Laporan Peperiksaan
STPM 2023

Biology (964)

Biology 964/1

OVERALL PERFORMANCE

For Semester 1, 1 766 candidates sat for the examination of this subject and 65.40% of them obtained a full pass.

The achievement of the candidates for this subject according to grades is as follows:

Grade	A	A–	B+	B	B–	C+	C	C–	D+	D	F
Percentage	2.27	3.28	4.87	9.29	12.40	16.87	16.42	4.49	7.53	3.22	19.37

RESPONSES OF CANDIDATES

SECTION A: *Multiple-Choice Questions*

Answer keys

Question number	Key	Question number	Key	Question number	Key
1	D	6	D	11	B
2	D	7	A	12	A
3	C	8	C	13	B
4	C	9	A	14	D
5	A	10	B	15	B

General comments

In general, Questions 1 and 3 were in the range of easy questions. More than 70% of the candidates managed to answer Questions 1 and 3 correctly. The most difficult questions were Questions 2 and 8, in which less than 30% of candidates answered the questions correctly. Meanwhile, the rest of the questions were in the range of moderate questions where 30% to 70% of the candidates could answer them correctly.

SECTIONS B AND C: *Structured and Essay Questions*

General comments

In general, the questions covered all aspects, which include the lower order thinking skills (LOTS) and higher order thinking skills (HOTS). The questions covered a range of topics in the Semester 1 syllabus, which contained both factual recall questions and questions which required application of knowledge. The questions were able to differentiate between the low ability and high ability candidates.

Comments on the individual questions

Question 16

The question was about specialised cell. In part (*a*), candidates were required to identify *P* which was *collenchyma*. However, there were candidates who mistakenly identified P as *sclerenchyma*. There were also candidates who spelt the word wrongly as *colenchyma*.

In part (*b*), candidates were required to describe the structure of *Q*. The answers given by the candidates lacked necessary details. For example, candidates described *Q* as *having thin cell* wall instead of *having thin primary cell wall*. Some candidates were able to give correct answers as *large central vacuole*.

In part (*c*)(i), candidates were asked to name two types of cells in *S* which were xylem vessel and tracheid.

In part (*c*)(ii), candidates were asked to differentiate cells in (*c*)(i). Many candidates were unable to answer this question correctly. Candidates who named the cells wrongly in (*c*)(i) were unable to differentiate the cells correctly. They tend to describe the structure in general, missing out the specific details. For example, candidates stated tracheid have tapered end, but vessel xylems do not have tapered end which was not accepted. Instead, vessel xylems have less tapered end. Candidates also pointed out the diameter of tracheid/vessel element as lumen diameter instead of the cell diameter.

In part (*d*), candidates were asked to relate the structure of *R* to its function. Candidates had to state clearly the structure of R, that was *sieve tube element or companion cell* and then relate them with their functions, respectively. Most of the candidates were unable to relate the structure of *R* to its function correctly as they stated *R as phloem that is used to transport sucrose*. The majority of candidates also wrote *phloem has companion that provide energy to transport sugar*, which was not accepted as the answer.

Question 17

The question was about carbon fixation in plants. In part (*a*), a majority of the candidates were able to name cells *J* and *K* as *mesophyll* and *bundle sheath cells* correctly.

In part (*b*), candidates were asked to name the enzymes involved in *X* and *Y* reactions. The majority of candidates could name the enzyme correctly. However, there were also some candidates who did not get marks due to incorrect spelling or incorrect naming format.

In part (*c*)(i), many candidates were not able to state the advantage of the carbon dioxide fixation which occurs separately. The acceptable answer was to reduce photorespiration and increase the rate of photosynthesis. But most candidates answered prevent/inhibit photorespiration which were not accepted.

In part (*c*)(ii), the candidates must give the reason that was relevant to the enzyme involved in this type of carbon fixation. They have to give the correct condition, for example PEP carboxylase has high affinity towards carbon dioxide even in lower concentration of carbon dioxide.

