procedures that are specified in the syllabus. Familiarity with the laboratory equipment and how it is used develops confidence in using skills in different contexts. To achieve a high standard in this paper candidates should:

- read questions carefully before starting to answer
- use SI units when appropriate
- use sharp HB pencils for drawing and labelling diagrams
- present drawings that occupy at least half of the space provided
- label graph axes clearly with the variable being plotted, including the units and use scales that occupy at least half of the grid.

General comments

Candidates were well prepared for this paper, with many candidates gaining high marks. Better candidates followed the instructions carefully and presented their answers clearly. Drawings were generally of a high standard with a clear continuous outline and the expected level of detail. Poorer answers often had guide lines that ended before the intended structure, had an arrow head, or were labelled directly on the diagram. If candidates correct an error in either drawing or labelling they should completely rub out all the previous pencil lines.

There were many good examples of graphs that used all of the grid space appropriately. Candidates should look carefully at the grid provided and the data so they can choose a scale that uses most of the available grid. Scales that result in points that cannot be plotted accurately should not be used, for example 10 mm = 3 units. Plotted points need to be small and accurately placed at the plot point. The type of graph should be suited to the data presented. In this paper, a line graph joined in the correct time sequence, either point to point by ruled lines or a smooth curve connecting each data point was most appropriate.

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. When papers are set, great care is taken to ensure that suitable biological specimens can be obtained in different parts of the world, although it is appreciated that on occasions this may not be possible. In these cases, where a substitution is made that is not quite the same as the intended specimen, for example a petiole or a whole seedling with roots, rather than a stem, the Supervisors 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 distance moved by water in two different situations and relating these to loss of water from leaves by transpiration. The practical skills tested were accurate measurement using SI units, drawing and labelling a cut section, plotting a graph of given data, observation of features of a leaf from a photograph and calculations based on these observations.

(a) (i) Most candidates gave a correct reason for placing oil on the surface of the water. The only common incorrect answer was to prevent dust or gases entering the water.

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(ii) Almost all candidates gave two appropriate measurements in mm. When question papers give the units expected, candidates should give their answer in these units. There were some examples where candidates had written their answers in cm.

(iii) Better answers made a clear comparison between the two test-tubes and correctly linked the difference in height to transpiration. Poorer answers often made a correct comparison with a link to use in photosynthesis. Candidates should understand that the volume of water used during photosynthesis is relatively small in comparison to that lost by transpiration. There were also examples of answers where candidates became confused between the two types of shoot so their explanations contradicted their measurements.

(b) (i) Most candidates were able to measure the distance moved in the shoots. Almost all candidates used mm. Credit was allowed for a wide variety of answers in view of the unpredictable effect of the prevailing conditions in laboratories at the time of the examination. Answers were expected to show that the distance moved in the shoots without leaves was less than that in the shoot with leaves. The Supervisor's reports were particularly important for this part of the examination.

(ii) The answers to this part of the question were variable. Better drawings were a cross-section that showed only the cut end of the shoot. Poorer drawings were 3D versions that included part of the shoot or a section memorised from a text book. The question instructed candidates to label the location of the coloured water. Many candidates followed this instruction, but poorer answers labelled xylem or vascular bundle without indicating that this was the location of the dye.

(iii) In this comparison between the results of two investigations, candidates were expected to make a connection between their results in **(b)(i)** of the distance moved by coloured water in the shoots and their results in **(a)(ii)** of the loss of water from the test-tubes containing the shoots. Better answers explained clearly that both observations supported the idea that more water is taken up and lost by shoots with leaves. For example, the greater distance moved by coloured water indicates more water uptake by the shoot with leaves and that more water would be lost by the test-tube containing this shoot. Poorer answers showed an understanding that a greater distance meant more water was taken up, but did not link this to the corresponding test-tube. Credit was given when the candidate's results did not show the expected pattern, but their explanations were appropriate to their results.

(c) (i) Many candidates gained maximum credit for this part of the question. Better answers correctly orientated the axes and used the headings from Table 1.1 as their axes labels. This is good practice and candidates should be encouraged to recognise that the first column of a table is often the independent variable and successive columns the dependent variable(s). Poorer answers reversed the axes.

