CARIBBEAN EXAMINATIONS COUNCIL

CSEC® BIOLOGY

Subject Report with Exemplars

January 2024

CARIBBEAN EXAMINATIONS COUNCIL

REPORT ON CANDIDATES' WORK IN THE CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

JANUARY 2024

BIOLOGY
GENERAL PROFICIENCY

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INTRODUCTION

This guide has been put together using candidate's responses to the 2024 January examination in CSEC Biology. The report is set out according to the original design of the examination paper.

Distribution of Grades per Profile

- For Profile 1 (KC), 44.52 per cent of candidates obtained Grades A–C in 2024 compared with 44.04 per cent in 2023 and 60.24 per cent in 2022.

- For Profile 2 (UK), 38.24 per cent of candidates obtained Grades A–C in 2024 compared with 48.97 per cent in 2023 and 32.46 per cent in 2022.

- For Profile 3 (XS), 93.41 per cent of candidates obtained Grades A–C in 2024 compared with 93.83 in 2023 and 92.40 per cent in 2022.

Description of Mean Scores

- The mean score for Paper 01 in 2024 was 36.50 out of 60. This was higher than the mean score in 2023 (31.37) and 2022 (35.13).

- The mean score for Paper 02 in 2024 was 27.56 out of 100. This was lower than what pertained in 2023 (37.35) and 2022 (33.81).

- The mean score for Paper 032 in 2024 was 19.27 out of 40. This was lower than the mean score in 2023 (22.48) and higher than what pertained in 2022 (17.67).

Overall, there was a decline in the performance in 2024 with 59.88 per cent of candidates obtaining Grades I–III compared with 64.19 per cent in 2023 and 63.16 in 2022.

PAPER 01 – MULTIPLE CHOICE

Paper 01 consisted of 60 multiple-choice items. It was designed to provide adequate coverage of the content with items taken from all sections of the syllabus. The mean score was 36.50 out of 60.

PAPER 02 – STRUCTURED/EXTENDED ESSAY

Question 1

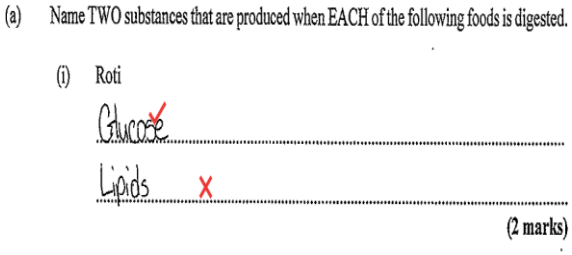
This question tested Specific Objectives B 2.9, 2.10 and 2.11. Candidates were provided with the following information.

> Roy and his friends visited a new roti shop in their neighborhood and purchased roti (round flatbread made of wheat flour, water and oil) and chicken curry. Dining was not permitted on the premises, so they went to Roy's home and ate the roti and chicken curry there.

In Part (a), candidates were asked to name two substances that are produced when the foods (i) roti and (ii) chicken are digested.

For Part (a) (i), many candidates incorrectly stated that 'starch and fats' are two substances produced when roti is digested. This indicates their lack of understanding of the fact that digestion breaks down complex substances to simple substances.

Candidate's Response to Part (a) (i) — Sample 1


(a) Name TWO substances that are produced when EACH of the following foods is digested.

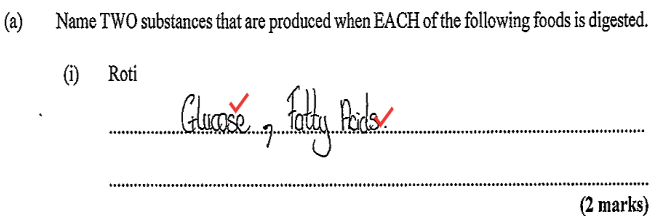
(i) Roti

Glucose ✓

Lipids ✗

(2 marks)

Candidate's Response to Part (a) (i) — Sample 2


(a) Name TWO substances that are produced when EACH of the following foods is digested.

(i) Roti

Glucose ✓, fatty acids ✓

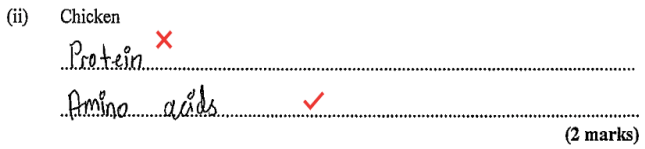
(2 marks)

Examiner's Comments

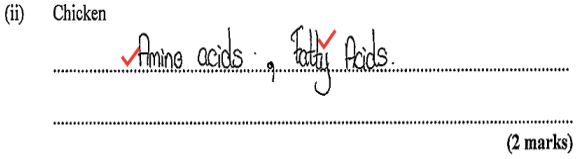
The exemplar samples show that a popular correct response was *glucose*. A full correct response would have included any two of the three substances: *fatty acids, glycerol, glucose*.

For Part (a) (ii), many candidates incorrectly stated that the substances produced when chicken is digested are 'protein and fats'.

Candidate's Response to Part (a) (ii) — Sample 1



Candidate's Response to Part (a) (ii) — Sample 2



Examiner's Comments

The exemplar samples show that a popular correct response was *amino acids*. A full correct response would have included any two of the three substances: *fatty acids, glycerol, amino acids*.

Part (b) required candidates to read a scenario and complete Table 1 based on details pertaining to Roy, the person mentioned in the scenario. For Part (b) (i), candidates had to suggest two dietary changes that Roy should make to manage his diabetes. Many candidates stated 'exercise and medication' which were not dietary changes and were therefore not accepted.

Acceptable answers were as follows.

- Use smaller amounts of carbohydrates (roti).
- Limit the amount of saturated fats eaten (fat from the chicken).
- Limit the amount of salt from meals of curry.
- Include salads in daily diet.

Part (b) (ii) asked candidates to state one consequence that may occur if each dietary change suggested in Part (b) (i) is not followed. Some candidates seemed to have ignored the words "NOT followed" and stated that blood sugar levels would be regulated and controlled. This part was poorly done by many candidates as they did not refer to direct consequences to biological organs and systems. Answers should have included the following.

- Vision loss
- Heart problems / increased risk of cardiovascular disease
- Kidney failure
- Cholesterol build-up in arteries

Candidate's Response to Part (b) (i) to (ii) — Sample 1

Dietary Change	Consequence
1. Ingest less roti and foods high in sugar (carbs).	Carbohydrates contain vast amounts of glucose which may overwhelm insulin production when not regulated.
2. Consume less oily or high fat food.	The high amounts of fat are likely to lead to the clogging of arteries and the increase in sub-epidermal fat, which decreases hormone regulation and worsens diabetes.

Examiner's Comments

This candidate scored three out of four marks.

Candidate's Response to Part (b) (i) to (ii) — Sample 2

Dietary Change	Consequence
1. Intake Less Carbohydrates	An increase in carbohydrates can make the blood glucose levels rise.
2. Less Oily Foods	Oily foods can increase risk of heart malfunctions

Examiner's Comments

The candidate scored four out of four marks.

The prompt given in Part (c) stated that excess glucose in the blood of a healthy person can be converted to glycogen and stored. For two marks, candidates were asked to explain why the process is not efficient in diabetic patients.

Most candidates provided vague answers; some referred to the chance of being hospitalized. Some candidates had the misconception that insulin is an enzyme. Also, it seems like the concept of efficiency was not understood, so candidates did not mention the following correct explanations.

- There is insufficient insulin in diabetic patients.
- The body cells of a diabetic patient is not being able to respond to the insulin produced.
- The deficiency of insulin in a diabetic patient reduces the ability of muscle and adipose tissue to store glucose as glycogen.

Candidate's Response to Part (c) — Sample 1

(c) Excess glucose in the blood of a healthy person can be converted to glycogen and stored. Explain why this process is NOT efficient in diabetic patients.

Insulin is required to convert glucose into glycogen. In diabetic persons insulin is either underproduced or inefficient.

(2 marks)

Candidate's Response to Part (c) — Sample 2

(c) Excess glucose in the blood of a healthy person can be converted to glycogen and stored. Explain why this process is NOT efficient in diabetic patients.

Lack of insulin to regulate glycogen levels

(2 marks)

Examiner's Comments

The candidate in Sample 1 received both marks; however, for Sample 2, no explanation was given, so the second candidate received one mark.

Part (d) was based on an experiment to investigate digestion. Candidates were given the appropriate diagrams and the procedure for the experiment. Part (d) (i) required candidates to suggest one reason why the starch/amylase mixture was kept in the water bath.

Acceptable answers include the following.

- To control the temperature
- Because the enzyme amylase works best at that temperature

Many candidates had the misconception that the water bath was to keep the mixture cool. This indicates that the layman's term of cooling by having a bath has not changed despite the conceptual learning of the science concept of the use of water baths.

Candidate's Response to Part (d) (i) — Sample 1

(i) Suggest ONE reason why the starch/amylase mixture was kept in the water bath.

For For both solutions to have the same temperature ✓

(1 mark)

Candidate's Response to Part (d) (i) — Sample 2

(i) Suggest ONE reason why the starch/amylase mixture was kept in the water bath.

Amalyse is used ✗ to break down starch in digestion.

(1 mark)

Examiner's Comments

The candidate in Sample 1 provided the correct answer but the candidate in Sample 2 seems to have misunderstood the question. That candidate therefore did not receive the mark.

Part (d) (ii) asked candidates to state one reason why the experiment requires the solutions to be kept at the same temperature. Many candidates vaguely referred to the need to get accurate results.

Candidate's Response to Part (d) (ii) — Sample 1

(ii) State ONE reason why the experiment requires the solutions to be kept at the same temperature.

To prevent the change of temperature which would cause the amylase to be ineffective.

(1 mark)

Candidate's Response to Part (d) (ii) — Sample 2

(ii) State ONE reason why the experiment requires the solutions to be kept at the same temperature.

Temperature ~~affects~~ effects the rate of enzymes.

(1 mark)

Examiner's Comments

These two samples for Part (d) (ii) show correct responses. Another acceptable response is that *the variables must be controlled*.

Part (d) (iii) asked candidates to suggest one reason why the starch and amylase solutions were not immediately mixed at the beginning of the experiment. Candidates found this question difficult, and some referred vaguely to the need to get precise results. Other incorrect responses are shown in the following two samples.

Candidate's Response to Part (d) (iii) — Sample 1

(iii) Suggest ONE reason why the starch and amylase solutions were not immediately mixed at the beginning of the experiment.

To give the iodine time to set in.

(1 mark)

Candidate's Response to Part (d) (iii) — Sample 2

(iii) Suggest ONE reason why the starch and amylase solutions were not immediately mixed at the beginning of the experiment.

To better control the rate of digestion.

(1 mark)

Candidate's Response to Part (d) (iii) — Sample 3

(iii) Suggest ONE reason why the starch and amylase solutions were not immediately mixed at the beginning of the experiment.

To be sure they were at the optimal temperature to be effective.

(1 mark)

Examiner's Comments

The candidate in this third sample provided an accurate response.

Other acceptable answers include the following.

- Amylase has an optimum temperature that is higher than room temperature.
- The reaction would occur slowly if the optimum temperature was not reached.
- Some of the colour changes would not have been observed.

Part (d) (iv) asked candidates to suggest a suitable aim for the experiment. Some candidates referred to investigating iodine reactions even though the stimulus stated that it was an experiment to investigate digestion. Acceptable responses include the following.

- To investigate the action of amylase on starch
- To find out how long amylase takes to digest starch at 37° C

Candidate's Response to Part (d) (iv) — Sample 1

(iv) Suggest a suitable aim of the experiment.

To measure the effectiveness of the amylase in breaking down starch.

(1 mark)

Candidate's Response to Part (d) (iv) — Sample 2

(iv) Suggest a suitable aim of the experiment.

To observe the length of time digestion (with starch and amylase) would ~~teh~~ take ~~pl~~ place.

(1 mark)

Examiner's Comments

The exemplar samples represent acceptable aims. It must be noted that aims must begin with the word 'to'.

The results of the investigation were provided for the candidates in Table 2, labelled Results of Experiment. The table is shown below.

TABLE 2: RESULTS OF EXPERIMENT

Time (minutes)	Observation of Starch–Amylase Mixture (when placed in cavity on spotting tile)
0	Blue-black colour
2	Blue-black colour
4	Blue-black colour
6	Dark brown colour
8	Brown colour
10	Light brown colour
12	Very pale brown colour
14	Light orange-brown colour
16	Light orange-brown colour
18	Light orange-brown colour
20	Light orange-brown colour

Part (d) (v) asked candidates to use the results presented in Table 2 to determine how many minutes it took for the digestion of starch by amylase to be completed. The expected answer was 12 minutes but either 12 or 14 was acceptable since both represent the number of minutes before the colour reverted to light orange-brown. Many candidates did not consider the colour reverting and therefore stated the final time found in the table, that is, 20 minutes. Weaker candidates added up all the minutes down to the final colour change.

Candidate's Response to Part (d) (v)

(v) Using the results in Table 2, determine how many minutes it took for the digestion of starch by amylase to be completed.

It took 14 minutes. ✓

(1 mark)

Examiner's Comments

This candidate gave a correct answer and received the mark.

Part (d) (vi) asked candidates for an explanation of the response given to Part (d) (v). Many candidates could not explain that *after 12 minutes there was no further change in colour* and that *this indicated that all of the starch had been broken down and no more remained in the mixture*.

Candidate's Response to Part (d) (vi) — Sample 1

(vi) Explain your answer to (d) (v).

When starch is present iodine turns the solution a very dark colour. When there is no longer any starch it become lighter in colour. The light orange-brown colour after 14 minutes proves that the starch has been digested.

(2 marks)

Candidate's Response to Part (d) (vi) — Sample 2

(vi) Explain your answer to (d) (v).

When starch is tested in iodine solution a blue-black colour is present until all the starch has left.

(2 marks)

Candidate's Response to Part (d) (vi) — Sample 3

(vi) Explain your answer to (d) (v).

The colour observered remains the same after this time.

(2 marks)

Examiner's Comments

The candidate in Sample 1 gave an acceptable explanation. Sample 2 shows that the candidate understands the relationship between starch and iodine but could not express it correctly. The candidate in Sample 3 gained only one of the two marks because no explanation was given.

Part (d) (vii) asked candidates to state what they would expect to observe in the cavity if another drop of the mixture is added to the drop of iodine after 22 minutes. The expected answer was that *there would be no change in colour* or that *there would be a light orange–brown colour*.

Candidate's Response to Part (d) (vii) — Sample 1

(vii) State what you would expect to observe in the cavity if another drop of the mixture is added to the drop of iodine after 22 minutes.

The mixture would slightly react in colour and the breakdown would continue. ✗

(1 mark)

Candidate's Response to Part (d) (vii) — Sample 2

(vii) State what you would expect to observe in the cavity if another drop of the mixture is added to the drop of iodine after 22 minutes.

It should remain a light orange-brown colour. ✓

(1 mark)

Examiner's Comments

In Sample 1, the candidate seemed to have misunderstood the question. The second sample shows a correct answer.

Part (d) (viii) asked candidates to list three precautions that should be taken when setting up and carrying out the experiment. Most candidates scored at least two out of the three marks.

Correct responses include the following.

- Careful handling of liquids to prevent spilling
- Caution in using the water bath/hot water
- Correct timing of solutions in the water bath
- Care in handling glass equipment
- Use of the right volume of reagents

Candidate's Response to Part (d) (viii) — Sample 1

(viii) List THREE precautions that should be taken when setting up and carrying out the experiment.

① ensure that the cavity's of the spotting tile are uncontaminated.
② ensure that the water bath does not get too hot,
~~④~~ ③ ensure the time between drops stay the same

(3 marks)

Candidate's Response to Part (d) (viii) — Sample 2

(viii) List THREE precautions that should be taken when setting up and carrying out the experiment.

