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 22.4. Some candidates had areas of weakness, however, as revealed by their performance in the following items:

Directions: Questions 2 to 4 refer to an experiment on the enzyme catalase, which speeds up the breakdown of hydrogen peroxide to release oxygen. John added a 1 cm^3 cube of pig liver to a boiling tube containing 5 mL hydrogen peroxide solution. Gas bubbles were released and he used a glowing splint to test the gas. He repeated the experiment with beef, potato and apple. The results are shown below:

Tissue	*Rate of bubbles released*	*Glowing splint re-lit*
Pig liver	Moderate	Yes
Beef	Moderate	Yes
Potato	Slow	Yes
Apple	Slow	Yes

2. Which of the following statements is an observation of the experiment?

	A.	These tissues contained catalase.	(6%)
	B.	Oxygen gas was released in the reaction.	(16%)
*	C.	The gas released re-lit the glowing splint.	(54%)
	D.	Animal tissues had more catalase than plant tissues.	(24%)

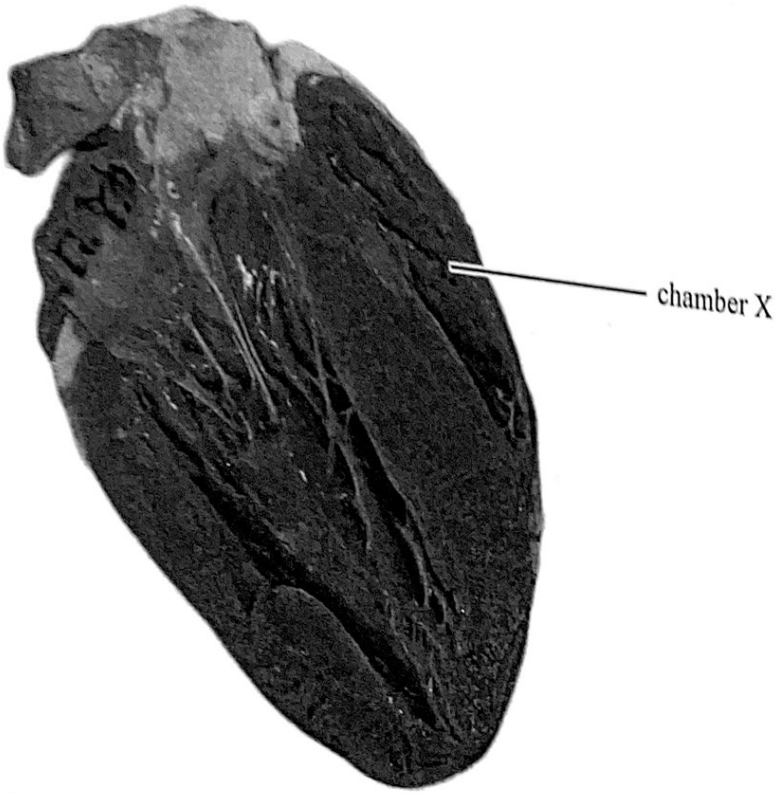
This was a simple question to assess candidates' ability to distinguish observations from inferences. However, only 54% of candidates chose the correct answer. The statement 'the gas released re-lit the glowing splint' was a qualitative observation that described what happened in the glowing split test. All other statements were reasoned deductions or inferences from the observations in the experiment. For example, it could be inferred that the gas released from the tissues was oxygen because it re-lit the glowing splint.

29. Which of the following substances contribute(s) most to the increase in biomass of a plant?

	A.	water	(47%)
	B.	oxygen	(4%)
	C.	minerals	(21%)
*	D.	carbon dioxide	(28%)

Despite the fact that photosynthesis is taught as the process that produces food in plants, only 28% of candidates correctly chose carbon dioxide as the factor that contributed most to the increase in the biomass of a plant. 47% of candidates chose water instead, and 21% chose minerals, both of which are absorbed from the soil. Candidates might have confused biomass with mass, thus they chose water which contribute much to the mass of plant. Or candidates might have thought that the biomass of the plants develops from visible entities such as water or minerals.

