

BIOLOGY (US)

Paper 0438/13
Multiple Choice

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

General comments

The test was pitched at an appropriate level for the abilities of the candidates. Only two questions were answered correctly by less than half of the candidates.

Comments on Specific Questions

Question 3

The key diagnostic feature for the identification of an arthropod is the number of legs the organism contains and not the possession or non-possession of wings.

Question 7

Xylem as an example of a tissue was not well known. All responses were seen, the most common incorrect response was organ.

Question 9

The movement of carbon dioxide in and out of a mesophyll cell by diffusion was not well known. Active transport and respiration were the more common incorrect responses.

Question 15

More able candidates knew that fats are first digested in the duodenum.

Question 22

Many candidates thought incorrectly that the kidney is involved in making urea and so gave **B** as their answer.

Question 24

The majority of candidates incorrectly chose the motor neurone rather than the sensory neurone with very few candidates choosing either of the other two options.

Question 26

This question was answered correctly by the vast majority of candidates.

Question 28

This proved to be a difficult question for many candidates. Less able candidates chose one of the options with sunlight, not appreciating that seeds are usually planted in soil where there is no light.

Question 29

The vast majority of candidates read and interpreted the graph correctly.

Question 33

Many candidates did not appreciate that producers undergo decomposition when they die and so chose only animals to supply energy to decomposers.

Question 39

The majority of candidates knew that carbon dioxide contributes to global warming but many candidates chose sulfur dioxide as the other gas rather than methane.

BIOLOGY (US)

Paper 0438/23
Core Theory

Key Messages

Read the questions carefully and answer the question asked.

General Comments

Most candidates were able to complete all sections, there did not seem to be a problem with the time allowed for the paper.

Comments on Specific Questions

Question 1

- (a) Candidates found it difficult to identify features from images in order to name the group to which they belonged.
- (b) The most common correct response was that the molluscs had a shell and a slimy skin. Many candidates thought incorrectly that reptiles do not have a backbone or used features that were not listed in the question.

Question 2

- (a) (i) Few candidates knew that chamber **B** is the right ventricle.
- (ii) Few candidates knew that the blood goes to the lungs after it leaves chamber **B**.
- (iii) Approximately half of the candidates knew that blood found in Chamber **C**, the left atrium, has a low concentration of carbon dioxide and a high concentration of oxygen. Some candidates ticked only one box.
- (iv) Few candidates knew that the tissue that makes up the wall of chamber **D** is (cardiac) muscle. A common incorrect response was heart tissue.
- (b) (i) Very few candidates identified one of the valves and labelled it with a **V**. All parts of the heart were labelled as valves.
- (ii) The idea of the valve causing a one way flow of blood or to prevent the blood flowing backwards was not commonly known to candidates.
- (c) (i) Many candidates appreciated that the heart speeds up or beats faster or accelerates when a person exercises. More forceful contractions of the heart was rarely seen.
- (ii) A whole variety of causes of CHD and reasons why people with this disorder are unable to do much exercise were given by candidates but few gained any credit.

Question 3

- (a) Many candidates gained full credit for choosing the correct words about enzymes.

- (b)(i) Many candidates used the graph correctly to determine that 7.5 is the pH at which the saliva works the fastest. Some candidates gave 7 which was not creditworthy.
 - (ii) Most candidates used the graph correctly to determine that it takes 4 minutes for the starch to be digested at pH 6.
 - (iii) Many candidates did not appreciate that the low pH in the stomach due to the hydrochloric acid will denature the enzyme which works best at pH 7.5, as determined in (b)(i). Many candidates repeated the question stem.
 - (iv) Many candidates appreciated that amylase digests starch but few knew that it is produced in the salivary gland. A common incorrect response for site of production was the stomach.
- (c) Few candidates appreciated that temperature can change the rate of enzyme activity.

