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BIOLOGY

Paper 0610/01

Multiple Choice

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17	**A**	37	**C**
18	**D**	38	**D**
19	**C**	39	**C**
20	**D**	40	**B**

General comments

With a mean of just over 31, this test was accessible to candidates across the entire ability-range.

Comments on specific questions

Question 9

It is a common misconception that the function of cilia in the respiratory tract is to filter dust and dirt from passing air. The inclusion of this as an option predictably attracted those of this belief. It was, however, disappointing that more than half the candidates opted for this answer.

Question 15

In that only 29% of candidates offered the correct answer, candidates clearly found this difficult. Those opting for incorrect answers, exposed some surprising beliefs. Even candidates scoring well on other questions did not appear to realise that carbohydrates are stored in the body. It may be that a number of candidates linked fatness with an unhealthy body, but those who did were also guilty of believing that a healthy body stores protein. The question therefore excelled in exposing faulty knowledge.

Question 17

Only a third of the candidates selected the correct answer and this may have been due to a failure to recognise the (syllabus) term 'translocated', thus allowing well over half to suggest that starch is moved from leaves. 'Growing parts' should have helped candidates towards the correct answer, but only the more able were able to accept that assistance.

Question 19

This question proved to be to the liking for most candidates and demonstrated that the functions of blood components is a topic that is very well understood.

Question 23

Candidates are usually able to link the terms 'urea' and 'kidney' but their understanding of that link is often faulty. In this case, almost a third believed that urea is formed in the kidney rather than in the liver, though well over 80% managed correctly to differentiate between the terms 'ureter' and 'urethra'.

Question 35

This was another question that failed to stretch candidates, but equally it demonstrated a sound knowledge of energy input into a food chain. The question was particularly unusual in that, of the distractors, only one option (**B**) attracted any significant interest.

Question 36

The arrow in the diagram was carefully placed to start from the centre of a xylem vessel in the leaf. A significant number (almost a third) of candidates failed to notice this and either believed that the arrow could show the route taken by carbon dioxide during respiration, or more seriously, during photosynthesis.

Question 40

This was a further example of a question with which candidates had little difficulty, but it was much to the candidates' credit that three separate pieces of knowledge had to be correctly applied before reaching the right answer.

Paper 0610/02

Paper 2 (Core)

General comments

Overall the candidates did not seem to find the paper too demanding in the quantity of questions they had to respond to as there was no real evidence that there was insufficient time to complete the paper. There were candidates whose performance suggested that they had not adequately prepared for the demands of this paper and who showed very limited knowledge and understanding. There was less evidence that there were candidates for whom the paper was not demanding enough and perhaps should have been entered for Paper 3, thus making the higher grades available to them. Responses in this paper revealed yet again certain misconceptions and misunderstandings that have been commented on in past reports.

Comments on specific questions

Question 1

It is the presence of 3 pairs (6) legs, one pair (2) antennae, wing buds or three body regions that identify the mayfly nymph as an insect. Numbers of candidates just listed the type of feature not realising that pairs of legs, antennae or body regions are also features of other animal groups. Some quoted insect features not visible in the drawing or quoted arthropod features that apply to crustaceans and arachnids as well.

The obvious feature in **(ii)** was the presence of gills but reference to tails for swimming or even a waterproof outer covering were acceptable.

Some candidates muddled responses between the two parts of **(a)**.

Although there were some muddled identifications of the species of mayfly these did not form any particular pattern and might indicate careless observation of the five drawings.

Question 2

This for most candidates proved to be a very testing question.

(a) Very many candidates did not seem to understand the fundamental difference between fresh and dry mass and also did not appreciate that many factors can alter fresh mass in an erratic pattern. The use of groups of seedlings eliminates individual variation and makes the results more reliable. Very many candidates confused accuracy with reliability not appreciating that the accuracy of results depends on the use of the equipment to measure the mass.

(b)(c) In both these parts there were a significant number who did not read the question carefully and commented on periods other than those under consideration and thus produced responses that were not credit worthy. Of those who did comment on the relevant time periods most recognised the rise or fall in the two graph curves but of these many tried to refine their responses with values taken from the graph and unfortunately misread or misquoted them. Very few offered logical responses for the reasons for the change in mass in each case.

(d) There were many processes that candidates could sensibly quote but there were very infrequent references to the processes initiated by the initial absorption of water and the mobilisation of the necessary materials from the food stores in the seed. Many recognised respiration and the later start of photosynthesis as relevant responses.

