Candidates' Performance

The 2012 DSE Biology Examination was the first examination based on the Biology Curriculum (S4-6) implemented in 2009. 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 good in general and the mean raw score was 24. Some candidate misconceptions were revealed from their performance in the following items:

19. The tRNA anticodon for the sequence AGT on the coding strand of DNA is

*	A.	UCA.	(31%)
	B.	AGU.	(45%)
	C.	TCA.	(28%)
	D.	AGT.	(16%)

Nearly half of the candidates mistook the coding strand of the DNA for the template strand that directs the synthesis of mRNA. In fact, the coding strand is complementary to the template strand and bears the same sequence as the mRNA except for having T instead of U. Therefore, its respective tRNA anticodon should be complementary to the mRNA, i.e. UCA. Just under half of the candidates wrongly thought that T is present in RNA.

30. Which of the following correctly describe the importance of phototropism to plants?

    (1)   The root can get water from the soil.
    (2)   The root can anchor to the soil for support.
    (3)   The shoot can reach a position where there is sunlight.

	A.	(1) and (2) only	(4%)
	B.	(1) and (3) only	(25%)
*	C.	(2) and (3) only	(35%)
	D.	(1), (2) and (3)	(36%)

About two thirds of the candidates wrongly thought that phototropism enables the root to get water from the soil. In fact, once the root grows into the soil, light is no longer present to serve as a stimulus to affect the directional growth of the root.

Section B (conventional questions)

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

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

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

Question Number	Performance in General
1	Well done. Only some candidates wrongly matched lymphocytes with the function of phagocytes.
2	Good in general. Most candidates showed an understanding of the transmission of Dengue fever and how to break the transmission link. However, some candidates misinterpreted the question and provided a description of how to spray pesticides and clear accumulated water.
3	Satisfactory. In part (a), most candidates correctly stated the difference between cell types P and Q. However, some of them gave vague descriptions and did not refer to the thickness of the cell wall in their answers. In part (b), some candidates wrongly thought that cell type P was a phloem. They simply gave the function of the phloem and xylem in transport rather than support of plants.
4	Poor. In part (a), some candidates failed to recognise that organism X did not possess eyes. As a result, they failed to answer part (b) correctly. Quite a number of candidates gave suggestions based on the habitat instead of the features of organism X. They failed to realise that body form or feature could be an adaptation to living in a certain habitat. In part (c), many candidates commented that the key does not include the morphological characteristics. They did not recognise the limitation that the construction of a key is based on information from existing organisms. In part (d), many candidates showed a good understanding of the comparison of DNA sequence and amino acid sequence to establish phylogenic relationships between organisms.
5	Poor. Most candidates answered part (a) correctly. Some candidates gave a time interval of several hours instead of pointing out the exact time from the graph. In part (b), some candidates were not aware of that fact that the day length is shorter in winter. They gave sketches with the same or even a longer light period. Some candidates were not aware that the overall rate should be lower due to a lower air temperature during winter. In part (c), only some candidates related the areas to food production and food consumption in the plant. Instead, most candidates related the phenomenon to the maintenance of the levels of oxygen and carbon dioxide in the atmosphere.
6	Unsatisfactory. Some candidates used the wrong method to calculate the percentage decrease in part (a). Many candidates gave vague answers in part (b). They simply mentioned energy loss in respiration or egestion without clearly indicating the trophic level. In part (c), quite a number of candidates did not realise that the percentage decrease in energy content would be greater. Some candidates wrongly thought that the percentage decrease would be greater because of the larger biomass of the tree.
7	Unsatisfactory. Many candidates gave poor interpretations of the graphs. They simply regurgitated facts about diabetes without referring to the graphs. In part (a), quite a number of candidates mixed up the two types of diabetes. They gave correct deductions from the graphs but gave the other type of diabetes in their answers. Some candidates just focused on the information from the graph about the blood insulin level. They should also have cited the fact that a high blood glucose level was detected in Tom's case, i.e. there is a stimulus of high blood glucose level but Tom failed to produce a normal amount of insulin. In part (b), many candidates stated the difference in the blood glucose response but failed to give the correct explanation. Many simply stated the point about insufficient insulin in Tom's blood. They should have elaborated on the action of insulin to account for the difference. Some candidates held the misconception that it is the insulin that converts glucose to glycogen. In part (c), many candidates answered correctly, but some thought that insulin could be taken orally.

