CARIBBEAN EXAMINATIONS COUNCIL

CSEC® BIOLOGY

Subject Report with Exemplars

May/June 2022

CARIBBEAN EXAMINATIONS COUNCIL

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

MAY/JUNE 2022

BIOLOGY
GENERAL PROFICIENCY

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INTRODUCTION

This guide is based on candidate responses to the 2022 May/June examinations in CSEC Biology.

Overall, the performance in 2022 May/June was marginally better than it was in the 2021 May/June sitting. This year, 77.15 per cent of candidates obtained Grades I–III in 2022 compared to 74.08 per cent in 2021, and 83.55 in 2020.

Performance by paper was as follows.

- This year, 84.91 per cent of candidates obtained Grades I–III on Paper 01 compared to 81.94 per cent in 2021 and 88.73 in 2020.
- For Paper 02, 66.68 per cent of candidates obtained Grades I–III in 2022 compared to 55.18 per cent in 2021. Paper 020 was not administered in 2020.
- For Paper 030 (SBA), 85.25 per cent of candidates obtained Grades I–III in 2022 compared to 86.39 per cent in 2021, and 7.43 in 2020.

The distribution of grades per profile were as follows.

- For Profile 1 (KC), 77.58 per cent of candidates obtained Grades A–C compared to 68.68 per cent in 2021, and 76.00 in 2020.
- For Profile 2 (UK),47.54 per cent of candidates obtained Grade A–C compared to 47.29 per cent in 2021, and 63.66 in 2020.
- For Profile 3 (XS), 96.93 per cent of candidates obtained Grades A–C compared to 97.41 per cent in 2021, and 96.43 in 2020.

Generally, candidates continue to experience difficulty applying their knowledge. This is evidenced by the consistently higher scores in Profile 1 (KC) when compared to Profile 2 (UK). Additionally, the COVID-19 pandemic affected the consistent delivery of instruction to candidates across the region. This may have played a major role in the results obtained during this sitting.

PAPER 01 – MULTIPLE CHOICE

Paper 01 consisted of 60 multiple-choice items. It was designed to provide adequate coverage of the content and was made up of items taken from all sections of the syllabus. The mean score for Paper 01 was 40.41. This was lower than the mean scores for 2021 and 2020 which were 40.63 and 42.62 respectively.

PAPER 02 – STRUCTURED/EXTENDED ESSAY

This year, the mean score for Paper 02 was 46.09. This was higher than the mean score for 2021 which was 41.25. Paper 02 was not administered in 2020 and therefore no mean score could be recorded for that year.

Question 1

This question tested Specific Objectives B 8.1 and 8.3. The question required candidates to construct graphs from data given and make deductions from simple investigations designed to demonstrate growth in a seedling and a baby. Candidates were also required to have knowledge of germination.

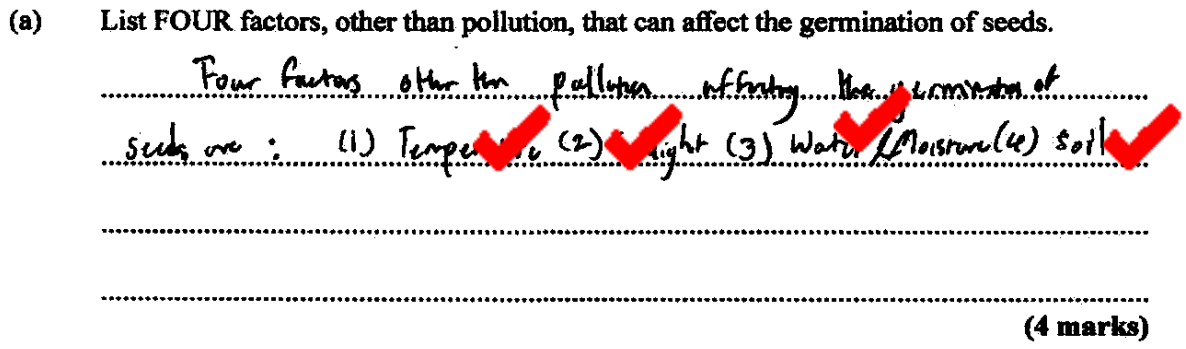
Part (a) required candidates to list four factors, other than pollution, that can affect the germination of seeds.

Most candidates gained four marks in this part. Acceptable responses included the following.

- Temperature
- Oxygen
- pH
- Water
- Light
- Seed dormancy
- Type of seed
- Disease

Candidates were not awarded marks for responses such as 'carbon dioxide', 'weather', 'climate', 'bad soil' or 'animals'.

Candidate's Correct Response to Part (a)



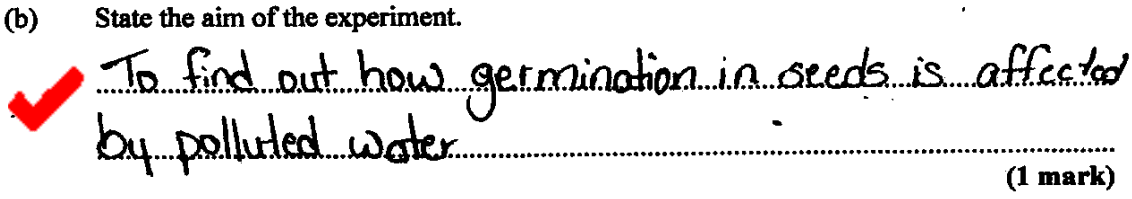
Part (b) required candidates to use the information provided in the stem and state the aim of the experiment.

Most candidates wrote acceptable aims, which

- began with "to"
- were related to the germination of seeds
- included the factor being tested, that is, polluted water.

The aim *to determine the effect of varying concentrations of polluted water on the germination of seeds* would have been an excellent response.

Candidate's Correct Response to Part (b)



Parts (c) required candidates to use the data given to explain how the concentration of polluted water affected germination at (i) 1% and at (ii) 50%.

For Part (c) (i), most candidates scored one out of the two marks for indicating that there was a small number of pollutants or germination of seeds that was not affected. For Part (c) (ii), most candidates again scored one out of the two marks. These were candidates who indicated that there was a high level of pollutants or germination of seeds that was affected. Very few candidates scored the mark for the explanation. To explain, candidates were expected to indicate that at 1%, enzymes were activated and at 50%, enzymes were deactivated.

Some misconceptions were as follows.

- The presence of fungus or bacteria in the polluted water can affect germination.
- High levels of pollutants affect osmosis.

Candidate's Correct Response to Part (c) (i)

Using Figure 1, explain how the concentration of polluted water affects germination at EACH of the following concentrations:

(i) 1%

1% Concentration of polluted water does not have any effect on germination since all 50 of the seeds germinated. Since seeds absorb water to activate enzyme to get food from endosperm for germination, there wasn't much pollutant to affect this process hence all 50 germinated. **(2 marks)**

Candidate's Correct Response to Part (c) (ii)

(ii) 50%

At 50%, the number of seeds that germinated fell below half. This could be caused by the higher percentage of pollutants present. The higher number reduces oxygen and water **(2 marks)** continued on page 21

Part (d) required candidates to state ways in which a farmer can use the given data to improve his farming practices.

Many candidates scored at least one of the two allotted marks. Marks were awarded for the following responses.

- Use less polluted water to water seeds.
- Do not use polluted water.
- Use clean/non-polluted water or purify the water before watering seedlings.
- Use natural and organic farming products.
- Plant the seeds at a different season or time of the year to avoid flooded waters.

Candidate's Correct Response to Part (d)

(d) The research team provided the results of the experiment to a farmer. State TWO ways in which the farmer can use the data to improve his farming practices.

1. Using natural pesticides instead of chemicals
2. Using clean water to water the seeds.

(2 marks)

For Part (e) (i), candidates were given a figure that showed the germination of 50 seeds in varying concentrations of polluted water. Candidates were required to place an X on the bar that represented the results of the control.

Most candidates correctly placed the X on the first bar labelled Distilled Water. Placement of the X on the *y*-axis, *x*-axis or anywhere outside the first bar was not accepted.

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

(i) On Figure 1, clearly place an X on the bar that represents the results of the control. (1 mark)

Germination involves the breakdown of food stores in a seed. Figure 1 shows the results of an experiment, where 50 germinating seeds were exposed to varying concentrations of pollutants in water.

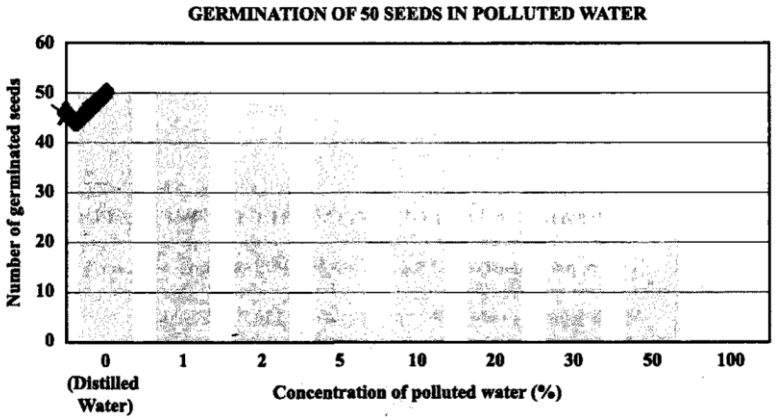


Figure 1. Germination of 50 seeds in different concentrations of polluted water

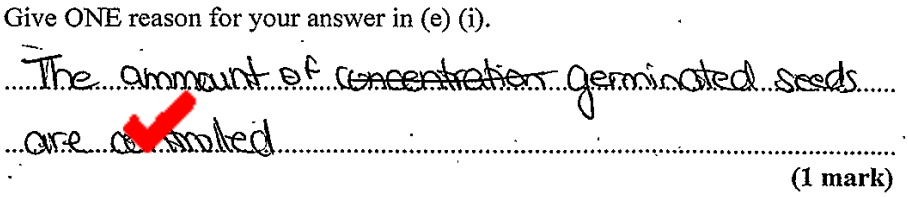
For Part (e) (ii), candidates were required to provide a reason for the answer given in Part (e) (i).

Many candidates were awarded the mark for stating any one of the following.

- There were no pollutants in the water.
- The data was used to compare the results of germinating seeds in X with the other results.
- This was the control because the distilled water did not contain any pollutants

Candidates were not awarded marks if they stated that 'a small number of pollutants was present' or simply wrote that 'it was the control'.

Candidate's Correct Response to Part (e) (ii)



Part (f) required candidates to draw a graph using data from a given table which showed comparisons in growth patterns using the height of some seedlings and the length of a human baby.