① Ensure the amount of starch-amylase mixture is the same for each cavity.
Ensure the amount of iodine used is the same.
~~Must~~ Monitor and ensure the temperature does not become to high as to ~~denature~~ denature the enzymes.

(3 marks)

Examiner's Comments

The candidate in the first sample provided two of the three precautions required while the second candidate gave three.

Part (d) (ix) asked candidates to name a reagent that may be used to identify the substance (mixture) remaining in the test tube after 20 minutes. Most candidates were able to name the reagent as *Benedict's or Fehling's reagent*.

Candidate's Response to Part (d) (ix) — Sample 1

(ix) Name a reagent that may be used to identify the substance ('mixture') remaining in the test tube after 20 minutes.

Iodine ×

(1 mark)

Candidate's Response to Part (d) (ix) — Sample 2

(ix) Name a reagent that may be used to identify the substance ('mixture') remaining in the test tube after 20 minutes.

~~Fehl~~ ~~Fehl~~ Benedict Solution.

(1 mark)

Examiner's Comments

The exemplar samples show one incorrect and then one correct answer.

Part (d) (x) asked candidates to suggest a suitable conclusion for the experiment. Many candidates found a suitable conclusion difficult to write, hence the need for teachers to provide as many laboratory activities as possible so that students can practise writing conclusions for experiments.

A suitable response would have been any of the following.

- The digestion of starch by amylase produces sugar (maltose).
- Starch is broken down by amylase to produce sugar.
- Starch is broken down by amylase at 37° C after 12 minutes.

Candidate's Response to Part (d) (x) — Sample 1

(x) Suggest a suitable conclusion for the experiment.

It takes at least 14 minutes for starch to be completely digested by amylase.

(1 mark)

Candidate's Response to Part (d) (x) — Sample 2

(x) Suggest a suitable conclusion for the experiment.

Starch was present in this experiment.

(1 mark)

Candidate's Response to Part (d) (x) — Sample 3

(x) Suggest a suitable conclusion for the experiment.

The average time taken for the starch break down of Starch by amylase was found to be...

(1 mark)

Examiner's Comments

The first sample contains an acceptable conclusion. However, the conclusion in Sample 2 was not aligned with the specific aim of the experiment and in Sample 3, the candidate wrote an incomplete conclusion.

It must be noted that the conclusion must be related to the aim of the experiment.

Part (d) (xi) asked candidates to state whether results like those in Table 1 would be expected if the starch solution in the experiment is replaced by roti. The more capable candidates were able to state 'yes.'

Candidate's Response to Part (d) (xi) — Sample 1

(xi) State if results similar to those in Table 1 would be expected, if the starch solution in the experiment is replaced by roti.

Yes ✓

(1 mark)

Candidate's Response to Part (d) (xi) — Sample 2

(xi) State if results similar to those in Table 1 would be expected, if the starch solution in the experiment is replaced by roti.

Similar results should be expected.

(1 mark)

Part (d) (xii) asked candidates to suggest one reason for their response to (d) (xi). Candidates who answered correctly were able to reason that *roti is made from flour which contains starch* or that *starch in flour is chemically the same as the starch in the experiment*.

Candidate's Response to Part (d) (xii) — Sample 1

(xii) Suggest ONE reason for your answer in (d) (xi).

roti is ~~is~~ comprised of a similar material to starch ✓

(1 mark)

Candidate's Response to Part (d) (xii) — Sample 2

(xii) Suggest ONE reason for your answer in (d) (xi).

The results should be similar because roti contains starch. ✓

(1 mark)

Examiner's Comments

Both candidates recognized that roti is made from flour which contains starch.

Generally, for Question 1, although candidates seemed familiar with the content, there were too many vague responses. This is an indication that there is an improper grasp or even outright misunderstanding of the material.

Question 2

This question tested Specific Objectives B 2.2, 2.3 and 2.4.

Part (a) (i) asked candidates to define the term *photosynthesis*. Most candidates earned one mark for indicating that photosynthesis is the process for making food. Many candidates were able to identify the need for light in the process but did not include specific reactants in their definition. The following misconceptions were encountered.

- Photosynthesis is a source of energy that is produced from sunlight.
- Photosynthesis is plants turning sunlight into energy.

Correct responses include the following.

- Photosynthesis is the chemical process by which plants make food from carbon dioxide and water.
- Photosynthesis is the process by which green plants make glucose from carbon dioxide and water.
- Photosynthesis is the process by which green plants use sunlight to synthesize food from carbon dioxide and water.

Candidate's Response to Part (a) (i) — Sample 1

(i) Define the term 'photosynthesis'.

Photosynthesis is the process of chemical respiration in which plants use sunlight for energy to convert water and carbon dioxide to oxygen and Glucose.

(2 marks)

(i) Define the term 'photosynthesis'.

Photosynthesis is the process by which plants obtain light energy from the sun for growth.

carbon dioxide + water —(energy absorbed by sunlight)→ glucose + oxygen

(2 marks)

Examiner's Comments

Both candidates received two marks. In Sample 1, no marks were deducted for calling photosynthesis "the process of chemical respiration". In Sample 2, although the candidate wrote "obtain light energy from the sun for growth", the candidate gained the two marks since the 'equation' given indicated an understanding of the process of photosynthesis.

Part (a) (ii) required candidates to write a balanced chemical equation for the process of photosynthesis. Overall, this part was poorly done. Some candidates gained one mark, mostly for stating both conditions or correct reactants or products. Problems candidates encountered include the following.

- Most candidates did not seem to know how to represent the reactants and products in the equation.
- Candidates simply could not write the balanced equation.
- Some candidates wrote superscripts instead of subscripts when writing the formulae.
- Candidates wrote the equation in the reverse.
- Most candidates did not know the accurate formulas for the reactants or products.

The equation was marked based on the following four points.

- All reactants
- All products
- A balanced equation
- Both conditions stated (sunlight and chlorophyll)

If the candidate was able to provide three to 4 points, two marks were awarded. If the candidate was able to provide one or two points, one mark was awarded.

Candidate's Response to Part (a) (ii) — Sample 1

(ii) Write a balanced chemical equation for the process of photosynthesis.

$Sunlight + 6H_2O + 6CO_2 \rightarrow 6O_2 + C_6H_{12}O_6$ + Energy

(2 marks)

Candidate's Response to Part (a) (ii) — Sample 2

(ii) Write a balanced chemical equation for the process of photosynthesis.

$6CO_{2(g)} + 6H_2O_{(g)} \xrightarrow{\text{energy absorbed by sunlight}} C_6H_{12}O_{6(aq)} + 6O_{2(g)}$

(2 marks)

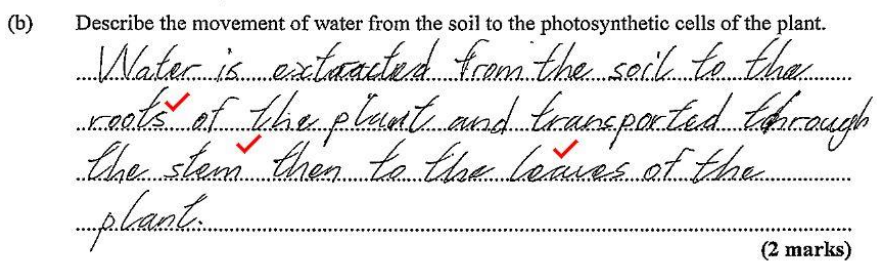
Examiner's Comments

Each of these candidates was awarded two marks for showing the reactants, the products and a balanced equation.

Part (b) asked candidates to describe the movement of water from the soil to the photosynthetic cells of the plant. This section was fairly done. Many candidates gained at least one of the two marks. If the candidate was able to provide three to four points, two marks were awarded. If the candidate was able to provide one or two points, one mark was awarded.

Most candidates correctly indicated that water is absorbed by the *root.* Not many candidates used the term *root hairs*. Many candidates also indicated that the movement of water was via the stem rather than using the term *xylem*. Candidates recognized that the water moved to the leaves but did not indicate the specific type of cells — mesophyll cells. Most candidates did not include the names of the processes by which water moved except for osmosis, that is, when water is moved into the root.

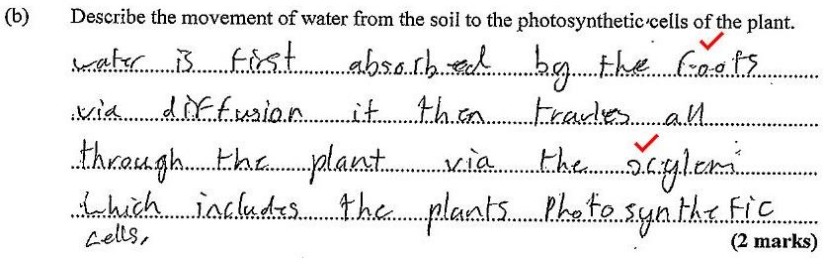
Candidate's Response to Part (b) — Sample 1


(b) Describe the movement of water from the soil to the photosynthetic cells of the plant.

Water is extracted from the soil to the roots of the plant and transported through the stem then to the leaves of the plant.

(2 marks)

Candidate's Response to Part (b) — Sample 2


(b) Describe the movement of water from the soil to the photosynthetic cells of the plant.

water is first absorbed by the roots via diffusion it then travles all through the plant via the xylem which includes the plants Photosynthetic cells.

(2 marks)

Examiner's Comments

The candidate in Sample 1 scored two marks for providing three points while the candidate in Sample 2 scored one mark, having provided only two points.

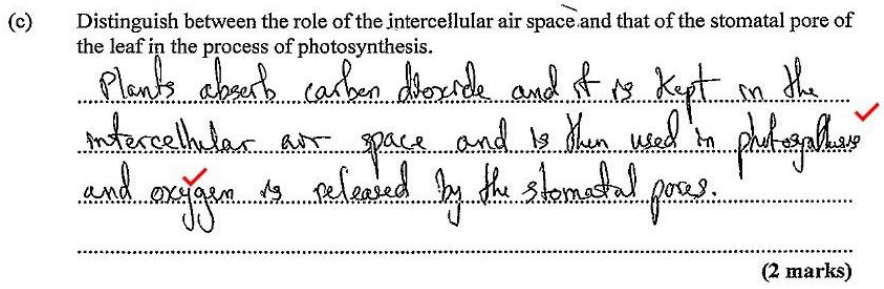
The expected response is given below.

1. Water in the soil is absorbed by the root hairs.
2. It is carried up the stem to the leaf in xylem vessels.
3. It is carried to the mesophyll cells through the process of osmosis.
4. Water travels to the chloroplasts by osmosis.

Part (c) asked candidates to distinguish between the role of the intercellular air space and that of the stomatal pore of the leaf in the process of photosynthesis. This section was very poorly done. Many candidates did not score and most who scored, received only one of the two marks. Most candidates gave inaccurate responses based on some of the misconceptions listed below.

- The intercellular air space stores water.
- The stomatal pore stores carbon dioxide for photosynthesis.
- The stomatal pore stores water needed for the leaf.
- The stomatal pore is where the leaf gets light.

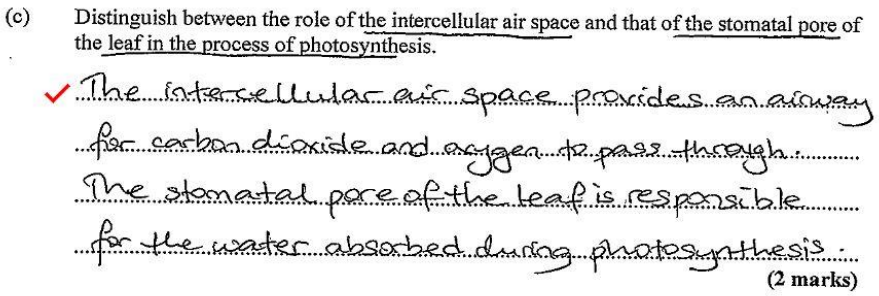
Candidate's Response to Part (c) — Sample 1


(c) Distinguish between the role of the intercellular air space and that of the stomatal pore of the leaf in the process of photosynthesis.

Plants absorb carbon dioxide and it is kept in the intercellular air space and is then used in photosynthesis and oxygen is released by the stomatal pores.

(2 marks)

Candidate's Response to Part (c) — Sample 2


(c) Distinguish between the role of the intercellular air space and that of the stomatal pore of the leaf in the process of photosynthesis.

The intercellular air space provides an airway for carbon dioxide and oxygen to pass through. The stomatal pore of the leaf is responsible for the water absorbed during photosynthesis.

(2 marks)

Examiner's Comments

Generally, candidates could not clearly distinguish between the functions; for example, in Sample 4, the candidate mentioned the use of carbon dioxide by the plant to photosynthesize but the diffusion of the gas into the intercellular space was not specified.

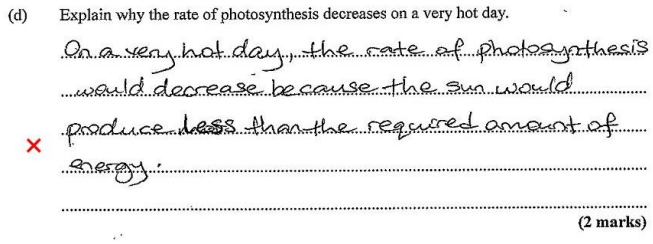
The more capable candidates who may have understood the functions of the intercellular air space and stomatal pore still gave inaccurate responses because those responses were not aligned to the process of photosynthesis. The entry of carbon dioxide into the leaf and the release of oxygen from the leaf were key points.

Expected responses include the following.

- The intercellular air space allows carbon dioxide to diffuse to all the mesophyll cells while the stomatal pores allow carbon dioxide to enter the leaf.
- The intercellular air space allows oxygen to diffuse away from the mesophyll cells while the stomatal pore allows oxygen to leave the leaf.

Part (d) asked candidates to explain why the rate of photosynthesis decreases on a very hot day. On average, candidates gained one mark. Candidates were able to give a reason but the reason was not explained, that is, it was not linked to the decrease in photosynthesis. Many candidates indicated that 'the water in the soil will dry up and none will be available to the plant so the plant will wither and die'. This response was not accepted.

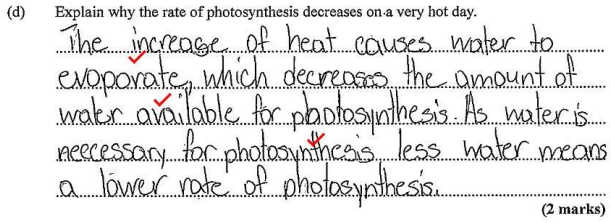
Candidate's Response to Part (d) — Sample 1


(d) Explain why the rate of photosynthesis decreases on a very hot day.

On a very hot day, the rate of photosynthesis would decrease because the sun would produce less than the required amount of energy.

(2 marks)

Candidate's Response to Part (d) — Sample 2


(d) Explain why the rate of photosynthesis decreases on a very hot day.

The increase of heat causes water to evaporate, which decreases the amount of water available for photosynthesis. As water is necessary for photosynthesis, less water means a lower rate of photosynthesis.

(2 marks)

Examiner's Comments

A general misconception was that on a hot day, plants focus on saving energy. This is seen in the first sample. Sample 2 represented a correct response.

Acceptable responses include the following.

- Rapid transpiration on a very hot day reduces the water required for photosynthesis.
- At high temperatures, the enzymes become denatured and can no longer function in the process of photosynthesis.
- On a very hot day, the plant wilts so the leaves are not held upright to capture the sunlight.
- The stomata are partially closed and this affects the plant's ability to get enough carbon dioxide.

Part (e) asked candidates to state one role of chlorophyll in photosynthesis. This was poorly answered. Most candidates did not gain the mark because of misconceptions which include the following.

- Chlorophyll produces magnesium.
- It produces minerals and energy which aids in photosynthesis.
- It gives nutrients by absorbing sunlight.
- Its role is to produce glucose or starch.
- It allows light to pass through.
- It provides energy or it is used as energy for the plant in photosynthesis.
- It stores food.

