

BIOLOGY

Paper 0970/12
Multiple Choice (Core)

Question Number	Key
1	A
2	D
3	C
4	D
5	D
6	C
7	A
8	B
9	D
10	D

Question Number	Key
11	B
12	B
13	B
14	A
15	A
16	A
17	B
18	B
19	A
20	A

Question Number	Key
21	C
22	D
23	A
24	C
25	B
26	B
27	D
28	D
29	D
30	A

Question Number	Key
31	D
32	D
33	D
34	B
35	C
36	B
37	A
38	A
39	A
40	A

General comments

There was a good understanding of the structure and function of the cell, types of teeth, identifying red blood cells and their function, and methods of HIV transmission.

The was some uncertainty about gas exchange, interpreting biological molecule tests and the structure of a stem.

Candidates need to take the time to consider diagrams carefully, for example **Questions 23 and 39**, and it is important to work methodically through information provided in questions, for example **Questions 7, 21 and 37**. Many candidates were confident in answering questions that contained graphs, for example **Question 26** and many had clearly learned and understood the information in the syllabus, for example **Questions 6, 12, 29 and 38**.

Comments on specific questions

Question 7

There was some confusion about applying the principles of gas exchange to a frog. Some had the directions of diffusion of oxygen and carbon dioxide reversed or that both would show net diffusion from the frog.

Question 10

Some candidates could not identify the positive result of a biuret test with a few confusing the positive result of the Benedict's solution test or the iodine solution test.

Question 11

Some candidates could not identify the third element found in fats along with carbon and hydrogen. Some chose iron or nitrogen.

Question 20

Some candidates knew that water is reabsorbed in both the colon and the small intestine, but a significant number thought this occurred in the small intestine or the large intestine only.

Question 21

Some candidates incorrectly thought that starch could be transported in the phloem and some incorrectly identified the xylem as the phloem.

Question 23

Some candidates could correctly identify the valve in the diagram as evidence that the vessel is a vein, but a significant number thought that the blood flowing upwards was the evidence.

Question 27

Some candidates did not know the order of neurones in a reflex arc, confusing motor neurones and relay neurones.

Question 31

The conditions required for germination were not well understood with many candidates selecting light.

Question 37

While many candidates understood that the allele for red was dominant, some thought the offspring were homozygous.

Question 39

Some candidates chose option **C**, perhaps confusing a pyramid of numbers with a pyramid of biomass.

BIOLOGY

Paper 0970/22
Multiple Choice (Extended)

Question Number	Key
1	A
2	B
3	D
4	C
5	B
6	D
7	A
8	C
9	B
10	C

Question Number	Key
11	C
12	B
13	C
14	D
15	C
16	A
17	B
18	B
19	C
20	C

Question Number	Key
21	C
22	D
23	A
24	B
25	C
26	D
27	C
28	C
29	C
30	D

Question Number	Key
31	B
32	B
33	B
34	D
35	D
36	D
37	C
38	D
39	C
40	C

General comments

There was a good understanding of how species are named, the functions of cell structures, DNA base pairing rules, defences about pathogens, and coronary heart disease risks.

The was some uncertainty about the structure of synapses, the development of antibiotic resistance, and the nitrogen cycle.

Candidates need to take the time to consider diagrams and graphs carefully, for example **Questions 10, 32 and 38**.

Candidates need to ensure they read the information given in questions carefully, for example **Questions 34 and 36**.

Comments on specific questions

Question 6

Some candidates did consider the units given carefully, and so incorrectly chose option **A** rather than option **D** which was correctly converted from mm to μm .

Question 7

There was a misconception about the direction of movement of water, with most candidates thinking that water would move by osmosis from **Q** to other cells which is the opposite direction.

Question 26

Many candidates could correctly identify the neurones in the synapse and the direction that the transmitters moved.

Question 27

Most candidates could describe the responses of the iris muscles to moving into a dim area, but some candidates selected option **B** which described the opposite responses.

Question 29

Some candidates believed that artificial selection is a part of the development of antibiotic resistance in bacteria. However, this is an example of natural selection as humans are not selecting for antibiotic resistance as a desired characteristic.