6 The following photograph shows a dissected pig heart:



Which of the following descriptions about chamber X is correct?

A. It receives blood from the pulmonary vein. (42%)
B. It pumps out blood to the aorta. (14%)
C. It receives blood from the vena cava. (24%)
* D. It pumps out blood to the pulmonary artery. (20%)

The question aimed to assess candidates' ability to identify the heart chambers of a dissected pig heart and relate them to the blood vessels that are connected to the chambers. Only 20% of candidates correctly identified chamber X as the right ventricle, which supplies blood to the pulmonary arteries. 42% thought that it was the left atrium while 24% of candidates thought it was the right atrium. They failed to recognise that the ventricular septum was located next to chamber X and therefore it was impossible for chamber X to be an atrium. This showed that candidates had difficulty in relating the locations of the chambers to the key structures of the dissected pig heart.

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

(a) Good. About 30% of candidates scored full marks. Many candidates gave only C or D as the answer for the failure of sound conduction.

(b) Good. The mean mark was about 61% of the full score. Many candidates wrongly spelt the word cochlea. Many candidates did not know that vibrations would finally set the fluid inside the cochlea in motion, which is then detected by sensory hair cells. Some candidates simply stated that the nerve impulses are transmitted through sensory neurones instead of specifying the auditory nerve.

(a) Satisfactory. About 45% of candidates answered this question correctly. Some candidates correctly identified X as a vacuole but misspelled the word. Others gave wrong answers such as cytoplasm, chloroplast or nucleus, showing that they had difficulty in identifying the various organelles shown in the photomicrograph.

(b) Satisfactory. About 23% of candidates scored full marks. Candidates usually said that the cells were plasmolysed or the cell membrane detached from the cell wall. Only some candidates attempted to describe the change in position of the chloroplasts, which was an obvious observation when comparing the two photomicrographs. However, they tended to give a simple description without referring to their relative positions. They did not know that chloroplasts were condensed at the centre of the cell because the vacuole has shrunk and the cell membrane detached from the cell wall. Some candidates answered that the cells were flaccid without knowing that flaccid referred to the texture, which could not be observed directly from a photomicrograph.

(c) Good. About 51% of candidates scored full marks. Instead of giving a comparison of the water potentials of sucrose solution and leaf cells, candidates often mentioned that the sucrose solution had a low water potential or that the leaf cells had a high water potential. Some candidates simply stated that the sucrose solution was hypertonic. They failed to show the comparison as the terms hypertonic, isotonic and hypotonic require a reference point. They should have written 'the sucrose solution is hypertonic to the leaf cells'. Some candidates did not state the direction of

water movement clearly while some missed out the word 'osmosis'.

3. This question presented both familiar and unfamiliar situations and required candidates to draw upon knowledge from the familiar situation and apply it to solve the problem in the unfamiliar situation. In part (a), skills assessed in SBA (photomicrograph interpretation) were required to compare the tissues shown in the two photomicrographs to single out the tissue which was present in Photomicrograph X (a familiar leaf section) but absent from Photomicrograph Y (an unfamiliar leaf section). Part (b) built upon the difference in the tissue distribution and required candidates to relate the distribution of the photosynthetic tissue to the vertical orientation of leaves. In this case, candidates should also have drawn upon experiences from everyday life in attempting to explain the relationship. Candidates did well in part (a) but answered poorly in part (b).

(a) (i) Excellent. About 79% of candidates correctly pointed out that tissue P was absent from Photomicrograph Y. This showed that candidates were able to transfer the skills required in SBA to solve the problem.