Question 4

- (a) Some candidates could match the diagrams to the type of cell found in the female reproductive system. Many candidates drew more than three straight lines or drew lines which were difficult to follow.
- (b)(i) Many candidates gave answers which were too vague to be creditworthy such as they remove or catch anything that goes into the lungs. Answers needed to be much more precise in order to gain credit for example, cilia beat and move the mucus up away from the lungs.
- (ii) Candidates found this difficult. Some knew the egg was involved but usually did not know how. Many thought the structures were in the nostrils rather than the oviducts.
- (c)(i) Most candidates scored some credit but few scored full credit for oviduct, ovary and uterus. A common error was to mix up oviduct and ovary.
- (ii) Few candidates appreciated that the sperm were released at the top half of the vagina/at the base of the uterus/on the cervix. Many put the X in the uterus wall or the oviduct. Many candidates omitted this part.
- (d) Many candidates knew that the tail of the sperm is used for movement to get to and to fertilise the egg.

Question 5

- (a) Many candidates do not understand diffusion and osmosis. There were a significant number who did not complete all eight boxes and those who did generally did not gain much credit.
- (b) Candidates found this very difficult. Many could describe what was happening to the small bag of coloured salts in the water but few could relate this information to help explain how tissues obtain oxygen from the blood.

Question 6

- (a) Many candidates correctly named one agent of pollination, with wind, insect and a named insect being the most common.
- (b) Few candidates could state why fruit and seed dispersal is important for plants in terms which were detailed enough to be creditworthy such as colonising new habitats, preventing overcrowding or reduction of competition. Many gave vague statements such as it's the way they reproduce or it is necessary for plant growth.
- (c) Most candidates could use the information given and realised that the means of dispersal was wind but not all of these could give a reason such as the fruits or seeds are light, easily detached, have a large surface area to catch the wind or hairs that act as a parachute.

- (d) Most candidates gained credit for some or all of water, oxygen and warmth. A common response was light. Many candidates gave more than three environmental conditions which included incorrect conditions thus preventing them from achieving full credit.

Question 7

- (a) Many candidates gained some credit. However, many candidates drew more than four straight lines at each side and some joined the left hand side boxes to the right hand side boxes omitting the boxes in the centre. Some drew lines which were difficult to follow.
- (b) Few candidates could define the term trophic level. Many gave vague and general comments which were not creditworthy such as the place in the chain of life or the four organisms in a food chain. It was also omitted quite often.

Question 8

- (a) (i) Few candidates knew that a population is a group of organisms of one or the same species living in the same place at the same time.
- (ii) Some candidates could use the graphs to arrive at the correct answer of 4300 million years but some of these omitted the million. A whole range of answers were given.
- (b) Many candidates could describe and understood the reasons why the patterns of population growth in Africa and Latin America were changing.
- (c) Many candidates showed a good understanding of the reasons why populations were decreasing.
- (d) (i) Most candidates appreciated that the numbers of seabirds increased but failed to realise that there was a decrease followed by an increase and so did not gain credit, whereas they did gain credit for the decrease in woodland birds.
- (ii) Many candidates showed good understanding of the reasons why there had been a change in the number of woodland birds since 1990.
- (iii) Many candidates appreciated that maintaining food chains and webs is important in conserving species and habitats but other reasons such as their use as a resource, for maintaining biodiversity, their aesthetic value and avoiding extinction were less well known.

Question 9

- (a) (i) Few candidates gave a description of inheritance which included being passed from parents to offspring or passed on in the genes or passed on in the eggs and sperm. Many mentioned genes, eggs or sperm but gave vague descriptions about things being passed on or things being obtained.
- (ii) Few candidates knew that an allele is an alternative form of a gene and that dominant is the characteristic seen in the outward appearance. Many gave answers in terms of genes from parents and being a capital letter, which were not creditworthy. Some candidates only described the term dominant rather than both terms, dominant and allele
- (b) (i) Stronger candidates worked their way through the family tree and gained full credit. When mistakes were made credit for later steps could still gain credit as the error was carried forward but each line needed to correspond with the preceding line. Many candidates did not understand how the genetic diagram should be completed and so gained no credit.
- (ii) Those candidates who had worked through the diagram well in (b)(i) usually gained credit for working out that all of the children have club thumbs.