Candidate's Response to Part (e) — Sample 1

(e) State ONE role of chlorophyll in photosynthesis.

✗ Chlorophyll produces magnesium which is important/necessary for the plant to survive.

(1 mark)

Examiner's Comments
This candidate's response demonstrates one of the misconceptions.

Candidate's Response to Part (e) — Sample 2

(e) State ONE role of chlorophyll in photosynthesis.

It helps to convert sunlight into usable energy. ✓

(1 mark)

Examiner's Comments
This candidate received the mark. For the one mark, candidates were expected to respond with either of the following. • The function of chlorophyll is to absorb sunlight or trap sunlight energy • The energy absorbed by chlorophyll is used to split water molecules into hydrogen and oxygen.

In Part (f), candidates performed well and gained at least two of the four marks. Many candidates were able to explain at least one way in which photosynthesis is important but could not accurately link its importance to living things. Some acceptable responses are listed below.

- It is the basic energy reaction that channels the energy from the sun into ecosystems.
- Plants store energy in carbohydrates and the energy is extracted by animals when they feed on plants, plant products or further up the food chain.
- Photosynthesis is essential for maintaining a constant global level of oxygen and carbon dioxide by using the carbon dioxide for photosynthesis.
- Carbon dioxide produced via respiration and from the combustion of fuels is used in photosynthesis. This prevents the levels of carbon dioxide in the atmosphere from rising too high.

Candidate's Response to Part (f) — Sample 1

(f) Outline TWO ways in which photosynthesis is important to living things.

- photosynthesis is responsible for the growth of plants. However, we (living organisms) obtain some food from plants so without photosynthesis, there would be an insufficient amount of food produced.
- plants provide living things oxygen. Without oxygen, living things cannot survive because they are dependent on plants.

Examiner's Comments

This sample represented how the majority of candidates responded, that is, relating photosynthesis to the production of food and oxygen by plants.

Candidate's Response to Part (f) — Sample 2

Question No. 2 f

① Without photosynthesis autotrophs would be unable to create their own food which would result in the ~~dest~~ slow starvation of many ecosystems.

② Without photosynthesis there would be too much CO_2 in the atmosphere resulting in higher temps and untirable conditions on earth.

Examiner's Comments

In addition to the production of food, this candidate mentioned the important part photosynthesis plays in the removal of excess carbon dioxide from the air.

Question 3

This question tested Specific Objectives A3.6, 5.1 and 5.2. Overall, this question was not well done. Candidates exhibited challenges across all subsections of the question.

In Part a (i), candidates were provided with an image of the carbon cycle and were required to label either the processes or substances shown in the image. This part was poorly done. Many candidates opted not to complete the question and most candidates who attempted it, misidentified the processes and substances.

Candidate's Response to Part (a) (i)

(a) (i) Figure 3 below is a diagram of the carbon cycle. Complete Figure 3 by inserting the names of the processes or substances in the numbered spaces provided.

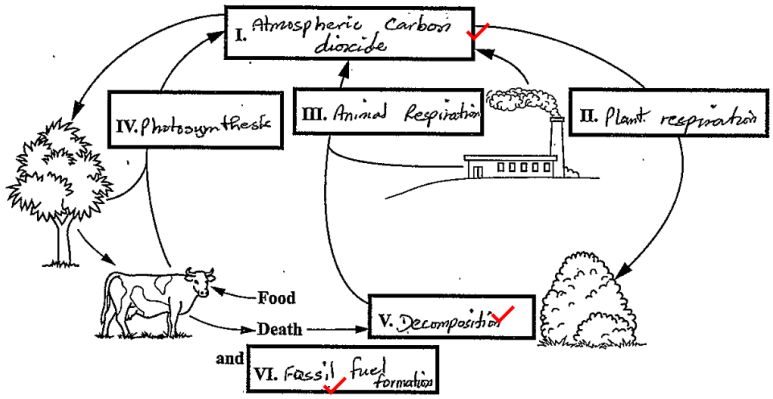


Figure 3. Carbon cycle

(3 marks)

Examiner's Comments

In this sample, the candidate gave three accurate responses and was awarded two marks.

Correct responses are noted below.

I. Carbon dioxide in the air/atmosphere
II. Photosynthesis
III. Combustion
IV. Respiration
V. Decay or decomposition
VI. Fossils or fossil fuels

In Part (a) (ii), candidates were required to state one reason why carbon is important to living things. While most candidates attempted to answer this question, it was still poorly done. The majority of candidates failed to score marks for their answers. In some cases, candidates misconstrued carbon as carbon dioxide.

Candidate's Response to Part (a) (ii) — Sample 1

(ii) State ONE reason why carbon is important to living things.

Helps to regulate the concentration of carbon dioxide in the atmosphere.

(1 mark)

Examiner's Comments

This is an example of an inaccurate response. No mark was awarded to this candidate.

Candidate's Response to Part (a) (ii) — Sample 2

(ii) State ONE reason why carbon is important to living things.

Carbon aids in many life processes/cycles, such as photosynthesis.

(1 mark)

Examiner's Comments

This candidate provided an accurate response and was awarded the one mark.

Suitable responses include the following.

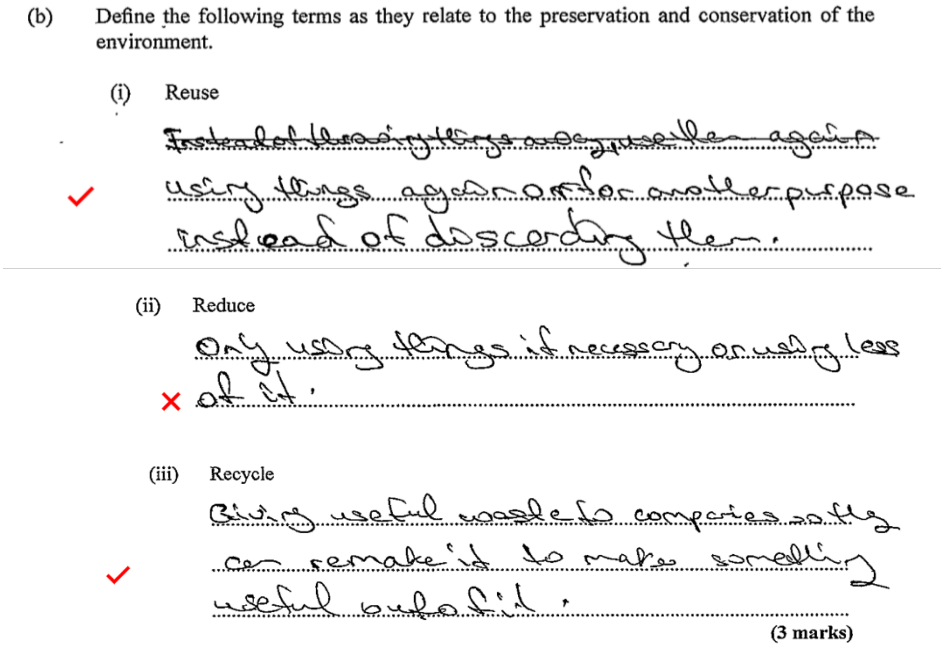
- Carbon helps with the regulation of the body.
- Energy production — breaking of the carbon-based molecules can release energy which can be used to fuel cellular processes.
- Carbon is
  - an essential part of carbohydrates
  - an essential part of fats
  - essential in the formation of proteins
  - needed to make food
  - used as a building block to create cells in the body
  - important for organic molecules.

Part (b) required candidates to define the terms *reuse, reduce, and recycle* as they relate to the conservation and preservation of the environment. Suitable responses include the following.

- Reuse
  - Find another use for a product which has already been used.
  - Find another use for a product so there is no waste to pollute the environment.
- Reduce
  - Decrease the number of products being used so there is less to pollute the environment.
  - To lessen or decrease the amount of waste generated.
- Recycle
  - Utilize an already used product in the manufacturing of another product that will be used again.
  - Change waste materials into new products.

Most candidates attempted this question; however, few were successful in scoring the allocated marks. Often, candidates could not define any of the indicated terms. In some cases, candidates were only capable of defining one term and they rewrote that definition for all the other terms.

Candidate's Response to Part (b) — Sample 1



(b) Define the following terms as they relate to the preservation and conservation of the environment.

(i) Reuse

Instead of throwing away use it again using things again and for another purpose instead of discarding them.

(ii) Reduce

Only using things if necessary or using less of it.

(iii) Recycle

Giving useful waste to companies so they can remake it to make something useful out of it.

(3 marks)

Examiner's Comments

The candidate provided accurate responses for Parts (i) and (iii), so two marks were awarded.

Candidate's Response to Part (b) — Sample 2

(b) Define the following terms as they relate to the preservation and conservation of the environment.

(i) Reuse

Reuse refers to the practice of using items or materials multiple times, extending their lifespan before the became waste. ✓

(ii) Reduce

Reduce involves minimizing the generation of waste by using fewer resources and producing less overall waste. ✓

(iii) Recycle

Recycling is the process of collecting, processing and transforming materials into new products to prevent them from being discarded as waste. ✓

(3 marks)

Examiner's Comments

This candidate provided an accurate response for each term and was awarded the three marks.

In Part (c) (i), candidates were given a scenario involving the disassembly of an iPhone and were required to suggest two advantages of recycling metals from the iPhone.

This part was better answered than the previous sections. For this question, most candidates were awarded at least one of the two marks allocated for the question. The samples below indicate this.

Candidate's Response to Part (c) (i) — Sample 1

(c) (i) Daisy, the latest disassembly robot from Apple, is able to recover aluminum, gold, silver, copper and other metals from iPhone devices.

Suggest TWO advantages of recycling metals from iPhones.

1) Reduction of wastage. ✓

2) Will be made into something more useful.

(2 marks)

Candidate's Response to Part (c) (i) — Sample 2

(i) Daisy, the latest disassembly robot from Apple, is able to recover aluminum, gold, silver, copper and other metals from iPhone devices.

Suggest TWO advantages of recycling metals from iPhones.

① These items ~~would~~ won't end up in places where they can pollute the environment. ✓

② Recycling the metals ~~stops~~ lowers the production of plastic which would of covered the robot.

(2 marks)

Other suitable responses include the following.

- Less waste is generated.
- Resources will not be used up as quickly or there will be more resources for later generations.
- Less land is needed for the disposal of waste.
- Less pollution of soil and water / less pollution of the environment occurs.
- In some cases, less energy is used to recycle than to extract.

In Part (c) (ii), candidates were required to complete a table to explain two ways in which the recycling of cell phones differs from the recycling of leftover foods. This part was poorly done. Most candidates scored only one or two out of the total four marks allocated for the question. Many responses were generalized statements not directly linked to the question asked.

Candidate's Response to Part (c) (ii) — Sample 1

TABLE 3: DIFFERENCE BETWEEN RECYCLING OF CELLPHONES AND RECYCLING OF LEFTOVER FOOD

Recycling of Cellphones	Recycling of Leftover Food
1. Is inedible	Is edible
2. Is not biodegradable ✓	Is biodegradable ✓

Examiner's Comments

This candidate provided one accurate comparison response. Two of the four marks were awarded.

Candidate's Response to Part (c) (ii) — Sample 2

TABLE 3: DIFFERENCE BETWEEN RECYCLING OF CELLPHONES AND RECYCLING OF LEFTOVER FOOD

Recycling of Cellphones	Recycling of Leftover Food
1. The phone can be taken apart and the metals can be used for other items.	The nutrients from the food can enrich the soil and make it better for planting in. ✓
2. Dosen't pollute water ways.	Creates foods for ~~ens~~ insects and worms

(4 marks)

Examiner's Comments

This candidate was given the benefit of the doubt and awarded the mark even though the comparison given was not clearly linked.

In Part (d), candidates were required to suggest two ways in which the recycling of a fallen tree could benefit the community. Most candidates who attempted the question gained one mark, as shown below.

Candidate's Response to Part (d) — Sample 1

(d) Suggest TWO ways in which the recycling of a tree, after it is cut down, can be beneficial to a community.

1) The community can obtain useful ~~materials~~ objects when the wood from the trees is used. ✓

Examiner's Comments

The candidate provided one accurate response.

Candidate's Response to Part (d) — Sample 2

(d) Suggest TWO ways in which the recycling of a tree, after it is cut down, can be beneficial to a community.

1- The tree can be used to make benches for the community.

2- The spot that is now cleared can be used as a landmark.

(2 marks)

Examiner's Comments

This candidate was awarded one mark. The second point was inaccurate based on the question asked.

Suitable responses include the following.

- Leaving the tree to rot will help to recycle the nutrients.
- The fallen tree can be used as mulch, for example, around homes or playparks. This would improve the nutrients, water retention, structure and drainage of the soil in that area.
- Use of the wood from the tree to create signposts, fencing etc. reduces the cost associated with such. It also decreases the requirement to source other materials.
- It can lead to a reduction in costs associated with transport and space allocation at landfills.
- Depending on the type of tree, the leaves and roots may be used as sources of oils which are used in cosmetics, essential oils and for traditional medicinal purposes.
- Materials derived from parts of the tree, for example, the bark, can be used to make jewelry, clothing, ropes, and other products.
- Oils and sap extracted from the tree can be used in the production of soaps and paint.

Question 4

This question tested Specific Objectives A6.4, B.4.8, B4.9 and 4.10.

In Part (a), candidates were required to define the term *transpiration*. Many candidates were not able to define the term transpiration. Common misconceptions include linking transpiration to respiration or gaseous exchange, and defining transpiration as a form of respiration.

Candidate's Response to Part (a) — Sample 1

(a) Define the term 'transpiration'.

Transpiration is the process by which plants lose water through the stomata of the leaves into the atmosphere.

(1 mark)

Examiner's Comments

This sample is representative of a correct response for which the candidate was awarded the mark.

Candidate's Response to Part (a) — Sample 2

(a) Define the term 'transpiration'.

Transpiration is the process where carbon dioxide (CO^2) is carried into plants to produce oxygen.

(1 mark)

Examiner's Comments

This response was incorrect. The candidate was not awarded the mark.

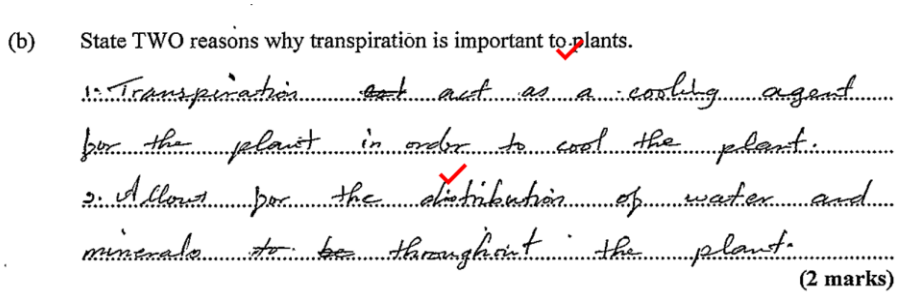
Acceptable responses include the following.

- Transpiration is the evaporation of water from the leaves and other surfaces of the plant.
- Transpiration is the process of water movement through a plant and its evaporation from aerial parts such as leaves, stems and flowers.
- The loss of water vapour from a leaf — the vapour diffuses out through the stomata.

Part (b) required candidates to state two reasons why transpiration is important in plants. This question received a mixture of responses. Some candidates scored one mark while others were not awarded any marks. Common misconceptions include the following.

- Transpiration makes plants grow and supplies energy.
- Transpiration allows plants to produce offspring.
- Transpiration is important to get rid of excess water and waste.