Question 3

(a) Most candidates correctly identified adrenaline but there were a significant number who thought that insulin was the relevant hormone. However, many were unable to make clear biological statements about the effect of adrenaline. The commonest correct response was about speeding heart beat and only a few mentioned the release of glucose from glycogen reserves and even fewer the diversion of greater quantities of blood to skeletal muscles.

(b) There were few correct word equations for anaerobic respiration in mammalian muscle. The commonest error was to identify carbon dioxide as a product or in a few cases ethanol. The lower quantity of energy released was often identified or less frequently the fact that lactic acid is toxic.

(c) The reading of the relevant data from the graph was poorly done, especially in **(ii)** when 3.5 dm^3 was a common response. Errors in **(i)** and **(ii)** were taken into account when considering candidates' responses in **(iii)** but then with this there were so many who failed to simply multiply their number of breaths in 15 seconds by 4 to get the number of breaths in a minute and then multiply this by the volume of each breath. The candidates were expected to complete the graph to show a greater depth and rate of breathing.

Question 4

This also proved to be a demanding question for the candidates.

(a) Candidates did not on the whole appear to understand that the effect of sweating is to remove heat from the body when the water in the sweat evaporates. Also very many confused vasoconstriction with vasodilation, which is understandable, but also with sweating or the erection of hairs on the skin.

(b) It seemed that many candidates had some understanding of the value of a constant body temperature but had great difficult in expressing this in a clear and unambiguous manner.

Question 5

(a) There was some confusion in linking the descriptions to the terms listed. This was most obvious between the terms gene and genotype which seemed to be considered as synonymous. There was the inevitable confusion between homozygous and heterozygous.

(b) Responses revealed many candidates' fundamental weaknesses in producing a genetic diagram. Candidates did not seem to appreciate that they must identify the various stages and make their use of the symbols very clear. There were few who utilised symbols other than those indicated. Candidates should realise that in **(iii)** unless the ratio is one such as 1 : 1 the identities of the two flower colours must be given. Thus 4 : 0 gains no credit while 4 red : 0 white would be credited.

Question 6

(a) As has occurred on many previous occasions candidates often named a type of energy rather than its source or they named the producer in the food web. Relatively few candidates identified the Adelie penguin as both a secondary and a tertiary consumer.

(b) The majority of candidates completed the food chain correctly. However, there were a significant number who created food chains, from the organisms in the food web, that did not actually occur.

(c) There were numbers of candidates who muddled which organism they were supposed to comment on in each of the response paragraphs. There were a wide range of responses that were offered with explanations and credit was given for any correct possible suggestion.

Question 7

(a) In general responses in **(i)** tended to be rather vague, such as “better for health”. Few recognised fibres value in aiding peristalsis, reducing constipation or lowering the risk of bowel cancer. Few realised that it was likely that herbivores would have enzymes present that are capable of digesting cellulose, even if they are the products of microorganisms in their alimentary canal.

(b) Few seemed to associate minerals and vitamins as being required in small quantities. Those who did and named specific examples often were under the impression that iron is vital for bone and teeth formation, a misconception that has been observed and commented on in past examinations.

Question 8

(a) The labelling of an atrium was better than that of the pulmonary artery. The shading of the chambers with deoxygenated blood produced a very mixed set of responses with many errors which had no common pattern.

(b) The common error was to suggest the thicker wall of the left ventricle (**Z**) was to withstand the higher pressure rather than to generate it. However, most recognised that the higher pressure was needed to force the blood a greater distance than the right ventricle had to.

(c) The vena cava was a popular erroneous response and few candidates seemed familiar with the coronary artery.

(d) The majority of candidates knew at least two preventative actions to reduce the chances of a heart attack.

Question 9

(a) A large number of candidates correctly identified a position for label **Z** on one of the two plateaus but an equally large number placed **X** on the higher plateau and not on a steeply ascending part of the graph curve.

(b) Unfortunately a significant number of candidates changed the subject of the population from rabbits to humans in this section and offered responses based on war and other human activities rather than on the factors that affect rabbit populations. For those who concentrated on the rabbit population most identified a range of suitable factors that could have been responsible for the decreased population.

Paper 0610/03

Paper 3 (Extended)

General comments

Candidates are coping well with the paper in its new format. Most Centres selected their candidates for this paper appropriately; and even the weaker candidates were able to make good attempts at answering the more straightforward parts of the questions, even when the subject matter was not familiar. Good use was made of biological and scientific language.