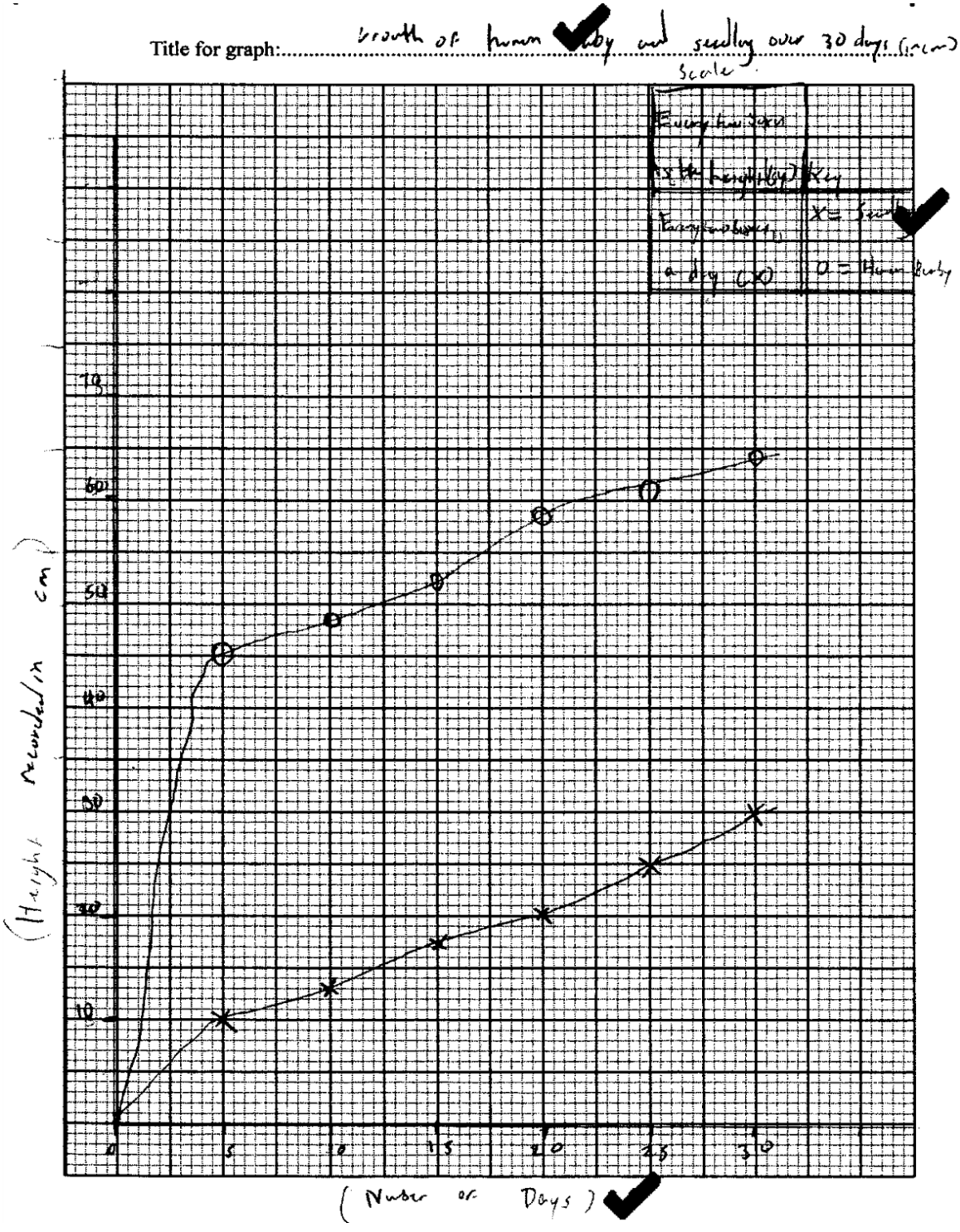
Most candidates did this part well. Candidates' skill in constructing all aspects of a graph has improved considerably from previous years. Various graphs were presented — line graphs, bar charts and histograms. A few candidates failed to connect the plotted points with a ruler.

Candidates were awarded marks for the following.

- Appropriate title
- Correctly labelled axes
- Appropriate scale
- Plot
- Legend

Most candidates wrote appropriate titles, used correct scales, and plotted the points accurately. For graphs which were plotted on two separate scales, only one graph was considered.

Candidate's Correct Response to Part (f)



For Part (g) (i), candidates were required to suggest two ways in which the growth of the baby differs from the growth of the seedlings.

Many candidates were awarded the full score for correctly comparing both organisms. Accepted responses included the following.

- Growth takes place for definite periods before maturity in the baby but growth continues throughout the life of plants.
- The baby ingests food and grows whereas the plant photosynthesizes and grows.
- The baby gets food from the mother through the placenta and breastfeeding while plants photosynthesize or make their own food.
- The baby grows faster than the seedlings.

Candidate's Correct Response to Part (g) (i)

(i) Suggest TWO ways in which the growth of the baby differs from the growth of the seedlings.

Two ways in which the growth of the baby differs are:

(1) Growth in animals happens at all regions and cannot be reversed. Growth happens over time till a certain period when it stop

(2) Growth in plants on the other hand is meristematic only occurs at the shoot system and roots. Growth in plants is continuous. (2 marks)

Part (g) (ii) required candidates to suggest one similarity between the growth of the baby and the growth of the seedlings.

Many candidates scored the mark for responses such as the following.

- Both seedling and baby are influenced by growth hormones.
- Both grow by mitotic division.
- Growth in both was irreversible/permanent.
- Both grew at least three cm in height every five days.

No mark was awarded for stating that 'oxygen or food is required for their growth'

Candidate's Correct Responses to Part (g) (ii)

(ii) Suggest ONE similarity between the growth of the baby and the growth of the seedlings.

One similarity is that they increase in size over time.

(1 mark)

Part (h) required candidates to describe how the height of seedlings is measured using a ruler.

The mark was awarded for stating that *measurement is taken from the base of the stem, that is, from the surface of the soil to the tip of the seedling.* Candidates were not awarded the mark if they stated that 'the height is measured from the roots to the tip of the plant'.

Candidate's Correct Response to Part (h)

Describe how the seedlings' height is measured using a ruler.

It is measured from the base of the seedling to the tip of the shoot.

(1 mark)

Part (i) required candidates to suggest one example that shows that an increase in cells is not always due to growth.

On average, candidates did not perform well in this part of the question. Candidates were awarded the mark for responses such as *production of gametes* and *increase in red blood cells*. Candidates, however, did not score the mark for responses such as 'moulting', 'new cells being formed to replace dead or old cells', or 'osmosis'.

Candidate's Correct Response to Part (i)

Suggest ONE example that shows that an increase in cells is NOT always due to growth.

Growth is permanent increase in size and mass, cells divide and increase (example RBC. increase every 120 days and our ~~body~~ size is same as before) but not always because of growth. **(1 mark)**

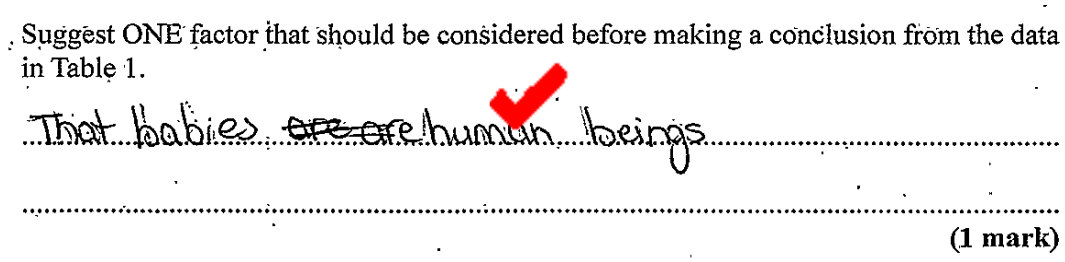
Part (j) required candidates to suggest one factor that should be considered before making a conclusion from the data provided in Table 1.

Most candidates did not score the mark for responses such as 'the baby cell is different from that of the seedlings' or 'light affects growth in seedlings unlike in a baby'.

Correct responses included the following.

- Plants of different or the same species grow at different rates, unlike the baby.
- Length/height is only a measure of one aspect of growth.
- Accuracy of data.

Candidate's Correct Response to Part (j)


Suggest ONE factor that should be considered before making a conclusion from the data in Table 1.

That babies ~~are~~ are human beings

(1 mark)

Question 2

This question tested Specific Objectives B 1.7; 2.1 and 2.2. Candidates were required to distinguish among heterotrophic, autotrophic and saprophytic nutrition and in each type of nutrition, identify sources of food for named organisms. Candidates were also required to describe the process of photosynthesis in green plants and the importance of diffusion, osmosis and active transport in plants.

Part (a) required candidates to define the terms *heterotrophic, autotrophic* and *saprophytic nutrition*.

This part was done well. Many candidates were able to score at least two out of the three marks allotted. Candidates were able to state that *in saprophytic nutrition, the organism takes nutrients from dead and decaying matter* and *in autotrophic nutrition, the organism manufactures organic food from simple inorganic compounds*.

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

(a) Define EACH of the following terms:

(i) Saprophytic nutrition

Saprophytic nutrition are animals that depend on decaying organisms and dead material for food.

(1 mark)

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

(ii) Heterotrophic nutrition

This is when organism feed on of other ~~the~~ organisms

(1 mark)

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

(iii) Autotrophic nutrition

This is where organism produce their own food from inorganic compounds.

(1 mark)

Part (b) required candidates to complete a table identifying two saprophytes and their food sources.

This question seemed challenging for many candidates as they could not identify two saprophytes. 'Vultures', 'earthworms' , 'flies' and 'maggots' were incorrectly named as saprophytes.

In addition, while many candidates were able to identify food sources of saprophytes, they lost the marks if the corresponding saprophyte was not given.

Some acceptable saprophytes with the accompanying food sources are provided below.

- Cheese mould – cheese
- Yeast – sugar
- Rhizopus - bread

Candidate's Correct Response to Part (b)

(b) Complete Table 2 identifying TWO saprophytes and their food sources.

TABLE 2: SAPROPHTES AND THEIR FOOD SOURCES

	Saprophyte	Food Source
1.	bacteria	dead plants and animal
2.	fungi	decayed organisms

(4 marks)

For Part (c), candidates were required to explain two processes by which raw materials required for making nutrients reach the leaves of a plant.

Many candidates were not able to explain the following processes correctly with respect to the plant.

- Osmosis: Osmosis is the movement of water molecules from a solution with a high concentration of water molecules to a solution with a lower concentration of water molecules, through a cell's differentially permeable membrane. Water travels from the soil and enters the root cells by osmosis then moves into tubes called xylem vessels to be transported to the leaves.
- Diffusion: Diffusion is the movement of molecules from a region of higher concentration to a region of lower concentration. Carbon dioxide from the stomata diffuses into the leaves through the stomata and finally into the leaf cells.
- Active transport: For plants to take up mineral ions, ions are moved into root hairs, where they are in a higher concentration than in the dilute solutions in the soil. Energy is required to do this.

Candidates were also given full credit for explaining alternative processes such as transpiration, capillarity, cohesion, adhesion or root pressure accurately.

Candidate's Correct Response to Part (c)

(c) Explain TWO processes by which the raw materials required for making nutrients reach the leaves of a plant.

- Diffusion: Carbon dioxide diffuses through the stomata into the air spaces to the palisade mesophyll layer and spongy mesophyll layer for photosynthesis to take place.

- Osmosis: water is absorbed through the root hairs by osmosis and by osmosis transferred to xylem stems from root cells and transported up the xylem vessels to leaves where it is used for photosynthesis.

(4 marks)

In Part (d), candidates were given the statement that "young seedlings use all the nutrients stored in their cotyledons to start their growth". Candidates were then required to explain the process by which seedlings make more nutrients in order to continue their growth.

Candidates generally scored some of the marks easily as they were able to state the raw materials, conditions and products of photosynthesis. Some candidates, however, lost marks because they could not explain the splitting of water by light energy and the subsequent reduction of carbon dioxide to a carbohydrate (glucose). Many candidates misinterpreted the question and gave explanations for germination instead.

Candidates are reminded/encouraged to read the entire leading statement and the question(s) asked and not just the beginning of the sentences.