Question 18

In part (*a*), the question required the candidates to differentiate between fibrous and globular proteins. In addition, candidates were not able to give the correct or complete differences for certain aspects such as the level of structure, the types of bonding and solubility of protein in water. A few candidates just described the fibrous and globular protein without making any comparison.

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In part (b), the question was about denaturation. Very few good candidates managed to explain this question by using the correct term such as *extreme temperature or extreme pH* which caused the denaturation of protein. Good candidates could even name the bonds involved in the denaturation process. For example, hydrogen bond/ ionic bond/ disulfide bridge would be broken in an extreme temperature while ionic bonds would be broken in extreme pH. However, many candidates described the denaturation process as *temperature higher than optimum temperature or low pH and higher pH* which were not accepted. Many candidates explained that amino groups or carboxyl groups would gain or lose protons and become charged or uncharged which was not acceptable. The fact that the functional groups were the groups that would gain or lose protons. There were candidates who wrote *secondary level or tertiary level of protein* instead of *secondary or tertiary structure of protein*.

Question 19

In part (a), candidates were required to explain the effect of non-competitive inhibitor on the rate of enzymatic reaction. The majority of the candidates did quite well for this question. The candidates were aware of allosteric sites and active site and mentioned it in their answers. However, there were quite a number of candidates who got confused with the enzyme kinetic involving non-competitive inhibitor: (i) by stating that inhibitor would stop the reaction, (ii) the effects of inhibitor on V_{max} and K_M, and whether the addition of more substrates would overcome the inhibition. This might be due to candidates' confusion between competitive and non-competitive inhibitors.

In part (b), the question was about biosensor. The majority of candidates lose marks due to the lack of detailed explanation. Candidates tended to write *biological sample is applied on the biosensor* instead of *biological sample is applied on the receptor*. Candidates also failed to mention that *the immobilised enzyme is on the receptor*. Candidates also would lose mark if general terms were used, such as, sample instead of biological sample and chemical reaction/signal instead of biochemical reaction/signal. There were candidates who were confused with the use of transducer and amplifier, i.e., *transducer will convert chemical signal into electrical signal* and *amplifier will amplify the chemical signal*. The majority of the candidates were able to state two applications of biosensor: *glucose blood detector and pregnancy / COVID-19 test*.

Question 20

In part (a), the candidates were required to describe the production of ATP from a molecule of glucose in an anaerobic condition where candidates needed to describe the process of glycolysis in an anaerobic condition. Many candidates describe the process using layman terms such as, converted, changed and reacted instead of scientific terms such as, phosphorylated, oxidised, substrate level phosphorylation and isomerised. A more specific example was fructose-1,6-bisphosphate lysis into glyceraldehyde-3-phosphate. The term lysis was not accepted. The correct term here would be splits into/ cleaves (as stated in Campbell). Other examples, glucose-6-phosphate was converted to fructose-6phosphate instead of glucose-6-phosphate was isomerised to fructose-6-phosphate; dihydroxyacetone phosphate was converted into glyceraldehyde-3-phosphate instead of dihydroxyacetone phosphate was isomerised into glyceraldehyde-3-phosphate and glycerate-2phosphate was converted into phosphoenolpyruvate instead of glycerate-2-phosphate was dehydrated into phosphoenolpyruvate. Some candidates answered 2 ATP were produced by glycolysis instead of the net 2 ATP produced in glycolysis. Some candidates drew a diagram showing the steps in glycolysis, which was not required to answer the question. Most candidates also included alcoholic fermentation and lactate fermentation in the explanation of

glycolysis which were not required. The candidates tend to calculate the number of ATP production from NADH and FADH2 produced in Krebs cycle in electron transport chain as well, which was also not required.

