BIOLOGY

Paper 0610/01
Multiple Choice

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

General comments

This year's paper gave good discrimination and it was pleasing to see many candidates gaining full marks.

Comments on individual questions

Question 1

It is reasonably common practice to begin the test with a straightforward question, but, in this case, the question proved very easy. 'Reproduction' was too implausible as a term for the removal of waste products of metabolism to attract any candidates at all, and 'nutrition' and 'respiration' faired little better, rendering the question of little value as a discriminator with 97% selecting the correct answer.

Question 2

This question highlighted the uncertainty in the minds of candidates over the use of capital letters in the binomial system of nomenclature. Almost a quarter of them, significantly the weaker ones, felt that capitals should be used for both the generic and specific names.

Question 7

A common misconception at this level is that cilia act as some sort of filter to trap bacteria. This misconception was confirmed by the 34% who opted for **D.**

Question 14

This question exposed a confusion between the positive results for the biuret and Benedict's tests, or, perhaps, over the food tests for which these reagents are used. Almost a quarter of the candidates felt that a brick-red colour is a positive test result for a protein.

Question 15

This question could have been answered with little biological knowledge. However, candidates should have realised that the upper surface of a leaf, where, in their likely experience, there is a waxy cuticle and no stomata, would be unlikely to lose water faster than the lower surface.

Question 17

This was the most difficult question on the paper. There appeared to be a considerable degree of guess-work, though it may be that the wording of the question was a little convoluted and thus confusing. Effectively, the question asked 'What does not travel in the phloem?' The answer for several of the better candidates was 'water' – presumably because they know that water is carried in the xylem, but forgetting that substances in the phloem must move in solution.

Question 22

Almost 80 % of candidates correctly rejected the ureter as a tube that carries glucose, yet still almost a third also discounted the renal vein, suggesting they had not thought carefully enough about what happens to the glucose as blood passes through the kidney.

Question 27

This was another question which proved very easy.

Questions 34 and 35

Candidates found these questions relatively easy, although they did differentiate at the lower end of the ability range.

BIOLOGY

Paper 0610/02
Core Theory

General comments

This year a significant number of candidates did not attempt every part of all questions and this appeared to be linked to the demands of some of the questions rather than having insufficient time to complete the paper. There were candidates who showed very limited knowledge of some topics from the syllabus and all candidates found the paper demanding in at least some of its aspects.

The questions in which candidates were asked to make predictions were answered with greater skill this year. However, there was evidence in a number of places that candidates had not read the questions with sufficient care 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 demand of each question. This was especially noticeable in questions where a specific number of responses were requested and candidates clearly exceeded this by adding further numbered responses. For instance, in **4(b)(ii)** some candidates numbered a space as 4 and gave a fourth response; similarly in **4(c)(ii)**, **8(b)(i)** and **9(a)(iv)**. Examiners will take account of the responses in the numbered spaces printed on the paper and will only take account of additional responses if a numbered space is left blank or is clearly a replacement for one of the numbered spaces.

A lot of candidates altered responses this year and they should be encouraged to make it very clear which response is their intended answer and if it is not in the designated answer space where the replacement response is situated.

Comments on specific questions

Question 1

The majority of candidates responded in the manner requested although a small but significant number inserted no ticks but gave names, or inserted the ticks but no names. Very few seemed to be guessing by inserting the common names for the six arthropods without any ticks. The use of names not given in the key may prevent a candidates gaining full credit if they make an error. This was obvious with a number identifying arthropod **C** as a 'spider' when in fact it is a 'tick'. Many gained full credit and others just missed full marks as they omitted one answer. The commonest error was to identify arthropod **B** as *Musca* and arthropod **E** as *Anopheles*. When candidates wish to alter their responses in such a question they must be certain that they have made it clear which ticks are to be taken note of and which are to be ignored and the same applies to changes of arthropod name.

Question 2

A large proportion of the candidates appreciated that many waste products are toxic although many seemed rather muddled between the ureter and urethra, renal vein and artery and the urinary bladder and the gall bladder in **(b)**. Many suggested that the organ storing urine was the kidney itself or even the stomach. Others believed that vessels such as the hepatic portal vein, pulmonary artery and vein and the aorta drained blood from the kidney.

Few candidates appreciated that the question in **(c)** was about 'how' the kidneys remove waste material and not 'why' it was removed or 'what' was removed. Reference to filtration and reabsorption were expected. In **(d)** few candidates linked deamination to the liver and many quoted that the amino acids were broken down into a wide variety of products of digestion or digestive enzymes, especially protease, rather than urea. Many responses to both **(c)** and **(d)** suggested that insufficient care was taken in reading the question.

Question 3

The introduction to **(a)** was about flowering plants, yet a number of candidates' responses centred on fertilisation in humans and even described intercourse as if this was fertilisation. Responses required the correct use of precise biological terms and thus flower was not an adequate alternative for anther or stigma. Many think that the actual pollen grain fuses with the ovule when in fact only the nuclei of cells fuse within the ovule. Good candidates commented on the fact that fertilisation is dependent on pollination occurring, or that pollination depends upon a transfer agent while fertilisation does not and that the former is external while the latter is internal within the plant tissue. There were candidates who, despite the reference to sexual reproduction in the question introduction, gave answers on the addition of chemicals to land for plant growth.

Candidates should be aware that seeds develop from ovules and fruits from the complete ovary.

In **(c)** it was pleasing to note that many realised that apart from its role in pollination, the wind also plays a part in seed dispersal and in dispersing the scent of flowers to attract pollinating agents such as insects. Despite this, many responses muddled both pollination and seed dispersal and used the terms pollen and seed as if they were synonymous.

Question 4

Many candidates understood the aspects of the water cycle that were examined, but some thought light energy was needed for evaporation and only limited numbers realised that clouds were formed when water vapour is cooled and condenses. There were a variety of responses for **(b)(i)** including photosynthesis and respiration but many associated label **R** to transpiration with a number using the term evapo-transpiration, an equally correct term. Evaporation on its own was considered inadequate. In **(b)(ii)** a significant number offered three of the following four factors, temperature, humidity, wind movement and light.

Responses to **(c)(i)** suggested that the question was not read carefully as it refers to effects on the climate inland and very many responses dealt with other environmental effects such as soil erosion or the destruction of habitats. Those who applied their understanding of the water cycle realised that deforestation would reduce transpiration and thus lower air humidity, cloud formation and rainfall inland. Having quoted general effects on the environment many were left with little to add in **(c)(ii)** when the earlier responses would have gained credit.

Question 5

A significant number of candidates gained full credit. One weakness was a failure to link the two plant cell types to their relevant functions.

Question 6

The majority of candidates responded in **(a)(i)** with colours although there were some who offered numerical values which were assumed to be references to pH. A significant minority responded with colours that were not shown on the chart (Fig. 6.2). The attempts by candidates to explain the colours chosen for tubes **A** and **D** were very pleasing as most linked the colour changes to the respiration of the water shrimp or the photosynthesis of the pondweed. There were a few responses that did not give sufficient detail and others where breathing was used synonymously for respiration. Many candidates in **(b)** utilised and amalgamated their earlier responses to **(a)(ii)** and gave a suitable explanation for the colour they chose, which could have been pinky-red, yellow or purple.