Candidate's Correct Response to Part (d)

(d) Young seedlings use all the nutrients stored in their cotyledons to start their growth. Explain the process by which the seedlings make more nutrients to continue their growth.

This process is called photosynthesis ~~and~~ in which plants containing ~~chloro~~ chlorophyll use the energy from sunlight to ~~photolyse~~ split water into hydrogen and oxygen (light-dependent stage). During the light-independent stage, the ~~water~~ hydrogen is combined with carbon dioxide to form glucose and eventually starch, and the oxygen is diffused out through the stomata.

$6CO_2(g) + 6H_2O(l) \xrightarrow{\text{sunlight, chlorophyll}} C_6H_{12}O_6(aq) + 6O_2(g)$

(4 marks)

Question 3

This question tested Specific Objectives B1.1, 1.3, 1.4, 1.6. The question required candidates to compare the structures of plant and animal cells, relate the structures of named organelles to their function, apply knowledge related to mitochondria function and cell type, and finally, discuss cell specialization using specific examples.

This question was generally well answered as candidates displayed a good understanding of the concepts tested.

In Part a (i), candidates were provided with images of a typical plant cell and a typical animal cell. Candidates were required to provide accurate labels for the structures indicated.

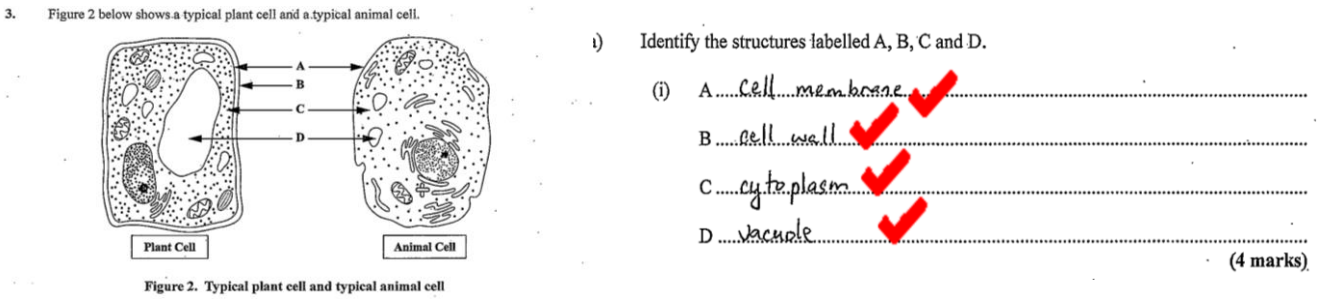
The question was generally well answered. Most candidates were able to score at least three of the four available marks. However, some candidates confused the label for A with the label for B, labelling the cell wall as the cell membrane and vice versa. Some candidates identified C (the cytoplasm) as chloroplast or granules. In addition, some candidates identified D (the vacuole) as the nucleus.

One mark was awarded for correctly identifying each of the following.

- A — Cell membrane or Plasma membrane or Cell surface membrane
- B — Cell wall
- C — Cytoplasm
- D — Vacuole

Although candidates were not penalized for spelling errors, it should be noted that some candidates misspelt the names of structures, especially cytoplasm and nucleus. During instruction, emphasis should be placed on spelling to help ensure that information can be accurately represented.

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



3. Figure 2 below shows a typical plant cell and a typical animal cell.

Figure 2. Typical plant cell and typical animal cell

i) Identify the structures labelled A, B, C and D.

(i) A cell membrane
B cell wall
C cytoplasm
D vacuole

(4 marks)

Part a (ii) required candidates to state the function of three of the organelles identified in Part a (i).

This question was also generally well answered. Most candidates were able to state the functions of the structures identified in Part a (i) and therefore were able to score at least two of the available three marks. It should be noted that many candidates did not state that *the cell membrane controlled the substances which move across the membrane* but rather indicated that 'it allows substances to enter and exit the cell'. No marks were awarded for such a response.

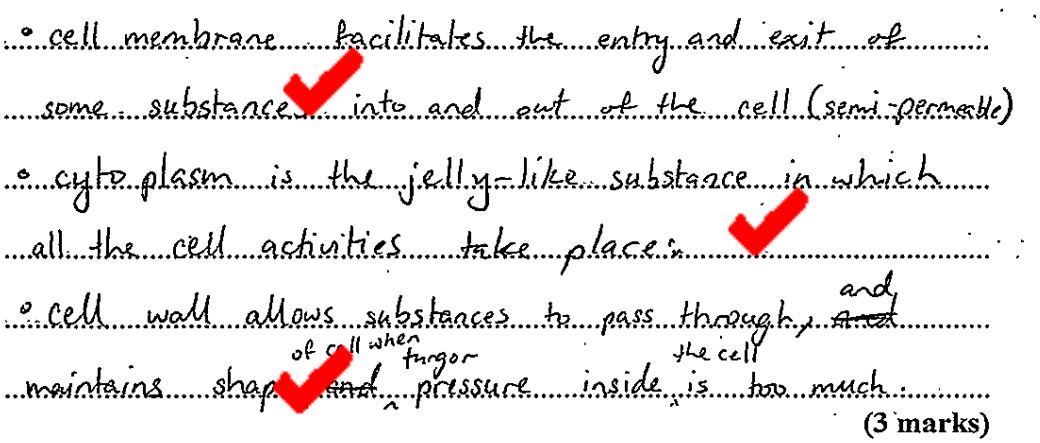
Marks were awarded as follows.

- Cell membrane — controls what enters and leaves the cell
- Cell wall — supports and protects the cell
- Cytoplasm — Gives a cell its shape/keeps organelles in place
- Vacuole – Contains or stores cell sap/Gets rid of waste products

Some candidates confused the functions of the cell membrane and the cell wall. For example, some candidates stated that 'the cell wall controls what enters and exits the cell' and that 'the cell membrane gives the cell its shape'. No marks could be awarded to candidates who gave such responses. Another misconception indicated by some candidates was that 'the vacuole stores energy'.

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

(ii) State the function of any THREE of the structures identified in (a) (i).



(3 marks)

Part (b) required candidates to apply the knowledge of organelle function. In this question candidates were given information regarding the presence of mitochondria within two specimens, that is, Specimen A contained more mitochondria than Specimen B. Candidates were required to suggest reasons for this difference.

Many candidates did not attempt Part (b) and those who did so performed poorly. Most candidates were not able to identify that Specimen A was most likely an animal while Specimen B was most likely a plant.

In most cases candidates identified the specimen in reverse, that is, Specimen A was identified as a plant and Specimen B was identified as an animal. It is most likely that candidates mistook the mitochondria for chloroplast.

Candidates were awarded marks for comparing and contrasting two points. Suitable responses included the following.

- Specimen A may have a higher metabolic rate when compared to Specimen B. For example, Specimen A may be a muscle cell while Specimen B is not and therefore does not require as much energy as Specimen A.
- Specimen A is likely an animal cell and Specimen B is likely a plant cell.
- Specimen A may move around or require more energy than Specimen B which does not move and therefore does not need as much energy as Specimen A.
- Specimen A is more complex than Specimen B or Specimen A is multicellular while Specimen B is unicellular.
- Both Specimen A and B are plants but they are different species and Specimen A requires more energy than Specimen B.
- Both Specimen A and B are animal cells but one produces more energy.

Many candidates did not compare and contrast well, and in fact, wrote solely about Specimen A without mentioning Specimen B. Additionally, some candidates erroneously mentioned 'anaerobic respiration occurring in Specimen A and B' while others indicated that 'Specimen A or B were either prokaryotic or eukaryotic cells'. Another example of a misconception was that some candidates indicated that plants do not require many mitochondria as they carry out photosynthesis which would be the source of energy for cellular reactions.

Candidate's Correct Response to Part (b)

(b) A student collected two specimens, A and B, from a seashore during her Biology field trip. She used a microscope to determine which structures were present in the specimens and found that Specimen A contained more mitochondria than Specimen B.

Suggest TWO reasons why Specimen A had more mitochondria than Specimen B.

- Specimen A ~~required~~ requires more ATP for cellular respiration as the mitochondria ~~produces ATP~~ i.e. is the site of ATP production.
- ~~Specimen A undergoes more aerobic respiration~~ is more mobile than specimen B as it requires more ~~as ATP is required to~~ ATP.

(4 marks)

Part (c) required candidates to identify and use two named examples to explain the importance of cell specialization to the function of the identified cells.

Candidates were awarded one mark for identifying the cell type and one mark for accurately stating how it was specialized for its function.

Appropriate responses included the following.

- The red blood cell: The biconcave shape of the red blood cell would allow for the rapid diffusion of oxygen **or** the flexible shape allows the cells to move through blood vessels.
- Nerve cells: These have dendrites which receive signals or messages from other cells **or** they have a myelin sheath which speeds up impulses.
- Muscle cells: These have more mitochondria and hence function effectively **or** they have protein or muscle fibres which can relax or contract to bring about movement.
- Xylem: These are hollow cells which are joined end to end to form tubes allowing for the transport of water **or** they possess walls of lignin for support.
- Alveoli cells: These are thin; this allows for rapid diffusion of gases.
- Sperm cells: These have a tail which is used for locomotion **or** the middle piece of theses cells has mitochondria for movement **or** the head of these cells contains the paternal DNA used to fertilize the egg.

This question was poorly done. Many candidates could not identify a specialized cell. Additionally, many candidates who were able to correctly name specialized cells were not able to explain exactly how the cells were specialized to carry out their functions or to give the relevant adaptations. However, some of the stronger candidates were able to gain full marks for this section.

Many candidates named the specialized cell and then stated its function without stating the specialization or characteristics which allow for this function, for example, ‘red blood cells carry oxygen or nerve cell transmits impulses’.

Many candidates misinterpreted the question and therefore discussed the importance of cell specialization.

It was apparent that there were some misconceptions or misunderstandings as it related to this question. For example, instead of what was required, some common terms used as examples were ‘osmosis’, ‘diffusion’, ‘differentiation’, ‘mitosis’, and ‘meiosis’. Some candidates gave the names of tissue for example, ‘photosynthetic tissue’, and hence could not be awarded marks.

Candidate's Correct Response to Part (c)

(c) Using TWO named examples, explain why cell specialization is important for cells to function effectively.

• Red blood cells ~~are able to~~ do not contain any organelles for other functions, leading to an increase in oxygen-carrying capacity.

• A sperm cell only contains a head with an enzyme to help penetrate the ~~fertilised~~ egg for fertilization and a flagellum to ~~be~~ enable it ~~to be motile~~ to swim fast enough to reach the egg.

(4 marks)

Question 4

This question tested Specific Objectives A 6.4, A 6.5. The question required candidates to discuss climate change and suggest how the environment may be conserved.

Part (a) (i) required candidates to define the term *climate change*.

Appropriate responses included the following definitions.

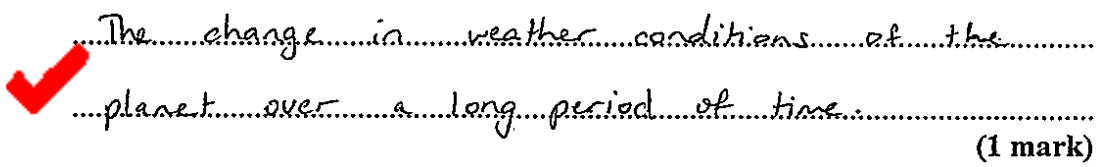
- Global or regional change in climate patterns
- Long-term change in weather patterns globally or regionally.
- Change attributed to the increased atmospheric carbon dioxide levels produced by the use of fossil fuels
- Changes in weather patterns caused by human activities

Candidates often stated that climate change was 'a change in atmosphere or temperature in a given location' and hence could not be awarded marks. There appears to be a general misconception among many candidates that climate and atmosphere are synonymous.