BIOLOGY (US)

Paper 0438/33
Extended Theory

Key Messages

- Candidates should ensure that they read all questions carefully. A number of responses were not specifically directed at the question and although good detail was often included in the answers it could not be credited. Careful attention should be paid to the command word in the question. Command words such as 'describe' and 'explain' were frequently misinterpreted.
- Candidates should be encouraged to use precise and correct scientific terminology. Phrases such as 'the temperature would *affect* photosynthesis' or the 'homes of organisms' do not earn credit.
- Numerical answers should always be followed by the appropriate units. Several questions in this paper included information based on data. Answers should be illustrated with figures taken from graphs or tables; no credit is given unless these answers include units.
- Comparative data quotes should include two complete sets of data with readings from both axes at key points on a graph or in a table.
- Candidates should always be equipped with a black ball point pen, pencil, ruler and electronic calculator. Only diagrams and graphs should be written in pencil. Candidates should avoid writing over pencil answers with a pen. Thick felt pens should never be used as the ink travels through the page and obscures the writing on the reverse side of the page.
- When required to give a simple answer, such as a letter or a number, candidates should not write over a previous answer if they change their mind. First answers should be crossed out neatly and a new answer should be written above or alongside. In cases where an answer is ambiguous, such as a **B** changed to a **D**, no credit can be awarded.
- Candidates should expect questions on experimental techniques and also be expected to make conclusions from experimental data. Some seemed unprepared for **Question 2** that was set on an experiment on osmosis.

General comments

There were very few cases where candidates failed to attempt a whole question and little evidence that candidates had insufficient time to complete the paper. Longer answers, such as those in **Questions 3(c)** and **5(c)(iv)**, were generally well structured with those candidates who wrote in continuous prose rather than in bullet points usually including appropriate detail and thus gaining much credit. Many candidates were able to draw on their own local experience to provide valid examples of causes for possible extinctions (**Question 1(b)**) and the benefits for integrated farming (**Question 6 (c)**). However where it was necessary to recall detailed knowledge correctly, a lack of precision was evident. Examples included aspects of excretion (**Question 4(a)(i), (a)(iii)**), the structure of the kidney (**Question 4(b)**) and details of human reproduction (**Question 5 (a)(i), (a)(ii), (b)(i), (b)(ii), (c)(ii)** and **(c)(iii)**). The term *water potential* (**Question 2(b)**) described only in the extended syllabus, was poorly understood by a considerable number of candidates with many not realising the connection to osmosis and the movement of water molecules across partially permeable membranes. The lack of the correct use of key terminology was often the main cause of a lower score in an otherwise able candidate.

Comments on specific questions

Question 1

- (a) Most candidates completed the identification key correctly. A few candidates put letters in all the spaces of the right hand column suggesting that they were unfamiliar with using simple dichotomous keys. A common error was to confuse the amphibians identified as **A** and **F**.

- (b) This question was answered well with many candidates giving insightful suggestions as to how amphibians might be endangered. Many answers made relevant reference to local situations, showing consideration of the problems specific to amphibians. Repetition or elaboration of the same point, for example pollution, prevented some candidates from gaining full credit. Some candidates used the colloquial word 'homes' rather than referring to the animals' habitats. Another common error was to suggest factors that may cause the death of an individual amphibian, but would not be a cause for the potential extinction of a whole species, for example falling prey to their natural predators and competition for mates.

