BIOLOGY

Paper 0610/01

Multiple Choice

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

General comments

The Paper produced a very good spread of candidates from full marks (40) down to well below the 'guessing level'. Only one of the questions proved very difficult, although two or three others did not pose a great enough challenge for the vast majority of candidates. Although the paper proved easier than in some previous years, an encouraging feature was the degree to which questions discriminated between candidates of differing abilities.

Comments on individual questions

Question 2

It is a syllabus requirement that candidates understand the characteristics of the major classes of vertebrate. It is to their credit that 95% of them knew the major distinguishing features of mammals, though, with so many reaching the correct answer, the question proved far from the best at separating the more able from the less able.

Question 6

A significant number confused cytoplasm with a vacuole, or, perhaps, believe cytoplasm to resemble more a fluid-filled space than a jelly-like substance.

Question 11

Candidates did well to avoid the easy mistake that an increase in temperature will always increase the rate of an enzyme-controlled reaction – with less than a quarter selecting that particular option.

Question 14

Again, with 92% selecting the correct response, this was an easy question, but, on this occasion, success in answering the question bore a close correlation with success in the paper as a whole.

Question 18

This proved to be one of the more difficult questions on the paper, though it was noticeable that it was the able candidates who reasoned their ways to the correct response. Evident errors were shown by over a third of the candidates who thought that high humidity would cause wilting, and by well over half of them that thought low light intensity might be responsible for the condition.

Question 24

The only significant, predictable error here was to mistake the sensory for a motor neurone.

Question 29

Perhaps a little carelessness may have been the cause of a third of the candidates failing to appreciate the significance of the slight drop in dry mass of a seed when it begins to germinate.

Question 30

This was another of the easy questions, but 93% of the candidates did well to realise the significance of the word ‘only’ in the question, and also to know that the environment does not play a part in determining blood groups.

Question 33

This question was based on the fundamental knowledge that sunlight is the source of energy for all living organisms in an ecosystem. Well over a third of candidates, including the majority of the able ones, did not appear to believe that animals and decomposers depend on this energy. It is likely that candidates understood the question to relate to the idea of direct rather than indirect dependence, and thus some of the more able suggested that neither animals nor decomposers were dependent. The rest appeared to resort to guessing. The question performed poorly, but it exposed a failure to read the question and to think carefully about the answer.

BIOLOGY

Paper 0610/02

Core Theory

General comments

Although there were a significant number of candidates who failed to attempt all parts of all questions, this did not appear to be linked to insufficient time to complete the paper, but rather to candidates who seemed inadequately prepared for the demands of the questions. There were candidates who showed very limited knowledge and understanding of some topics from the syllabus and 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 again this year certain misconceptions and misunderstandings. The handling of questions in which candidates were asked to make predictions were overall answered with less confidence than in recent examinations. However there was evidence in a number of places that candidates had not read the questions carefully or thoroughly enough and thus their responses were inadequate or off the point. Candidates should be made aware of the need to read the questions carefully and to take note of the demands of each question.

Comments on specific questions

Question 1

This question revealed how little knowledge or understanding candidates had about the external features of groups named in the syllabus, as they were unable to identify with reasons the relevant organisms. Additionally few were able to show how to work out the magnification of one of the drawings by simply dividing the drawing length by the actual length of the organism. Candidates should be made aware that magnifications should be expressed in terms of x(times) 10 and not as a unit of length such as 10 mm.

Question 2

This question was poorly answered overall. There was limited understanding of flower structure and function, seed dispersal and the conditions necessary for germination and growth.

Candidates commonly misidentified **A**, the sepal, and **B** a stamen or anther, with petal and stigma being offered instead. Part **C** was often named instead of a function being quoted and when this was attempted the responses were often erroneous with answers such as “forms seeds”, “carries out fertilisation” or “produces pollen”. Few candidates seemed to be aware that fertilisation occurred or that implantation did not occur during flowering plant reproduction. Also implantation was frequently left unticked for reproduction in humans. Although in **(e)(i)** the question asked for a method of seed dispersal, very many responses named methods of pollination. Other candidates did not seem to focus on the clues such as the bright colour and fleshy tissue as an indicator that birds or mammals might be involved. Although most candidates realised that conditions such as water and a suitable temperature were necessary for germination in a forest environment, few commented on the need for light, for the later growth, and the need for mineral salts was mentioned by a very tiny minority. Candidates should be made aware that in regard to the requirements of plants they should refer to “mineral salts” or “ions” rather than the less specific term “nutrients” which would encompass water and carbon dioxide as well in terms of plant nutrition.

Question 3

It was clear that few candidates were familiar with the concept of continuous variation and could recognise it from the graph. Although the question demanded the plotting of a bar chart, the production of a line graph was not infrequent. The bars should be clearly labelled and not have labels at the junction of or the gap between two bars. Also a significant number of candidates only plotted three of the four sets of data for the blood groups. A significant number appreciated that blood groups are determined by a person's genes. In **(c)** few could define a mutation, and even fewer seemed to have knowledge of what factors could increase the frequency of such events. Candidates should appreciate that factors such as radioactivity and chemicals should be quoted, rather than the sources of these factors such as atomic explosions or smoking.

Question 4

In part **(a)** the question that gave rise to the most wrong responses was **(iii)**, as many candidates allowed only for one year's destruction and not the ten indicated in the question. Hence by 2010 there would be no forest left in area **F**. There appeared to be quite limited understanding and knowledge of decomposition. Few candidates could identify bacteria or fungi as the microorganisms involved in decay or knew that beneficial products of the process are carbon dioxide and mineral salts. Candidates should be made aware that nitrogen is a gas and that this is not the same as the mineral salt nitrate. In part **(c)** few seemed to realise that crops, unlike standing natural vegetation, regularly remove various minerals which are not replaced as there is little left to decompose and that after a period the ground becomes infertile and crop yields drop to very low levels.

Question 5

The additions to the carbon cycle diagram were often not attempted, and when they were there were many errors. The diagram should have given guidance that box **X** represented "carbon compounds in animals" and that the correct arrow representing photosynthesis should be a mirror image of arrow **C**. Identifying the arrows that represented various other aspects of this cycle were accomplished with limited success suggesting little familiarity with the carbon cycle. Few candidates were able to produce a word equation for photosynthesis with some giving that for respiration, or leaving out one or other of either the reactants or products. A significant number of candidates attempted to substitute a chemical equation in lieu of a word one. Unfortunately many were not totally familiar with the formulae of all the reactants or products and thus this should be discouraged as no extra credit is given for such an equation, even if totally correct, and it is more open to errors being made.

Question 6

There were errors in identifying the parts only found in plant cells but overall this was correctly answered. However, the question requested the relevant letter labels and not the names of the parts as this does not indicate that a candidate can interpret the diagram. There was considerable confusion in the responses in both parts **(b)** and **(c)**. The hair-like extension of the root hair cell is not itself a root. This extension allows for a greater surface area for absorption of water and minerals. Also root hair cells, like all root cells, lack chloroplasts and this is related to there being no light underground. Candidates regularly identified a way in which the red blood cell is different from a typical animal cell, namely lacking a nucleus, being biconcave or having haemoglobin, but failed to link this clearly to a relevant advantage that the particular feature confers. Many quoted advantages of features other than that named in part **(c)(i)**.

Question 7

Defining the term enzyme proved to be a stumbling block for many candidates, although more knew that it was a catalyst than knew that it had a biological or cellular origin. Overall the line graphs were produced well but again there were some who, despite the demand in the stem, produced bar charts. Candidates should be made aware that scales should be in a logical sequence and that they should have a linear pattern to them. There were candidates who placed the seven values for the rate of activity in a sequence with the value for 15 being between those for 10 and 9. There were others who spaced the values at equal intervals so that the values for 0 and 1 were same distance apart on the vertical axis as those for 10 and 15. Points on a line graph should either be joined by straight lines or a line of best fit should be included.

