Candidates' Performance

The Biology public examination consists of two papers. Paper 1 assesses the compulsory part of the curriculum and Paper 2 assesses the elective part.

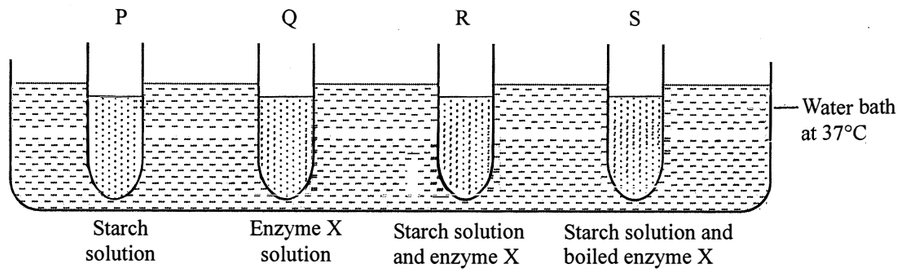
Paper 1

Paper 1 consisted of two sections, Section A (multiple-choice questions) and Section B (conventional questions). All questions in both sections were compulsory.

Section A (multiple-choice questions)

There were 36 questions in this section. Candidates' performance was satisfactory in general and the mean raw score was 23. Some candidates had areas of weakness, however, as revealed by their performance in the following items:

Directions: Questions 2 to 4 refer to the diagram below, which shows four test tubes prepared by a student to investigate the action of a starch-digesting enzyme X:



2. In which of the following regions of the human alimentary canal can enzyme X be found?

(1) mouth cavity
(2) stomach
(3) small intestine

	A.	(1) and (2) only	(13%)
*	B.	(1) and (3) only	(67%)
	C.	(2) and (3) only	(8%)
	D.	(1), (2) and (3)	(12%)

67% of candidates chose the correct answer. 13% of candidates were not aware that pancreas secretes pancreatic amylase into the small intestine while 8% were not aware that salivary gland secretes salivary amylase into the mouth.

3. The student conducted some tests on the content of each test tube at the beginning and after 30 minutes. Which of the following correctly shows the results of the tests for tube R at the beginning?

		Benedict's test	***Iodine test***	***Test for proteins***	
*	A.	negative	positive	positive	(34%)
	B.	negative	positive	negative	(21%)
	C.	positive	negative	negative	(23%)
	D.	positive	negative	positive	(22%)

In conducting this experiment, it was necessary to compare the results of the chemical tests at the beginning with those observed at the end of the experiment in order to draw valid conclusions. At the beginning, the content of tube R would give negative results in Benedict's test and positive results in the Iodine test as the digestion of starch takes time. About 45% of candidates gave the wrong prediction and chose C or D as the answer. Some candidates who correctly predicted the results for Benedict's test and Iodine test in tube R were not aware of the fact that enzymes are proteins in nature and would therefore give rise to positive results in the test for proteins.

4. Which of the following is ***not*** the purpose of the experimental design?

		Design	***Purpose***	
	A.	setting up tube P	to show the result of iodine test if starch is present	(23%)
	B.	setting up tube Q	to show that enzyme X alone cannot give positive result in Benedict's test	(37%)
*	C.	setting up tube S	to show that enzyme X is denatured after boiling	(23%)
	D.	setting up water bath	to simulate the temperature of the human body	(17%)

Only 23% of candidate chose the correct answer. This reflected the fact that many candidates were not aware of the importance of setting up different tubes in this experiment to fulfill the aim of this experiment. In fact, each tube had a different role to play in coming to valid conclusions.

The results of tube P proved that any disappearance in starch in tube R was due to the action of enzyme X, but not to the spontaneous breakdown of starch. It was expected that the same intensity of the blue-black colour would be observed in the Iodine test, both at the beginning and the end of the experiment. This also acted as a system check to ensure that there was no contamination with reducing sugar right at the beginning (negative results at the beginning).

The results of tube Q proved that any reducing sugar produced in tube R was due to the action of the enzyme on the starch solution. Hence, the enzyme alone would give negative results in both Benedict's test and the Iodine test. This means that the results of tube R could be used for comparison in order to draw valid conclusions. Tube R contained the mixture (i.e. the substrate and the enzyme) in which digestion was supposed to take place. Positive results in Benedict's test were expected, showing that reducing sugar was produced. Yet the colour intensities of the results of the Iodine test could be compared with those of tube P to show that the amount of starch had been reduced at the end of the experiment. It deserved mention that a certain amount of blue-black colour was expected at the end of the experiment if the digestion was incomplete.

The setting up of tube S was based on the knowledge that enzymes would be denatured and lose their function after boiling. Hence, if the result of tube R were really due to enzymatic action, tube S (with denatured enzymes) would yield similar results to tube P. Therefore, rather than showing that enzyme X was denatured after boiling, the inclusion of tube S was to prove that the digestion of starch in tube R was due to the action of an enzyme.