Question 7

Knowledge of the topics in this question was poor overall. Few appreciated that sense organs are composed of sensory/receptor cells and that they respond to stimuli, or that the organs that detect chemicals are the nose and the tongue. The mouth was considered as an inadequate answer for the latter organ. Responses to **(b)** were very poor with very small numbers identifying the suspensory ligaments or realising that the lens becomes less convex for distant vision. Candidates should appreciate that the lens in the human eye never becomes concave. Candidates seemed to have great difficulty in interpreting the graphical data.

Question 8

Candidates were able to correctly label the sperm duct and the urethra, but were less confident of where gametes and testosterone were formed. However, there was again the muddling of the ureter with the urethra. (*cf*. comment for **2(b)**). Candidates should be aware that it is essential that label lines terminate clearly on the structure that they are labelling. Although most of the responses in **(b)** were linked to features in males regulated by testosterone, very many were rather vague and gained no credit. 'Developing a more muscular build' was acceptable but 'developing muscles' was inadequate, similarly 'producing sperm' or 'widening of shoulders' were acceptable but 'sperm' and 'shoulders' were not. In completing the sentences in **(c)** the commonest correct responses were the third and fourth while the most common erroneous response was the second. The selection of the first response seemed very much to be an even choice of the two types of nuclear division.

Question 9

A very large proportion of candidates either offered only one response, or one of the responses was a mineral ion or an element such as 'nitrogen' or 'phosphorous' rather than 'nitrates' or 'phosphates'. Magnesium and nitrates were the commonest correct response. Common errors included substances such as glucose, amino acids etc. Many candidates seemed unaware of the effects of the overuse of fertilisers and suggested that the fertilisers burnt or destroyed the soil or the plants in it. There were responses that dealt with eutrophication, with or without recourse to that term, in great detail and which were worthy of many more than the maximum four marks. Very few seemed aware of the nature of herbicides or pesticides. The former was thought by many to kill herbivores, most especially insects, rather than weeds (herbaceous plants). Those who did make the correct link went on to describe how this removed competition for minerals, water or light. Herbicides and pesticides were thought by many to damage the soil by having effects similar to those erroneously suggested for fertilisers. A few recognised that pesticides can kill not only pests but other animals which may be vital in the environment that contains insect pollinators or predators of the pests themselves.

In **(b)** the two terms were poorly understood and few related artificial selection to the selection of plants that were interbred to hopefully produce another generation with combined or improved advantageous features, or that genetic engineering was a technique to alter the genes or DNA within plants to improve their inherited features and that both could be used to improve the yields of crops. There were many references to genetic engineering in which the only comment was the involvement of scientists or that it involved machinery. Some overlooked the reference to crops in the question and based their responses on selecting or altering the genes of animals.

Location Entry Codes

UNIVERSITY of CAMBRIDGE
International Examinations

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 0610/31
Extended Theory

General comments

This paper concentrated on several topics from the supplement part of the syllabus that candidates often find difficult to explain. Question **5(d)** proved to be the most challenging question on the paper. There were more marks for longer answer questions than in some previous papers with more space provided on the examination paper. This worked well as candidates rarely needed to continue answers beyond the dotted lines. It appeared that candidates had sufficient time to answer the paper; blank spaces were indicative of lack of knowledge rather than insufficient time.

The wording of the questions did not pose too many problems. As in June 2008 it was the question on natural selection that candidates found most difficult to answer. Most understood the question, but were not precise enough in their answers. They failed to take a cue from the genetic diagram and use the genotypes in their answers.

The calculations in **2(b)(ii)**, **4(b)** and **6(b)** were done well. The Examiners were pleased to see most candidates attempt these. In **2(b)(ii)** and **6(b)** candidates wrote out their working which meant that if they made a slip in calculating the answer the Examiners could award a mark if it was done correctly. It was obvious that some candidates did not have calculators. The major problem in **2(b)** was measuring in centimetres but not taking this into account when calculating the magnification. As a result many candidates gave answers that were incorrect by a factor of 10. It is important that, when quoting data in support of an answer, the relevant units are included. In **4(c)** candidates were expected to use the data from table 4.1 including units for wind speed and water uptake. Most gave units for each figure they used, but some gave no units at all or only used them for some of the figures. Each figure must be accompanied by its appropriate unit.

The following questions were very accessible to almost all candidates: **1**, **2(a)** and **(b)**, **4(b)** and **(d)**, **5(c)** and **6(e)**. More difficult were **4(f)** and **5(d)** which required careful interpretation of the question and good phraseology. In answering these questions candidates often struggled to express complex ideas and include sufficient key facts to score highly. However, the Examiners were very pleased to read some excellent, well phrased answers that showed a great depth of knowledge. In general, there were many who gave full descriptions and explanations showing a good grasp of biological vocabulary and a good command of English.

The paper generated a good spread of marks, with almost all candidates attempting all parts of each question. Many demonstrated considerable biological knowledge and had learnt the material, even though they did not always apply it correctly in interpreting the questions. There were some instances of considerable over-teaching with unnecessary detail for this level. The Examiners saw examples of this in the questions on blood clotting (**3(d)**) and hormonal control of glucose (**2(c)**).

There were some candidates who had obviously been entered for the incorrect level of paper and who struggled with many of the questions.

Comments on specific questions

Question 1

Almost all candidates used ticks and crosses to complete the table. Some candidates changed their minds and changed ticks into crosses. Some may well have tried to change crosses to ticks, but in all cases crossed ticks were treated as crosses. The most common mark was 3 out of 4 since many candidates were unsure how to answer the row for scales / scaly skin. They often gave a cross for birds. The Examiners

accepted a cross if it was qualified by a statement to the effect that birds have scales on their legs and/or feet. Weaker candidates thought that amphibians and reptiles have external ears.

Question 2

(a) The Examiners had a lengthy list of likely tubular structures that were accepted in answer to **(i)**. Most candidates gave the small intestine, duodenum or ileum. Common errors were the pancreas, which is drained by the hepatic portal vein but is not tubular, the stomach and the kidney. Most answers to part **(ii)** were correct, although some candidates omitted *portal* from their answers. The Examiners accepted some misspellings such as 'hephatic' that they found quite frequently. 'Artery', 'pulmonary artery' and 'renal vein' were common errors.

(b) The three structures in Figure 2.2 were identified correctly in **(i)** by most candidates. Some candidates thought that the nucleus was a vacuole and the cell membrane was occasionally identified as the 'cell wall'. Candidates who measured the line **P**-**Q** in millimetres, or converted from centimetres to millimetres, calculated the magnification successfully as x2000 in part **(ii)**. The Examiners awarded one mark for those who did not reach the right answer but knew that they should divide a measurement by the actual size (0.06). Some candidates worked entirely in centimetres and divided by 0.6 so achieved the correct answer. Candidates should be advised always to measure drawings and photographs in millimetres.

(c) Candidates showed a good knowledge of the action of insulin and glucagon on liver cells in controlling the blood glucose concentration. Good answers included references to insulin stimulating an increase in the absorption of glucose and its storage as glycogen. The role of glucagon in stimulating the breakdown of glycogen to glucose and its movement into the blood was also included. Good answers kept to the key principles and did not repeat the question; these candidates often scored highly with concise answers. Common errors were to state or imply that the two hormones acted as enzymes, confusion between glucagon, glycogen, glucose and the use of hybrid words such as glycose and glucogen. Some candidates answered the second part of the question with reference to reduction of insulin output without mentioning glucagon. Relatively few references were made to the effects on the concentration of glucose in the blood and those that were attempted were rather vague. Few mentioned that this is an example of homeostasis or negative feedback. Many weaker candidates gave rambling, unfocused answers. A common misconception in these answers was that the liver or the hypothalamus stimulates the pancreas to release hormones. There were quite a few examples of candidates giving unnecessary detail, for example about the role of the hypothalamus and about alpha and beta cells in the pancreas, which does not gain credit at this level.