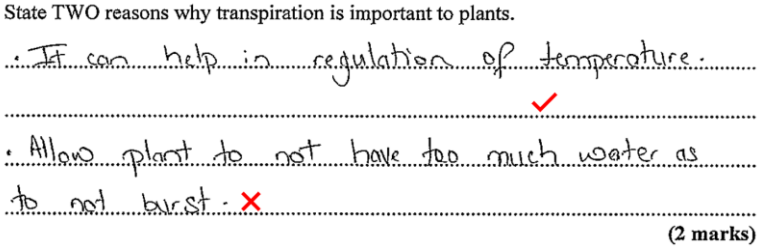
Candidate's Response to Part (b) — Sample 1



Examiner's Comments

This candidate provided two accurate reasons. The two marks were awarded.

Candidate's Response to Part (b) — Sample 2



Examiner's Comments

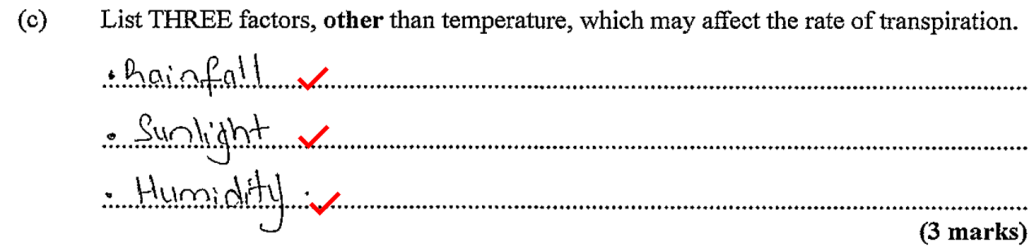
This candidate provided one accurate response, so one mark was awarded.

Acceptable responses include the following.

- Keeps plants cool
- Helps to transport water from the roots to the leaves
- Provides water to keep plant cells hydrated
- Allows for the movement of minerals in plant cells
- Provides water to the very highest part of the plant
- Helps with the movement and absorption of minerals in the plant
- Provides water to keep plant cells turgid
- Supplies water to the leaf which is used to carry out photosynthesis

Part (c) required candidates to list three factors other than temperature which may affect the rate of transpiration. This part was well done.

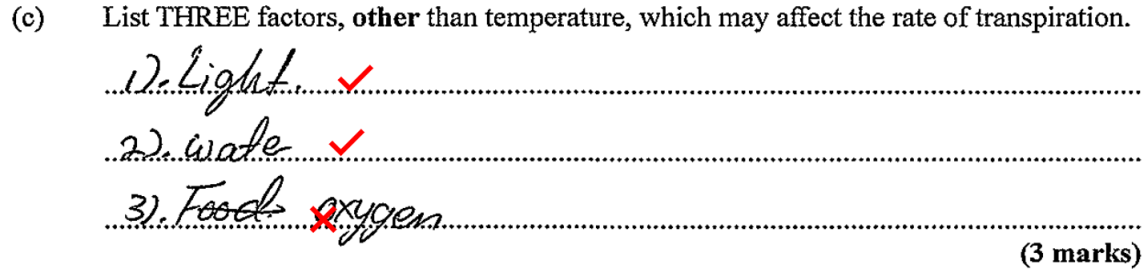
Candidate's Response to Part (c) — Sample 1



Examiner's Comments

This candidate provided three accurate responses and was awarded the three marks.

Candidate's Response to Part (c) — Sample 2



Other correct responses include the following.

- Leaf size
- Water availability
- Cuticle thickness
- Number of stomata
- Atmospheric pressure

Common inaccurate responses include the following.

- pH
- Soil
- Environment
- Weather

In Part (d), candidates had to explain how each of the three factors listed in Part (c) affects the rate of transpiration. Most candidates, even those who had listed the factors in Part (c), could not adequately explain how the factor affects the rate of transpiration. For example, sunlight was most often linked to temperature instead of being linked to the opening and closing of stomata.

Candidate's Response to Part (d)

(d) For EACH of the THREE factors listed in (c), explain how it affects the rate of transpiration.

Wind - will blow away the water from around the leave of the plent there fore increasing the rate of transpiration.

light - will increas the rate of photosynthis that will decreas the rate of transpiration

humidity - the level of humidty will affect the rate of transpiration.

Examiner's Comments

The candidate provided one accurate response. Two marks were awarded. No mark was awarded for light or humidity as explanations of how they affect the rate of transpiration were not given.

Suitable responses include the following.

- Light: The stomata are open during the day to allow for photosynthesis. The rate of photosynthesis increases when stomata are open.
- Humidity: Increased humidity decreases the rate of transpiration. Water evaporates more easily into dry air than into saturated air.
- Wind speed: Windy conditions cause the leaf to move continuously, and gases will diffuse quickly out of the leaf, this leads to a steep concentration gradient which increases diffuse out of the leaf. An increase in wind speed leads to an increase in transpiration.
- Leaf size: The larger the leaf, the greater the surface area for evaporation. Larger leaf size will increase transpiration.
- Water availability: The more water that is available in the soil, the more water would be available to the plant. Well-watered soil will therefore increase the rate of transpiration.

- Cuticle: Leaves vary in the thickness of their cuticles. Cuticles prevent the excessive loss of water from the plant. Thick cuticles will slow the rate of transpiration.
- Number of stomata: Leaves vary in their number of stomata. Possession of more stomata increases the number of openings through which transpiration can occur. An increase in the number of stomata increases the rate of transpiration.
- Atmospheric pressure: When atmospheric pressure is low the rate of transpiration increases. Air moves from high to low-pressure areas. In low atmospheric pressure conditions, the air will move from the inside of the plant to the outside taking water with it.

In Part (e) (i), candidates were required to explain one way in which climate change can negatively impact the agriculture sector in the Caribbean region.

Candidates performed poorly in this section as some candidates, while able to state the way in which climate change would negatively affect the agricultural sector of the Caribbean, could not go further and provide the explanation. For example, some candidates were able to state that climate change could cause an increase in rainfall but were not able to provide an explanation beyond this point.

Candidate's Response to Part (e) (i)

(e) (i) Explain ONE way in which climate change can **negatively** impact the agriculture sector in the Caribbean region.

The sea level increase so so the beaches are more likly the can eraded.

(2 marks)

Examiner's Comments

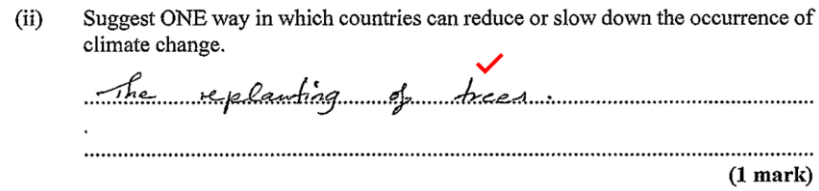
Although the candidate provided a response which is a potential ecological impact caused by climate change, no marks were awarded for the response since the candidate did not state how it affects the agricultural sector.

Examples of suitable responses include the following.

- Changes in temperature may reduce yields of desirable crops or may cause the introduction of weeds or new pests which will reduce yield.
- A decrease in water or increase in droughts may result in a reduction in the yields of desirable crops or there would be a loss of crops and livestock.
- The increased carbon dioxide concentration increases the global greenhouse effect causing temperatures to rise. This in turn would result in livestock loss and a reduced production of plants.
- Changes in rainfall patterns would affect the timing associated with agricultural crops thereby affecting crop production and yield. This may lead to changes in food availability.

Part (e) (ii) required candidates to suggest one way in which countries can reduce or slow down the occurrence of climate change. Candidates performed better on this part than on the previous ones. Generally, candidates were able to score the mark. However, some candidates appeared to have misinterpreted or misread the question and submitted responses such as 'greenhouse gases' and 'the greenhouse effect'.

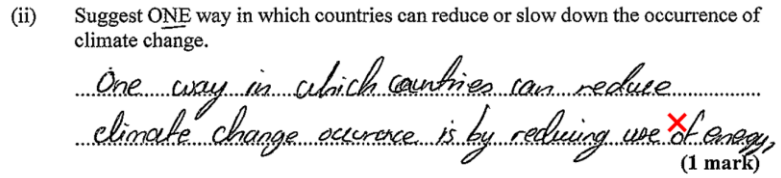
Candidate's Response to Part (e) (ii) — Sample 1


(ii) Suggest ONE way in which countries can reduce or slow down the occurrence of climate change.

The replanting of trees.

(1 mark)

Candidate's Response to Part (e) (ii) — Sample 2


(ii) Suggest ONE way in which countries can reduce or slow down the occurrence of climate change.

One way in which countries can reduce climate change occurrence is by reducing use of energy.

(1 mark)

Examiner's Comments

The first sample represented a correct response. The candidate in the second sample was not awarded the mark. This candidate could have linked the answer to energy production by stating *reduce or remove the reliance on fossil fuels for energy production* or could have suggested *the use of green or renewable energy sources*. However, as written, the response was too vague.

Suitable responses include the following.

- Ban plastics (government policy).
- Encourage recycling and reuse of products.
- Use more renewable energy.
- Use green energy.
- Burn fewer fossil fuels.
- Use electric cars.
- Encourage regenerative farming practices.
- Plant trees.
- Reduce the amount of waste sent to landfills.
- Encourage residents to compost.
- Encourage or increase the use of public transportation.
- Reduce air pollution.
- Reduce pollution.
- Reduce carbon emissions.

Question 5

For this question Specific Objectives C 1.1, 2.4, 2.9 and 6.2 were tested.

Part (a) required candidates to give definitions of terms. The table below summarizes accepted responses.

Term	Definition
Gene	A portion of segment of DNA that carries information to produce a specific protein -or- A unit of inheritance
Allele	One of the forms of a gene -or- An alternative form of a gene
Chromosome	Made of protein (histones) and DNA -or- A threadlike body containing genes which pass on traits from parent to child -or- Made of two chromatids held together by a centromere

Candidate's Response to Part (a) (i)

(a) Define EACH of the following terms.

(i) Gene

Section or Segment of DNA that determines a specific characteristic. ✓

Candidate's Response to Part (a) (ii)

(ii) Allele

An alternate ✓ form of a gene that can be either recessive or dominant.

Candidate's Response to Part (a) (iii)

(iii) ~~Chromosome~~

Threadlike ~~structures~~ DNA strands containing DNA & protein ✓

Examiner's Comments

The samples represent accurate definitions of the three terms given.

Part (b) required candidates to describe the events occurring at the areas of Figure 4 marked A, B and C (process of meiosis).

Candidate's Response to Part (b) — Sample 1

With reference to Figure 4, describe the events occurring at the areas marked A, B and C.

A The chromosomes are lining up with their homologous pairs. they are crossing over this is prophase I

B The chromosomes are in pairs in the middle of the cell this is metaphase I

C The chromosomes were pulled away by ~~by~~ the process of anaphase I and cytokinesis split the cell into four. The spindle fibers pulled the cromatids to the end of each cell.

(3 marks)

Candidate's Response to Part (b) — Sample 2

With reference to Figure 4, describe the events occurring at the areas marked A, B and C.

A ~~The chromosomes have combined to become~~ doubled to becom four pairs of chromosoms

B The cell splits into two ~~wh~~ with each cell containing ~~fnow~~ pairs of chromosomes.

C The two cells each split into ~~tow~~ two which leaves four total cells each containing one pair of chromosomes.

(3 marks)

Examiner's Comments

The candidates in theses samples for Part (b) correctly described the events occurring at the areas marked A, B and C. Each candidate was awarded the three marks.

Expected Response

A – Each chromosome duplicates itself/duplication of chromosomes occurs. OR There are now eight chromatids in the nucleus. OR Homologous chromosome pair formed bivalents. OR Genetic crossing over of chromatids has occurred.

B – The cell divides into two to form a new cell, each with four chromatids. OR There was a reduction (or division).

C – The cell divides again to form four sex cells each with only two chromosomes. OR Four daughter cells are formed each with the haploid number of chromosomes.

Part (c) required candidates to suggest one possible consequence if meiosis did not occur.

Candidate's Response to Part (c) — Sample 1

(c) Suggest ONE consequence that may occur if meiosis does not occur as illustrated in Figure 4.

May result in down syndrome ✓ if
correct numbe of chromosomes not passed on.

(1 mark)

Candidate's Response to Part (c) — Sample 2

(c) Suggest ONE consequence that may occur if meiosis does not occur as illustrated in Figure 4.

Doubling of chromosomes. ✓

(1 mark)

Examiner's Comments

Each of the candidates suggested an acceptable consequence of meiosis not occurring, as illustrated in Figure 4. Each candidate was awarded one mark.

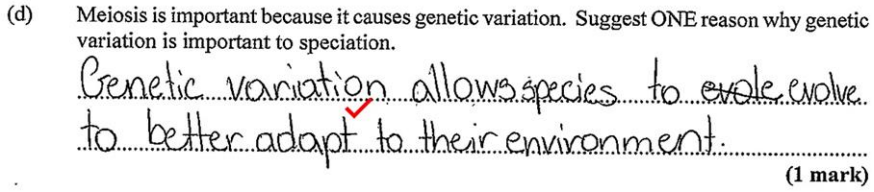
Other accepted responses include the following.

- Offspring may have an extra chromosome/missing chromosome.
- Birth defects/deformity occurs, for example, down syndrome.
- Infertility.
- Death/limited life span/not viable.
- No sex cells.
- Extinction of species.
- Doubling up of chromosome number in each successive generation.

In Part (d), candidates were asked to suggest an acceptable reason why genetic variation is important to speciation. The responses expected were as follows.

- Less likely that a change in environmental conditions will wipe out an entire species
- Production of desirable traits leading to 'survival of the fittest'
- Adaptation to changing environmental conditions and hence survival (or evolution)

Candidate's Response to Part (d)


(d) Meiosis is important because it causes genetic variation. Suggest ONE reason why genetic variation is important to speciation.

Genetic variation allows species to evole evolve to better adapt to their environment.

(1 mark)

Examiner's Comments

The candidate suggested an acceptable reason why genetic variation is important to speciation. The mark was awarded.

Finally, in Part (e), candidates were asked to complete all the elements of a genetic cross between a tall purebred pea plant and another pea plant such that all the offspring were tall.

Many candidates struggled to complete this section and accurately complete the genetic cross. Despite the prompts provided to define the alleles and provide the genotypes and phenotypes of the parents, candidates still did not include this information. Overall, this question was poorly done. Candidates omitted multiple parts of the question.

Candidate's Response to Part (e) — Sample 1

(e) The height of pea plants is controlled by a single gene which has two alleles. A tall purebred pea plant is crossed with **another** pea plant and all of the offspring have the same phenotype. With the use of a genetic diagram, state the phenotype of the offspring.

Define the alleles. Let T ✓ represent tall pea plant (dominant)

Let t ✓ represent short pea plant. (recessive)

Parents' phenotype. tall ✓ tall ✓

Parents' genotype. TT ✓ Tt ✓

homozygous dom. heterozygous.

Cross.

	T	T
T	① TT	② TT
t	③ Tt	④ Tt

Phenotype ratios: 1:0 ~~100%~~ tall plants. ✓

✓

Genotype ratio: 1:1 ✓

homozyg. dom: heterozyg.

All offspring will have Tt (tall plant) gene ✓ but they are carries for short plant gene.

Candidate's Response to Part (e) — Sample 2

(e) The height of pea plants is controlled by a single gene which has two alleles. A tall purebred pea plant is crossed with **another** pea plant and all of the offspring have the same phenotype. With the use of a genetic diagram, state the phenotype of the offspring.

Define the alleles. P – tall p – short (pea plants)

Parents' phenotype. Tall pea plant X Tall pea plant

Parents' genotype. PP × Pp

Gametes: (P)(P) × (P)(p)

Cross.

Parent's Gametes → P P

	P	P
P	PP	PP
p	Pp	Pp

∴ 100% of all of offsprings are tall purebred pea plants.

Examiner's Comments

These candidates all completed the genetic cross correctly. Each one was awarded the seven marks.

Recommendations

- Candidates should note that questions will come from Section C of the CSEC Biology syllabus and they must therefore prepare adequately for such.