The water bath, on the other hand, was simply a set-up to provide a constant temperature for the reaction to take place in and 37°C was used because it is human body temperature.

Section B (conventional questions)

This section included a wide variety of question types and assessed candidates' basic understanding of biological knowledge and concepts, the application of biological concepts to realistic and novel situations, the scientific enquiry process and communication skills.

Markers considered the paper appropriate with regard to the level of difficulty, and balanced in terms of curriculum coverage.

The following table shows the general performance of candidates in individual questions:

Question Number	Performance in General
1	Well answered
2	Fair
3	Satisfactory
4	Fair
5	Fair
6	Fair
7	Poor
8	Well answered
9	Fair
10	Good
11	Fair

1. Well answered. About half of the candidates got full marks. Candidates often mixed up the degree of elasticity of ligaments with that of tendons. Some candidates were not aware that cartilages are found at the two ends of long bones.

2. Fair. About 26% of candidates provided a full and logical explanation of the phenomenon. Although most candidates were aware that osmosis is involved in this daily life scenario, many of them failed to link this up with the knowledge about turgidity in the support of plants. They failed to use the term 'flaccid' or 'the loss of turgor pressure' to describe the cells of the preserved pineapples. Some candidates failed to refer to cells of the preserved pineapple when they described the movement of water. Some used the term 'plasmolysed' without knowing that it is a term for depicting the separation of a cell membrane from the cell wall and it was not sufficient to explain the soft texture of the preserved pineapples.

3. (a) Well answered. About 70% of candidates correctly identified the process. Some candidates gave answers such as pollination and sexual reproduction without paying attention to the fact that the diagram presented two processes, X and Y, which were self-pollination and cross pollination respectively. As a result, their answer was not accurate enough to score marks. Candidates needed to study the diagram carefully before they answered the question. Many candidates misspelt 'pollination'.

   (b) Satisfactory. The mean mark obtained for this part was about 50% of the total score. Although the question required a straightforward description of the fertilisation process in flowering plants, some common misconceptions were persistently observed. For instance, many candidates treated pollen grains as male gametes or ovules as female gametes. They wrongly described fertilisation as the fusion of pollen grains and ovules. Some candidates wrongly referred to the pollen tube as the tunnel resulting from the digestion of the style. In fact, it is an outgrowth from the pollen grain.

   (c) Poorly answered. Some candidates mistakenly treated self-pollination as asexual reproduction and wrongly thought that identical offspring would be produced. Many candidates mentioned that there would be more genetic variations but they failed to point out that this referred to the offspring produced by process Y. Many candidates wrongly thought that producing more genetic variations in the offspring could help them to better adapt to the changing environment. Instead, the changing environment was exerting a selection which favoured or did not favour the survival of individuals with certain traits. Thus, the existence of a wide range of variants increases the chance of survival during natural selection.

4. (a) Good. About half of the candidates correctly identified the structures (A & B) and correctly spell their names.

   (b) Satisfactory. More than half of the candidates correctly stated the stage of the cell cycle shown in the photomicrograph. However, only half of them provided a proper reason to support their answer, showing that candidates were weak at linking up the observation shown with knowledge learned.

   (c) Fair. Only 15% of candidates provided a full and logical answer to explain how A and B work together to perform the function of the pancreatic cell. Many candidates gave descriptions about the function of A and B separately. Some candidates mixed up translation with transcription or wrongly stated the locations of these two processes. Many candidates gave lipid production as the function of A but this did not relate to the function of pancreatic cells.

5. (a) Satisfactory. The mean mark was about 50% of the full score. However, many candidates failed to give the events in sequence. Sometimes they mixed up the causal relationship between the change in volume and the change in lung pressure. Some candidates gave the description of the contraction of the diaphragm muscles and intercostal muscle in one sentence and their actions in another sentence. However, the actions did not match the muscles involved. A more desirable practice was to give the contraction of one muscle and its corresponding action in one sentence, and the other muscle and its action in another sentence. Candidates often mixed up thoracic volume and lung volume in their answers. They are not interchangeable. Candidates should be careful with the use of these specific terms.

   (b) Poorly answered. Most candidates did not relate the collapse to the elastic nature of the lung tissue, nor did they know that the lung was inflated because of the negative pressure in the pleural cavity.

6. (a) Well answered. About 65% of candidates correctly identified and spelt the kingdom involved.

   (b) Fair. Candidates had difficulty in relating how these advancements in technology provided new evidence which formed the basis for the development of the classification system. Generally, they were able to point out the importance of the technology but they seldom linked it up with how it helped distinguish between the organisms in each classification system.

