BIOLOGY

**Paper 0610/12
Multiple Choice (Core)**

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

General comments

There was a good understanding of the characteristics of living organisms, the function of the xylem and white blood cells, asexual reproduction and the description of the term gene.

There was some uncertainty about mitochondria, rate of diffusion, osmosis, assimilation and germination.

Candidates need to carefully read the question and be methodical when applying concepts to experiments, for example **Questions 8**, **9** and **10**.

Comments on specific questions

Question 4

There was some confusion identifying a mitochondrion in a photomicrograph with a significant number selecting the ribosome. Candidates should be able to identify cell structures in images and drawings.

Question 7

Some incorrectly thought that decreasing the concentration gradient would increase the rate of diffusion.

Question 8

Only a few candidates could correctly interpret the osmosis experiment. Most candidates thought that the solution in the test-tube was water.

CAMBRIDGE
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Question 9

Some candidates could not identify the correct test and positive result for reducing sugars.

Question 10

Whilst the majority of candidates could identify that protein digestion would happen fastest at the higher temperature; some did not realise that an enzyme found in the stomach would work best at a lower pH.

Question 12

Few candidates could correctly recognise the description as assimilation, many thought it was absorption.

Question 23

Many candidates thought that the bladder is where urea is excreted rather than the kidney.

Question 29

Many candidates did not know the conditions required for germination. Sunlight is not required but oxygen is required.

Question 30

Whilst most candidates correctly identified the changes in the lining of the uterus in the days before ovulation, a significant number thought that it was breaking down or thinning.

Question 33

Many candidates could correctly describe the variation in height and the reasons for this variation, some did not think that the environment affects height.

BIOLOGY

Paper 0610/22
Multiple Choice (Extended)

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

General comments

There was a good understanding of the elements of biological molecules, structure of the leaf, types of teeth, effects of testosterone and the carbon cycle.

The was some uncertainty about classification of arthropods, respiration and the menstrual cycle.

Candidates need to carefully look at diagrams and graphs, such as **Questions 2**, **5**, **10** and **31**, and also work methodically through information provided in questions, such as **Questions 5**, **6** and **19**.

Comments on specific questions

Question 2

Some candidates correctly identified the organism as an arachnid, but many incorrectly identified it as a crustacean.

Question 5

Some candidates incorrectly selected option **A**, perhaps not considering all of the options. In option **A** the direction of water movement is incorrect for the given water potentials.

Question 6

Some candidates did not understand that active transport must occur across a membrane.

Question 9

A few candidates thought that the substrate and the active site are the same shape rather than complementary shapes to each other.

Question 18

A small number of candidates thought that the larynx prevents the trachea from collapsing.

Question 19

Most candidates could compare the number of carbon dioxide molecules produced in aerobic and anaerobic respiration, but some incorrectly selected 2 molecules.

Question 20

Some candidates incorrectly thought that the lowest concentration of urea would be in the hepatic artery rather than in the renal vein.

Question 21

Some candidates knew that the suspensory ligaments would be slack when ciliary muscles are contracted but some could not then identify the effect this would have on the amount of refraction of light.

Question 25

Some candidates did not realise that self-pollination can occur between different flowers on the same plant as well as within a single flower.

Question 31

Some candidates incorrectly selected option **C**. It is important to read any graph or diagram carefully. Here the *y*-axis label is mass of DNA per cell so two cells are formed at **D**.

BIOLOGY

Paper 0610/32
Theory (Core)

Key messages

It is essential that candidates read each question carefully. Some candidates gave factually correct responses that did not answer the question asked.

General comments

There were some excellent scripts which were awarded very high marks. There was a good standard of scientific knowledge and understanding with many candidates providing detailed and accurate responses. On occasions, some responses were lacking detail. Candidates can use the mark allocation of the question as a guide to how many specific points they need to make.

Comments on specific questions

Question 1

(a)   This was well answered. Less able candidates did not know the elements present in all proteins. A few candidates confused fatty acids and amino acids.

(b)   The majority of candidates knew that catalysts increase the rate of a reaction. Fewer stated that the catalyst is unchanged at the end of the reaction. The most common misconception was that a catalyst is not involved in the reaction.