Candidates were expected to use the whole grid to plot the data, so the most appropriate scale for the x-axis was to start at 10.00 and for 2 cm to represent 6 hours, following the 24 hour clock notation. For the y-axis the most appropriate scale was to start at 0 and for 2 cm to represent 2 g. Other scales were credited, for example the x-axis as an accumulative scale from 0 to 48 hours. Scales occupying less than half the grid were not credited.

Most candidates plotted the points accurately unless an inappropriate or small scale was used. Poorer answers often omitted the first plot point at 10.00 or used overlarge plot points, occupying 1 mm^2. Candidates should be encouraged to use small crosses or dots inside circles to place plot points. These should be less than 0.5 mm^2. Other candidates appeared to be confused by the 24 hour clock data and plotted their points non-consecutively.

Candidates were expected to join all the points either point to point, or a curve passing through all the points. A line of best fit or a bar chart was not appropriate for this data. Candidates should be encouraged to consider the biological process being studied before deciding on the best presentation of a graph. In any situation where the process being studied is likely to be influenced by external factors there will not be a linear relationship, so a point to point graph is more appropriate.

(ii) Better answers were able to relate the mass loss to the presence or absence of light and explain this in terms of more or less transpiration from the leaf surfaces. The best answers also linked the presence of light to the opening of stomata and the subsequent increase in water loss. Poorer answers described the data in the table but did not recognise a pattern related to light. Some

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poorer answers recognised the effect of light but linked this to water use in photosynthesis, supporting the statement made in **(a) (iii)** of this report that candidates showed little understanding of the relative small quantity of water used by photosynthesis compared to that lost by transpiration.

(d) Many candidates were able to correctly identify both structures, although a surprising number then reversed their answers. Poorer answers showed confusion in the use of precise names, for example epithelial instead of epidermal and stomata instead of guard cells.

(e) This part of the question was presented as a series of calculations that developed from the observation of the number of stomata in **(i)** and the calculation in **(ii)** of the actual size of one side of the leaf shown in Fig.1.4. Good answers followed through the entire sequence to find the number of stomata on the lower surface of the leaf. Poorer answers often gave correct answers to **(ii)** but then reverted to using the image size to calculate the total area in **(iii)**. Poorer answers also indicated that candidates were uncertain about how to manipulate the number of stomata from **(i)** and the area calculated in **(iii)** to obtain the answer to **(iv)**. A great many divided the surface area by the number of stomata, instead of the number of stomata by the area which was less than 1 mm^2. Candidates should practice this type of calculation. In **(v)** many candidates understood that the number from **(iv)** had to be multiplied by the total area. Credit was awarded (as error carried forward) if answers to the different parts of this question were incorrect, but the candidate's working showed that they knew how manipulate the figures from one part of the question to obtain the answer to the next part of the question. Candidates should be encouraged to show steps in their working to benefit in similar types of question.

Question 2

This question tested the practical skills of observation and drawing.

(a) Most candidates were able to draw an outline of one of their fingers from the correct side of the hand. Better answers had a clear outline drawn with a sharp pencil without any gaps or shading and were a suitable size. Candidates should be encouraged to use most of the space provided for their drawing. Good drawings also showed some detail of the finger in the correct proportion. The nail, hair and the loose skin at joints were the most usual features shown. If details were drawn, they were usually correctly labelled, the most common being the nail and the position of joints. 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. Poorer drawings did not show sufficient detail or were drawn from the underside.

(b) (i) The most common correct answer was **five** fingers or digits. Candidates were expected to observe carefully and give a specific answer. Credit was not awarded for the answer 'has fingers' or 'has the same number of fingers'

(ii) There were some good answers to this question. Candidates who observed carefully were able to identify two differences, usually the relative length of the fingers and the relative size of the hands. Some of the better answers made use of the magnification shown in Fig. 2.1 to work out the actual size of the hands. Poorer answers did not always take into account the size of the hand in relation to the body and stated that a mole hand is larger than a human hand. Poorer answers commonly gave two variations of the same answer, often related to the shape of the hand, for example, mole hand is wider, human hand is narrow, followed by mole hand is short, human hand is longer.

(c) (i) Almost all candidates gave a correct answer. The commonest incorrect groups were Amphibians and Reptiles.

(ii) The majority of candidates gave one visible feature, almost always hair.

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Question 3

This question tested the practical skills of processing experimental results and planning investigations.