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

(a) Define EACH of the following terms:

(i) Climate change



(1 mark)

Part a (ii) required candidates to define the term *population*. One mark was awarded for stating the accurate ecological definition of the word *population*.

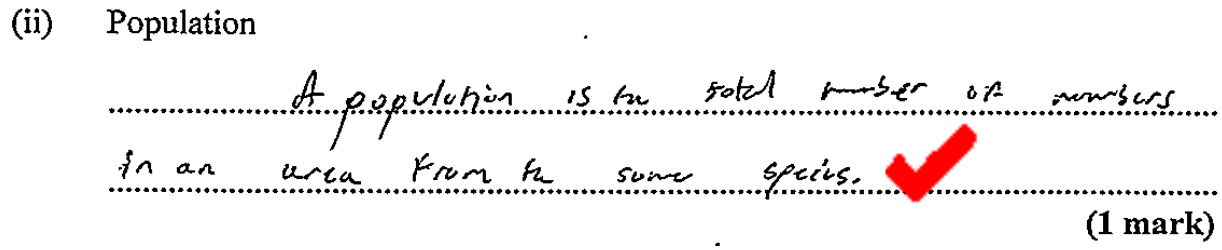
Although this question required an ecological definition for population, many candidates indicated that a population was 'the number of humans, people or all of the organisms living in a particular location'. Another common incorrect response given by candidates was 'the amount or number of organisms living in an area'.

Some candidates misread this question and gave the definition of pollution rather than population.

Appropriate responses included the following definitions.

- All the organisms of the same species living within a specific geographic area
- All the organisms of a species living in a particular area.
- All the organisms of the same species.

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



Part (b) required candidates to state four methods which can be used to conserve the environment.

This section was generally well done. Most candidates were awarded at least three of the available four marks which could be awarded. However, it should be noted that responses like 'conserve resources' and 'conserve soil' were too vague to be awarded marks.

Candidates would have been awarded the marks for any four of the following methods.

- Reduce pollution by stopping the burning of fossil fuels.
- Use alternative energy sources to conserve natural resources.
- Protect endangered species.
- Recycle resources.
- Carry out biological pest control.
- Use organic fertilizers.
- Implement crop rotation or plant different crops on a rotational basis so that the soil is never left exposed.
- Ban harmful agricultural practices, for example, slash and burn.
- Reduce deforestation/Replant trees/Ensure reafforestation of trees when removed.
- Conserve soil, for example, through the use of terraces and boundaries.
- Ensure that endangered species are kept in sanctuaries and appropriate breeding grounds.
- Place limits on hunting.
- Educate persons on the importance of conserving the environment.
- Create appropriate laws to protect the relevant species.
- Use natural pesticides.

Candidate's Correct Response to Part (b)

(b) State FOUR methods that may be used to conserve the environment.

(1) Reforestation: Reforestation is the planting of trees to get the environment back to the way it ✓

(2) Sanctuaries: Sanctuaries and Parks help provide spaces which can be used for the conservation of a set area ✓

(3) Domestic regulations: Stopping the exploitation of resources from the environment, or pollution of an environment ✓

(4) International laws: These are laws implemented by governments to achieve the set goals of conservation for a period ✓

(4 marks)

For Part (c), candidates were asked to use three examples to explain how lobal warming may lead to an increase in infectious diseases in the Caribbean region.

This part was generally poorly done. Many candidates were unable to link conditions arising from climate change to ways in which infectious diseases may be spread. In some cases, candidates linked the wrong environmental change to the spread of an infectious disease. For example, a candidate linked increasing drought conditions to the spread of malaria. Additionally, some candidates exhibited misconceptions about infectious diseases as they discussed conditions and diseases like increases in cancer cases and sinusitis.

Another observation was that some candidates referenced global warming but could not indicate how it could be linked to the spread of the named infectious disease which they were using as an example. Marks were awarded for each of the ways stated when provided with an accurate explanation for how it increased the presence of infectious diseases in the Caribbean region. Acceptable responses included the following.

- As a result of increased rainfall experienced due to climate change, there could be more flooding and the occurrence of more stagnant water in some places. Such increases in the number of places with stagnant water would result in more places for mosquitoes to breed thereby causing an increase in the mosquito population. Increases in the mosquito population could then lead to more cases of mosquito-borne illnesses like dengue.

- A rise in temperatures provides optimal conditions for bacteria replication/for bacteria to reproduce. Increases in the bacterial population could lead to an increase in the occurrence of bacterial infections associated with these bacteria.
- Extreme temperatures (very hot or very cold) may occur because of climate change which may cause habitat loss. This can lead to the movement of displaced organisms which may carry diseases from one area to another.

  Or

  As a result of habitat loss/change, displaced animals may seek new homes bringing them into contact with humans and thereby leading to an increase in vector-borne diseases.
- Melting of ice caps and tundra due to rising temperatures could lead to the emergence of microorganisms which were trapped in the ice. Humans may be susceptible to and therefore contract the diseases associated with these microbes.
- Poor or limited food availability due to droughts or other conditions may result in humans not meeting nutritional requirements. This may lead to them having weakened immune systems which make them more susceptible to contracting and transmitting diseases.

Candidate's Correct Response to Part (c)

(c) The earth's climate has warmed considerably over the past few decades. Using THREE examples, explain how global warming may lead to an increase in infectious diseases within the Caribbean region.

Three examples of global warming leading to an increase of infectious diseases are:

(1) An increase of temperature affecting climate may cause pathogenic diseases that are more present in hotter climates to increase. This can also make the disease much more contagious and cause cases to rapidly increase. ✓+

(2) Global Warming can cause a migration of people from one region to more temperate such as the caribbean, allowing a possible infected person with a virus to spread the disease abroad, leading into an epidemic. ✓+

(3) Since expenses will be spent on recovery from natural disasters such as storms, the needed revenue for buying medical aid may not be available therefore causing the Caribbean region to become much more susceptible to various infectious diseases. ✓+

(6 marks)

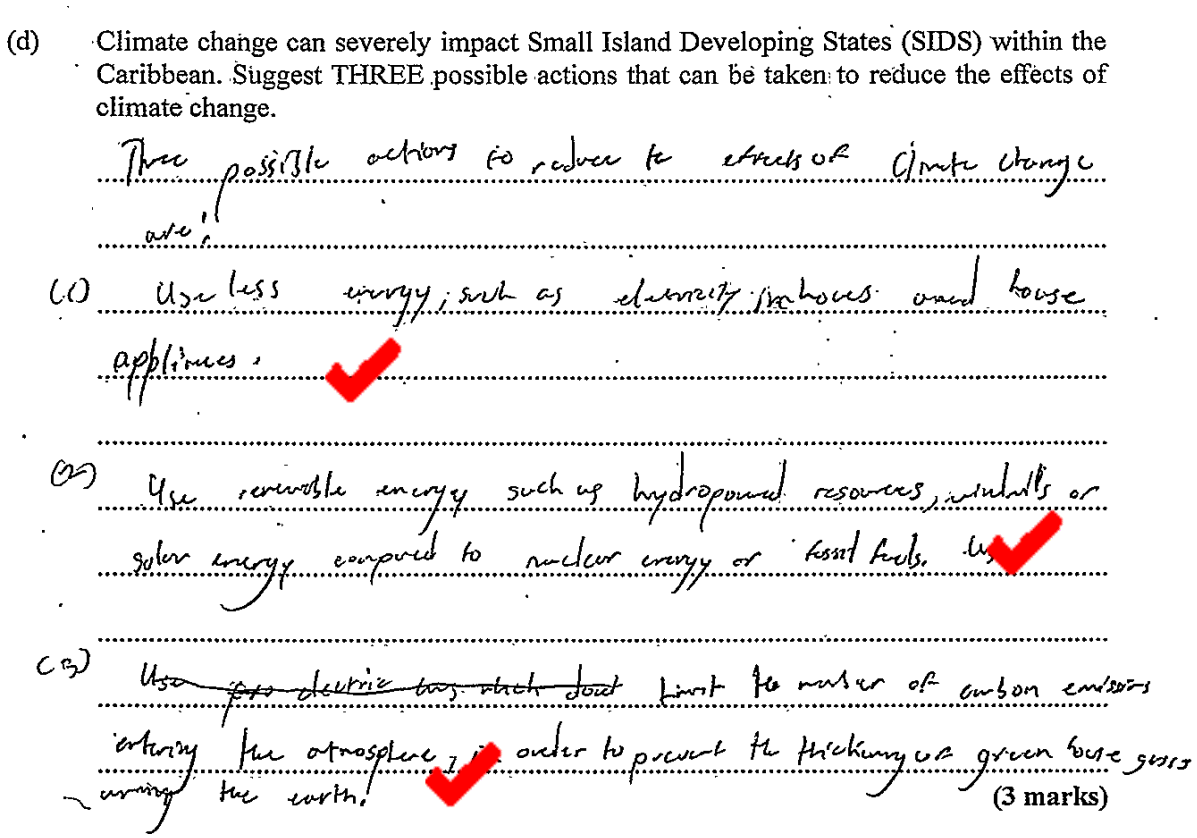
For Part (d), candidates had to suggest three possible actions that can be taken to reduce the effects of climate change. Generally, this question was poorly answered. Candidates showed a variety of weaknesses ranging from misconceptions regarding definitions to the inadequate expansion of concepts. Many candidates gave the same responses that were given in Part (b), often with no further expansion. Hence, these candidates were not awarded the marks allocated to this question.

Accepted responses included the following.

- The implementation of carpooling or using hybrid vehicles to reduce fossil fuel combustion
- The use of educational programs to sensitize people about the effects of climate change and what to do to mitigate factors that cause climate change
- Implementing afforestation to remove the carbon dioxide in the atmosphere
- Improving solid waste management by recycling
- Voting for legislation that aids against the detrimental effects of climate change

The recommendation is for a general revision of the methodologies used to teach this subject area, as misconceptions were evident across centres. This topic may also benefit from workshops and activities aimed at addressing specific problem areas or highlighting new approaches to both teaching and learning.

Candidate's Correct Response to Part (d)


(d) Climate change can severely impact Small Island Developing States (SIDS) within the Caribbean. Suggest THREE possible actions that can be taken to reduce the effects of climate change.

Three possible actions to reduce the effects of climate change are:

(i) Use less energy; such as electricity in houses and house appliances.

(ii) Use renewable energy such as hydropower resources, windmills or solar energy compared to nuclear energy or fossil fuels. Us

(iii) Use ~~gas electric bus which don't~~ Limit the number of carbon emissions entering the atmosphere in order to prevent the thickening of green house gases around the earth.

(3 marks)

Question 5

This question tested Specific Objectives B 4.4, 10.1, C 2.9. The question tested candidates' understanding of how the structure of the components of the blood relate to their function. The question further examined the inheritance of sickle cell disease in humans.

In Part (a) (i), candidates were required to state one function of the red blood cell, the white blood cell and the platelet.

Generally, candidates were able to provide the functions and many scored at least two of the allotted three marks for this question. The table below summarizes accepted responses.

