LAPORAN PEPERIKSAAN
STPM 2022

Biology (964)

BIOLOGY 964/1

OVERALL PERFORMANCE

For Semester 1, 2 233 candidates sat for the examination of this subject and 66.23% 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	4.30	5.55	5.33	9.09	14.69	11.64	15.63	6.40	2.78	5.87	18.72

RESPONSES OF CANDIDATES

SECTION A: *Multiple-Choice Questions*

Answer keys

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

General comments

In general, Questions 3, 7, 12 and 15 were in the range of easy questions. More than 68% of the candidates managed to answer them correctly. Meanwhile, Questions 6, 8, 10, 11, 13 and 14 were in the range of moderate questions where 38% to 58% were answered by the candidates correctly. The easiest question was Question 12, in which 74% of the candidates answered the question correctly. The most difficult question was Question 4, in which only 28% of the candidates answered the question correctly.

SECTIONS B AND C: *Structured and Essay Questions*

General comments

In general, the questions were comprehensive and provided appropriate challenges to the candidates. The questions were suitable for STPM level. The questions encompassed all aspects; constructed from low to high cognitive levels including factual recall and understanding the concepts and processes in biology. The

language used in the questions was easily understood where the words used were familiar to the candidates. The results of the assessment could be used to identify the strengths and the weaknesses of the candidates, as well as to differentiate between the weak, moderate, and good candidates.

Comments on the individual questions

Question 16

The question was about carbohydrate. In part (*a*), a majority of the candidates were able to identify the α-glucose and β-glucose. Some candidates answered *P* as β-glucose and *Q* as α-glucose and consequently lose marks.

Those candidates who answered correct for part (*a*) were also able to give correct answer for part (*b*). Few candidates gave the answer as *amylase* instead of *amylose*, which was the correct answer.

In part (*c*), the candidates were required to sketch the formation of maltose from the given monosaccharides. Some candidates were able to sketch the formation of glucose correctly. However, few candidates were able to sketch correctly but did not label the bond formed or did not write the formation of water during the condensation. Many candidates used monosaccharides *P* and *Q*, instead of *P* and *P*, which caused them to lose marks.

Question 17

The question was about aerobic respiration in the liver cell. In part (*a*), majority of the candidates were able to answer correctly for *J* and *K*. Few candidates were able to answer *L* as oxidative phosphorylation or electron transport chain and chemiosmosis. Many candidates wrote only chemiosmosis which was not acceptable. In addition, there were candidates who lose marks due to the incorrect way of writing scientific name, for example, small k instead of capital K for Krebs cycle.

In part (*b*), the acceptable answer was phosphorylation. If the candidates gave the answer as addition of phosphate, then, it would not be accepted. Some candidates answered as *for glucose to form pyruvate, as energy requirement*, and *to break glucose into small components*, which were not accepted.

Although part (*c*) was rather a straightforward question, there were still candidates who gave incorrect answers such as two, three, or six carbon dioxide molecules instead of four, which was the acceptable answer.

In part (*d*)(i), a majority of the candidates were able to answer the question correctly. Some candidates answered NADH, NAD^+, H^+, carbon dioxide, $FADH_2$ and FAD^+, which were not accepted as the correct answers. There was an answer given by the candidates for *M* as ½ oxygen which was also not accepted.

For part (*d*)(ii), the candidates must have the knowledge about *M* which occurred in electron transport chain (ETC) and part of oxidative phosphorylation. Few candidates were able to answer the function of *M* in ETC as the last electron acceptor and when *M* was absent, ETC cannot occur. Most candidates answered ETC/chemiosmosis stopped, which was not acceptable as the answer. Some candidates expected that electrons would accumulate at the electron carrier and no oxidative phosphorylation occurred. Few candidates identified *M* as the final electron donor instead of the acceptor. Answer in (*d*)(ii) was dependent on the correct *M* in part (*d*)(i).

Question 18

In part (*a*), the question was about the functions of three types of connective tissue in humans. Certain candidates managed to score full marks for this part. Many candidates were able to correctly describe the types of connective tissues like *cartilage*, *bone* and *blood*. Very few candidates managed to mention *adipose tissue* or *collagen*, which were acceptable answers too. Quite a number of candidates managed to give the functions for these connective tissues. Some candidates wrote incomplete answer such as *bone protect organs* instead of *bone protect internal organs*, which caused them to lose mark. Most candidates' answer for the type of connective tissues were blood, cartilage, and bone. There were seven types of connective tissues but the other four types of namely loose connective tissue, dense connective tissue, elastic connective tissue and reticular connective tissue were rarely found in candidates' answers.