(c)   Many candidates did not follow the instruction to use the information in the diagram. The weakest responses simply restated what had been said in **1(b)**. However, most stated that the enzyme and substrate combined and that this occurred at the active site. Relatively few candidates went further and pointed out that the bond in the substrate is broken, the products released, or that the enzyme is then free to work on another substrate molecule.

(d)(i) Most candidates could identify the optimum temperature as 50 °C.

(ii)   Nearly all candidates could state that the enzyme was completely denatured at 66 °C. Far fewer could explain how they identified this value, with many restating from the question that the enzyme was denatured. More able candidates referred to zero enzyme activity.

(iii)   Most candidates could calculate the difference as 7.2 arbitrary units.

(iv)   Even the strongest candidates struggled to draw the required line. Many were reluctant to draw on Figure 1.2 and sketched their own axes instead. Of those who drew the curve for a human enzyme on the graph, the majority had the optimum at about 37 °C. Only a few candidates drew the correct shape for the curve showing a gradual increase in activity followed by a sharp decrease.

Question 2

(a)(i) Whereas the majority of candidates identified the pancreas correctly, far fewer could state two pancreatic enzymes. The most common incorrect answers were insulin, glucagon and bile.

(ii) Candidates of all abilities found it difficult to identify an associated organ of the digestive system. Of those who answered incorrectly, the most common organ selected was the stomach, **F**. The most common correct answer was the liver, **D**.

(iii) Digestion and absorption were well known, as was peristalsis.

(b)(i) Many candidates stated an increase and a decrease and identified the peak. The latter was often referred to as the optimum, which is an inappropriate term in this context. Fewer candidates identified when the peak occurred, or that the increase in concentration in the blood happened rapidly, followed by a much more gradual decrease. It needs to be emphasised that when figures are quoted, the information from both axes is required. A number of candidates attempted to explain the shape of the curve rather than describe it as they were asked to.

(ii) Most candidates correctly circled ingestion.

(iii) Many candidates did not know the role of plasma. Common incorrect answers were red blood cells, white blood cells, platelets and blood.

(iv) Stronger candidates knew that antibiotics work against bacteria. Some candidates stated pathogens, which is not specific enough, or gave a list of possibilities.

Question 3

(a)(i) Many correctly labelled the left ventricle wall. Other candidates labelled the chamber instead of the wall or selected some other part of the heart including the atria and some of the blood vessels.

(ii) There were some very confused answers as candidates did not follow the instructions and attempted to describe blood flow round the entire circulatory system. Even so, many candidates earned marks for blood flowing from the atrium into the ventricle. Only a few candidates earned a mark for stating that the blood passed through a valve.

(iii) Many candidates identified **C** as a pulmonary vein. Other candidates said it was a vein but did not specify which one.

(b)(i) The majority of candidates selected the correct ECG for each activity.

(ii) Some candidates did not follow the instructions and gave ECG as one of their answers. Many described taking the pulse rate, although a significant number omitted the word 'rate' and so were not awarded the mark. A number of candidates explained where and how to take a pulse rate, but many of these did not mention 'pulse rate' in their description. The use of stethoscopes or listening to the closing of the heart valves was given quite frequently. A common misconception was that the heart valves make a noise when opening. The use of blood pressure monitors and current technological devices were also accepted.

(c)(i) Most candidates gained two marks for identifying the description of anaerobic respiration. Many gained all three marks.

(ii) A significant number of candidates incorrectly thought that during vigorous exercise the rate of breathing increases, but that the depth of breathing decreases.

Question 4

(a) This question was answered accurately by candidates of all abilities.

(b) Most candidates identified the ovule or ovary. Fewer candidates knew the filament, and very few knew the sepal (which was usually called a leaf).

(c)(i) Most candidates ignored the instruction to use the information from Figure 4.3 in their answer. The majority correctly identified the crocus flower as being insect pollinated. However, the reasons usually stated: brightly coloured petals, the presence of nectaries and the scent given off by the flower, could not be credited as these features are not visible in the photograph.

(ii) A few candidates gave the correct description. Some had the idea that pollen transfer was involved but did not specify that it was from the anther to the stigma. A common error was to describe fertilisation instead of pollination.