Question 2

- (a) (i) All potential marking points were seen, but references to carriers, channels or pumps were infrequent. Most candidates gave features of diffusion that are not applicable to active transport but, where candidates clearly stated that their answers were given in terms of active transport instead, these were also credited. Some candidates used the phrase 'along a concentration gradient' instead of 'down' or 'against' which did not gain credit.
- (ii) Almost all candidates knew that root hairs are an adaptation for the absorption of ions. In addition, many discussed the extensive branching of roots and their large surface area. Only the more able candidates realised that ions are absorbed by active transport and thus described the role of carrier molecules and the large vacuole in this process.
- (b) (i) Many candidates calculated the percentage change in mass correctly but there was a minority who did not attempt this question. Those candidates who did not obtain the correct answer were able to gain partial credit if their working was shown and was correct, highlighting the importance of showing all working. The extensive arithmetical workings of a small number of candidates suggested that they did not have an electronic calculator.
- (ii) Only the most able candidates were aware of the reasons for percentage change calculations such as the one they performed in (b)(i). The idea that the onions had a different starting mass and therefore the calculation of percentage change in mass allowed results to be compared was rarely stated. A number of candidates gave vague answers suggesting that they had some idea about this concept but they did not express their ideas clearly enough to be creditworthy.
- (c) (i) Candidates needed to complete the graph using their own calculated values from (b)(i). Even if an incorrect value had been calculated, this error was carried forward, enabling all candidates the opportunity to gain credit for correct plotting. Most candidates plotted their data correctly, but a minority were confused by the minus sign in front of the value or extrapolated the trend line beyond their data point.
- (ii) This question was straightforward for those candidates who were familiar with how water potential can be derived graphically from reading the intercept with the x-axis. However, some candidates gave a wide range of guesses at the value. A number of candidates who had correctly found the value omitted the units and thus did not gain full credit.
- (d) Almost all candidates used the term water potential in their answers with stronger candidates showing understanding of the term. Of those who understood the term, comparative statements between the water potential of the onion bulbs and the solutions were sometimes lacking; stating that water potential was high or low was usually too vague to gain credit. Although the more able candidates knew that change in mass was caused by the movement of water in and out of the onion cells, a considerable number incorrectly attributed this to the movement of the 'solution' or even the 'salt'. A few candidates also did not understand that osmosis applies only to water and very few made reference to the partially permeable membranes.

Question 3

- (a) Although most candidates attempted to use data from the graph to compare the two batches of tree leaves, many seemed unsure of what the graph was showing. Many candidates implied that the x-axis was time rather than temperature, with statements suggesting that batch J peaked later than batch H. Additionally, references to data were not always precise and/or comparative in otherwise good answers.

- (b) (i) Most candidates understood that temperature was the limiting factor however, few were able to explain why temperature has such an effect. Only a minority mentioned that the stomata open wider and therefore more carbon dioxide would be taken into the leaf. Comments rarely involved the use of enzymes or the frequency of collisions between enzymes and substrate molecules. Many attempted to explain the effect on the process of photosynthesis rather than the effect of temperature.
- (ii) Most candidates mentioned the consequence of high temperatures on enzymes and stated that their activity at high temperatures would decrease or stop. The term *denatured* is only relevant to enzymes and not to cells or photosynthesis. Few mentioned the closing of stomata.
- (c) Almost all candidates mentioned an increase in plant growth and increase in photosynthesis although sometimes these were too vague to be credited. Fewer candidates went on to explain the consequences of this in the form of increased production of glucose, energy for cells or proteins for enzymes. References to greenhouse gases and global warming were seen but the consequences were less well understood or stated. Weaker candidates did not realise that carbon dioxide uptake measured in the experiment equated to the rate of photosynthesis and thus found this question demanding. This is an extended response question and answers were generally too brief or covered the same points numerous times.

Question 4

The excretory functions of the liver and kidney were examined in this question. The kidney was generally well understood, the excretory role of the liver was not.

- (a) (i) Many definitions of excretion were limited or vague and so not creditworthy. Many candidates did not describe the removal of waste from the body and confusion of excretion with egestion was very common.
- (ii) Almost all candidates identified carbon dioxide as an excretory product that is passed out through the lungs.
- (iii) The liver was frequently associated with 'filtering' the blood or 'excreting' toxins or alcohol, neither of which is correct. Good answers that included references to deamination, production of urea and the breakdown of toxins were rare. A few candidates described the production of bile, which could not be credited as they did not mention bile pigments which are the excretory products.
- (b) Most candidates named and identified the blood vessels carrying blood to and from the kidney. The rest of **Table 4.1** was often incomplete. Very few candidates identified **K** (cortex) as the region where blood is filtered. A significant number of candidates were able to identify the structure on the diagram from its function, but no credit could be awarded because they did not know the names of the structures. The spelling of ureter was important so that there was no confusion with urethra.
- (c) (i) A wide variety of correct answers were given; salts, urea, and toxins were the most common. A few candidates thought incorrectly that carbon dioxide, amino acids or glucose were removed during dialysis.
- (ii) Candidates answered this very well. They were aware of the time constraints on people having dialysis as well as the restricted diets. Many also mentioned the possibility of rejection of the kidney and many stronger candidates mentioned the need to take immunosuppressants as disadvantages of kidney transplants.