Question 6

This question tested Specific Objectives A 5.2, 5.3, 5.4 and 7.11. The question assessed candidates' knowledge and understanding of the structures and functions of the skin and kidneys.

Candidate's Response to Part (a) — Sample 1

(a) The human skin is responsible for temperature regulation. State ONE **other** function of the human skin.

The skin provides a barrier ✓ giving protection

(1 mark)

Candidate's Response to Part (a) — Sample 2

(a) The human skin is responsible for temperature regulation. State ONE **other** function of the human skin.

To excrete ✓ waste products mainly sweat and salts.

(1 mark)

Examiner's Comments

This part was well done with most candidates being awarded the KC mark. Candidates in each of the scripts stated one of the accepted functions of the human skin other than temperature regulation.

Protection was the most popular correct answer but some candidates also correctly mentioned *excretion* as a function. A very rarely mentioned but accepted response was the function of *sensation in detecting stimuli such as pain or touch*.

For Part (b), candidates were given a stimulus statement and were required to explain two ways in which two different structures in John's skin functioned to regulate his body temperature while gardening.

Most candidates obtained two of the four UK marks. The most popular structure was *sweat glands or pores* and this was accompanied in most instances with the explanation that *when stimulated they increase release of sweat or perspiration, which cools the body when it evaporates*. However, a few candidates failed to mention the structure releasing sweat, simply saying 'the skin'. Such candidates were only able to obtain one mark for the explanation.

Some candidates went on to provide another structure — *the blood vessels*, and then correctly explained that *they dilate or widen to increase the blood flow to the skin's surface to release more heat*. Another structure identified was *the hair*. A correct explanation that it *lays flat on the surface of the skin to allow heat to easily escape from the body*.

A misconception noted was that hair shelters the skin from sun exposure. No marks were gained for such an explanation. Marks were not awarded for stating that 'fat cells make you feel warm inside' or that 'fat cells provide insulation'.

Some candidates did not read the question carefully so they explained two behavioral activities John may have taken to stay cool. No marks were awarded for these which included 'drinking cold water', 'wearing a hat or long sleeves' and 'becoming accustomed to the heat so his temperature stayed normal'.

Candidate's Response to Part (b) — Sample 1

(b) John took his temperature in the morning and it was normal. At midday, while gardening, he took his temperature again and it was also normal. John is surprised that his temperature remained normal despite being in the sun all afternoon.

Explain TWO ways in which **two different** structures in John's skin functioned to regulate his body temperature while he was gardening.

1) sweat glands secreated sweat ~~to~~ t which cools Thors body down as it evaporates which helps to keep Thor cool

~~2) hairs on Thors skin lay flat this is to allo. keep Hete out~~

2) blood vessels in Thors skin come closer to the surface in order to better radiate off any exess heat.

Examiner's Comments

This candidate obtained the four UK marks. Having understood the question, the candidate stated the structures first and then explained how they work.

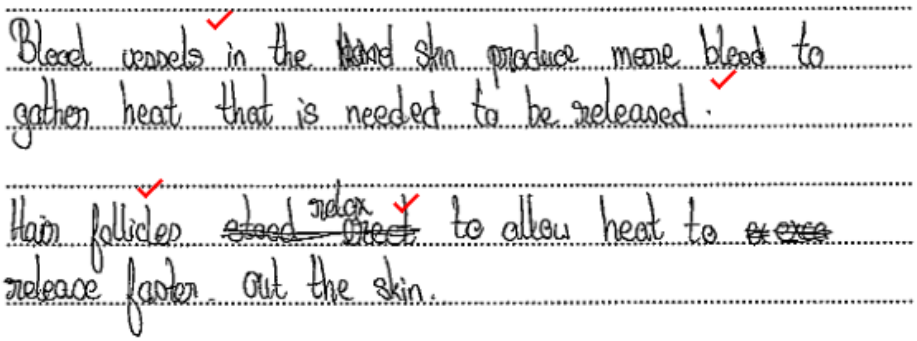
The first response was a proper explanation of how sweat functions so that the body stays at a normal temperature despite being in the sun. In the next structure that this candidate explained, there was a misconception that "blood vessels come closer to the surface". The candidate should have written that *blood vessels dilate or widen*, but the meaning was understood.

It was good that the candidate crossed out the structure, hair. Although that structure was correct, the explanation was incorrect.

Candidate's Response to Part (b) — Sample 2

(b) John took his temperature in the morning and it was normal. At midday, while gardening, he took his temperature again and it was also normal. John is surprised that his temperature remained normal despite being in the sun all afternoon.

Explain TWO ways in which **two different** structures in John's skin functioned to regulate his body temperature while he was gardening.



Examiner's Comments

Although this candidate did not use the best terms, four out of four UK marks were still awarded.

The explanation for the first structure could have been better, but the mark was still awarded as "produced more blood to gather heat that is needed to be released" fits the explanation of dilation or widening of the blood vessels.

In addition, "hair follicles" was accepted as a structure for hair; and "relax to allow heat to release faster" was accepted as being similar to the expected response that *hairs lay flat*, since the hair does lay flat when the hair erector muscle is relaxed. The marks were given, noting that candidates may not always use the exact phrasing as given in the mark scheme.

For Part (c), candidates were given another stimulus statement and were asked to explain one reason why Jan needed to be more cautious than her husband and why she frequently reapplied her sunscreen.

Candidates were expected to indicate that Jan had a smaller amount of melanin and then explain the function of melanin as follows.

- Melanin serves as a physical barrier that scatters UV rays.
- Melanin is an absorbent filter that reduces penetration of UV rays through the epidermis.
- Melanin blocks UV radiation from causing DNA damage and skin cancer/sunburn.
- It provides a sun protection factor.

Most candidates linked the lack of melanin to being more prone to sunburn/becoming easily sunburnt. For this, they were able to score the two UK marks. The explanation that *melanin blocks or scatters harmful UV rays* was correct but not as popular, being written by very few candidates. No marks were awarded for simply stating 'Jan is white', 'Jan is lighter in colour', 'Jan has a high complexion' or 'Jan has sensitive or soft skin'.

Candidate's Response to Part (c) — Sample 1

(c) Jan is Caucasian and her husband, Anthony, is African-American. They recently returned from a vacation in the Caribbean. While they both applied sunscreen daily, Jan was a bit more cautious and, unlike her husband, frequently reapplied her sunscreen during the day.

Explain ONE reason why Jan needed to be more cautious than her husband and why she frequently reapplied her sunscreen.

Jan has significantly less melanin in her skin than her husband and is therefore more suseptible the suns harmful ~~rays~~ UV rays; since melanin helps to filter out most of the UV rays.

(2 marks)

Examiner's Comments

This candidate correctly identified Jan as having less melanin than her husband and then went further to explain her susceptibility to the sun's harmful UV rays and how melanin helps to filter out most of the UV rays. The candidate was awarded the full two UK marks.

Candidate's Response to Part (c) — Sample 2

(c) Jan is Caucasian and her husband, Anthony, is African-American. They recently returned from a vacation in the Caribbean. While they both applied sunscreen daily, Jan was a bit more cautious and, unlike her husband, frequently reapplied her sunscreen during the day.

Explain ONE reason why Jan needed to be more cautious than her husband and why she frequently reapplied her sunscreen.

Jan needed to be more cautious than her husband because her husband has more melanin meaning he can adapt to hot conditions while she lacks melanin which makes her more prone to sunburn and skin cancer.

(2 marks)

Examiner's Comments

This candidate obtained the two UK marks. The candidate's explanation was more concise than others but it was correct and the marks were awarded. It should be noted that writing space was wasted restating part of the question.

In Part d) (i), candidates were asked to define the term *homeostasis*. This part was poorly answered. For one KC mark, candidates were expected to say the following.

- Homeostasis is the maintenance of a constant internal environment.
- Homeostasis is the regulation of the internal environment.

Many wrong definitions indicated that candidates simply did not know this biological term. Some incorrect answers were 'homeostasis is a cell', 'homeostasis is a hormone', 'homeostasis is when the kidney cleans the blood', 'homeostasis is removal of metabolic waste' and 'homeostasis is high blood pressure'.

Candidate's Response to Part (d) (i) — Sample 1

(d) (i) Define the term 'homeostasis'.

The way in which one maintains their internal body temperature whilst the environment changes.

(1 mark)

Candidate's Response to Part (d) (i) — Sample 2

(d) (i) Define the term 'homeostasis'.

Homeostasis is the regulation salts, in the body ✓ and sugars.

(1 mark)

Examiner's Comments

In the first response, the candidate narrowed down homeostasis to the regulation of the body's temperature, as that was the basis of Parts (a) and (b). The second response was more specific, stating that salts and sugars are regulated. Both responses were credited the KC mark.

For Part (d) (ii), candidates were given the statement "The kidney is responsible for maintaining homeostasis". Candidates were asked to describe, with reference to a named hormone, how the kidney achieves homeostasis on a hot day.

This question appeared challenging, as most candidates did not respond to it. Those candidates who attempted the question gave very poor responses such as 'heat makes you thirsty', 'urea is the hormone', 'the sweat hormone' and 'bile is the hormone'. No candidate was awarded the full four KC marks. Very few candidates were able to correctly name the hormone or describe how homeostasis is achieved.

Candidates were expected to name *anti-diuretic hormone (ADH)* for one KC mark. The other three KC marks were to be awarded for describing how ADH achieves homeostasis, as follows.

- On a hot day. water is lost through sweating.
- This makes the blood more concentrated.
- Osmoreceptors/the hypothalamus detects a change in concentration.
- ADH is secreted (by the pituitary gland).
- ADH stimulates the kidney to become more permeable to water / to reabsorb more water.
- It causes a reduction in urine volume which compensates for the loss of water through sweating.

Candidate's Response to Part (d) (ii) — Sample 1

Question No. 6 d ii

on hot days the brain ✓ increases the amount of ADH (Anti-diuretic hormone) ✓ in the blood which tells the kidney to reabsorb ✓ more water. with this the distal SEEN convoluted tubule begins absorbing as much water as is needed. resulting in less ✓ urination.

Examiner's Comments

This candidate was awarded three out of the four marks — one mark for correctly naming antidiuretic hormone (ADH) and two marks for the description of how homeostasis is achieved. The candidate clearly recognized the role of the brain in releasing the ADH even though there was no mention of the pituitary gland secreting the hormone.

Candidate's Response to Part (d) (ii) — Sample 2

(ii) The kidney is responsible for maintaining homeostasis. Describe, with reference to a named hormone, how the kidney achieves homeostasis on a hot day.

On a hot day the kidney would recive ADH ✓ which is a hormone that signals the kidney to reduce ✓ the amount of water it sends to the bladder. This allows that water to be used by the sweat glands to aid in cooling down the body.

Examiner's Comments

The candidate was awarded one mark for the hormone (ADH) and one other mark for "the kidney reduces the amount of water it sends to the bladder". There were no other valid points made. The candidate mentioned that "the water could be used by sweat glands to aid cooling" but this did not align with the explanation required.

Part (e) (i) provided candidates with a scenario and asked them to suggest two consequences James could experience due to his kidney failure. This part was well done with many varied answers. Many candidates gained at least one of the marks. Better candidates were able to use their knowledge of the functions of the kidney to explain what would not occur if the kidneys fail. Marks were awarded for any two of the following consequences.

- Inability to regulate water/ fluid levels in the body
- Build-up of toxins because the kidneys play a role in excretion
- Require dialysis/ need a kidney transplant
- Death
- Becoming ill/ feeling sick/ in severe pain
- Reduction in the quality of life
- Increase in health care costs/ bills (to family)

Candidate's Response to Part (e) (i) — Sample 1

(e) James has had hypertension for the last ten years. Recently, he developed kidney failure.

(i) Suggest TWO consequences that James could experience due to his kidney failure.

① high amounts of unwanted chemicals in his blood eg: urea ✓

② ~~#~~ Too much or too little water in the blood ✓ ~~stream~~

Examiner's Comments

This candidate linked the kidney failure to two major kidney functions.

Candidate's Response to Part (e) (i) — Sample 2

(e) James has had hypertension for the last ten years. Recently, he developed kidney failure.

(i) Suggest TWO consequences that James could experience due to his kidney failure.

① James's body will not be able to regulate water levels properly. ✓

② James may not be able to rid waste products ✓ from his blood stream properly.

Examiner's Comments

This candidate mentioned two major kidney functions that kidney failure would prevent.

For Part (e) (ii), candidates were asked to suggest one way in which James could have avoided developing kidney failure. This part was well done. Most candidates were able to score the UK mark. Candidates drew on the stimulus from Part (e) (i) as the link to suggestions for avoiding the development of hypertension such as the following.

- Drink an appropriate amount of water.
- Pursue a healthy lifestyle (exercise, no smoking, limit or avoid alcohol, eat lots of fruits and vegetables)
- Control high blood pressure (take medication regularly, limit salt intake).

Candidates who responded that James must change his diet or visit the doctor for his hypertension were also credited with the UK mark.

Candidate's Response to Part (e) (ii) — Sample 1

(ii) Suggest ONE way in which James could have avoided developing kidney failure.

By reducing salt consumption. ✓

Examiner's Comments

The candidate was very succinct and linked the salt consumption to hypertension and kidney failure.

Candidate's Response to Part (e) (ii) — Sample 2

(ii) Suggest ONE way in which James could have avoided developing kidney failure.

Maintaining a healthy ✓ diet that includes a variety of fruits, vegetables, whole grains and lean protein.

(1 mark)

Examiner's Comments

This candidate showed an understanding of the link between diet and disease, describing the foods in the healthy diet that James should eat. The candidate was awarded the one mark.

PAPER 032 – ALTERNATIVE TO THE SCHOOL-BASED ASSESSMENT (SBA)

The nature of this examination demands competency in a broad spectrum of practical skills which ideally should be acquired over a span of at least two years of full-time study. Candidates should also be able to apply these skills to accurately answer questions which require higher-order operations, for example, analysis, evaluation, reasoning, and the use of knowledge.

The spelling of biological words/terms has shown marked improvement over the years and could be attributable to the supportive structure of the questions which often contain the more challenging words.

It is imperative that candidates make greater effort to improve and develop their drawing skills.

Question 1

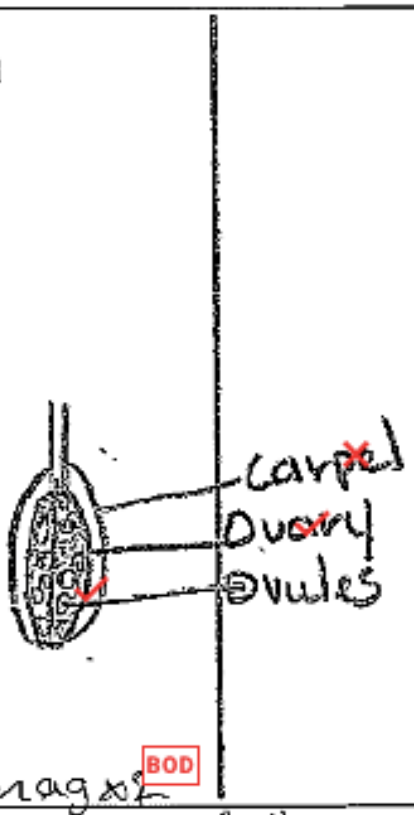
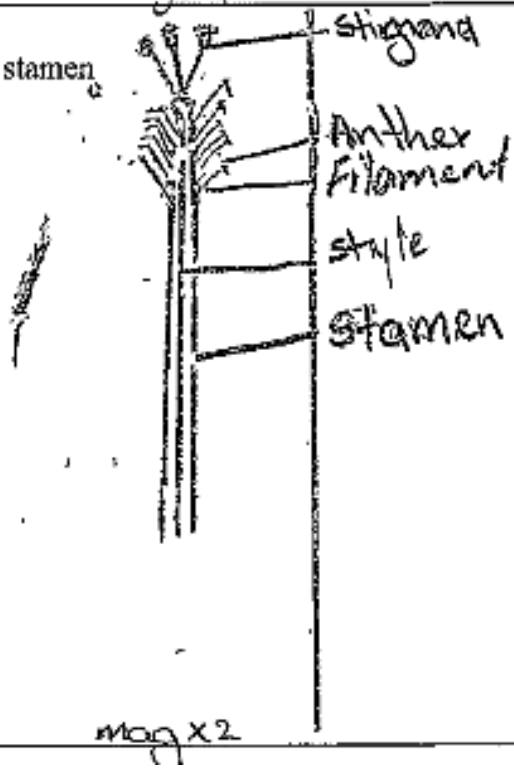
This question, which tested Specific Objectives B 9.7 and 9.8, required candidates to relate the parts of a flower to their functions and compare the structure of an insect-pollinated flower to that of a wind-pollinated flower. Candidates were also tested on their drawing and labelling skills, the calculation of the magnification of each drawing and a statement of the relationship between the floral structures and their functions.