Question 8

Although some candidates were aware of the importance of iron in the diet they failed to offer clear biological explanations. They should have linked its importance to the formation of haemoglobin and its role in transporting oxygen instead of simply stating that, for example, it was needed for healthy blood. Too many linked iron to the strengthening of bones and teeth. Very few explained that vitamin D was important in the absorption or deposition of calcium ions and that these are used in tooth and bone formation and maintenance. Many responses effectively stated that the vitamin itself became the strengthening agent in such structures. There was also confusion between this vitamin and vitamin C.

Very many candidates dealt with effects of a lack of specific minerals and vitamins despite the instruction not to deal with these in the answer. However some were clearly familiar with effects such as obesity, coronary heart disease, atherosclerosis, constipation, nutritional marasmus and kwashiorkor and the fundamental dietary defects related to them.

Question 9

Few candidates seemed to have any understanding of the value of enzymes being able to operate or metabolism being able to occur at a constant rate. Even fewer linked the constant body temperature to the ability of an organism to act independently of the external environment or to live in a wide range of differing environmental temperatures. Many linked sweating to its cooling effect but could not develop this beyond a simple statement and deal with the evaporative effect, often stating that it was the release of sweat that cooled the body. Many erroneously linked sweating to vasodilation and other cooling mechanisms. There were a significant number who overlooked the cooling effect of sweat and suggested it was a major excretory process.

Question 10

Most candidates identified the structures as stomata or guard cells, and the tissue referred to as xylem, although in the latter response the inevitable confusion with phloem occurred. Many selected graph line **A** in part **(i)** but did not link this to greater transpiration in moving air. They should have realised that the same changes of temperature applied to both line **X** and line **A** and thus could not be an explanation for the difference in the two lines. In **(ii)** very many candidates correctly selected line **C**, but failed to give an adequate reason for their choice, which in this case was related to the air in the plastic bag becoming saturated and thus depressing transpiration.

Location Entry Codes

UNIVERSITY of CAMBRIDGE
International Examinations

From the June 2007 session, as part of CIE's continual commitment to maintaining best practice in assessment, CIE has begun to use different variants of some question papers for our most popular assessments with extremely large and widespread candidature, The question papers are closely related and the relationships between them have been thoroughly established using our assessment expertise. All versions of the paper give assessment of equal standard.

The content assessed by the examination papers and the type of questions are unchanged.

This change means that for this component there are now two variant Question Papers, Mark Schemes and Principal Examiner's Reports where previously there was only one. For any individual country, it is intended that only one variant is used. This document contains both variants which will give all Centres access to even more past examination material than is usually the case.

The diagram shows the relationship between the Question Papers, Mark Schemes and Principal Examiner's Reports.

Question Paper	Mark Scheme	Principal Examiner's Report
Introduction	Introduction	Introduction
First variant Question Paper	First variant Mark Scheme	First variant Principal Examiner's Report
Second variant Question Paper	Second variant Mark Scheme	Second variant Principal Examiner's Report

Who can I contact for further information on these changes?
Please direct any questions about this to CIE's Customer Services team at: international@cie.org.uk

BIOLOGY

Paper 0610/03

Extended Theory

General comments

The Examiners were agreed that this paper was generally comparable to previous papers. There was a full range of performance including some exceptional scripts in which candidates showed a very wide knowledge and a deep understanding of the subject matter. There was no evidence that candidates were short of time. **Question 1** proved to be a straightforward start to the paper and many candidates scored full marks. **Question 4**, however, proved very difficult for almost all candidates. Very few realised what part **(ii)** of the question was asking about. The Examiners accepted a long list of answers in part **(i)** and looked for understanding in part **(ii)** and gave credit wherever possible.

The genetics in **Question 5** proved difficult for some candidates. Part **(c)** proved to be most challenging as candidates were often not aware that they were being asked to give 'discontinuous variation' as their first response. Even when they did, their explanation about the inheritance was often vague and imprecise. It was encouraging to find many candidates completing the genetic diagram in **(d)** correctly, although a common omission was the link between the genotypes of the F_1 and their phenotypes. Many candidates struggled with both parts of **(e)**.

The Examiners rarely had trouble understanding the answers – most were clearly written and addressed the questions asked. Weak candidates tended not to write concisely and they often did not use scientific terms accurately. Spelling of scientific terms was also sometimes inaccurate, but this is not penalised.

If candidates run out of space, or cross out their answer and start again, they should use blank space on the same page for their answers if possible. If not, then they should use blank space on another page and make it clear where their answer is to be found. Many candidates do this, but some do not and make it difficult for the Examiners to mark their scripts.

Comments on specific questions

Question 1

The calculation in part **(c)** proved to be the most challenging part of this question.

(a) Most candidates were able to give two appropriate structural features of plant cells viewable with the light microscope that are not found in animal cells. Some candidates gave 'sap' as their answer rather than 'sap vacuole' or just 'vacuole'. Chlorophyll was seen on some scripts rather than chloroplast. The Examiners assumed that answers were about plant cells unless they were told that 'animal cells have …..' Some candidates gave a comment about the shape of plant cells that did not gain any credit.

(b) The correct responses were **B**, **E**, **F**, **A**, **D**. In some scripts **C** and **E** were confused. A few candidates named the structures instead of using the letters from Fig. 1.1. In this case the Examiners only accepted the answers if the names were also written alongside the figure in the correct places. It was quite difficult to see the difference between the label lines for the cell wall and the cell membrane, but most candidates had no difficulty with this.

(c) To answer this question candidates had to measure the length of the cell in millimetres and divide by 0.1 to arrive at the answer of x 1000. Candidates made a variety of errors including:

- measuring the distance between the *letters* **X** and **Y**;
- measuring in centimetres and failing to multiply by 10;
- multiplying the length by 0.1 instead of dividing.

The Examiners allowed a tolerance of +/- 1 mm so that they accepted answers between 990 and 1010. Two marks were awarded if the Examiners found the correct answer without any working. If candidates used an incorrect measurement but divided by 0.1, they gained one mark for showing the correct method. Some answers were clearly incorrect by a very large margin. Candidates should consider whether they have given an answer in a likely range before moving on to the next question.

(d) The Examiners expected candidates to give red blood cell as the enucleate animal cell and xylem vessel or phloem sieve tube as the plant cell. They were proved correct with the animal cell, but candidates often struggled to think of an appropriate plant cell to give. The Examiners accepted 'xylem' and 'phloem' but they only gave marks for the functions in this question if the cells were named correctly. Muscle, epithelial, epidermal, root hair and guard cells were given by a minority of candidates. Some gave non-cellular structures such as waxy cuticle. Some candidates referred to 'blood cell' without indicating that it would be a **red** blood cell.

Question 2

Parts of this question proved to be difficult for some candidates as they were not careful to explain their answers fully. Vague use of words also cost candidates some marks in **(a)(i)**. For example, 'alcohol affects the brain' did not gain marks. Answers to **(b)(i)** were disappointing as they lacked the detail expected by the Examiners.

(a) (i) This question on the effect of alcohol on the body was answered in a great variety of ways. The Examiners considered a long list of effects and restricted these to physical effects, not social or behavioural. They saw many short term effects linked to intoxication that were discounted: examples included alcohol poisoning and drowsiness. Many such answers were acceptable in **(c)(ii)** rather than here. Answers that dealt with damage to the kidneys did not gain credit.

(ii) Almost all candidates gave the correct response here – 1000 cm^3. Incorrect answers were 500 and 2000 cm^3.

(b) (i) This question tended to discriminate between candidates as weaker candidates tended to concentrate on mechanical digestion rather than chemical digestion. Many missed the point of the question and explained the need for food rather than the need for digestion. Some thought that the question stated '… food nutrients do **not** need to be digested'. There were several ways to approach this question. Candidates referred to molecular size and solubility. Rarely did they refer to the need for nutrients to move through the wall of the intestine or the walls of capillaries within the intestine. In terms of molecular size and solubility some wrote that the molecules are insoluble and complex or large or they stated that they had to be changed into small, soluble molecules. The Examiners were surprised how few candidates gained two marks here. References to solubility seemed to be centre-based. The Examiners knew that if prompted further almost all candidates would know why nutrients have to be broken down. References to absorption without mention of the wall of the intestine gained no marks. Candidates did not gain credit if they used the terms *particle* and *substance*. It is important that they realise that *molecule* is the appropriate term to use.