(ii) Fair. About 28% of candidates got full marks. Some candidates gave inaccurate descriptions of the observable features. For example, they said that the cells were packed regularly or evenly instead of packed closely. Many candidates stated that there were a lot of chloroplasts in tissue P; however, chloroplasts could not be observed in this photomicrograph. Some lost marks because their answers were lacking in detail. For example, they often stated that it helped photosynthesis but did not say how (i.e. absorbing more light).

(b) Very poor. More than half of the candidates pointed out that the photosynthetic tissue was evenly distributed throughout the leaf section. However, only a small proportion of candidates were aware that the sun shines from different directions as the earth rotates. As a result, both sides of the leaves will have the chance of receiving sunlight. In fact, many candidates ignored the fact that the question emphasised the relationship between the distribution of photosynthetic tissues and the orientation of the leaves. They gave irrelevant answers regarding how the distribution of vascular bundles supports the leaves, or descriptions related to phototropism. This showed that candidates had difficulty in applying relevant knowledge to solve problems involving unfamiliar situations.

4. (a) Excellent. About 91% of candidates correctly chose low-income countries as the answer.

(b) Very good. The mean mark was about 67% of the full score. Instead of explaining why there were more infectious diseases as one of the top five types of diseases that caused death in low-income countries, some candidates gave answers related to high-income countries and so scored no marks.

(c) Good. The mean mark was about 59% of the full score. 22% of candidates provided a clear and logical answer to this question. Most candidates correctly stated a lifestyle habit in high-income countries which is related to coronary heart disease. However, the explanations often lacked details or accuracy. For example, some candidates simply mentioned the deposit of fat/cholesterol in blood vessels but did not pinpoint it in coronary arteries. Also, they simply stated the nutrients/blood/oxygen supply to the heart was reduced instead of specifying the heart muscles. Candidates should pay more attention to the details such as the exact location and type of cells involved.

5. (a) Excellent. About 79% of candidates correctly identified the sex chromosomes in the photomicrograph.

(b) Fair. About half of the candidates correctly identified that the karyotype was obtained from somatic cells and they usually provided a supporting reason. Some candidates mixed up chromosomes with chromatids. Other candidates wrongly thought that pairing of homologous chromosomes was taking place and thought the karyotype was taken from a gamete.

(c) Fair. Most candidates were aware that the somatic cells of the mother have two X chromosomes while those of the father have one X chromosome and one Y chromosome. However, they had difficulty in describing how the sex chromosomes were inherited by the offspring in terms of the types of gametes produced.

6. (a) Poor. Most candidates pointed out that blood group O individuals were universal donors. However, many of them were not aware that they could only receive blood from the same blood group. Some confused antigens with antibodies. Some candidates simply wrote there were no antigens in blood group O instead of writing no antigens A and B. Only some candidates knew that the population of blood group O individuals is the largest in Hong Kong.

(b) Excellent. About half of the candidates scored full marks for this question. Most candidates correctly pointed out the difference between male and female donors. Some candidates simply stated menstruation but did not elaborate by stating that it resulted in regular loss of blood in females. Many students misspelt 'menstruation' as 'measuration' or 'mensuration'.

7. (a) Satisfactory. About one-third of the candidates scored full marks in this question. However, the answers of some candidates often lacked some key information. For example, candidates mentioned digestion but did not relate it to carbohydrates with glucose as products, or they mentioned absorption but did not state that it occurred in the small intestine. Some did not pay attention to the question and attempted to describe the differences between the two curves.

(b) (i) Excellent. About 91% of candidates correctly named the hormone insulin. Some candidates answering in English gave a wrong spelling of insulin while some incorrectly answered glucagon.

(ii) Fair. Candidates often gave incomplete or inaccurate descriptions of the functions of insulin. Candidates should bear in the mind how hormones work in our body: hormones are secreted by endocrine glands, circulate in the blood stream and are then bound to the receptors on the membrane of the target cells to trigger responses. Candidates sometimes mixed up or forgot to mention the target cells in their answers. For instance, many candidates wrongly stated that insulin converted glucose to glycogen. However, insulin does not participate in the conversion. In fact, it binds to the receptors of target cells and stimulates the uptake of glucose from blood. In the liver cells, insulin triggers a cascade of reactions. The stimulation of the enzymatically catalyzed conversion of glucose to glycogen is one of these reactions.