7. (a) Very poor. Very few candidates correctly stated the assumption that was related to the validity of the method used. This showed that they did not have a full understanding of the given experimental design. In fact, the dependent variable, i.e. the rate of photosynthesis, could not be measured directly in this set-up. What was measured was the rate of oxygen released during the experiment. Many candidates forgot that the rate of oxygen released, in fact, represents a net change in the gas exchange as a consequence of the two opposing processes, oxygen production by photosynthesis and oxygen consumption by respiration. In order to take the rate of oxygen released as a valid parameter for measuring the rate of photosynthesis, it is necessary to assume that the rate of oxygen consumption (rate of respiration) remains more or less the same during the experiment. Indeed, this set-up is a classic example illustrating the necessity of having an assumption about the method of measurement so that valid conclusions can be drawn. The

performance of the candidates was poorer than expected. Many candidates gave assumptions that were scientifically untenable and unrealistic. For example, many candidates assumed that there was no respiration in the plant during the experiment or the rate of respiration was zero.

(b) Poorly answered. Candidates did not know that temperature was an important factor that should be controlled carefully in this experiment. Temperature affected both the rate of photosynthesis and respiration. As a result, both the measurement and assumption could not hold. Many candidates suggested that sodium hydrogencarbonate should be added to provide a constant supply of carbon dioxide. In fact, the amount of carbon dioxide in water was maintained fairly constantly because the carbon dioxide in air would continuously dissolve in water to replace that consumed by the water plant. Adding sodium hydrogencarbonate might boost the rate of photosynthesis at first but when the experiment was repeated with different light intensities, the concentration of carbon dioxide in water would drop. Therefore, adding sodium hydrogencarbonate might, in fact, introduce another variable that affected the rate of photosynthesis during the experiment.

(c) Satisfactory. More than half of the candidates stated the two products of the photochemical reactions. However, many of them simply recited the process of carbon fixation but failed to point out the importance or the roles of ATP and NADPH in the steps. In addition, they often mixed up the intermediates involved or mixed up the Calvin Cycle with the Krebs Cycle.

8. The question presented an unfamiliar situation based on a series of experiments on the growth of a foreign plant species. Candidates were required to describe and interpret the trends in the data, analyse the data and predict the effect of increased soil temperature on the competitiveness of the foreign plant species, and evaluate its impact on native plant species in Hong Kong. In general, candidates did well in this question.

(a) Well answered. About 65% of candidates scored full marks in this question. Some candidates simply referred to the effects as high, medium and low. They were not aware that comparison should be made with the results of the control so that conclusions about promotion or inhibition of growth could be drawn. Some merely gave a numerical description rather than an inference from the results.

(b) Good. About 40% of candidates scored full marks in this question. Most candidates correctly identified the relationship between bacterium B and plant X as mutualism. However, many candidates wrongly thought that the relationship between bacterium A and plant X was competition or commensalism. Spelling mistakes were common.

(c) (i) Well answered. About 96% of candidates read the figures from the graph correctly. Some gave a range of temperatures or failed to write the unit, however.

(ii) Well answered. About 70% of candidates gave the correct predictions about the population sizes of bacteria A and B. Some candidates gave a comparison of the populations of bacteria A and B instead of giving the predictions about population change. Some attempted to explain the change, which was not required in this question.

(d) Satisfactory. About 75% of candidates correctly predicted the impact of global warming on the native plant community. However, only 38% of candidates followed the guidance given by the question and provide a proper explanation, i.e. increased soil temperature led to a higher population of bacteria B or a lower population of bacteria A, which in turn promoted the growth of plant X. It was the enhanced growth of plant X that posed more of a threat to the native plant community. Some candidates simply stated that native plants would die or become extinct instead of addressing the effect on the plant community.

9. The question was based on an unfamiliar situation about data on the effectiveness of various vaccination treatments for Japanese encephalitis. Candidates were required to apply their knowledge about vaccination to explain the trends shown in the graph and choose a vaccination treatment based on a given scenario. In general, the candidates' performance was fair.

(a) Well answered. About 74% of candidates identified mosquitoes as the vector transmitting the disease. Some simply gave insects as answer, which was too vague to score a mark. Spelling mistakes were common.

(b) Poorly answered. Many candidates forgot to mention the production of memory cells during the first injection. Instead, they said memory cells could recognise or remember the antigen in the vaccine as if memory cells were there already. They did not know it was the first encounter with an antigen that would trigger the differentiation of lymphocytes to form memory cells for that specific antigen. Many candidates only gave vague answers, such as the body or immune system produced a large amount of antibodies in the second injection. They missed the key point about the encounter with the same antigen again which triggered the secondary immune response. Quite a number of candidates failed to mention plasma cells and stated that memory cells produced antibodies directly. When they accounted for the sharp rise in protection against JE, they usually mentioned the production of a large amount of antibodies but failed to point out that this happened in a shorter time. Candidates often mixed up antigens with viruses in their answers. Many candidates failed to use specific terms to express the ideas, e.g. they simply stated that lymphocytes produced memory cells or lymphocytes had the memory of the antigens. Instead, they should have stated that some lymphocytes differentiated into memory cells.