A very good standard of answers was seen, but the paper still discriminated well and there was no evidence of any candidates running out of time. **Question 2** proved to be the most difficult for candidates (where some of the responses lacked the precision expected on this paper), closely followed by **Question 3**. Questions relating to plants were generally answered better.

The quality of spelling continues to be variable, even when the correct terms were written in the question, for example, in **Question 2 (c)**. Problem words included ciliary (muscle), intercostal (muscle), diaphragm and meiosis.

Candidates need to give more accurate details in their descriptions, particularly when making observations from diagrams given in the question. Some candidates need to read instructions more carefully, especially when details are emphasised in table headings, such as **Question 2 (a)** and **Question 3 (a)**. Explanatory questions continue to be the most difficult, especially amongst candidates using English as a second language, who are sometimes unable to answer with the subtlety required when required to make comparisons. Descriptions were sometimes given when asked to give an explanation.

Comments on specific questions

Question 1

The question was intended to be accessible to examinees of all abilities, with sections varying in the level of difficulty.

(a) Most candidates were able to state three conditions, although some ignored the rubric of the question and referred to minerals or water, for example humidity.

(b)(i) Many answers lacked sufficient detail to be credit worthy for both the available marks for the description (particularly that of the leaves), although there were plenty of observable differences shown in Fig. 1.1. This may be because the candidate had not related the colour key on plant **C** with leaf features in plant **B**. Responses such as 'poor growth' and 'unhealthy leaves' were too vague. While most were aware that nitrate is needed by plants to make proteins, few knew that chlorophyll is a protein (or stated that the leaves were lacking chlorophyll, although the yellowing shown on **B** should have drawn out this explanation).

(ii) Knowledge of the effects of chlorophyll deficiency was good although, again, descriptions of the leaves were often lacking detail. There was occasional muddling of information between description and explanation.

(c)(i) Good responses were given, with sound knowledge shown of the use of nitrates by crops, leaching and the actions of denitrifying bacteria.

(ii) Again good answers were usually written but some responses lacked enough detail. For example, candidates were aware that leaving a field fallow can be helpful, but they did not add that the plants would need to be ploughed in. Similarly, crop rotation was often offered, without giving further detail about the use of leguminous crops in the cycle. The question required a description rather than a brief statement. A common misconception was the suggestion of adding bacteria to the soil.

(d) This question proved to be a good discriminator. More able candidates were able to explain the role of nitrogen fixing bacteria in the root nodules of leguminous plants, or the method by which carnivorous plants capture and digest insects to obtain amino acids. Weaker candidates linked nitrogen fixing bacteria with soil rather than plant root nodules, or named the bacteria incorrectly. Others misunderstood the question and made statements about farmers adding fertilisers, repeating answers already given in **(c)(ii)**. Some thought that plants could absorb gaseous nitrogen through their leaves.

Question 2

The question was generally the most poorly answered on the paper.

(a) While muscle **A** was usually named correctly, the effect of contraction of the iris circular muscle was frequently given as 'controlling light entering the eye' or 'contracts or relaxes to make the pupil narrower or wider'. These responses lacked sufficient detail and suggested that the heading in the table had not been read carefully enough. Candidates should be aware that contraction of the circular muscle will make the pupil smaller, reducing the amount of light entering the eye.

(b)(i) Most candidates were aware that a voluntary action can be controlled by will; fewer were able to explain the term antagonistic. They were often confused, stating that pairs of muscles work together (rather than in opposition).

(ii) This question was far more poorly answered than expected: many thought that muscle **C** controlled the shape of the lens, or was involved with blinking. The correct answer was that the eye would be pulled to the right (or towards muscle **C**).

(iii) One mark was available for a statement about the relaxation of muscle **C** and the contraction of muscle **D**. However, few gave both parts of this explanation. A second mark was awarded for a reference to the antagonistic nature of muscles **C** and **D**, or that muscle **D** would pull on the eye ball.

(c) While most candidates had no difficulty in giving the sequence correctly, others got it hopelessly wrong. The most common error was due to confusion between the aqueous and vitreous humour. Few appeared to use the diagram as an aid.

(d) There were major problems with describing the distribution of rods and cones in the retina. Again, precision was lacking in answers. There was often confusion between the role of rods and cones.

Question 3

Again, candidates tended to have difficulty with the question.

(a) The parts of the thorax **A**, **B** and **C** were known by the majority of candidates. Many could describe the movements of the parts, but did not include enough about the effects of these movements on breathing in. Some answers again ignored both the question instructions and details in the table heading, giving statements about both breathing in *and* out. Weak candidates sometimes referred to muscles pushing. Accuracy was often lacking when describing changes to the thorax, with references to space or expanding rather than to volume.