(d) The question asked candidates to describe what happens to amino acids *inside* liver cells. Some candidates missed this and discussed the formation of proteins elsewhere in the body, for example in muscle cells. Many, however, showed a good understanding of deamination and urea production often going beyond the demands of the syllabus. Most described deamination or stated that amino acids are broken down with the formation of urea. Some stated what the remainder of the amino acid molecule was, but did not state that it is used for storage or for respiration. Common errors were stating that 'excess amino acids are stored for later use' and extensive descriptions of removal of urea by the kidney. Most candidates gained at least two marks here although some were clearly confused about what exactly happens in deamination.

Question 3

(a) Candidates had to describe the changes in activity of an enzyme with increasing temperature. Many did this, successfully quoting appropriate temperatures such as 10 ^{o}C, 50 ^{o}C / 60 ^{o}C and the optimum at 90 ^{o}C. Others described the changes without quoting these key temperatures and thus were not awarded any marks. Many *explained* the changes that occurred referring to collisions, active sites and denaturation. This was not required by the question. Those that did describe the effect of increasing temperature failed to quote temperatures accurately from the information given. Most described an increase from 0 ^{o}C rather than from 10 ^{o}C. A surprising number of candidates stated that the temperature with the highest activity was 80 ^{o}C and not 90 ^{o}C. Candidates must read graphs accurately to gain marks. The Examiners were disappointed to see some candidates ignore the graph completely and state that the optimum temperature of the enzyme was 37 ^{o}C.

(b) This question proved to be a good discriminator as it required careful reading. The better candidates easily gained maximum marks. Many candidates gave answers that were too general, others gave lengthy descriptions of the techniques of genetic engineering that were not appropriate and some described the action of washing powder enzymes which they often repeated in **(c)**. This question was about culturing bacteria in a fermenter or bioreactor, providing a suitable feedstock and conditions, such as temperature and pH, and harvesting the enzymes that may be secreted by the bacteria or made internally. The Examiners did not award a mark for 'harvesting enzymes' unless other points on the mark scheme were given.

(c) This question was answered very well by many candidates who gave good detail about lipases and proteases in biological washing powders. Some also mentioned amylases and cellulases that are also in some brands of washing powder. A mark was available to reward comments about the soluble nature of the products of their action, but this was only awarded to answers that gained at least one other point. Those who did not quote the products of digestion usually gained a mark for stating that these are soluble and easily washed away having correctly named the enzymes involved.

(d) Many candidates showed a good understanding of the process of blood clotting. There was some misunderstanding about the role of thrombin (which is a protease) with some candidates confusing it with fibrin. Some candidates had obviously been taught the process in considerable detail and were unclear about the roles of thrombokinase and prothrombin. Some reversed the roles of fibrinogen and fibrin, but many stated that fibrin forms a mesh or network in the wound. Many candidates did not gain any marks here. Some gained one mark for stating that a 'protease' is involved but were unsure of its action. Some mentioned the 'insolubility of fibrin' but did not make it clear that fibrinogen is soluble. Many answers included confused descriptions of platelet response that were not appropriate and some suggested that fatty meals contributed to clotting.

Question 4

(a) Candidates responded well to the instruction to use the term *water potential* in their answers and many referred to a gradient between the soil and the root hairs. Some struggled with the concept, stating that water moves from a low water potential to a high water potential, but they often included osmosis in their answers and so gained one mark. Some mentioned water potential and then referred to 'concentrations of water', stating that water moves from 'high to low' without making it clear that they meant down a water potential gradient. Candidates should always use the term water potential in questions of this sort and there were few references to 'water concentrations'. Only better answers referred to partially permeable membranes. However, there were many good answers including those from lower scoring candidates and water potential was well known. Some did not make any reference to water crossing a membrane; the last marking point on the scheme was not seen very often as very few related the solutes in the root hair to its low water potential.

(b) Almost all candidates calculated the rate of water uptake correctly as 20.0 mm per minute. Some candidates left this question blank suggesting that they did not see it.

(c) There were many good descriptions of the trend shown in the table. However, many did not give figures in support of their answers. Of those that did give figures, some did not use any units; others used them inconsistently so often only gained one mark. Hardly anyone noticed that the pattern is not linear. Candidates could have sketched a graph of the results in the white space on the examination paper to see this.

(d) This was well answered with temperature and humidity appearing most often, but some answers were spoiled by imprecise expressions such as 'amount of light'.

(e) There were many correct references to the use of water in photosynthesis and maintaining turgidity. To gain a mark for transport candidates had to identify something that is transported such as sucrose, amino acids, ions or even just solutes or food substances. The Examiners insisted that the term translocation be qualified with the name of a substance transported as in 'translocation of sugars' that appeared on scripts occasionally.

(f) Many candidates clearly understood the idea of mass flow down a water potential gradient and had some understanding of cohesion-tension, but they struggled to express this coherently and did not include the specific details required by the mark scheme. Many did not score more than one mark. For example they made no reference to stomata but stated that 'water is lost by evaporation from the leaves' or 'water evaporates into the air around the leaf' which did not gain credit. A significant number of candidates described water being pushed up the plant, down a water potential gradient by water entering the root through osmosis. There were some references to root pressure. These candidates appear not to have recognised the importance of the wording of the question. Mention of osmosis, root pressure, suction and capillarity were frequent but they did not tell a coherent story. Many realised that water molecules stick together, although the word 'cohesion' often occurred in the middle of a jumble of incorrect statements which suggests that they had simply learnt the word without any understanding. Candidates who had written confidently about water potentials in part **(a)** wrote vaguely about water pressures and 'like sucking on a straw'. Surprisingly few stayed with the words of the question and wrote about 'the tops of trees' and did not refer to leaves. Good candidates recognised that loss of water vapour reduced the water potential in leaves so that water was drawn into the air spaces from the xylem.

(g) The Examiners saw a wide range of adaptations for hot, dry environments. Some answers were not specific enough. 'Long roots' was considered to be too vague and Examiners insisted on 'deep roots' and 'long, shallow roots' or similar descriptions. Cuticles were often just described as 'waxy' instead of 'thick waxy'. Descriptions of stomata opening only at night did not gain credit as the question asked for structural adaptations. There were many vague references to root systems and 'spines' but these were not linked to the structural adaptations required by the question.

Question 5

(a) Many candidates gave definitions that were far too generalised and this question revealed many misconceptions of an important biological term. The Examiners rewarded definitions that stated that a gene is made of DNA or is part of a chromosome and codes for a protein or controls a characteristic. Therefore candidates had to link two points in order to gain their mark. Language often let them down here, but many had learnt a suitable definition and were successful. The 2010 syllabus defines the term gene as 'a length of DNA that is the unit of heredity and codes for a specific protein. A gene may be copied and passed on to the next generation.' It is worth pointing out that many terms are defined in the 2010 syllabus and candidates should expect to recall these in future examinations.

