

BIOLOGY

Paper 0610/12
Multiple Choice
(Core)

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

General comments

The paper worked well to provide a meaningful challenge to candidates at this level. Some questions required candidates to use information given in diagrams and the stem of the question to arrive at the correct answer. It is important that candidates read all the information given in the questions.

Comments on specific questions

Question 5

Whilst most candidates correctly identified the location of photosynthesis in the cell, some were unsure as to whether starch is stored in the cytoplasm or in chloroplasts.

Question 16

Many candidates showed an understanding of the events that occur during transpiration. However, some were unsure of the difference between diffusion and osmosis in the context of water loss from leaves.

Question 17

Most candidates correctly identified the positions of the xylem and phloem on the diagram.

Question 18 & 19

The ability to identify structures from diagrams of parts of the circulatory system proved challenging for candidates although some were able to correctly identify the structures.

Question 23

Many candidates identified that the carbon dioxide produced by the leaf would then be absorbed by the substance in the test-tube and therefore predicted the direction of movement correctly. It was important that candidates considered all the information provided in the diagram.

Question 27

Some candidates understood that, in the control, gravity needed to be eliminated and that only option A achieved this. Knowledge of what a 'control' is may have proved challenging for some.

Question 28

Whilst most candidates correctly identified that alcohol abuse could result in addiction and reduced self-control, less were aware that withdrawal symptoms can also occur.

Question 30

Candidates showed a high level of knowledge of flower structure with the majority selecting the correct answer.

Question 33

Some candidates correctly identified that lipase is made of protein and therefore coded for by a length of DNA.

Question 35

In order to identify the correct phenotypic ratio candidates needed to use the information to identify hairy stems as being dominant. Recall of key word definitions for 'pure-breeding' and 'heterozygous' would also have helped candidates to identify the correct option. Candidates may find it helpful to draw out a Punnett square when deciding upon their answer.

Question 39

Knowledge of sewage treatment was not well understood by some candidates. However recall of the conditions required by microorganisms was another route to successfully answering the question.

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Paper 0610/22
Multiple Choice
(Extended)

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

General comments

The test was well-matched to the ability level of the candidates and all questions appeared to be accessible. One area for improvement is the interpretation of graphs but in general candidates exhibited a sound knowledge of the subject matter presented.

Comments on specific questions

Question 3

Whilst most candidates correctly identified the location of photosynthesis in the cell, some were unsure as to whether starch is stored in the cytoplasm or in chloroplasts.

Question 10

Candidates clearly understood how enzyme-substrate complexes form.

Question 13

The majority of candidates showed a good understanding of the mineral ion requirements of plants and the effect mineral ion deficiencies.

Question 17

Most candidates showed a good understanding of the events that occur during transpiration. However, some were unsure of the difference between diffusion and osmosis in the context of water loss from leaves.

Question 20

Candidates correctly appreciated that a reduction in pain would not have any effect on the risk of heart disease. Fewer knew that aspirin reduces the tendency for blood to clot.

Question 23

The interpretation of the pressure graph proved challenging for some. Candidates needed to make the link between the ribs lowering during exhalation and the subsequent rise in pressure in the thoracic cavity. Some selected areas on the graph where pressure was decreasing.

Question 28

Some candidates understood that, in the control, gravity needed to be eliminated and that only option A achieved this.

Question 29

Whilst most candidates correctly identified that alcohol abuse could result in addiction and reduced self-control, less were aware that withdrawal symptoms can also occur.

Question 39

Whilst generally well answered, it should be emphasised that isolating the DNA in a human gene is a necessary initial step in the process of genetic engineering.

BIOLOGY

Paper 0610/32

Theory (Core)

Key messages

Candidates need to read each question carefully and consider the number of marks available when composing their answers to ensure that they are answering the question asked and to the required level of detail.

General comments

Many candidates performed very well on this paper and some scripts were excellent. There was no evidence that candidates were short of time. The majority of candidates attempted every part of the paper. There are some areas where specific improvements could be made and these will be clarified in the relevant sections.