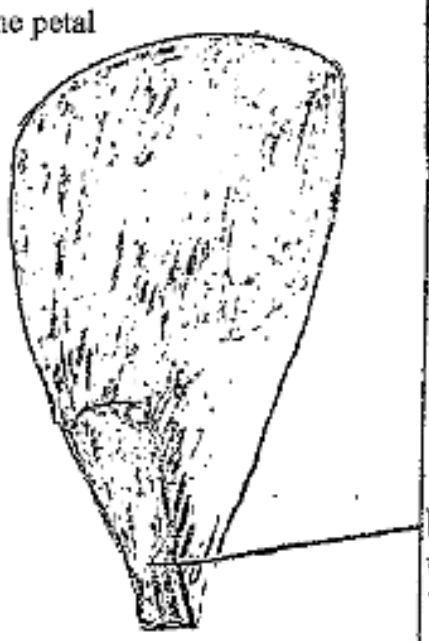
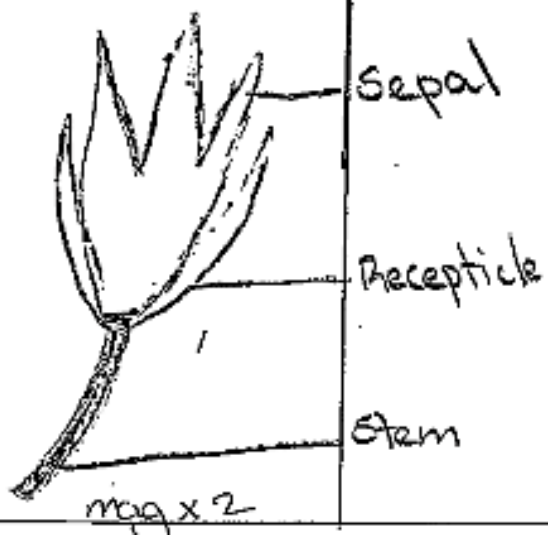
Part (a) was fairly well done. However, drawing skills were generally weak. Some examples of the weaknesses observed are given below.

- Candidates failed to produce accurate representations of the floral structures.
- Some candidates did not show their method of computation for the magnification of the drawings.
- Only a few candidates stated the measurements used to calculate the magnification thus one was left with the impression that they merely guessed or estimated the answer.
- The value given for the magnification, in some cases, had the unit 'cm' beside it, indicating a lack of understanding of the concept of magnification as being a comparison between the length of the drawing and that of the actual specimen being measured.
- Some candidates labelled the drawings incorrectly, often confusing style with filament, stigma with filament, stamen with sepal, and carpel with ovary.
- Only a few candidates produced an accurate representation of the sepal. Other candidates presented what was in most cases unrecognizable or they did not attempt the question at all.

The drawing of the petal was well done by most candidates who were able to accurately state the relationship between the structure and function(s) of each floral part. This is commendable and should be applauded!

Candidate's Response to Part (a) (i) to (iv) — Sample 1

	Drawing of Structure	How Structure Relates to Function
(i)	The carpel 	The structure around the ovary
(ii)	The stamen 	The stamen Function is to ~~keep~~ provide support to the Anther and filament

	Drawing of Structure	How Structure Relates to Function
(iii)	One petal 	The petal is the brightly colored part of the flower that attract insects to the flower so pollination could happen.
(iv)	One sepal 	The sepal the bright green part of the flower found attach to the stem function is to support the flower / Ovary or the reproductive part of the flower

Examiner's Comments

For Part (a) (i), the candidate received three out of three XS marks and zero out of one UK mark for providing

- two correct labels for the carpel – 2 marks
- the magnification (given the benefit of the doubt) – 1 mark
- nothing to say how any of the structures shown relate to the function of the flower – 0 marks.

The candidate's scores for Part (a) (ii) were two out of three XS marks and zero out of one UK mark for providing

- the labels *anther* and *filament* – 2 marks
- no magnification – 0 marks
- a faulty response – 0 marks. The filament supports the anther but the candidate reported incorrectly that the stamen provides support for the anther and filament.

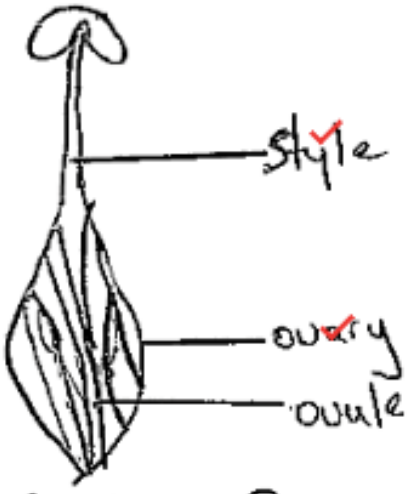
The candidate's scores for Part (a) (iii) were zero out of three XS marks and one out of one UK mark for providing

- no correct label – 0 marks
- no correct magnification for the petal – 0 marks
- the function of the petal – 1 mark

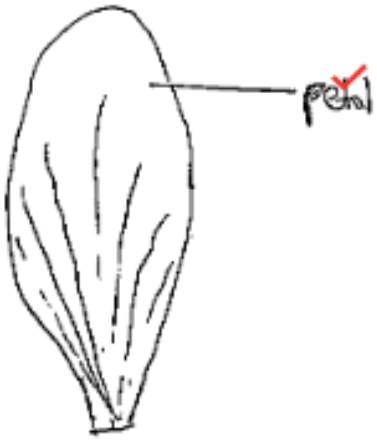
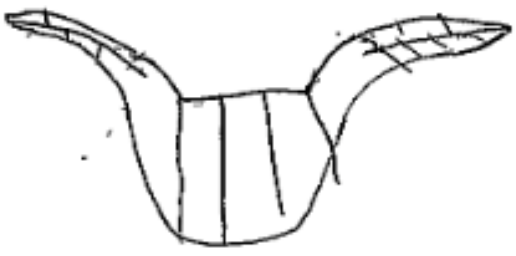
For Part (a) (iv), the candidate scored one out of three XS marks and one out of one UK mark for providing

- one correct label, the sepal – 1 mark
- the function of the sepal – 1 mark

Candidate's Response to Part (a) (i) to (iv) — Sample 2

	Drawing of Structure	How Structure Relates to Function
(i)	The carpel  magnification x5x	This is the female reproductive part of the flower this is where the pollen from the anther travels to the ovary.
(ii)	The stamen .  magnification x3	The anther houses the pollen grain and is used for pollination. the structure is necessary for pollination.

v

	Drawing of Structure	How Structure Relates to Function
(iii)	One petal  magnification x 1.5	It is brightly coloured and therefore is able to attract insects or birds for pollination.
(iv)	One sepal  Magnification x 3	It holds the flower in place

Examiner's Comments

For Part (a) (i), this candidate scored two out of three XS marks and one out of one UK mark. These marks were awarded for providing two correct labels for the carpel and a correct explanation of how the carpel is related to the function of the flower. Magnification was incorrect so no marks were awarded.

For Part (a) (ii), the candidate scored one out of three XS marks and one out of one UK mark. These marks were awarded for providing one correct label for the stamen and a correct explanation of how the anther functions. Magnification was incorrect so no marks were awarded.

For Part (a) (iii), the candidate scored two out of three XS marks and one out of one UK mark. These marks were awarded for providing one correct label for the petal, correct magnification and a correct explanation of how the petal is related to the function of the flower.

For Part (a) (iv), the candidate scored three marks. There were no correct labels or magnification; however, two XS marks were given because three of the four drawings had correct proportions, and the lines were smooth and continuous. One UK mark was awarded for providing the correct function of the sepal.

For Part (b), most candidates, having completed Part (a) and correctly stating that the petals were large, brightly coloured and scented to attract insects/pollinators, described the flower as *insect-pollinated*. There were a few candidates who incorrectly stated that the flower is 'wind-pollinated'. This indicates a lack of understanding of how to relate structure to function.

Candidate's Response to Part (b) — Sample 1

(b) Based on the observations made in (a), determine whether this flower is wind pollinated or insect pollinated.

From observation it is observed that the flower is insect pollinated

(1 mark)

Candidate's Response to Part (b) — Sample 2

(b) Based on the observations made in (a), determine whether this flower is wind pollinated or insect pollinated.

This flower is insect pollinated.

(1 mark)

Candidate's Response to Part (b) — Sample 3

(b) Based on the observations made in (a), determine whether this flower is wind pollinated or insect pollinated.

It is insect pollinated as all the structures are inside the flower.

(1 mark)

In Part (c), candidates were required to state two precautions that should be taken when dissecting the flower. This part was very well done and most candidates scored the full two marks. Not surprisingly, the most common response to this question referred to *the need for great care to be taken when using the scalpel to dissect the flower*. Candidates also mentioned that *care must be exercised in the handling of the delicate floral parts to avoid damaging them in the process*.

Candidate's Response to Part (c) — Sample 1

(c) State TWO precautions that should be taken when dissecting the flower.

One should be gentle to prevent the damaging of the specimin and be attentive to potentialy staining or poisioneus substances.

(2 marks)

Candidate's Response to Part (c) — Sample 2

(c) State TWO precautions that should be taken when dissecting the flower.

① to avoid damaging individual parts of the flower Ensure to use minimal force during the dissection. ② to avoid confusion be sure to seperate the parts of the flower post dissection

(2 marks)

Examiner's Comments

This candidate scored one mark. The second mark was disallowed because the candidate referred to a procedure that should be taken after the dissection and not while dissecting the flower.

Question 2

This question tested Specific Objectives B 1.6 and B1.7. Candidates were provided descriptions of two experiments and were required to answer a series of questions related to the experiments.

Part (a) required candidates to write a detailed account of what would be observed over the two minutes after the potassium permanganate had been placed into the beaker of water.

Overall, candidates performed poorly in this section. Some candidates were able to score one mark for mentioning that the entire solution became purple. However, there were some notable misconceptions which include the following.

- Some candidates indicated an incorrect color that the solution would change, for example, the water would become cloudy or white.
- Some candidates indicated that the crystal would expand.

Candidate's Response to Part (a) — Sample 1

In an experiment, a teaspoonful of potassium permanganate crystals was placed at the bottom of a 500 ml beaker. Cold water was then slowly poured down the side of the beaker. The beaker was observed over two minutes and the observations were recorded.

(a) Write a detailed account of what would be observed over the two minutes.

The crystals will slowly dissolve and its particles will be spread in the water. This will be able to be seen and will look like air mixing in the water until its completely mixed.

(3 marks)

Examiner's Comments

This candidate did not provide an accurate response, so no marks were awarded. It must be noted that in this experiment, the crystals would dissolve quickly.

Candidate's Response to Part (a) — Sample 2

In an experiment, a teaspoonful of potassium permanganate crystals was placed at the bottom of a 500 ml beaker. Cold water was then slowly poured down the side of the beaker. The beaker was observed over two minutes and the observations were recorded.

(a) Write a detailed account of what would be observed over the two minutes.

After a teaspoonful of potassium permanganate crystals was placed at the bottom of a 500 ml beaker. Because of the crystals that was placed a color change was observed and the color ~~wa~~ Spread through the water during the two minutes.

(3 marks)

Examiner's Comments

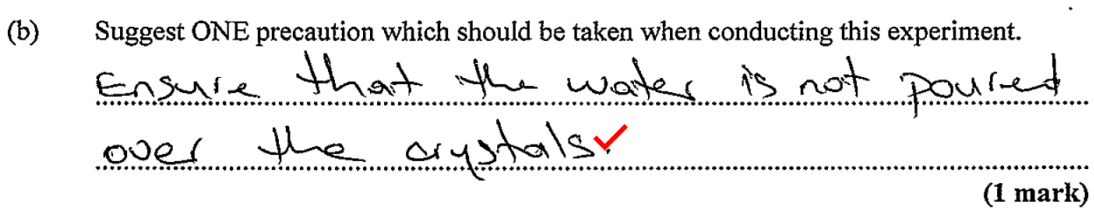
This candidate's response was vague. One mark was awarded. The candidate could have strengthened this response by including information regarding the colour that would be seen, which is purple; by speaking about the crystals dissolving; and by mentioning that the colour would slowly spread throughout the water until the colour is evenly distributed.

Suitable responses would have included the following points.

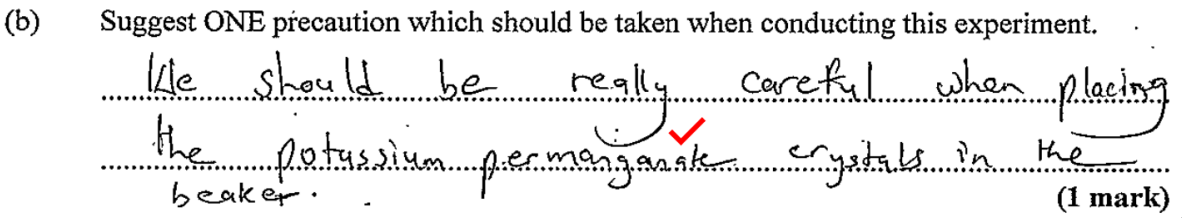
- The potassium permanganate crystals or the purple colour was initially only at the bottom of the beaker.
- The crystals dissolved quickly.
- Over time, the purple colour slowly spread into the rest of the water.
- As the purple colour spread through the water the area near the bottom of the beaker had a darker colour purple than the upper area.
- At the end of two minutes, the entire solution was purple in colour.
- At the end of the two minutes, the liquid was homogenous and the entire solution had the same shade of purple throughout.

Part (b) required candidates to give one precaution which should be taken when conducting the experiment. Candidates were generally able to score the one mark allotted for this question.

Candidate's Response to Part (b) — Sample 1



Candidate's Response to Part (b) — Sample 2



Examiner's Comments

Each of the candidates in the exemplar samples provided an accurate response and were each awarded one mark.

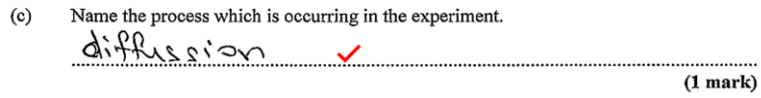
Other suitable responses include the following.

- The beaker should be clean before use.
- The water should not be poured directly onto the crystals.
- Do not shake or disturb the beaker.
- The beaker should be placed in an area where there is no movement.
- Care should be taken when handling the potassium permanganate to avoid stain/damage to clothing.
- Avoid direct contact between exposed skin and potassium permanganate.
- Wear gloves.
- Wear protective clothing.
- The potassium permanganate crystals should not be dropped in but should be placed gently.

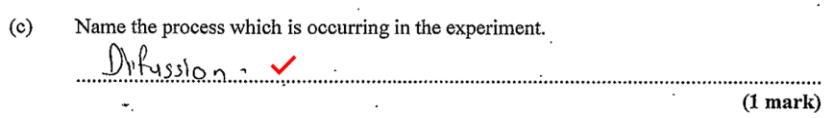
In Part (c), candidates were required to identify the process observed in the experiment. The suitable response for this question was *diffusion*. Most candidates could identify the process; however, some candidates incorrectly identified the process as

- osmosis
- transpiration
- condensation.