Question Number	Performance in General
8	The performance of candidates was poor in general. Part (a) was a demanding question that required candidates to integrate knowledge from different topics and analyse the unfamiliar situation. Most candidates were aware of the fact that different food stores would affect the water potential of the seed but they failed to integrate this knowledge with the process of seed development. As a result, they failed to mention that sweet corn would store up more water than starchy corn and when drying up, the sweet corn would become wrinkled. Quite a number of candidates did not know that the process of drying up was simply due to evaporation of water. These candidates attempted to use osmosis to account for it. They wrongly thought that water was lost to the atmosphere through osmosis during drying up. Most candidates did well in part (b)(i). However, their performance in part (b)(ii) was poor. Many candidates simply regurgitated the law of independent assortment and the ratio of dihybrid cross (9:3:3:1). They failed to use the law to explain the occurrence of four types of gametes produced by F_1 generation. In part (c), only a few candidates linked Mendel's work with the nature of science. Many candidates mixed up the terms 'allele', 'gene', 'genotype' and 'phenotype', using them interchangeably in their answers.
9	Some candidates showed a good understanding of the key processes involved in respiration and did well in parts (a) and (b). Some candidates provided answers involving detailed steps which were not required. In fact, candidates were required to have a good understanding about the products and sequence of the key processes in order to solve the problem. They had to identify the curial changes after the drug treatments, e.g. low level of all products indicated that the first key process was being inhibited and the exceptional high level of pyruvate indicated ongoing glycolysis, which ceased thereafter. Candidates generally did well in part (c) but only some candidates related the cellular components to be isolated were the sites where these key processes take place in part (d).
10	Most candidates did well in parts (a), (b) and (c), but poorly in part (d). Most candidates mentioned the action of bile salts. However, some candidates just mentioned a large surface area and did not mention lipase, leading to incomplete answers. In part (c), many candidates did not understand the words 'in vitro' and gave answers involving piglets or mice. Some candidates suggested methods that involved qualitative determination of fat rather than quantitative measurement.
11	In this question, candidates were required to state the differences between mitosis and meiosis and link the differences between these with the significance of each type of cell division. Some candidates gave lengthy separate descriptions of the various events that take place during mitosis and meiosis instead of concisely pointing out the differences between the two processes. Some candidates simply listed the significance of each of the processes without referring to their differences. In general, candidates were aware that mitosis involved one division whereas meiosis involved two divisions, and that random segregation of homologous chromosomes results in genetic variations between gametes formed in meiosis, which further results in genetic variations in offspring due to random fertilisation. Candidates are advised to spend some time on planning what is to be included in the essay and give a structured response rather than pieces of information. Some candidates failed to use genetics terms correctly.

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:

Section	Popularity %	Performance in General
A	95	The performance in part (a) was satisfactory. Some candidates failed to give the general patterns in part (a)(i), however. Candidates chose the correct sports drink based on the urine output but most of them missed out fluid balance in their answers for part (a)(iii). The performance in part (b) was satisfactory. Quite a number of candidates missed out breathing as one of the ways of losing water while some mixed up respiration with breathing in part (b)(i). Most candidates were well aware of the heat loss problem associated with the given conditions but they often missed out the fact that heat was produced during exercise in part (b)(ii). Some candidates were not aware of the importance of restoring the blood pH to normal in part (b)(iii).
B	62	The performance in part (a) was unsatisfactory. Some candidates were not aware that ecological succession took place in the abandoned land in part (a)(i). They gave descriptions about the activities of soil bacteria instead. Quite a number of candidates failed to give the correct agricultural activities to account for the difference in the annual runoff between Stage I and Stage II in part (a)(ii). Some candidates mixed up the minerals and their respective functions and answered wrongly in part (a)(iii). Most candidates pointed out that leaching leads to loss of soil nutrients, which are dissolved and lost together with water in part (a)(iv). However, the loss of soil nutrients together with soil particles in the form of soil erosion was often missed out. The performance in part (b) was fair. Most candidates gave correct descriptions of the number of fish species in the two sites in part (b)(i). They had some understanding of the roles of ARs as shelters and spawning grounds in part (b)(ii). However, most of them were not aware of the fact that the ARs provided different habitats for fish species and did not appreciate that increasing biodiversity also played a role in attracting new species to the AR site.
C	11	The performance in part (a) was poor. Most candidates answered part (a)(i) correctly. In part (a)(ii), many candidates wrongly thought that the growth of viruses was similar to that of other microorganisms. As a result, they mentioned that the slow growth rate in Phase I was due to the fact that it took time for viruses to adapt to the new environment. Many candidates were not aware that viruses are non-living things and failed to use the term 'disintegrate' in their answers in part (a)(iii). In part (a)(iv), many candidates were not aware that viral infection was species specific and therefore failed to give a correct explanation. In part (a)(v), many candidates failed to evaluate the methods in relation to biological knowledge. Instead, they mentioned the costs or equipment in their answers. The performance in part (b) was unsatisfactory. Some candidates simply gave the name of the equipment for determining the population size of bacteria rather than the methods in part (b)(i). Many candidates focused on the difference between the growth rates in part (b)(ii) but failed to explain why there was such a difference. Some candidates wrongly thought that cell walls can control the water movement. Most candidates answered part (b)(iii) but they often missed the point about the stationary phase in their answers.