Question 5

- (a) (i) Many candidates seemed unfamiliar with the sequence of changes within the ovary during the menstrual cycle and thus were not able to identify structures **R** and **S** as the corpus luteum (yellow body) and the follicle.
- (ii) Ovulation was generally identified correctly but was occasionally confused with menstruation.
- (b) (i) Although the majority of candidates knew that oestrogen stimulated the growth of the uterine lining, the other three reproductive hormones were seen regularly.

- (ii) Most candidates named progesterone as the hormone involved in the maintenance of the lining but as with (b)(i) it was confused with the other reproductive hormones. Some spelling was poor but phonetic spellings were accepted. A few candidates gave FSH as an answer to both parts of (b).
- (c) (i) The differences between sperm and eggs were generally well known. The most common responses being sperm have tails, are motile and are smaller than eggs. Most candidates achieved full credit, but some was lost for failure to make comparative references to the size of the gametes or to suggest that the individual sperm would contain either X or Y chromosomes. Those candidates who referred to the site of production or numbers produced gained no credit as these are not differences between the two cell types.
- (ii) Many candidates knew that haploid is the term that describes the number of chromosomes in the gametes, but many incorrect responses were also seen. A small minority gained no credit because they wrote 'haploid and diploid' and hence contradicted themselves.
- (iii) The vast majority of candidates believed that fertilisation occurs in the uterus, ovary or vagina, rather than in the oviduct. 'Ovary duct' was not accepted, although phonetic spellings of oviduct or Fallopian tube were accepted.
- (iv) Stronger candidates recounted the events between the sperm reaching an egg and implantation using correct technical terms. Many knew that only the nucleus of the sperm enters the egg cell and that following this a fertilisation membrane forms preventing other sperm from entering. Many knew that a zygote forms, but there was a tendency for weaker candidates to mention meiosis of the zygote instead of mitosis. The best answers included description of movement, using cilia or peristalsis, in the oviduct.
- (d) (i) Most candidates described correctly the slight increase at first and then an exponential increase to a small plateau between 1992 and 1993 hence gaining full credit. A few vague descriptions were seen which were less creditworthy. Candidates should be advised to include units and avoid 'unlinked' numbers in data quotes.
- (ii) There was much confusion between artificial insemination and IVF. Strong candidates recognised that the fertility drug should be taken when the follicles are developing, but a number of candidates suggested taking the drug for five days with no mention of the stage of the reproductive cycle when this would be appropriate.

Question 6

- (a) (i) Almost all candidates appeared to be familiar with the term producer, but many described its role in a food chain rather than the meaning of the term and thus did not gain credit. Stronger candidates knew that a producer makes its own food using energy from the sun. Very few used the term autotroph in their descriptions. There was a common misconception amongst many candidates that plants 'produce energy'.
- (ii) Most candidates drew a correct food web. Some omitted the arrow heads or showed arrows going in the wrong direction. Almost all recognised that elephant grass was another producer. A minority added organisms to the food chain that were not in the text thereby not gaining full credit.
- (b) Only the most able candidates described what happens to energy that is not passed from producers (vegetables) to primary consumers (humans). Most candidates seemed to be familiar with energy flow as a concept, but often gave processes by which animals might lose energy, such as movement and egestion rather than considering the reasons for energy loss at the first step in the food chain. Other common errors referred to loss of energy through 'photosynthesis' or 'into the soil'.
- (c) Many candidates recognised that fish provide another possible source of income for the farmer and that the fish could feed on waste materials, elephant grass cuttings and phytoplankton. A number mentioned the reduced risk of eutrophication. This question showed some insightful thinking on an unfamiliar context with many achieving full credit.

BIOLOGY (US)

Paper 0438/04

Coursework

General Comments

There was some excellent work from some Centres, who made good use of the freedom and responsibility of designing their own tasks to devise challenges that interested and engaged their candidates, bringing out the best in them.