Question 31

Few candidates understood that all cells in the human body contain the same genes, but different cells express different genes. Most candidates incorrectly believed that the DNA sequence varied between cells in the human body.

Question 33

There was a common misconception that DNA is made from amino acids.

Question 34

Some candidates did not read the question carefully and so calculated the energy lost between producers and primary consumers rather than secondary consumers.

Question 35

The processes in the nitrogen cycle were not well known with few candidates correctly identifying nitrogen fixation as the process that removes nitrogen gas from the atmosphere. Many candidates believed that it was denitrification.

Question 38

Most candidates could calculate the percentage increase, but a few divided by the final value rather than the initial value.

BIOLOGY

Paper 0970/32
Theory (Core)

Key messages

Candidates need to read each question carefully, as there is often information in the question that must be used in the answer. Candidates often see one or two words and write everything they know about that topic, much of which does not answer the question and cannot be credited.

Command words such as 'describe', 'explain', 'suggest' and 'compare' require different responses from candidates. If a description is required for a question that includes a graph or a table, then it is expected that data will be used in the description given. Many candidates can do this effectively. An explanation requires more than just a description and candidates should be encouraged to practise the difference between 'explain' and 'describe' questions.

General comments

Candidates often score well on the objective questions but are unsure of how to express themselves clearly in the longer prose questions.

Care should be taken with handwriting. If writing is illegible, marks cannot be awarded. This includes the writing of numbers.

Comments on specific questions

Question 1

- (a) Many candidates gained both marks here, the best responses ended their label lines clearly in the middle of each structure.
- (b) Many candidates incorrectly chose thick and wide for the artery and thin and narrow for the vein. Some candidates had not read the question properly and circled thick/thin or wide/narrow.
- (c) Many different answers were given here, not all were part of the circulatory system.
- (d) (i) Heart was the most common correct answer. Lungs and heart were often the wrong way round. The brain was frequently given as the answer for **A**. Kidney was seen less frequently for answer **C** with liver being the most common incorrect answer.
- (ii) More candidates got this wrong than right, usually by drawing the arrows from **A** to **B** for the pulmonary artery and from **B** to **A** for the pulmonary vein but there were also arrows drawn on all parts of the diagram.
- (e) Most candidates correctly gave capillaries. Common incorrect answers included arteries, veins and other named blood vessels.
- (f) Most correctly identified carbon dioxide and urea. However, glucose and oxygen were also seen.

Question 2

- (a) Some candidates missed marks by ticking the two correct options but then ticking a further box, and in some cases a further two boxes.

(b) (i) Candidates demonstrated good skills in being able to apply their understanding and accurately read the correct pH from the graph.

(ii) Most candidates could use the given data to select a suitable value. Most of the correct answers given were pH 5.3 indicating the point where the two lines intersect.

(iii) Most candidates were again able to read off the graph to select a suitable value from the possible ranges. The most frequent correct answer was pH 10. Very few gave answers in the 0 to 4 pH range.

(iv) Many candidates did not know that protease is found in the stomach or that it breaks down proteins. Many gave the small intestine as the location. Candidates need to know the locations where enzymes are produced.

(v) Some candidates misinterpreted the question and read it as what is produced by the salivary glands rather than linking it to the enzyme produced by the salivary glands. This meant that many answers referred to saliva as the product. A significant number seemed unfamiliar with the terms 'substrate' and 'product'.

(c) Most candidates gave the correct answer. The most common incorrect answer was physical digestion.

(d) Most candidates knew that temperature affects enzyme activity.

Question 3

(a) (i) Many were able to identify photosynthesis as **Q** and combustion as **R**. Incorrect answers for photosynthesis were transpiration and absorption. Generally, other incorrect answers included decomposition, evaporation and condensation. Fewer were able to correctly identify process **S** as feeding with some referring to it as respiration.

(ii) The most common incorrect answers showed the arrow going the wrong way and the reverse of the **S** arrow.