(iii) Very good. About half of the candidates correctly sketched the curve for the change in the plasma insulin level. Some candidates were not aware that the plasma insulin response curve should lag behind the plasma glucose curve while others sketched a curve that dropped before the drop of the plasma glucose curve. Some candidates did not show the return of the insulin response curve to the initial level or its vicinity.

(c) Poor. Many candidates focused their discussion on the undesirable outcomes of consuming high GI meals but failed to point out the pros of consuming low GI meals, which was required by the question. Some candidates only referred to the impaired glucose control in diabetes, or contrasted type I diabetes with type II diabetes, which were irrelevant.

8. (a) Fair. Many candidates failed to give a proper word equation. Some candidates treated lipase as a substrate and put it on the left hand side of the word equation. Many candidates confused glycerol with triglycerides. Many candidates did not know the products of lipid digestion and

gave wrong answers such as lactic acid, amino acids or phosphates. Some candidates put down the number of fatty acids. They were not aware that the number of molecules was not required in the word equation.

(b) (i) Good. 60% of candidates correctly stated the independent variable of the investigation.

(ii) Excellent. About 69% of candidates correctly described the results of the investigation. Some candidates were not aware that milk accounted for the white colour of the mixture once the indicator was decolourised. Some attempted to explain the results instead of describing them.

(iii) Fair. About 80% of candidates correctly pointed out that tube A contained full fat milk. However, many of them failed to give a full and clear explanation for their deduction. Candidates were aware that the pH of the mixture dropped during the experiment, but only some of them pointed out whether the mixtures were alkaline or acidic based on the given results. Some candidates did not point out that tube B was still in an alkaline condition at the end of the reaction, which was also a clue for drawing the conclusion. Some candidates wrongly thought that it was amino acids that turned the mixture acidic, or the white colour was due to emulsification of fat.

(a) Poor. About half of the candidates scored zero in this question. Instead of explaining how the gene mutation of mitochondrial DNA would affect oxidative phosphorylation, these candidates tried to explain what would happen if oxidative phosphorylation was affected, such as failure to produce ATP. The answers of candidates who focused on gene mutation were often incomplete or some terms were mixed up. Candidates usually pointed out that mutation resulted in changes in the nucleotide sequence of the gene. Some candidates wrongly thought that gene mutation was the change in RNA sequence or amino acid sequence. Only some related the change in the nucleotide sequences of the gene to the events in protein synthesis and the altered amino acid sequence of the protein produced. Answers lacked detail; for example, they tended to write 'the protein structure is changed' but failed to point out that it is the change in the shape of the active site which makes it no longer capable of fitting the substrates. Some mistakenly thought that no protein could be produced once there was a gene mutation.

(b) Fair. More than half of the candidates correctly stated the major products. However, many candidates named other products such as water and carbon dioxide, which are by-products and have no important role in oxidative phosphorylation. The function of ATP was in general well answered. However, only a few candidates pointed out the role of NAD and FAD as hydrogen acceptors. Some candidates gave details of the pathway but mixed them up.

(c) (i) Poor. Only 23% of candidates correctly pointed out why the sperm did not contribute mitochondria to the zygote. Many candidates failed to give an accurate description with reference to the structure of the sperm and the fertilisation process. They simply stated the head of the sperm entered the egg (process) without pointing out the head contains the male nucleus (sperm structure) only, or they simply stated that the nucleus of the sperm entered the egg while mitochondria did not without any reference to the structure of sperm and the fertlisation process. Some candidates gave a teleological explanation; that sperms were so small that they did not carry any mitochondria, or sperms had used up mitochondria on their way to reach the egg.

(ii) Very good. 50% of candidates scored full marks for this question. Some candidates thought that only Lily contributed to the DNA of the nucleus.