(b)(i) Lack of biological accuracy was common in the question. Two types of cells were visible in Fig. 3.2: ciliated cells and goblet cells. A common misconception was that ciliated cells trap mucus or bacteria. Often the cells were not named, or the ciliated cells were described as having hairs or villi. There was some confusion between cilia and ciliated cells, with candidates using the words as if they were synonymous. Movement of mucus by the ciliated cells was frequently inaccurately described as being to the stomach. Few were aware of the sticky nature of mucus or of its secretion by goblet cells.

(ii) Again generalisations abounded, with the (unnamed) cells being killed or damaged. Often, a compound in tobacco smoke was not named. The best answers named tar or nicotine and linked tar with cells becoming cancerous, or the increased production of mucus, or paralysis of cilia; or linked nicotine with paralysis of the cilia. Candidates need to be aware that the principle effect of carbon monoxide is the prevention of transport of oxygen by red blood cells (since carbon monoxide form a permanent bond with haemoglobin. The naming of carbon monoxide was, therefore, not appropriate in this question.

Question 4

The majority of candidates performed well in this question. Perhaps because the material was unfamiliar, candidates found themselves compelled to read carefully instead of glancing at the illustrations and jumping to conclusions.

(a)(i) 1 Most answers gained one mark by referring to reduced transpiration. Better candidates were aware that having the stomata on the inside of the leaf would reduce air movement and allow the humidity to increase.

2 A common misconception shown was that the wax would block the stomata. Most candidates correctly stated that the thick waxy cuticle would reduce transpiration, or evaporation of water, from the leaf.

(ii) 1 Candidates generally understand that very long roots would give the cactus better access to water.

2 There were two elements to this question: the fact that the stem was fleshy and that it was green. Not all answers reflected this.

(b) Frequently, candidates gave the functions of leaves, but did not state why having a few, very small leaves would be a disadvantage. There was confusion with some stating that *the rate of* photosynthesis would be reduced, rather than photosynthesis would be reduced.

(c) Naming the processes described in the table was straightforward for most examinees. Generally, variables were also identified correctly; those who did not do this usually failed to read the table heading correctly. The most problematic variable was the one linked to transpiration: humidity was sometimes incorrectly given.

Question 5

The content of this section had been generally well studied.

(a)(i) Most candidates were able to name meiosis. Inevitably, mitosis was sometimes given in error and spellings were not always accurate.

(ii) A range of correct answers was given, including details about the sperm's haploid nature, that it has half the number of chromosomes of a cell from a fetus, the presence of a tail and its ability to swim.

(iii) Both zygote and diploid were acceptable answers. 'Embryo' was rejected as it consists of a large number of cells, not a single cell.

(iv) While the majority of examinees were aware that an egg cell that develops into a girl has been fertilised by a sperm carrying an X chromosome, other terms such as gene or allele were sometimes used instead of chromosome. Some thought that the egg was fertilised by a sperm carrying two X chromosomes.

(b) The correct answers were ovary, oviduct (or fallopian tube) and uterus (or womb). Most candidates gained full marks here.

(c) Details of the function of amniotic fluid were sometimes too imprecise, with vague, brief statements about protecting the fetus, preventing shocks or insulating it being common. Most were aware that the amniotic sac contains or secretes the amniotic fluid. One common misconception was that the sac prevents any infections getting to the fetus.

(d)(i) Answers given here also often lacked sufficient detail. Candidates gave statements about the passage of nutrients (or foods) to the fetus and waste products from the fetus without naming any. Few mentioned the role of the placenta in allowing the blood of the mother and fetus to come close together without mixing, or in protecting the fetus from the mother's higher blood pressure. Some thought that oxygenated blood passed from mother to fetus.

(ii) Better candidates were aware that the placenta secretes progesterone to maintain the lining of the uterus during pregnancy. Weaker answers merely repeated details already given in the previous part of the question.

Question 6

This involved the manipulation and interpretation of unfamiliar material. Some candidates struggled to express themselves clearly in parts of the question.

(a) Most were able to state the presence of a beak and feathers in birds. The term beak was not in all candidates' vocabularies.

(b)(i) This is now well known by the majority. Some candidates were able to describe the term binomial system, but ignored the instruction to illustrate this with an example from the passage. The term gene was sometimes used instead of genus.

(ii) Most had no difficulty identifying two reasons why the two species of duck are closely related. Not all stressed the importance of the production of fertile offspring.