(d)(i) Many candidates identified a pollen grain from a wind-pollinated flower.

(ii) Many candidates found it difficult to calculate the length of the pollen grain and give an appropriate unit. Many attempted a magnification calculation rather than using the scale bar. Often the length of the pollen grain given was implausibly large (e.g. 3 cm).

(iii) Candidates did not read the question with sufficient care, and many gave characteristics of insect-pollinated flowers and not the characteristics of the pollen which they produce. Of those who attempted to describe the pollen, most could state that it was sticky.

Question 5

(a)(i) An insect feature, visible in Figure 5.1, was identified by some candidates.

(ii) Very few candidates could state a feature that identified the leaf insect as an arthropod.

(b)(i) Many candidates recognised that this insect looks like a leaf and so it would be camouflaged and less likely to be eaten by a predator. Very few took the idea further and stated that this would enhance its chances of survival.

(ii) This was quite well answered. The most common error was to put genetics for the second answer.

(c) Many candidates could state at least two ways of conserving an endangered species. However, there was a tendency to state the same point with slightly different terminology. For example, protecting the habitat and creating a nature reserve would be the same marking point.

Question 6

(a)(i) Even the strongest candidates found this a demanding question. Perhaps this was because they did not read the question with sufficient care as the majority gave the answer as **C** and their reason as being that this was the where the highest yield of barley occurred. Those who did identify **B** correctly tended to reuse the phrase from the question 'this was when the largest increase in yield occurred'. A few referred to the steepness of the slope of the line.

(ii) This was well answered by candidates of all abilities. Those who misread the value from the graph were able to gain one mark (error carried forward) for the calculation.

(iii) Candidate were usually unable to arrange the processes in their correct order.

(iv) A significant number of candidates misread the question and answered by describing the process of selective breeding. Those who answered the question asked usually described the use of fertilisers, insecticides, herbicides and genetically modified seeds.

(b)(i) It is important that candidates clearly state that a monoculture involves the culture of one type, or one species of plant, and is not the culture of one plant.

(ii) In general, this topic was not well known. It is important that answers contain comparative descriptions – for example in a monoculture the yield is higher and there is an increased risk of a disease spreading.

BIOLOGY

| Paper 0610/42 |
| Theory (Extended) |

Key messages

It is important for candidates to use the correct scientific terminology as stated in the syllabus. There were instances when candidates did not achieve all the available credit due to inaccuracies in the scientific language used in their responses. This was the case in **Questions 1(e)** and **6(b)(i)**.

Candidates should read every question carefully and complete all the instructions contained therein. **Questions 1(b)(ii)**, **2(a)(i)**, **5(a)(i)** and **5(a)(ii)** were occasionally missed.

General comments

There was a high standard of scientific knowledge and understanding seen with many candidates providing detailed and accurate responses. On occasions, some responses were lacking detail. Candidates can use the mark allocation of the question as a guide to how many specific points they need to make.

Whilst many candidates had a broad knowledge of the syllabus, it was evident that some areas of the syllabus were better known than others. For general guidance, the syllabus can be used as a guide to what content needs to be covered and can provide an excellent revision tool for candidates.

Comments on specific questions

Question 1

(a) (i) Most candidates could describe the meaning of the term diffusion. Very occasionally, candidates contradicted themselves by referring to particles moving against their concentration gradient.

(ii) The correct response of kinetic energy was often seen. Incorrect responses included activation energy, passive energy and suggestions that energy was not required.

(b) (i) The correct response of respiration was commonly seen. Breathing was a common incorrect response.

(ii) Most candidates were able to draw an arrow crossing the cell membrane to indicate movement out of the cell.

(c) Most candidates recognised that the particle movement involved energy, and that the movement was from a region of lower concentration to a region of higher concentration and therefore that **Q** represents active transport. Occasionally, candidates tried to explain other forms of particle movement such as osmosis or diffusion, which were unsuccessful.

(d) Some reasonable explanations were seen, including that starch is a large insoluble molecule that is already digested in the mouth. Candidates should use the mark allocation as a guide to how many distinct points they need to make in their responses. Some candidates only gave one reason. Some candidates stated that starch needs to be broken down, but did not explain that starch had already been broken down by the time it reached these epithelial cells.