(ii) Most gave correct responses to this question: they stated that the small intestine or the ileum is the site of absorption. The Examiners accepted villi as an answer since the question did not ask for an organ; they also accepted duodenum although most absorption occurs in humans in the jejunum and the ileum. IGCSE candidates are not expected to know about the jejunum.

(iii) This gave candidates some problems. Many did not realise that this was a question about absorption of the products of fat digestion into lacteals. The expected answer was, therefore, fatty acids or glycerol. Fat is not a product of digestion, so was unacceptable. However, some thoughtful candidates gave maltose and peptides as answers and indeed these are correct as they are products of digestion if not *final* products and they are often absorbed into the epithelial cells of the villi for further digestion. Proteins, amino acids, glycogen, glucose, fibre and fat soluble vitamins were incorrect answers that were seen.

(c) (i) This question referred to the graph in Fig. 2.1. Most candidates gave x 9 or x 9% as their answer for the increase in risk. Some gave figures around x 15. However, some candidates were confused by the scale of the horizontal axis, which also led them to give incorrect data quotes in part **(ii)**.

(ii) In describing the relationship shown by the graph most gave variations on the answer given in the mark scheme:

'as the blood alcohol content increases, so does the risk of accident'.

However, some did not specify that the alcohol was **in** the blood and so lost the marking point. Although not prompted by the question, some gave data quotes and these were rewarded if appropriate and accurate. Simple descriptions of the graph such as 'small increase in risk followed by a much steeper increase' also gained the second mark. Many referred accurately to the difference in rate of increase above and below a blood alcohol content of 0.75 g per 100 cm^3. A common misconception was to state that the relationship is directly proportional. Some candidates tried to explain the relationship giving points that were appropriate in **(iii)** not here.

(iii) Candidates were not always very confident about how alcohol would influence drivers and so increase their risk of having an accident. There were many vague references to 'the brain slowing down' and similar comments. Some knew that alcohol is a depressant and explained that impulses are slower. References to 'messages' or 'signals' did not gain credit. The Examiners saw many good answers that linked the slow response to stimuli to ways in which accidents may occur, such as failure to brake or swerve to avoid hitting another car or an object. Some candidates did not take heed of the mark allocation here and wrote lengthy accounts that dealt with one aspect only. 'Reaction time decreases' was a common error.

Question 3

Most candidates performed well on this question. It dealt with three different areas of biology and the responses to all were most encouraging.

(a) (i) Most candidates identified hair, fur, whiskers or external ears (pinnae) as characteristics of mammals visible in the photograph of the Namibian lioness. Some gave mammalian features that were not visible.

(ii) Here most candidates identified a suitable characteristic. The Examiners considered a fairly long list of features although they expected to find 'mammary glands', 'feed their young on milk' and 'give birth to live young' as the most common responses. Some candidates gave another visible feature which did not gain credit. 'Warm blooded' and 'four chambered hearts' were other answers that did not gain credit as they apply to birds as well as mammals. General vertebrate features were also offered.

(b) (i) Almost all candidates realised that the lioness was sitting in bright light as her pupils were so small.

(ii) Candidates often explained that pupils need to be this size to reduce the light entering the eye to protect the retina against damage. Some made this question more difficult than intended by only referring to one aspect – reducing light entering the eye or protection against damage.

(c) Candidates were asked to suggest how they would confirm by studying the retina whether the lion could not see in colour. Good answers conveyed the idea that there would be no cones in the retina or only rods. Some candidates talked about relative numbers of each and did not gain the mark. A few did not gain the mark by stating that they would look for cones rather than giving the expected outcome. Some also referred to the absence of a fovea, which is not correct. Mammals that do not see colour would have a fovea composed of rods – each with its own sensory neurone in the optic nerve. This allows for the visual acuity at the centre of its visual field. Some candidates suggested strategies that would only be undertaken by the foolhardy: 'stand close to a lion with pictures of zebras in black and white and in colour and see what happens….'

(d) Almost all candidates were aware that they should write about accommodation here. Unfortunately, some were unsure about the details and gave incorrect statements, such as 'ciliary muscles contract', 'suspensory ligaments relax', 'the lens becomes fatter' and 'there is more bending of the light in the lens'. The most common mistake was the first one: stating that the ciliary muscles contract rather than relax. Some candidates made little diagrams of the lens, suspensory ligaments and ciliary body in the margin of the scripts. Almost all of them drew vertical sections of the eye. Accommodation is more understandable from the front as it is more obvious that in order for the lens to be thinner the ciliary body must relax and the suspensory ligaments develop more tension. Weak candidates confused the ciliary body with circular muscles in the iris. Some candidates were confused by the information in the question and wrote about focusing on the zebras and the tourists but did not make it clear that the changes they described referred to focusing on the zebras. The mark scheme gave credit to references to the formation of images of the zebras on the retina, but this point was not awarded very often. The use of the word *picture* is not appropriate when describing an image falling on the retina.

(e) Most candidates interpreted this question in terms of conserving animals so that they do not become extinct. Many also referred to the loss of habitat, promoting tourism, making animals available for scientific study and, in a variety of ways, to the role of animals in balanced ecosystems. Marks tended to be high for this question when candidates realised that it was best to refer to several different reasons. Some candidates thought game reserves would be more like zoos in which animals are free from predation. Some also thought that the habitat would be created (as in some zoos) rather than being maintained.

Question 4

Very few candidates gained good marks on this question. Many were unsure about the terms 'sink' and 'source' and so were at a loss to complete the table in **(i)** and answer part **(ii)**. Many may also have been unsure about 'translocation'. The Examiners considered a wide range of possible answers for sources and sinks in the table. Few candidates were able to name suitable substances transported in translocation. Sucrose and amino acids were the most appropriate answers. Common errors were to give 'water and nutrients' as the materials moved in transpiration and 'glucose' in translocation. The source of materials in the plant was often given as 'soil' for transpiration with the sink being 'air'. This showed that more careful reading of column headings was needed. 'Xylem' and 'phloem' were often given as sinks.

Successful answers to part **(ii)** tended to begin with references to the seed and germination. Candidates described the movement of materials from the seed to the growing parts of the seedling. They then described how this would change as leaves developed. The quality of answers here was poor – few explained these ideas at all clearly. Many referred to food stores without reference to the seed or cotyledons. Other answers referred to the development of flowers, fruits and seeds and also to leaf fall when sources and sinks change. Answers also suggested that the differences between translocation and transpiration are not well understood as many candidates wrote about the root developing to gain water. Sad to say many candidates left part **(ii)** blank.

Question 5

This also proved to be a high scoring question for those who understood the principles of selection in **(a)** and genetics in **(b)**, **(c)** and **(d)**. Responses to **(e)** tended to be poor.

(a) Many candidates were confused by the word 'caught' in the introduction to the question. Some thought, correctly, that this referred to the researchers catching the moths that had survived and had not been eaten by predators, such as birds. Others thought that the catching referred to the predators. They were also confused by 'wood' and 'bark' as used in the question. However, many candidates knew the peppered moth 'story' and gave very full and informative answers. When candidates had clearly mistaken researchers for predators, the Examiners did their best to give credit for biologically correct ideas about predation and camouflage.

(i) Despite the difficulties described above, most candidates realised that the black moths were not camouflaged and had been eaten by predators. A few candidates thought that the black moths would have felt vulnerable and flown away. A significant number thought that the black moths were well camouflaged against the bark.

(ii) More black moths would be caught in the wood with trees blackened with soot. Many candidates gave this idea and were credited even if they said that the results 'would be the other way around' compared with **(a)(i)**. Some thought that pollution would have killed moths of both phenotypes and also gained credit.

(b)(i) Most correctly identified the terms phenotype and genotype and most also knew that pale, speckled is the dominant form. Explanations as to why this is the case were often unclear. 'Because a capital letter is used' was not considered to be appropriate as the capital letter is used when a feature is known to be dominant. Good answers referred to the heterozygote in the explanation. Others referred to the black phenotype only being possible in the homozygous state.