(c)(i) One common misconception was that the presence of the cross-bred duck would mean that the Ruddy duck would not become extinct, suggesting that the species could be recovered by selective breeding. Others erroneously thought that the differences were caused by a single gene, so a double recessive individual formed from breeding of the hybrid duck would have the Ruddy duck phenotype. However, most read the first sentence of the passage carefully and gave the correct answer.

(ii) A range of acceptable suggestions were seen. Sometimes answers lacked detail. For example, 'predation' was not accepted, as this factor is likely to be present in any balanced ecosystem. 'An increase in predation' or 'the introduction of predators' were better, and acceptable, answers.

(d) This was quite a challenging explanation. Better candidates recognised that a food chain only shows one source of food at each trophic level. The example included two secondary consumers and two tertiary consumers. Also, the Ruddy duck feeds as both herbivore and carnivore, which a food chain cannot show. Descriptions of food webs as networks rather than a straight line were rewarded with a mark. Some candidates stated that there was no producer in the example (overlooking the reference to seeds and suggesting a lack of understanding of producers in food webs). There were some references to feeding relationships not given in the question.

Paper 0610/04

Coursework

General comments

Most of the Centres that enter for this paper have now been doing so for at least two years, and have found a number of tasks that work well for them and their candidates. Most use between seven and twelve tasks, but a few use up to sixteen.

Some tasks are used, in various forms, by many Centres. These include enzyme experiments, osmosis using potato strips, food tests, heart rate investigations and photosynthesis. A few are more innovative, for example making use of the school surroundings to carry out long-term investigations of tree growth or other ecological studies, or investigating the elasticity of pieces of artery and vein.

Relatively few Centres use many tasks that have been taken, unchanged, from other sources. Most write their own tasks. Sometimes, published experiments are modified to ensure that candidates can show their ability to reach the descriptors at the top of the mark range. Most Centres give their candidates worksheets, but some prefer to give instructions orally; in this case, it is important to give the Moderator a description of what the candidates have been told to do.

The Moderators find it especially helpful when some background is included with each experiment – for example, what did the candidates know beforehand, had they done any related practical work?

Although many Centres use mark schemes based on descriptors, some have worked out tick-list schemes. The latter can be difficult to construct so that they effectively match the candidates' performances against the criteria, but once this has been done then they do help in situations where not all candidates are assessed at the same time or by the same person. Whichever style of scheme is used, it is very important that rigorous internal moderation brings all marks into line with one another. The External Moderator deals with all entries from one Centre together, and cannot apply different mark changes to different teaching groups.

Where there is a wide ability range in a teaching group, several Centres use 'help sheets', which they offer to candidates who cannot move forward through the task unaided. This is an excellent practice, but it is of course most important that an indication is made on the candidates' work when a help sheet has been given.

It is good to see an increasing proportion of candidates demonstrating a very secure understanding of scientific method, and able confidently to discuss sources of error and reliability.

Paper 0610/05

Practical Test

General comments

It was clear that as many as half the candidates did not follow the instructions carefully in **Question 1**, the most common error being the measurement in the increase in height of the contents of the tubes. It was clear that many candidates simply measured and recorded the actual height instead of the increase in height. While this was not a disaster on this occasion, candidates should be encouraged to read carefully and follow the instructions exactly.

Some confusion arises with measurement and time should be spent in making sure that candidates can measure and record accurately. They should be discouraged form attempting to convert from one unit to another (e.g. mm to cm) unless they are able to do so without error.

The Confidential Instructions document is a valuable source of information. **Question 2** required candidates to be supplied with an insect pollinated flower that was large enough to be cut longitudinally to show a carpel and stamens. In a number of cases the candidate was supplied with a small flower of *Alstroemeria* which was far too small to cut and then be able to observe the structures inside the flower.

The last page of the Confidential Instructions now contains the Supervisor's Report, which should be cut from the booklet and enclosed with the candidates' scripts. A number of Centres failed to supply a report and seating plan but some did enclose a 'worked' script. The more information that a Centre can supply the more help it is to the Examiners, especially if some candidates appear to obtain unusual results.

Comments on specific questions

Question 1

(a) Measuring proved to be a problem for some candidates. Many recorded the actual height of the tube contents in the table, often changing the units to cm but not necessarily stating this. Some measurements also appeared to have been recorded in the wrong place in the table or the instructions had not been followed, as the bar graph seemed not to match the table. 10.6 mm was recorded by one candidate when it was clear that the intended measurement was 16 mm. Many thought that 100 mm = 1 cm. An increase in height (or even actual height) of 220 mm was clearly most unlikely as the test tube would have needed to measure at least 25 cm.