(e) There were many detailed and accurate explanations seen. However, some candidates incorrectly referred to salt solution moving rather than water. Also, when referring to this phenomenon, candidates should be reminded to give their responses in terms of water potential rather than water

concentration. Generally, descriptions of the cells were good with subject specific language used such as turgidity and plasmolysis.

Question 2

(a) (i) Most candidates gave the correct temperature range. Very few candidates omitted the units.

(ii) Candidates who completed this question mostly drew a line at 37°C. Occasionally a line drawn at 36°C or 38°C was seen. Sometimes a vertical line was drawn rather than a horizontal line.

(iii) Candidates should take care not to repeat the information already provided in the question. A number of candidates gave the response of homeostasis, which was already provided to them. Reference to negative feedback was the required response.

(iv) A few candidates misinterpreted the question and gave the responses of the body to a temperature above the set point. The question asked for the changes the body makes to increase the internal body temperature. It was evident that there is some confusion over what is meant by vasoconstriction. Some candidates referred to contraction of incorrect blood vessels such as veins or capillaries rather than constriction of arterioles. There were instances of candidates referring to blood vessels moving towards or away from the surface of the skin. There were also some vague references to less blood flowing to the skin rather than less blood flow to the skin surface. However, the mechanisms of shivering and contraction of the hair erector muscles to raise hair and trap a layer of insulating air were generally well understood and correctly described.

(b) (i) The sweat gland was commonly identified by nearly every candidate.

(ii) Structure **C** was sometimes misidentified as a blood vessel, a neurone or a receptor. Structure **D** was sometimes misidentified as a receptor or a blood vessel.

Question 3

(a) (i) Most candidates were able to calculate the mass. Candidates should be encouraged to 'sense check' their calculations. If the total mass of a human eye is 28 g, then the calculated mass of water should not exceed this value. Any value over this should have made candidates realise that they need to check their calculation. Candidates should be encouraged to complete all the instructions contained within the question. Several candidates completed the correct calculation but did not express their value to two significant figures, giving the value of 26.6.

(ii) There were some excellent responses seen, with a large variety of uses of water given. Occasionally, candidates were not specific enough and simply referred to a lack of water causing dehydration or that water was a large component of the body.

(b) (i) **L** was sometimes misidentified as the cell wall. **M** was sometimes misidentified as mitochondria.

(ii) This question asked for the identification of two features. Candidates should be reminded that the absence of something does not constitute a feature. Any references to the absence of membrane-bound organelles were not credited.

(iii) Bacteria was commonly stated. Incorrect responses included *Vibrio*, cholera and virus.

(iv) *Vibrio* was commonly seen. Incorrect responses included *cholerae* and *Vibrio cholerae*.

(v) It was evident there was a good understanding of how cholera causes dehydration. Occasional misconceptions included that the cholera bacteria, or the toxins, secrete chloride ions and that a higher water potential in the gut is created.

(vi) Genetic modification was generally understood. There were a few occasions where some candidates confused ligase with lipase. There were also some inaccurate spellings of recombinant.

Question 4

(a) (i) One of the main functions of the placenta is to keep the blood of the mother and fetus separate. This was missed by a number of candidates. Some candidates were too vague in their responses

and simply described exchange of nutrients or waste products. The best responses referred to transfer of oxygen or nutrients from the mother to the fetus and removal of urea and carbon dioxide from the fetus to the mother. Several other correct functions were seen including those related to immunity and hormones.

(ii) Several functions of the amniotic sac and fluid were given. The most common being the role of amniotic fluid as a shock absorber and protection against mechanical damage. However, this was often the only function given. Candidates should realise that three different functions should be described for a three-mark question. Occasionally vague responses referring to protection were seen which were ignored.

(b) (i) HIV was the most common sexually transmitted infection given. Other correct examples of sexually transmitted infections were also acceptable.

(ii) Methods of controlling the spread of sexually transmitted infections were well known. Some candidates needed to be more specific in their responses. Unqualified references to contraception, regular checks or using clean needles were ignored.

Question 5

(a) (i) Many candidates were not careful enough in their drawings. On many occasions, the circle drawn around the vascular bundle was too large, incorporating air spaces and sometimes even the epidermis.