(b) Few candidates gained this mark. The most common incorrect responses referred to nitrogen or, oxygen.

(c) Most candidates were able to suggest planting more trees. Some gave ways to reduce the production of carbon dioxide (e.g. reduce burning of fossil fuels) rather than positive ways to remove carbon dioxide from atmosphere.

(d) Nearly all candidates were able to give at least one chemical element all proteins contain. Some candidates did not seem to know what an element is and gave examples of molecules such as amino acids, enzymes or proteases.

(e) There were very few correct answers because most did not refer to energy.

Question 4

(a) Many candidates were able to identify two correct features of fish; usually scales, fins, or gills. Some did not understand the question and instead gave suggestions such as 'use a key', 'use its genus name'. There was no mention of swim bladder or lateral line.

(b) The syllabus definition of population was clearly stated by some candidates. Some candidates described the number of species rather than the number of individuals in a species. The idea of area and time together were not always clearly expressed. Candidates need to be able to recall definitions given in the syllabus.

(c) (i) Most candidates completed this question by drawing three lines and were awarded full marks. A few answers linked **C** to the death phase.

(ii) Many were awarded at least one or two marks. Candidates linked some ideas to general causes of population change and not to the data given for the fish population. A good range of answers from all the marking points were seen.

Question 5

(a) (i) Some candidates were not able to calculate the rate. Often answers were given with no indication of how the answer had been calculated. Some did not state their answers to two decimal places. Many candidates used the gaps in the data to guess an answer of 0.12 mm per second following patterns in the data.

(ii) Many candidates did not know the direction the bubble would move, and some did not recall precisely enough where processes occurred in the cellular structure of the leaf. Candidates need to ensure they are familiar with the expected results of practical work. Few responses gained full marks. Most gave decreased, fewer gave distance, mesophyll and stomata or stoma. However, nearly all incorrectly gave beaker, ruler or capillary tube for the last response.

(iii) Temperature and humidity were the most frequent correct answers.

(b) Many gained at least one mark. Photosynthesis and support were the most common correct answers. Growth was a common incorrect answer. Keeping the soil moist was often stated.

(c) Some candidates were able to give a clear and full definition of an organ. However, many gave answers that were too vague and did not link tissues to a specific function that the organ would perform. The idea that there is more than one tissue in an organ was often missed, instead cells or groups of cells were mentioned.

Question 6

(a) Some candidates were able to calculate the correct percentage increase. Of those that did not, many gained mark point one for correct data selection but were unable to correctly calculate the percentage increase as they had divided the difference by 300 instead of 120. Some candidates did not show their working potentially missing out on a marking point if their final answer was incorrect.

(b) Most candidates were able to gain at least one mark either by stating that disease could spread more easily or for identifying animal welfare concerns. Pollution, slurry and waste were common responses. Very few candidates mentioned antibiotics being routinely used.

(c) Although many candidates identified that the desirable trait was laying more eggs, some stated quality rather than quantity and others just stated desirable features rather than referring to the context in the question. Most candidates recognised that you had to breed the chickens together, but few appreciated that the process should be repeated over many generations instead using phrases such as many times or many years.

(d) The majority of candidates achieved two marks. Where one was missed it was for doubling up on the fertiliser answer, usually with manure or soil improvement which were considered to be the same point. Some suggested planting more seeds or cultivating more land. The use of fertilisers, pesticides or herbicides were the most common methods stated. Some candidates correctly wrote about genetic modification, irrigation, and drainage.

Question 7

(a) Most candidates could explain that more juice was produced with pectinase. Some candidates were unable to read correct figures from the graph. When quoting figures, the units must always be included.

(b) The components of a balanced diet were well known.

(c) Few candidates gained two marks. The most common correct answers were the rapid reproduction rate and the ability to make complex molecules.

(d) Most gained at least one mark here, usually for ‘changes the genetic material of an organism.’. The most common incorrect answer was ‘involves sexual reproduction.’.

Question 8

(a) (i) Many candidates did not give features of gas exchange surfaces, instead they named structures such as the lungs, alveoli and bronchi. Of those that identified the features, most used an appropriate adjective to describe the feature such as large surface area, good blood supply.