(c) Fair. 44% of candidates stated the other benefit of vaccination treatment C. Some candidates just focussed on the point that the protection could last longer but did not mention the high level of protection, or vice versa. Some simply stated that the vaccine lasted longer without relating it to the immunity.

(d) (i) Good. About 86% of candidates chose the correct vaccination treatment for Mathew. However, only half of them quoted the appropriate data from the graph to support their choice. They often forgot to refer to the minimum level for effective protection against Japanese Encephalitis, which is a crucial indication of whether the vaccination treatment offers protection that covers the period of travel.

(ii) Poor. Only 30% of candidates stated the rationale for the precaution. Many candidates failed to link up the use of insect repellant with the idea of mosquitoes being the vector for transmitting the JE virus from one individual to another. They simply gave vague answers such as this prevented the spread of the JE or JE antigens. Some wrongly thought that Mathew carried the mosquitoes or their eggs on his clothes and the insect repellent helped to kill them.

10. The question presented some data that led to the development of the understanding about the inheritance of the ability to roll one's tongue, a well-known example of discontinuous variation. This is often presented as a trait which is purely influenced by a pair of genes. In fact, study data showed that there were other factors influencing the expression. Candidates were required to analyse the data, provide explanations and making logical deductions. In general, the performance was satisfactory.

(a) (i) Good. About 80% of candidates correctly pointed out that the trait belongs to discontinuous variation. However, only half properly explained how they arrived at their answer by referring to the characteristics of discontinuous variation.

(ii) Fair. About 32% of candidates scored full marks. Many candidates failed to distinguish between allele and gene. They wrongly referred to genes instead of alleles for controlling tongue rolling. Others attempted to explain the conclusion by referring to the ratio of the phenotypes instead of deducing the genetic composition from the phenotypes observed in parents and offspring.

(b) Good. More than half of the candidates scored full marks. Some candidates used the same logical deduction in (a)(ii) to address the question and stated the deduction that the non-tongue rolling trait should be the dominant phenotype. However, they did not pay attention to the fact only a small proportion of the offspring showed opposing traits. Hence, the data itself did not provide a strong argument that the non-tongue rolling trait was the dominant phenotype as compared to the data presented in part (a). It only showed that a small proportion did not follow the genetic rule and therefore there might be something else that affects the expression of the trait.

(c) (i) Fair. About 65% of candidates were able to give the fact that identical twins are of the same genetic composition. However, candidates had difficulty in pointing out how this unique feature made them suitable subjects for the study of inheritance. Only a small proportion of candidates pointed out that they should show the same phenotype if the trait is controlled purely by genetics. Some candidates wrongly stated that the genetic composition of the identical twins was similar.

(ii) Good. About 40% of candidates correctly quoted the data to support the conclusion. Some candidates only used descriptions such as large proportion or small proportion instead of quoting the data.

(d) (i) Well answered. The mean mark for this part was about 70% of the full score. Quite a number of candidates wrongly thought that the three studies about the inheritance of the ability to roll one's tongue were based on the same set of data.

(ii) Poorly answered. Only a small proportion of candidates pointed out that scientists should be skeptical and be ready to accept results that were contrary to previous beliefs. Many candidates simply stated some other aspects of the Nature of Science which had been assessed in previous examinations.

11. The overall performance was fair. The question was structured as two distinct parts: (1) assessing the formation of lymph and its circulation and (2) whether the claims about lymphatic drainage are scientifically valid.

For the part assessing the formation of lymph and its circulation, excess marks were allocated. The performance was fair. Only 16% of candidates got full marks for this part. Candidates were weak at giving accurate descriptions about the formation of tissue fluid and lymph. For example, many did not know that the formation of the tissue fluid is due to the higher blood (hydrostatic) pressure at the arteriole end of the capillary bed. Instead, they wrongly thought that it was due to diffusion. Some candidates mixed up the terms 'tissue fluid', 'lymph' and 'blood' in their answers. When they described the movement of fluid in and out of the capillary, they often simply referred to the capillary network but did not mention whether the fluid movement is taking place at the arteriole end or the venous end of the capillary network. Some wrongly stated that fluid moves out from arterioles. Most candidates mentioned that the flow of lymph is assisted by the squeezing action brought about by the contraction of skeletal muscles, and the presence of valves in the lymph vessels helped prevent the back flow. However, some forgot to mention that the lymph will return to the heart eventually.