However, in some Centres the quality of the samples of work was below what would normally be expected of IGCSE candidates. Graphing skills, for example, were often extremely weak, and it appeared that candidates did not appreciate the importance of displaying results clearly and accurately. Candidates would benefit from having more practice in drawing graphs. They should be provided with the type of graph paper used on Cambridge examination papers, ruled in 2 mm squares, rather than 5 mm squared paper. This encourages better construction of scales and more accurate plotting of points. The example graphs given in the *Coursework Training Handbook (Part 1): Guidance*, which is available on the Teacher Support Site, could be used to show candidates the standards they should be aiming to achieve.

Graph drawing skills are also helped when candidates carry out experiments that generate suitable data. In several cases, only three values of the dependent variable were collected, which is not enough to construct a line graph. Such limited data collection also lowers the possible marks that can be obtained for C2, where a simple table listing, for example, three observations of the results of a food test, is insufficiently challenging to be awarded a mark of six.

On the whole, candidates tended to demonstrate their skills most fully where they used worksheets that were not too structured; examples of such worksheets are given in the *Handbook*. Initially, students will need a lot of guidance, but as they progress through the course they should be given more freedom to show what they can do with less help.

Not all Centres provided evidence for their assessment of C1. These tasks do not provide written evidence from the candidates, and so the assessors need to provide such evidence that can be seen by the external moderators. Centres are expected to provide tick lists that show how each individual candidate has met the criteria used during the assessment task.

Some Centres did not provide all of the paperwork required. The external moderator needs to have full information about the tasks that were set, which means that any worksheets that were provided to candidates need to be enclosed with the sample. If oral instructions were given, a summary of these should also be enclosed. The work samples all need to be fully marked, with comments from the teacher written on the work. The samples themselves must be complete, so that all of the assessed work from the sampled candidates can be inspected.

In large Centres, where more than one teacher is involved in assessment, it is essential to ensure that standards of assessment are identical for each candidate. This should involve planning before any assessment begins, perhaps deciding on a set of tasks that will be used, as well as their mark schemes. There should also be internal moderation of the marks following assessment, and Centres are required to provide evidence of this. Not all Centres followed this guidance.

BIOLOGY (US)

Paper 0438/53

Practical Test

Key Messages

Candidates should be familiar with practical procedures outlined in the syllabus and be confident to use these skills in the practical tests.

To achieve high marks candidates

- are advised to pay particular attention to careful reading of the questions to plan the available time before starting to answer.
- need to be able to construct a results table, using ruled lines to include columns with appropriate headings and sufficient rows to show all results clearly.
- should understand how results are collected and measured, so that sources of error can be recognised and ways of improving an experiment can be suggested.
- should label graph axes clearly with the variable being plotted including the units, and use scales that occupy at least half of the grid.
- drawings need to be made using an HB pencil [not ink] so that use of an eraser can thoroughly remove all double lines. The guide line for a label must make contact with the structure intended without a gap or an arrow head.
- should show all stages in a calculation. Measurements must use SI units as specified in the syllabus.
- should be familiar with variables that are to be changed, to be measured and to be controlled.

General Comments

Many candidates gave clear well presented answers.

Some candidates drew clear results tables but many did not and some drew two separate tables for the food tests results in **1(b)(i)**.

Graphs should be plotted so that most of the grid area is used, candidates should look carefully at the data so they can choose a scale that fits the available space. The scales should also be linear and easy to use when plotting the points. Plotted points need to be small and accurately placed at the plot point. The correct choice of graph to represent the data accurately is important, **1(e)(i)** required a line graph.

Drawings of a half flower needed to be accurate, sufficiently large to occupy at least half of the space available with the correct number and proportion of floral parts and labelled with lines that made contact with the intended structure.

The Supervisor's Report is very important in ensuring that candidates are credited appropriately when materials have to be substituted for those specified in the Confidential Instructions. Supervisors should trial the practical materials specified in the Confidential Instructions some time in advance of the actual examination. This means that if difficulties arise there is time to seek advice about alternative materials from Cambridge Assessment, using the contact information on the Confidential Instructions. In cases, where a substitution is made the Supervisors Report should include as much detail as possible to allow examiners to assess the candidate's answers appropriately.

Comments on Specific Questions

Question 1

This question was based on artificial urine samples for analysis following two common food tests for candidates to follow the instructions given for proteins using biuret and for reducing sugar using Benedict's solution. A planned results table had to be constructed to record observations of these food tests. Making the link between the recorded observations and the scenarios presented candidates were expected to make and explain a conclusion about the health of the person whose urine sample had been tested.