(b) The Examiners saw many excellent genetic diagrams which were presented very clearly. Some candidates may have been confused by the two short lines for the gametes and they only gave one allele for each of the parents instead of two in the normal way. However, many then drew a Punnett square or criss-cross lines giving all four types of gametes in the usual way so gained the mark for giving the gametes. A few candidates did not identify the genotype of the child with sickle cell anaemia. Common errors included giving only one allele for each of the parents, gametes and child. Some used both the alleles given in the question and N and S (often in a Punnett square). They were not penalised for this. It was not uncommon to see X and Y written down as the gametes.

(c) Some candidates gave superb answers describing the effects of sickle cell anaemia on the body. There was some confusion about what 'sickle shape' is, and also if it was the cell or the haemoglobin that is sickle-shaped. Capillaries were not always identified as the blood vessels that are blocked by sickle cells. Most candidates gained the mark for the inability to transport as much oxygen as normal and many developed this theme through their answer very well indeed. Some of the points on the mark scheme were not seen very often, particularly those numbered 10, 11, 12 and 13, but the Examiners anticipated that candidates would know quite a wide variety of effects as indeed was the case.

(d) This was undoubtedly the most challenging question on the paper and was generally poorly answered. Many candidates did not mention the link between malaria and the geographical distribution in the map although some described this in detail, with an impressive knowledge of geography, without giving any biological explanation. It was hoped that candidates would take a cue from the genetic diagram in **(b)** to structure their answers around the three genotypes explaining that the heterozygotes (or carriers of the sickle cell allele) have a resistance to malaria. The Examiners rejected the terms 'immune' and 'immunity' here only awarding a mark if 'resistant' or some other acceptable alternative was given. As immunity is studied in this syllabus, the

Examiners consider that candidates should know that this is not an example. Unfortunately, the majority of candidates did not specify the different genotypes and the Examiners had to pick out correct statements which referred to 'the H^S allele' or 'the allele for sickle cell anaemia'. Possession of the allele does confer resistance, so this gained a mark, but possession of the normal allele (H^N) does not mean there is no resistance to malaria since the heterozygotes have this allele. Many candidates stated that people with the sickle cell allele survive and have children without distinguishing carriers from those who are homozygous recessive. Poorer answers tended to refer only to normal and abnormal haemoglobin rather than dealing with genotypes. Unfortunately, most candidates did not answer the question asked and did not explain clearly the role of the allele. Many answers did not distinguish having sickle cell anaemia from having just a single allele (H^S) and being heterozygous. Many answered it simply in terms of natural selection and Darwin's theory without being specific enough to gain marks.

(e) There were many impressive answers to this question which showed that candidates were applying their knowledge of variation to this example – something which they may never have done before. Some candidates described *continuous variation* which was unnecessary. However, many referred to the genetic nature of the condition and the fact that the environment does not have any effect. They also stated that there are distinct groups, which were described in terms of phenotype or genotype, and the absence of intermediates.

Although many recognised the genetic component and/or stated that the environment was not involved, they failed to explain the other points required by the mark scheme. They often simply stated that sickle cell anaemia is 'like blood groups but not like height or weight'. It was often difficult for the Examiners to tease out marking points 1, 2 and 3 from the answers.

Question 6

(a) In part **(i)** there was the usual confusion between nitrogen fixation and nitrification. In **(ii)**, some candidates thought that decomposition and decay are two different processes. The Examiners were impressed to find some candidates using the term *ammonification* in their answers. Candidates were better informed about the nitrogen cycle than in recent years.

(b) Almost all candidates calculated the percentage correctly as 24%.

(c) Candidates gave a range of uses of nitrogen compounds in the cattle's diet. Many stated that they would be used to make proteins and then listed some examples. Others referred to growth and repair and also to respiration. This is a good question to get candidates to think of the fate of such compounds in the body and their uses that are covered in different parts of the syllabus. 'Making cheese and yoghurt' did suggest to the Examiners that a candidate had misread the question. There were also many answers that included 'urine', 'excretion' and 'faeces'.

(d) Candidates made good use of Figure 6.1 to describe the fate of the nitrogen compounds after leaving the bodies of the cattle. Many gained marks by referring to urine and faeces, but many developed their answers to describe what happens to urea in the environment. While many mentioned nitrification they did not state that nitrate ions are produced and then absorbed by plants. Some explained that the nitrogen compounds would enter waterways and then described eutrophication and the depletion of oxygen in waters receiving faeces and urine from the cows in considerable detail. The Examiners awarded some marks to this approach but did not think that it was acceptable to award more than two for this line of argument. Some candidates did not read the question carefully and referred to other uses of nitrogen compounds in the cattle such as in the growth of muscle and horns. Candidates were sometimes confused about what the question required and only gained two marks for 'urine and faeces'. Few gained marking points 6, 7 and 8 on the mark scheme. The phrase 'in their bodies' in the question was not understood by weak candidates and it was unfortunate that answers to this section overlapped with question **2(d)**. If they had had difficulty with deamination and the compounds in that question then they had them again here.

(e) Most candidates were able to give quite lengthy answers with plenty of the marking points from the mark scheme.

BIOLOGY

Paper 0610/32
Extended Theory

General comments

This paper concentrated on several topics from the supplement part of the syllabus that candidates often find difficult to explain. Question **5(d)** proved to be the most challenging question on the paper. There were more marks for longer answer questions than in some previous papers with more space provided on the examination paper. This worked well as candidates rarely needed to continue answers beyond the dotted lines. It appeared that candidates had sufficient time to answer the paper; blank spaces were indicative of lack of knowledge rather than insufficient time.

The wording of the questions did not pose too many problems. As in June 2008 it was the question on natural selection that candidates found most difficult to answer. Most understood the question, but were not precise enough in their answers. They failed to take a cue from the genetic diagram and use the genotypes in their answers.

The calculations in **2(b)(ii)**, **4(b)** and **6(b)** were generally done well. The Examiners were pleased to see most candidates attempt these. In **2(b)(ii)** and **6(b)** candidates wrote out their working which meant that if they made a slip in calculating the answer the Examiners could award a mark if this was done correctly. It was obvious that some candidates did not have calculators. The major problem in **2(b)** was measuring in centimetres but not taking this into account when calculating the magnification. As a result many candidates gave answers that were incorrect by a factor of 10. It is important that, when quoting data in support of an answer, the relevant units are included. Most gave units for each figure they used, but some gave no units at all or only used them for some of the figures. Each figure must be accompanied by its appropriate unit.

The following questions were very accessible to almost all candidates: **1**, **2(a)** and **(b)** and **5(c)**. More difficult was **5(d)** which required careful interpretation of the question and good phraseology. In answering these questions candidates often struggled to express complex ideas and include sufficient key facts to score highly. However, the Examiners were very pleased to read some excellent, well phrased answers that showed a great depth of knowledge. In general, there were many who gave full descriptions and explanations showing a good grasp of biological vocabulary and a good command of English.

The paper generated a good spread of marks, with almost all candidates attempting all parts of each question. Many demonstrated considerable biological knowledge and had learnt the material, even though they did not always apply it correctly in interpreting the questions. There were some instances of considerable over-teaching with unnecessary detail for this level. The Examiners saw examples of this in the questions on blood clotting (**3(d)**) and hormonal control of glucose (**2(c)**).

There were some candidates who had obviously been entered for the incorrect level of paper and who struggled with many of the questions.