Blood component	**Function**
Red blood cell	Transports oxygen from lungs to tissue/transport small amount of carbon dioxide from tissues to lung.
White blood cell	Produces antibodies/engulf bacteria/to protect the body from invading organisms
Platelets	Help blood to clot

A common misconception noted from candidates is that 'platelets prevent blood clots'.

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

(a) Ellis received a blood test from his doctor. His test results showed that his white blood cell and platelet levels were normal while his red blood cell levels were not normal.

(i) Complete Table 3 below to show ONE function of EACH of the blood components.

TABLE 3: BLOOD COMPONENTS AND FUNCTIONS

Blood Component	**Function**
Red blood cell	Transports oxygen around the body
White blood cell	Fights off foreign, harmful substances in the bloodstream
Platelet	Assists in the healing of cuts/wounds

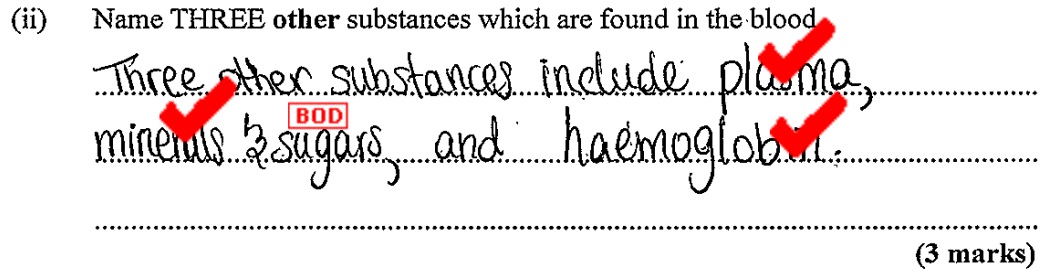
(3 marks)

Part (a) (ii) required candidates to state three components of the blood other than those listed in (a) (i).

Candidates were generally able to obtain full marks for this part of the question. Acceptable responses included any three of the following.

- Waste products (CO2, nitrogenous waste, for example, urea)
- Plasma proteins (fibrinogen, antibodies)
- Hormones (insulin, estrogen)
- Haemoglobin
- Dissolved food/nutrients (glucose, amino acids, fatty acids, vitamins)
- Oxygen
- Minerals
- Heat
- Water
- Salts

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


(ii) Name THREE **other** substances which are found in the blood.

Three other substances include plasma, minerals & sugars, and haemoglobin.

(3 marks)

Part (b) required candidates to suggest one way in which the red blood cell of Ellis, a man with sickle cell, differed from a person who does not have sickle-cell anaemia.

Many candidates obtained one out of two marks because they failed to make the comparison. An example of a complete response is as follows.

> Ellis' red blood cells will have a sickle shape while a person who doesn't have sickle-cell anaemia will have a biconcave shape.

Other acceptable responses included the following.

Sickle cell (Ellis)	**No Sickle cell**
The blood contains the abnormal hemoglobin S.	The blood contains the normal hemoglobin A.
Sickle-shaped cells have a small oxygen carrying capacity.	Normal cells can carry the full amount of oxygen.
Sickle-shaped cells may not pass easily through blood capillaries	Normal cells will flow easily through blood capillaries.

Candidate's Correct Response to Part (b)

(b) Ellis received additional tests which revealed that he has sickle-cell anaemia. Suggest ONE way in which Ellis' red blood cells may differ from a person who does NOT have sickle-cell anaemia.

BOD

Ellis' red blood cells would have an abnormal deformed shape compared to a person without sickle-cell anaemia who would have dome-like ~~disc of~~ disc-shaped red blood cells with a slight dent in the centre.

(2 marks)

For Part (c), the following scenario and question was presented to candidates.

Ellis becomes concerned that his child may also develop sickle-cell anaemia. His doctor tested his wife's blood and told Ellis that it is unlikely that he will have a child with sickle-cell anaemia. With the use of a genetic diagram, explain why it is NOT possible for Ellis to have a child with sickle-cell anaemia.

In your answer, let S denote the allele for the sickle-cell trait and A the allele for the normal trait.

Part (c) was not so well done. Some candidates had no response while some expressed limited knowledge of monohybrid inheritance. Candidates who were familiar with using genetic crosses easily scored the full seven marks. An example of a correct response is as shown below.

Phenotype (father): Sickle-cell Phenotype (mother): Normal
Genotype (father): SS Genotype (mother): AA
Gametes: S S A A

Genetic cross

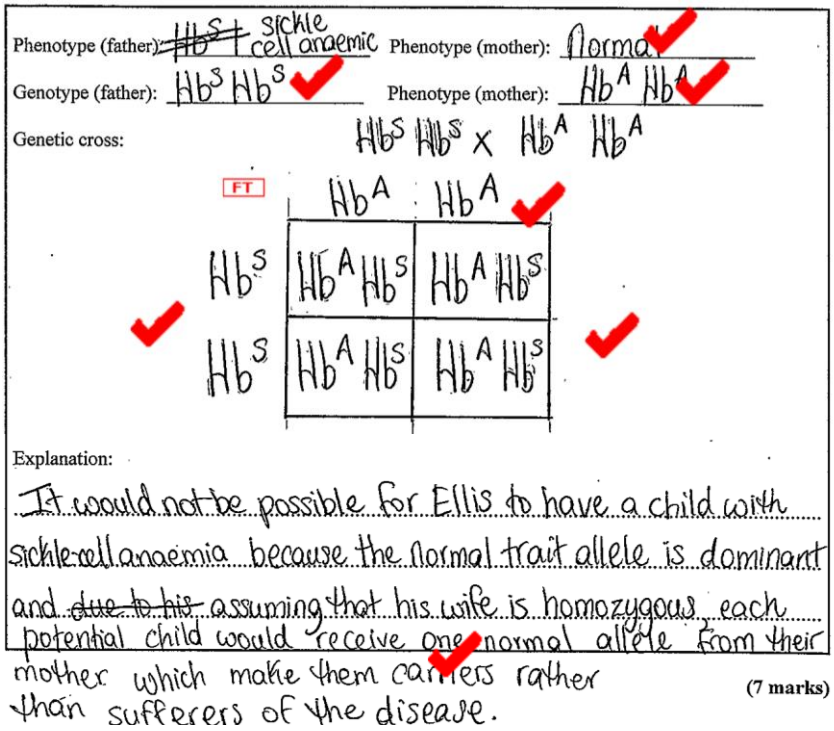
	A	**A**
S	SA	SA
S	SA	SA

Explanation: The child will not have sickle-cell anemia because all the children will have the genotype (SA) or are heterozygous. However, the child will have the sickle cell trait/be a carrier.

Candidate's Correct Response to Part (c)

(c) Ellis becomes concerned that his child may also develop sickle-cell anaemia. His doctor tested his wife's blood and told Ellis that it is unlikely that he will have a child with sickle-cell anaemia. With the use of a genetic diagram, explain why it is NOT possible for Ellis to have a child with sickle-cell anaemia.

In your answer, let S denote the allele for the sickle-cell trait and A the allele for the normal trait.



(7 marks)

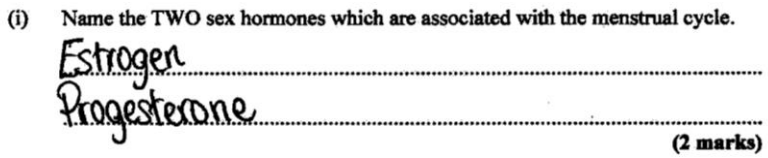
Question 6

This question tested Specific Objectives B 9.1, 9.3, 9.5, 9.6. Candidates were assessed on their knowledge of the menstrual cycle, their ability to draw the graph of its hormones, and their understanding of the effect of pregnancy on these hormones. Candidates were also required to explore their knowledge of birth control methods and name sexually transmitted diseases.

For Part (a) (i), candidates were asked to name two sex hormones which are associated with the menstrual cycle.

Many candidates were able to gain the two marks for correctly identifying *oestrogen* and *progesterone*. *Luteinizing hormone (LH)* and *follicle stimulating hormone (FSH)* were also credited. Many candidates had difficulty spelling the names of the hormones, especially progesterone. A few candidates incorrectly included 'testosterone'.

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


(i) Name the TWO sex hormones which are associated with the menstrual cycle.
Estrogen
Progesterone
(2 marks)

Having named the hormones in Part (a) (i), candidates were then provided with a figure which showed the changes occurring in Anna's uterine lining during her menstrual cycle, over 28 days. For Part (a) (ii), candidates were required to sketch lines on the figure to show how the level of each hormone changed over the 28-day cycle. Candidates also had to label each line.

This part of the question was challenging. Many candidates had extreme difficulty drawing accurately on the figure provided. No marks were awarded for brackets, annotations, or vertical lines. The better candidates were able to draw the two lines/curves with correctly located peaks, as follows.

- The line for oestrogen: This began at a low which ranged from Day 1 to 7. Then spanning between Day 10 and 14, it showed increasing levels of oestrogen which ended with a major peak. From there, the level decreased until Day 28.
- A second line for progesterone: This line showed the increase beginning at Day 14 and peaking later than the oestrogen, around Day 21. From there, there was a return to the low levels by Day 28.

Candidates who named the hormones and then drew the lines for LH and FSH were credited appropriately based on the drawings provided.

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

6. Anna has a 28-day menstrual cycle. Figure 3 shows the changes which occur in Anna's uterine lining during her menstrual cycle.

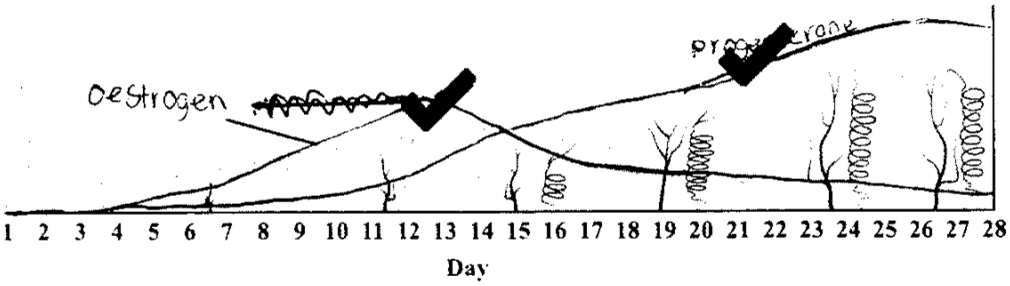


Figure 3. Changes occurring in Anna's uterine lining

(ii) On Figure 3, sketch a line for EACH hormone to show how the levels of the sex hormones named in (a) (i) change over the 28-day cycle. Label EACH line.
(2 marks)

Part (b) required candidates to explain the effect that pregnancy will have on the two sex hormones identified in Part (a).

This part was challenging for many candidates as they misinterpreted and explained the effect of hormones before pregnancy (during the menstrual cycle) rather than during pregnancy as required.

For each hormone, one mark was awarded for describing the change in hormone level when pregnant and another mark was given for explaining the effect of this change. Many candidates were able to score two out of the four marks. Expected answers were as follows.

- Progesterone levels will increase or remain high (effect). This is to stimulate the uterine lining to thicken more and inhibit menstruation; or this is to maintain the built-up uterine lining for the pregnancy (explanation).
- Oestrogen levels would decrease or remain low (effect) to prevent ovulation (explanation).