In part (*b*), candidates were required to explain the process that would alleviate muscle cramp due to strenuous activity. Many candidates were able to mention muscle cramps occurred because of the accumulation of lactic acid/lactate during anaerobic respiration. Candidates were also able to state lactic acid/lactate was converted to pyruvate but still lose their marks since they did not mention regenerating glucose. Many candidates failed to mention breathing deeply to get more oxygen to oxidise lactic acid/lactate. Candidates were also confused about the process which occurred in the liver or muscles.

Biology 964/2

OVERALL PERFORMANCE

For Semester 2, 1 654 candidates sat for the examination of this subject and 59.92% of them obtained a full pass.

The achievement of the candidates for this subject according to grades is as follows:

Grade	A	A–	B+	B	B–	C+	C	C–	D+	D	F
Percentage	6.83	5.80	6.83	8.52	13.00	9.25	9.67	6.94	5.96	5.90	21.28

RESPONSES OF CANDIDATES

SECTION A: *Multiple-Choice Questions*

Answer keys

Question number	Key	Question number	Key	Question number	Key
1	D	6	B	11	D
2	A	7	C	12	C
3	B	8	B	13	C
4	D	9	A	14	D
5	B	10	A	15	A

General comments

In general, Questions 13 and 15 were in the range of easy questions. More than 80% of the candidates managed to answer Questions 13 and 15 correctly. Meanwhile, the rest of the questions were in the range of moderate questions where 30% to 70% of the candidates could answer them correctly.

SECTIONS B AND C: *Structured and Essay Questions*

General comments

In general, the questions covered all aspects, which include the lower order thinking skills (LOTS) and higher order thinking skills (HOTS). The questions covered a range of topics in the Semester 2 syllabus, which contained both factual recall questions and questions which required application of knowledge. The questions were able to differentiate between the low ability and high ability candidates.

Comments on the individual questions

Question 16

The question was about G-coupled receptor signalling transduction pathway. In part (*a*), most of the candidates were able to name the proteins correctly. However, the intermediate and poor candidates had given various answers that were not related to the diagram. Some candidates had inter-changed the answers between *P*, *Q* and *R*. Some of the candidates also lose mark by wrongly spelling Adenylyl/ Adenyl cyclase, cyclic adenosine monophosphate, or the abbreviation of cAMP.

In part (*b*), most candidates obtained marks as they correctly answered part (*a*). Most candidates were able to give the function of *R* which was to act as a second messenger. A small number of candidates identify *R* as secondary messenger, which was not accurate. Some candidates wrote *R* produces protein kinase instead of activate protein kinase.

In part (*c*), candidates were required to link the cellular events to adrenaline stimulation. If the candidates merely memorise cellular events without comprehension, they struggled to connect these events to a stimulus-response relationship. Therefore, most candidates only obtained one mark by answering to convert glycogen to glucose. They were also unable to score well because they were explaining the diagram instead of describing the events. Most of the candidates were also unable to state the name of enzymes involved and the processes (i.e., activated phosphorylase kinase activate glycogen phosphorylase). Some of the candidates answered cascade effect occurs instead of activated phosphorylase catalyse the phosphorylation cascade.

Question 17

The question was about the negative feedback mechanism of blood glucose level regulation. In part (*a*), the question required candidates to identify hormone *X* and hormone *Y* based on its ability to increase or decrease blood glucose levels. Most of the candidates were able to correctly name the hormones *X* and *Y* as insulin and glucagon. Unfortunately, some candidates did not obtain any marks as they have wrongly spelled the word insulin or glucagon. Other candidates could not relate the function of hormone *X* and hormone *Y* towards the increased or decreased of the blood glucose level as the endpoint response. Thus, they have identified *X* and *Y* as ADH, aldosterone or adrenaline.

In part (b), the question required candidates to name the cells that secrete hormones *X* and *Y*. Many candidates were able to write the answer correctly, i.e., beta/β cell and alpha/α. However, some answers were not accepted due to not directly answering the posed question. These candidates wrote insulin was secreted by beta cells while glucagon was secreted by alpha cells instead of *X* is beta cells while *Y* is alpha cells, as required by the question.