Comments on specific questions

Question 1

Almost all candidates used ticks and crosses to complete the table. Some candidates changed their minds and changed ticks into crosses. Some may well have tried to change crosses to ticks, but in all cases crossed ticks were treated as crosses. The most common mark was 3 out of 4 since many candidates were unsure how to answer the row for scales / scaly skin. They often gave a cross for birds. The Examiners accepted a cross if it was qualified by a statement to the effect that birds have scales on their legs and/or feet. Weaker candidates thought that amphibians and reptiles have external ears.

Question 2

(a) The Examiners had a lengthy list of likely tubular structures that were accepted in answer to **(i)**. Most candidates gave the small intestine, duodenum or ileum. Common errors were the pancreas, which is drained by the hepatic portal vein but is not tubular, the stomach and the kidney. Most answers to part **(ii)** were correct, although some candidates omitted *portal* from their answers. The Examiners accepted some misspellings such as 'hephatic' that they found quite frequently. 'Artery', 'pulmonary artery' and 'renal vein' were common errors.

(b) The three structures in Figure 2.2 were identified correctly in **(i)** by most candidates. Some candidates thought that the nucleus was a vacuole and the cell membrane was occasionally identified as the 'cell wall'. Candidates who measured the line **P**-**Q** in millimetres, or converted from centimetres to millimetres, calculated the magnification successfully as x2000 in part **(ii)**. The Examiners awarded one mark for those who did not reach the right answer but knew that they should divide a measurement by the actual size (0.06). Some candidates worked entirely in centimetres and divided by 0.6 so achieved the correct answer. Candidates should be advised always to measure drawings and photographs in millimetres. number of errors they saw on scripts considering that this type of question is common on Paper 6.

(c) Candidates showed a good knowledge of the action of insulin and glucagon on liver cells in controlling the blood glucose concentration. Good answers included references to insulin stimulating an increase in the absorption of glucose and its storage as glycogen. The role of glucagon in stimulating the breakdown of glycogen to glucose and its movement into the blood was also included. Good answers kept to the key principles and did not repeat the question; these candidates often scored highly with concise answers. Common errors were to state or imply that the two hormones acted as enzymes, confusion between glucagon, glycogen, glucose and the use of hybrid words such as glycose and glucogen. Some candidates answered the second part of the question with reference to reduction of insulin output without mentioning glucagon. Relatively few references were made to the effects on the concentration of glucose in the blood and those that were attempted were rather vague. Few mentioned that this is an example of homeostasis or negative feedback. Many weaker candidates gave rambling, unfocused answers. A common misconception in these answers was that the liver or the hypothalamus stimulates the pancreas to release hormones. There were quite a few examples of candidates giving unnecessary detail, for example about the role of the hypothalamus and about alpha and beta cells in the pancreas, which does not gain credit at this level.

(d) The question asked candidates to describe what happens to amino acids *inside* liver cells. Some candidates missed this and discussed the formation of proteins elsewhere in the body, for example in muscle cells. Many, however, showed a good understanding of deamination and urea production often going beyond the demands of the syllabus. Most described deamination or stated that amino acids are broken down with the formation of urea. Some stated what the remainder of the amino acid molecule was, but did not state that it is used for storage or for respiration. Common errors were stating that 'excess amino acids are stored for later use' and extensive descriptions of removal of urea by the kidney. Most candidates gained at least two marks here although some were clearly confused about what exactly happens in deamination.

Question 3

(a) Candidates had to describe the changes in activity of an enzyme with increasing temperature. Many did this, successfully quoting appropriate temperatures such as 10 ^{o}C, 50 ^{o}C / 60 ^{o}C and the optimum at 90 ^{o}C. Others described the changes without quoting these key temperatures and thus were not awarded any marks. Many *explained* the changes that occurred referring to collisions, active sites and denaturation. This was not required by the question. Those that did describe the effect of increasing temperature failed to quote temperatures accurately from the information given. Most described an increase from 0 ^{o}C rather than from 10 ^{o}C. A surprising number of candidates stated that the temperature with the highest activity was 80 ^{o}C and not 90 ^{o}C. Candidates must read graphs accurately to gain marks. The Examiners were disappointed to see some candidates ignore the graph completely and state that the optimum temperature of the enzyme was 37 ^{o}C.

(b) This question proved to be a good discriminator as it required careful reading. The better candidates easily gained maximum marks. Many candidates gave answers that were too general, others gave lengthy descriptions of the techniques of genetic engineering that were not appropriate and some described the action of washing powder enzymes which they often repeated in **(c)**. This question was about culturing bacteria in a fermenter or bioreactor, providing a suitable feedstock and conditions, such as temperature and pH, and harvesting the enzymes that may be secreted by the bacteria or made internally. The Examiners did not award a mark for 'harvesting enzymes' unless other points on the mark scheme were given.

(c) This question was answered very well by many candidates who gave good detail about lipases and proteases in biological washing powders. Some also mentioned amylases and cellulases that are also in some brands of washing powder. A mark was available to reward comments about the soluble nature of the products of their action, but this was only awarded to answers that gained at least one other point. Those who did not quote the products of digestion usually gained a mark for stating that these are soluble and easily washed away having correctly named the enzymes involved.

(d) Many candidates showed a good understanding of the process of blood clotting. There was some misunderstanding about the role of thrombin (which is a protease) with some candidates confusing it with fibrin. Some candidates had obviously been taught the process in considerable detail and were unclear about the roles of thrombokinase and prothrombin. Some reversed the roles of fibrinogen and fibrin, but many stated that fibrin forms a mesh or network in the wound. Many candidates did not gain any marks here. Some gained one mark for stating that a 'protease' is involved but were unsure of its action. Some mentioned the 'insolubility of fibrin' but did not make it clear that fibrinogen is soluble. Many answers included confused descriptions of platelet response that were not appropriate and some suggested that fatty meals contributed to clotting.

Question 4

(a) This was generally answered very well with candidates showing a good knowledge of the use of energy from respiration in active uptake. There was some confusion about the direction of the concentration gradient and some stated that ions move with the gradient and that this requires energy. Some candidates stated correctly that ions move against the concentration gradient and then contradicted themselves by describing root cells as having a lower concentration of ions than the soil. When this happens candidates lose a mark for directly contradicting themselves. Some candidates became muddled with active uptake and water potential and concentrations of water. Several candidates mentioned 'carriers' in the membrane, but failed to gain a mark for this as they did not mention their protein nature. The majority were clear about roles of mitochondria and cellular respiration in active uptake.

(b) Some candidates missed this calculation and some found it difficult to work out what they had to do. There were quite a few incorrect answers. A surprising number could not work out rate of growth and calculations scribbled in the margins showed that they had looked for obscure mathematical links rather than read the column headings.

(c) There was a long list of factors that candidates could control. The Examiners rejected answers that referred to 'the amount of light', 'the amount of nutrients' and 'the amount of carbon dioxide'. Candidates should always refer to light intensity, concentration or volume of nutrients and the concentration of carbon dioxide.

(d) To gain three marks candidates had to state that the radish plants would be dried for a given length of time. Some candidates stated that the plants would be placed in an oven or in the sun but did not give any length of time. Many candidates stated that the plants would be boiled or placed in a concentrated solution so water would be removed by osmosis. These answers did not gain marks. Very few candidates stated how they would obtain the mass of the plants. It is standard practice to place the plant material to dry and take repeat weighings until two readings are the same. The phrase 'weighing to constant mass' was expected, but was seen in very few scripts.

