

BIOLOGY

Paper 0438/13
Multiple Choice

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

General comments

This paper fell well within the capabilities of most candidates, with a full range of marks scored.

Comments on Specific Questions

Question 6

The presence or absence of a cell wall and its position in a cell is a topic with which candidates often struggle. However, many candidates identified the correct answer.

Question 19

Only living things can photosynthesise, and thus they must release energy from respiration to remain alive. However, this is an unlikely explanation as to why a significant number of candidates chose option **D**, suggesting that respiration relies on the Sun's energy. It is more likely that they did not link peristalsis with a muscular action that requires energy. A high proportion of those opting for the correct answer did well on the test as a whole.

Question 21

Traditionally, the way in which ciliary muscles operate to alter the focal length of the lens is a difficult topic. It was, however, rather disappointing to note that there were more candidates opting for the exact opposite of what happens than opted for the correct answer, although, again, this was not true of the more able candidates.

Question 27

This required a piece of simple knowledge, and the majority of candidates were able to answer correctly.

Question 32

A significant minority of candidates did not understand the uni-directional flow of energy. However, only a very small minority believed that energy flows in cyclic fashion.

Question 33

Many candidates appear to be confused by the distinction between the processes of growth and development. This was illustrated by this question with many candidates opting either for mitosis, a growth process, or fertilisation.

Question 36

A significant minority of candidates thought that the breakdown of glucose was involved in the recycling of energy. This suggests that either they did not consider the more plausible possibilities of water and/or carbon dioxide, or they erroneously believed that energy is recycled. However, this misunderstanding appeared to be limited to those who did not perform well on the test as a whole.

Question 39

This question was competently answered by the vast majority of candidates. No candidates chose the incorrect option **A**, a food web pyramid.

BIOLOGY

Paper 0438/23
Core Theory

Key Messages

Candidates need to be encouraged to read the whole of a question before beginning their response to any section, and to think about the theme of the question. This might avoid responses being duplicated, which rarely gain credit.

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

General comments

Most candidates appeared to have sufficient time to complete the paper and virtually no whole questions were left totally blank. Some candidates showed very limited knowledge and understanding of some topics from the syllabus, especially genetics and deforestation, and many could not apply basic principles in unfamiliar situations, such as in **Question 4**. Almost all candidates found at least some aspects of this paper demanding. Some candidates appeared to have considerable difficulty in expressing themselves clearly where explanations were required.

Comments on specific questions

Question 1

This question presented few problems to most candidates, with the majority gaining full credit. The commonest error was to misidentify **A**. A few individuals tried to give the common names of the species or put several letters in each box.

Question 2

Many of the candidates found this question challenging. In many cases the functions of the various chambers of the heart and their associated blood vessels were not known. The thickness of the ventricle walls should have guided candidates to selecting the right and left sides of the heart and enabled them to identify structures passing deoxygenated blood to the lungs in **(a)(i)**. Valve **V** is clearly between a ventricle, **H**, and a blood vessel, **E**, but a significant number of candidates suggested that it prevented backflow from the ventricle to the atrium. Others believed that valves push the blood on its way around the body. In **(b)(i)** many wrote about breathing rate although the question was about pulse rate. The need for extra energy during exercise was known, but this was not always related to muscle action or to the need to supply the muscles with more oxygen and glucose to supply this energy. In **(b)(ii)** most candidates knew that pulse rate is normally timed over one minute but a suitable site at which to make the measurement was not always identified. A significant minority thought it could be measured on a vein.

Question 3

In **(a)(i)** many candidates did not appear to appreciate that starch formation would only occur in area **L**. In **(ii)** they were unable to explain that both chlorophyll and light must be present for photosynthesis and starch formation to take place and that this only occurred in area **L**. Most recognised the process as photosynthesis, but a number thought that carbon dioxide was released in this process. Most candidates struggled in part **(b)** with many not knowing where or how mineral ions such as magnesium enter a plant. Many suggested that they entered through the stomata.

