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.

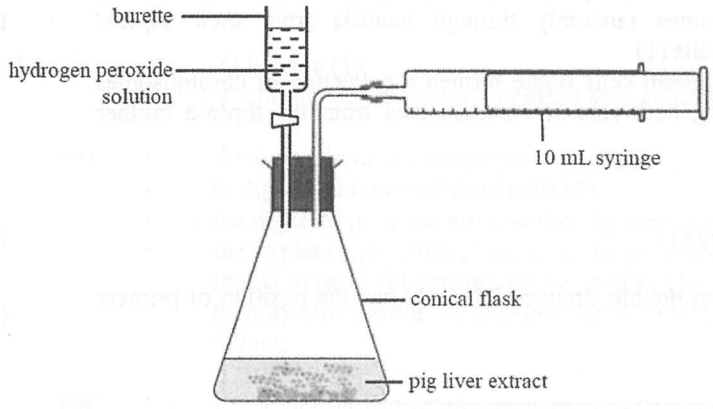
Paper 1

Paper 1 consisted of two sections, Section A (multiple-choice questions) and Section B (conventional questions). All questions in both sections are 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 20. Some candidates had areas of weakness, however, as revealed by their performance in the following items:

Directions: Questions 9 and 10 refer to the diagram below, which shows an experimental set-up prepared by a student to investigate the effect of temperature on catalase activity. Pig liver extract contains catalase which speeds up the breakdown of hydrogen peroxide into oxygen and water. A fixed volume of hydrogen peroxide solution was added to the liver extract and a 10 mL syringe was used to collect the oxygen gas released from the reaction mixture.



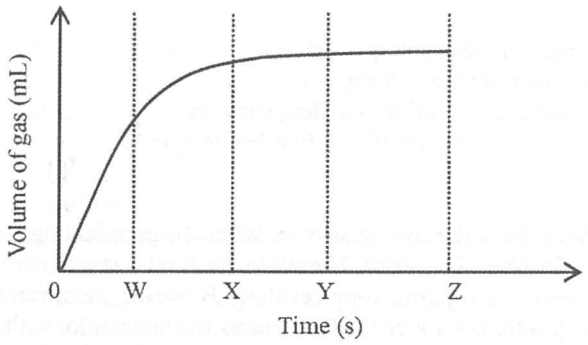
9. In the trial run conducted at room temperature, the student found that the volume of oxygen released was greater than the maximum collection volume of the syringe. How should he modify the set-up in order to collect valid data when repeating the experiment at different temperatures?

(1) use a larger syringe
(2) use a larger conical flask
(3) reduce the volume of the hydrogen peroxide solution added

	A.	(1) and (2) only	(10%)
*	B.	(1) and (3) only	(72%)
	C.	(2) and (3) only	(5%)
	D.	(1), (2) and (3)	(13%)

The question aimed to assess candidates' knowledge and understanding of scientific investigations. A scenario involving a trial run was given as a stimulus. It was gratifying to see that about 72% of the candidates chose the correct modifications. About 10% of the candidates were not aware that reducing the volume of hydrogen peroxide solution (substrate) added would reduce the volume of oxygen (product) released. About 5% of the candidates did not know that a bigger syringe (the measurement tool) could collect more oxygen. About 13% of the candidates wrongly thought that the use of a larger conical flask could hold more oxygen. However, they were not aware the space of the conical flask was pre-occupied with air before the reaction, and thus has no effect on the measurement of oxygen released.

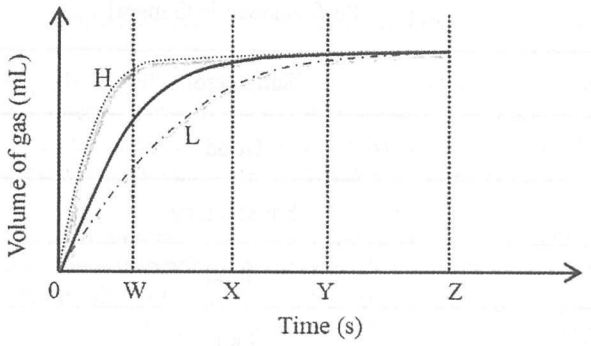
10. After modifying the set-up, the following graph was obtained which shows the volume of gas collected over time at room temperature:



The student planned to use the volume of gas collected over a fixed period of time as the dependent variable to study the effect of different temperatures on catalase activity. Which of the following is the most suitable time period for the measurement?