For the part about whether the claims are scientifically valid, candidates were required to justify their judgements with biological knowledge. However, the performance was poor. Only 30% of candidates provided relevant biological knowledge to support their judgements about the claim of improving lymph circulation. Many candidates simply stated it was difficult to find the lymph vessels without referring to where the lymph vessels were located. Even fewer candidates provided arguments for the claim of losing body weight. Some simply mentioned that it was necessary to reduce energy input to reduce body weight. However, they had never referred to the practice of lymphatic drainage in their argument. Some candidates mentioned reasons for as well as reasons against the claims without citing any biological knowledge to support their arguments.

Candidates were generally weak in selecting relevant information and organising their ideas to provide sound and logical arguments regarding the validity of the claims. This was reflected in the distribution of scores awarded for effective communication:

Marks award for effective communication	Percentage of candidates
0	36
1	30
2	18
3	7

This year, about 9% of candidates did not attempt this question, which was higher than last year. Nevertheless, it was noted that some of these candidates wrote very long answers for other questions. It was suggested the candidates should allocate time wisely and avoid writing lengthy answers to questions that are worth fewer marks.

Paper 2

Paper 2 consisted of four sections. Section A contained questions on 'Human Physiology: Regulation and Control', Section B on 'Applied Ecology', Section C on 'Microorganisms and Humans' and Section D on 'Biotechnology'. Candidates were required to attempt all questions in two of the sections.

The following table shows the general performance of candidates and the popularity of each section:

Question Number	Popularity %	Performance in General
1(a)	95	Satisfactory
1(b)		Satisfactory
2(a)	66	Poor
2(b)		Poor
3(a)	7	Poor
3(b)		Fair
4(a)	32	Poor
4(b)		Satisfactory

Section A

1. (a) (i) Good. About 58% of candidates answered this part correctly. They were well aware of the fact that holding the breath involves voluntary control, which should come from the cerebrum.

(ii) (1) Poorly answered. Many candidates simply stated a decrease in blood pH as their answer. They wrongly thought that holding the breath would result in anaerobic respiration which produced lactic acid. They were not aware that carbon dioxide was not excreted if one was holding breath. As a result, the carbon dioxide concentration in blood increased due to accumulation.

(2) Fair. When giving a description of nervous coordination, candidates should bear in mind that they should mention the receptor, the coordinating centre and the effector involved, and their respective locations. In this case, many candidates did not have a clear idea of the location of the chemoreceptors. They wrongly thought that the chemoreceptors were located at the hypothalamus or the respiratory centre. When they described the actions of the effectors, they often forgot that the response involved increased rate and depth of breathing. They often mentioned that the rate of contraction of respiratory muscles increased but

often forgot to mention that the contraction was more powerful than before. Some candidates simply recited that nervous control was for the heart rather than breathing.

(iii) Satisfactory. About 28% of candidates were awarded full marks. Candidates were aware of the responses involved in thermoregulation but their descriptions were inaccurate. For example, they often mixed up constriction with contraction. Another common mistake was that they mixed up the location where the vasoconstriction takes place. They often mentioned the constriction of capillaries instead of arterioles. This showed that candidates failed to link up the structure of the capillary with its function. They did not know that the wall of a capillary being one cell thick is incapable of constriction. It is important to point out how structural feature was related to functioning during the learning and teaching of Biology. Some candidates gave hair erection as their answer. They were not aware of the fact that this response is not effective in humans.

(b) (i) Poorly answered. Candidates showed a poor understanding of the structures and functions of different regions of the nephron. Many candidates wrongly thought that the first coiled tubule was located after point B and said that there was no reabsorption along AB. Some candidates who were aware of the fact that reabsorption takes place along AB failed to recognise that the reabsorption of useful materials drives the absorption of water by osmosis. In fact, water always moves along with solutes because when a solute dissolves in water, water molecules are attracted to and surround the solute molecules. Hence, when solutes are reabsorbed along the first coiled tubule, water will move together with the solute particles in such a way that the solute concentration of the fluid remains unaltered.

(ii) Good. About 39% of candidates scored full marks. Most candidates knew that ADH could increase the permeability of the collecting duct to water. However, some were unsure about how to apply the knowledge to explain the difference in the solute concentration. They did not know that a higher solute concentration inferred more water reabsorption. Some simply stated the data but failed to point out the difference.

(iii) Fair. Many candidates wrongly answered Bowman's capsule. They were not aware that plasma proteins were too large to pass through the capillary wall of the glomerulus.

Section B

2. (a) (i) Good. More than 70% of candidates pointed out at least one effect caused by bottom trawling on the physical environment on the sea bottom. Some candidates ignored the keywords 'physical environment' and gave answers related to biotic factors instead.

(ii) (1) Poorly answered. Many candidates simply compared the biomass inside and outside the marine protected area. They were not aware that sites D and F were further away from the marine protected area than sites B and E. As a result, they failed to state the pattern shown in the data.