In part (*b*), candidates were required to describe the pathway which was involved in the synthesis of secretory protein. Few candidates were able to provide complete answer and use the correct term of the structures involved. Some candidates mentioned *protein is package in vesicle* instead of *protein is package in transport vesicle*, which was the correct answer. There were candidates who answered *protein is transported to Golgi apparatus* instead of *transport vesicle is transported to cis face of Golgi apparatus*, which was the acceptable answer. Candidates also answered that the *vesicle is transported from Golgi apparatus to plasma membrane*. The correct answer should be the *secretory vesicle pinch of from trans face of Golgi apparatus and move toward plasma membrane*. Inappropriate use of scientific terms and wrong spelling also caused them to lose mark. For example, the *Golgi apparatus* was spelt as *golgi apparatus*, which was not accepted as the correct answer.

Question 19

In part (*a*), the question was about the differences between competitive and non-competitive inhibitions. The comparison between these two inhibitions was needed. Some of the candidates just mentioned the details on each inhibition in one paragraph without indicating any comparison. Some candidates answered *competitive inhibitor has similar shape with the enzyme while non-competitive has different structure with the enzyme* instead of *competitive inhibitor has similar shape with the substrate while non-competitive inhibitor has different structure with the substrate*. The candidates had misconception about the similarity of the shape of substrate and enzyme. Another answer by the candidates was *competitive inhibitor can be overcome by adding substrate, but non-competitive inhibitor cannot be overcome by adding substrate* instead of *the reversible reaction of competitive inhibitor can be overcome by adding more substrate, but the reversible or irreversible reaction of non-competitive inhibitor cannot be overcome by adding more substrate*, which was the correct answer.

In part (*b*), mentioning the specific enzyme and non-competitive inhibitor were good to test students' understanding. However, to be more specific alpha-amyrinpalmitate is a non-competitive inhibitor, chymotrypsin is an enzyme (digestion enzyme) and this enzyme belongs to serine protease enzyme groups (which make serine protease also an enzyme). By mentioning more on the enzyme and the group, and not mentioning the substrate, candidates tend to be confused and guessed that chymotrypsin was the substrate. Most candidates tend to describe the structure and function of a non-competitive inhibitor (alpha-amyrinpalmitate) and not relating it with its kinetic activity, especially when bound to the enzyme (chymotrypsin/serine protease). The inhibition needed to be displayed using Lineweaver-Burk which was the double reciprocal plot and to be explained as the text paragraph as well. Many candidates were able to draw the inhibitor and non-inhibitor plot with correct labels and wrote the interception at x-axis ($-1/K_m$) correctly. Many candidates managed to mention *non-competitive inhibitor binds to allosteric site of enzyme*,

V_{max} *will be reduced*, and K_m *remain unchanged in the presence of non-competitive inhibitor*. Only a few candidates were able to describe the meaning of K_m as *substrate concentration at half of its maximum velocity* and K_m *measures the affinity of enzyme for its substrate*. It was also found that some candidates tend to sketch Michaelis – Menten graph instead of Lineweaver – Burk plot. Some candidates have misconception about the effect of non-competitive inhibitor on V_{max} and K_m. For example, in the presence of non-competitive inhibitor, V_{max} remains unchanged while K_m will be reduced.

Question 20

In part (*a*) the question was about the light independent reaction in pineapple plants which was a CAM plant. Many candidates understood the need of the question well and managed to obtain good marks, but some candidates answered the question by describing the light independent reaction in C_4 plants. Many candidates lose mark for incorrect technical term for biological processes such as *phosphoenolpyruvate (PEP) combine*, *accept or react with carbon dioxide to form oxaloacetate* instead of *PEP fix carbon dioxide to form oxaloacetate*. Since the reaction was carbon fixation, candidates must use the term fix. Some candidates spelled PEP carboxylase as PEP carboxylate, which was incorrect. For CAM plant, the carbon fixation was a temporal separation, thus mentioning at night or during the day was also important. Few candidates wrote *stomata open during the day and close during the night* instead of *stomata open during the night and close during the day*. Many candidates neglected the basic biochemical reaction such as oxaloacetate was reduced to malate was wrongly stated as oxidised. Only a few candidates managed to use the term oxidative decarboxylation of malate to form pyruvate and carbon dioxide correctly. Some wrote it as malate oxidise into carbon dioxide or malate decarboxylate into pyruvate which were wrong statements. There were also spelling mistakes of *stoma* as *stroma*. Candidates confused with the reaction, whether it was oxidised or reduced. Oxaloacetate was reduced to malate, but some mistakenly stating oxaloacetate was oxidised to malate. In plant, the reduction coenzyme is NADPH, but some wrote it as NADH. Some candidates did not recognise that CAM plants do not have Kranz anatomy, and the light independent reaction occurs in the same cell but the first and second carbon fixation were separated temporally. These confused candidates explained the first carbon fixation in mesophyll cell and the second carbon fixation occurred in bundle sheath cell.