Question 4

Many candidates were unable to name the structures on the diagram. The urethra, **B**, was correctly identified more often than the prostate gland. The site of testosterone production was clearly and correctly indicated in only a minority of cases. Some candidates placed the point of their arrow on the boundary between the testis and the epididymis, possibly hoping that the Examiner would choose the correct response, while others placed this in the bladder or the prostate gland. None of these attempts gained credit. Many were able to name the stage in development in **(a)(iii)** as puberty. In **(b)** many candidates were unable to select from their knowledge of the effects of testosterone, (secondary sexual features of males), two features which might enhance athletic performance. Candidates are expected to know that radiation is a possible cause of mutations and apply this knowledge to explain why the testes should be protected from such effects, but many simply stated that sperm might be destroyed or damaged.

Question 5

Most candidates correctly selected Brazil as the country with the largest area of rainforest and were able to calculate the area of rainforest lost in the Philippines over the 15 year period, but the percentage calculation in **(a)(iii)** proved more difficult. Many candidates confused the harmful effects of deforestation with the effects of global warming. Some mentioned loss of habitats for wildlife but few mentioned the disruption to food chains or the possible extinction of whole species from this ecosystem. Physical effects such as increased soil erosion or changes in drainage were rarely mentioned. Some candidates realised that burning the remaining vegetation would increase the carbon dioxide content of the air, but few also commented on the loss of photosynthetic material and how this might alter the composition of the air. A number speculated that the air might run out of oxygen.

Question 6

In **(a)** many candidates were unfamiliar with the term homeostasis, and a surprising number suggested that feeding or digestion would remove glucose from the blood. Most candidates were able to extract the correct data from the graph in **(b)**, but few were able to identify the point at which the pancreas started to increase production of insulin. Few realised that this must be before the concentration of glucose in the blood began to fall, not after this point. The effect of the fight on the blood glucose level was well known, but a surprising number thought, erroneously, that the hormone produced was testosterone rather than adrenaline. Effects of adrenaline on the body were not well known, with many just suggesting that it would make him stronger, which was too vague to be awarded credit.

Question 7

Part **(a)** about insect pollination was well answered, although unqualified responses such as colour and petals were considered too vague to gain credit. Knowledge of the events leading to fertilisation was very poor. The development of a pollen tube was rarely described and many suggested that the whole pollen grain rather than the male gamete fused with the female gamete. Some candidates failed to mention fusion of gametes at all. A few candidates wrote here about germination.

In **(c)** only a minority of candidates showed a clear understanding about the likely genetic make up of the seed or why its genotype was likely to be different from that of the parent plant. Very few suggested that environmental conditions were likely to affect the growth of the seedling after germination.

Question 8

Most candidates completed the pyramid of numbers correctly, but a significant minority did not realise that leaves are not organisms and that they should have put the tree at the base of the pyramid. Most also realised that the pyramid of biomass would be widest at its base and were able to label this correctly, but the reason for the difference in shape of the two pyramids was not understood. In **(b)** most candidates correctly named a herbivore and a carnivore but were unable to name a suitable group of organisms in **(iii)**.

Question 9

There was evidence that candidates did not read this question carefully enough. In **(a)** candidates were asked how light intensity changed, but a significant number of responses were about the changes in the pupil brought about by the change in light intensity. In **(a)(ii)**, some candidates used the terms iris, pupil and even eye as if they were synonymous, which lead to considerable confusion.

Part **(b)** was about the pupil reflex, but many simply repeated information from **(a)(ii)** here, without stating that reflex actions were very fast and automatic. Many did not seem to realise that the pupil reflex protects the cells of the retina from excessive light which would damage them. Very few candidates mentioned the retina at all.