In part (*c*), the question required candidates to describe the way hormone *Y* increases the concentration of blood glucose. Most candidates can answer well by naming the process of glycogenolysis and gluconeogenesis and describe it briefly. They have scored full marks, and some candidates even provided more than the requirement. Few candidates obtained only one mark by providing the common answer, i.e., by converting glycogen to glucose. Some candidates have misspelled their answer or wrongly identify the process as glycogenesis.

In part (*d*), the question required candidates to explain the way hormone *X* assists in reducing the level of blood glucose back to normal. Most candidates only score one point for glycogenesis // conversion of glucose to glycogen. They cannot relate with the process that might happen to reduce the level of

glucose. Several candidates lose marks because they wrongly spelled the name of processes such as glycogenelysis and glyconeogenesis. Most of the candidates did not mention that insulin will increase the uptake of glucose into the cell. A few candidates were able to mention that insulin will inhibit glycogenolysis and gluconeogenesis. The candidates appeared to struggle with comprehending insulin's functions beyond its basic role in regulating blood glucose. They are unable to delve into the broader processes associated with insulin's actions to restore blood glucose levels to a normal state.

Question 18

In part (*a*), the question required candidates to explain the control of breathing mechanism in humans during vigorous exercise. Candidates have failed to relate the stimulus with specific detector, regulator and effector. For example, they just generally wrote intercostal muscles instead of external and internal intercostal muscles. Several of the candidates also wrongly spelled intercostal muscles, they spelled it as intercoastal muscles. They also mixed-up nerves involved with the effector, phrenic nerve for diaphragm and thoracic/intercostal nerve for external intercostal muscle. Some also did not mention at all phrenic nerve/thoracic nerve. Instead, they have just explained force inhalation without force expiration. Only a few candidates were able to mention that the internal intercostal muscles contract at a higher rate when the stretch receptor send impulses to expiratory centre through vagus nerve. Quite a handful of candidates emphasised on the binding of haemoglobin with oxygen molecules to form oxyhaemoglobin, which did not secure any mark. There were a few candidates who wrote about the requirement of oxygen during vigorous exercise and the energy production during respiration, which were not accepted as correct answers. A few candidates answered about oxygen dissociation curves that was not required by the question. Most of the candidates also failed to state that carbon dioxide level decrease to normal or blood pH increase to normal level.

In part (*b*), the question required candidates to describe the response of stomata during a severe drought in C_3 plants. There were a few common mistakes frequently presented in the answers by the candidates. For instance, stomata closed to prevent water loss during transpiration instead of stomata closed to reduce water loss during transpiration; stoma becomes flaccid instead of guard cell becomes flaccid. Most of the candidates did not score well as they give answers by referring to C_4 plants, plants open stomata during the night and close during the day. A small number of candidates obtained mark by stating that ABA binds to receptor site in the plasma membrane of guard cells. Candidates also showed lack of knowledge regarding water potential concept. They have failed to accurately state potassium channel opening and causing movement of potassium ions. They also did not indicate the direction of movement potassium ions or water from a specific cell to another. They should write *Water moves out of guard cell into neighbouring cell by osmosis*, *potassium ions move out from guard cell to the neighbouring cells*, etc. Overall, the candidates were unable to score well in this question as they did not relate draught with ABA production and regulation of opening and closing of stomata based on potassium ions accumulation hypothesis.

Question 19

In part (*a*), the question required candidates to explain how blood in the human heart is ensured to flowin the correct direction. Most of the candidates failed to obtain good marks for this question. This is because they have explained the events in a cardiac cycle and the initiation and regulation of the heartbeat instead of function of valves to ensure blood flow in one direction. Heart valves allow blood to flow in one direction by opening and closing due to the differences between atrial and ventricular