(a) Most candidates completed the table of results correctly. Poorer answers showed errors in the calculation of the mean number of flies in the lilies, commonly for those with light green sheaths, for example 15/2 = 7.5 instead of 15/3 = 5.

(b) Almost all candidates gave at least one correct answer. The most common answers were the idea of 'more lilies' and 'equal numbers of both colours'. Better answers often referred to obtaining lilies from different environments. Candidates often showed an understanding that the flies needed to be trapped in order to count them accurately, but only better answers suggested an appropriate method of doing this, for example, opening the sheaths inside a bag. Some candidates misinterpreted the question and designed a different experiment. This involved removing all the flies from the lilies and then releasing the flies in a closed environment containing lilies with different coloured sheaths.

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BIOLOGY

Paper 0610/53
Practical Test

Key Comments

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

It is always important that candidates read the questions carefully before starting to answer.

SI units should be used when appropriate for measurement.

An HB pencil should be used for drawing, labelling drawings and constructing graphs. These should occupy at least half of the printed grid.

General Comments

Questions were generally answered within the spaces provided.

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

The overall performance of the majority of candidates was good.

Drawings should be arranged so the outline does not extend beyond the space available. The outline needs to be larger than the image with an accurate representation of the shape and proportion of the image. If labels are required then these must be shown to gain full marks, and the guide line should make contact with the intended structure, without a gap or an arrow head.

Graphs need to be scaled so these fit and use most of the available grid, not covering less than half for example in both dimensions. The axes should be fully labelled with appropriate units as shown in the data table. The correct choice of graph to represent the data accurately is important and in this paper candidates were required to construct a histogram.

There continues to be a lack of understanding of the difference between accuracy and reliability.

Development of planning investigations needs further practice.

Comments on specific questions

Question 1

(a) (i) The candidates were required to carry out a starch test on the pieces of starch agar jelly retained from cutting the holes in the Petri dish. This was a familiar procedure and provided the introduction to this investigation based on the activity of amylase on the starch incorporated into agar jelly. The iodine solution was dilute so the positive result was blue rather than a dark blue-black. This permitted the activity of the enzyme to continue so the disappearance of the blue colour for a positive presence of starch could be observed.

(ii) Candidates recorded the appearance of the zones around the three holes P, Q and R by drawing the zones on the outline of a Petri dish shown in Fig. 1.3; the best drawings were shaded and labelled to show a clear indication between the cleared and stained areas. It was noted that there was considerable variation in enzyme activity both within and between Centres. Many candidates indicated the appearance of a larger clear zone around P or where enzyme 1 was introduced.

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(iii) The explanation was often a reiteration of the observations. Some candidates linked the breakdown of starch within the 'clear' zone by the enzyme and continued to explain that enzyme '1' placed into hole P was more concentrated than enzyme '2' in hole Q. Many references were made to the addition of water to hole R for comparison as required for **(a)(v)**.

(iv) Many candidates identified and named the correct enzyme. There was a range of incorrect suggestions given including maltase, lipase, catalase, and protease.

(v) This question was well answered by many candidates.

(b) The use of germinating peas as a source of the enzyme to be tested to find if a similar enzyme was involved in the breakdown of starch stored in the seed, was a challenging question for candidates, even though the instructions indicated that the same method was to be followed. Some suggested that a whole geminating pea should be dropped into a hole in the agar jelly; although the enzyme would diffuse from the seed, this would take longer than if an extract had been made. The use of a controlled variable such as the same type of pea or the same temperature was mentioned by a few candidates. The idea of repetition was considered but this needed to refer to the context of why this was required not just 'repeat' alone.

(c) A pea seedling was provided by Centres that had been allowed to germinate for five days at room temperature. The drawing needed to show the whole of the seedling as an accurate, large, labelled representation on a full page of the exam paper. This permitted ample space and opportunity for candidates to demonstrate drawing skills. Although most candidates did present a well-proportioned, large drawing with a clear outline filling more than half of the available space, there are still some candidates who do not follow this instruction. Constructing the proportions of the length and width of the shoot or plumule with regard to the root radicle was not well demonstrated by many. Many drawings showed no labels. It is important that the label lines make contact with the named feature. Arrow heads or label lines are not required.

(d) (i) Based on notes of actual records of the number of peas found in 23 pods, candidates were required to complete a tally chart. Most candidates followed the instructions correctly.