Comments on specific questions

Question 1

This was answered correctly by almost every candidate.

Question 2

Candidates did not need to know about each specific animal and descriptions of the illustrated environments were not required. The best answers gave a logical response for the possession of the chosen feature.

Question 3

- (a) Although most candidates did not give the syllabus definition of an enzyme, most could state two correct facts about one. Marks were not awarded for tautology i.e. saying that an enzyme was a biological catalyst and that it increased the rate of a chemical reaction, only gained one mark.
- (b) (i) Correctly answered by many candidates.
- (ii) Most candidates could identify where hydrochloric acid and amylase are produced, but most thought that bile is made by the gall bladder. Knowledge of egestion was vague, with most candidates identifying it with any part the colon, and not where defecation occurs.
- (c) (i) This posed no problem for most candidates, but a few selected the colon as the site of absorption.
- (ii) Some candidates correctly described the absorption of glucose. The commonest error was to describe assimilation rather than absorption.

Question 4

- (a) The majority of candidates showed a good understanding of sexual reproduction. A few candidates were unsure about the difference between a zygote and an embryo.

- (b) Many candidates focussed on the social and logistical aspects surrounding birth rather than the actual physiological stages that occur during birth and therefore did not answer the question. A common misconception was that the stomach contracted rather than the uterine muscles. Care of the baby after birth was also a focus for some candidates and was not relevant to the question asked. The stages of birth are an area that needs reinforcing.

Question 5

- (a) (i) This question was well answered by the majority of candidates.
(ii) This question was well answered by the majority of candidates.
- (b) Some candidates made the link between increased muscle contraction requiring more energy but few could state the source of the energy.
- (c) (i) This proved challenging for some and while many calculated a percentage, some incorrectly selected data from the wrong part of the graph. This was unnecessary as the data was given in the question.
(ii) Some candidates showed their understanding that there was a need to lose the heat generated by muscle contraction and a few made reference to homeostasis. However, the most common reason given for the increased blood flow to the skin was that the latter required more energy in order to exercise.
- (d) & (e) These two questions were the most testing for all candidates. They were both “suggest” questions and as such candidates were required to produce a logical response. Few, however, could suggest reasons for the blood flow.

Question 6

- (a) (i) The syllabus definition was not quoted in the majority of responses, but many candidates were able to write a reasonable description of a chromosome.
(ii) Many were able to correctly identify the nucleus. Some candidates selected the chloroplast as the location of the chromosomes.
- (b) Most candidates performed well here. A few did not know that gametes are haploid or the distinction between a genotype and a phenotype. In this question, there was “error carried forward” for the various stages, so that even if candidates failed to state the correct parental genotypes, it was still possible for them to gain some marks. It needs to be noted that a ratio is correctly shown in its simplest form, so that here the correct response was 1 black : 1 white, but in this instance 2 black : 2 white was accepted.
- (c) Some candidates were able to correctly identify the sex chromosomes.

Question 7

- (a) Many candidates could identify the structures.
- (b) This was answered accurately with most candidates giving the correct word equation for photosynthesis. A few gave the equation for respiration. Core candidates are not expected to know the balanced (symbol) equation.
- (c) (i) The majority of candidates were able to state that the yield increases as the mass of fertiliser added increases. Few attempted to give a second point.
(ii) This question was well answered by the majority of candidates.
- (d) (i) Some candidates knew the effect of herbicides while some incorrectly discussed insecticides.
(ii) Few candidates were able to confidently discuss genetic engineering whilst some incorrectly referred to selective breeding instead. Genetic engineering is an area that was not well understood by some candidates.

Question 8

- (a) This question was well answered by the majority of candidates.
- (b) Most candidates could state at least two different stimuli (or name the senses involved). However, naming the sense organs alone did not answer the question.
- (c) Some candidates were able to state the sequence occurring in a reflex action but the many thought that the brain was involved in “deciding” what action ought to be taken which is not the case.

BIOLOGY

Paper 0610/42
Theory (Extended)

Key message

A high standard of biological knowledge and understanding was displayed by many of the candidates. Many candidates should be congratulated for their clear, articulate and accurate responses.