* A. 0 – W (22%)
B. 0 – X (23%)
C. 0 – Y (33%)
D. 0 – Z (22%)

This was a novel question type for candidates as it involved decision making to choose a sensible time period for subsequent measurements based on the preliminary results obtained in the trial run. Only about 22 % of candidates chose the correct answer. To solve this problem, candidates needed to consider the curves obtained at temperatures higher than room temperature and those at temperatures lower than room temperature:



The curve would shift to the left and level off sooner (just like curve H) at a higher temperature and shift to the right and level off much later (just like curve L) at a lower temperature. Therefore, the chosen time period should allow a reasonable range for the shifts so that the volume of gas collected over that period of time could show the differences. Therefore, the preliminary results in the trial run could give us useful information about the design of the experiment.

30. Which of the following parameters is best used for recording the growth of a potted germinating seedling over a period of time?

	A.	the dry mass of the seedling	(24%)
	B.	the fresh mass of the seedling	(38%)
*	C.	the total surface area of the seedling's leaves	(18%)
	D.	the time taken for the seedling's first leaf to appear	(20%)

Only about 18% of the candidates chose the correct answer. When the germinating seedling continues to grow, the number of leaves and the size of each leaf increase. Therefore, the total surface area of the seedling's leaves could be a parameter to show the growth of a germinating seedling. However, most candidates chose to measure the fresh mass of the seedling. They were not aware that fresh mass fluctuates a lot with the water content of the soil. Therefore this is not an appropriate parameter. The use of dry mass, on the other hand, would kill the seedling and was therefore a one-time measure per seedling. To show the growth over a period of time, a large number of seedlings would be required and the average growth would need to be measured. As for the time taken for the seedling's first leaf to appear, again this was a one-time measure.

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	Satisfactory
2	Good
3	Satisfactory
4	Good
5	Fair
6	Satisfactory
7	Satisfactory
8	Good
9	Poor
10	Poor
11	Poor

1. (a) (i) Good. About half of the candidates answered this question correctly. Most candidates knew that skin is a physical barrier but they were not aware that the blood clots formed on the wounds also constitute a physical barrier.

(ii) Poor. Only about 20% of the candidates answered this question correctly. Many wrongly chose antibodies as the chemical barrier, confusing first and second lines of defence. Antibodies fight against pathogens which have already overcome physical and chemical barriers.

(b) Good. About 19% of the candidates scored full marks in this question. Many candidates failed to give accurate descriptions of the roles of P in phagocytosis. Many candidates mixed up the terms antigens, antibodies and pathogens. As a result, they gave wrong answers such as 'P attached to pathogens', ' P binds antigens together to form a clump' and ' P combined antibodies and pathogens together'. Some candidates did not know that the clump formed would facilitate phagocytosis. Some candidates neglected the requirements of the question and gave functions of antibodies which were not related to phagocytosis.

2. (a) Satisfactory. About half of the candidates correctly chose P as the substrate. Of these candidates, about two thirds provided a clear explanation for their choice. Others simply repeated the definition of anabolic reaction without referring to the given diagram. Some candidates mixed up anabolic reactions and catabolic reactions. As a result, they chose Q as the substrate.

(b) Good. About 75% of the candidates correctly chose R as the enzyme. Of these candidates, about half of them provided a clear explanation for their choice. Candidates tended to ignore the given diagram and recite the characteristics of enzymes. Since characteristics such as the ability for enzyme to be regenerated or reused were not observable in the given diagram, they were not relevant.