(2) Poorly answered. Many candidates related the high biomass in the protected area to the growth and reproduction of marine animals. However, they did not attempt to explain the difference in the animal biomass of the sites outside the marine protected area.

(iii) Very poor. Many candidates simply answered that choosing more sites could enhance the accuracy of the results. However, they were not aware that mean animal biomass was not a good indicator to determine whether the fishery resources were sustainable or not. It could not reflect the number of animal species in the marine protected area.

(iv) Fair. Only 27% of candidates gave one marine protected area in Hong Kong. Many candidates gave wrong answers such as Ocean Park, Victoria Harbour or Tolo Harbour.

(b) (i) Good. About 43% of candidates were able to extract relevant information from the diagram to give a sound explanation for the deterioration of coral health. They related the health deterioration to the cut-off of food or oxygen supply from zooxanthella once they were expelled. Some candidates wrongly said that the coral could not undergo photosynthesis. They did know that corals were animals and not plants.

(ii) Poorly answered. Many candidate simply stated that heat was trapped by carbon dioxide but they failed to point out the heat radiation is reflected from the earth's surface. Many candidates did not link this with the increased seawater temperature.

(iii) (1) Poorly answered. Only about 30% of candidates pointed out that the native corals had greater health deterioration than the transplanted corals once they were put into tanks with seawater at 32°C. However, only some of them could select relevant data from the charts to support their answers. The majority of candidates simply gave lengthy descriptions about the data of each chart. They ignored the requirement for comparison which had been clearly stated in the question.

(2) Very poor. This was a challenging question to candidates as it required them to point out the implication of the study for coral bleaching. In fact, it showed that corals could somehow adapt to the changing environment. However, many candidates simply gave irrelevant answers such as the impact of human activities on global warming.

Section C

3. (a) (i) Fair. About 20% of candidates got full marks. Many candidates wrongly included yeast as the reactant in their word equations. Some candidates neglected the requirement of a word equation and used symbols such as CO_2 for carbon dioxide. Some candidates inaccurately stated that alcohol instead of ethanol was the fermentation product.

(ii) Poorly answered. Most candidates failed to give a clear description of how the malting process would lead to the collection of sugar solution at the end. When they described the germination of barley grains, they often ignored the role of water. They often failed to mention the absorption of water at the beginning. They tended to give lengthy descriptions about the swelling of the seeds and bursting of seed coats but they were not aware that these processes were irrelevant to the sugar solution. Candidates who could relate the enzyme actions to the production of sugar solution often forgot to mention the importance of the sugar solution in the subsequent fermentation process.

(iii) Poorly answered. Most candidates knew that it was related to aerobic respiration but they failed to link this with growth and the increase in the amount of yeast for fermentation.

(iv) Poorly answered. Many candidates did not relate the products of fermentation to the alcoholic component and bubbles of the beer.

(b) (i) Satisfactory. Many candidates failed to recognise the common trend shown by the two types of viruses on the death rate of mice. Some merely gave a description of the two sets of data without comparing them. Nevertheless, most candidates pointed out that virus X was more lethal than virus Y.

(ii) Poorly answered. Only a few candidates related the faster replication rate of viruses in the host to the degree of damage to the body system. They often included in their answers irrelevant information such as HIV infection and mutation of the virus.

(iii) Satisfactory. This was a straightforward question. About 16% of candidates scored full marks. Most candidates simply stated that the virus entered the host cells and took control of them to produce new viruses. They did not know that it was the viral DNA or RNA that was injected into the host cells and the viral DNA or RNA could make use of the host cell's nucleic acid synthesis and protein synthesis to produce new viral DNA or RNA and protein coat respectively.

Section D

4. (a) (i) Fair. About half of the candidates knew that GM salmon could grow faster than non-GM salmon. However, when they attempted to provide an explanation, many of them thought that there was no growth hormone gene in non-GM salmon whereas GM salmon have additional copies of growth hormone genes.

(ii) (1) Poorly answered. Only 22% of candidates gave the advantage of using the microinjection method over the viral vector. Candidates should have paid attention to the scenario and tried to answer the question by referring to the situation given. In this case, the GM salmon was approved for human consumption. Hence, health and safety issues were important consideration when scientists chose the method of transformation.

(2) Satisfactory. Many candidates correctly stated the disadvantage of using the microinjection method.

(iii) Poorly answered. Only 31% of candidates pointed out at least one reason for the selection step. They were not aware that the insertion of the transgene did not guarantee the effect could last forever in the GM salmon in the future generations. Some of them knew the importance of selecting GM salmon that were homozygous for the transgene but they failed to use proper terminology such as establishing pure-bred lines.