Some candidates were not able to gain full credit due to misinterpretation of the question. Candidates should be reminded of the importance of the differences between command words, particularly describe and explain. Candidates should also be reminded to take care when annotating diagrams. Candidates should use a sharp pencil and draw lines and labels clearly.

General comments

Candidates had a good understanding of biological processes and mechanisms. They were generally able to communicate their responses clearly. There was evidence of a wide variety of knowledge and understanding of all parts of the syllabus and an ability to apply different skills depending on the question demand.

Some candidates only gained some of the marks available due to their responses not answering the question completely. In these cases, candidates should be reminded to read the stimulus material and each question carefully and complete all the instructions contained within the question to be able to access the maximum marks available.

Comments on specific questions

Question 1

- (a) (i) Many candidates were able to correctly identify part A as the cytoplasm and part B as the nucleus. The most common incorrect answer given was referring to part B as the chloroplast, although few candidates did this. A minority of candidates switched their answers giving part A as the nucleus and B as the cytoplasm. Candidates should be reminded to study diagrams carefully and write their responses with care.
- (ii) Most candidates correctly stated that the cell membrane controlled the movement of substances into and out of the cell. Simple reference to the cell membrane being partially permeable was not quite enough as a function was required here.
- (iii) This question required candidates to describe the difference in cell **shape**. Some candidates did not read the question carefully and instead identified the differences in cell components between an epithelial cell and a palisade cell. Candidates who did refer to the differences in shape, generally scored highly, most commonly stating that epithelial cells had an irregular or rounded shape or that palisade cell has a rectangular shape.
- (b) The majority of candidates were able to suggest that the inner membrane was folded to increase surface area. Some candidates confused the mitochondrion with a cell. Surprisingly few candidates referred to increased respiration in their responses.

- (c) The question asked for candidates to explain the data given. Simply quoting data from the table did not answer the question. Most candidates were able to conclude that the liver cells and heart muscle cells required more energy than sperm cells or red blood cells and were able to give the correct function of these cells. Fewer candidates explained the reason for the presence of mitochondria. There was credit available for explaining that mitochondria were the site of production of ATP.

Question 2

- (a) Many candidates were able to give the correct order to describe a reflex action. The most common error was for candidates to place C next to A, omitting the receptor cell.
- (b) Many candidates gave clear and detailed responses. All the available marking points were seen, the most commonly achieved being reference to neurotransmitters and their diffusion. Fewer candidates could describe the area that the neurotransmitter was released from or the binding of the neurotransmitter to receptors on the other side of the synaptic gap. A few candidates described the passage of impulses along a neurone, which was not required. Candidates should be reminded not to refer to the diffusion of neurotransmitters as impulses.
- (c) (i) Some candidates confused the effects of heroin usage with withdrawal symptoms. Candidates that did recognise that withdrawal symptoms were required provided a variety of appropriate answers.
- (ii) Many candidates were able to link heroin abuse to drug users turning to crime to finance their addiction. Some candidates gave incorrect effects of heroin use, leading to criminal behaviour, which was not accepted.
- (d) (i) Some excellent responses were seen, with many candidates able to explain how vaccination stimulates active immunity. There was some confusion between active and passive immunity in a minority of candidates. A few incorrectly referred to antibodies as antibiotics or antigens.
- (ii) Again a variety of good responses were seen for this question. Many candidates were able to explain the meaning of passive immunity and provide examples. The most common example being antibodies passed through breast milk. Although antibodies come from an external source such as the mother, they are passed on and not inherited, some candidates seemed unsure on this point.