3. (a) Very good. About 65% of the candidates gave a correct structure. Answers such as ovum and pollen grains were not accepted as these are cells produced by meiosis rather than floral structures.

(b) (i) Fair. Only about 39% of the candidates correctly named event W as crossing over. Some wrongly stated 'cross over' in their answers. Some candidates wrongly stated DNA duplication or prophase as their answers despite the fact that the overlapping of chromosomes had been highlighted in the photomicrograph.

(ii) Poor. Many candidates mixed up the terms 'homologous chromosomes', 'sister chromatids' and 'non-sister chromatids'. As a result, they gave wrong descriptions about the exchange of genetic materials. For example, they wrote 'exchange of genetic materials between sister chromatids' or 'exchange of materials between non-homologous chromosomes'. They did point out that event W would increase the genetic variation within the population. Some candidates only mentioned pairing of homologous chromosomes. Consequently, they erroneously gave the importance of the pairing process instead of crossing over.

(c) (i) Good. About 80% of the candidates were able to point out which photomicrograph represented the first meiotic cell division. However, only one-third of them were able to present the pairing of homologous chromosomes as supporting evidence. Others often gave irrelevant descriptions which were not observable in the photomicrograph.

(ii) Poor. About half of the candidates scored zero mark in this question. They were confused about the purposes of the first and second meiotic cell division. Many candidates wrongly thought that the chromosome number was halved in the second meiotic division. Some candidates simply wrote some features of the divisions, such as the number of cells produced in each division, or the importance of meiotic cell division. In fact, there are two sets of homologous chromosomes and 23 chromosomes in each set. Therefore, the meiotic cell division involves the separation of duplicated chromosomes in an orderly manner such that each gamete would correctly end up with one set of homologous chromosomes. The

pairing of homologous chromosomes in the first meiotic cell division allows the separation of the two sets of homologous chromosomes while the lining up of chromosomes in the second meiotic cell division allows the separation of duplicated chromosomes (i.e. sister chromatids).

4. (a) Excellent. About 76% of the candidates correctly chose the muscles involved.

(b) Poor. Many candidates did not pay attention to the requirement that the possible defects should be related to neurotransmission at the neuromuscular junction. As a result, they often gave answers related to nervous transmission along the neurone or issues related to muscle contraction, which were irrelevant. Many candidates mixed up axons and dendrites and wrongly stated that the dendrites could not release neurotransmitters. Some candidates treated it as normal synaptic transmission and gave answers related to the dendrites failing to receive the neurotransmitters, ignoring the fact that the receiving side should be the muscles.

5. (a) Good. Most candidates gave a correct comparison of the oxygen and glucose content in blood vessels A and B. However, the explanations were often very vague and unclear. When they attempted to explain the oxygen content, some candidates gave incomplete answers such as 'gas exchange takes place in air sacs' or 'oxygen diffuses to capillaries / blood vessel A' while some candidates simply stated 'the blood in vessel A is oxygenated blood while that in B is deoxygenated blood' which offered no explanation at all. When they attempted to explain the glucose content, some candidates simply stated 'glucose is consumed' or 'glucose is taken up by the body / cells'. As it involved comparison between the blood vessels leading to and leaving air sacs, candidates should have specified that the cells that have taken up glucose for respiration are the cells of the air sacs themselves. Many candidates did not mention that glucose is consumed for respiration. Some candidates mixed up the two blood vessels. As a result, they gave wrong comparisons.

(b) Poor. Many candidates simply gave the adverse effects on gas exchange such as 'dust deposits increase the diffusion distance' or 'dust deposits reduce the surface area'. They neither made reference to the conditions of the lung disease nor gave descriptions of how the dust deposits brought about the effects. They should have related the increased diffusion distance to the formation of a layer of dust on top of the respiratory surface or related the reduced area available for gas exchange to the dust deposits covering up the surface of the air sacs. Many candidates were not aware that the hardened layer of dust would decrease the elasticity of the lungs, which in turn would decrease the capacity of the lungs when inflated.