blood pressure. When blood pressure in the atrium is greater than the pressure in ventricle, the AV valves opens to allow blood flow from atrium into ventricle. When pressure in ventricle is greater than pressure in atrium, AV valve closes to prevent back flow of blood. When pressure in ventricle is greater than pressure in the aorta and pulmonary artery, semilunar valve opens, blood flows from ventricle into aorta and pulmonary artery. When the pressure in pulmonary artery and aorta is greater than pressure in ventricle, semilunar valve closes to prevent back flow of blood. Several candidates did not really compare the pressure in atrium and ventricle while answering. For example, they did not mention the pressure in atrium is greater than the pressure in ventricle. They will not award any mark by only write when pressure in ventricle increases, AV valves close instead of when pressure in ventricle is greater than pressure in atrium, AV valves close. Some of the candidates only explained one side of the heart which is the left side. They also failed to state the direction of blood flow i.e., from atrium to ventricle or from ventricle to aorta and pulmonary artery. Wrongly spelled of atrioventricular valve also make them lost another mark.

In part (b), the question required candidates to describe three pathways of water movement in plant roots. Generally, candidates scored quite well for this part. For apoplast pathway, most of the candidates did not obtain mark because they did not explain the movement of water until Casparian strip. Their answer was water moves across the cell walls instead of water moves across the cell wall until it reaches the Casparian strip. Most of the candidates did not mention that the water moves to the adjacent cells. They only mentioned water move through the cytoplasm. Most candidates also lose mark when not mentioning osmosis in vacuolar pathway. They also wrongly spelled Casparian and plasmodesmata. Some candidates got it confused with the other two pathways and interchanged their answers between pathways. There were also candidates who explained on the process of water entering the plants, or how plants absorb water from the soil by a process called osmosis - the natural movement of water molecules from an area of high concentration, across a semi-permeable, sieve-like membrane, to an area of low concentration.

Question 20

In part (a), the question required candidates to describe the causes and symptoms of dengue. Dengue is caused by a dengue virus (DENV-1/DENV-2/DENV-3/DENV-4) and transmitted by a vector, a female <u>Aedes</u> <u>aegypti</u> or <u>Aedes</u> <u>albopictus</u>. The symptoms range from high fever, petechiae, rashes, joint and muscular pains, low platelet count, bloody stools, nausea and pale skin. Many candidates focused their answers more on describing the causes of its development in human after being bitten by an infected mosquito instead of the symptoms of dengue fever. Several candidates have attempted to state the vector, but they failed to obtain any mark as their answer was not accurate. They wrote female <u>Aedes</u> sp. instead of female <u>Aedes</u> <u>aegypti</u> or <u>Aedes</u> <u>albopictus</u>. Some answers were not accurate since it did not mention female mosquito. Others lose their marks as they underlined both genus and species name, or incorrectly spelled the vector's name. Most of the candidates were able to describe the symptoms but a few candidates lost mark as incomplete answer was given. The symptom mentioned include fever but not high fever. Very few candidates have mentioned disseminated intravascular coagulation (DIC) and petechiae as one of the symptoms. Another example of common mistakes made by the candidates in their answer was blood pressure decreases or number of platelets / white blood cells decreases instead of low blood pressure or low number of platelets/white blood cells. The students' answers have a drawback in that they delve extensively into the virus's life cycle in both mosquitoes and humans, which is not in line with the question's intended focus.

In part (*b*), the question required candidates to describe the prevention methods to reduce dengue infection. Most candidates did well for this part. Some of the candidates attempted to answer by stating prevention methods to reduce dengue not dengue infection such as education and campaign. They also did not answer accurately. Example, avoid outdoor activities during morning and evening instead of avoiding outdoor activities during early morning and late evening. Quite a handful of candidates mentioned introduce sterile male into environment to reduce dengue infection, which was accepted as the answer. Common mistakes that were committed by candidates would be incorrectly spelling larvicide and using pesticide instead of insecticide as a preventive method.

Biology 964/3

OVERALL PERFORMANCE

For Semester 3, 1 633 candidates sat for the examination of this subject and 62.39% of them obtained a full pass.