Some candidates recognized that the placenta produces oestrogen later in pregnancy, and this increases oestrogen levels to stimulate the continued growth of the myometrium or uterine wall. These candidates were also credited with two marks for effect and explanation. Candidates who identified LH and FSH needed to say that they each decrease or remain low during pregnancy to prevent ovulation or the release of another ovum.

Candidate's Correct Response to Part (b)

(b) Anna recently became pregnant. Explain the effect that pregnancy will have on the TWO sex hormones named in (a) (i).

~~Oestrogen~~ When pregnancy occurs, the Graafian follicle would secrete increased amounts of progesterone in order to increase and thicken the uterus ~~lining~~ lining. This also prevents menstruation. ~~This thickening of the uterus lining is in preparation for the foetus.~~ Oestrogen levels decrease and this hormone is no longer secreted from the Graafian follicle ~~as this hormone would secrete it~~ so that ovulation is not stimulated.

(4 marks)

Part (c) (i) required candidates to recommend one suitable birth control method for Anna who has just given birth to a healthy baby boy, does not want another child so soon but would like to have another child in the future.

This part was well done. Most candidates recognized that a temporary birth control method needed to be named. They correctly identified *the contraceptive pill, condom or barrier method, intra-uterine device (IUD), spermicide and injections*. *The rhythm method, withdrawal method* and *abstinence* were also credited.

For Part (c) (ii), candidates had to state two advantages and one disadvantage of the birth control method that they recommended in (c) (i). Candidates provided a wide, extensive list of advantages and disadvantages. However, repeating the stem of the question 'prevents pregnancy' was not credited. Some accepted answers are shown below.

Method: Abstinence

Advantages

- Completely effective
- Protects against STIs
- Inexpensive

Disadvantages

- Relies on self-control by both partners
- May cause emotional strain in the relationship if the other partner does not 'agree'

Method: Contraceptive pill/ Oral hormonal pill/"The pill"

Advantages

- Temporary birth control method and fertility resumes when this method is stopped
- Reliable/effective if taken as prescribed
- Easy to use
- Menstruation is lighter/shorter/less painful
- Prevents ovulation
- Affordable
- Does not require surgery/operations
- Prevents fertilization/thickens cervical mucus to prevent sperm entry, thins uterine lining to prevent implantation
- Does not reduce stimulation like condoms

Disadvantages

- Many side effects (nausea, risk of cervical cancer, weight gain etc.)
- When used alone, does not protect against STIs
- If one pill is/some pills are missed, the method is not as effective
- Needs to be taken every day at the same time for it to be effective

Method: Injection

Advantages

- Temporary birth control method and fertility resumes when this method is stopped.
- Reliable/effective method

Disadvantages

- Some persons may fear injections.
- When used alone, it does not protect against STIs.

Candidate's Correct Response to Part (c) (ii)

(ii) State TWO advantages and ONE disadvantage of the birth control method recommended in (c) (i).

Advantages:

① protects against sexually transmitted infections

② easy to use

Disadvantage:

① Condom can slip out during sexual intercourse if not used with ~~sp~~ gel.

(3 marks)

Part (d) (i) required candidates to state two sexually transmitted diseases.

Many candidates were able to identify *HIV/AIDS, gonorrhoea, syphilis, herpes* and *chlamydia*. However, a major weakness was that too many candidates were unable to spell gonorrhea/gonorrhoea, chlamydia and syphilis.

In addition, a common misconception was that HIV and AIDS were two different STDs.

Candidate's Correct Response to Part (d) (i)

Not all birth control methods can prevent both pregnancy and infections from sexually transmitted diseases.

(i) State TWO sexually transmitted diseases.

AIDS

Gonorhea

(2 marks)

For Part (d) (ii), candidates were asked to identify a birth control method that would be effective at preventing both pregnancy and infections from sexually transmitted diseases. Most candidates attempted this question and many were able to use their knowledge from Part (c) to correctly state *the condom* or *abstinence*.

Candidate's Correct Response to Part (d) (ii)

(ii) Identify a birth control method which would be effective at preventing pregnancy AND infections from sexually transmitted infections.

Condom

(1 mark)

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

This year, the mean score for Paper 032 was 21.47. This was higher than the mean score for 2021 and 2020 which were 17.84 and 17.54 respectively.

Question 1

This question tested Specific Objectives B 9.7 and 9.11. For this question, candidates were required to observe two specimens and make suitable deductions. Additionally, the question tested the parts of the flower and their related functions.

For Part (a), candidates were provided with two specimens, X and Y, and were asked to observe each carefully and then dissect the specimens longitudinally to view the internal structures. Candidates then had to complete Table 1 which required them to observe the external and internal structures of both fruits.

Many candidates were able to complete this activity satisfactorily. Supervisors at centres where there was no *Cajanus cajan* (pigeon pea), made appropriate substitutions and candidates were marked accordingly. No candidate was disadvantaged as a result of the substitutions made.

Candidate's Correct Response to Part (a)

You are provided with TWO specimens, X and Y. Observe EACH specimen carefully, then dissect the specimens longitudinally to view the internal structures.

(a) Complete Table 1.

TABLE 1: OBSERVATIONS/INFERENCES

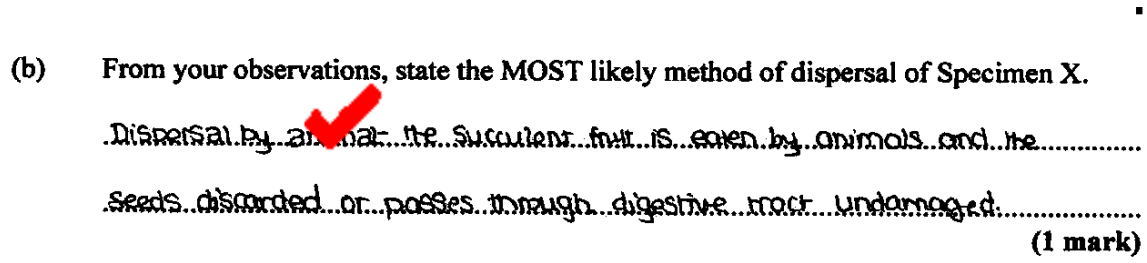
	Specimen X	Specimen Y
Type of fruit	(i) Succulent Fleshy Fruit (1)	(ii) Dry Fruit (1)
Description of fruit	(iii) Red and round with many seeds, smooth surface. Inferred to be a tomato (1)	(iv) Green, pod-like with a length of about 9 cm. Inferred to be a green pea pod. (1)
Description of pericarp (epicarp, mesocarp, endocarp)	(v) Very smooth epicarp and a very fleshy mesocarp and endocarp (1)	(vi) Thin dry epicarp with almost non-existent mesocarp and endocarp. (1)
Description of seed	(vii) Small, yellowish and numerous (1)	(viii) Green and smooth with a count of 4 seeds. (one cut in half) (1)

(8 marks)

Still using their observations, candidates were asked in Part (b) to state the most likely method of dispersal of Specimen X.

Most candidates were able to gain this mark.

Candidate's Correct Response to Part (b)



Part (c) required candidates to make a large drawing of Specimen Y and place an 'A' to indicate the scar where the fruit was attached to the parent plant and a 'B' to indicate the scar where the style was attached to the ovary.

Most candidates did not know the correct placement of the scar where the style was attached to the ovary, so only the more competent candidates received all five marks for this question.

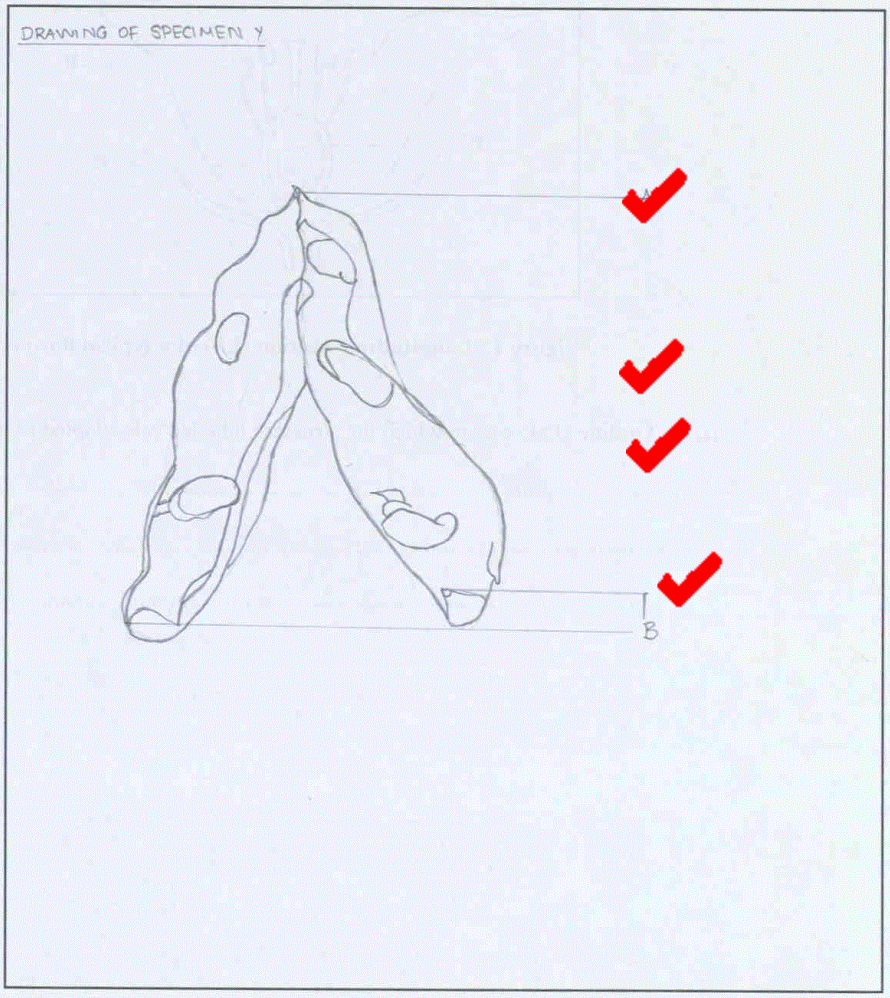
One mark was awarded for each of the following.

- Providing the large drawing
- Proportioning the drawing correctly
- Using smooth, continuous lines
- Placing the 'A' correctly
- Placing the 'B' correctly

Candidate's Correct Response to Part (c)

(c) In the space below, make a large drawing of Specimen Y. Label the following TWO structures **only**:

- Scar, where the fruit was attached to the parent plant. Label this structure A.
- Scar, where the style was attached to the ovary. Label this structure B.



(5 marks)

For Part (d), candidates were asked to suggest a suitable title for the practical.

Many candidates were able to earn the mark. An acceptable title was *Comparing the Structure of Two Different Fruits*.

Candidate's Correct Response to Part (d)

(d) Suggest a suitable title for this practical.

Investigating the internal structures of a succulent fruit and a dry fruit

(1 mark)

In Part (e) (i), candidates were given a longitudinal section of a typical flower and were asked to outline one way in which the structure labelled A (a petal) is adapted to its function.

This part was well done. Acceptable answers were as follows.

- It is large/conspicuous, so it is easily seen by insects/pollinators.
- It is brightly coloured, so insects and birds are attracted to the flower for nectar.
- It is scented, so insects and birds are attracted, effecting pollination.
- It has pollen guides/nectar guides which guide insects to the nectaries.
- It protects the reproductive organs of the flower while they are being developed.
- The size and shape aids in the protection of the inner structures.