(a) Satisfactory. The mean mark was about 53% and around one third of the candidates scored fu marks.

(b) Fair. Candidates had difficulty in applying Darwin's theory of evolution to the given case. Th elaboration lacked details and accuracy. For example, many candidates failed to mention that t

long neck of the giraffe was a genetic variation. Some candidates answered that the population of giraffes with a long neck increased instead of the increasing proportion of long-necked giraffes in the population.

(c) Poor. Only 32% of candidates correctly stated that science could be influenced by cultural or religious factors. Others reproduced other aspects of the nature of science which were not related to the given case.

11. In general, the performance was not satisfactory.

More than half of the candidates got full marks for how the carbon atom was released from the dinosaur to the atmosphere. Many candidates wrote a lengthy description of the formation of fossil fuels. Some candidates mixed up fossil fuels and fossils in their answers.

The part on the cycling of carbon atom before reaching Sharon was poorly answered. Most candidates were aware that they should discuss the carbon cycle in their answers. However, they simply recited the details of the carbon cycle without gearing their answers to include the dinosaur and Sharon. Some candidates mixed up the carbon cycle with the nitrogen cycle and thought that decomposition of dinosaur's dead body would release carbon into the soil for plants to absorb and reuse.

The journey of the carbon atom inside Sharon's body was also poorly answered. Candidates usually pointed out that Sharon obtained the carbon atom through food consumption but they forgot to give the details of the journey of the carbon atom inside her body. They seldom mentioned the roles of the circulatory system in the transport of absorbed food and the transport of carbon dioxide to the lungs for excretion.

The answers suggest that candidates recalled information they had learned and wrote down everything without selecting the most relevant information. They often gave fragmentary descriptions of photosynthesis, respiration and feeding without properly addressing the flow of the carbon atom in different forms. The ability to paraphrase the knowledge to meet the requirements stated in the question or relate the knowledge to the given scenario was generally weak. This was reflected in the distribution of scores awarded for effective communication:

Marks award for effective communication	Percentage of candidates
0	49
1	25
2	12
3	9

This year, about 5% of candidates did not attempt this question.

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)	97	Satisfactory
1(b)		Satisfactory
2(a)	61	Fair
2(b)		Fair
3(a)	8	Very poor
3(b)		Poor
4(a)	34	Poor
4(b)		Satisfactory

Section A

1. (a) (i) Satisfactory. The mean mark for this question was about 47% of the full score. Many candidates failed to compare the water potential of group C with that of groups A and B. They simply stated that the water potential of group C was low. Regarding hormonal control of osmoregulation, candidates failed to give a detailed description or mixed up the response. For example, some wrongly stated that the hypothalamus was located in the medulla oblongata, and that the increased permeability of the collecting duct resulted in a smaller proportion of water being reabsorbed by the kidneys.

(ii) (1) Excellent. About 83% of candidates correctly pointed out the possible effect of alcohol consumption on urine production. Some candidates simply described the difference between the volume of urine collected from group A and group B.

(2) Satisfactory. About 51% of candidates correctly suggested one possible effect of alcohol consumption on hormonal control of osomoregulation.

(iii) Fair. Most candidates pointed out that sweating could affect the results but failed to state clearly how sweating could reduce urine production.

1. (b) (i) Very good. About 44% of candidates scored full marks in this question. Some failed to relate the difficulty to lose heat with decreased evaporation of sweat. Instead, they mentioned other ways of losing heat through conduction, convection and radiation, which were irrelevant to increased humidity.

(ii) Poor. Most candidates were not aware that increasing the air temperature led to narrowing of the temperature gradient, and so reduced the effectiveness of heat loss through conduction, convection and radiation. Instead, some candidates wrongly thought that increased air temperature would lead to heat absorption by the body from the surroundings. They were not aware that the data only showed up to 36°C and so their argument was incorrect.