(ii) This data has to be shown as a histogram. Most candidates followed this instruction spacing out the first column and then, after a gap for three data values of zero, the remaining data columns in contact. A frequency histogram should be used, not a bar chart or a line graph.

(iii) The first column with the lowest number of peas per pod should be indicated as this represents an outlier compared to the other data. This is not the most frequent value of pods with 10 seeds per pod as indicated by some candidates.

(iv) Most candidates suggested a reason for the variation of number of peas in each pod.

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Question 2

(a) On part of one leg, a scale line was shown. From the measurement, most candidates calculated the actual length of this part of the leg in millimetres. The error, made by a few candidates, was to record the value in centimetres without correcting to millimetres.

(b) Candidates were required to link their observations to the classification of the animal and to name the group of arthropods. Some candidates named incorrect groups of animals such as insects and vertebrates. Most suggestions were correct but the spelling of Arachnid**(a)** varied. A few able candidates supported their choice by identifying two features shown in Fig. 2.1; other candidates only mentioned the number of legs but confused 'segments' with two parts of the body.

Question 3

(a) Based on Fig. 3.1 showing a photomicrograph of a TS root as viewed by a light microscope, candidates were required to identify two types of cells. Many candidates correctly identified the root hair cell but there were many mistaken cortex cells within the central vascular tissue.

(b) Knowledge of water and food tests was tested by completing the spaces in the table. Candidates were required to recall the colour changes involved to indicate either a positive or negative outcome or name the reagent to be used. Many candidates did follow the question fully but others failed to read all of the information and so confused the colours. The least well known test was for the presence of water and there was some confusion over the reagents needed for the reducing sugar and protein tests.

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BIOLOGY

Paper 0610/61
Alternative to Practical

Key Messages

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

It is always important that candidates read the questions carefully before starting to answer.

Overall, candidates were generally well prepared to answer the questions.

General Comments

Questions were generally answered within the space provided.

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

The overall performance of the majority of candidates was good.

Candidates often lost credit for not giving both the start and finishing colours for food tests.

It is important that a good HB pencil and eraser are used for drawings and graphs so that errors can be carefully and thoroughly erased.

Drawings should be arranged so that the outline does not extend beyond the space available or into the next question. The outline needs to be larger than the image, and should be an accurate representation of the shape and proportion of the image.

If labels are required then, in order to gain full credit, these must be shown and the guide lines should make contact with the intended structure, without a gap or an arrow head.

Graphs must be scaled so that they fit and use most of the available grid, for example not covering less than half in both dimensions. The correct choice of graph to represent the data accurately is important; in this paper candidates were required to construct a bar chart.

There continues to be a lack of understanding of the difference between accuracy and reliability.

Comments on Specific Questions

Question 1

(a) There were many good answers with most candidates naming the correct reagent, although spellings varied. Very few chose a different indicator such as iodine solution. A significant number of candidates failed to mention the initial colour of Benedict's solution. Candidates had clearly been taught to prepare food samples before testing so quite a few crushed the albumen before adding the reagent. Safety points were well known, ranging from the use of a water bath or a beaker of water to heat the mixture, to the use of eye protection or laboratory coats.

(b) Although most candidates knew that Biuret turned purple/violet with protein, many omitted to mention the starting colour of the reagent.

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(c) (i) Many candidates identified that a reaction was occurring between the acid and the albumen, but very few linked this to protein denaturation. Some candidates simply repeated the results, stating that acid solidified, or 'had an effect', on the albumen. Others confused the result with the test for a fat.

(ii) This question attracted a variety of responses with less than half the candidates correctly identifying the purpose of the test-tube with water added. A large number of candidates mentioned the word 'control', or realised that the test-tube allowed a comparison to be made.

(d) This test was very familiar to candidates. Most suggested cloudiness, white or milky. A few mentioned turbidity.

(e) The independent variable, i.e. the one to change, was correctly identified by most candidates. Some candidates lost credit here because they just gave 'concentration' without referring to the acid. Few candidates correctly identified the dependent variable, i.e. the one to measure. Many candidates gave a vague answer such as 'colour change'.