Question 3

- (a) Some candidates were able to give the balanced chemical equation for anaerobic respiration of yeast. Common errors included giving the equation for aerobic respiration or anaerobic respiration in animals. A minority incorrectly gave the word equation rather than the chemical equation.
- (b) (i) The vast majority of candidates were able to predict the correct value.
- (ii) Candidates were generally able to predict the shape of the line and draw it accurately. Only a small minority drew above the line or drew sketchy or feathered lines, which were not acceptable.
- (iii) Many candidates were able to state that the enzymes had been denatured. A few candidates incorrectly referred to enzymes being killed or yeast being denatured.
- (c) Many candidates could name another process that used yeast. The most common answer being the production of alcohol. Some candidates simply repeated the process that had already been given of baking. The question specified that **another** example should be named.
- (d) (i) Some candidates were too vague in their responses, referring to the stirrer's function as simply to mix and the water filled jacket to cool the mixture. The question asks for an explanation of the function rather than a simple statement of function. The function of the probe was not widely understood, although correct reference to monitoring rather than maintaining the specific conditions was seen in some responses.
- (ii) It was clear that some candidates did not know the meaning of the word sterile. Candidates that did were able to identify that it was important to avoid contamination.

Question 4

- (a) Many candidates provided excellent descriptions of the data shown, with many quoting and manipulating the data. Many candidates were able to give the general trend and then provide more detail on the yearly fluctuations seen. Some candidates attempted to explain the results shown by the data, and although explanations may have been correct, this did not answer the question. The majority of candidates that quoted data gave the correct units which was essential.
- (b) (i) The vast majority of candidates were able to correctly name a greenhouse gas, with the majority stating methane. It was clear that some candidates confused the greenhouse effect with acid rain and gave the incorrect answer of sulfur dioxide.
- (ii) A number of candidates tried to incorrectly link the greenhouse effect to the ozone layer. Only some were able to explain that short wave radiation from the sun is able to enter the atmosphere and is reflected by the Earth as long wave radiation, which is trapped by carbon dioxide, warming the Earth. Some candidates gave unnecessary information about the effects of global warming on the Earth, which was not asked for.
- (c) Many candidates knew the function of magnesium and the effect of its deficiency on plants. Some candidates confused the pigment chlorophyll with the organelle chloroplast. Fewer candidates were able to provide accurate function of nitrates as being required for the production of amino acids or for protein synthesis. Specific functions were required rather than more general statements such as growth unqualified.
- (d) This was a long response question on eutrophication. It was clear that many candidates knew this topic well, giving concise and accurate answers. The most common misconception was that the fertiliser covered the surfaces of lakes or that it caused bacteria to grow, which covered the surface of the lake. Another misconception was that the death of underwater plants was the main cause of the reduction of dissolved oxygen in the water rather than the aerobic respiration of decomposing bacteria.

Question 5

- (a) Most candidates were able to provide the correct answer for the function of canines and molars. Some candidates provided additional descriptions of canine and molar teeth, which were not necessary.
- (b) (i) The best responses were specific rather than generalised and included; the differences in the type and shape of the teeth, referring to the absence of canines in rabbits and the jagged shape of the molars in tigers. Reference to size was not appropriate as the photographs were not to scale.
- (ii) The majority of candidates were able to state one feature from the figure that identified the tiger as a carnivore. The most common correct response was the presence of canines. Simple reference to having sharp teeth was not enough.
- (c) (i) It was clear that the majority of candidates were able to calculate the percentage difference correctly. Most candidates remembered to give their answer as a whole number as instructed to by the question.
- (ii) The best responses compared the number **and** type of teeth with the carnivorous, herbivorous and omnivorous mammals in the table, providing evidence for **and** against. It was important for candidates to be specific in their answers and simply referring to mammal X having a similar number of teeth to carnivores was not enough.
- (d) Some excellent responses were seen. It was clear that many candidates had a clear understanding of the importance of a low pH in the stomach. All marking points were seen. Some candidates referred to the wrong enzyme instead of specifying pepsin.
- (e) Again some excellent responses were seen. All marking points were seen and many candidates were able to describe and explain how the microvilli, lacteal and blood capillaries adapt the villi for absorption.

- (f) The best responses referred to deficiency diseases and the effects on the body of specific nutrient deficiencies. Some candidates simply provided a list of deficiency diseases without any description of their effects on the body or how they would be caused which did not answer the question.