Candidate's Response to Part (c) — Sample 1



Candidate's Response to Part (c) — Sample 2

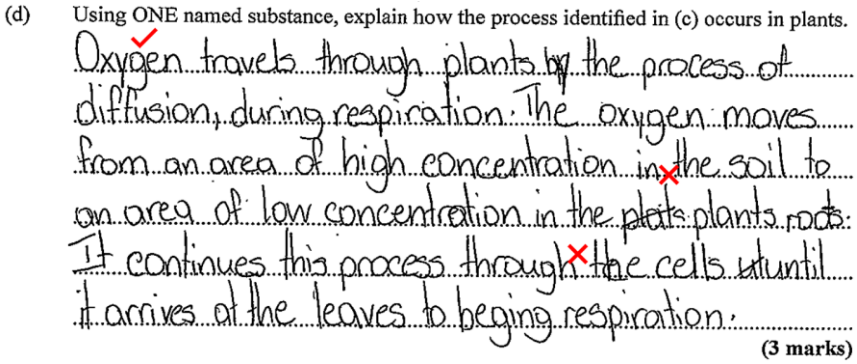


Examiner's Comments

These first two candidates provided an accurate response and were each awarded the one mark. No penalty was applied for their spelling errors.

Part (d) required candidates to name a substance and use that substance to explain how the process identified in Part (c) occurs in plants. Some candidates correctly identified a substance which could undergo diffusion in plants; however, many candidates could not explain how it occurred.

Candidate's Response to Part (d) — Sample 1



Examiner's Comments

This candidate provided a partially correct response. One mark was awarded.

Candidate's Response to Part (d) — Sample 2

(d) Using ONE named substance, explain how the process identified in (c) occurs in plants.

This process takes place in plant when carbon dioxide is absorbed. As carbon dioxide diffused in partial pressures through the veins of the plant. This eventually spreads carbon dioxide throughout the plant from the stomata to the rest of the leaf.

(3 marks)

Examiner's Comments

This candidate provided an accurate response and was awarded the full three marks.

Suitable responses include the following.

- Carbon dioxide – Carbon dioxide is taken into the leaf through the stomata during photosynthesis. There is a higher concentration of carbon dioxide in the atmosphere than inside the leaf and it therefore diffuses into the leaf through the stomata.
- Oxygen - Is produced during photosynthesis**.** Therefore, oxygen diffuses out of the leaf down the concentration gradient to the outside of the leaf because the concentration is lower than in the leaf.
- Water vapour – During transpiration water vapour diffuses from intercellular air spaces where it is in high concentration through the stomata to the air outside of the leaf.

In Part (e) (i), candidates were provided with a description of a second experiment. In Part (e) (i), candidates were required to suggest a suitable aim for the experiment. Candidates were generally able to suggest a suitable aim for the experiment. However, misconceptions were often observed as shown in the samples below.

Candidate's Response to Part (e) (i) — Sample 1

(i) Suggest a suitable aim for the experiment outlined above.

To find starch in the potato.

(1 mark)

Examiner's Comments

This candidate did not provide an accurate response. No marks were awarded.

Examples of suitable aims include the following.

- To investigate the effects of osmosis on potato tissue
- To determine the effect of different solutions on the weight of potato tissue
- To investigate the effect of distilled water and sucrose solution on the weight of potato tissue
- To compare the effect of sucrose solution and distilled water on potato tissue

In Part (e) (ii), candidates were required to provide a suitable hypothesis for the experiment. Candidates did not perform well. Only a few candidates were capable of providing an accurate hypothesis for the experiment. The most common error was candidates writing the hypothesis in the form of an aim or conclusion.

Candidate's Response to Part (e) (ii) — Sample 1

(ii) Write a suitable hypothesis for the experiment.

The potato slice will become turgid in the distilled water and flaccid in the sucrose solution.

(2 marks)

Examiner's Comments

This candidate provided an accurate response and was awarded the two marks.

Candidate's Response to Part (e) (ii) — Sample 2

(ii) Write a suitable hypothesis for the experiment.

After the 30 min mark, the potato left in the solution, will weigh less that the distilled water example. BOD

(2 marks)

Examiner's Comments

This candidate's hypothesis was vague. One mark was awarded.

A suitable hypothesis would take the details of the experiment into consideration and be testable and measurable, for example, *the mass of the potato placed in distilled water will increase while the mass of potato slices placed in the sugar solution will decrease* or *At the end of the experiment potato slices placed in distilled water will weigh more while those placed in sugar solution will weigh less*.
Part (f) (i) required candidates to complete a table of the expected results for the experiment. Candidates were generally able to accurately complete the table.

Candidate's Response to Part (f) (i) — Sample 1

TABLE 2: EXPECTED OBSERVATIONS

Test Tube	Change in Mass (Increase or Decrease)	Flaccid (Soft) or Turgid (Firm)
Potato in distilled water	Increase ✓	Turgid (firm) ✓
Potato in sucrose solution	Decreaso ✓	Flaccid ✓

(4 marks)

Candidate's Response to Part (f) (i) — Sample 2

TABLE 2: EXPECTED OBSERVATIONS

Test Tube	Change in Mass (Increase or Decrease)	Flaccid (Soft) or Turgid (Firm)
Potato in distilled water	Increase ✓	Firm ✓
Potato in sucrose solution	Decrease ✓	Soft ✓

(4 marks)

Examiner's Comments

In these two samples for Part (f) (i), the candidates provided accurate responses. In each case, the four marks were awarded.

Part (f) (ii) required candidates to suggest two precautions which should be taken when conducting the experiment.

Candidate's Response to Part (f) (ii) — Sample 1

(ii) Suggest TWO precautions which should be taken when conducting this experiment.

1. Ensure the slices are the same length. ✓
2. Ensure that the distilled water is labeled accurately.

(2 marks)

Examiner's Comments

The candidate provided one accurate response and was awarded one mark.

Candidate's Response to Part (f) (ii) — Sample 2

(ii) Suggest TWO precautions which should be taken when conducting this experiment.

Be carful when peeling potatos that way we would avoid cutting our selves; Secondly, We must wear lab coats incase there is any Spillage.

(2 marks)

Examiner's Comments

This candidate provided two accurate responses and was awarded the full two marks.

Expected responses include the following.

- Same volume of solutions used (sucrose and distilled water)
- Potatoes used should be of the same size.
- The same technique used for weighing the potatoes.
- Blot or dry the potato using a tissue before weighing.
- The same technique should be used for weighing the potatoes.
- Use the same weighing device.
- Ensure potato strips are blot dry before weighing.
- Ensure petri dishes are covered to prevent evaporation.
- Ensure potatoes are fresh.
- Ensure all potato strips used come from the same species.

Part (f) (iii) required candidates to provide a suitable conclusion for the experiment described. This part was poorly done. Many candidates could not suggest a suitable conclusion for the experiment. Some common misconceptions were that the distilled water would have no effect on the potato and that the sucrose solution moved in a different direction due to the presence of pure water within the potato slices.

Candidate's Response to Part (f) (iii) — Sample 1

(iii) Suggest a suitable conclusion for the experiment.

The potato slice in the distilled water became turgid ✓ as more water entered it and flaccid ✓ as it lost water.

(2 mark)

Examiner's Comments

The candidate provided an accurate response. Two marks were awarded.

Candidate's Response to Part (f) (iii) — Sample 2

(iii) Suggest a suitable conclusion for the experiment.

In conclusion the potato tends to be much firmer in water (distilled water), while it ✓ is much softer in the sucrose solution ✓.

(2 mark)

Examiner's Comments

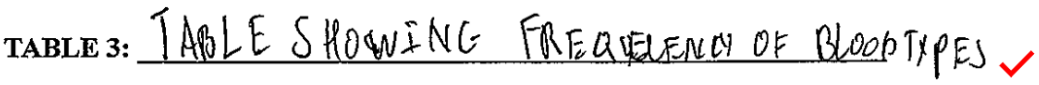
The candidate provided an accurate response. Two marks were awarded.

Question 3

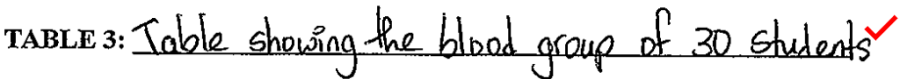
For this question Specific Objectives A 2.3, B2.4 and C 3.3 were tested.

In Part (a) (i), candidates were required to give a title for the table given. The answer below is an example of an acceptable answer. Most candidates were able to score the mark.

Candidate's Response to Part (a) (i) — Sample 1



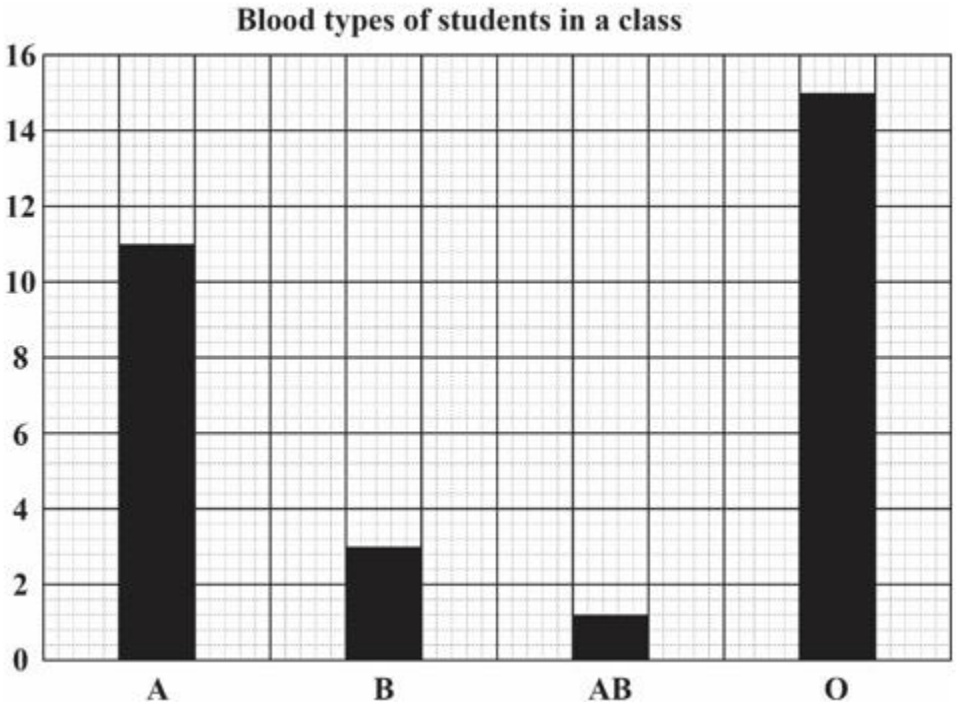
Candidate's Response to Part (a) (i) — Sample 2



Examiner's Comments

Each of the candidates gave a suitable title for the table and in each case, the mark was awarded. Another suitable title would have been *Blood Types of Students in a Class*.

In Part (a) (ii), candidates were required to plot a bar graph from the data in the table. The graph below is what was expected.

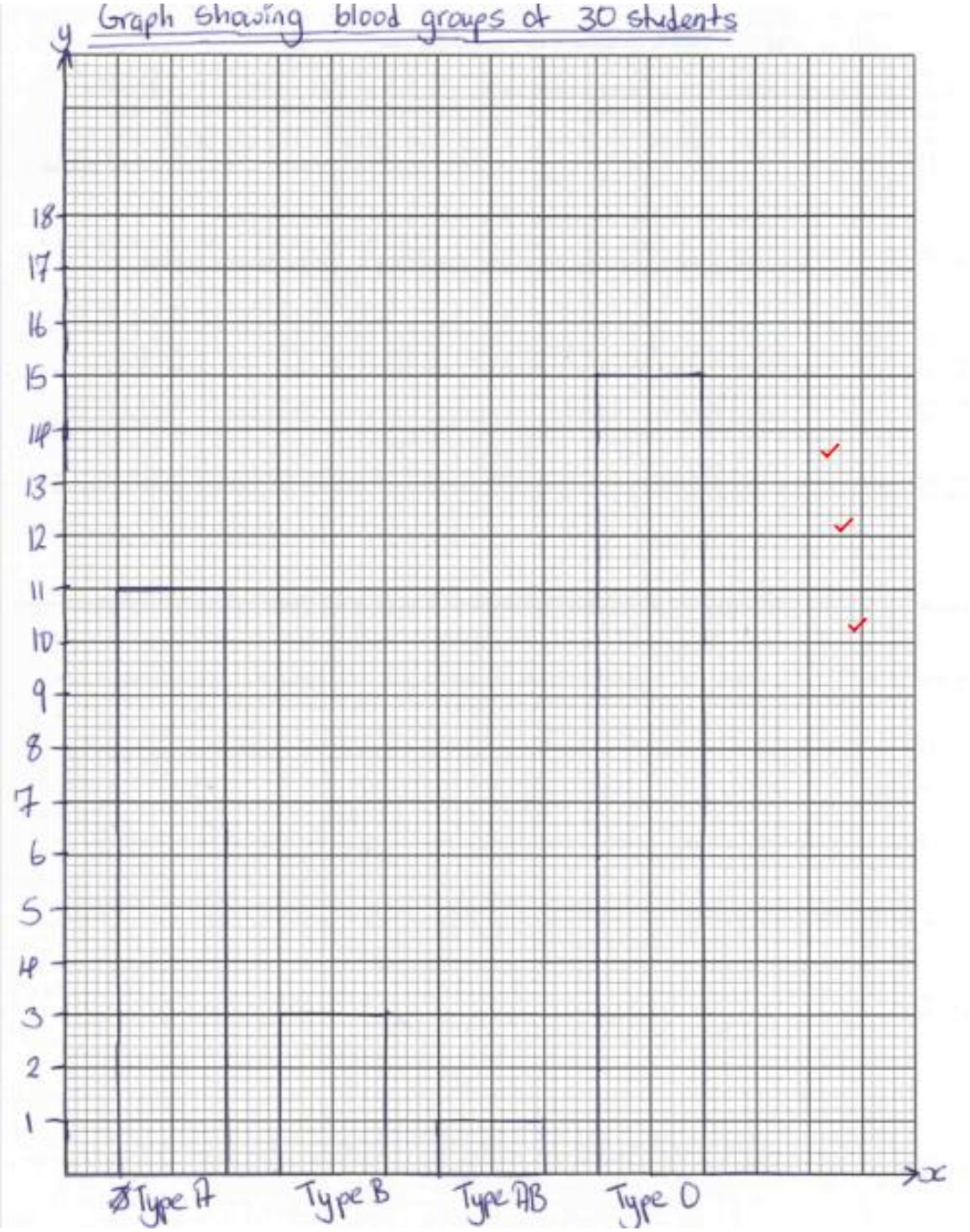


Marks were allocated as follows:

- Both axes labelled (1 mark)
  - X axis – Blood type
  - Y axis – Frequency
- Scale (1 mark)
- Plot (2 marks)
  - 3–4 correct (2 marks)
  - 1–2 correct (1 mark)

Most candidates were able to draw a bar graph and score the four marks. However, some candidates joined the bars and did not consider that the data was not continuous but discrete.