In part (*b*), the candidates were required to describe the compensation point and its role in plants. Many candidates wrote *compensation point can be defined as the rate of respiration is equal to the rate of photosynthesis* instead of *compensation point can be defined as the level of light intensity the rate of respiration is equal to the rate of photosynthesis*. None of the candidates mentioned *when light intensity is higher than the compensation points, the production of sugar exceeds the use of sugar, the excess sugar is stored as starch, light intensity should be higher than the compensation points to ensure proper growth*. However, quite a number of candidates were able to draw the hyperbolic line to show the net photosynthesis rate in the graph. Few candidates were able to write the *x*-axis (light intensity) and *y*-axis (CO_2 concentration) correctly even though they were able to plot the compensation point in the graph.

BIOLOGY 964/2

OVERALL PERFORMANCE

For Semester 2, 2 210 candidates sat for the examination of this subject and 48.24% 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	4.71	4.57	8.46	7.15	8.42	5.61	9.32	6.20	6.29	8.05	31.22

RESPONSES OF CANDIDATES

SECTION A: *Multiple-Choice Questions*

Answer keys

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

General comments

In general, Questions 14 and 15 were in the range of easy questions. More than 70% of the candidates managed to answer Questions 14 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 cardiac cycle. In part (*a*), most candidates were able to identify phase *J*, phase *K*, and phase *L* correctly. Some candidates experienced confusion and had wrongly switched between atrial and ventricular phases.

In part (*b*), most candidates were able to state atrioventricular valves open during phase *J*.

In part (*c*), the candidates were required to explain the reason why the 'dub' sound is produced. Generally, the candidates were aware that the 'dub' sound as the second sound produced in a heart cycle and it was caused by the blood recoils against the semilunar valves, but very few candidates explained how this sound was produced correctly.

Question 17

The question was about nephron. In part (*a*), most candidates were able to name *P*, *Q* and *R* correctly.

In part (*b*), candidates were required to explain the reabsorption of water into the blood through *R*. Most candidates were able to provide the point at which *water diffuses into blood capillaries by osmosis* and *low water potential at the interstitial fluid*. Not many candidates knew that most solutes are transported into interstitial fluid. Some of the candidates also did not use the correct term to explain the process involved.

In part (*c*), candidates were required to explain one factor that contributes to the filtration at glomerulus. Most candidates were unable to answer this question. There are several factor that contributes to the filtration at glomerulus. This includes the differences in the diameter sizes of involved arterioles which is an *afferent arteriole that has a larger diameter than an efferent arteriole*. This difference had led to high hydrostatic pressure in the glomerulus. However, when presenting their answer, it was unclear whether the candidates referred to the larger lumen or diameter, thus it was unaccepted. There were some candidates who think that the afferent arteriole is smaller than the efferent arteriole. Other candidates mistakenly spelled the arteriole's name, or wrongly referred to arterioles as neurone or just a blood vessel.

Question 18

In part (*a*), candidates were required to describe the behavioural response by large mammals on a hot-sunny day. Majority of the candidates chose to answer this question but many failed to get marks because they were unable to give the correct behavioural responses together with its description. Most candidates were able to provide two or three behavioural responses. Some candidates explained about physiological responses such as sweating and vasodilation shown by humans in hot environments. Majority of the candidates failed to clearly describe the behavioural adaptation shown by the mammals. They were unable to describe the process involved in regulating body temperature such as how mammals bathe to cool down their bodies. Others failed to use the correct terms in explaining their answers such as how mammals extending their tongues instead of *panting*. Most of the answers also did not relate to the mechanism of heat loss but the candidates kept repeating to prevent heat loss. Many candidates believed that mammals need to increase their metabolic rate to produce more heat and dissipate it to the surrounding, which was wrong. Others believed that the mammals should reduce their metabolic rate but did not relate it to the reduction in physical activity.