(iv) (1) Poorly answered. Only a few candidates referred to the pairing of homologous chromosomes in meiosis to point out that having 3 sets of homologous chromosomes would result in production of gametes with uneven number of chromosomes. This showed that they were not aware of the importance of the pairing of homologous chromosomes in meiosis. In fact, this step ensured that the gamete produces one set of homologous chromosomes so that a zygote resulting from fertilisation could be restored to its normal diploid number. In the English version of the paper, some candidates mixed up 'sterile' with 'sterilize' and gave irrelevant answers related to the killing of microorganisms.

(2) Fair. Most candidates pointed out that sterile GM salmon could not mate with wild salmon, which prevented the spread of the transgene to the wild salmon. Some wrongly said that the breeding took place with other organisms rather than with wild salmon species. Some used very general terms such as gene pollution without elaboration of how this was done with regard to the situation presented in the scenario.

(b) (i) Good. 80% of candidates chose the correct restriction enzyme. However, only some of them gave a clear and logical explanation for their choice. Many candidates were aware that both the plasmid and DNA fragment contained the same DNA sequence but they failed to mention that this sequence was the cut site of the chosen restriction enzyme. Some candidates pointed out that the restriction enzyme could produce sticky ends either on the DNA fragment or on the plasmid. Again, they failed to indicate that both the DNA fragment and the plasmid should have the same sticky end so that they could be joined together due to the complementary nature of the base sequence on these sticky ends. Some candidates used wrong words such as 'compatible' and 'match' instead of 'complementary'.

(ii) Satisfactory. 38% of candidates scored at least two marks in the question. Many candidates pointed out that the ampicillin resistance gene in the plasmid allowed bacteria which have successfully picked up the plasmid during transformation to survive on the agar plate containing ampicillin. However, they were not aware that these plasmids could be either recombinant plasmid with the DNA fragment or the original plasmid which had not been cut or had self-ligated. They wrongly assumed that all plasmids taken up by the bacteria contained the DNA fragments.

(iii) Poorly answered. Only 34% of candidates knew that bacteria that have not survived on an agar plate with tetracycline contained recombinant plasmid with DNA fragments inserted while bacteria that have survived contained the original plasmid. However, only some of them could provide an explanation which was clear enough to score full marks. Most candidates thought that mutation had taken place instead. They did not pay attention to the construct of the plasmid and how the insertion of the DNA fragment would affect the construct.

General comments and recommendations:

Generally, candidates did well in questions requiring a lower cognitive demand such as simple recall of biological knowledge [e.g. Paper 1B Q.1, Q.3(a), Q.4(a), 6(a)], and simple data description and interpretation [e.g. Paper 1B Q.8(a) and Q.8(c)]. However, with questions that involve reasoning [Paper 1B e.g. Q.2, Q.3(c), Q.4(b), Q.5(b)], analysis [Paper 1B e.g. Q.9(b) and Q.9(d)] and inference [Paper 1B e.g. Q.6(b), Q.8(b), Q.8(d), Q.10(c)], candidates experienced difficulty in selecting and organising their ideas to give a coherent and fluent answer. Irrelevant points and vague ideas were often found in the answers of less able candidates. They simply reproduced textbook materials or answers from previous examinations without paying attention to what was actually required by the questions. Sometimes, they gave lengthy irrelevant answers that scored very few marks. Rather than wasting time on writing irrelevant answers, candidates should read the questions carefully to understand the given scenarios and requirements, select useful information, either from the question stem or from knowledge previously acquired, to construct a pertinent answer. Candidates should exercise care with terminology: some terms have specific meanings that cannot be replaced by laymen's terms. Candidates should also pay attention to the details when they describe a certain process [Paper 1B e.g. Q.3(b), Q.4(c), Q.5(a) and Q.11], especially regarding the location of the specific cell type, the site at which the event occurs, or the cell type that performs the function. The lack of these important details often resulted in vague answers that did not score any marks at all.

Candidates were weak at handling questions involving scientific investigation, as evident in their performance in Paper 1B Q.7 despite the fact that the experiment was a familiar and classic experiment that appeared in all textbooks. The performance in questions related to assumptions and controlling variables was unsatisfactory. Despite the fact that some questions called for a comparison of the data sets, candidates often merely provided a simple description of data, i.e. summarised the data in words, without attempting to write statements using comparative terms [e.g. Paper 2 Q.2(a)(ii), Q.2(b)(iii)(1) and Q.3(b)(i)]. Again, they wasted their time on giving irrelevant answers that scored no marks. Candidates should note that when interpreting the data in scientific studies, the differences in the data imply that the treatments have some effect on the outcomes and the explanation of these differences is often related to the aims of the studies. Therefore, it is important to compare and point out the differences in the data sets when interpreting the results of the studies using comparative language. To foster learning related to scientific investigations and data interpretation, it is important for students to have a wider exposure to a diversity of practical activities during the learning of Biology. The poor performance of candidates in questions related to Scientific Investigation and data interpretation supports the observation that most practical work submitted in the SBA involved simple experimental design and qualitative variables that required description of results only. Indeed, candidates showed that they mastered these basic skills, as mentioned in the previous paragraph. Once they have grasped these basic skills, it is important that more challenging practical work, such as practical work involving hypothesis making, assumptions and quantitative variables, is provided so that candidates can excel in their studies and properly handle questions with a higher cognitive demand.