(c) This required candidates to state the type of variation as discontinuous and then explain how it is inherited. Some candidates thought that they had to explain why the variation is discontinuous and referred to the lack of intermediates. The question did not prompt this explanation. Some thought that this was an example of continuous variation. Good answers were rare, but those that referred to dominance and the transfer of the gene for wing colour and the ways in which the different phenotypes were produced gained marks. Candidates who followed a logical line of reasoning gained three marks very easily. Most, however, did not mention the parental genotypes at all. It was not uncommon to read that there would be more pale, speckled moths because that feature is dominant. Some candidates confused inheritance with natural selection in this question.

(d) The genetic diagram was not answered particularly well. Many candidates did not put down the parental genotype at the top of their answer. This meant that many gave incorrect gametes such as G, g and g, g. Candidates who chose this cross could gain a maximum of two marks if they showed how they derived gametes from the parental genotypes and showed the F_1 genotypes. Candidates who showed the incorrect gametes without the appropriate parental genotypes could only gain a maximum of one mark but to do this they had to derive the F_1 correctly from the gametes that they had chosen.

Candidates did not have to use lines between gametes to derive the F_1 but if they did then the derivation had to be correct. It was pleasing to see many using Punnett squares, although these candidates often did not state the phenotypes that would be produced. Instead they went straight to the proportion of black moths. The genetic diagram should make clear the phenotype that results from each genotype given in the Punnett square. Some candidates gave the impression that moths with the genotype GG would be pale rather than pale, speckled as were the heterozygous moths (Gg). This suggested to the Examiners that the candidates thought that this was an example of co-dominance.

(e) (i) Answers here were many and various. Many candidates did not realise that this was a question about mutation and instead wrote about natural selection or selective breeding. The Examiners were surprised by the few correct answers they saw here and in part **(ii)**.

(ii) The Examiners looked for 'radiation' and 'chemicals' as possible factors that would increase the rate of mutation.

Question 6

This question tended to be high scoring.

(a) Many candidates were successful in describing genetic engineering as the transfer of genes from one organism to another. Some referred to the transfer of chromosomes which did not gain credit. Others gave too much detail here referring to plasmids, restriction enzymes and other details of this process. Some confused gene therapy with genetic engineering and they wrote about 'improving genes'.

(b) Many candidates gave DNA or RNA as correct responses. Incorrect answers included 'nucleus', 'chromosome', 'capsid' and 'plasmid'.

(c) (i) There were many misspellings of testosterone, but the Examiners only rejected them if they could be confused with other hormones. Most candidates gained a mark here.

(ii) Some candidates did not state the characteristics that develop at puberty in boys accurately enough to gain credit. Some stated that there would be hair on the body. Pubic proved to be a difficult word for some as they wrote 'public' instead. 'Voice breaking' was often given as voice becomes 'stronger', 'harsher' and 'louder'.

(d) (i) There were many excellent answers to the sketch graph. However, some candidates put *time* on the vertical axis and *toad population*, or an acceptable equivalent, on the horizontal axis. In this case, the Examiners ignored the axes labels and looked for the next two marking points as independent marks. Many drew an S-shaped curve even though their axes were the wrong way round. In this case they gained a mark and another if they indicated the exponential phase, or log phase, in the correct place. Some labelled 'lag' and 'log' phases but confused them or wrote either 'lag' or 'log' twice. Some candidates lost the mark for drawing the curve because they showed a decline or death phase. This was not prompted by the question.

(ii) There were many excellent answers showing that candidates understood the term *limiting factor*. 'Space' was not accepted as an answer.

(e) (i) Candidates were asked to draw a food web using the organisms named in the question. This involved drawing a food web with five organisms – sugar cane, scarab beetle, cane toad, dingo and crocodile. Common errors involved:

- not putting lines or arrows between the names
- not using arrows
- arrows going from higher to lower trophic levels
- using organisms other than those on the list, e.g. grass, rabbit and fox.
- including 'pests of sugar cane' as well as scarab beetles
- putting dingo and crocodile together at the top of a food chain, rather than drawing a web with an arrow from toad to dingo and a separate arrow from toad to crocodile.

The Examiners awarded a mark for having the arrows pointing in the correct direction, for example sugar cane to scarab beetle, and a second mark was awarded for having the organisms in the correct sequence in the food web. Some candidates were confused by the introductory text and thought that scarab beetles and 'pest of sugar cane' were different organisms. At least one candidate included the scientists in the food web.

(ii) Most candidates gained three marks by assigning the organisms to the correct trophic levels. Common mistakes here were:

- failing to include all three carnivores
- listing the cane toad as a herbivore.

Some candidates did not follow the instructions to use the organisms listed in the question in **(i)** and **(ii)**. The Examiners did not allow any marks for these organisms in **(ii)**.

BIOLOGY

Paper 0610/03

Extended Theory

General comments

The Examiners were agreed that this paper was generally comparable to previous papers. There was a full range of performance including some exceptional scripts in which candidates showed a very wide knowledge and a deep understanding of the subject matter. There was no evidence that candidates were short of time. **Question 1** was not the usual straightforward start to the paper and many candidates struggled with part **(b)**. **Question 4** also proved difficult for many candidates. Other questions were much more approachable and candidates responded well.

The genetics in **Question 6** proved difficult for some candidates. Part **(c)** proved to be most challenging as candidates were often not aware that they were being asked to give 'discontinuous variation' as their first response. Even when they did, their explanation about the inheritance was often vague and imprecise. It was encouraging to find many candidates completing the genetic diagram in **(d)** correctly, although a common omission was the link between the genotypes of the F_1 and their phenotypes. Many candidates struggled with both parts of **(e)**. Some candidates did not answer parts **(d)** and **(e)** and as there was no evidence of shortage of time they must have thought that the large white space on page 15 indicated the end of the paper.

The Examiners rarely had trouble understanding the answers – most were clearly written and addressed the questions asked. Weak candidates tended not to write concisely and they often did not use scientific terms accurately. Spelling of scientific terms was also sometimes inaccurate, but this is not penalised.

If candidates run out of space, or cross out their answer and start again, they should use blank space on the same page for their answers if possible. If not, then they should use blank space on another page and make it clear where their answer is to be found. Many candidates do this, but some do not and make it difficult for the Examiners to mark their scripts.

Comments on specific questions

Question 1

(a) (i) Identifying the blood cells in Fig. 1.1 proved to be quite difficult for many candidates. Almost all the candidates identified **P** as a red blood cell or an erythrocyte. Many confused the phagocyte with the lymphocyte or gave both **Q** and **R** and white blood cells without distinguishing between them.

(ii) The Examiners awarded marks according to the answers given in part **(i)**, so those that identified **Q** as a phagocyte could gain marks for describing the functions of a phagocyte in part **(ii)**. Many candidates found it easy to describe appropriate functions of the two cells even if they had misidentified them in **(i)**. Candidates should not state that phagocytes 'eat' bacteria. They should also be careful to avoid confusing antibodies with antibiotics when they write their answers. It was pleasing to find that few candidates wrote about 'germs'. No marks were awarded for details of blood clotting that were given when **Q** or **R** was identified as a blood platelet.

(b) This proved quite difficult for candidates – especially if they did not have the appropriate vocabulary to describe the action of the immune system.

(i) The candidates were expected to explain that transplanted tissue is foreign to the body and therefore will prompt an immune response. Details of the immune response, such as migration of white blood cells to the foreign tissue and the production of antibodies were other responses that were credited.

(ii) Candidates often saw that the reason for the rejection of the transplanted tissue is that the immune system recognises the tissue as foreign in the same way as it detects pathogens. Many answered in terms of the skin graft and not generally as was the intention of the question. Many concentrated on what was likely to happen to the patients following tissue rejection.

(iii) The consequences of the taking of immunosuppressive drugs were well known as most explained that there were dangers of susceptibility to diseases.

Question 2

Parts of this question proved to be difficult for some candidates as they were not careful to explain their answers fully. Vague use of words also cost candidates some marks in **(a)(i)**. For example, 'alcohol affects the brain' did not gain marks. Answers to **(b)(i)** were disappointing as they lacked the detail expected by the Examiners.

(a) (i) This question on the effect of alcohol on the body was answered in a great variety of ways. The Examiners considered a long list of effects and restricted these to physical effects, not social or behavioural. They saw many short term effects linked to intoxication that were discounted: examples included alcohol poisoning and drowsiness. Many such answers were acceptable in **(c)(ii)** rather than here. Answers that dealt with damage to the kidneys did not gain credit.