Question 6

- (a) The majority of candidates were able to give the correct genus. A small number of candidates gave incorrect answers the most common of which was *castaneicola*. Other incorrect answers of amphibian, frog and reptile were also seen.
- (b) (i) A great variety of diagrams were seen to varying degrees of success. It was expected that candidates should draw a double helix with cross-links labelled with the letters of the bases A, T, C and G which should have been lined up in complementary pairs. Many candidates were able to successfully gain the full marks available. Most achieved this for drawing a double helix, cross-links and bases. Fewer candidates annotated their diagram carefully with some contradictory labels seen. It was common for bases to be incorrectly labelled as genes or chromosomes.
- (ii) Many candidates could state that more closely related organisms would have similar DNA. Fewer candidates were able to specify that it was the sequence of DNA bases that would be used to provide the comparison.
- (c) (i) Many candidates were able to provide the correct answer of gene. Incorrect answers included chromosome and RNA.
- (ii) It was clear that protein synthesis was relatively well known by candidates. However, there was some confusion amongst candidates regarding the details of the process. Most candidates identified that some form of genetic material was taken from the nucleus to the ribosomes. Fewer candidates were able to correctly describe this material as mRNA copied from a single strand of DNA. A misconception was that DNA changed into RNA. However, some were able to correctly state that the order of amino acids is dependent on the sequence of bases in the mRNA.

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Paper 0610/52
Practical Test

Key messages

Candidates should be familiar with all the practical exercises stated in the syllabus.

- Always read the question carefully.
- Make sure tables have cells for all the data to be collected and that units are given in the column header only, not in the body of the table.
- Learn the basic principles of the design of a scientific experiment.
- Practice making drawings in which the lines are clean smooth lines and in which structures are clearly labelled with a straight line and no arrowhead.

General comments

The Supervisor's Report is very important in ensuring that candidates are credited appropriately when materials have to be changed from those specified in the Confidential Instructions. If any difficulties arise there is time to seek advice about alternative materials from Cambridge Assessment, using the contact information in the Confidential Instructions. The Supervisor's Report should include as much detail as possible to allow examiners to assess the candidates' answers appropriately.

Comments on specific questions

Question 1

This question required candidates to carry out some practical work and most appeared to have done this with some degree of success.

- (a) Virtually all candidates gained this mark.
- (b) A pleasing number of candidates were able to gain all six marks here. Good examples included those that drew ruled table lines, considered that the initial time would be zero and successfully state the correct unit for time. Some candidates stated the unit as being seconds but failed to convert the time recorded to match this.
- (c) Most were able to discuss the need to avoid mixing the contents of W and C in the context of affecting either the temperature or causing contamination.
- (d) A significant number of candidates wrote a description of the results in W, others wrote about the differences between W and C. A pleasing number were, however, able to take a systematic approach and explain why the colour was blue-black to start with, a less intense blue after a few minutes and showing no colour change at all by the end of the experiment.
- (e) Most of those who agreed gave a correct statement about the speed of change in W compared with C. This was less common, though, than candidates who simply agreed but gave no reason. Responses that disagreed with the statement were credited where an appropriate reason was given.

- (f) This question was generally well answered, with discussions of the inadequacy of using the number of drops as a measurement of volume. Some suggested the use of a pipette or dropper to reduce the error but candidates needed to suggest a graduated pipette, as pipettes and droppers will not reduce this error. Many discussed the fluctuation of temperature in the test-tubes and made suggestions varying from insulation to using a thermostatically controlled water-bath.
- (g) This long response planning question was very well answered by the vast majority of candidates. Considered answers with a logical progression through their proposed plan suggested that most candidates were well prepared for this new assessment objective. Some answers lacked a means of maintaining temperatures or gave only one or two different temperatures another common error was to suggest a range of temperatures that did not go above 40 °C. A few candidates gained marks by mentioning the use of equipment such as a water-bath but devised experiments which would not answer the question.
- (h) The majority were able to state that Benedict's solution was required to test for reducing sugars and a pleasing number knew that heat needed to be applied. The idea that there would be a colour change from blue to orange or red was almost universally known.