Question 2

(a) (i) Most candidates mentioned five digits (with varying terminology). Some said that the animals had five legs. A few referred to the leg as having joints. Candidates should be encouraged to be specific in their answers, as many non-credited responses simply stated 'same number of toes' rather than 'both have five toes.'

(ii) Many candidates put multiple differences in the table. These were frequently correct but were not visible in the photographs.

Several thought that animal **B** had smaller nails. Others made stand-alone statements in each box such as 'webbing' versus 'claws'.

(b) Many candidates produced very good drawings.

The most common errors were:

Outline: double lines or extensive feathering. Inclusion of scales was not involved in the outline.

Size and proportion: Credit was lost if the drawing extended into the next question space or if the leg and foot were drawn out of proportion.

Detail: Five digits were required and at least four clearly demarcated claws. The claws were not always clearly shown.

Label: Some candidates did not label their drawing or failed to draw label lines accurately enough to touch the feature.

(c) Most candidates measured the line **PQ** correctly in millimetres; few used other units. A significant minority did not fulfil the question requirement to 'Draw line **PQ**' and consequently lost credit.

The most common calculation errors were to either divide 36 by their measurement, to round the final answer for the magnification up/down incorrectly, or to include units with their answer.

(d) (i) This question was answered well. The most common error was failure to read the question and hence not double the data to account for males **and** females. Candidates should be instructed to take extra care when questions contain instructions in bold type.

(ii) Most candidates gained full credit. Several either made a correct figure reference or identified the peak. Very few described the increases and decreases as not being smooth, but gained credit for contrasting a rapid change with a slower one. Several referred to 'lag phase, log or death phase' without clarifying any further. Some lost credit as they attempted to explain why populations might be changing in size in terms of predation, food supply, etc.

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Question 3

(a) (i) Many answers referred to improving accuracy, precision, reliability or to make a fair test, when in fact the answer needed was that the actual measuring process would be much easier. Some referred to growth being stopped, which is an outcome not a reason.

(ii) Many candidates correctly explained that involving ten seedlings improved the reliability of the measuring exercise, but some believed that the reason was to improve accuracy, get a mean/average or to increase precision. These terms appear not to be understood despite forming part of the scientific method covered in planning skills. Only one or two responses were seen that mentioned identification of errors or anomalies.

(iii) Completion of the total length of ten seedlings and the respective mean value, in Table 3.1, were correctly recorded by most candidates. Where an error was made in the total length of the ten seedlings, the correct calculated mean was permitted, if correct, based on the total given.

(iv) A few candidates did not know how to work out the mean increase. If an error had been made in part **(iii)**, allowance was made here for a correct calculation.

(b)(i) Most candidates correctly presented the data in the form of a bar chart which was well constructed using correctly labelled axes, scaled evenly to use most of the printed grid. Drawing the four spaced columns was generally neat and accurate. Occasionally candidates plotted histograms, without spaces between the bars, or line graphs. The most common error was to label the axes incorrectly. It was encouraging to see the use of keys to easily identify the types and treatment of the seedlings.

(ii) Many candidates found these last two questions on interpretation of the data difficult. The increase in mean height of the onion seedlings with the tips removed and those with the tips left on (10 mm and 9 mm respectively), were often either reversed or just repeated and the difference of 1 mm missed. This was a small increase, however expressed, but the increase needed to be qualified. More candidates were able to correctly describe the effect of removing the tips in the beetroot experiment, as in this case the decrease in growth was greater. Again, a qualified decrease, between the seedlings with the tips left on and the tips removed, was necessary. Some candidates compared the growth changes of the onion with the beetroot.

(iii) Although more candidates correctly identified the tip of the shoot or seedling for the beetroot, many had difficulty in locating the site of growth for the onion seedling. Other areas of the plant or onion bulb were incorrectly given. Mention of auxin was not required because this question was based on the data given in table 3.1. Many candidates did not attempt this question.

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BIOLOGY

Paper 0610/62
Alternative to Practical

Key Messages

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

It is always important that candidates read the questions carefully before starting to answer.

Overall candidates were generally well prepared to answer the questions.

General Comments

Questions were generally answered within the space provided. The standard of English was good and there did not appear to be time constraints, so candidates had sufficient time to complete the paper.

It is important that candidates use a good HB pencil and eraser for drawings and construction of graphs so that errors can be carefully and thoroughly erased to leave no trace of carbon.