(ii) Almost all candidates gave the correct response here – 1000 cm^3. Incorrect answers were 500 and 2000 cm^3.

(b) (i) This question tended to discriminate between candidates as weaker candidates tended to concentrate on mechanical digestion rather than chemical digestion. Many missed the point of the question and explained the need for food rather than the need for digestion. Some thought that the question stated '… food nutrients do **not** need to be digested'. There were several ways to approach this question. Candidates referred to molecular size and solubility. Rarely did they refer to the need for nutrients to move through the wall of the intestine or the walls of capillaries within the intestine. In terms of molecular size and solubility some wrote that the molecules are insoluble and complex or large or they stated that they had to be changed into small, soluble molecules. The Examiners were surprised how few candidates gained two marks here. References to solubility seemed to be centre-based. The Examiners knew that if prompted further almost all candidates would know why nutrients have to be broken down. References to absorption without mention of the wall of the intestine gained no marks. Candidates did not gain credit if they used the terms *particle* and *substance*. It is important that they realise that *molecule* is the appropriate term to use.

(ii) Most gave correct responses to this question: they stated that the small intestine or the ileum is the site of absorption. The Examiners accepted villi as an answer since the question did not ask for an organ; they also accepted duodenum although most absorption occurs in humans in the jejunum and the ileum. IGCSE candidates are not expected to know about the jejunum.

(iii) This gave candidates some problems. Many did not realise that this was a question about absorption of the products of fat digestion into lacteals. The expected answer was, therefore, fatty acids or glycerol. Fat is not a product of digestion, so was unacceptable. However, some thoughtful candidates gave maltose and peptides as answers and indeed these are correct as they are products of digestion if not *final* products and they are often absorbed into the epithelial cells of the villi for further digestion. Proteins, amino acids, glycogen, glucose, fibre and fat soluble vitamins were incorrect answers that were seen.

(c) (i) This question referred to the graph in Fig. 2.1. Most candidates gave x 9 or x 9% as their answer for the increase in risk. Some gave figures around x 15. However, some candidates were confused by the scale of the horizontal axis, which also led them to give incorrect data quotes in part **(ii)**.

(ii) In describing the relationship shown by the graph most gave variations on the answer given in the mark scheme:

'as the blood alcohol content increases, so does the risk of accident'.

However, some did not specify that the alcohol was **in** the blood and so lost the marking point. Although not prompted by the question, some gave data quotes and these were rewarded if appropriate and accurate. Simple descriptions of the graph such as 'small increase in risk followed by a much steeper increase' also gained the second mark. Many referred accurately to the difference in rate of increase above and below a blood alcohol content of 0.75 g per 100 cm^3. A common misconception was to state that the relationship is directly proportional. Some candidates tried to explain the relationship giving points that were appropriate in **(iii)** not here.

(iii) Candidates were not always very confident about how alcohol would influence drivers and so increase their risk of having an accident. There were many vague references to 'the brain slowing down' and similar comments. Some knew that alcohol is a depressant and explained that impulses are slower. References to 'messages' or 'signals' did not gain credit. The Examiners saw many good answers that linked the slow response to stimuli to ways in which accidents may occur, such as failure to brake or swerve to avoid hitting another car or an object. Some candidates did not take heed of the mark allocation here and wrote lengthy accounts that dealt with one aspect only. 'Reaction time decreases' was a common error.

Question 3

Most candidates performed well on this question. It dealt with three different areas of biology and the responses to all were most encouraging.

(a) (i) Most candidates identified hair, fur, whiskers or external ears (pinnae) as characteristics of mammals visible in the photograph of the Namibian lioness. Some gave mammalian features that were not visible.

(ii) Here most candidates identified a suitable characteristic. The Examiners considered a fairly long list of features although they expected to find 'mammary glands', 'feed their young on milk' and 'give birth to live young' as the most common responses. Some candidates gave another visible feature which did not gain credit. 'Warm blooded' and 'four chambered hearts' were other answers that did not gain credit as they apply to birds as well as mammals. General vertebrate features were also offered.

(b) (i) Almost all candidates realised that the lioness was sitting in bright light as her pupils were so small.

(ii) Candidates often explained that pupils need to be this size to reduce the light entering the eye to protect the retina against damage. Some made this question more difficult than intended by only referring to one aspect – reducing light entering the eye or protection against damage.

(c) Candidates were asked to suggest how they would confirm by studying the retina whether the lion could not see in colour. Good answers conveyed the idea that there would be no cones in the retina or only rods. Some candidates talked about relative numbers of each and did not gain the mark. A few did not gain the mark by stating that they would look for cones rather than giving the expected outcome. Some also referred to the absence of a fovea, which is not correct. Mammals that do not see colour would have a fovea composed of rods – each with its own sensory neurone in the optic nerve. This allows for the visual acuity at the centre of its visual field. Some candidates suggested strategies that would only be undertaken by the foolhardy: 'stand close to a lion with pictures of zebras in black and white and in colour and see what happens….'

(d) Almost all candidates were aware that they should write about accommodation here. Unfortunately, some were unsure about the details and gave incorrect statements, such as 'ciliary muscles contract', 'suspensory ligaments relax', 'the lens becomes fatter' and 'there is more bending of the light in the lens'. The most common mistake was the first one: stating that the ciliary muscles contract rather than relax. Some candidates made little diagrams of the lens, suspensory ligaments and ciliary body in the margin of the scripts. Almost all of them drew vertical sections of the eye. Accommodation is more understandable from the front as it is more obvious that in order for the lens to be thinner the ciliary body must relax and the suspensory ligaments develop more tension. Weak candidates confused the ciliary body with circular muscles in the iris. Some candidates were confused by the information in the question and wrote about focusing on the zebras and the tourists but did not make it clear that the changes they described referred to focusing on the zebras. The mark scheme gave credit to references to the formation of images of the zebras on the retina, but this point was not awarded very often. The use of the word *picture* is not appropriate when describing an image falling on the retina.

(e) Most candidates interpreted this question in terms of conserving animals so that they do not become extinct. Many also referred to the loss of habitat, promoting tourism, making animals available for scientific study and, in a variety of ways, to the role of animals in balanced ecosystems. Marks tended to be high for this question when candidates realised that it was best to refer to several different reasons. Some candidates thought game reserves would be more like zoos in which animals are free from predation. Some also thought that the habitat would be created (as in some zoos) rather than being maintained.

Question 4

This question on water lily plants proved to be challenging for many candidates. Many did not spot the clues in part **(c)** and of those that did many wrote that respiration 'produces' or 'makes' energy. Candidates should be advised that these answers do not gain credit. They should refer to the release of energy or the transfer of energy.

(a) (i) Many identified the structure as 'chlorophyll' rather than a chloroplast.

(ii) The Examiners awarded marks for the functions of chloroplasts even if chlorophyll was given in part **(i)**. Answers here were good, often with considerable detail.

(b) (i) The advantages of the large air spaces within the water lily leaf were described in terms of providing carbon dioxide and oxygen to all the cells of the leaf. Diffusion of gases throughout the leaf is helped by having such large air spaces. Some candidates stated that the air spaces help with buoyancy and others that this allows light to penetrate to the cells at the bottom of the leaf. However, many just stated that the air spaces are needed for photosynthesis and respiration without being more precise. There were many references to 'air moving in and out'.

(ii) This proved difficult as the question asked about the reason for not having stomata on the lower part of the leaf. Some candidates thought that the main problem would be the entry of water through the stomata thus causing waterlogging and the sinking of the leaves. Many thought that there would be no movement of oxygen and carbon dioxide into the leaf through the stomata if they were exposed to the water. The Examiners rejected this line of argument as these gases are dissolved in water and they would diffuse through the water into the flooded air spaces. However, the Examiners accepted the idea that the gases diffuse more slowly through water than through air although they did not find this stated very often.