(e) There were many good answers to part **(i)**. The Examiners did not award marks for stating that the plants or stems would be 'weak'. Some candidates stated that the plants would be wilted which was not accepted either. Part **(ii)** was also answered well although some candidates stated that protein would be formed and then said that this would be converted into amino acids rather than the other way around.

(f) This was also answered very well. The steps in the link between lack of chlorophyll and lack of growth were explained well. Common errors were to state that magnesium is used to make chloroplasts and to describe the role of chlorophyll rather than the effect of its deficiency.

Question 5

(a) Many candidates gave definitions that were far too generalised and this question revealed many misconceptions of an important biological term. The Examiners rewarded definitions that stated that a gene is made of DNA or is part of a chromosome and codes for a protein or controls a characteristic. Therefore candidates had to link two points in order to gain their mark. Language often let them down here, but many had learnt a suitable definition and were successful. The 2010 syllabus defines the term gene as 'a length of DNA that is the unit of heredity and codes for a specific protein. A gene may be copied and passed on to the next generation.' It is worth pointing out that many terms are defined in the 2010 syllabus and candidates should expect to recall these in future examinations.

(b) The Examiners saw many excellent genetic diagrams which were presented very clearly. Some candidates may have been confused by the two short lines for the gametes and they only gave one allele for each of the parents instead of two in the normal way. However, many then drew a Punnett square or criss-cross lines giving all four types of gametes in the usual way so gained the mark for giving the gametes. A few candidates did not identify the genotype of the child with sickle cell anaemia. Common errors included giving only one allele for each of the parents, gametes and child. Some used both the alleles given in the question and N and S (often in a Punnett square). They were not penalised for this. It was not uncommon to see X and Y written down as the gametes.

(c) Some candidates gave superb answers describing the effects of sickle cell anaemia on the body. There was some confusion about what 'sickle shape' is, and also if it was the cell or the haemoglobin that is sickle-shaped. Capillaries were not always identified as the blood vessels that are blocked by sickle cells. Most candidates gained the mark for the inability to transport as much oxygen as normal and many developed this theme through their answer very well indeed. Some of the points on the mark scheme were not seen very often, particularly those numbered 10, 11, 12 and 13, but the Examiners anticipated that candidates would know quite a wide variety of effects as indeed was the case.

(d) This was undoubtedly the most challenging question on the paper and was generally poorly answered. Many candidates did not mention the link between malaria and the geographical distribution in the map although some described this in detail, with an impressive knowledge of geography, without giving any biological explanation. It was hoped that candidates would take a cue from the genetic diagram in **(b)** to structure their answers around the three genotypes explaining that the heterozygotes (or carriers of the sickle cell allele) have a resistance to malaria. The Examiners rejected the terms 'immune' and 'immunity' here only awarding a mark if 'resistant' or some other acceptable alternative was given. As immunity is studied in this syllabus, the Examiners consider that candidates should know that this is not an example. Unfortunately, the majority of candidates did not specify the different genotypes and the Examiners had to pick out correct statements which referred to 'the H^S allele' or 'the allele for sickle cell anaemia'. Possession of the allele does confer resistance, so this gained a mark, but possession of the normal allele (H^N) does not mean there is no resistance to malaria since the heterozygotes have this allele. Many candidates stated that people with the sickle cell allele survive and have children without distinguishing carriers from those who are homozygous recessive. Poorer answers tended to refer only to normal and abnormal haemoglobin rather than dealing with genotypes. Unfortunately, most candidates did not answer the question asked and did not explain clearly the role of the allele. Many answers did not distinguish having sickle cell anaemia from having just a single allele (H^S) and being heterozygous. Many answered it simply in terms of natural selection and Darwin's theory without being specific enough to gain marks.

(e) There were many impressive answers to this question which showed that candidates were applying their knowledge of variation to this example – something which they may never have done before. Some candidates described *continuous variation* which was unnecessary. However, many referred to the genetic nature of the condition and the fact that the environment does not have any effect. They also stated that there are distinct groups, which were described in terms of phenotype or genotype, and the absence of intermediates.
Although many recognised the genetic component and/or stated that the environment was not involved, they failed to explain the other points required by the mark scheme. They often simply stated that sickle cell anaemia is 'like blood groups but not like height or weight'. It was often difficult for the Examiners to tease out marking points 1, 2 and 3 from the answers.

Question 6

(a) A large number of answers to this question related to the animal rather than the plant and so lost marks. Most answers related to animals and animal feed; many wrote answers very similar to the ones they wrote in part **(c)**.

(b) This was answered very well with almost all candidates calculating the percentage as 19%.

(c) There was a good basic understanding of the ideas underpinning this question but insufficient detail in the answers to gain many marks. Many candidates included a lot of general description around the difference in energy at the first and second trophic levels but without mention of loss of energy at or between them. Answers, though quite coherent, were often not specific enough and so gained few marks. Some candidates lost one of the marking points by not using units to describe the energy available from the first trophic and second trophic levels. Some candidates were confused about where humans would be feeding by stating that they would be *at* the first trophic level when feeding on plants and *at* the second trophic level when eating meat. Some candidates were distracted into discussing eating at the first trophic level as a healthier option, with lack of saturated fats and cholesterol and higher quantity of dietary fibre. Candidates often did not gain the obvious points (1 and 2 on the mark scheme) because they did not refer to plants as producers, and animals as primary consumers in their answers, frequently using either the term 'plants' or 'consumer' in isolation. There were many rambling, repetitive answers which gained no credit.

(d) The answers were good when candidates referred to energy in their answers. Many explained that the animals would move around less when kept in sheds and would not need to generate heat.

(e) Many candidates were rather vague about the sources and effects of acid rain. However, others gave very specific answers referring to the increased use of fossil fuels and the effects of acid rain on limestone buildings. Poorer answers were often very general statements like 'destroys the environment', 'kills all the aquatic life' and 'damages buildings, plants and animals'. There was some confusion between acid rain and global warming. References to sulfur dioxide often failed to link it to the atmosphere.

BIOLOGY

Paper 0610/04

Coursework

General comments

New Centres continue to enter their candidates for this Paper, which is very good to see. Centres are reminded that they cannot enter candidates for this Paper without written approval from CIE. In-service training and distance training materials are available to help teachers to become confident in assessing their candidates' practical skills.

There is much evidence that candidates put a great deal of effort into their coursework, and develop their skills as investigative scientists who can think and make decisions for themselves. Many teachers are very imaginative in the tasks that they set their candidates.

The majority of Centres do not assess every piece of practical work that candidates do, but choose between 6 and 12 tasks that are assessed throughout the two-year course. Most assess two skills with each task, but a few choose to assess only one skill per task, and others assess three (either 1, 2 and 3 or 2, 3 and 4).

The great majority of Centres assess their candidates' practical skills entirely appropriately. Tasks are set at a level that allows candidates to access all of the criteria for each skill, and which are sufficiently demanding for IGCSE. Mark schemes are written that address all aspects of the generic criteria and that are specific for the particular task. Comments and marks are made on the candidates' work, making it possible for the external Moderators to see how and why marks have been awarded. The great majority of marks submitted are not changed by the external Moderators.