6. (a) Excellent. About 87% of the candidates gave the correct sucrose solution concentration which has the same water potential as the potato cells. Some failed to give the unit and lost marks. About half of the candidates gave a clear explanation of how they arrived at the answer. Some explanations were vague and unclear. For instance, some candidates simply stated there is no net movement but forgot to mention that the movement refers to water. Some stated there is no movement of water but forgot the concept of net movement. Some forgot to mention that the concentration at which there was no change in mass was the concentration which had a water potential equivalent to that of potato cells.

(b) Poor. Many candidates sketched a curve which shifted to the right instead of to the left. Some had the sketched curve with the same starting point or the finishing point as the original curve. Some drew a curve that intersected with the original curve.

(c) Very poor. Many candidates did not distinguish accuracy from reliability. They mistakenly thought that measuring the change in mass of three potato cylinders would increase the accuracy of the experiment. In fact, accuracy refers to the exactness or precision of a measurement. For example, using an electronic balance instead of a triple beam balance would increase the accuracy. Reliability refers to the degree with which repeated observations and measurements taken under identical circumstances will yield the same results. In this case, the water potential of the potato cells might vary between different parts of the same potato or between the same parts from different potatoes.

Therefore, taking repeated measurements would allow one to detect if there were individual differences and if such differences would affect the reliability of the results. Only a small proportion of candidates were able to point out that this treatment helped to minimise individual differences and thereby increased the reliability of the experiment.

(d) Satisfactory. Most candidates correctly pointed out that Y is the cell wall. However, they had difficulty in identifying X. Many of them labelled it as starch instead of a starch granule, showing that they did know that starch would be stained by iodine solution but they neglected the requirement of stating a cell structure when they answered the question. Some candidates wrongly labelled X as a chloroplast, nucleus or vacuole while some candidates wrongly labelled Y as a cell membrane.

(e) Poor. Many candidates failed to relate the high vulnerability to the fact that all potatoes shared the same genetic composition due to vegetative propagation. Candidates who said that the offspring produced by vegetative propagation have a similar genetic composition to their parents did not know that it is impossible to have evolved a strain of potatoes which was resistant to the pathogens if there was no genetic variation. Therefore, the whole population would be susceptible to attack by the pathogens. Some candidates were not aware that crops were all grown close together in agricultural practice and blamed crop overcrowding and the spread of disease.

7. (a) Very good. Most candidates were able to give the type of succession shown; however, only half of them provided a proper explanation. They simply gave the definition of secondary ecological succession without referring to the given situation.

(b) (i) Poor. Only a small number of candidates knew that the nitrogen cycle is involved in restoring the nitrogen content of the soil. However, they were not aware that the landslide itself removed the top soil with humus containing the nitrogen compounds, which was the major reason for the drop in the nitrogen content after the landslide. They often mixed up the roles of the different bacteria involved. Candidates were able to point out that the decomposition would return nitrogen compounds back to the soil but only some of them mentioned the actions of nitrogen fixing bacteria (especially those in the root nodules of some plant species). Some candidates simply described the data and did not offer any explanation.

(ii) Satisfactory. Most candidates pointed out the change in the plant composition (more herbaceous plant species than woody plant species in the early stage and increasing number of woody plant species / decreasing number of herbaceous plant species at a later stage). However, some candidates gave explanations such as 'the shading of the woody plants hindered the growth of herbaceous plants' or 'herbaceous plants had a faster growth rate than woody plants', which were not related to the change in soil nitrogen content. They should have paid attention to the requirements of the question. Some candidates simply described the data and did not offer any explanation. Some candidates wrongly thought that woody plants became the dominant species. They were not aware that the number of woody plant species did increase but at a rate lower than that of herbaceous plant species.

8. (a) (i) Good. About 63% of the candidates drew a proper conclusion based on the information given.