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Paper 0438/33
Extended Theory

Key Messages

1. Before starting to answer a question candidates should read through the whole of the question in order to decide what is required in each part. Candidates who fail to do this often repeat the same ideas in several parts of the question.
2. Candidates should be advised not to rewrite the question before starting their answer. Candidates who do this often run out of space and do not give the required number of points in their answer.
3. If it is necessary to continue an answer on a blank page or on a supplementary sheet candidates should indicate that there is a continuation and its location.
4. Candidates should take great care over the spelling of terms or names of structures or functions. Examiners will always reward phonetic spellings so long as there is no confusion with another term that candidates should know from the syllabus.
5. Where a candidate wishes to change an answer they should be advised to cross out the original answer clearly and write the new answer above, below or at the side of the original answer. This is especially important where letters or data values are required in an answer.
6. Care should be taken with teaching detailed information that goes beyond the requirements of the syllabus. A few candidates wrote about transamination in **Question 4(b)** confusing it with protein synthesis.

General comments

Many candidates appeared to find **Question 2**, on the eye, very difficult; there were quite a few scripts where candidates had not attempted some parts or even the entire question.

Candidates did not always make good use of technical terms, and used vague language, resulting in answers that were not clear. Many wrote about 'immunity' to pesticides in **Question 1(e)(ii)**, so a very high proportion did not gain credit here for the idea that the grasshoppers may be *resistant* to pesticides. As the idea of immunity is covered in **Section II** of the syllabus and antibiotic resistance in **Section III**, the Examiners expect candidates to know how to differentiate between resistance and immunity.

Some candidates did not read the question carefully and lost credit due to missing important information. This was particularly noticeable in **Question 6** where candidates did not seem to realise that the bacteria produce lipase.

Comments on specific questions

Question 1

This question covered aspects of **Section I** and **Section IV** of the syllabus. Candidates of all abilities used the key in Fig. 1.2 successfully and many were able to translate the information in the graph (Fig. 1.3) into prose. They were less successful at using their biological knowledge to explain the different effects of a pesticide and an agent of biological control in part **(e)(ii)**.

- (a)** The features visible in Fig. 1.1 that show that the goliath beetle is an arthropod are its jointed legs and its exoskeleton. Many candidates identified at least one of these features.
- (b)** Almost all candidates used the key to identify the seven arthropod pest species of date palms.
- (c)** The command word *outline* should have prompted a number of different damaging effects and candidates identified a range of these, particularly the risk of pesticides entering bodies of water and the effect that they may have on other species. More able candidates referred to the effects on non-target or harmless species, and to the idea that pesticides may become concentrated in the body tissues of animals in food chains. There were very few answers that discussed the consequences of this for top predators such as local extinction and egg shell thinning. Health hazards were mentioned. The effect of spray drift on people living near fields sprayed with pesticide was mentioned by a few.
- (d)** There were some good ideas to account for the inclusion of the unsprayed field in the study. The simplest acceptable answer was to say that it is a control. Better answers explained that this would show what would happen to the numbers of grasshoppers if no agent (pesticide or fungal spores) were sprayed on the field, and this would allow valid comparisons.
- (e) (i)** There were many good answers that described the effects very clearly. Data quotes were not always accurate. In each case the Examiners looked for the population density on a given day. Many, however, did choose appropriate figures to illustrate their answers.
- (ii)** Many candidates repeated their descriptions from **(i)**. Candidates who gained credit here stated that the pesticide killed grasshoppers immediately and then gave some explanation as to why the numbers recovered. Ideas included resistance of some grasshoppers to the pesticide, migration of grasshoppers from neighbouring areas and reproduction. The latter explanation was only likely if some grasshoppers hatched from eggs during the study period which was quite short, however, the Examiners allowed reproduction as a possible explanation. Some candidates also stated that the pesticide would not remain in the area for very long after spraying. In contrast, candidates had more difficulty explaining the effect of the fungal spores; only a few candidates realised that the spores would take time to grow within the grasshoppers, which explains the delayed effect shown in Fig. 1.3. The most able candidates explained the low numbers at the end of the study as being due to transmission of fungal spores from grasshopper to grasshopper.

Question 2

This question proved difficult for many candidates who appeared to know little about the eye. Quite a large number did not attempt part **(b)(ii)**.