A few Centres, however, did not always choose suitable tasks. Centres are reminded of the statement in the syllabus that 'All assessments must be based on experimental work carried out by the candidates'. It is therefore not acceptable to use tasks that are based on, for example, a worksheet on which a set of results is provided, unless the candidates have been involved in the collection of those results. Similarly, on-line simulations, or simulations from a CD-ROM, are not suitable, as they do not constitute experimental work. Collecting results from a simulation is not the same as collecting them from a real-life experiment, so C2 cannot be properly assessed in this way. Nor can C3, as candidates cannot comment on sources of experimental error if they have not done the experiment.

It is also important that, for C4, candidates not only plan their own experiment but also carry it out. Unless they do this, they cannot meet all the criteria for this skill, such as making changes to their plan or evaluating their chosen procedures.

Centres are also reminded that is essential that the work submitted is the candidate's own, unaided work. It is not, for example, suitable for the class or groups to discuss a plan for an investigation together, and for individuals then to write up the plan and have it assessed. This is an excellent way of developing this skill, but is not appropriate for its assessment. It is just as important that the work for Paper 4 is entirely the candidate's own as it is for Paper 1, 2 or 3.

BIOLOGY

Paper 0610/05

Practical Test

General comments

The general standard of work was similar to that seen in previous sessions. The general comments are also similar to those made in previous sessions as the same points need to be made and acted upon if candidates' performance is to improve. Some Centres clearly follow the advice given in Examiner's Reports and their candidates are well-prepared and perform well.

A significant number of Centres did not submit Supervisor's Reports or a seating plan, although there were fewer omissions 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 observe and do, even if the material had looked or behaved in an unexpected way. 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 in the past have supplied photographs of specimens and test results, both of which were useful. It should be noted that the Supervisor's Report form found in the Confidential Instructions.

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, preferably in good time before the date of the examination.

There is an increasing tendency for candidates to use ballpoint pen or very thick pencil to draw diagrams and graphs. Centres should advise their candidates to use a well-sharpened pencil (preferably 2B) for diagrams and graphs. The lines and points should then be clear and unambiguous and any errors can be easily erased.

Comments on specific questions

Question 1

(a) Most candidates had been supplied with a suitable specimen, although some had been cut horizontally rather than vertically and in a few cases the cut had not been completed, so the two halves of the onion were still attached. While some drawings were very well executed, others were poor, with sketchy and ill-defined structures. A significant number of candidates used pen rather than pencil. The drawing should be large, clear, unshaded and have a clear outline rather than a sketchy outline. Even an unlabelled drawing here would have scored three marks. Many candidates experienced problems with the labelling, some not providing labels at all.

(b) (i) A significant number of candidates were unable to identify suitable similarities between the two specimens. The most common references were to colour or shape. While many candidates referred to the skins of the onion and potato, few recognised that the skins were thin.

(ii) Candidates were more easily able to state differences between the two specimens and could frequently identify two valid differences. It is important to indicate which specimen has the stated feature in order that a valid comparison can be made.

(c) (i) and (ii) Candidates were required to record observations rather than conclusions. Consequently, no credit was given for recording conclusions in Table 1.1. So an observation of 'blue-black' for S2 would be awarded a mark but 'starch present' or 'positive' would not, as these are conclusions. Those candidates who followed the instructions and recorded observations generally recorded those as expected.

(d)(i) Many candidates detailed the procedure that had been given on the previous page, for the initial preparation of the sample. The question had specifically asked about the test for a reducing sugar and marks are not given for repeating information or details of procedure given in the question. Most candidates correctly identified the reagent and had at least some idea of the way in which the test should be carried out. The requirement to consider safety precautions seemed to distract some candidates, as they supplied very general references with no explanation. Consideration of safety was Centre dependent, and from the candidates' answers it was evident which Centres routinely consider safety when conducting practical work.

(ii) Again, some candidates provided conclusions rather than observations. There was some evidence that candidates might not have been working carefully, as the observations in a significant number of cases showed that the potato contained more reducing sugar than the onion – whereas the opposite was expected. This is a situation in which Examiners look to the Supervisor's Report to see whether the results obtained by the candidate were an accurate reflection of the material supplied by the Centre, and if so a potentially incorrect answer could be credited.

(e) If candidates had read the question paper before starting to answer it, then it would have been clear that this is the point at which the conclusions should be made. Candidates tended to score their marks for conclusions of the food tests but the idea of the specimens as storage organs was not given as a widespread answer.

Question 2

(a) (i) This question was answered well by those candidates who attempted it. It was unfortunate that a significant proportion of candidates either did not know the answer or simply did not realise that they had to place a label on the diagram, as they had not spotted the question.

(ii) Candidates tended to express themselves poorly in answering this question. It was common to see incorrect references to veins or to arteries pumping blood around the body.

(b) (i) Many candidates followed the instructions and correctly completed Table 2.1. Some pulse measurements for 15 seconds were unreasonably low or high, but most figures quoted were within an appropriate range. It was surprising to see how many candidates were unable to multiply by 4, with some unlikely results recorded that appeared to bear no relationship to multiplying by 4. The most frequent error was incorrect rounding to 1 dp when calculating the mean.

(ii) Few candidates recognised that this would increase reliability. When this was mentioned, it was often in a group of other suggestions, the most common one being 'improves accuracy'.

(iii) Once again, this was often poorly expressed – even when candidates certainly had the correct idea. Weaker responses referred to exercise or diet without a clear description or explanation of the effect that the factor has on heart rate. When the factor itself is vague (e.g. 'diet') then it is very difficult to relate this to a suitable explanation.

(c) (i) Many candidates produced good, accurate bar charts, although some were drawn without a ruler. The most common error was not to include zero on the y axis and the choice of scales in some made accurately locating the tops of the bars difficult. Scales should be chosen that are easy for the candidate to place the plots with as little chance of making an error as possible. Candidates are reminded that bars should be drawn within the limits of the labels on the x axis – some that overlapped the categories were drawn. Despite being asked to draw a bar graph, some candidates drew a line graph – which is not appropriate for this data.

(ii) There were mixed responses to this question. Many recognised that animals that had a high body mass had a low heart rate while those with a low body mass had a high heart rate. A significant proportion of candidates referred to individual animals rather than looking for a trend. Some answers implied that candidates were trying to relate it to humans by giving statements such as 'as you get bigger your heart rate is lower'.

(d) While many candidates made the correct association here, some only referred to body mass or heart rate and therefore did not score. Others tried to give explanations or found other ways, such as referring to overworked and failing hearts, to complicate what was a straightforward exercise in deduction.

BIOLOGY

Paper 0610/06
Alternative to Practical

General comments

The standard of English was high and the presentation of answers showed good understanding of the questions. Some candidates had difficulty with the language, for example in **Question 2(d)**. The drawings were sometimes well presented but often unlabelled. Many candidates presented accurate bar charts.

There were examples throughout the paper of candidates not reading questions carefully and therefore losing marks. For instance, in **1(a)** no labels were given; no mention of safety precautions was made in **1(c)**; some answers to **2(d)** only described the effect of one part of the question of heart rate or body mass on life expectancy and in **3(a)** plasma was labelled when cells were specified.

Performance was Centre-dependent – some Centres prepared the candidates well for practical work and drawings, others did not.

Overall, the paper produced the full range of marks, many in the over-30 range. Candidates attempted all questions and showed that they had adequate time to finish the paper.