(c) Some candidates realised that this was about the uptake of minerals from the soil by active uptake. They spotted the clues in the question and reasoned that respiration in the roots provides the energy for the uptake of minerals and that this requires oxygen. The oxygen diffuses from the leaves through the large air spaces to the roots. Many candidates did not follow this line of argument. They assumed that minerals 'climb' through the air spaces within the plants. Some also thought that the air spaces increase the rate of transpiration so that more water and minerals are drawn up faster. Many also thought that root hairs absorb water by active uptake and minerals by osmosis.

Question 5

This question tended to be high scoring.

(a) Many candidates were successful in describing genetic engineering as the transfer of genes from one organism to another. Some referred to the transfer of chromosomes which did not gain credit. Others gave too much detail here referring to plasmids, restriction enzymes and other details of this process. Some confused gene therapy with genetic engineering and they wrote about 'improving genes'.

(b) Many candidates gave DNA or RNA as correct responses. Incorrect answers included 'nucleus', 'chromosome', 'capsid' and 'plasmid'.

(c) (i) There were many misspellings of testosterone, but the Examiners only rejected them if they could be confused with other hormones. Most candidates gained a mark here.

(ii) Some candidates did not state the characteristics that develop at puberty in boys accurately enough to gain credit. Some stated that there would be hair on the body. Pubic proved to be a difficult word for some as they wrote 'public' instead. 'Voice breaking' was often given as voice becomes 'stronger', 'harsher' and 'louder'.

(d) (i) There were many excellent answers to the sketch graph. However, some candidates put *time* on the vertical axis and *toad population*, or an acceptable equivalent, on the horizontal axis. In this case, the Examiners ignored the axes labels and looked for the next two marking points as independent marks. Many drew an S-shaped curve even though their axes were the wrong way round. In this case they gained a mark and another if they indicated the exponential phase, or log phase, in the correct place. Some labelled 'lag' and 'log' phases but confused them or wrote either 'lag' or 'log' twice. Some candidates lost the mark for drawing the curve because they showed a decline or death phase. This was not prompted by the question.

(ii) There were many excellent answers showing that candidates understood the term *limiting factor*. 'Space' was not accepted as an answer.

(e) (i) Candidates were asked to draw a food web using the organisms named in the question. This involved drawing a food web with five organisms – sugar cane, scarab beetle, cane toad, dingo and crocodile. Common errors involved:

- not putting lines or arrows between the names
- not using arrows
- arrows going from higher to lower trophic levels
- using organisms other than those on the list, e.g. grass, rabbit and fox.
- including 'pests of sugar cane' as well as scarab beetles
- putting dingo and crocodile together at the top of a food chain, rather than drawing a web with an arrow from toad to dingo and a separate arrow from toad to crocodile.

The Examiners awarded a mark for having the arrows pointing in the correct direction, for example sugar cane to scarab beetle, and a second mark was awarded for having the organisms in the correct sequence in the food web. Some candidates were confused by the introductory text and thought that scarab beetles and 'pest of sugar cane' were different organisms. At least one candidate included the scientists in the food web.

(ii) Most candidates gained three marks by assigning the organisms to the correct trophic levels. Common mistakes here were:

- failing to include all three carnivores
- listing the cane toad as a herbivore.

Some candidates did not follow the instructions to use the organisms listed in the question in **(i)** and **(ii)**. The Examiners did not allow any marks for these organisms in **(ii)**.

Question 6

This also proved to be a high scoring question for those who understood the principles of selection in **(a)** and genetics in **(b)**, **(c)** and **(d)**. Responses to **(e)** tended to be poor.

(a) Many candidates were confused by the word 'caught' in the introduction to the question. Some thought, correctly, that this referred to the researchers catching the moths that had survived and had not been eaten by predators, such as birds. Others thought that the catching referred to the predators. They were also confused by 'wood' and 'bark' as used in the question. However, many candidates knew the peppered moth 'story' and gave very full and informative answers. When candidates had clearly mistaken researchers for predators, the Examiners did their best to give credit for biologically correct ideas about predation and camouflage.

(i) Despite the difficulties described above, most candidates realised that the black moths were not camouflaged and had been eaten by predators. A few candidates thought that the black moths would have felt vulnerable and flown away. A significant number thought that the black moths were well camouflaged against the bark.

(ii) More black moths would be caught in the wood with trees blackened with soot. Many candidates gave this idea and were credited even if they said that the results 'would be the other way around' compared with **(a)(i)**. Some thought that pollution would have killed moths of both phenotypes and also gained credit.

(b)(i) Most correctly identified the terms phenotype and genotype and most also knew that pale, speckled is the dominant form. Explanations as to why this is the case were often unclear. 'Because a capital letter is used' was not considered to be appropriate as the capital letter is used when a feature is known to be dominant. Good answers referred to the heterozygote in the explanation. Others referred to the black phenotype only being possible in the homozygous state.

(c) This required candidates to state the type of variation as discontinuous and then explain how it is inherited. Some candidates thought that they had to explain why the variation is discontinuous and referred to the lack of intermediates. The question did not prompt this explanation. Some thought that this was an example of continuous variation. Good answers were rare, but those that referred to dominance and the transfer of the gene for wing colour and the ways in which the different phenotypes were produced gained marks. Candidates who followed a logical line of reasoning gained three marks very easily. Most, however, did not mention the parental genotypes at all. It was not uncommon to read that there would be more pale, speckled moths because that feature is dominant. Some candidates confused inheritance with natural selection in this question.

(d) The genetic diagram was not answered particularly well. Many candidates did not put down the parental genotype at the top of their answer. This meant that many gave incorrect gametes such as G, g and g, g. Candidates who chose this cross could gain a maximum of two marks if they showed how they derived gametes from the parental genotypes and showed the F_1 genotypes. Candidates who showed the incorrect gametes without the appropriate parental genotypes could only gain a maximum of one mark but to do this they had to derive the F_1 correctly from the gametes that they had chosen.

Candidates did not have to use lines between gametes to derive the F_1 but if they did then the derivation had to be correct. It was pleasing to see many using Punnett squares, although these candidates often did not state the phenotypes that would be produced. Instead they went straight to the proportion of black moths. The genetic diagram should make clear the phenotype that results from each genotype given in the Punnett square. Some candidates gave the impression that moths with the genotype GG would be pale rather than pale, speckled as were the heterozygous moths (Gg). This suggested to the Examiners that the candidates thought that this was an example of co-dominance.

(e) (i) Answers here were many and various. Many candidates did not realise that this was a question about mutation and instead wrote about natural selection or selective breeding. The Examiners were surprised by the few correct answers they saw here and in part **(ii)**.

(ii) The Examiners looked for 'radiation' and 'chemicals' as possible factors that would increase the rate of mutation.

BIOLOGY

Paper 0610/04

Coursework

General comments

There is now a wide variety of Centres choosing to enter candidates for this Paper. A great deal of interesting and challenging work is in evidence, with many candidates demonstrating excellent ability within each of the four areas of practical skills.

The majority of Centres continue to use between eight and twelve tasks. A few use the minimum of four tasks, but this is not ideal as it does not allow candidates to discard any marks that are not up to their usual standard. Using more tasks than this for assessment is generally not a good idea, as it reduces the opportunity for candidates to work in groups and share ideas. For assessment, they must work for the most part individually.

Skill C1 tasks are easy to find and almost any piece of practical work can be used to assess this. For C2, it is best if Centres can use at least one task that involves observing a specimen and constructing diagrams, as well as others that involve the collection and recording of quantitative data. For C3 and C4, it is not possible to reach Levels 5 and 6 unless there is a quantitative component to the work. Practical work involving enzymes, photosynthesis, heat loss and osmosis are all widely used.

Most Centres write mark schemes that closely address the general criteria in the syllabus, but that are adapted to be task-specific. Where this is not done, it makes it much more difficult for the Moderator to understand how and why marks have been awarded – and will cause similar difficulties for the teacher or teachers making the assessments. A few Centres use tick lists rather than descriptive schemes, and this can work well so long as the marking points are linked to the appropriate criteria and levels.

Relatively few changes are made to marks, especially where Centres have settled down to using a range of tasks and a set of mark schemes that work well for them. In a few cases, marks have been adjusted downwards. This is almost always because of overgenerous assessment of candidates' performances in C3 and C4, especially in the area of evaluation – a high level skill which discriminates between candidates scoring 4 or 5–6 in these skill areas. Marks are also occasionally moved upwards.