The achievement of the candidates for this subject according to grades is as follows:

Grade	A	A–	B+	B	B–	C+	C	C–	D+	D	F
Percentage	12.12	6.43	5.51	6.49	10.04	11.45	10.35	6.25	10.41	5.27	15.68

RESPONSES OF CANDIDATES

SECTION A: *Multiple-Choice Questions*

Answer keys

Question number	Key	Question number	Key	Question number	Key
1	A	6	B	11	A
2	C	7	A	12	B
3	A	8	D	13	B
4	B	9	C	14	C
5	D	10	D	15	D

General comments

In general, Questions 2 and 15 were in the range of easy questions. More than 70% of the candidates managed to answer Questions 2 and 15 correctly. Meanwhile, the rest of the questions were in the range of moderate questions where 30% to 70% of the candidates could answer them correctly.

SECTIONS B AND C: *Structured and Essay Questions*

General comments

In general, the questions covered all aspects, which include the lower order thinking skills (LOTS) and higher order thinking skills (HOTS). The questions covered a range of topics in the Semester 3 syllabus, which contained both factual recall questions and questions which required application of knowledge. The questions were able to differentiate between the low ability and high ability candidates.

Comments on the individual questions

Question 16

The question was about three modes of selection. In part (*a*), candidates were required to name *P*, *Q* and *R* which were stabilising selection, disruptive selection and directional selection.

In part (*b*), many candidates only chose one selection, either *Q* or *R*. Both selection *Q* and *R* could cause changes to the mean value of phenotype. Stabilising selection reduced the variation, but the mean value would remain the same.

In part (*c*) candidates were required to describe the characteristics of disruptive selection. Candidates' answers were satisfactory. Candidates were reminded that selection *Q* should favour both the extreme phenotypes, not just one of the extremes. Most candidates were able to mention the extremes and intermediate but instead of using the term phenotypes, students used traits, characteristics, groups and class. There were candidates that only mention favours extreme phenotypes, which was rejected as students must state favours both extreme phenotypes.

Question 17

The question was about restriction enzymes. In part (*a*) candidates were requires to name the restriction enzymes X and Y which were *Eco*R1 and *Sma*1. Most candidates gave the correct answers for *X* and *Y*.

In part (*b*), most candidates knew the name of the bacteria that produced *X*. But they made a lot of errors in writing out the name scientifically. Common errors include E. coli (without underline), E. coli (underline both words together), Ecoli (without ".") and ECOR1/ECoR1 (capital letters). The correct name should be written as E. coli or Escherichia coli. It must be underlined separately when hand-written. Very few candidates managed to name the bacteria that produced *Y*.

In part (*c*), most of the candidates were able to state that *X* had a sticky end and *Y* had a blunt end. A few candidates were confused about the types of cuts and the types of ends. They used the term staggered end for *X*, which was not accepted. As the candidates had to write all their answers on the examination pad provided by the MEC, they must indicate their answers by referring to *X* or *Y* respectively. No mark will be given if the candidate wrote the answer without referring to *X* and *Y*.

In part (*d*), candidates were required to predict and explain the result when products of *X* and *Y* were mixed with DNA ligase. More than half of the candidates could predict that the products could not be joined together as they had different types of ends. Some candidates answered that the products would join and form recombinant DNA due to the effect of DNA ligase. They forgot that the products of *X* and *Y* had different ends.

Question 18

The question was about the ecosystem. In part (*a*) the question stem talked about the disaster that happened in Cameron Highlands due to illegal farming. Most candidates did not know that it was a mudslide disaster. Nonetheless, if we analyse the question stem carefully, it was actually asking for the activities that caused depletion in biodiversity. Therefore, candidates were expected to write the activities that threatened the biodiversity and their effects.