Drawings were generally of a high standard with a clear continuous outline and at least two details shown. When labels are required these must be shown to gain full marks and the guideline must make contact with the structure intended without a gap or an arrowhead.

Plotting graphs need to be scaled so these fit and use most of the available grid, covering more than half in both dimensions. The correct choice of graph to represent the data accurately is important – in this paper candidates were required to present the data as a line graph.

Comments on Specific Questions

Question 1

(a) (i) This question required the candidates to identify the independent variable. While many stated 'leaves', there was a significant number who thought that the height of the water was the independent variable. Candidates need to understand that the independent variable is the one that is actively changed in an investigation and the dependent variable is the resulting change that is measured.

(ii) This question was answered well. The only common incorrect answer was to prevent dust or gases entering the water.

(iii) Candidates were required to measure the height of the water in two test-tubes as shown in Fig. 1.1. This was well answered. The question required the answers to be in millimetres; if a candidate decides to convert millimetres into centimetres, the change of unit must be indicated. It is important that the correct SI units are used.

(iv) In this question, the candidates needed to describe their observations and explain why the height of the water level was different in each test-tube. While many candidates gained credit for their description, others missed stating the difference in height and provided a reason for the difference in water absorption by the two shoots instead. Whilst a few candidates correctly identified transpiration to be the reason for the difference, too often an incorrect explanation related to the uptake of water for photosynthesis.

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(b) (i) Candidates were asked to measure the distance moved by the coloured water shown in Fig. 1.3. Again, this was well answered, with most candidates recording their measurements correctly in millimetres.

(ii) In this question, candidates were expected to make the link between the greater height of the coloured water in the shoot with leaves in Fig. 1.3 and the lower level of the water in the test-tube in Fig. 1.1. Most candidates could explain clearly that both observations supported the idea of greater water uptake in the shoot with leaves. Many explained why the water was absorbed, and some made the correct link with the corresponding test-tube in Fig. 1.1.

(iii) Candidates were required to plan an investigation into the effect of temperature on the process of transpiration. Most candidates based their experiment on the set up given in Fig. 1.1 or Fig. 1.3. They were familiar with the idea that temperature would affect the rate of water uptake and therefore rate of evaporation/water loss. In this experiment, candidates needed to suggest at least three temperatures within a realistic range of 5°C – 40°C. While most realised the need for more than one temperature, citing hot/cold or fridge/room temperature, a few achieved the different temperatures by placing the shoots in water baths. Very few used three different controlled temperatures to achieve full credit. While many candidates were able to give a suitable control variable for this experiment, very few indicated a method for measuring the rate of water uptake. For 'rate', both distance and a period of time need to be considered. Often candidates mentioned repeating their experiment, but this needed to be qualified in terms of reliability. Most candidates managed to score well on this question.

(c) (i) This question presented data for an experiment to measure the mass lost from a flask containing a shoot with leaves set up over a time period of two days. The candidates had to plot this continuous data; most candidates correctly chose a line graph. Many candidates correctly used a scale for the time of day in the same order as in the data table. Most candidates used a line graph to plot the given data of mass lost / g on the y-axis and time of day in hours on the x-axis, either using the 24 hour method or the accumulative scale from 0 to 48 hours. For the x-axis, if time was compressed between the origin and 10:00, it is necessary to show a broken-axis to indicate this compression. Some candidates altered the starting point so that it did not follow the sequence of the data. Other errors included use of points that were too large, reversing the axes, using a line of best fit and missing some of the changes to the curve by not joining all of the plotted points. Lines that were drawn need to join up point-to-point using a ruler. Where candidates use a dot and circle it, the dot must be in the precise spot for the reading. Some circles were too large. Most candidates correctly did not extrapolate their graph.

(ii) Candidates needed to describe and explain the results for the data from Table 1.1. The 'mass lost' needed to be correctly linked to the 'time of day', and then the connection made between mass lost and transpiration. The more able candidates were able to make the correct link. Often, mass loss was linked to photosynthesis, and this was not relevant to this investigation. A few candidates mentioned stomata opening or closing.

(d) Candidates needed to name the two identified structures indicated on a photomicrograph from the surface of a leaf. Most candidates could label the guard cells, but there was occasional confusion for structure G in that it was labelled epithelial cell, not epidermal cell. Other incorrect names included red blood cells, root cells or specific organelles.