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

(e) Figure 1 represents a longitudinal section through a typical flower.

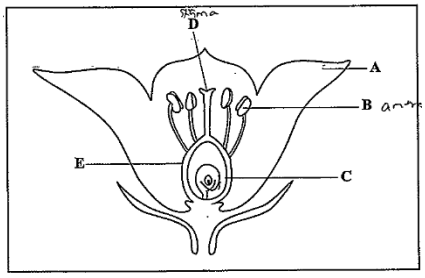


Figure 1. Longitudinal section (LS) of a typical flower

(i) Outline ONE way in which the structure labelled A is adapted to its function.

The function of A which is the petal/corolla is to attract insects and birds and one adaptation it has to do this is that the petals are usually large and brightly colored.

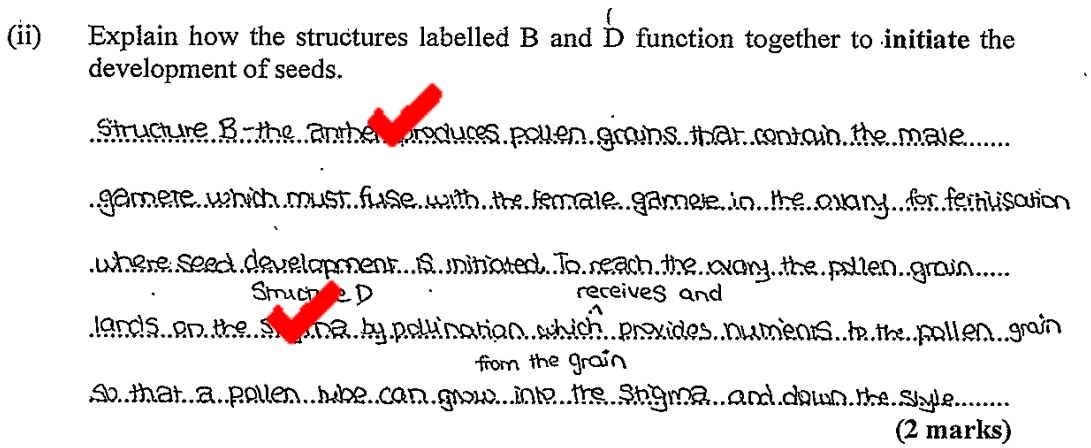
(2 marks)

Part (e) (ii) required candidates to explain how the structures labelled B and D function together to initiate the development of seeds.

This part was poorly done as many candidates did not seem to know the identity of the structures labelled B (anther) and D (stigma). Some of them seemed to be confused and used the names of the two structures interchangeably. Any two of the following three points would have been acceptable.

- B (anther) produces pollen grains containing male gametes.
- D (stigma) catches the pollen grains.
- The male nuclei of the pollen grains then migrate down the style to the ovule (in the ovary).

Candidate's Correct Response to Part (e) (ii)



(ii) Explain how the structures labelled B and D function together to **initiate** the development of seeds.

Structure B - the anther produces pollen grains that contain the male gamete which must fuse with the female gamete in the ovary for fertilisation where seed development is initiated. To reach the ovary the pollen grain lands on the stigma (Structure D) by pollination which receives and provides nutrients to the pollen grain from the grain so that a pollen tube can grow into the stigma and down the style.

(2 marks)

Question 2

This question tested Specific Objectives A2.2 and A7.1. This question required candidates to distinguish between a population and community, discuss factors which would affect the growth rate of a human population, and construct a graph from data provided in a table. Additionally, candidates were required to provide a method to investigate a given scenario and to state one expected result of the investigation designed.

In Part (a), candidates had to distinguish between a population and a community.

An example of an adequate response to Part (a) is as follows.

> A population is the number of organisms of the same species living in the same habitat whereas a community consists of several organisms of different species living in the same habitat.

Many candidates were able to score the two marks allocated for this part. However, some candidates could not make the distinction and often confused the definitions.

Common misconceptions presented were as follows.

- A population is the amount of people that live in a country and a community is the amount of people that live within a small village.
- A population is a group of living organisms that work individually whereas a community works together to better the environment.

Candidate's Correct Response to Part (a)

(a) Distinguish between 'a population' and 'a community'.

A population is the number of organisms of the same species living in the same habitat whereas a community consists of a number of varying organisms in the same habit

(2 marks)

In Part (b), candidates were asked to explain one factor, other than the availability of resources such as water, that may affect human population growth.

Most candidates were able to score at least one of the two marks allocated for this question. Some incorrect responses regarding the factors that could affect the growth of human populations were as follows.

- Land to build houses
- Sunlight
- Reproduction
- Deforestation

Additionally, many candidates did not explain how the factor they named would affect human population growth.

Candidate's Correct Response to Part (b)

(b) Explain ONE factor, **other** than the availability of resources such as water, that may affect human population growth.

One other factor that may affect human population growth could be the ~~ability~~ availability of fertile specimen in the population, as well as the sex (gender) ratio of the population, which can either result in an increase if numbers are high and equal respectively

(2 marks)

Part (c) required candidates to plot a graph to show the data in Table 2 and provide a suitable title.

TABLE 2: NUMBERS OF TWO ORGANISMS, X AND Y.

Time (days)	Number of Organisms (X)	Number of Organisms (Y)
5	35	65
10	15	30
15	25	50
20	40	55
25	30	45

Marks were awarded for the following.

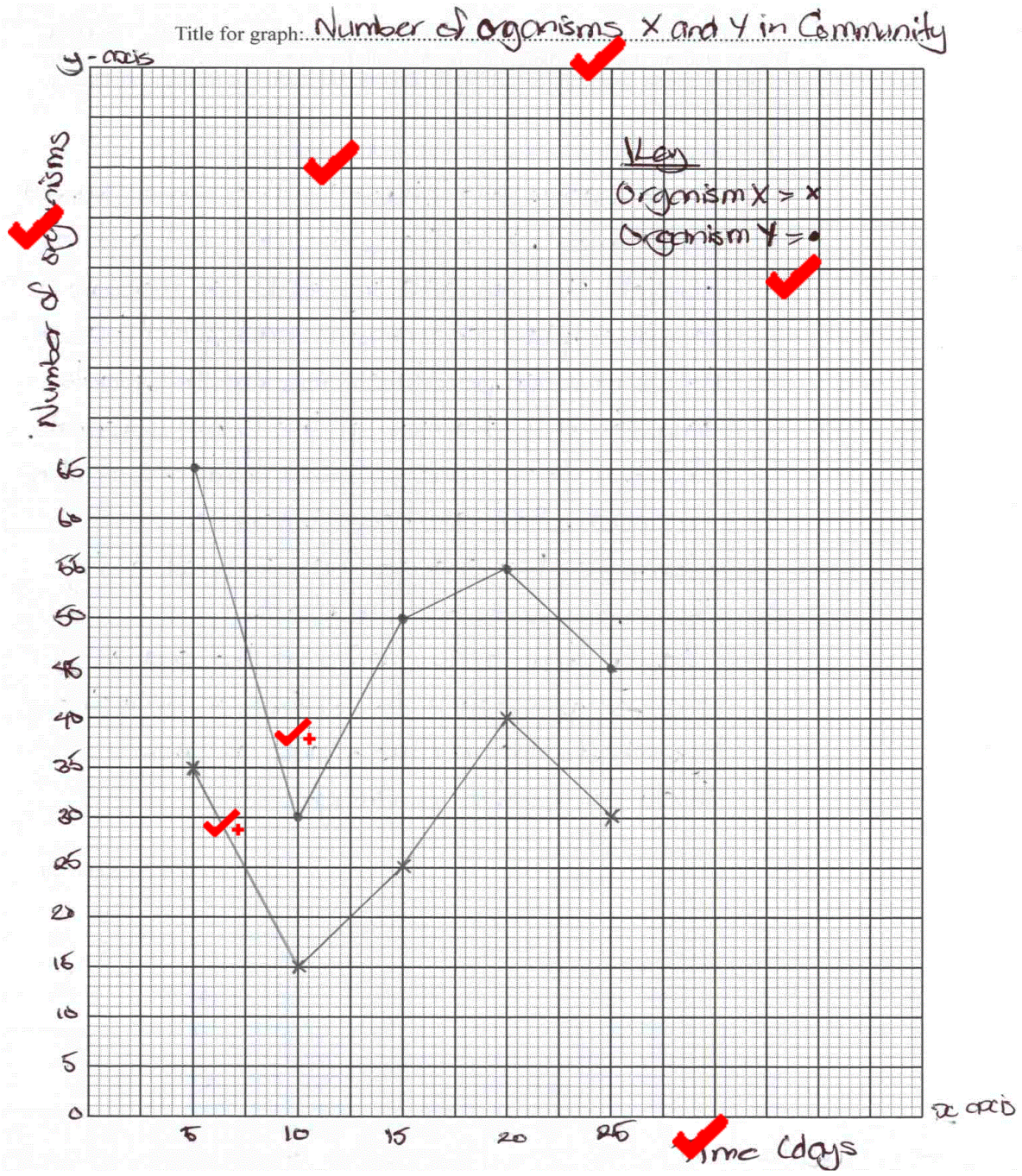
- Appropriate title
- Appropriate scale
- Labelled axes (*x* and *y* axes)
- Clear legends
- Plotting of points

This part of the question was well done. Many candidates scored eight or nine marks. For this question, both line charts and bar graphs were accepted.

Many candidates lost marks if they did the following.

- Did not connect the points (plotted points); Some candidates connected all the points that are the plots for both X and Y, thereby producing one line graph.
- Did not provide a descriptive title; Some candidates just gave 'Number of Organisms' or 'Number of Organisms vs Time'. Examples of other incorrect titles submitted by some candidates were as follows.
    - X and Y
    - Migration of organisms
    - Populations of organisms
    - Growth of organisms
- Labelled the axes incorrectly; candidates often placed the name of one axis on the opposite axis. Another common error in the labelling of the axes occurred because some candidates labelled the Y axis as 'Organism Y' and the X axis as 'Organism X'.
- Did not include the key for the graph.

Candidate's Correct Response to Part (c)



Part d (i) required candidates to describe a suitable procedure to investigate the effect of lack of water or drought conditions on the survival of lettuce and cacti.

Overall, this section was poorly done. Many candidates did not understand how to perform an investigation, which may reflect their lack of exposure to planning and designing activities. Common misconceptions or areas of concern include the following.

- Some candidates incorrectly explained why cacti would survive and how they are adapted to conserve water.
- Some candidates incorrectly stated that the cacti survive because Josh protected them against pests and disease.
- Many candidates did not give a specific time frame, for example, the number of days.
- Most candidates mentioned only cacti without speaking about the lettuce.

Marks were awarded for the following.

- Use of both plant types
- Subjecting both plants to variations stated water exposure
- Ensuring that all other factors are constant
- Stating a suitable period of time to conduct the experiment
- Stating that the plant would be observed and growth recorded
- Indicating the control for the experiment and stating that the experiment would be repeated

An example of an acceptable procedure is provided below.

- Obtain two cacti plants and two lettuce plants. Place each plant into a separate pot, each pot containing equal amounts and types of soil.
- Position all four plants so that they receive the same amount of sunlight.
- To investigate non-drought conditions, irrigate one cactus and one lettuce plant every three days for 15 days.
- Record the growth observed in each plant at the end of days 5, 10 and 15.
- To investigate drought conditions, irrigate one cactus and one lettuce plant every day for five days.
- Record the growth observed in each plant at the end of days 5, 10 and 15.
- Compare the plant growth under drought and non-drought conditions.