Comments on specific questions

Question 1

Photographs of the outside view and horizontal sections of a garlic bulb and a potato stem tuber were shown and candidates were asked to make labelled biological drawings and interpretations based on observation of these figures.

(a) Many able candidates made a high quality drawing and showed the correct arrangement and number of cloves in the garlic bulb. These candidates used clear lines to show what they observed, did not use shading and showed relevant features such as the outer covering and the darker central regions of the cloves. They could also use the information given and their own interpretation to label cloves, stem and outer covering.

However, the shape of other drawings showed poor observation, outlines of cloves overlapped and careless circles were drawn to show the central region of the cloves, some were shaded in. Common mistakes included labelling the outer edge of a clove as the outer covering of the bulb (the lines were inaccurately aligned). Many candidates did not observe and draw the outer covering and others did not include any labels.

A significant number of weaker candidates showed misunderstanding of the size of cloves as cells – both photographs were at natural scale and the candidates labelled nuclei and cell walls. It was mainly weaker candidates who made drawings of a ball of 'cells' with small round shaded 'nuclei' bearing little relationship to the actual specimen in the photograph. A number of candidates incorrectly drew the wrong figure (Fig. 1.1a) or a section of Fig. 1.1b. A few drawings were of other structures not recognisable as a section of a garlic bulb. Some drawings were labelled incorrectly using names of tissues which could not be recognised at this scale e.g. phloem and xylem.

(b) (i) Only the more able candidates identified skin or outer layer as the similarity and the words used to describe the outer layer were many and varied. Some candidates, instead of identifying a similarity, identified a clear difference such as stem, rather than answering the question and looking at the photographs. Other candidates chose non-visible characteristics such as colour, texture or a general comment on the use of the specimens as a vegetable.

(ii) Most candidates were able to gain at least one mark here. Many candidates realised that the garlic was made up of **many** cloves or parts and the potato was one structure but the most common answer was just to say the garlic had cloves and the potato did not. The other straightforward difference which many candidates just stated (possibly from the information given) was that the garlic had a central stem.

Some able candidates did actually look at the photographs and made comments on the skin (speckled/plain or loose/attached), or recognised the 'eyes' or buds on the potato.

Quite a number correctly described a shape difference between the two but there were a number of vague answers simply stating that they were a different shape and making no further observation.

(c) The majority of candidates described the procedures for the food tests to show the presence of starch and reducing sugars in the plant tissues well and had clearly carried out the tests before as many practical details were included. Many accounts did not refer to the safety precautions. The common safety precautions given include the use of a 'water bath' and 'goggles'. Candidates from some Centres did not describe the practical procedures and only mentioned the names of the tests. Only a few candidates used the incorrect reagents and muddled the colour changes for a positive result.

The idea of using equal samples and/or using equal volumes of reagents was mentioned and a large number of candidates did gain the comparative mark for different quantities of starch or reducing sugars.

Weaker candidates had obviously learned how to test a leaf for starch and went into great detail of how to remove the chlorophyll, some even tried to destarch the sample by leaving it in the dark. As in previous examinations, there were some candidates who knew the method but tested by adding starch, reducing sugar or enzymes. Some candidates were unable to answer this part of the question.

Question 2

This question was based on heart rate, how it could be measured and involved data handling to plot a bar chart and interpret some aspects based on this chart.

(a) (i) An appropriate site on the outline of the body was usually identified; neck, temple and other wrist were common. Only a few candidates labelled heart or chest.

(ii) Many marks were lost for not mentioning an artery near a bone or other hard structure as the site for recording a pulse – blood vessel, vein or capillary given as alternatives – yet many candidates included incorrect references to nerves.

(b) (i) Most candidates were able to calculate the rate per minute correctly and then to calculate the mean. The most common error was to multiply the pulses for 15 seconds by 60. Even when candidates did calculate the pulses per minute incorrectly they usually could work out the mean.

(ii) The question asked why repeat readings were advised and many candidates were unable to answer. There is obviously considerable confusion between accuracy and reliability. Relatively few candidates referred to reliability but managed to gain marks by reference to reducing error.

(iii) Most candidates described the effects of exercise or emotion/adrenaline leading to an increase in heart rate. Other effects noted included fitness, rest or relaxation. Answers relating to smoking gave detail about the effects of carbon monoxide and tar linking incorrectly to the heart rather than the heart rate. Those candidates, who did associate smoking with an increase in heart rate, seldom linked it to nicotine. The most common errors were answers linking the 'health' of the heart

to diet, cholesterol, obesity or age and describing illnesses like coronary heart disease that would affect the heart.

(c) (i) The candidates were instructed to present the data in the form of a bar chart. This should show columns of equal width with a space between the columns. Most candidates copied the mean human pulse rate correctly but some left the space in Table 2.2 blank. Often when candidates had miscalculated and arrived at an answer for **(b)(i)** that they recognised as being unreasonable, they substituted a 'known' figure for human heart beat rate.

Generally the data in Table 2.2 was plotted accurately but many candidates drew histograms instead of bar charts. Plotting was generally accurate but the choice of scale to fill more than half the grid varied considerably. Some candidates used an evenly distributed scale until the 100 beats per minute was reached and realised this scale would not fit in 150 and 200 and so continued with the same spacing but unevenly. There were a few candidates who used the data spaced evenly along the y-axis instead of an evenly and equally spaced scale. A number of candidates incorrectly presented line graphs.

Although many bar charts or histograms were drawn neatly with ruled lines, often the standard of drawing and shading was poor. A few candidates used pen to draw the graph and then could not correct errors and some had used scribble for shading, which was unnecessary.

(ii) Many candidates correctly described the trend shown by the data.

(d) A significant number of candidates, who had worked out the relationship, failed to gain a mark because they did not read the question carefully. They continued their answer to the previous question and failed to mention the effect of **both** heart rate and body mass on life expectancy.

Question 3

(a) (i) In this question there was quite a large variation in performance across different Centres.

Most candidates identified the red and white blood cells by name but many then labelled the wrong cells in the photograph. Label lines often failed to reach or touch the outline surface of a particular cell. A number of candidates knew the names lymphocyte and phagocyte but many labelled these incorrectly. Platelets were included, if known, and these were usually correctly identified and labelled correctly. A few candidates did not read the question properly and instead of labelling and identifying by naming a particular cell, these were numbered 1, 2 or 3. Some candidates thought the cells were dividing (as in a previous examination).

(ii) Candidates did not all read 'parts of the blood' and incorrectly gave answers of glucose, water, nutrients etc. It appeared that some candidates guessed red cells and white cells. Almost everything in the blood was mentioned in the answers. Plasma was not frequently mentioned.

(b) (i) This part of the question was well answered; there were very few inaccurate measurements, few outside the accepted range. The most common error seemed to be to measure in cm (0.5) and not notice that the required units were given as mm. Answers of 6 or 7 mm are hard to account for if a ruler had been used accurately for measurement.

(ii) The calculation of the actual size of cell A – a red blood cell – was usually carried out well though some marks were lost by the omission or confusion of the units. The weaker candidates tended to get the decimal place wrong – 0.05 mm or 50 mm were common incorrect answers. The correct working was linked to candidate ability. Most candidates used the appropriate required unit and gave the answer in standard form using a calculator.

(iii) The function of cell A was generally well known. A common error among weaker candidates was to state that red blood cells carried oxygenated blood. A small minority either did not know the function of red blood cells or stated that they were to fight infection, misidentifying with white blood cells.