(b) Most candidates were able to provide a similarity but weaker candidates simply stated that there was a difference without saying what it was.

(c) Many candidates did not distinguish between the observations in S3 and S4 or failed to state that the comment applied to both tubes.

(d)(i) Some very poor bar charts were seen. Candidates were expected to label the axes and, in the case of the *y*-axis, indicate the units. A useful tip is to use the headings as written in the table. In a bar chart of this type, where the 'categories' being plotted are discontinuous, a space should appear between the bars – they should not be joined. The choice of scale is also important, as the candidate should be able to use the scale to accurately plot the information. Those who used strange or awkward scales were normally penalised, as they were not able to use them to plot accurately. Wherever possible, the scale should start at 0 and go up in regular steps. If it is necessary to start with, for example, 5 then this should be clearly shown at the base of the scale.

(ii) Many candidates did not explain the changes but simply described them, thus losing all 4 marks. The idea of increased surface area in S2 was normally recognised but further information was muddled. There was some confusion between catalase and catalyse and some thought that the hydrogen peroxide was acting on the enzyme or the potato. S1 and S3 was sometimes misread as S3 and S4, meaning that the whole point of the question was missed.

(e) Only the more able candidates were able to make a serious attempt at this part of the question. It was clear from their accounts, that many candidates had not been particularly careful in carrying out the experiment and suggested making sure that the cubes of potato were the correct size. As this (and other similar suggestions) was what the candidate should have done anyway, this was not credited. Candidates need to consider carefully specific ways in which the experiment could be improved and indicate the problem and solution clearly.

Question 2

(a)(i) Some good, clear diagrams were seen but many had sketched outlines or had been altered so many times that it was sometimes difficult to make out the drawing at all. Provided the candidates had been given a reasonable specimen they could get full marks quite easily. The reproductive structures proved challenging for some candidates to label. Centres are reminded to instruct their candidates to put clear, ruled label lines that touch the structure being labelled.

(ii) The instruction to 'use a line to show where you made the measurement' was ignored by many candidates and some had drawn it so faintly that it was easy to miss. If two short lines were used to indicate the limits of the drawing then a single line should be drawn between them so that the accuracy of measurement could be assessed. Once again, there were a number of candidates who converted between units, often unsuccessfully. Candidates are reminded that they are expected to measure in metric units (mm and cm) rather than in inches. Candidates who do not show any working are disadvantaged as, if their answer is wrong, they cannot be awarded a mark for correct working. Some Centres have noted previous reports in which it has been stated that answers for magnification should be given to one decimal place as the greatest degree of accuracy.

(b) This posed few problems for the candidates, the main error being not to mention heating or boiling in the test for a reducing sugar.

(c)(i) The majority of candidates scored well on this part of the question. It should be stressed that the iodine solution stayed yellow/orange/brown rather than turning that colour, as some confusion with the other test could be assumed. Some did not record observations but simply stated the conclusion as to whether the substance was present or not.

(ii) This proved challenging for many candidates. They did not start with the idea that nectar contains reducing sugar but not starch. This was important when answering the question from the viewpoint of the insect, as had been asked. Many candidates concentrated on the benefit of pollination to the flowering plant rather than benefits to the insect.

(d) Candidates found it difficult to score here, even though a simple investigation, clearly described, could easily yield full marks. Candidates were expected to describe an investigation that could be carried out and not to just predict the outcome and then explain that this proves the suggestion is correct. Therefore, an account such as this would not gain any marks. 'Insects visit the brightly coloured flowers because they are attracted by the pretty colours to get the nectar that they want for food'. Most candidates who scored in this part of the question did so by choosing a selection of differently coloured flowers, although some seemed to think that the colour of the petal indicated how much sugar was in the nectar as the colour corresponded to the colour obtained from carrying out the Benedict's Test.

Paper 0610/06

Alternative to Practical

General comments

The candidates entered for this paper showed a wide range of abilities. Many candidates scored high marks and showed a sound knowledge of practical skills with an ability to express their understanding and biological knowledge clearly and concisely. Overall the standard of written English was high and there were comparatively few spelling errors. The drawing skills were well shown. The graphical part of **Question 1** was well answered by most candidates using data recorded from readings on Table 1.1.

Most candidates correctly used a pencil to draw and to construct their bar charts in this examination session. The number attempting these parts of the paper using an ink pen or ball-pen is decreasing. There were only a few instances where correcting fluid had been used.