Coursework assessment generates some excellent work from candidates, which feeds in positively to their work in other areas of the course. They gain in confidence by designing and carrying out their own experiments, and especially by looking critically at results and considering how valid and reliable they are.

BIOLOGY

Paper 0610/05

Practical Test

General comments

Once again, a significant number of Centres did not submit Supervisor's Reports or a seating plan, although fewer than in previous sessions.

The Supervisor's Reports are an invaluable resource to Examiners in assessing the work of candidates. It could be the case that an experiment or material behaved in a way that was not anticipated or that candidates were supplied with a specimen that had features that were not expected and so had not been considered in the mark scheme. Under such circumstances, candidates can gain credit for what they could do and observe, even if the material had looked or behaved in an unexpected way. In this session, for example, some Centres reported that they had been unable to grow sufficient mung beans to supply each candidate with five specimens. As candidates were required to record the measurements of five germinated and five non-germinated beans, they would not get full marks if they did not record measurements for all five. For candidates in Centres that reported problems and then stated how many beans had been supplied to each candidate, Examiners were able to credit candidates with appropriate measurements. If a candidate simply recorded four measurements, for example, without this information then the marks would not be available. Centres not submitting reports with the scripts could therefore find that their candidates are at a disadvantage. Examiners find that any additional information can be helpful, so Centres should include any information that they feel would be of assistance, even if it is not specifically requested. Identification and/or drawing of specimens supplied to the candidates is always a good idea. Some Centres supplied photographs of specimens and test results, both of which were useful. It should be noted that the Supervisor's Report form is now found in the Confidential Instructions rather than the question paper itself.

If any difficulty is experienced in supplying suitable material or if there are any queries concerning how the material should be presented to the candidates, Centres should contact CIE for advice, in good time before the date of the examination.

Comments on specific questions

Question 1

(a) (i) Table design skills were not generally very good; which was a pity as good, clearly presented table formats are a relatively easy way to gain marks. Centres are advised to encourage their candidates to design appropriate tables for the results of their practical work, with suitable headings and units, for a range of requirements. In this way, they can develop the ability to decide how best to display the information. Some very untidy tables were seen and candidates were frequently unable to include a 'length' heading, although most were able to distinguish between S1 and S2 results.

(ii) Most candidates were able to record five measurements for S1 and five for S2. A surprising number only recorded four, but with no indication of problems from the Centre it was not possible to discover whether this was the fault of the candidate or whether they had not been supplied with the correct number of beans. Where candidates had only recorded the measurement of one bean, however, it was not possible to give credit here or in **(iii)** for calculation of the mean. Candidates should appreciate the limitations of measuring with a ruler. It is not possible to get accurate measurements of, for example, 7.9 mm and measurements to that degree of 'accuracy' were rejected. Some candidates were measuring and recording in cm, while others attempted to convert cm to mm with varying degrees of success.

(iii) The calculations were mostly well done, with good candidates showing all their working in the space above the answer boxes.

(b) (i) The answers to this part of the question often failed to score full marks, although well-prepared candidates were able to do so. Many presented highly rambling descriptions that were repetitive and wasted space, while scoring few marks. Answers were often vague, with references to 'suitable conditions' rather than quoting the temperatures that S1 and S2 had been exposed to. Few candidates referred to the data that they had collected. Some candidates concentrated on colour and etiolation to the exclusion of all else.

(ii) This part of the question was poorly understood by many candidates, who either supplied experimental detail (taken from the stem of the question) or included the explanation that should have been given in **(i)**. Neither of these approaches would ensure that an experiment would clearly show that the differences were only due to the temperature that the specimens had been exposed to. Candidates were expected to refer to other variables that should be eliminated or remain constant from one set of material to the other. Suitable answers would include ensuring that they were exposed to the same intensity or duration of light, or kept in the dark. They might have mentioned soaking in the same volume of water or for the same amount of time. Suitable references to oxygen were credited, although it was felt that a supply of carbon dioxide would not be vital at this stage of development.

(c) (i) Candidates could mostly name biuret, although some did confuse it with Benedict's.

(ii) Supervisor's Reports were of great help to the Examiners in this part of the question. As a variety of material had been supplied to candidates and the quantity of protein in the material would be variable, it was most useful to have an indication of typical results. This allowed Examiners to credit anomalous results when they did not correspond with the expected answers. Once again, if candidates did not produce the expected results and their colour changes were not supported with detail in the Supervisor's Report, then they could not be credited. Candidates should be aware of the possible confusion between the 'dark purple' often quoted for the result of the starch test and 'purple' as the result of the biuret test. Also, as the solution remains blue in the absence of protein, results such as 'blue/purple' could be taken as ambiguous. It would be far better to describe the change simply as 'purple' or as 'blue turning slightly purple' or 'blue with a purple ring' to avoid any confusion.

(iii) Candidates were expected to look at their results, as quoted in **(ii)**, and to come to suitable conclusions. Examiners were therefore marking a correct conclusion for the candidates' responses to **(ii)**, not what the candidates thought should have happened and ignoring the results that had been obtained. Unfortunately, some candidates drew a conclusion that, although expected, did not correspond to the results that they had obtained. These did not gain credit.

Question 2

(a) (i) The candidates who had experience of handling and drawing specimens answered the whole of part **(a)** well. Few candidates were penalised for drawings that were too small, but the quality of drawing was, in general, very poor. In some cases, it was not possible to determine which stage of the life cycle the candidates had been supplied with. A diagram or a picture of the specimen in the Supervisor's Report would have helped, particularly in the light of the poor quality of the drawings, as it was clear that some Centres had not supplied the candidates with maggots and at least one had supplied them with mosquito larvae. Candidates should be reminded that biological diagrams should not be drawn in pen or biro. The drawing should be large, clear and have a clear outline. Even an unlabelled drawing here would have scored two marks. Label lines should point clearly to the structure concerned and should not cross each other.

(ii) Some strange suggestions were seen here, but most candidates managed to score at least one mark. The use of an electron microscope was not considered to be practical and it was felt that the use of a stronger magnifying lens would not necessarily reveal more detail. Using a light microscope, however, was frequently suggested and credited.

(iii) Some candidates compared the two specimens well, making comparative statements about the same feature across the table. It should be stressed to candidates that each line of a table such as this should make the comparison.
e.g.

S4	S5
segments present	no visible segments

would score one mark,
but

S4	S5
segments present	dark colour
longer	no visible segments

would not score at all as the comparative statements were not on the same line ~ segments are being compared with colour and then size is being compared with absence of segments.

(b) (i) This was well known; candidates either identifying the group as insects or arthropods.

(ii) A surprising number of candidates stated that the larvae would develop into S4, although the majority correctly gave the answer as egg. Candidates should be aware that answers that include choices, such as 'egg/larvae', will not be credited as the candidate is asking the Examiner to select the correct answer

(iii) Some weaker candidates struggled to provide three characteristic features of insects or arthropods, often being rather vague or imprecise, particularly with reference to the numbers of legs, wings or antennae. Other responses were good, with the features clearly stated.

(c)(i) The drawing of the graph proved to be quite a problem for a number of candidates. The axes were generally suitably labelled with the parameter and units. The most common omission was 'time'. Candidates quite often did not score the second mark. This was either because the orientation of the axes was incorrect ('temperature' should have been on the x axis as it was the controlled variable) as candidates felt that 'time' should always go on the x axis or because the scale on one or both of the axes did not go up in equal increments. It was not unusual to see one or both scales with the actual readings inserted on each of the major divisions on the grid. There was some inaccurate plotting of the points, not only by candidates who chose rather strange and unhelpful scales for the axes. A significant number of candidates failed to read the instructions carefully enough and plotted the data for S4 to S5 as well as the required set of data. This plotting error resulted in the loss of a mark. Those who tried to draw a bar chart but had labelled the axes as though they were going to draw a line graph found it difficult to score the plotting marks, as the scale markers should be in the middle of the bars for a bar chart. Candidates were expected to either join the points or to draw a line (or curve) of best fit, using a single solid line. Some simply ignored an 'odd' result and joined the remaining points, which was incorrect. Lines were not expected to extend beyond the first and last plotted points.