- (a)** Candidates who realised that this question was testing their knowledge of cell structure scored well. Those who thought that the structures were in some way specialised for rods and cones struggled to find appropriate labels. **A** had to be labelled as *cell membrane* rather than just 'membrane'.
- (b) (i)** Many candidates knew that rods and cones are found in the retina. Incorrect answers included other parts of the eye such as the sclera.
- (ii)** This proved to be much more difficult and many did not attempt to answer. The Examiners accepted a variety of alternative terms for fovea and blind spot, but many candidates had clearly guessed the answer. The syllabus makes it clear that candidates should know the distribution of these two photoreceptors in the eye.

- (c) There were some excellent answers to this question on the functioning of rods and cones. Again, it appeared as if some candidates did not have the detailed knowledge to offer much of a suggestion as to how these two receptors function. Successful candidates stated that rods are sensitive to light of low intensity while cones are sensitive to light of high intensity and also 'detect colour'. Some candidates lost credit here by stating the direct opposite. Few candidates described the action of these receptors in converting light energy into electrical impulses that travel to the brain. Some knew the term *transducer* and gained credit.

Question 3

Part (c)(ii) proved to be the most difficult question on the paper.

- (a) Explanations of the advantages of carbon dioxide enrichment were not very well structured. Candidates who began by stating that carbon dioxide is required for photosynthesis, or is a raw material for the process, were more likely to offer a better explanation. Better answers referred to carbon dioxide *concentration* as an important limiting factor of photosynthesis, and that boosting the concentration often increases the rate of photosynthesis unless there is another important limiting factor. Candidates could also say that enrichment prevents the concentration falling below that of the atmosphere as it might do if plants in the glasshouse are growing in high light intensity and a warm temperature.
- (b) Many candidates appeared not to understand the point of this question. Those who looked carefully at Fig. 3.1 noticed that the concentration of carbon dioxide in glasshouse **E** was much higher than the concentration in the atmosphere outside. This would mean that carbon dioxide would diffuse out of the glasshouse and be wasted. As far as the grower is concerned this might not matter if the extra production by the plants offsets the cost of maintaining the enrichment.
- (c) (i) This part tested candidates' knowledge of gas exchange in plants; at night there is no photosynthesis, but respiration continues so the concentration of carbon dioxide in the glasshouse will increase.
- (ii) There are a variety of reasons for ventilating the glasshouse and candidates who considered some of these gained credit here. Some simply stated that opening the windows allows carbon dioxide to enter and oxygen to leave. The Examiners only awarded credit for these statements if they were linked to the appropriate time of day, which was the cue provided by part (i). Ventilation allows some control of the temperature inside the glasshouse so it does not become too hot and allows water vapour to escape so that the air does not become too humid. High humidity favours the spread of plant diseases.

Question 4

Functions of the liver appear in a variety of places in the syllabus. This question linked together aspects of the circulatory system, the metabolism of amino acids, the control of blood glucose concentration, homeostasis and the mechanical and chemical digestion of fat.

- (a) Many candidates answered this correctly, although **P Q R** was a not uncommon answer which possibly indicates misreading of the question. The introduction to Table 4.1 makes it clear that the question refers to concentrations in the blood as a meal is absorbed.