(iii) Satisfactory. Most candidates suggested at least one other factor, usually wind speed, with a clear explanation. Many candidates chose UV light as their answer but they were not aware that heat radiation mainly comes from the infrared spectrum rather than the ultraviolet spectrum of the light.

(iv) Good. About 57% of candidates provided a sensible explanation for the advice. Some candidates wrongly thought that drinking more water would lead to increased sweating.

Section B

2. (a) (i) (1) Very good. About 73% of candidates correctly calculated the ratio. Some forgot to show the steps in their calculation.

(2) Very poor. Only 13% of candidates pointed out the implication of a Cb/Cp ratio greater than 1. The answer often provided was that there were more heavy metals in the consumers than the producers, but they did not state that this was an accumulation or a magnification.

(3) Poor. About 60% of candidates gave the correct comparison of the ratios. However, only some of them gave two valid reasons to account for the differences. Many candidates simply gave descriptions of how the heavy metal would be accumulated along the food chain. Some candidates wrongly thought that filter feeders would filter out the heavy metals.

(ii) Fair. Only 17% of candidates listed the essential variables for the design of the experiment to study the effect of different concentrations of cadmium on the mortality of bivalves. Most candidates pointed out that a fixed period of exposure should be adopted. Some candidates failed to point out that the same number of bivalves should be kept in water with different concentrations of cadmium.

(iii) Very good. Most candidates pointed out at least one way of reducing cadmium pollution using the 3R principles.

2. (b) (i) Fair. The mean mark of this question was 43% of full score. Despite the fact that the question stem mentioned that the invertebrates feed on organic matter, many candidates failed to use this piece of information to construct their answers. Instead, they wrongly thought that it would increase the decomposition of organic matter which, in turn, promoted the growth of the algae which are food for invertebrates.

(ii) (1) Fair. Most candidates could quote some trends from the graph but their reasoning was usually incomplete. They failed to deduce the body size of the organisms in the community from the two trends shown, namely, a decrease in biomass and an increase in the total number.

(2) Very poor. Only a small proportion of candidates related the decrease in the number of large invertebrates to the depletion of oxygen due to microbial decomposition. Instead, many candidates wrongly thought that there was competition between the smaller and larger invertebrates for food. They did not realise the important piece of given information: these invertebrates consumed organic matter. Hence, an increase in the amount of organic matter also increased the food supply and eased the competition.

(iii) Very good. About 68% of candidates provided the correct evidence.

(iv) Fair. About 36% of candidates gave one characteristic of the dominant species in the invertebrate community at Stage C.

Section C

3. (a) (i) Fair. About 39% of candidates correctly stated the relationship with a clear explanation. Some candidates gave commensalism as the wrong answer instead of mutualism. Wrong spellings of 'mutualism' were common.

(ii) (1) Fair. A small proportion of the candidates pointed out two other pieces of information regarding the physiological conditions in the stomach which were required in the simulation. Many candidates attempted the question with the idea of a fair test in mind and simply stated pH and temperature as the controlled variables. They were not aware that the controlled variables were meant to simulate the physiological conditions of the stomach. Some candidates simply stated pH 2 but failed to point out that this was the pH in the stomach.

(2) Very poor. Most candidates did not know how to estimate the number of living probiotic bacteria. Only a few of them provided a clear and workable method for estimation. Many candidates gave other methods of estimation e.g. turbidity or simple cell count, which could not distinguish live bacteria from dead ones.

(3) Very poor. Many candidates did not know that probiotic bacteria would be in competition with pathogens and, as a result, keeping a large population of probiotic bacteria would offer protection against the invasion of pathogens.

3. (b) (i) Satisfactory. The mean mark for this question was 50% of the full score. Some candidates gave a description of the results instead of the effect of the compounds on the growth of the fungus, i.e. size of the clear zones.

(ii) (1) Fair. Candidates had difficulty in using the observation of the experiment to propose a possible action of compound X on the fungal cells. They failed to draw a clear and logical deduction from the difference in the results.