(ii) Many candidates were able to correctly identify the correct organ system, but many referred to the lungs as an organ system.

(b) Most candidates attempted to give a word equation with the majority gaining at least one mark. Many confused aerobic respiration and photosynthesis. Those who gave a symbol equation needed to get it completely correct. Some gave an = symbol instead of an arrow showing the direction of the process.

(c) Many candidates were able to explain that muscles move or contract but were unable to correctly make the link between high respiration rate and the release of energy. Many referred incorrectly to energy being produced or made.

BIOLOGY

Paper 0970/42
Theory (Extended)

Key messages

It is very important for candidates to understand what is expected by the command words ‘describe’ and ‘explain’. These command words require different responses and understanding this was critical for answering **Questions 2(b) and 3(a)(ii)**.

It would be beneficial for candidates to practise the spellings of keywords, particularly in cases where they could get confused with another keyword. The spelling of bronchioles was important for **Question 2(a)(i)** and the spelling of glycogen and glucagon was of great importance for **Question 3(b)**.

It was clear that many candidates had a good scientific knowledge, however on occasion they needed to ensure that their knowledge was tailored to the specific context given in the question. There were many questions that involved more than a simple recall of knowledge and the skill lay in the application to the context given. **Questions 1(d)(i), 2(b), 5(b) and 5(d)** were examples where this skill was critical.

General comments

There was a high standard of scientific knowledge and understanding with many candidates providing detailed and accurate responses.

While many candidates had a broad knowledge of the syllabus, it was evident that some areas of the syllabus were better known than others. The syllabus can be used as a revision tool.

Comments on specific questions

Question 1

(a) The majority of candidates were able to give species as the correct additional information required to name an organism using the binomial system. Several candidates gave the term ‘specie’ presumably thinking this was the singular of species. Very occasionally incorrect responses were seen including genus and *Chlorella*.

(b)(i) A variety of incorrect cell structures were seen including cell membrane, cell wall and cytoplasm. The correct response of chloroplast was frequently seen with nucleus seen less frequently. It appeared that some candidates were not able to link the fact that prokaryotes do not possess membrane-bound organelles with the cell structures shown in Fig. 1.1.

(ii) This question was more successfully answered with a variety of correct cell structures seen. Very occasionally candidates included cell structures that were not visible in Fig. 1.1 such as ribosomes. These responses were not awarded credit.

(iii) Most candidates were able to state the correct names of the kingdoms. A minority gave the names for groups of vertebrates such as mammals and reptiles, while others gave bacteria and viruses.

(c)(i) This question proved demanding and required careful reading. The first step was to identify the correct values to use from Table 1.1. Candidates needed to identify that each tablet only contained 5g of *Chlorella* supplement to be able to calculate the correct number of tablets. For full credit, the value had to be given to one decimal place, a step that some candidates missed. Common

inaccuracies included trying to include the value of iron in the *Spirulina* supplement and incorrect rounding or truncating of values.

- (ii) It is important that candidates understand the meaning of the command words commonly used in questions. Some candidates simply described the data without any attempt at an explanation. Candidates were also specifically instructed to refer to the data in Table 1.1 to justify their answer. This was missed by some candidates. Some responses were too vague, simply referring to the *Chlorella* supplement having more nutrients. The best responses were able to link the importance of vitamin C and calcium to the relative values in the *Chlorella* and *Spirulina* supplements.
- (iii) The vast majority of candidates were able to give an appropriate dietary source of vitamin C. Both specific named examples as well as more general categories such as fruit or vegetables were acceptable.

(d)(i) A common misconception was that proteins provide the energy for active transport. Many candidates were able to give a definition of active transport, but fewer were able to link the role of proteins as protein carriers with active transport. During active transport, ions and molecules are transported against a concentration gradient.

(ii) The correct response of amino acids was commonly seen. Occasionally the chemical elements that proteins are composed of were given. The question required careful reading as it specified the names of the smaller molecules and not the elements that make up proteins.