(ii) Excellent. About 71% of the candidates were able to provide an elaboration of how the events in the discovery of ultrasound navigation of bats could be used to illustrate different aspects of the Nature of Science. This was probably because choices were given and candidates could choose two of the three aspects for the elaboration. As a result, they could attempt the two aspects which they were confident with. Some candidates simply gave repeated descriptions of the events without elaborating on how the events were related to the nature of science.

(b) (i) Very poor. Many candidates did not distinguish between results and conclusions. They simply described the results, e.g. 'treatment A and treatment B resulted in the same rate of successful escape'. They were not aware of the purpose of including the treatment involving cutting and regluing the wing tail in the experimental design. In fact, a similar design had been employed in the study of the effect of auxins on germinating seeds in which the cut tip was put back onto the seedling to demonstrate that the cutting treatment itself did not affect the results. Only a small proportion of candidates were able to transfer and apply the same concept to this novel situation and point out that the manipulation involving cutting and gluing had no effect whatsoever on the rate of successful escape.

(ii) Very good. About 55% of the candidates scored full marks in this question.

(iii) Very good. About 50% of the candidates drew a valid overall conclusion.

(c) Satisfactory. Most candidates described the evolution of the long wing tail in the moths but only a small number of them scored full marks. Many candidates failed to mention that the length of the wing tail was a genetic variation. Some candidates pointed out that the moths with long wing tails have a higher chance of survival but they failed to identify predation by bats as the selection pressure.

9. (a) Fair. Most candidates had difficulty in providing full and clear support for their answers. Many candidates just gave description about the decrease in the average mass of the two snails but only some of them were able to link this with their ecological relationship which was competitive in nature. As a result, many of them failed to deduce the effect of competition on the population of snail K.

(b) Poor. Most candidates had difficulty in relating the destruction of young leaves and buds to the chance of reproduction. They often focused their discussion on the growth of individual plants instead of the effect on the community of the local wetland.

(c) Very poor. Many candidates did not know the meaning of biotic factor and gave irrelevant answers. Some candidates were able to point out that the apple snails might have a higher reproductive rate in their answer.

(d) Poor. Many candidates wrote about how foreign species could be imported into Hong Kong, which was irrelevant.

10. (a) Very good. About 70% of the candidates provided a clear description of the relationship between the rate of transpiration and the stem diameter. Some failed to figure out the causal relationship and thought that the rate of transpiration increased as the stem diameter decreased. Some candidates misinterpreted the relationship as inversely proportional or opposite.

(b) Very poor. Many candidates simply described the process of transpiration. Only a small proportion pointed out that the resulting transpiration pull was a pulling force which would pull the wall of the xylem vessels inwards, leading to a decrease in the diameter of xylem vessels. The higher the transpiration rate, the greater the pulling force and the smaller the diameter of xylem vessels. Some candidates thought that the stem diameter decreased because less water would remain in the stem during transpiration.

(c) Poor. Most candidates experienced difficulty in providing a clear description of the adaptive features and how these features were related to water transport. Descriptions of the features were often incomplete; for example, they mentioned modifications such as the absence of end walls or cytoplasm but failed to state clearly that it formed a hollow tube. Some treated these as separate features. The concept of resistance was seldom used to explain the advantage of this feature. Most candidates mentioned that the xylem wall was thickened or lignified, but they gave the advantage of supporting the plant instead of preventing the collapse of the xylem vessels or withstanding pressure. Some stated that the xylem vessels were dead and wrongly thought that this was an advantage for water transport because water would not be consumed.

11. Questions involving genetics and inheritance demand deduction and logical reasoning to work out how would the allelic combinations of the offspring change in different situations. The allelic combinations would lead to different possible phenotypes expressed in the offspring. Therefore, this essay was considered demanding and the performance was poor in general.