Candidate's Correct Response to Part (d) (i)

(d) The availability of resources, such as water, can affect the growth in plants. Two CSEC Biology students, Josh and Marie, are growing plants for their class project. Josh is growing cactus and Marie is growing lettuce. Josh states that his cactus plants are more likely to survive a drought.

(i) Write a suitable procedure to investigate Josh's statement.

Procedure:

1. Take two seperate plants with the cactus & lettuce respectively

2. Place them in the same room a ensure they are both exposed to equal amounts of UV light (same exposure to UV light) and temperature.

3. Pour 900 ml of water unto both plants. Water both plants with 50 ml of respectively. Leave for approximately 2 weeks

4. After this time, check back at both plants and records observations based on the changes/developments that took place.

(5 marks)

Part d (ii) required candidates to state one expected result of the procedure they designed in Part (d) (i).

This part was well done with most candidates being able to score the mark.

Examples of acceptable responses included the following.

- Josh's cactus plants are expected to survive the drought conditions.
- Both the cacti and lettuce would survive better in non-drought conditions.
- Cactus plants are more likely to survive in drought conditions than lettuce plants.

Some misconceptions and/or areas of concern noted from candidates' responses are as follows.

- Writing the expected results as a hypothesis or an aim
- Indicating that a cactus does not need water to survive but lettuce does
- Indicating that the leaves would be yellow or brown
- Stating that the lettuce will remain flaccid and the cactus turgid
- Indicating that withering would take place
- Indicating that the pericarp looks the same

Candidate's Correct Response to Part (d) (ii)

(ii) State ONE expected result for the investigation.

One expected result of the investigation would be that the cacty plants of Josh would be more likely to survive a drought, as it survived longer than the lettuce in the investigation

(1 mark)

Question 3

This question tested Specific Objectives B 2.1 and 2.11. It required candidates to plan and design an experiment to test for fat and glucose in a food supplement. Suitable precautions and expected observations were also required. Additionally, the question tested vitamin deficiencies and physiological diseases which could occur as a result of a poor diet.

Part (a) required candidates to use a list of apparatus and materials in order to write a procedure to test for (i) glucose and (ii) fat.

Marks were awarded for a suitable procedure, written in order and using the materials and apparatus provided. Similar to Question 2, it appeared that some candidates were not exposed to how to suitable plan and design an experiment. Examples of acceptable procedures are provided below.

Test for Glucose

- Place a small spatula full of powder in a test tube.
- Make a solution/paste.
- Using the dropper, add one ml of Benedict's solution/Fehling's to the test tube.
- Shake the contents of the test tube well.
- Using the test-tube holder, heat the test tube containing the mixture in a hot water bath for two minutes.

Test for Fat

- Place a small spatula full of powder in a test tube.
- Make a solution or paste.
- Using the dropper, add one ml of ethanol to the sample.
- Shake the contents vigorously.
- Add two ml of distilled water to the mixture.

Candidates were still awarded marks if the grease spot test was used for fats. Some misconception/errors and these are outlined below.

- In some instances, students wrote the procedure out of sequence.
- For the glucose test, some candidates named the reagent 'the biuret test' instead of Benedict's reagent.
- In an attempt to use the materials and apparatus provided, some candidates described their use incorrectly. Examples are included in the following.
  - Instead of stirring with the stirring rod, the spatula was used.
  - In the description provided, the test tube holder was utilized as a test tube rack.

- When testing for fat, iodine solution was the named reagent instead of alcohol.
- In some instances, when testing for fat, the ethanol emulsion test was fused with the grease spot test.

Candidate's Correct Response to Part (a)

Adam uses a powdered supplement daily. He wishes to conduct an experiment to determine if the supplement contains glucose and fat.

(a) Using the list of materials/apparatus below, describe TWO suitable procedures which can be used to determine if the powdered supplement contains glucose and fat. In your procedure provide suitable names of the food test reagents.

List of materials/apparatus

- Spatula
- Test tubes
- Test-tube holder
- Food test reagents
- 1 mL dropper
- Hot water bath
- Distilled water

Procedure 1: Testing for glucose

Add 2 ml of ~~glucose Solution~~ crush food sample to a test tube. Add two (2 ml) of Benedicts Solution and shake. Place in a water bath and heat.

Procedure 2: Testing for fat

Add 2 ml ~~fat~~ crush food sample to a test tube add 2 ml of ethanol and shake vigorously with finger over test tube. Add distilled water and shake.

(10 marks)

Part (b) required candidates to provide two suitable precautions for the procedures outlined in (a).

Overall, candidates were able to obtain these marks. Some acceptable responses included the following.

- Wear eye protection.
- Do not use ethanol if there are naked flames nearby.
- Wear an apron or protective clothing to avoid damage to clothing.

As a note, many candidates were unable to distinguish between precautions and sources of errors. As a result, they were unable to obtain the marks for this part of the question.

Candidate's Correct Response to Part (b)

State TWO precautions that should be taken when following the procedures described in (a).

1) Ensure that ~~there~~ there are no open flames when handling the Ethanol.

2) Ensure that Specimins have not been Contaminated.

(2 marks)

For Part (c), candidates were provided with a scenario which stated that after following the procedures described in (a), Adam concluded that the powdered supplement contained fat and glucose. Candidates were asked to state the observations that would have led Adam to his conclusion.

The candidates who were familiar with the food tests were able to obtain the two marks for stating the following observations for glucose and fat.

- Glucose: yellow/green/orange/brick red
- Fat: white/white emulsion/precipitate (translucent if grease spot test was described)

Candidate's Correct Response to Part (c)

After following the procedures described in (a), Adam concluded that the powdered supplement contained fat and glucose. State the observations that would have led Adam to this conclusion.

Glucose test

Solution turns from blue to orange

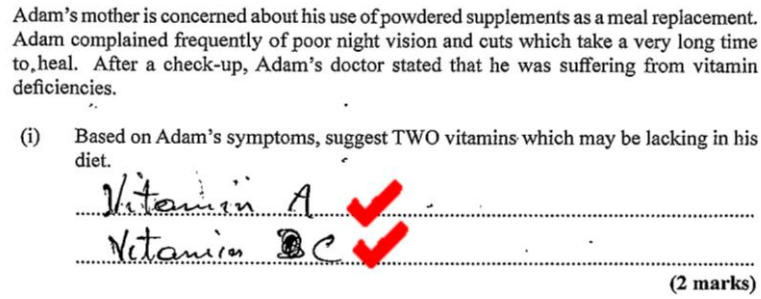
Fat test

Solution turns milky white

(2 marks)

Part (d) (i) required candidates to suggest vitamin deficiencies which would cause poor night vision and cuts which take a very long time to heal. Vitamin C was the most commonly provided response as it relates to cuts taking a long time to heal. However, Vitamin K was also accepted. Vitamin A was the other required vitamin.

Candidate's Correct Response to Part (d) (i)


Adam's mother is concerned about his use of powdered supplements as a meal replacement. Adam complained frequently of poor night vision and cuts which take a very long time to heal. After a check-up, Adam's doctor stated that he was suffering from vitamin deficiencies.

(i) Based on Adam's symptoms, suggest TWO vitamins which may be lacking in his diet.

Vitamin A

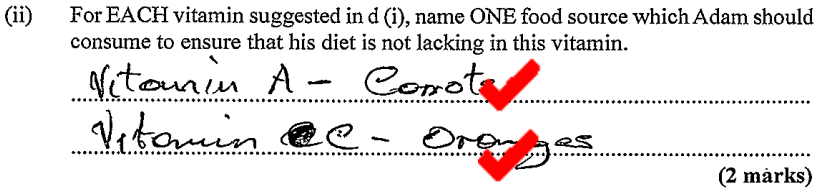
Vitamin C

(2 marks)

For Part (d) (ii), candidates were required to suggest a food source for each vitamin listed in (d) (i). This question was done well. Acceptable responses included the following.

- Vitamin A – carrots
- Vitamin C – citrus fruits
- Vitamin K – green leafy vegetables

Candidate's Correct Response to Part (d) (ii)


(ii) For EACH vitamin suggested in d (i), name ONE food source which Adam should consume to ensure that his diet is not lacking in this vitamin.

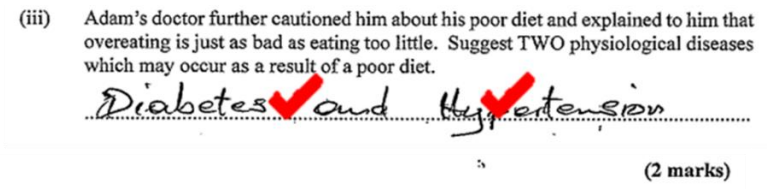
Vitamin A – Carrots

Vitamin C – Oranges

(2 marks)

Part (d) (iii) required candidates to provide two physiological diseases which may occur as a result of a poor diet. *Hypertension* and *diabetes* were the most commonly written and accepted responses. However, some candidates wrote deficiency diseases instead of physiological diseases and such, received no marks.

Candidate's Correct Response to Part (d) (iii)


(iii) Adam's doctor further cautioned him about his poor diet and explained to him that overeating is just as bad as eating too little. Suggest TWO physiological diseases which may occur as a result of a poor diet.

Diabetes and Hypertension

(2 marks)

Part (e) required candidates to use the graph below to describe the relationship between exercise intensity and the source of calories.

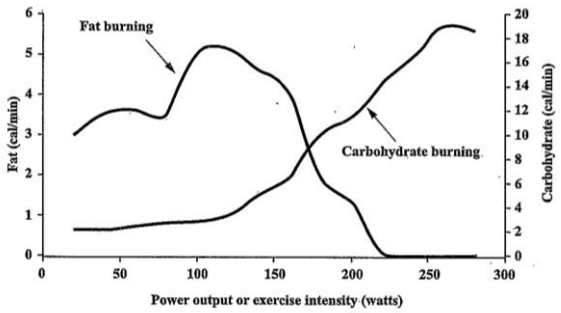


Figure 2. Total calories of fuel burned per minute

Adapted from https://www.jupiterhealth.com.au/metabolism-explained/metabolism-during-exercise/.

Some candidates did not receive any marks because they explained the relationship without reference to the graph. However, many candidates were able to score at least one of the two marks allotted for this part of the question.

Candidate's Correct Response to Part (e)

(e) Peter is an athlete. His trainer conducted an experiment to determine the number of calories of fuel which he burned from both fat and carbohydrates during various exercise programmes. The results from the experiment are shown in Figure 2. Use the graph shown in Figure 2 to describe the relationship between exercise intensity and the source of calories.

At the begining stage of the exercise his body started burning fat ✓ as an energy source, this steadily declines and the body starts burning carbohydrates for the more intense exercises. ✓

(2 marks)

Recommendations

- Overall, for Paper 032, it is evident that candidates have gained greater mastery of the important biological concepts required to lay a solid foundation for further study in the discipline. As a suggestion, instructors should utilize as many practical sessions as possible to help reinforce theoretical presentations.
- A significant number of candidates wrote perfect answers and then crossed them out without replacing the work with another answer. Candidates are reminded that crossing out work is like deleting it, and deleted work cannot be marked. Candidates should therefore desist from this practice or always ensure that they have a replacement answer before crossing out.