Question 2

(a)(i) Candidates should be reminded that it is important to spell keywords correctly to avoid confusion with other biological terms. The spelling of bronchioles proved challenging for many. The intercostal muscles were often misidentified as the ribs and the bronchioles as the bronchus. The diaphragm was commonly misspelt as 'diaphram'.

(ii) Cartilage tissue was commonly seen as was its correct function. It was evident that some candidates confused the oesophagus with the trachea. Vague functions such as protection were not credited.

(iii) The question specified the cells that protect the breathing system from particles. Responses that included white blood cells were not credited. Another response commonly seen was cilia. This was also not credited as the question asks for the names of the cells.

(b) There were some excellent responses seen with some candidates successfully linking the events happening in the graph with their scientific knowledge to give an informed description and explanation. Some responses only gave a description of section **A** of the graph with no attempt at an explanation. It was important to recognise that the question specified a description and an explanation for section **A** of the graph only. Candidates that described and explained the whole graph contradicted themselves unless they specified which part of their response related to section **A** and which related to section **B**. However, many candidates were able to link the change in pressure and volume in the thorax to the mechanism of inhalation referencing the roles of the diaphragm, intercostal muscles and the ribs.

(c) An increase in carbon dioxide concentration of the blood was commonly given as the reason for an increased breathing rate. The organ of detection was less well known with some candidates referring to organs other than the brain such as the lungs and the liver. Some candidates reiterated in a variety of ways that rate of breathing would increase. Fewer identified that the depth of breathing would increase.

Question 3

(a)(i) Fluid **A** was sometimes misidentified as water. A very common incorrect response was to give the name of fluid **C** as urea instead of urine.

(ii) This question required a description and an explanation of the differences in the components found in the fluids listed in Table 3.1. Several candidates simply gave descriptions. The question instructed candidates to use the stimulus material to aid their responses. Candidates needed to refer to the differences in the values of the components of the fluids and give a reasoned explanation for these differences. A common misconception was that protein was selectively reabsorbed rather than being

too large a molecule to enter the Bowman's capsule. Many candidates recognised that all of the glucose was reabsorbed from fluid **B**. The best responses stated that protein was absent in fluid **B** and **C**, glucose was absent in fluid **C** and that the percentages of water, ions and urea increased in fluid **C** in addition to giving reasons for each of these differences.

(b) The spellings of keywords were important for this question. Glucose, glycogen and glucagon are similar in spelling but very different in their roles. The brain was often incorrectly identified as the organ that detects a change in blood glucose concentration. Most candidates were able to state the role of insulin in stimulating the conversion of glucose to glycogen in the liver. Fewer were able to correctly describe the role of glucagon. The best responses were able to describe the roles of the liver and pancreas organs and the insulin and glucagon hormones and how they control blood glucose concentration through the mechanism of negative feedback.

(c) (i) Some candidates partly repeated the question and described a change in the gene. Candidates needed to specify it was a change in the sequence of bases instead of simply stating a change of bases in the DNA.

(ii) The treatment of type 1 diabetes through use of injections of insulin was commonly known. Fewer candidates were able to give other methods of treatment such as controlling the intake of carbohydrates and monitoring blood glucose concentration.

Question 4

(a) (i) There were many vague descriptions of the term species, with many trying to describe species in terms of a group of organisms with similar DNA or characteristics. The term species has a specific biological meaning, which is stated in the syllabus. It is beneficial for candidates to learn the specific descriptions of terms that are in the syllabus.

(ii) It was necessary for candidates to include arrowheads to show the direction of the transfer of pollen from anther to stigma. Occasionally candidates labelled every structure in the flower, which was unnecessary, but not penalised. There was some inaccurate labelling with the style labelled as the stigma and the filament labelled as the anther. Occasionally the labels for pollination were drawn too short, suggesting the transfer of pollen was to the air; or too long extending down the style.

(iii) A variety of correct responses were acceptable with the site of fertilisation and contains the ovules commonly seen for **X**. The function of **Y** was more demanding with many candidates simply referring to protection. To gain credit there had to be reference to protection during the bud stage. Some candidates misread the question and stated the names of the parts instead of the functions.