The first part of the essay required candidates to explain why genetic diseases are often carried by recessive alleles. A small proportion of the candidates scored full mark in this part while the rest of them had difficulty in answering the question. Very often, they were able to point out that the recessive alleles would be masked by the dominant alleles. However, they failed to establish the reasoning that the masking effect allowed the passage of the disease-carrying allele from generation to generation without being selected against by natural selection. Their dominant counterpart, on the other hand, would be expressed in both homozygous and heterozygous conditions, disadvantaging the individuals and making them more susceptible to elimination by natural selection. Some candidates gave some descriptions of genetic diseases which were irrelevant.

The second part of the essay required candidates to compare the effects of the breeding processes on the genetic composition of the offspring and used this as a basis to discuss why pure-bred pets were at a higher risk of suffering from genetic diseases than hybrid pets. Again, a small proportion of the candidates scored full marks in this part while the majority had difficulty in answering the question. Many candidates wrongly thought that hybrid pets resulted from breeding between different species. Some candidates tried to compare the breeding processes step by step instead of the effects on the genetic composition of the offspring. In general, candidates knew that there would be more genetic variations in hybrid pets and fewer genetic variations in pure-bred pets. However, they often failed to link these deductions with the likelihood of having more homozygous conditions in pure-bred pets, making the chances of expressing the genetic diseases in homozygous recessive conditions greater.

Some candidates displayed a poor understanding of the terms in genetics and inheritance. They failed to distinguish between 'alleles' and 'genes' and mixed up 'homologous' with 'homozygous'. Some candidates thought 'pure-bred' carried the same meaning as 'homozygous' while 'hybrid' carried the same meaning as 'heterozygous'. As a result, they gave irrelevant answers and scored zero.

This year, about 8% of the candidates did not attempt the essay. The distribution of the scores awarded for effective communication is as follows:

Marks awarded for effective communication	Percentage of candidates
0	40
1	38
2	12
3	2

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) 1(b)	96	Good Poor
2(a) 2(b)	58	Poor Poor
3(a) 3(b)	7	Satisfactory Poor
4(a) 4(b)	39	Fair Poor

Section A

1 (a) (i) (1) Good. Most candidates correctly described the change in the plasma oestrogen level of the given period. About 40% of the candidates provided a clear explanation for the change. Instead of explaining the change, many candidates gave its consequences.

(2) Good. Most candidates correctly described the change in the plasma oestrogen level of the given period. About one third of the candidates provided a clear explanation for the change. Again, many candidates gave the consequences of the change rather than how it was brought about. Some simply stated that the oestrogen came from ovaries but failed to point out that it was secreted by the developing follicles.

(ii) (1) Satisfactory. Most candidates understood that negative feedback was in operation. However, they had difficulty in quoting relevant data to support their answer. Many candidates simply described the change in FSH level in the two graphs. Only some were aware that the difference in the changes was a result of the injection treatment and how it would be used as evidence to show that it was negative feedback. Some candidates wrongly described it as 'negative effect' instead of 'negative feedback'.

(2) Good. About 40% of the candidates correctly explained the function of oestrogen in contraceptive pills. Some candidates ignored the fact that the question focused on the function of oestrogen only. They mentioned the role of progesterone, which was irrelevant.

1 (b) (i) Poor. Many candidates simply used 'increased' and 'decreased' to describe the change in the cardiac output of the dehydrated group and hydrated group respectively. As a result, they did not account for the maintenance of constant cycling speed in the hydrated group. They did not pay attention to the magnitude of the change. In fact, the change in the cardiac output of the hydrated group is minimal and could be considered 'more or less the same'. Many candidates failed to establish the link between blood supply and cycling speed in the two groups. Instead, they tried to explain the drop in performance in terms of accumulation of lactic acid due to anaerobic respiration, resulting in muscle fatigue. They failed to see that (1) the decrease in cardiac output would reduce the supply of both food and oxygen to the contracting muscles and (2) both groups were performing the same intensity of exercise, hence lactic acid will be produced in both groups. Therefore, the drop in performance should be related to the total energy supplied. Candidates needed to pay attention to the data presented in the question and work out clearly how the differences in the treatments of the two groups would lead to the differences in the results obtained.