Section	Popularity %	Performance in General
D	32	The performance in part (a) was satisfactory. Some candidates mixed up the ligase with DNA polymerase in part (a)(i). Some also failed to point out that the same restriction enzyme should be used to cut DNA and plasmid. In part (a)(ii)(2), some candidates cited typical cases from textbooks and mentioned the screening of bacterial cells instead of crop cells in their answers. In part (a)(iii), some candidates were not aware that competition was involved in making the suggestion. They failed to differentiate clearly between the GM corps and other plants. The performance in part (b) was fair. Most candidates answered parts (b)(i) and (ii) correctly. In part (b)(iii), many candidates mixed up the sequence of the treatment. Some wrongly thought that the stem cells were introduced into the body before proliferation. Some wrongly stated that nerve cells were introduced instead of nerve stem cells. Some did not seem to be aware of the need for differentiation.

General comments and recommendations:

The performance in this paper showed that candidates were generally able to answer questions that required the recall of basic biological knowledge. Many candidates relied too heavily on textbooks and tended to regurgitate textbook materials when answering the questions, however. Hence, their performance in questions that required the integration of biological concepts and the application of knowledge in daily life scenarios was poor. This was also reflected in the questions related to the interpretation of photographs, data and graphs. Most candidates successfully described the data set but they failed to recognise meaningful general trends and patterns from the data. Some candidates failed to provide explanations to address the trends or changes shown in the graph. They simply reproduced facts on related topics with little selection or adaptation. Spelling mistakes were common. Some candidates did not use biological terms correctly; they tended to use layman's terms, which did not have the same, precise meaning.

School-based Assessment

All school candidates sitting for HKDSE Biology Examination have to participate in School-based Assessment (SBA). A total of 17093 Biology students from 437 schools submitted their SBA marks this year. The schools were divided into twenty four 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.

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. 65.4% of schools fell into the 'within the expected range' category, while 19% of schools had marks higher than expected, and 15.6% 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 more than two thirds of the teachers had a good understanding of the SBA requirements, and that the marking standards were appropriate, which is encouraging. 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 on 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:

1. Many of the assessment tasks came from the sample SBA tasks and textbooks, and clustered around a limited number of topics such as food, enzymes and cells. Teachers are encouraged to construct their own tasks on more diverse topics so that the tasks suit the interests of their students more and fit better into the teaching and learning of the relevant topics. The assessment tasks usually started with an everyday scenario. However, these scenarios were often not meaningfully connected with the subsequent investigations. The purposes of using scenarios are manifold, for example, to arouse students' interest by making investigations relevant to daily life, and letting students experience the stages of question formulation and hypothesis generation in scientific investigations. Therefore, teachers should attempt to construct interesting ones from students' everyday experience and engage them in fruitful discussions within the scenario to explore various investigative questions and hypotheses.

2. The difficulty levels of the assessment tasks varied considerably across schools. Some involved complex experimental design, multiple controls of variables, multiple measures and quantitative data, whereas in some there was little experimental design, simple variables and qualitative data. It is acceptable for the difficulty level of assessment tasks to be tailored to the academic level of students, but the tasks should still be pitched at a level of difficulty appropriate to senior secondary level.

3. Some reports missed out the principles of design. If an assessment task is too simple to require any stated principles of design, it may not be an appropriate task and is likely to receive a low score. In most of the reports, the dependent, independent and control variables were correctly identified and the relevant scientific principles stated. However, students were relatively weak in articulating the overall design and pointing out the assumptions behind the design. In the discussion and conclusion section, conclusions were often drawn straightforwardly from data. Very few students discussed the reliability of the data or the validity of the conclusions with reference to the limitations of the design and the implementation of the experiment.