Candidates had difficulty in identifying the main activities that caused the depletion of biodiversity. Deforestation that happened in large scale should be the main cause not cutting down tress. Habitat

loss would be the result following deforestation. As the question was referring to "explanation", no mark will be awarded to habitat loss if the main activity of deforestation was not written first. A lot of candidates wrote about the climatic change or even global warming. This was incorrect as the question was referring to the local deforestation in Cameron Highlands, not the deforestation at the global level. Therefore, the activity would only lead to changes in micro climate at most.

When writing about the use of fertilisers or insecticides, most candidates failed to emphasise that the disaster would only happen if the chemicals were used excessively. Eutrophication and river pollution that kill the aquatic organisms would be the explanation of overuse of fertilisers or insecticides. The same case goes to the explanation of over exploitation or extreme land use. Candidates would not be given mark when they wrote about the flash flood, landslides or soil erosion if they did not mention the over usage of land or over exploitation in the first place.

Very few candidates wrote about habitat fragmentation, which would disturb the balance of environment and reduces the carrying capacity of the ecosystem. The main problem of candidates was to plan their answer in appropriate manner, they should mention the activities and then explain or elaborate the activities on how it causes depletion of biodiversity.

In part (b), candidates were required to describe six threats to biodiversity in Malaysia if water pollution occurs. The threats should be limited to the effect of water pollution only. The biodiversity on the other hand, may include human beings.

The candidates answers were quite general, without referring to the water pollution specifically. For example, some candidates wrote that the pollution would cause extinction of species or reduction of animal population, which were both not accurate as only aquatic species would be affected. The extinction of aquatic species would further lead to the reduction of genetic diversity.

Not many candidates wrote about the loss of breeding ground due to water pollution. Pollution near the mangrove swamp would certainly affect the breeding ground of a lot of aquatic species. Most candidates did well by relating the water pollution to the depletion of natural resources like water and food. Few candidates wrote about the effect of water pollution on the shallowing of river bed and the loss of feeding ground for aquatic species.

Question 19

The question was about about the energy flow in a forest and food chain. In part (a), the question required candidates to describe the flow of energy between trophic levels in a forest in general. Candidates do not need to give examples of the organisms involved.

The answers given by candidates were satisfactory. They showed good understanding of the concept of energy flow from producers to the consumers. Even though most candidates wrote that there was energy lost from level to level, but a lot of them forgot to mention that heat should be the main form of energy lost to the environment.

Most of the candidates were able to describe correctly the energy flow between trophic levels in a forest ecosystem. They could start with the solar energy, converted to chemical energy, by photosynthesis in producers and then transfer to consumers via feeding, also including the energy lost as heat in physiological activities such as respiration and excretion, energy assimilated in biomass of producer/consumer, energy transfer to decomposers and a typical ecosystem usually have 4 to 5 trophic levels only.

A slight misconception was detected about the energy transfer in ecosystem. Almost all candidates wrote that 10% of energy was transferred from trophic level to trophic level. This was not accurate as 10% should be the efficiency in energy transfer, not the amount of energy being transferred to the next trophic level. Not many candidates wrote that the energy flow along the trophic levels could be illustrated in a food chain. When the decomposers decomposed the dead bodies, they would obtain energy from the process. At the same time, nutrients were recycled back to the environment.

Some of the candidates, they tend to describe the energy transfer/flow using the example that had been given in the question 19(*b*) and they lack stages involving the solar energy, conversion to chemical energy, and the involvement of photosynthesis in producers. Most of the candidates failed to understand that the 10%/less efficiency in energy transfer/flow between trophic levels as most of them wrongly quoted that about a total of 10% energy that transfer/flow between the trophic levels.

In part (*b*) the question is about the effect of the disappearance of a consumer to a given food chain. Candidates were able to write about the fluctuation in population size of the rest of the components in the food chain, but they seemed to fail in predicting the final outcome after 10 years.

Most of the candidates were able to explain well what will happen to the food chain when the population of frog disappeared especially to the population of snakes, population of grasshopper and population of the grass. Some of the candidates were able to describe the population of snakes will be mostly affected, either they will migrate/die, and also able to describe the population of grasshopper will reach carrying capacity and will cause intraspecific competition that later will decrease the grasshopper population.