(ii) (1) Very good. About 70% of the candidates correctly pointed out that it was the stroke volume that leads to the change in the cardiac output in the dehydrated group. Some candidates answered both the stroke volume and heart rate, suggesting that they simply recalled information they had learned without paying attention to the data and requirements in the question.

(2) Poor. Many candidates described at length the role of kidney tubules in osmoregulation, which was irrelevant. They failed to see that the dehydrated group kept losing water without replenishment. Although some candidates mentioned water loss, they were not aware that the total blood volume would decrease.

(iii) Very poor. Many candidates described the nervous control of heart rate to explain why there was an increase in the heart rate of the dehydrated group. However, the question was on comparing the heart rate of the groups and required an explanation of why the dehydrated group had a greater increase in heart rate than the hydrated group. As a result, many candidates failed to score marks. Only a small number of candidates related it to the greater drop in stroke volume in the dehydrated group and the necessity of having a higher heart rate for maintaining a high cardiac output. In fact, the cardiac output of the dehydrated group could be maintained at 60 minutes. However, as the stroke volume continued to drop further for the next 50 minutes, the increase in the heart rate could not counteract the effect of the decrease in stroke volume anymore. As a result, the cardiac output of the dehydrated group could not be maintained, nor the cycling speed.

Section B

2. (a) (i) Poor. Only a small number of candidates correctly gave the processes of primary treatment in sewage treatment plants. Some wrongly included chemical treatments in their answers.

(ii) (1) Poor. Most candidates pointed out that the effluent from the sewage treatment plant had lower organic nitrogen content than that of artificial wetland. However, they failed to provide a full explanation. Most of them were not aware that air was pumped into the sewage to speed up the aerobic decomposition of organic pollutants in sewage treatment plant. Others gave descriptions of the nitrogen cycle in their answers. Some candidates mixed up decomposers with nitrogen fixing bacteria and nitrifying bacteria.

(2) Satisfactory. Most candidates pointed out the correct nutrients in the effluent but only some related them to the synthesis of correct biomolecules. Many candidates wrongly referred to cell structures instead of biomolecules in their answers.

(iii) Very poor. Only some candidates gave clear advantages by referring to the differences in the operation of the two systems. They referred to the manpower requirements but some gave vague answers such as 'lower cost' without any elaboration.

2. (b) (i) Satisfactory. Answers usually related to the destruction of habitats or a decrease in biodiversity. Some did not refer to the photographs when discussing the impacts of mining on the habitat but gave irrelevant answers related to heavy metal pollution.

(ii) (1) Poor. Many candidates ignored the requirements about providing evidence to support why species B is more suitable for removing heavy metal X in the ecological restoration of the abandoned mining site. They drew simple conclusions such as 'species B grew faster than species A' or 'the root of species B absorbed more heavy metal X'. They were not aware that the addition of fertiliser would increase both the dry mass of species B and the concentration of heavy metals X in their roots, and hence the amount of heavy metal X accumulated in the roots of species B was multiplied. As a result, species B was better at removing heavy metal X from the soil of the abandoned mining site. Some candidates simply repeated the data about species B without any deductions.

(2) Satisfactory. Both species B and C had their advantages but candidates often failed to establish clearly their reasoning. For example, they were not aware that the shoot of species C could be harvested and therefore heavy metal X could be removed from the soil, or they knew heavy metals in shoots might pose health threats to other organisms but they did not state clearly that they would enter the food chain via herbivores.

(3) Very poor. Many candidates thought that native plant species grew or reproduced faster than foreign plant species, which is not necessarily true. They missed the aim, which was about restoring the habitat.

Section C

3. (a) (i) Satisfactory. About 25% of the candidates scored full marks. Some failed to give a unit in their answer while others had wrong calculations.

(ii) Good. Most candidates correctly chose pathogen C. They usually related it to the highest doubling time in pH 4 at 37°C. However, only a few said clearly that these conditions resembled the conditions in the human stomach.