- (b) Some candidates gave very confident answers describing the role of the liver in metabolising amino acids. They described deamination accurately and stated that urea is produced. There were fewer descriptions of the use of amino acids in protein synthesis *within* the liver. Candidates should know that a variety of proteins are made in liver cells, for example some that are involved in blood clotting. Some gave the term transamination thinking that it meant protein synthesis.
- (c) It was relatively easy for candidates to gain full credit for this question if they knew about the antagonistic actions of insulin and adrenaline in stimulating the liver cells.
- (i),(ii) Many were able to state that insulin promotes glycogen synthesis and adrenaline stimulates glycogen breakdown. Candidates should also refer to the effect on moving glucose across the cell membranes of liver cells. Insulin promotes uptake and adrenaline promotes release of glucose into the blood. Candidates should not write statements that imply that these two hormones (and glucagon) act as enzymes in forming glycogen and breaking it down.
- (iii) This part was answered well by some candidates who referred to fatty liver, cirrhosis and liver cancer. Vague answers, such as 'fat kills cells' did not gain any credit.
- (d) This question proved to be a challenge. Candidates had first to recall how bile is involved in fat digestion and then work out what would happen if bile did not reach the duodenum. Very few stated that bile contains bile salts that emulsify fats. If they had recalled this (from the core syllabus) then they should have realised that emulsification would not happen and fats would remain as large globules. This would mean that the enzyme lipase would only be able to act on fat at the edge of these large globules, so slowing down the *chemical* digestion of fat. Very few explained that bile is involved in *mechanical* digestion and thus in its absence the rate of chemical digestion is very slow. The Examiners gave credit for any consequences of this such as poor absorption of fat, poor assimilation of fat and the high fat content of faeces. Many thought that without emulsification the fat in the diet would be trapped in the liver.

Question 5

This question on human reproduction included some information about artificial insemination (AI). The Examiners have noticed in papers in recent sessions that candidates often confuse AI with *in vitro* fertilisation (IVF). The syllabus does not include anything on IVF.

- (a) Candidates who divided the actual length of the scale bar (35 mm) by 0.14 mm would have calculated the magnification as $\times 250$. The Examiners allowed some leeway here accepting measurements between 34 mm and 36 mm to give answers between $\times 243$ and $\times 257$. Many candidates did not know how to carry out this type of calculation. Credit was awarded to those who knew that the actual length (0.14 mm) is the denominator in the calculation even if they measured something other than the scale bar or measured in centimetres and did not multiply their measurement by 10 before dividing by 0.14.
- (b) There were many good answers to this question on *structural* differences between an egg cell and a sperm cell. Many thought that the 'jelly coat' and the follicle cells were part of the egg cell even though it is made clear by the labelling in Fig. 5.1 that they are not. The Examiners did not credit differences in size or numbers produced as the question specifically asked for structural features.
- (c) Reduction in chromosome number from diploid to haploid is an important feature of meiosis that candidates should know from **Section III** of the syllabus. Many answered this question in terms of human chromosome numbers, which was perfectly acceptable especially as the whole of the rest of the question was set in the context of human reproduction. Many did not continue the argument to state that at fertilisation the diploid number is restored and that meiosis ensures that the chromosome number does not double with each generation.
- (d) There are many reasons why men and women may be infertile. The Examiners credited a wide range of suggestions that included the mechanical (blocked oviducts, defective sperm), the chemical (hormone imbalance) and the intentional (vasectomy, tube ligation). This proved to be a high scoring question.

- (e) Many candidates struggled to explain why sperm are placed in the uterus near the time of ovulation. Those who described what happens at ovulation were often more successful at explaining that the ovum moves along the oviduct, so would be present just before or just after sperm would be placed in the uterus. They explained that this would be more likely to ensure that fertilisation occurs. They also explained that both eggs and sperm only survive for a short period of time. Some candidates explained why it is important to place the sperm in the uterus rather than in the more hostile environment of the vagina.
- (f) There were some good answers to this question on the reasons for the secretion of progesterone after ovulation. Many stated that progesterone maintains the endometrium, which was often described as the lining of the uterus. The advantages of this was often explained in terms of implantation. Another line of reasoning involves inhibiting the secretion of FSH and the development of another follicle.
- (g) Many candidates gave rather vague responses to this question. Some, however, wrote out an equation making it clear that the number of women who had become pregnant following AI should be expressed as a percentage of those who had received this treatment for infertility.