In part (*b*), candidates were required to describe the mechanism of immune response of a person's body when infected by bacteria. Many candidates had a good understanding regarding the topic of immunity but the way they presented their answers was unsatisfactory. Candidates needed to describe the humoral immune response or cell-mediated immune response in detail, but some candidates were unable to describe the flow of the mechanism correctly. Some candidates were confused and skipped some steps or wrongly spelled specific terms. Although the question had clearly mentioned the infection was caused by the bacteria, there were still many candidates who referred to the virus generally as antigen. Many candidates were able to mention B cells involved in humoral immune response and T cells involved in cell-mediated immune response. Majority of the candidates were able to state the function of plasma cells and cytotoxic T cells correctly; 'plasma cells produced antibodies and cytotoxic T cells released perforin to perforate target cells'. However, only a few candidates mentioned the role of memory B cells or memory T cells 'in permitting rapid immune response on subsequent exposure to the same antigen'. Most candidates answered without the phrase 'rapid response' and 'same antigen'. Many candidates also explained the complete mechanism of humoral and cell-mediated immune responses. Candidates elaborated generally on the mechanism starting from how macrophages engulfed the invaded bacteria until the rapid response of memory cells towards secondary infection. Few factual mistakes written by the candidates included how bacteria were engulfed by the antibody, antigen's fragment bound to the MHC complex, T cells produces IL-1 or IL-2, IL-1 change to become IL-2. Many candidates forgot to mention the activated B cells or cytotoxic T cells then proliferate and differentiate, and memory B or T cells were used for rapid response for secondary infection. They also wrongly used the abbreviation for interleukin (IL- I and IL-II). Some candidates also confused the facts on humoral immune and cell-mediated immune responses.

Question 19

In part (*a*), candidates were required to describe the roles of two plants' hormones which were gibberellin and abscisic acid. Most candidates could recall the roles of gibberellin and abscisic acid but unable to describe how these roles were performed. This caused candidates to fail to score marks due to incomplete points, eg. 'gibberellin promotes seed germination' without mentioning 'by breaking the seed dormancy'. The roles of gibberellin and abscisic acid should be natural which exclude in promoting parthenocarpy which was well known as artificial induced production of fruit without fertilisation of ovules.

In part (*b*), candidates were required to explain the process of seed germination in corns. Most candidates understood the germination process very well. They started their answer with *water absorption* or *imbibition process*. Some candidates were able to present almost all the steps without making a mistake, but other candidates missed a few steps or confused some facts with others. Some candidates had wrongly written 'gibberellin acid', forgot to write 'α'-amylase by presenting amylase instead, and did not mention *sugar was absorbed by the embryo for cellular respiration*. Some candidates did not mention the effect of gibberellin in breaking the seed dormancy. A few candidates also mentioned other enzymes such as lipase and protease, although these enzymes were not mainly involved in nutrient's mobilisation. Some incomplete points presented by the candidates such as how starch was converted into maltose instead of using the correct term hydrolysed or broken down. Many candidates mentioned nutrient as the main source for cellular respiration of the embryo instead of glucose. Some candidates got confused with the embryonic development and discussed the double fertilisation process of flowering plants which was not required by the question.

Question 20

In part (*a*), candidates were required to describe the process involved in the embryonic development of a dicotyledonous seed. Some candidates mistakenly answered this question by describing the pollination and explaining the double fertilisation of flowering plants. They failed to mention the zygote, some candidates referred to it as a seed, undergoes mitosis, or the embryo anchor and obtained nutrient from parent plant or terminal/apical cells then divided to form proembryo, or the suspensor pushes the proembryo into the embryo sac cavity, and proembryo began to specialise into tissues. Most candidates didn't mention the proembryo but kept referring to it as embryo. Many candidates were unable to identify the stages of the seed germination which were the heart stage and torpedo stage. The candidates also did not mention that matured embryo which consists of radicle, plumule and cotyledons.