(2) Very poor. Only a small proportion of the candidates provided a clear explanation of the results of agar plate I. Many candidates did not mention the diffusion of compound X through the agar plate. As a result, they simply stated that compound X killed the fungal cells resulting in a clear zone. They did not take into account the fact that the fungal colony grew in size during the course of experiment.

(iii) Fair. About 44% of candidates correctly stated the importance of using aseptic techniques during the inoculation of the fungus on the agar plate. Some candidates simply gave safety precautions instead of the importance of the aseptic technique in this experiment.

(iv) Very poor. Only a very small proportion of candidates suggested one possible daily use of compound X in household products. Many candidates gave very general answers such as disinfectants. They did not pay attention to the fact that compound X acted specifically on fungi and their answers should have focused on products that prevented fungal deterioration or the spreading of mildew.

Section D

4. (a) (i) Fair. About 59% of candidates provided at least one disadvantage of the treatment. Many candidates gave answers such as transfusion of the wrong type of blood or contamination. These are medical blunders rather than disadvantages of the treatment itself. Some gave vague and inaccurate answers such as a higher cost.

(ii) (1) Fair. About half of the candidates explained why stem cells should be used in Approach II but most of their answers were incomplete. Some candidates just reproduced texts from textbooks without making reference to the case. For instance, many candidates simply stated that stem cells could differentiate into normal cells without pointing out liver cells in this case. Thus, they also failed to point out that these normal liver cells could produce the protein for blood clotting. Candidates should pay attention to the given scenario and paraphrase their answers to include specific information highlighted in the scenario so that their answers are applicable to the specific situations.

(2) Poorly answered. Many did not pay attention to the major difference between approaches I and II. As a result, they simply gave irrelevant answers which only applied to the potential hazards of gene therapy in general. In fact, the major differences included: (1) transfer of normal gene by viral vector carried out inside the patient's body in Approach I but outside the patient's body in Approach II and (2) selection of liver stem cells could be done in Approach II before putting them back into the patient's body. Candidates failed to give answers relating to these two major differences. Some candidates simply gave the risk of triggering an immune response but were not aware that such a risk was removed in Approach II due to the difference (1). Instead, they wrongly thought that no viral vector was involved in Approach II.

4. (b) (i) Very good. The mean mark was 71% of the full score. Some wrongly thought that DNA was a protein. They did not realise that DNA denaturation was different from protein denaturation.

(ii) (1) Fair. About 45% of candidates provided at least one correct primer in this case. Many candidates were not aware that the primer itself was a short fragment of DNA and uracil should not be present. Also, they did not pay attention to the direction of the DNA extension and failed to notice that the base sequence of the primer should be reversed in this case.

(2) Very poor. Only 20% of candidates correctly stated the size of the PCR product. Many candidates did not know that the PCR product should include the primer sequences. As a result, they thought the size of the PCR product was 340 base pairs. Some gave the correct figure but forgot to state the unit.

(iii) (1) Fair. Only 26% of candidates gave the correct answer about the purpose of adding ampicillin and scored full marks. Candidates often mixed up plasmids with transformed bacteria (i.e. bacteria which had successfully picked up the plasmids). As a result, they often wrote that the plasmids were selected or the plasmids remained alive on the agar with ampicillin instead of using the transformed bacteria. Some wrongly used the term selection marker to describe ampicillin.

(2) Poor. Many candidates mistakenly thought that Z gene was the DNA which was inserted into the plasmid. As a result, they thought that bacteria which have taken up the plasmid could produce the enzyme that converted substance X to blue compounds. Therefore, they wrongly thought that the white colonies contained non-recombinant plasmids. They failed to see the information that restriction sites were located within the Z gene. The Z gene would be interrupted if the DNA was inserted successfully. Therefore, white colonies contained recombinant plasmids while blue colonies contain non-recombinant plasmids.