Question 6

- (a) Answers that dealt with disposal of waste paper in landfill sites were not credited. The question specified disposal by burning, for example in incinerators or combined heat and power plants that convert waste into electricity and heat for buildings. Candidates concentrated on reduction in the use of trees for making paper and therefore the reduction in deforestation. They also explained that there would be less carbon dioxide released as the result of not burning the paper which frequently led onto a discussion of the greenhouse effect and global warming. It should be pointed out that recycling paper uses energy that also generates carbon dioxide, although the energy involved in recycling is less than that used in producing paper from trees.
- (b) Some candidates saw that this question on the use of bacteria used in the Indian study to investigate the removal of ink from paper pulp was testing aspects of growth of microorganisms (from **Section IV**) and the secretion of enzymes (**Section II**). Candidates who gained credit here referred to the growth of the bacteria so that they would continue to secrete lipase. This activity would maintain a higher concentration of lipase than that in the mixture which only contained a solution of lipase. Over time it is likely that lipase molecules become less effective. However, candidates should have realised that the bacteria could divide so they could increase the concentration of lipase.
- (c) This proved to be an easy question as many candidates used their knowledge of enzyme activity from **Section II** to explain that at high temperatures enzymes are denatured. It is also likely that the bacteria will die and so will not secrete any lipase.

BIOLOGY

Paper 0438/53

Practical Test

Key Comments

It is most important that candidates read through questions carefully before they start to work to ensure that they understand what is required.

Candidates should apply scientific understanding, precision and terminology in their answers. As stated in the syllabus, measurements are expected to be made using metric (SI) units.

It is most important that the Supervisor's report is sent with the scripts.

General comments

The presentation of answers showed a reasonable understanding of the questions. Most candidates showed that they had adequate time to finish the paper.

Question 1 was based on the discoloration of apples on exposure to oxygen in the air. Different varieties of apple were used at different Centres. Unfortunately, it was not clear which variety of apple was supplied to each group of candidates. Some apple pieces discolored and turned brown, while others did not. In **Question 1(d)(ii)**, candidates were asked to explain if their observations supported the idea that enzymes were involved in the color change of the apple. Many candidates were unable to answer fully as they did not understand what the question required. The effect of pH and stopping enzyme activity was seldom clearly expressed.

The drawings of the head of the ant in **Question 2(a)** were mostly made using ink, so any corrections were impossible to erase. A good HB pencil and clean eraser are necessary equipment for drawings and construction of graphs. A drawing should be an accurate representation of the structure, with correct proportions and orientation. Many drawings were inaccurate, too small and shown in a different orientation, or with oversize mouthparts.

In **Question 2(b)(i)**, few candidates referred to reducing sugars; most simply referred to 'sugars'. The syllabus refers to the Benedict's test for reducing sugars to distinguish these from non-reducing sugars. This requires another stage to break the bond joining two monomers prior to testing.

In **Question 2(c)** many candidates only gave an outline and did not describe any practical procedure that could have been carried out. Candidates would benefit from more guidance in planning investigations as this would result in an improvement in the performance of candidates of all abilities.

In **Question 3(a)** many candidates were unable to name parts **A** to **D** or to identify from which parts the pollen is collected and placed. In **3(b)**, few candidates made accurate measurements in millimetres (mm) as instructed, and so were unable to accurately calculate the actual length of the pollen grain.

Comments on specific questions

Question 1

The first part of this question was based on an experiment to investigate an enzyme (polyphenol oxidase) found in apple cells that causes the formation of colored compounds after a few minutes in the presence of oxygen from the air. The experiment used two types of apple pieces; some that had been cut with a knife and others broken between the fingers.