In part (*b*), candidates were required to describe the adaptation of cactus to reduce water loss. Most of the candidates were aware that cactus was a xerophyte, thus explaining the adaptation adopted by xerophyte plants. This includes the plant's ability in storing water such as having a succulent stem or being highly efficient in obtaining water such as have a long and network root. These points were not required by the question. Most candidates knew about the plant's adaptation in reducing water loss, only a few were able to relate these adaptations to mechanism in reducing water loss. Some candidates were confused about the water-loss mechanism such as transpiration and evaporation. Most candidates failed to give a proper description on how the adaptation can reduce water loss that was basically by either transpiration or evaporation process.

BIOLOGY 964/3

OVERALL PERFORMANCE

For Semester 3, 2 191 candidates sat for the examination of this subject and 61.20% 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	11.23	5.75	7.44	7.21	8.99	11.50	9.08	5.57	6.57	3.15	23.51

RESPONSES OF CANDIDATES

SECTION A: *Multiple-Choice Questions*

Answer keys

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

General comments

In general, Questions 7 and 10 were in the range of easy questions. More than 70% of the candidates managed to answer them correctly. Meanwhile, the rest of the questions were in the range of moderate questions where 30% to 69% 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 the patterns of population distributions. In part (*a*), most of the candidates were able to name *P*, *Q* and *R* correctly. Only a few candidates misunderstood the patterns of population distributions.

In part (*b*), a few candidates were able to describe the distributional patterns of *P*, *Q* and *R* correctly. Most candidates lose their marks because of wrong terminologies and wrong concepts.

In part (*c*), most of the candidates answered correctly for distribution pattern for Asian elephant which was *R* or clumped and Dandelion which was *Q* or random.

Question 17

The question was about the dihybrid cross between the dominant traits of the green pod and the purple flower and the recessive traits of the yellow pod and white flower of *Pisum sativum*. To answer this question, candidates must have knowledge about Mendelian law and able to calculate the distance between two genes.

In part (*a*), most of the candidates answered the question correctly. However, a few candidates did not realise that the gene involved were linked genes and crossing over had to occur. They still mentioned classical ratio which was 9:3:3:1.

In part (*b*), a few candidates managed to answer this part correctly. Most of the candidates could not give the correct formula for calculating the COV. Some of candidates wrote wrong formula that made them lose mark.

In part (*c*)(i), a few candidates were able to name the method used to study the distance between two gene loci which was genetic mapping. Some of the candidates gave the wrong answer such as crossing over value, crossbreed, dihybrid cross, Hardy-Weinberg Equilibrium, etc.

In part (*c*)(i), only a few candidates were able to answer this part correctly. The candidates lack understanding of the importance of identifying the gene loci. The acceptable answer was *to locate the relative positions of gene on a chromosome*.

Question 18

In part (*a*), the question was about biogeochemical cycle. The candidates were required to describe phosphorus cycle. Some candidates were able to identify the main reservoir of the phosphate ion and how the phosphate ion changes to phosphate while some candidates were confused with the phosphate conversions and had misconception that phosphate cycle starts with sedimentation of organic matters. Many candidates were unable to state the "*main*" reservoir of the phosphate was in phosphate rocks. Most candidates were able to explain the weathering could bring phosphate into phosphorus cycle, but "*inorganic phosphate/ dissolved phosphate*" was not written. Candidates lose marks because of this wrong terminology. Most candidates were able to identify the roles of decomposers and how the phosphate was absorbed and used by the plants. For example, the correct answer was *inorganic phosphate are absorbed by plants* but the candidates wrote *phosphorus are absorbed by plants*. Candidates must also be aware that there were few related terms, such as *phosphorus, phosphate, inorganic/ soluble phosphate/ PO_4^{3-}, organic phosphate* and they were not interchangeable. There were precise processes in the cycle that were associated with specific terms.

In part (*b*), the question was about the population size. The candidates were required to state the factors that influence the population size in the lake ecosystem. Overall, most candidates were able to write good answers on this question coherently to the marking scheme but some candidates misinterpreted the question and wrote the factors that 'decrease' the population size. The keyword on the question was the *increased of population*. Some of the candidates just stated the factors involved without emphasising the quality of the factor which will increase the population size. For example, they only mentioned *food sources, number of predators* instead of *plenty of food sources, small number of predators*.

Question 19

In part (*a*), the question was about population ecology. The candidates were required to state the condition for a population to achieve the Hardy-Weinberg equilibrium. Most candidates were able to state correctly the conditions of a population to achieve the Hardy-Weinberg equilibrium. They managed to determine the condition of no mutation, close population/no migration/no gene flow/no genetic drift, large population size, random mating and no natural selection/population equally reproducing. However, some candidates misinterpreted the question and wrote on the principle of the Hardy-Weinberg formula, instead of Hardy-Weinberg equilibrium conditions.