(b) There were many detailed responses seen although some responses only described asexual reproduction. This question was about self-pollination and why it can result in sexual reproduction. The best responses recognised the involvement of haploid gametes resulting in fertilisation. The name of the female gametes in plants was often misremembered as ovum or egg cells instead of ovules.

(c) Most candidates could state an aquatic or water environment. Occasional incorrect responses included dry and warm. Inaccurate responses such as rainy, damp and moist were not credited.

Question 5

(a) Most candidates could identify that there were four people with XY chromosomes. The number of people that had only one **I^A** allele was much more challenging, with fewer candidates gaining this mark.

(b) There were a number of confused responses with many trying to explain in terms of inheritance or that discontinuous variation is caused by genes only. The question expected candidates to explain using Fig. 5.1 so any responses referencing bar charts versus line graphs were insufficient. The best responses identified there being only four blood groups with no intermediates as characteristics of discontinuous variation shown in the figure.

(c) It was evident that this question confused many of the candidates. Examples of discontinuous and continuous variation are clearly stated in the syllabus. Other correct examples that are not stated in

the syllabus were also accepted. A wide variety of incorrect responses comparing variation between species were seen instead of discontinuous variation within a species.

(d) This was a demanding question. Candidates needed to link their knowledge of codominance to this specific example. A general description of codominance was insufficient to gain credit. Candidates had to refer to the **I^A** and **I^B** alleles or the existence of the **AB** blood group in order to gain marks. There was some confusion about the difference between an allele and the blood group.

(e) This question was very well answered. Many candidates were able to complete clear genetic diagrams and include the correct percentage. Occasionally candidates tried to include both alleles in the gamete circles and it was clear there was some confusion between the meaning of the terms genotype and phenotypes.

Question 6

(a) The nitrogen cycle was a demanding topic for many candidates. A variety of incorrect answers were seen for the first box including air, microorganisms and decomposition. Nitrate ions were commonly known. Some candidates were imprecise and gave mineral ions, which was ignored. Bile or amino acids were often given in place of urea. Nitrification was often given in the place of denitrification.

(b) The synthesis of information across topic areas is an important higher-level skill. Many candidates were able to identify that decomposition occurred in both cycles. Fewer were able to give a second process. Those that did usually gave feeding or excretion although other correct examples were accepted.

(c) The majority of candidates identified the Sun as the principal source of energy.

BIOLOGY

Paper 0970/52
Practical Test

There were too few candidates for a meaningful report to be produced.

BIOLOGY

Paper 0970/62
Alternative to Practical

Key messages

Candidates should read questions and instructions carefully. Mistakes were made when candidates did not follow all the instructions. For example, some did not convert the time to seconds in **Question 1(a)(i)**. Some referred to differences in size in **Question 1(d)**, and in **Question 1(e)(i)** some gave the positive result for starch rather than the negative result.

Candidates should know the difference between significant figures and decimal places. There was some confusion about this in **Question 1(c)(ii)**.

Some candidates did not give an answer to **Question 2(a)(i)**, where they had to draw some apparatus on Figure 2.1. Candidates should read all questions carefully to look for instructions and make sure that they do not leave any questions unanswered.

When asked to state two variables, e.g., in **Question 2(a)(ii)**, candidates should list one variable on the first line and the second on the second line. Sometimes candidates gave two variables on the first line, or a list of many variables.

General comments

The standard of responses was often very good with many candidates achieving high marks.

Candidates showed a good understanding of the independent, dependent and constant variables in both investigations outlined in the paper. Candidates should practise recognising errors in investigations and methods for improving an investigation.

Drawing skills were generally good, although some used a ruler to draw straight lines. Competent graph drawing skills were also demonstrated, although candidates are reminded to choose sensible scales for their graphs so that plotting is easier.

There was some confusion between the difference between volume and concentration. Candidates should understand the difference and know the units for both.