Question 2

- (a) (i) Of the marks available most candidates obtained those for the axes and scale but less were able to draw an appropriate line of best fit. Common mistakes included omitting the origin, drawing a straight line either through one of the points or extrapolating it passed the last data point. It should be made clear that a line of best fit does not have to be straight.
- (ii) Even if the line of best fit drawn in (a)(i) was incorrect, almost all candidates were able to estimate the distance from the lamp when 6 bubbles per minute would have been produced.
- (iii) The relationship between light intensity and the rate at which oxygen was produced was generally not well described. Many candidates did not use the term 'rate' or refer to the number of bubbles per minute. Some candidates incorrectly believed that the relationship between light intensity and rate of bubble production is proportional. A few candidates used data quotes from the information to support their answers but the units were often missing or incomplete.
- (iv) Although many candidates knew that a water-bath can be used to control temperature, only those familiar with the procedure were able to realise that in this case, the water-bath is used to prevent the heat from the lamp from warming up the plant.
- (b) (i) Although many good drawings were seen a number of candidates drew individual cells in their drawings contrary to the instructions; only a low plan diagram was required. The size and detail of the drawing were usually correct but many drawings were done with thick or feathered outlines. Drawing the layers in the correct proportions was also important.
- (ii) Almost all candidates were able to label the stele on their drawings.
- (iii) Many candidates were able to measure the line AB precisely and calculate the magnification of the figure. A common mistake was to give the answer to one of two decimal places, even though the question asked for a whole number.

BIOLOGY

Paper 0610/62
Alternative to
Practical

Key messages

- Candidates should have sufficient hands-on practical experience with the full range of investigative work listed in the syllabus during the course so as to access all the questions in this paper. This includes planning and evaluating practical work, as well as conducting experimental techniques.
- Candidates should read questions and their answers carefully. It is important to check that they have answered all questions, including those that do not have answer lines, such as labels on diagrams and graphs.
- Candidates need to use a sharp HB pencil for drawings and graphs. This ensures that any incorrect lines can be erased completely.
- Candidates can complete an answer immediately underneath the last answer line if only the end of a phrase is required. Should it be necessary to continue an answer on a blank page or additional paper, candidates should clearly number any answers written on blank pages or additional paper. They should also indicate that the answer is continued somewhere other than in the answer space provided.
- Candidates need to include all units appropriately when quoting data, drawing graphs and tables and performing calculations.

General comments

Most candidates were well-prepared and able to access all aspects of the practical work outlined in the updated assessment objectives in the current syllabus. It was reassuring to see that most candidates were able to confidently draw tables, graphs and diagrams, as well as plan and evaluate investigations. Those candidates who seemed unfamiliar with the experimental procedures to investigate temperature on amylase (**question 1**) and light intensity on photosynthesis (**question 2**) found it difficult to visualize the procedures and relied on their theoretical knowledge rather than practical experience. This was most evident in **Q1(a), (f), (g), (h)** and **2(a)(iv)**.

Question 1

This question involved an investigation on the effect of temperature on the activity of amylase. This investigation seemed familiar to most candidates and many confident and well-constructed answers were seen.

- (a) Only the more well-prepared candidates knew that the liquids in the test-tubes would need to be extracted and tested on a white tile or spotting tile with iodine. Many candidates suggested that iodine should be added to the solutions or discussed the breakdown of starch by amylase. Many simply repeated the steps in the method that had been given. A few assumed iodine would not interfere at a low concentration. Responses were seen which related to withdrawal of a sample but without qualification of 'how' or 'where to'.
- (b) Most candidates were able to draw a suitable table. Common errors included omitting time or minutes as a heading and using 'm' as an abbreviation for minutes.
- (c) (i) Although many candidates realized that the waiting step in the method was to allow a temperature equilibration period, many were not able to follow their thoughts through; many incorrectly stated that the test-tubes would reach room temperature or that both test-tubes would reach the same temperature. Some incorrectly thought that the time was required for the reaction to take place.