Candidates needed to understand how results are collected and measured, so that sources of error can be recognised and ways of improving an experiment might be suggested. Following a given set of data comparing glucose content of blood with that of excreted glucose in urine, a graph and data handling followed.

- (a) Most candidates recorded correctly in **Table 1.1** that sample **C** appeared cloudy; and samples **A** and **B** clear yellow.
- (b)(i)&(ii) Based on the information given many candidates constructed a single results table with ruled rows and columns to record their observations obtained after testing each of the samples in turn for the presence of reducing sugars and proteins. A few candidates presented two separate tables, one for each food test. Some drew boxes to record the final colours though many included extra details for the initial colour before testing. Many candidates completed the tests correctly.
- (c) Given the scenarios for alternative health problems coupled with their food test results, many candidates could deduce and explain the three possible health diagnoses for the three people who had given 'urine' samples. However, many candidates found these links difficult. Where the final colours were different from those expected links could sometimes not be made.
- (d) Very few candidates were able to give precise answers to this question. When assessing sources of error, candidates need to think about the variable in the experiment that must be standardised and the way in which the results are obtained. The improvement must cover details to explain how the error can be overcome. The error of differing water temperature was sometimes given but often not accompanied by how this might be improved such as using a thermostatically controlled water bath. Repetition was also given but again not accompanied by the reason. A few candidates indicated the difficulty of seeing the final colours and knew that the use of a colour chart would help.
- (e)(i) The graph needed was a line graph and candidates found it challenging. The independent variable should be plotted on the horizontal axis (x-axis) which is the first column in **Table 1.2**. The dependent variable should be plotted on the vertical axis (y-axis) which is the second column in **Table 1.2**. The axes needed to be labelled to show the full title of each variable as given in the column headings of **Table 1.2b** and also the units. The scale for the axes needed to permit more than half of the printed grid to be used. The plotting of each point should be made by using a neat accurately positioned cross with a well-constructed ruled line between the plotted points or a smooth line not extending beyond the points. Candidates are advised not to use a large circular dot for plotted points as this fills a small square and creates difficulties when ruling the line between points. The correct choice of graph to represent the data accurately is important, a histogram or bar chart is not a suitable means to display this data.
- (ii) Most candidates accurately described the trend as a positive correlation and also noticed that no glucose was excreted in the urine until after 200 mg per 100 cm³ in the blood had been measured.
- (iii) Most candidates managed to record correctly the mg per minute of glucose excreted in the urine when the blood glucose level reached 280 mg per 100 cm³. Where the graph was presented correctly this involved a straightforward reading from the curve.

Question 2.

- (a) Details of the half flower provided by Centres were recorded in the Supervisor's Report. This is important to compare with the candidates' drawings. Overall drawings of the half flowers were large, showing a well-proportioned image and labelled. The most common labelling error had the guidelines from the name not making contact with the intended part of the flower. Some candidates drew two flowers but a single drawing was required showing both the male and the female parts. Some candidates presented drawings of any flower but it was important that the drawing should resemble the flower that was supplied by the Centre. Use of a sharpened HB pencil was essential because if an ink pen is used it is impossible to erase errors so it becomes very difficult to award credit to the final version. The details of the numerous parts needed to be shown without any shading.
- (b)(i)&(ii) Many candidates based the similarity and difference on the petal arrangement of the half flower shown in **Fig. 2.1**, however the part of the flower shown in **Fig.2.1** was the male flower and lacked any female parts.
- (c) Most candidates accurately measured the length of the line **DE** on **Fig.2.1** to the nearest millimetre and applied the formula to determine the actual length given the magnification $\times 0.4$ which was printed at the right hand side of **Fig. 2.1**.
- (d)(i) Most candidates identified the independent variable correctly as the concentration of sugar solution.
- (ii) Many candidates identified the dependent variable to be the growth of the pollen tube but this was not creditworthy as it does not take into consideration the time factor. It is the rate of growth of the pollen tube.
- (iii) Many candidates gave one correct controlled variable but stronger candidates gave two.