Comments on specific questions

Question 1

(a) (i) The majority of candidates drew good tables with columns for test-tube or distance, and time. Most candidates correctly converted the stop-clock times into seconds. The most common mark to miss was marking point two. There were several ways in which this marking point was missed. Some candidates put units into the body of the table or omitted a heading, usually the heading for the test-tubes. Some wrote out 'test-tube' in the body of the table, rather than just 'A' and 'B'. The words 'test-tube' should not be repeated in the column heading and in the body of the table. Additionally, the unit for seconds is 's' and not the abbreviation 'secs'.

(ii) When stating the conclusion for an investigation, candidates should always refer to the statement at the start of the method. In this case, the statement reads: 'Students investigated the effect of light intensity on the rate of photosynthesis in a chloroplast suspension.' Therefore, the conclusion given should relate light intensity to the rate of photosynthesis. In this case, as light intensity increases, the

rate of photosynthesis increases. It is not enough to only refer to the time taken for both test-tubes to return to a green colour, which is a description of the results. Additionally, it is not enough to refer to the rate of reaction being higher at higher light intensities. The conclusion had to link the rate of photosynthesis to light intensity.

(iii) Candidates should practise identifying the dependent and independent variables in investigations. Most were able to state that the dependent variable was time, although some named the independent variable, light intensity, or a constant variable such as volume of DCPIP. Some gave rate of photosynthesis as the dependent variable, but this was not credited as time was recorded rather than rate.

(iv) Step 7 and step 11 in the investigation were to measure the time taken for the blue liquid in the test-tube to return to a green colour. Looking for a colour change can be an error as the end-point can be difficult to determine, as it is subjective and can differ from person to person. Those that recognised this error were likely to also suggest a suitable improvement such as use of a colorimeter or colour chart to compare to. A very common incorrect answer was to suggest there was an error in timing, such as not using the stop-clock correctly. Another common incorrect answer was to say that the investigation was not repeated. Although this is true, it does not relate to the error in step 7 and step 11.

(b) Many candidates were able to name vitamin C (or ascorbic acid) as the substance present in food that can be identified using DCPIP. Those that gave vitamin as their answer did not get the mark. Occasionally, answers such as protein, sugars, or starch were given.

(c) (i) Figure 1.2 showed a photograph of a dandelion seed. Candidates were expected to draw the whole seed, which includes the achene, beak and pappus. Those that just drew the achene were still able to get three marks. Candidates are reminded that drawings should be drawn freehand, in pencil and a ruler should not be used. Some candidates missed a mark for using a ruler to draw the beak of the seed. Drawings were usually bigger than the dandelion photograph but marking point two was sometimes missed for the drawing being so large that it extended into the surrounding text or went off the page. Marking points three and four were for accurately including detail. In this case candidates were expected to draw the beak as a double line, to include the spikes on the achene and to draw the ridge down the achene.

(ii) **PQ** was accurately measured to 19 mm in the majority of cases. Most candidates divided 19 by 15 to calculate the magnification. However, some candidates confused significant figures with decimal places and gave 1.27 as their answer, rather than 1.3. Some rounding errors were seen.

(d) Candidates were not expected to use correct botanical terms to describe one similarity and two differences. However, candidates were told that the photographs were of seeds and not of a seedling or whole plants. Therefore, the pappus should not have been described as being leaves, petals or anthers. Most candidates described both seeds as having a pappus and common differences described included the pappus being thicker in the milk thistle, the presence of the beak in the dandelion and the milk thistle having a smoother or rounder achene. Candidates were given instructions to not use reference to size in their answer. This was because magnification of the photographs was not given. Many candidates ignored this instruction. Therefore, answers such as the dandelion being longer or the achene being thinner did not get a mark.

(e) (i) If a drink that does not contain starch is tested with iodine solution it remains yellow-brown. Most candidates answered this question correctly, although some gave blue-black as the answer, which is the positive result if the solution had contained starch.

(ii) This question was answered well and most candidates named Benedict's solution as the reagent used to test for reducing sugars. The majority also stated that the sample should be heated with the Benedict's solution. Use of a water-bath was not enough for the second mark. Candidates needed to say that a hot water-bath was used. It was not necessary to describe the results of the test as the question just asked for a description of the test for reducing sugars. Occasionally, candidates described the biuret or emulsion test rather than the Benedict's test.