It is important that candidates read carefully through the introduction to the questions and follow the rubric exactly.

It appeared that candidates had sufficient time to complete the paper.

Comments on specific questions

Question 1

The first question was based on enzyme activity, involving reading values from a table, handling and presenting this data in the form of a bar chart and short questions on some of the practical procedures.

(a)(i) Part of eight inverted measuring cylinders were presented in Table 1.1, containing the remaining water which had not been displaced by the oxygen given off by the action of catalase in potato or liver tissue on the hydrogen peroxide added to the test tube (see Fig. 1.1). Candidates were expected to read the values for the volume of oxygen in the part of the cylinders which was not shaded and to enter this value in Table 1.2, the units were given in the column headings. Common errors were:

- reading cylinders C and D as 10cm^3
- recording these values for C and D as a dash and not 0
- misreading values for A and B by reading the volume of water remaining
- rounding up measurements e.g. 4.5 as 5 cm^3.

(ii) Using the data recorded in Table 1.2, candidates were required to present the data as a bar chart. Overall, many well drawn bar charts were seen where the bars (vertical columns) had been ruled parallel, neatly and of equal width with a narrow space between the bars.

Label mark – the labels for the axes should represent the column headings in the table with the volume of oxygen collected/cm^3 for the *y*-axis and the tissues A to D on the *x*-axis. Some candidates used a key to distinguish between the tissue treatments whilst others chose to label the bars. Although the zero values could not be represented by vertical bars the position for these should be shown on the horizontal axis. The letters A to D should be placed centrally below the bars.

Scale mark – most candidates used an even scale to fill more than half of the printed grid. A few candidates chose to start the vertical scale below zero so that the values for C and D were presented. It was unfortunate that many other candidates did not leave sufficient space for C and D on the horizontal axis.

Plot mark – most candidates plotted the values from Table 1.2 correctly and accurately. A common error was to plot 4.5 as 5.0 cm^3 and 6.5 as 7.0 cm^3.

Bars mark – awarded for even spacing of the bars and these bars to be of an equal width. Many candidates showed bars which touched sideways – this is not a bar chart, see the section "Terminology, Units, Symbols and Presentation of Data for Biology" in the syllabus.

(iii) The difference between volume of oxygen collected for sample A for potato and sample A for liver could be expressed in terms of more/less or a calculation could be carried out to use the numerical data. Most candidates failed to recognise a difference in the speed of production. A common error made by candidates was to compare sample A with sample B for either liver or potato.

(iv) This part of the question was answered well by the more-able candidates. A common error was to give only part of the answer – candidates recognised that sample B had been cut into pieces but did not state how this was differed compared to sample A being in one piece. This point led onto another difference, namely sample B had a larger surface area or vice versa. It was seldom that any reference was made to the number of enzyme/substrate collisions.

(b) Many candidates correctly identified these samples C and D as controls but did not explain the importance of these for comparison to show no activity when the enzyme had been denatured. It was pleasing to note that most candidates realise that enzymes are molecules produced by living cells and cannot be 'killed'.

(c) This part was well answered by many candidates. A common error was failing to understand the difference between a 'lighted' and a 'glowing' splint which is crucial for this test.

Question 2

The question starts with sections based on drawing and identification and then food tests on honey and experimental design involving C4 planning skills.

(a)(i) The quality and size of drawings varied widely – some of the drawings showed flowers which were well proportioned with clear outlines and accurately represented stamens and carpels to those sketched shakily in ink and other drawings illustrating a regular flower with free petals and a very different shaped stigma and style. Generally, most candidates attempted to carefully represent the half flower shown in Fig. 2.1 and some constructed a grid to aid the correct proportions. Unfortunately some candidates attempted to illustrate a half of the half flower shown in the photograph.

Candidates should realise that presentation of an accurate well-proportioned drawing is based on observation and careful recording of the detailed structures, all of which are important practical skills.

The outline for the drawing needed to be constructed with a single clear line using a sharp pencil. This should include all parts of the half flower shown in Fig. 2.1. This should not be an artistic sketch and shading should not be included.

Although there were many well drawn half flowers, many candidates did not take care to show all of the features in proportion – the shape of the petals, the tube of the corolla. Many candidates changed the orientation of the half flower making the shape more difficult for the drawing. Some candidates simply did not bother to attempt to represent this flower but chose to recall a standardised one from a textbook.

The androecium showed three stamens with the top one bent towards the upper petal edge, all three below the level of the stigma and the anthers differed in shape. Most candidates did draw three stamens but they showed little resemblance to the observed features listed above.