(ii) Common misconceptions included labelling of the spongy mesophyll or the air spaces.

(iii) The correct answer of chloroplast was commonly seen, with chlorophyll being the most common incorrect response.

(iv) There were some excellent responses seen with the tissues in the vascular bundle identified and their functions described. There were some incorrect substances named as being transported by the xylem or phloem. The function that was commonly missed was the structural support function of xylem.

(b) (i) The term hydrophyte was commonly given. Incorrect responses such as aquatic plants or xerophytes were also seen.

(ii) Feature **T** was occasionally identified as spongy mesophyll rather than air space. Candidates should be encouraged to use the terminology given in the syllabus. The term 'air gap' was ignored. In addition, some candidates repeated the information in the stem of the question and referred to the leaf floating rather than referring to a reduction in density or an increase in buoyancy.

(iii) Candidates generally referred to the presence of stomata on the upper epidermis for gas exchange. Some candidates gave the adaptation but did not explain it adequately to gain the full credit available for this question. Several candidates described the large surface area of the leaf as another adaptation. However, many plants have leaves that have a large surface area, and this is not an adaptation wholly for aquatic plants.

Question 6

(a) (i) Several reasonable suggestions were seen including the difficulty of collection, the possibility of consumption by organisms or the vast nature of the world's ocean.

(ii) Percentage increase calculations were done well. Inaccuracies included misreading from the graph and dividing by the incorrect value resulting in the answer of 88.2%.

(b) (i) Candidates recognised that producers use light energy with fewer giving the production of nutrients or carbohydrates. Some vague language was used with references to producers making their own food, or being at the bottom of the food chain, these were ignored.

(ii) The mechanism of how microplastics end up in consumers was generally well understood with references to the microplastics moving through the food chain. Fewer candidates were able to

explain that the plastics were not broken down or biodegradable and hence remained in the food chain.

(iii) A number of ways to conserve shearwater birds were described. Sometimes candidates described several different versions along the same theme such as conserving their natural habitat. Candidates should be encouraged to look at the mark allocation and make three separate points in order to gain all the marks available.

(iv) The risk of extinction was frequently given. Many candidates described the effects on the rest of the food web, but the question specifically asked for the risks to a population rather than the environment.

BIOLOGY

Key messages

Candidates should ensure that they read the questions carefully before starting to answer. This is particularly important for any planning exercise that is required. Identification of the dependent and independent variables is vital before a plan is completed. Controlled variables must also be considered and included in a plan.

Data should be presented in a table using the appropriate SI units. Tables must be bordered with appropriate headings. Appropriate SI units or suitable abbreviations should be used. Units must not be used in the body of the table.

General comments

Many candidates performed well on this paper, with good answers seen in many cases. It is essential that all questions are attempted, even if the candidate is unsure of the answer as they may gain partial credit even if full marks are not awarded.

For the graph question, candidates demonstrated a strong ability to plot the data with good attention to detail, but care needs to be taken when selecting appropriate scales.

Some candidates did not carefully read instructions about giving calculated answers to a specified number of significant figures or decimal places or made errors in rounding.

Comments on specific questions

Question 1

(a) (i)   Almost all candidates knew the volumes of the stock glucose solution and distilled water required to make the 1.5% solution.

(ii)   Many candidates were able to draw a suitable table that accurately presented the data they collected. The most common error was not including units in the heading.

(iii)   Many candidates gave a suitable estimate of the concentration of glucose solution **U**. Although, some suggested concentrations that did not match the colour value for **U**, suggesting they did not understand what the question was asking.

(iv)   Many candidates were able to identify two suitable control variables for the experiment. It is important that they qualify these variables, rather than vaguely stating, Benedict's solution.

(v)   Although nearly all candidates correctly identified the error in steps 2 and 3, many provided imprecise descriptions of the effect on the results. Several candidates understood that the concentration of **U** would be changed but did not specify how it would change.