(iii) Poor. Many candidates did not distinguish food poisoning from food-borne infection. They gave contradictory arguments in their answers. Some gave the definition of food poisoning but did not refer to the data.

3. (b) (i) Fair. Only a small number of candidates correctly identified both structures, X and Y.

(ii) Poor. Only a small number of candidates correctly referred to the external digestion of fungi and gave full explanations. Often missed was the fact that after external digestion, the digested products would be absorbed by the fungi for growth and as a result, the hyphae could grow deeper into the skin tissue and stimulate the nerve endings. Some candidates wrongly referred to the ecological role of fungi as decomposers.

(iii) (1) Very good. About 82% of the candidates gave correct answers.

(2) Very poor. Many candidates did not refer to the life cycle of fungi and wrongly thought that the fungi had developed drug resistance. Some candidates simply stated that some fungi were killed but some were not. They forgot that the spores produced from reproduction could survive through adverse conditions and germinate again when the conditions were favourable. Only a small number of them referred to the lysis of hyphae / structure X in their answer.

Section D

4. (a) (i) Poor. Many candidates answered only suspect 2 without giving any deductions.

(ii) Fair. Many candidates knew that the different patterns of DNA fingerprints were produced because shorter DNA fragments would migrate at a faster speed than longer DNA fragments during gel electrophoresis. However, only some candidates explained how the different lengths of DNA fragments were produced. Some candidates simply stated that the VNTR was different in different persons instead of the number of repeats; hence, the higher the number of repeats, the longer the DNA fragments after enzyme digestion.

(iii) (1) Good. Most candidates got the correct answer. They were aware that there were other nucleated cells, such as white blood cells, in the blood stain. Some candidates wrongly thought that there was mitochondrial DNA in red blood cells or there were immature red blood cells in the blood stain.

(2) Poor. Many candidates were not aware that there were a large number of sperm cells in semen, and so the chromosomes obtained would be the sum of all the chromosomes available, i.e. the same as that of diploid cells.

4. (b) (i) Good. Most candidates stated process II.

(ii) Poor. Many candidates were not aware that the expected PCR product was a double-stranded DNA fragment with a primer on each DNA strand, but at different ends. They usually labelled one strand as the original DNA and the other as template DNA. In some cases, candidates labelled primers at two ends of one of the DNA strands.

(iii) Very poor. Many candidates misinterpreted the question and simply stated that the PCR product was shorter when a short primer was used. They were not aware that the chance of annealing to a wrong position would be increased as the combinations of the base sequence would be limited for shorter primers.

(iv) Fair. Many candidates pointed out that *Agrobacterium* could infect plant species and transfer gene K to the infected plant cells. However, only some mentioned the recombinant plasmid.

(v) Poor. Many candidates simply stated that the chance of survival for transgenic plants was higher, or the transgenic plants would bear more fruit, without referring to the functions of roots. Some presented their answers as if transgenic crops and non-transgenic crops would be cultivated together and the transgenic crops would out-compete non-transgenic crops.

General comments and recommendations:

Generally, candidates were able to handle simple and straightforward questions. For questions that required selection and application of knowledge, they recited knowledge about the topics concerned but their answers were often irrelevant. Similar cases were noted in other questions where candidates did not score marks because they gave information which was irrelevant to the situations or scenarios presented in the question. Candidates should pay attention to the requirements of the question and avoid giving irrelevant answers. For questions involving scientific investigations and data analysis, most candidates were able to handle basic and simple questions such as comparisons of data, descriptions of trends and explanation of results involving familiar situations. However, they had difficulty in handling questions involving unfamiliar situations. Only the more able candidates were able to establish links between the results and the treatments. Others repeated the data without further actions or recited related knowledge without making connections with the results or treatments. This reflected that candidates are able to memorise information but often fail to apply it to phenomena in novel situations. Candidates should pay more attention to the requirements of the questions and the information presented in them. Only if they select the relevant knowledge and apply it in working out the link to the results / phenomena presented can they excel in questions involving higher thinking order skills.