The shape of the stigma, style and ovary needed to be represented accurately and not just a single line for the curved lobes of the stigma which appeared to join to form the style. These structures were situated a centimetre above the anthers.

(ii) Label lines were specified in the question though some candidates chose to ignore this. Label lines need to be carefully drawn so that the end is located accurately on the intended structure not ending millimetres short with a gap. Some candidates did not use the letters X, Y and Z and others forgot this part of the question.

The label lines for X should touch one of the three anthers; for Y onto the top edge of the stigma and not entering through the middle of the joined structure and for Z to the style or upper part of the ovary.

(b)(i) Two food tests on honey – most candidates were familiar with the procedure to carry out the Benedict's test for reducing sugar though sometimes the need to heat the mixture was not included. It was not sufficient to state 'place in a water bath' since this may not be heated. Some candidates did not carry out the test on a sample of honey but used a known reducing sugar as outlined for the standard class testing procedure.

Most candidates were familiar with the starch test using iodine solution.

(ii) Many candidates gave the full range of colours expected by the Benedict's test for different concentrations of reducing sugars but failed to begin with the original colour blue for the test solution so did not state the change in colour which was asked in the question.

(c)(i) Fig. 2.2 shows a pollen grain magnified 200 times and candidates were requested to find the actual size by measuring the diameter of the grain and dividing this measurement by the magnification. The actual size needed a unit as it is a discrete value. This was well answered by many candidates though some omitted to record the unit (mm or cm) and others confused the actual size with magnification so gave an answer 'x…', but with no unit given. Some candidates tried to calculate volumes of the spherical pollen grain but this was not required though often the approach for working out the size gained credit.

(ii) Most candidates stated one feature of the pollen grain to suggest that it was from an insect-pollinated flower though the descriptions varied.

(d)(i) This question was based on experimental design and tested planning skills (C4). Although many candidates had apparently completed work on planning investigations, it seemed that others were not familiar with the basic design points and simply wrote descriptions of the pollination process.

The basic design points should mention procedures such as – controlling variables, using the same plant species, repeating procedures to check reliability of data, using precise times, quantities or conditions. Most candidates mentioned the need to quantify the number of visits by counting the number of insects using direct observations in a set period of time e.g. one hour, to find out which petal colour would attract most insects. Some candidates described the use of insecticides and counted the number of dead insects by the chosen colour of flower, or painted the petals with sticky glue, not realising that the number of dead insects would be likely to deter other insects visiting the flowers. Others suggestions involved measuring the change in mass in pollen or nectar or waiting until the end of the flowering season to record the numbers of seeds formed although these ideas would involve other factors besides the initial choice of flower colour by pollinating insects.

(ii) Most candidates mentioned the smell, fragrance or scent of flowers to attract insects to collect nectar if the flowers lacked the usual brightly coloured petals. A few candidates mentioned other points such as guides or flowers shaped like female insects, etc. A few candidates failed to read the question carefully and mentioned large petals or nectaries as answers.

Question 3

The question involved observation and experimental design skills on seedling development and phototropism and was generally answered well by candidates.

(a)(i) This part of the question involved table completion to describe two visible differences between the seedlings, one from the clear plastic box and the other from the box made of black card. Most candidates were able to complete the spaces in the table by comparing the same feature for the two seedlings such as larger leaves versus smaller leaves or thick or thin stem. A number of candidates tried to record too much information into the spaces and comparative points were not matched in the adjacent spaces in the two columns. Although there were many alternative features to be compared some candidates referred to colour or health of the seedlings.

(ii) The comments noted in **Question 2 (d)(i)** are relevant to this question also involving planning skills. The able candidates gained full marks for describing the control of two variables, using one type/species of seed and increasing the number of seeds used to eliminate the results of non-viable seeds. Other valid suggestions made by these candidates involved quantifying this investigation by measuring the length of the seedling stem or hypocotyl and calculating an average.

Unfortunately, some candidates did not try to improve the existing investigation but planned a different investigation by using a clinostat, boiling the seeds to introduce a control, or using different species of seed.

(b) The appearance of the seedling shown in Fig. 3.3 was recognised and well described by most candidates. The seedling curved towards the slit shown on the adjacent box and the response to light was described in terms of positive phototropism. Some candidates continued to explain the mechanism by which auxins bring about this response.

Unfortunately a few candidates thought the seedling had wilted or was an unhealthy or a diseased specimen due to lack of light. A few descriptions were based incorrectly on phototaxis or geotropism.