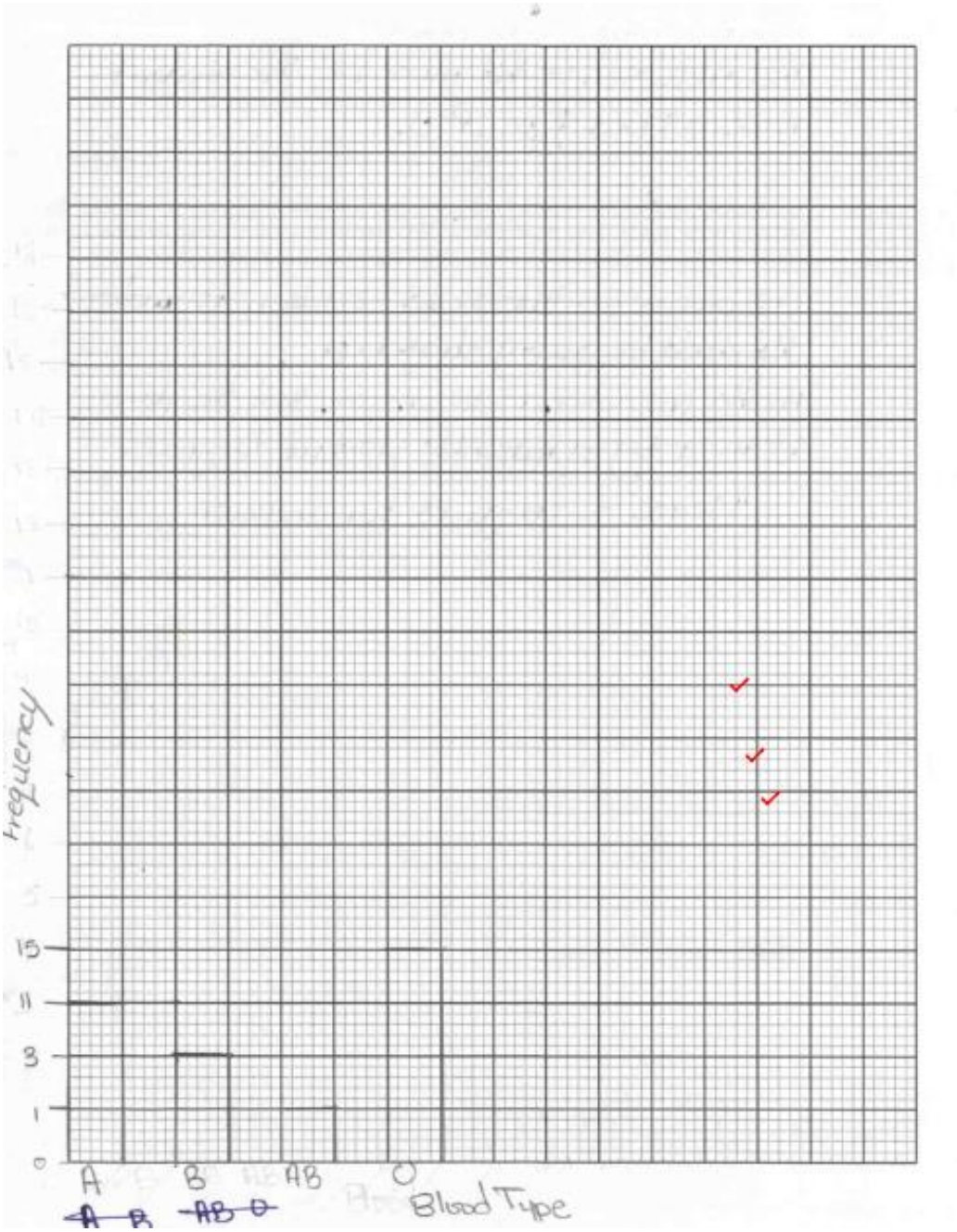
Candidate's Response to Part (a) (ii) — Sample 1



Examiner's Comments

This candidate did not label the axes, so only three out of the four marks were awarded.

Candidate's Response to Part (a) (ii) — Sample 2



Examiner's Comments

This candidate did not use an appropriate scale to occupy 75 per cent of the graph, so only three out of the four marks were awarded.

Part (b) required candidates to write a suitable aim for the experiment. The response expected was *Aim: To determine the blood type of students in a biology class*

Candidate's Response to Part (b)

(b) State a suitable aim for the experiment.

To determine the frequency of each blood type from of students in a biology class. ✓

Examiner's Comments

This candidate was awarded the mark for the aim provided.

Part (c) required candidates to calculate the percentage of each blood type from the data given. Not all candidates were able to arrive at the correct answers due to their inability to calculate percentage. The expected percentages were as follows.

- A – 37%
- B – 10%
- AB – 3%
- O – 50%

Candidate's Response to Part (c) — Sample 1

(c) Use the results in the table to determine the percentage frequency of EACH blood type.

A $^{11}/_{30} \times 100 = 36.67\%$ ✓

B $^{3}/_{30} \times 100 = 10\%$ ✓

AB $^{1}/_{30} \times 100 = 3\%$ ✓

O $^{15}/_{30} \times 100 = 50\%$ ✓

Candidate's Response to Part (c) — Sample 2

(c) Use the results in the table to determine the percentage frequency of EACH blood type.

A $\frac{11}{30} \times 100\% = \frac{110}{3} = 36.6$ ✓

B $\frac{3}{30} \times 100\% = 10\%$ ✓

AB $\frac{1}{30} \times 100\% = \frac{10}{3} = 3.3$ ✓

O $\frac{15}{30} \times 100\% = 50\%$ ✓

Examiner's Comments

Each of the candidates calculated the percentage frequencies correctly. Two marks were awarded.

In Part (d), candidates were asked to write an appropriate conclusion for the experiment. The expected responses were any one of the following.

- Blood type O is the most common blood type in the general population.
- Blood type AB is the least common blood type in the general population.

Candidate's Response to Part (d) — Sample 1

(d) Suggest a suitable conclusion for the experiment.

Blood type O is the most frequent ✓ in the biology class. while blood type AB is the least frequent.

Candidate's Response to Part (d) — Sample 2

(d) Suggest a suitable conclusion for the experiment.

The most frequent blood type was found to be type O. ✓

Examiner's Comments

Each of the candidates gave a suitable conclusion for the experiment. One mark was awarded in each case.

In Part (e), candidates were asked to list two precautions for the experiment conducted. The precautions were not to be related to the environment.

Candidate's Response to Part (e) — Sample 1

(e) The students in the class designed and conducted a second experiment to examine the variation in the height of pea plants. State TWO precautions which should be taken when conducting this experiment **other** than controlling for environmental factors.

- Ensure that the pea plants are getting the same amount of water ✗
- Ensure that the pea plants are ~~put to it~~ all handled at the same time intervals from start to finish. ✓

(2 marks)

Examiner's Comments

This candidate only gave one precaution which was not environmental, so only one mark was awarded.

Candidate's Response to Part (e) — Sample 2

(e) The students in the class designed and conducted a second experiment to examine the variation in the height of pea plants. State TWO precautions which should be taken when conducting this experiment **other** than controlling for environmental factors.

The plant must be measured from ~~top to~~ bottom to top ensuring the the measurements start at the zero ✓ mark.
The plants should not be stretched ~~wh~~ when measurements are being taken. ✓

Examiner's Comments

Both of the precautions provided by this candidate met the criteria of not being an environmental factor. Both marks were awarded.

Other expected responses include the following.

- Use the same ruler or measuring instruments for all plants.
- For plants that are bent, straighten before measuring.
- Do not damage plants when taking measurements.

In Part (f), candidates were asked to state how controlling any two environmental factors would affect the growth of the plants.

Expected responses were as follows.

- Sunlight (1 mark) — the pea plants may not all have had equal exposure to sunlight.
  - As such, some of the plants may have photosynthesized while others did not photosynthesize as well. (1 mark)
  - Decrease in photosynthesis could cause limited growth. (1 mark)

- Water (1 mark) — there may not have been equal administration of water to all of the plants.
  - Water is essential for the manufacture of substances in the plant, the transport of minerals and ions, turgor pressure and cell division. (1 mark)
  - Lack of water would affect cell division (etc.), therefore unequal administration of water would cause growth to be limited in some plants. (1 mark)

- Temperature (1 mark) — some plants may be exposed to warmer temperatures than others.
  - While increasing the temperature increases the rate of photosynthesis, above an optimal temperature, photosynthesis may stop (or not increase further) because stomata may close to prevent water loss. (1 mark)
  - This decrease in photosynthesis may limit plant growth. (1 mark)

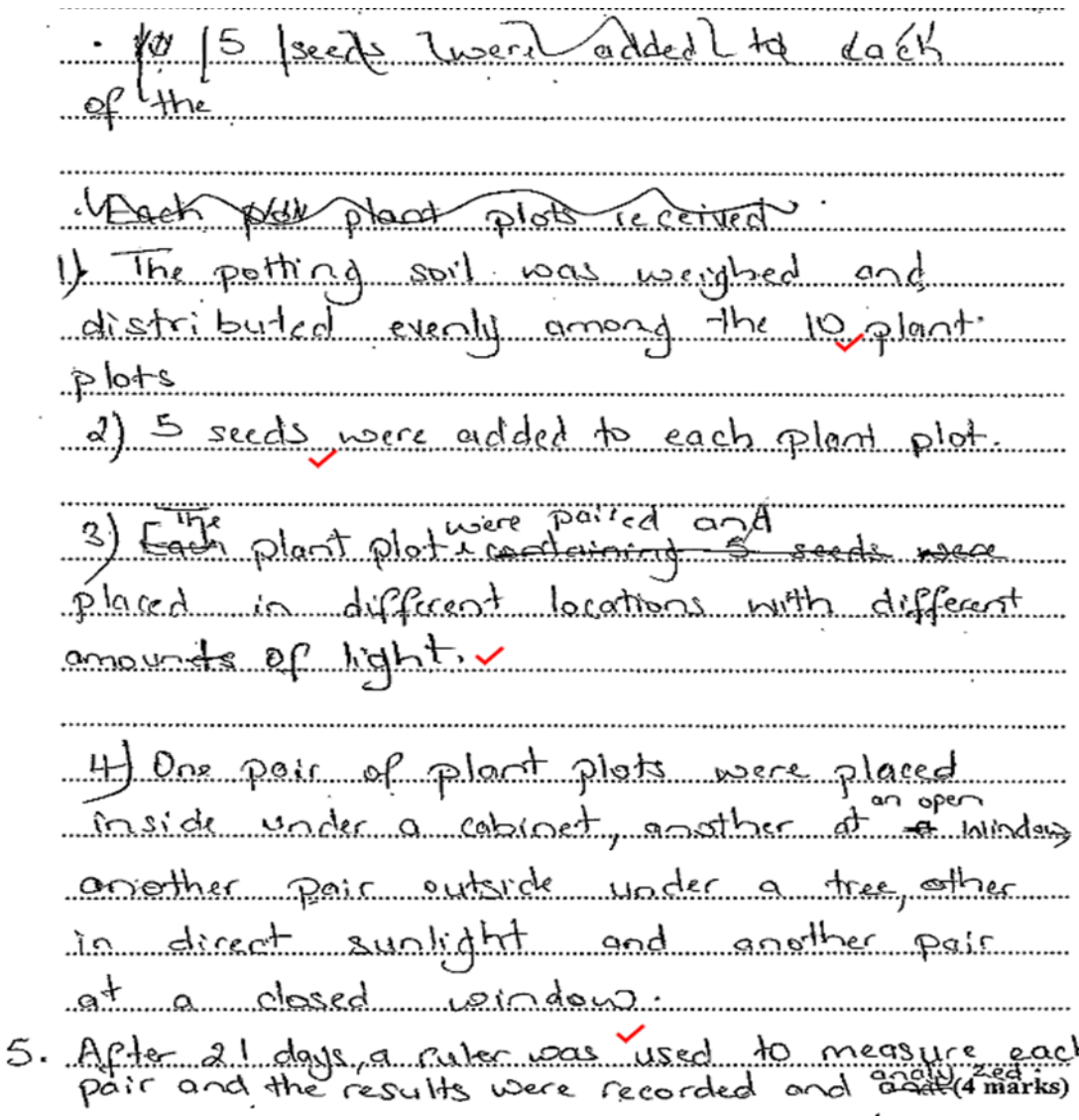
In Part (g), candidates were asked to use the listed apparatus to write a suitable procedure showing how one of the factors from Part (f) could affect plant growth. A suitable procedure is shown below.

- Using the ten plant pots, place an equal amount of potting soil into each.
- Carefully place five seeds in each plant pot.
- Ensure that the seeds are covered with a thin layer of soil.
- Expose five of the plant pots to Condition X and the other five will get none/or a smaller amount of the conditions. All other conditions remain the same, for example, if light is the variable, then control water, nutrients etc.
- Once each seed has sprouted, mark each plant's stem at the soil level with a permanent marker.
- On the 21st day, find the height of all the pea plants exposed to the condition and the height of those not exposed to the condition.
    - Measurements are taken from the soil to the marked area on the plant stem.
    - Plants are straightened to ensure accurate measurements.
- Find the average height of the plants from each group, X and Y.

To receive the allocated marks, candidates had to

- use all of the materials provided in the question
- expose the seeds to consistent amounts of water, nutrients etc.
- vary exposure of seeds to one factor
- measure the height of the plant at the end of the experiment (21 days).

Candidate's Response to Part (g) — Sample 1



Examiner's Comments

The candidate used all apparatus/materials and had a suitable procedure but did not have a consistent amount of water. Three out of four marks were awarded.

Candidate's Response to Part (g) — Sample 2

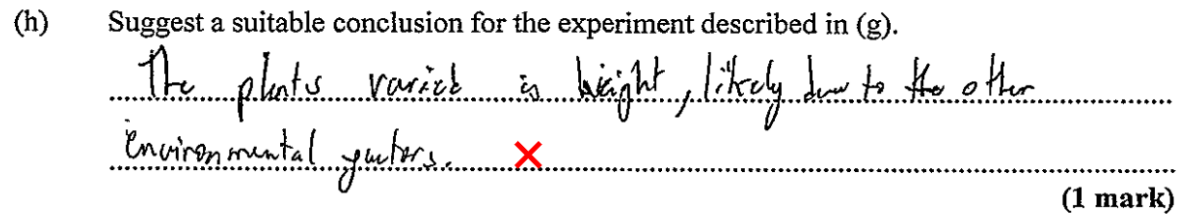
In this experiment we will use the 50 ✓ seeds and place ~~3 them 5 of them into one plant pot~~ 5 seeds into each plant ✓ pot, ~~we will the cover the seed~~ with but before we do this we will need to fill the pots with potting ✓ soil in order for the seeds to grow, after putting the seeds and covering it you will then proceed to watering ✓ the soil so that the plant can get nutrients and moisture to grow. but for 21 days we will place the plant outside where they can get good sunlight and air, but we will need to ✓ measure the plant as the shoot would start to grow as you water it everyday for the 21 days.

Examiner's Comments

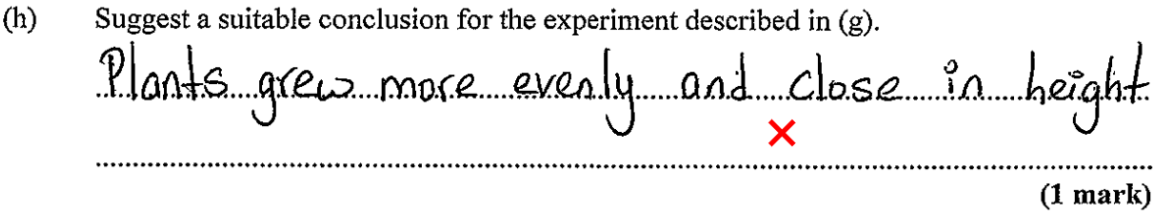
The candidate used all apparatus/materials and had a suitable procedure but did not vary one of the conditions. Three out of four marks were awarded.

In Part (h), candidates were asked to write a suitable conclusion for the experiment.

Candidate's Response to Part (h) — Sample 1



Candidate's Response to Part (h) – Sample 2



Examiner's Comments

None of the candidates in the samples gave a suitable conclusion, so no marks were awarded. The expected conclusion is *Plant exposed to variable X will experience an increase in growth*.

Recommendations

- Candidates writing Paper 032 should note that the questions will test the experimental skills outlined in the CSEC Biology Syllabus and must prepare adequately for such questions.