School-based Assessment

All school candidates sitting for HKDSE Biology Examination have to participate in School-based Assessment (SBA). A total of 13,734 Biology students from 441 schools submitted their SBA marks this year. The schools were divided into 24 groups and the implementation of SBA by the teachers in each group was monitored by a District Coordinator (DC). The DCs were also responsible for reviewing the samples of students' work which were submitted.

The statistical moderation method was adopted to moderate the SBA scores submitted by schools. Outlier schools after statistical moderation were identified for further follow-up by the SBA Supervisor. 69.7% of schools fell into the 'within the expected range' category, while 16.3% of schools had marks higher than expected, and 14.0% of schools had marks lower than expected. However, among the schools with marks higher or lower than expected, the majority only deviated slightly from the expected range. These figures seem to indicate that the majority of the teachers had a good understanding of the SBA requirements, and that the marking standards were appropriate. However, a number of schools had moderated SBA scores which were significantly higher or lower than their raw scores, which indicates that the marking standards of the teachers concerned were either too strict or lenient as judged by the supervisor and the DCs. Teachers should pay due attention to this discrepancy and adjust their marking standards in the future.

Some schools were visited by the DCs to gather first-hand information on the implementation of the Scheme in schools. According to the feedback of teachers and the DC's reports, the assessment process was smooth and effective in general. SBA marks were submitted on time and all requirements were met. The major observations on this year's SBA are:

The assessed laboratory reports were largely simple experiments such as comparing the vitamin C content of different fruits. This kind of experiment did not involve a hypothesis. It involved categorical independent variable and a simple experimental design without much underlying theory. While simple experiments can serve to build up students' basic skills and confidence in conducting investigation at the beginning stages, more challenging ones are needed for developing higher levels of competency at later stages, particularly for the academically more capable students.

In explaining the design of the experiment, students mostly focussed on the methods of measuring the dependent variable (DV) and independent variable (IV), such as the working principles of Benedicts' test and DCPIP solution. However, discussions about alternative methods of measurement and their respective strengths and limitations were very rare. Also the process of sampling was seldom discussed as the subjects had been provided by the teacher. The control of an experiment was often routinely done by removing the treatment on the factor being studied without discussions on the limitation of the control and how a more effective one could be set up. We understand that the design of an experiment is limited by the availability of equipment and materials, but a discussion of a wider range of possibilities for investigation at the design stage would be valuable and engaging for students.

Some students seemingly lack a good understanding of the concept of data errors. While they were able to point out some errors in measurement, they seldom took account of them in analysing the data. For instance, students always considered two data sources to be different no matter how small the difference was. Actually the difference may be due to measurement or sampling errors. These errors are often expressed in error bars, confidence intervals or significance tests in actual research, but they rarely appeared in the student reports. Even though sometimes students replicated tests to obtain multiple data with a range of numerical values, the variation in the values was seldom taken into account in the discussion of the results.

The presentation of results in tables was appropriate in general, but graphical representation was not satisfactory. One common problem was that students did not use the line of best fit to estimate values such as water potential of potato tissues. Another problem was that students were not able to make judgements about when a graphical representation was needed. For results having only a few categorical IV such as different kinds of fruit, a bar chart could be used but was not essential. However, for data with continuous IV and DV such as temperature and enzyme activity, a line graph was often required to discern the patterns.

In the discussion of results, students often mixed up a conclusion supported by data with an explanation of the data or conclusion. For instance, in an experiment about different types of substrates on the rate of respiration in yeast, a student wrote 'as shown by the data, the smaller the molecules, the faster the respiration rate'. The molecular weight of the substrates could account for the differences in respiration rate observed, but this conclusion was not directly supported by the data. Another common weakness in the discussion of results was a lack of an appraisal of the degree to which the conclusion could be generalised, from the samples to the general population. For instance, did the water potential of the potato tubers found in an experiment represent that of other kinds of potatoes, or potatoes grown in different conditions?

Students should complete the assessment tasks honestly and responsibly in accordance with the stipulated requirements. They will be subject to severe penalties for proven malpractice, such as plagiarising others' work. The HKDSE Examination Regulations stipulate that a candidate may be liable to disqualification from part or the whole of the examination, or suffer a mark penalty for breaching the regulations. Students can refer to the information leaflet HKDSE Examination - Information on School-based Assessment (http://www.hkeaa.edu.hk/DocLibrary/Media/Leaflets/SBA_pamphlet_E_web.pdf) for guidance on how to properly acknowledge sources of information quoted in their work.