- (ii) More candidates were able to correctly suggest a purpose for using separate dropping pipettes in the two test-tubes. Similar numbers of candidates suggested the idea that separate pipettes would minimize contamination and the idea that it allow for simultaneous measurements from the two test-tubes.
- (d) Although this question was well answered with most candidates familiar with iodine solution as an indicator for starch, a minority restated the colour changes rather than explaining them. Other candidates, who did not read the question carefully, wrote an account of how the observations for test-tube W differed from those for test-tube C.
- (e) This question elicited some well-considered responses, with a full range of valid suggestions explaining why the conclusion may or may not be true. Surprisingly few candidates thought to use the results of the investigation to explain whether these did or not support the conclusion.
- (f) (i) Many candidates were able to identify a source of error in step 5, but there was a minority who struggled to express their thoughts. Some answers lacked clarity, for example 'shaking test-tube' without stating the negative effect this might have or reference to droppers and drops without mentioning volume or even 'size' of drops. Some candidates only restated the method given in step 5 rather than identifying a source of error.
 - (ii) The vast majority of candidates who were able to identify a source of error in **Q1(f)(i)** were also able to offer a suitable piece of apparatus to minimize this error. A common error was to suggest a pipette or dropper to reduce the error on measuring a consistent volume in drops. Candidates needed to suggest a graduated pipette, as pipettes and droppers will not reduce this error.
- (g) A wide range of other sources of error and improvements in the method used in the investigation were suggested. This confirmed that most candidates had enough experience in similar practical work and what factors are likely to cause invalid results. Unfortunately a small minority of candidates repeated their answer to the previous question which was not what was required in this question. Improvements were offered but the error to be rectified was not always clear. Some candidates gave suggestions that were extending the investigation rather than sources of error (such as using a wider range of temperatures).
- (h) This long response planning question was very well answered by the vast majority of candidates. Considered answers with a logical progression through their proposed plan suggested that most candidates were well prepared for this new assessment objective. Some answers lacked a means of maintaining temperatures or gave only one or two different temperatures. Many candidates did not explain how it would be possible to decide the temperature at which the amylase was most active. There were only a very few references to changing the frequency of recording the time from that already given in the question.
- (i) Almost all candidates knew that Benedict's solution was required to test for reducing sugars. However, a considerable number of candidates described the need for a water-bath without suggesting that heat needed to be applied. Warming was also not accepted as an alternative to heating. Several candidates gave blue to purple as the positive test for reducing sugars.

Question 2

The rate of photosynthesis at different light intensities and the structure of the root of a water plant formed the basis of this question. Most candidates seemed well prepared for the graphing and drawing skills that were examined with only a small minority were not able to measure and calculate magnification.

- (a) (i) Most candidates were able to plot a graph showing the number of bubbles produced per minute at different distances from a lamp. However a number of common mistakes were seen. These included omitting the origin, drawing a straight line either through one of the points or extrapolating it passed the last data point.
 - (ii) Even if the line of best fit drawn in **(a)(i)** was incorrect, almost all candidates were able to estimate the distance from the lamp when 6 bubbles per minute would have been produced.

- (iii)** The relationship between light intensity and the rate at which oxygen was produced was generally not well described. Many candidates did not use the term 'rate' or refer to the number of bubbles per minute. Some candidates incorrectly believed that the relationship between light intensity and rate of bubble production is proportional. A few candidates used data quotes from the information to support their answers but the units were often missing or incomplete and hence no credit could be given.
- (iv)** Although many candidates knew that a water-bath can be used to control temperature, only those familiar with the procedure were able to realise that in this case, the water-bath is used to prevent the heat from the lamp from warming up the plant.
- (b)(i)** Although many good drawings were seen a number of candidates drew individual cells in their drawings contrary to the instructions; only a low plan diagram was required. The size and detail of the drawing were usually correct but many drawings were done with thick or feathered outlines.

 - (ii)** Almost all candidates were able to label the stele on their drawings.
 - (iii)** Many candidates were able to measure the line AB precisely and calculate the magnification of the figure. A common mistake was to give the answer to one of two decimal places, even though the question asked for a whole number.