(e) (i)–(v) The stages in the calculation of the number of stomata on the lower surface of a whole leaf based on the number recorded in the photomicrograph, were arranged into individual steps. Many candidates followed each step and correctly calculated the final number. In weaker answers, this detail was not achieved. Most candidates could count the number of stomata correctly and calculate the actual length of side of the square of leaf surface. For **(e) (iv)**, to calculate the number of stomata per mm^2, the number of stomata from **(e) (i)** needed to be divided by the candidate's answer for **(e) (iii)**, the total area of the square of leaf surface. However, many answers inverted this equation. Another common mistake for **(e) (iv)** was failure to round up to get a whole number of stomata for their calculation. Candidates should practice this type of calculation.

Question 2

(a) This question tested the practical skills of observation and drawing. Candidates had to make a large labelled drawing of one of their own fingers by placing the palm of their hand on the paper so

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the upper surface included the whole of the nail. Generally, this was well done; very little shading was seen, and outlines on the whole were acceptable. Size was good with most candidates' drawings being larger than the actual size of their finger, and containing plenty of detail, which usually included the nail. If details were drawn, these were usually correctly labelled. In some cases, candidates had drawn the outline of the whole hand, and in some it was not possible to tell which surface as no detail was given. A few candidates incorrectly drew their thumbs. Candidates should be reminded to extend their label lines to make contact to the feature identified. An arrowhead should not be used.

(b) (i) Candidates were presented with Fig. 2.1, showing the European mole, *Talpa europa*, and had to state one visible similarity between the structure of the mole's hand and their own hand. This was well answered, with most stating five fingers or digits. Candidates should be encouraged to be specific like this, as non-creditworthy responses simply stated 'has fingers/digits'.

(ii) Candidates had to complete Table 2.1 to state two differences visible between the shape and size of the mole's hand and their own hand. Most candidates were able to note two differences but were not able to appreciate these on the basis of shape or size. The most common error was to repeat alternatives to the first marking point in separate boxes. If a candidate referred to size being large compared to small, this needed further clarification as a mole's hand is small compared to a human's hand but large in proportion to its body.

(c) (i) This was answered well: most candidates gave Mammal as the correct animal group. Incorrect groups given included Amphibians and Reptiles.

(ii) Most candidates could state one visible feature in Fig. 2.1 for Mammals. Occasionally, references to non-visible features were noted.

Question 3

(a) Candidates had to calculate the total and mean number of flies found in each colour of sheath. Most could complete the arithmetic; confusion occurred between the number of examples when calculating the mean of flies for the light green sheaths, for example 15/2 = 7.5 instead of 15/3 = 5.

(b) Candidates needed to suggest two ways in which this investigation could be improved. There was generally a good response to this question; the candidates having understood the improved design involved having 'more lilies' and 'equal numbers of both colours'. Some candidates did suggest opening the sheaths in an enclosed area, either in a room or bag to prevent the escape of flies prior to counting.

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BIOLOGY

Paper 0610/63
Alternative to Practical

Key Comments

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

It is always important that candidates read the questions carefully before starting to answer.

SI units should be used when appropriate.

Overall candidates were generally well prepared to answer the questions.

An HB pencil should be used for drawing, labelling drawings and constructing graphs. Drawings should occupy at least half of the printed grid.

General Comments

Questions were generally answered within the space provided.

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

The overall performance of the majority of candidates was good.

It is important that candidates use a good HB pencil and eraser for drawings and graphs so that errors can be carefully and thoroughly erased. Drawings should be arranged so the outline does not extend beyond the space available. The outline needs to be larger than the image with an accurate representation of the shape and proportion of the image. If labels are required then these must be shown to gain full credit, and the guide line should make contact with the intended structure, without a gap or an arrow head.

Graphs need to be scaled so these fit and use most of the available grid, not covering less than half in both dimensions. The axes should be fully labelled with appropriate units as shown in the data table. The correct choice of graph to represent the data accurately is important: in this paper candidates were required to construct a histogram.

There continues to be a lack of understanding of the difference between accuracy and reliability. Development of planning investigations needs further practice.