(ii) This part was less well answered, with the majority of candidates only scoring one mark. It was not unusual to see the same point repeated in a number of different ways in the same answer. Some candidates expressed themselves badly when referring to the effect of temperature on development. Answers were commonly seen that stated that high temperature leads to low development or low rate of development. It may be that the candidates meant that high temperature leads to development taking a low number of days, but these answers given actually meant the complete opposite. It was rare to see reference to the data or any explanation offered. Some candidates were unable to make any sense of the data at all, completely misinterpreting it.

BIOLOGY

Paper 0610/06
Alternative to Practical

General comments

Overall, the paper produced almost the full range of marks from 39 out of 40 to zero.

Candidates seemed able to attempt all questions with no indication of a shortage of time. This paper was comparable to the paper for last year in terms of difficulty. There were parts of some questions based on investigative and planning skills (C4), which some candidates found difficult and perhaps require further practise. There was evidence that some candidates had not experienced some of the practical techniques such as photomicrographs of dividing cells and so based their answers on general knowledge. Their suggestions were credited wherever possible. Drawing skills were good; many of the drawings showed the whole life cycle of the insect not the stage required in the rubric. Detailed knowledge of classification was shown by many candidates.

Candidates should be made aware of the differences in responses that they should make when questions involve terms such as describe and explain. One of the problems seemed to be candidates giving descriptions when explanations had been requested or just describing or explaining and not both.

Comments on specific questions – all questions to be attempted

Question 1

This question was based on the effect of temperature on the growth of bean seedlings. It involved the candidates in observing, measuring and handling data to present in graphical form.

(a) (i & ii) Most candidates measured the overall lengths of the seedlings shown in Figs 1.1 and 1.2 accurately within the tolerances allowed for variation between different rulers. Most measurements were recorded in mm (cms were used in some instances infringing the rubric). A common error was to measure to or from the horizontal line which was interpreted as being the 'soil level' even though the introduction explained the seedlings were grown on paper.

Recording the measurements of seedling lengths in Table 1.1 was expected. It was not necessary to repeat the units in the rows as the unit, mm, was given in the table heading.

Most candidates were able to correctly calculate the mean length of the seedlings and recorded this in Table 1.1, often using the blank space below the question to do the working.

(b) (i) This part of the question started with 'describe and explain' – candidates were expected to demonstrate their observational skills and comment on the differences shown in the figures, to handle the recorded data and to link these details to a biological explanation for these observed differences. Many candidates answered with either a description or an explanation, not both, and so limited the number of marks available for this section.

All of the seeds had germinated but it was the growth of the seedlings that showed differences in the root, shoot and cotyledon or leaf structure. Weaker candidates referred to the overall difference that those seedlings in the warm place at 30°C had grown faster or more than those grown in a refrigerator at 4°C. Able candidates not only described the structures in detail including the presence or absence of the testa but also manipulated the data from the table and recorded that the seedlings had extended six to seven times longer in the warmer conditions making the answers comparative.

The explanation for these observed differences should be based on metabolism including enzyme activity and, of course, with seeds, the source of the energy from stored materials such as carbohydrates/starch being broken down by enzymes such as amylase. Again these ideas should be expressed in comparative terms. The two temperatures involved in this question were not likely to approach the optimum for the enzymes concerned nor were the enzymes likely to be denatured. Some candidates thought that 4 °C was low enough for ice crystals to form, others referred to the need for light and auxins but these were not involved.

(ii) Although many candidates were able to indicate the need to measure more than one seedling and to calculate a mean, too many candidates made vague references about accuracy in their explanation. Able candidates referred to reducing errors and the idea that seedlings differed in growth and development.

Question 2

This question was based on the life history of the fly, observation of the stages involved and their development.

(a) **Drawing:** Most candidates are now producing good diagrams of a large size with single clear lines instead of sketches constructed with artistic lines. The majority of candidates no longer use shading which is encouraging. Some candidates did not read the instruction carefully as there were a number of diagrams of the life cycle with a very small pupal stage.

The sizes of the drawings were generally as large or larger than the photograph. Many drawings showed accurate details such as the same number of segments and spiracles on the sides of the body segments.

Labelling: although body segments was the most common label seen, some candidates labelled the anterior or posterior ends as mouth or anus.

(b) Classification is covered in ***Section 1*** of the Syllabus.

(i) Many candidates did not know the term Arthropod or Arthropoda, though some candidates tried to spell the term phonetically. The group name 'insects' was given credit.

(ii) The common features of the adult fly shown in Fig. 2.2 were well known. Many candidates did not refer to a pair of antennae although the two structures were clearly shown in the drawing. Large eyes were mentioned without expressing biological knowledge that these were compound and not simple eyes.

(c) (i) This part of the question was based on the presentation of one data set given in Table 2.1 for the second column 'from stage shown in Fig. 2.4 to adult' as a suitable graph. Although most candidates correctly plotted just this set of data, too many ignored the rubric and chose to plot both sets of data and so limited the scale for the line graph. Very few candidates presented column graphs.

Orientation of axes – it was expected that the time in days would be on the horizontal axis and the temperature in °C would be plotted on the vertical axis. This can be remembered because the first column in a table is the 'x' or horizontal axis. Most candidates labelled the axes with appropriate units as indicated above. Candidates made an effort to use an appropriate scale to utilise the printed grid. It is not necessary to start the scale from zero days or degrees. Plotting the data accurately was achieved by many candidates.

The line joining the points was generally well drawn with a steady curve or a ruled line point to point with a clear, unbroken line. The line should not be extrapolated beyond the recorded data points.

(iii) As the temperature is raised, this speeds up metabolism and so the time taken for the life cycle of the fly to progress to the next stage is shortened. Linking temperature and development time was the basis for the description part of the question of the effect of temperature on the development. The explanation, the second part of this question was based on the faster metabolism due to increased enzyme activity or respiration. The comparison of the two sets of data from larva to pupa and pupa to adult was seldom made.

Question 3

This question was based on ***section III*** of the syllabus, topic 3.2 mitosis. The photomicrograph of the root tip cells showing the stained DNA of the chromosomes was visible and the outlines of the cells were clear. Candidates should become familiar with photomicrographs during the IGCSE course.

(a) (i) Most candidates were able to circle correctly one of the cells which showed the 'daughter' chromosomes separating at the equator and at a stage where the chromosomes were moving towards the opposite poles of the dividing cell. There were three cells at that stage shown on Fig. 3.1. The question referred to anaphase in brackets for those candidates who were familiar with the names for the stages, it was neither expected nor necessary for the name for this stage to be known, the description is all that is required and is included in the core syllabus.

(ii) By careful observation of the photomicrograph and reading the whole question, many candidates were able to recognise the stained structures and identify visible chromosomes, to comment on the absence of a nuclear membrane or nucleus or to comment on the shape of the cell.

(iii) The majority of candidates correctly identified that the type of cell division taking place was mitosis.

(b) This part of the question was a 'suggestion' and candidates presented a range of answers some were possible such as the cells would increase in size and develop to form vascular tissues for transport such as xylem. Others only referred to the cells dividing again.

Question 4

The answer for this question needed to show planning and organisation skills. The candidate needed to be able to describe the procedure to carry out the food tests for simple sugars and proteins, to be aware of the reagents used and of colour changes (including the starting colours). Safety factors also needed to be described.

It was pleasing to note that many candidates were able to cover all of these aspects and gain full marks. However, it was clear that some candidates were not able to describe the details for carrying out these tests as there was much confusion over names for the reagents, procedures and results. Often Benedicts' test was incorrectly described for proteins. The expected changes in colour were frequently given incorrectly or omitted. The Iodine or the emulsion tests were inappropriately described by some candidates. Weaker candidates often got the chemicals wrong e.g. sodium chloride instead of sodium hydroxide for biuret test.

A few Centres may still be using older food tests and other Centres used clinistix and albustix and these were credited if correct. A few candidates attempted to include details for chromatographic methods which were again given credit, though it would not be easy to carry out these procedures without the use of a fume cupboard and these tests are beyond this level.