(f) Some very good plans were seen. Candidates often gained full marks by describing the independent and dependent variables, the constant variables and some detail of the method, such as planting the seeds in soil and watering them regularly. Most candidates were able to correctly identify multiple variables that needed to remain constant such as temperature, species of seed, volume of weedkiller,

pH and time the seeds were left for. Candidates should ensure that the plan is clear and straightforward, avoiding the use of the term 'about', for example 'leave the seeds for about 3 days'. Many candidates correctly recognised that the weedkiller solutions could pose a safety issue and gave suitable methods to reduce this risk.

Some candidates confused concentration with volume, so they might have said that the seeds should be exposed to different concentrations of weedkiller, but then described using different volumes rather than different concentrations. Some candidates used different types of weedkiller rather than different concentrations. Also, some were not accurate with their description of the dependent variable. The investigation was to determine the effect of weedkiller concentration on germination of seeds, not on seed growth. So those that measured the length of the seedlings after a certain time rather than the percentage germinated or time taken to germinate, did not get the second marking point. Investigations should be repeated more than once, so those that just said the investigation should be repeated did not get mark point nine.

Question 2

(a) (i) Candidates were expected to draw and label one additional piece of apparatus that could be used to reduce the heating effect of the lamp. Some candidates drew a piece of apparatus but did not label it. Some chose apparatus that would block light from reaching the syringe. This did not gain credit. Use of a labelled heat shield or piece of glass or beaker of water between the syringe and lamp were correct. Some used correct apparatus, such as a water-bath, but only submerged the bottom of the syringe in the water, which would not have had an impact on the heat reaching the syringe. Some drawings were not labelled so did not get the mark.

(ii) Candidates generally were able to state two constant variables in the investigation. Common answers included light intensity, same number or size of leaf discs in the syringe, or same volume of sodium hydrogencarbonate solution. Some gave distance between the syringe and the lamp as one constant variable and light intensity as the second constant variable, but these are the same marking point. Some stated the concentration of sodium hydrogencarbonate solution, but this was the independent variable. Some gave time as their answer, but this was the dependent variable. Some were not precise enough and said the number or size of the leaves was the same in each syringe, rather than leaf discs. Some candidates referred to the same amount of sodium hydrogencarbonate solution.

(iii) The majority of candidates gave carbon dioxide concentration or sodium hydrogencarbonate concentration as the correct answer. Answers such as carbon dioxide unqualified, or amount of carbon dioxide, or concentration of solution were not precise enough for the mark.

(b) (i) Some very good graphs were drawn. Candidates should know that the independent variable is usually placed on the x -axis and the dependent variable on the y -axis. The graphs were often too small if the axes were put the other way round. Candidates should practise planning usable scales such as ten small squares being worth five minutes in this graph, or ten small squares being worth 0.2 percentage concentration of sodium hydrogencarbonate. Those that used scales such as five small squares being worth three minutes often had incorrect plotting. Some candidates did not include a unit for time or gave 'm' rather than minutes or mins as the unit.

If the candidate had drawn a line of best fit close to the plotting points, extrapolation was accepted but only if the line did not extend off the grid. Plot-to-plot lines should not be extrapolated. Lines joined up without a ruler need to be smooth. Only a few bar charts were seen.

(ii) Most candidates followed instructions and indicated on their graph how they obtained an estimate for the sodium hydrogencarbonate concentration at which it took 12 minutes for the leaf discs to float. The best answers showed a line that started at 12 minutes and reached their graph line and then continued to the axis for concentration of sodium hydrogencarbonate solution, showing where their reading was taken from.

(iii) Candidates had to select the correct data from Table 2.1 and use this data to calculate a percentage change. Most correctly selected 20 and 17 from the table, but some did not use this data in a correct percentage change calculation. Others calculated the percentage change between the values 0.2 and 0.4. Candidates should be familiar with percentage change calculations.