Comments on specific questions

Question 1

(a) (i) The outcome of the starch test was familiar and provided the introduction to this investigation based on the activity of amylase on the starch incorporated into agar jelly. The iodine solution was dilute so the positive result was blue rather than a dark blue-black. The blue colouration did not block the activity of the enzyme so as the breakdown continued the stained starch agar jelly cleared and the blue colour disappeared.

(ii) The estimation of the size of the holes cut into the agar jelly proved challenging for many candidates. The key to Fig. 1.2 showed each small square on the grid as equivalent to 4 mm^2. The estimated number must be multiplied by 4 to give the answers in correct units. Alternatively a mathematical calculation could be used. A wide range of areas was noted from as low as 4 mm^2 up to 80 mm^2.

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(iii) and **(iv)** Candidates described the appearance of the zones around the three holes P, Q and R as shown in Fig. 1.3. Most candidates described the appearance and referred to a larger zone around the P or where enzyme '1' was involved. No use of numerical data was quoted to support the description and some confusion was made concerning the terms 'holes' 'zones' and 'areas'. The explanation was often a reiteration of the description. Few candidates linked the breakdown of starch with the 'clear' zone by the enzyme yet many explained that enzyme '1' placed into hole P was more concentrated than enzyme '2' in hole Q.

(v) Many candidates identified and named the correct enzyme. Many incorrect suggestions included maltase, lipase, catalase, or protease.

(vi) This question attracted a variety of responses with less than half of the candidates correctly identifying the purpose of the water added in hole R. A large number of candidates did use the word 'control' or realise that the tube permitted a comparison to be made.

(b) This was a challenging question for candidates, even though the instructions indicated that the same method was to be followed. Some suggested dropping a whole geminating pea into a hole in the agar jelly. Although the enzyme would diffuse from the seed, this would take longer than if an extract had been made. The use of a controlled variable such as the same type of pea or the same temperature was mentioned by a few candidates. The idea of repetition was considered but this needed to refer to the context of why this was required not just 'repeat' alone.

(c) A germinated pea seedling was shown in Fig. 1.3; the drawing was based on the whole of the seedling to be made as a large labelled representation on the opposite page. This allowed ample space and opportunity for candidates to demonstrate their drawing skills. Although most candidates did present a large clear outline filling more than half of the available space, there are still some candidates who do not follow this instruction.

Constructing the proportions of the length and width of the shoot or plumule with regard to the root, radicle was not well demonstrated in many of the outlines. Similarly, greater observation skills are required such as the development of the first indications of side adventitious roots. Many drawings showed no labels. It is important that the label lines make contact with the named feature. Arrow heads or label lines are not required.

(d) (i) Based on notes of actual records of the number of peas found in 23 pods, candidates were required to complete a tally chart. Most candidates followed the instructions correctly.

(ii) This data had to be shown as a histogram. Most candidates followed this instruction spacing out the first column then giving a gap for three data values of zero, followed by the remaining data columns in contact. A frequency histogram should be used, not a bar chart or a line graph.

(iii) The first column with the lowest number of peas per pod should be indicated as this represents an outlier compared to the other data. This is not the most frequent value of pods with 10 seeds per pod as indicated by some candidates.

(iv) Most candidates suggested a reason for the variation of number of peas in each pod.

Question 2

(a) On part of one leg, a scale line was shown. From the measurement, most candidates calculated the actual length of this part of the leg in millimetres. The error, made by a few candidates, was to record the length in centimetres without correcting to millimetres.

(b) Candidates were required to link their observations to the classification of the animal and to name the group of arthropods. Some candidates named incorrect groups of animals such as insects and vertebrates. Most suggestions were correct but the spelling of Arachnid**(a)** varied. A few able candidates supported their choice by identifying two features shown in Fig. 2.1; other candidates only mentioned the number of legs but confused 'segments' with two parts of the body.

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Question 3

(a) Based on Fig. 3.1 showing a photomicrograph of a TS root as viewed by a light microscope, candidates were required to identify two types of cells. Many candidates correctly identified the root hair cell but there were many mistaken cortex cells within the central vascular tissue.

(b) Knowledge of water and food tests was tested by completing the spaces in the table. Candidates were required to recall the colour changes involved to indicate either a positive or negative outcome or name the reagent to be used. Many candidates did follow the question fully but others failed to read all of the information and so confused the colours. The least well known test was for the presence of water and there was some confusion over the reagents needed for the reducing sugar and protein tests.

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