(b)   A wide range of different plans to investigate the effect of pH on the digestion of albumen by protease were seen. Many of these plans described inventive ways to measure the enzyme activity and gave good detail about how they intended to change pH and keep other variables constant. However, it was common to see a list of the independent, dependant and control variables even though this is not sufficient as a plan. A description of how to conduct the investigation must be

included to gain full credit. Some of the safety measures suggested were not relevant, or unnecessary. For example, there was no risk for which a laboratory coat was necessary nor was the use of tongs to handle test-tubes if the stated temperature was only slightly above room temperature. Some candidates used terms such as 'approximate' or 'about' when describing the quantity of their variables, but these terms imply that the variable are not kept constant.

(c) Many candidates were familiar with the emulsion test for fats.

Question 2

(a) (i) Most candidates made a large drawing of the leaf that was of a suitable size. Many provided suitable detail observations with accurate leaf shapes and vein positions. Most used sharp pencils and drew continuous lines without shading. Some did not get the outline mark due to lines that extended beyond the leaf margin or jagged outlines.

(ii) Most candidates were confident with the magnification calculation. The most common errors were measuring incorrectly in cm. There was some confusion between significant figures and decimal places.

(iii) Many observable differences between the oak leaf and the hollyhock leaf were correctly noted by candidates. Most candidates followed the guidance and did not mention the size of the leaves. Common comparisons included descriptions of the leaf margin and the number of veins.

(b) (i) Almost all candidates were able to identify surface area as the dependent variable. General comments, such as area, were not accepted.

(ii) While some candidates correctly explained why many plants were used in the investigation, many responses were vague or incorrect, often relying on generic phrases about reliability, accuracy, avoiding bias, or anomalies without considering the specific context.

(iii) Most candidates suggested counting the squares that the leaf covered to measure the surface area of each leaf. A few candidates went on to describe a suitable method to take account of the squares that were only partially covered or realised that they would need to find the area of one square and multiply the number of covered squares by that area. Common incorrect suggestions included measuring the length and width of the graph paper without any consideration for the area that was covered, or vague references to counting squares without qualification of coverage by the leaf. It was rare for candidates to take into account that the leaf has an upper and lower surface and thus the need to multiply their answer from the boxes covered by the leaf by two.

(c) (i) Most candidates drew a bar chart correctly although some did not label the *y*-axis, gave the wrong units or did not label all the bars. Some candidates did not include any gaps between the bars. Few candidates selected awkward scales and these invariably resulted in plotting errors.

(ii) The majority of candidates successfully identified the correct data from the table to calculate the percentage increase in the surface area of the old leaves. Candidates are encouraged to take careful note of instructions in the question, so that they provide the correct number of decimal places.

(iii) This question was answered well by candidates. They clearly understood the requirements for writing a suitable conclusion.

(d) Few candidates were able to correctly identify the colour change when carbon dioxide is removed from hydrogencarbonate indicator.

BIOLOGY

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Paper 0610/62
Alternative to Practical
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Key messages

Candidates are advised that safety precautions should include a description of the specific hazard for which the precaution is suggested. The use of laboratory coats or adult supervision is not creditworthy.

Candidates are reminded that a list of identified variables is not sufficient to describe how to plan an investigation and also that they are not required to describe the expected results of the investigation.

Candidates are encouraged to consider why investigations should be repeated and to be explicit in their descriptions of what is being repeated.

General comments

There was strong evidence that most candidates had had sufficient hands-on practical experience to access the paper and answer the questions with detailed insight. However, the emulsion test (**Question 1(c)**) and the use of hydrogencarbonate indicator (**Question 2(d)**) were not well understood. In addition, many candidates did not carefully read instructions about giving calculated answers to a specified number of significant figures or decimal places or made errors in rounding (**Question 2(a)(ii)** and **Question 2(c)(ii)**). Almost all candidates knew how to calculate the actual leaf length from the magnified image.

Question 1

(a) (i) Almost all candidates knew the volumes of the stock glucose solution and distilled water required to make the 1.5% solution.

(ii) Almost all tables had a header line and sufficient columns. However, many candidates included extra columns from Table 1.1 even though they were only asked to present the results. Although extra columns were ignored, those candidates who included units in the body of the table, or forgot to give units or suitable column headings were not awarded the second mark point. Some did not include the data for **U** in the results table so were not awarded the third mark point.

(iii) Most candidates estimated a concentration of glucose for **U** that was in the correct range. A significant minority suggested a value of 2.5%, possibly as they had not taken note of the colour.