In part (*b*), the question was about DNA replication. The candidates were required to describe the DNA replication in bacteria. Most of the candidates were able to write good answers on this question. However, there were also candidates who were unable to give the *function of topoisomerase* and the *role of both DNA parental as templates*. Some candidates were unable to describe the 'continuously' synthesis of leading strand and 'discontinuously' synthesis of the lagging strand. The candidates must have an in depth understanding about replication process. Majority of the candidates lose their marks because they wrote wrongly or not specific terms in their explanation. For example, *DNA polymerase III catalyse the synthesis of new DNA* strand instead of *RNA polymerase*. Some candidates did not use the specific name of enzyme such as *DNA polymerase III or I* instead of *DNA polymerase* only. Some candidates also explained about cloning procedures/steps in genetic engineering that was totally wrong.

Question 20

In part (a), the question was about genomic and cDNA libraries. The candidates were required to differentiate the genomic library and cDNA library. A few candidates answered this question well. They were able to differentiate the genomic and cDNA libraries based on the starting materials, the presence of intron and exon, the size of the library, the enzymes that were involved in the libraries, and the structure of the libraries. They also gave the usage of genomic libraries to express the eukaryotic gene in prokaryotic cells and cDNA libraries could be used for cloning both eukaryotic and prokaryotic genomes. Some of the candidates did not use accurate terms, for example the incorrect usage of terms such as *exon*, *intron and cistron*. One of the common mistakes written by candidates was they did not write all type of enzymes required. For example, *the genomic libraries required restriction enzyme and ligase only, cDNA libraries required restriction enzymes, reverse transcriptase, ligase and DNA polymerase III*. Some candidates answered the differences based on presence or absence such as the presence of reverse transcriptase and DNA polymerase III in the genomic library but absent in the cDNA library. Some others were confused between the facts for genomic libraries and cDNA libraries.

In part (*b*), the question was about the characteristics of the plasmid in the topic of recombinant DNA. The candidates were required to describe the characteristics of the plasmid. Most of the candidates answered this question well and could score good marks. Most of them could describe that plasmids were small in

size, able to replicate freely/independently in the host cells, able to express cloned genes, possess selectable/specific marker genes, contain the origin of replication, have multiple/unique restriction sites, easy to manipulate and able to transform into the host cells. However, some of the candidates tend to give general answers such as being able to replicate in the cells, have restriction sites, able to carry/transfer into the host cells which makes them lose marks. A few of the candidates also explained cloning in genetic engineering which was not related to the question. They also had misconception that plasmid possessed only one restriction site.

PAPER 964/5 (WRITTEN PRACTICAL TEST)

Question 1

The question was about osmosis focusing on tonicity and the movement of water from tissue to solution. Most of the candidates were able to answer part (*a*), (*b*) and (*c*) correctly. In part (*d*) most of the candidates were unable to explain the changes that occur in Q. In part (*e*) most of the candidate were able to predict the condition of P if P is replaced with animal cell which is cell burst or lyses but they were unable to explain such condition occurs.

Question 2

The question was about histology of mammalian blood circulation system. Many candidates failed to identify the cross-section diagram as a blood circulation system. Thus, this caused the candidate providing totally unrelated answers to part (*a*) which requested the candidate to identify the structures in the cross-section diagram. At the same time, the candidates also failed to answer the other parts of the question on the functions of the structure of the organ due to the misidentification of the structures.

Question 3

The question was about taxonomy of insects and plant. Part (*a*) required the candidates to name the insect orders for the different insects. All the candidates had no problem to identify the given insect (pictures). However, part (*a*)(i) the question required the candidates to name the insect orders P: Lipidopera, Q: Odonata, R: Orthoptera and S: Coleoptera which all the candidates were not able to do it.

Part (*b*) required the candidate to name the phylum and classes of the plants. Some candidates did have some idea on the phylum and classes of the plants, but they could not give the proper (correct) scientific names of the plant phylum as angiospermophyta and classes X: dicotyledonae Y: monocotyledonae. Furthermore, part (*b*)(iii) required the candidates to differentiate between X and Y based on their morphology, and many candidates failed to give the correct pair of contrast answer, causing them to lose marks.