- (a) (i) Candidates were presented with a cut piece of apple that had been left exposed to the air for at least one hour. This was to illustrate the change in color that could be observed in the type of apple provided for later parts of the question. Some varieties of apple became brown in color and others a deeper yellow.
- (ii) Most candidates completed the table, noting any changes in color.
- (b) Many candidates managed to note a difference between the cut and broken surfaces that had been covered with water.
- (c) Most candidates were aware that the color change of litmus paper from blue to red/pink/orange showed that citrus juice is acidic.
- (d) (i) Several candidates confused this question with the earlier one and compared the two surfaces in dish **2** rather than comparing the cut surfaces of pieces of apple in the two dishes.
- (ii) This question proved difficult for most candidates. The basis for the involvement of an enzyme was centered on the pH of the citrus juice that had been tested with litmus paper. This lower pH deactivated the enzyme involved, resulting in no colored compound being produced. There were a number of candidates who, incorrectly, said that the enzyme had been killed.
- (e) Many candidates realized that breaking the piece of apple may cause less damage to cells or that the cells in the broken piece of apple could release less contents. Better candidates went further and explained that it was possible that the cells were separated rather than cut open. Weaker candidates only gave answers about the cells in the piece of apple cut with a knife, without comparing this to the piece that had been broken. A small number of candidates incorrectly tried to link the browning of the cut apple with an apple that is starting to rot.
- (f) The idea that the enzyme was denatured or destroyed, (not 'killed'), was not suggested by many candidates, although some did refer to the enzyme being stopped from working.

Question 2

- (a) A few candidates used a pencil for the drawing, but most used ink. There were many different interpretations of what the head looked like, and the head structure was shown from a number of different angles. Candidates should represent the orientation, features and proportions accurately. The objective is to produce a drawing that is a true representation of what is shown. The outline was usually a single line, but this was often broken in places and shading was used. Most drawings were larger than the photograph but few candidates made appropriate use of the space available. A small number of candidates drew the complete animal and consequently the head was too small. The eyes and antennae were mostly represented accurately. The antennae were seen drawn with single or double lines.

The mouthparts were clearly visible in the photograph. However, many drawings showed very large, serrated, fang-like structures. Candidates need more practice drawing specimens, using a pencil and drawing parts to scale. The majority of candidates did label at least one structure such as antennae or feelers.

- (b) (i) Most candidates correctly named the two tests. However, the majority referred to the 'sugar test' rather than the '**reducing** sugar test'. Some candidates incorrectly linked the Benedict's reagent for the starch test. Another error was to use other reagents, e.g. biuret or ethanol, instead of, or in addition to, the expected reagents, often testing for other non-carbohydrate foods.

A common omission was the need to prepare the banana either simply by cutting, mixing with water or, more effectively, by crushing or grinding a sample.

Most candidates correctly used Benedict's solution, although a considerable number did not mention the need to heat the mixture using some form of water bath.

The common error for the starch test was to use 'iodine' instead of iodine solution or drops of iodine. Iodine is a solid and has to be dissolved in potassium iodide solution. A few candidates confused biuret with Benedict's, or tested for fats, implying that they believed fat to be a carbohydrate.

- (ii) The color changes were recorded but often the conclusion was omitted.
- (c) The apparatus shown in part (b) could have been used as a basis for the investigation. Many candidates attempted to describe a suitable experiment. For the method, any idea of placing both the banana and plantain separately, with the fruit flies having free access to both foods, was acceptable.

To collect the results, some candidates chose to count the flies visiting each food, and others looked for a change in mass of the two fruits. Ensuring that the experiment is conducted over the same time period, i.e. the idea of a controlled variable, is important both for counting flies and looking for a change in mass, but quite a number of candidates gave vague references to leaving for some time, for a few hours, after a while, etc.

A small number of candidates suggested testing the banana and plantain for sugars and starch with Benedict's solution and iodine solution in an attempt to find out which would contain more carbohydrates and so be more likely to attract the fruit flies.

Question 3

- (a) (i) Few candidates correctly identified any of the flower parts, but many structures such as roots, stem, etc, were suggested.
- (ii)(iii) Few candidates correctly identified these parts but all letters were seen. The correct answers were anther, **B**, for the part from which the pollen is taken and stigma, **D**, for the part where the pollen is put. **B** and **D** were sometimes reversed or not given at all.
- (b) Some measurements were accurate, although the most common error was to give an answer in cm rather than mm, or to omit the units. Magnification is the number of times an image is enlarged, and the actual length would be found by dividing the measured length by 200. The most common error was to multiply by 200 rather than divide by it.