Some candidates did not manage to predict the outcome of the food chain correctly after 10 years. Some candidates wrote that the food chain would be destroyed or all the organisms would die, which were both wrong. In fact, organisms would find their way out from the unexpected situation. Snake would either look for a new food resourced, or migrate to other places. If not, they would die and even face extinction. The grasshopper population would increase due to lack of predation, until a new carrying capacity was achieved. This point was not touched by most candidates. High population of grasshoppers would result in competition and their number would decrease again. When the number of grasshoppers dropped, the grass population would increase subsequently. All of these fluctuations would finally lead to a new dynamic equilibrium in the ecosystem. Most candidates were unable to present this final outcome.

Question 20

The question was about test cross and the skill in drawing genetic diagram. Part (*a*) required candidates to describe the cross that can be used to identify the unknown genotype of the long horn cow. Most of the candidates answered this question well. They described the test cross used to determine the unknown genotype of long horn cow, which is homozygous dominant (HH) or heterozygous (Hh) and need to be crossed with the homozygous recessive (hh) or breed with short horn cow. The candidates could also describe well through the genetic diagram of crossing the HH or Hh genotype parent with the hh genotype parent and produce offspring with all long horn (Hh), and half long horn (Hh) and half short horn (hh)/with phenotypic ratio of 1:1.

Some minor errors were detected. In the genetic diagram, the labels should be written precisely. Candidates should write "parental genotype/phenotype" or "F1 genotype/phenotype" clearly. Candidates seemed to show some confusion in the use of genetic terms. The dominant genotype of long horn cow could either be homozygous dominant or heterozygous. The term "heterozygous dominant" was

not accepted. Some candidates used the term "heterozygous alleles" which was also not accepted. The crossing should be carried out between individuals/cows, but some candidates wrote that "the long horn cow is test-crossed with homozygous recessive alleles" which was not accurate.

In part (b), the question was about knowledge on the genetic basis of blood group. The question state that children of the married couple can have all types of blood group except O. This means that the children can have blood group A, B and AB. To get this result, the woman's genotype must be $I^A I^O$ while the man must be $I^A I^B$. The candidates should further elaborate to the possible types of gametes and alleles in man and women. The use of Punnett square was accepted too.

Most of the candidates could determine the codominant alleles I^A and I^B, and recessive allele I^O/i. Good candidates also could describe the man with genotype $I^A I^B$ married with the woman with genotype $I^A I^O$. Most of the good candidates could explain by using genetic diagram to show the cross between the male parent with genotype $I^A I^B$ married with woman $I^A I^O$, and having all children with all blood type group (A, B and AB) except for the O blood group.

Some of the candidates just drew the genetic diagram without any explanation and some of them wrongly explained by using the woman blood type A with genotype $I^A I^A$ married to a man with genotype $I^A I^B$.

PAPER 964/5 (WRITTEN PRACTICAL TEST)

Question 1

The question was about a cross section of Heliantus stem. Most of the candidates were able to answer part (a), (b) and (c) correctly. The candidates have problems to identify the plant cell structures and could not differentiate between cortex, vascular bundle, pith, xylem, phloem, and epidermis.

Question 2

The question was about embryonic development. In part (a), some candidates have problems to identify the zygote, morula and trophoblast. In part (b) some candidates could not provide the number of chromosome which was 46. Most of the candidates were able to answer part (c) and (d). In part (f) most candidates able to state the germ layers which were ectoderm, mesoderm and endoderm. However, only a few were able to link them with their respective associated organ.

Question 3

The question was about quadrat sampling. Most of the candidates have no problem answering the questions in part (a), (b), and (c), they were able to make correct calculations. However, some failed to provide the unit for the value provided. In part (d) most candidates were able to state the dominant species which was species Q. In part (e) and (f) most candidates were able to give the correct answers which were randomly distributed and line transect.

Laporan Peperiksaan
STPM 2023

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