(iv) Most candidates gave two correct constant variables although a few vague, unqualified answers, such as Benedict's solution, were seen.

(v) Almost all candidates identified an error but there were many answers describing the effect on the results that were too vague. Many realised that the concentration of **U** would be changed but did not qualify how the concentration would change.

(b) A wide range of different plans to investigate the effect of pH on the digestion of albumen by protease were seen. Many of these plans described inventive ways to measure the enzyme activity and gave good detail about how they intended to change pH and keep other variables constant. However, it was common to see a list of the independent, dependant and control variables even though this is not sufficient as a plan. A description of how to conduct the investigation must be included to gain full credit. Some of the safety measures suggested were not relevant, or unnecessary. For example, there was no risk for which a laboratory coat was necessary nor was the use of tongs to handle test-tubes if the stated temperature was only slightly above room

temperature. Some candidates used terms such as 'approximate' or 'about' when describing the quantity of their variables, but these terms imply that the variable are not kept constant.

(c) Although many candidates correctly described how to do the emulsion test, it was not uncommon for the water to be added before, rather than after the ethanol. Similarly, some candidates either omitted the step to shake the food sample with the ethanol or described a step of shaking the food sample with water, rather than ethanol. Other candidates incorrectly thought that heat was required. A small number of candidates misread the question and thought that they could give any test for lipids and incorrectly referred to the use of Sudan III.

Question 2

(a) (i) Almost all candidates made a large drawing of the leaf, although a few did not think about where to position it in the space and either went into the text or off the page. There were many examples of detailed observations, with the shape of the leaf and location of the veins carefully positioned relative to each other. Most candidates used a sharp pencil and drew continuous lines without any shading. A number of candidates were not awarded the outline mark because their drawings had veins that extended beyond the edge of the leaf margin or had used a ruler to draw the midrib.

(ii) Many candidates measured the length of the image accurately and gave their calculated actual length correct to two significant figures. A few candidates did not round their answer or gave their answer to three significant figures, with 41.0 a common incorrect answer. The vast majority of candidates stated the length of the leaf in millimetres, as indicated by the question. Those who chose to use centimetres instead, often made an error in converting units.

(iii) A full range of observable differences between the oak leaf and the hollyhock leaf were seen and almost all candidates followed the guidance and did not refer to the size of the leaves. Common correct comparisons included descriptions of the leaf margin and the number of veins.

(b) (i) Almost all candidates knew that the dependent variable for the investigation on the soybean plants was the surface area of the leaves. A few candidates stated 'area' which was too vague, and a few others gave the independent variable rather than the dependent variable.

(ii) Although a number of candidates gave correct reasons why a large number of plants were used in the investigation, many vague answers, or incorrect reasons were seen. These usually included stock phrases without specific thought to the context, such as references to reliability, avoiding bias, accuracy, or avoiding anomalies.

(iii) Most candidates suggested counting the squares that the leaf covered to measure the surface area of each leaf. A few candidates went on to describe a suitable method to take account of the squares that were only partially covered or realised that they would need to find the area of one square and multiply the number of covered squares by that area. Common incorrect suggestions included measuring the length and width of the graph paper without any consideration for the area that was covered, or vague references to counting squares without qualification of coverage by the leaf. It was rare for candidates to consider that the leaf has an upper and lower surface and thus the need to multiply their answer from the boxes covered by the leaf by two.

(c) (i) Most candidates drew a bar chart correctly although some did not label the *y*-axis, gave the wrong units or did not label all the bars. Some candidates did not include any gaps between the bars. Few candidates selected awkward scales and these invariably resulted in plotting errors.

(ii) Almost all candidates selected the correct data from the table to calculate the percentage increase in the surface area of the old leaves. Many candidates went on to give their answer correct to one decimal place, although incorrectly rounded answers were sometimes seen. Another common error was to divide by the wrong denominator (78 rather than 58).

(iii) Two correct conclusions were given by most candidates. Some candidates offered a correct conclusion followed by a re-statement of the same point, or an explanation for the conclusion.

(d) Few candidates knew the colour change that occurs when carbon dioxide is removed from hydrogencarbonate indicator. Yellow, blue, colourless and milky/cloudy were the most common incorrect answers.