

Combined Science (Biology part)

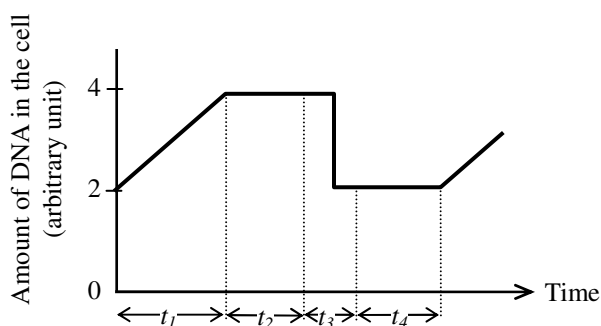
Report on Student Performance in the Practice Papers

Most questions in the Combined Science (Biology part) paper, both Sections A and B, were extracted from the relevant sections of Biology Paper I, with appropriate modifications. In view of the fact that the question types and the skills to be tested were largely the same in both the Biology papers and the Combined Science paper, no piloting of the Combined Science (Biology part) paper had been conducted. Nevertheless, the following observations and report on student performance in the Biology practice papers would be equally useful to students taking Combined Science (Biology part). Readers are advised to study this report together with the selected samples of students' work from the piloting of the Biology practice papers so that they can have a better understanding of the anticipated high, mid and low performance levels of students in the Combined Science (Biology part) practice paper.

Section A (multiple-choice questions)

Section A consisted of 24 questions. Students' performance in the following items helps illustrate some of their misconceptions:

1. The graph below shows the change in the amount of DNA in a cell which is undergoing cell division:

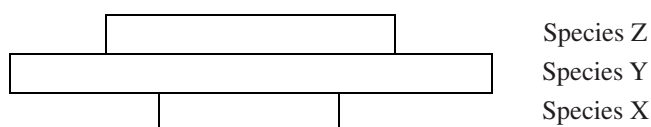


Which of the following statements correctly describes the event that is taking place in the respective time period?

- | | | |
|------|--|-------|
| A. | During t_1 , the nuclear membrane disappears. | (9%) |
| B. | During t_2 , the homologous chromosomes pair up. | (24%) |
| C. | During t_3 , the homologous chromosomes separate. | (46%) |
| * D. | During t_4 , the synthesis of cell organelles takes place. | (21%) |

This question tested students' ability to identify the type of cell division from the graph and recall the processes involved in different phases of cell division. About 70% of the students did not pick up the clue from the graph that the DNA content of the daughter cell remained the same as the parent cell. They wrongly chose option B or option C, which are processes involved in meiosis. The increase in DNA content during t_1 indicates that the cell was preparing for cell division. Thus, option A is incorrect as the nuclear membrane was still intact at this phase.

18. In an aquatic ecosystem, species X, Y and Z form a food chain. The following diagram shows the pyramid of biomass of this ecosystem:

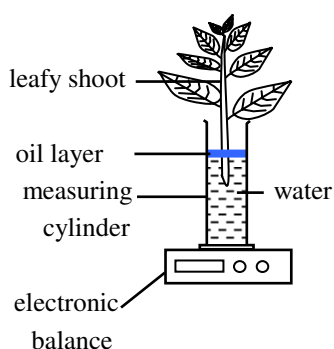


With reference to the above pyramid of biomass, which of the following statements are correct?

- (1) Species Z is the secondary consumer in this food chain.
 - (2) The body size of species X is larger than that of species Y.
 - (3) There is an energy loss when energy flows from species Y to species Z.
- A. (1) and (2) only (5%)
 - * B. (1) and (3) only (55%)
 - C. (2) and (3) only (14%)
 - D. (1), (2) and (3) (26%)

This question required students to apply their biological knowledge in a pyramid of biomass which was unfamiliar to them. About half of the students did not realise that the body size of the organism has been taken into account in calculating the biomass at a particular trophic level and wrongly chose options that included (2).

27. The diagram below shows a weight potometer used in an experiment. The leafy shoot was left in the laboratory for 3 hours. The change in the reading of the electronic balance and the change in the volume of water in the measuring cylinder were recorded. The experiment was then repeated under the same environmental conditions with the upper surface of all the leaves of the shoot smeared with vaseline. The results are shown in the following table:



Treatment	Change in the reading of the balance (g)	Change in the volume of water in the measuring cylinder (mL)
(I) Leaves not smeared with vaseline	p	r
(II) Upper surface of all leaves smeared with vaseline	q	s

Note:

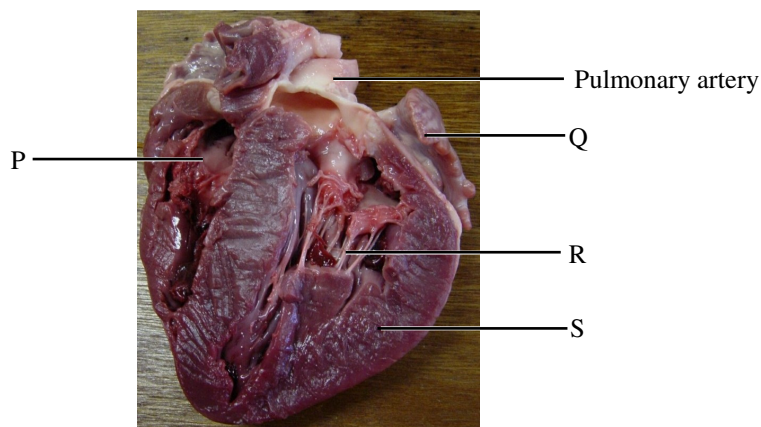
1. p , q , r and s are numerical values
2. mass of 1 mL of water = 1 g

From the results of the experiment, we can calculate the amount of

- A. water absorbed by the shoot in Treatment (I) from $p - r$. (12%)
- B. water transpired by the shoot in Treatment (II) from $r - s$. (23%)
- * C. water retained by the shoot in Treatment (II) from $s - q$. (30%)
- D. water transpired by the lower surface of the leaves of the shoot in 3 hours from $p - q$. (35%)

This question required students to understand the design of the experiment. Students had to realise that the change in the balance reading (p and q) indicated the amount of water transpired, and that the change in the volume of water in the measuring cylinder (r and s) indicated the amount of water absorbed. In addition, they needed to realize that smearing the upper surface of the leaves in treatment (II) allowed transpiration to take place in the lower surface only. Hence, the difference between p and q indicated the amount of water transpired by the upper surface of the leaves.

31. The following photograph shows a dissected pig's heart:



Which of the following descriptions of the labelled structures is correct?

- A. Structure P contracts to deliver blood to various parts of the body except the lungs. (5%)
- * B. Structure Q receives blood from the pulmonary veins. (55%)
- C. Structure R controls the opening and closing of the valve. (23%)
- D. Structure S contracts to force the blood out of the heart through the pulmonary artery. (17%)

This question tested students' ability to identify the various structures of a real dissected heart and required an understanding of the functions of these structures. The heart string (R) is responsible for preventing the valve from being turned inside out. However, 23% of the students wrongly associated its function with controlling the opening and closing of the valve. 17% of the students chose option D. They might not have realized from the thick wall that S is the left ventricular wall or that they failed to recall that the left ventricle is connected to the aorta.

Section B (conventional questions)

Section B consists of compulsory questions. The performance of students in the relevant items in Biology Paper I Section B is shown in the table below:

Question Number	Performance in General
1.	Performance was good in general. Some students might not have been familiar with the disease 'dengue fever' and wrongly matched the preventive measure 'wrapping rubbish properly before disposal' with it.
2. (a)	Most students were able to point out that the fatty acids diffuse through the phospholipid bilayer but not many of them were able to explain this with reference to the fact that fatty acids are fat soluble. Some did not make reference to 'the structure of the cell membrane as illustrated by the fluid mosaic model', as required for answering the question.
(b)	Students generally were aware that amino acids are transported across the membrane by / via the membrane proteins. Most of them, however, did not explain why the polar nature of the amino acids prevents them from diffusing across the membrane.
3. (a)	Most students were able to give one to two reasons. However, some of them: <ul style="list-style-type: none"> – did not read the question carefully; e.g. it was given in the question that the student collected the individuals on the sediment surface but some students still gave 'the student did not dig deep enough to find the clams' as the reason. – did not realise that the quadrat method is not suitable for 'fast moving' organisms, not unsuitable for 'moving' organisms.
(b)	Performance was good.

5.	<p>Students showed confusion in the use of genetic terms in their answers (e.g. using the term 'genes' when they were referring to 'alleles') and they were generally weak in presenting their deduction. Some students ignored the fact that the trait in the question was sex-linked. They put down a typical answer for deducing the genotype of an individual in a typical cross of monohybrid inheritance without due reference to the fact that the alleles concerned were located on the X chromosome.</p>
6. (a) (b) (i) (ii)	<p>Quite a number of students wrongly regarded the change in relative abundance of the plant species over the long period of time as being due to the process of 'natural selection'.</p> <p>Many students overlooked the clue 'symbiotic bacteria' in the question and put down 'nitrifying bacteria' to account for the increase in the soil nitrogen content.</p> <p>A lot of students did not demonstrate an understanding of the action of the nitrogen fixing bacteria and wrongly stated that atmospheric nitrogen is fixed directly into nitrates in the soil. Quite a number of students did not realise that the ammonium compounds obtained from nitrogen fixation were utilised by the plants for making proteins, and that the proteins in the plants could become the nitrates in the soil by the decomposition and nitrification actions of other soil microbes after the plant died.</p>
8. (a) (b) (c)	<p>Some students gave a description of each of the two curves instead of utilising the differences observed in deducing the relationship between PHBA and diphenol oxidase.</p> <p>Some students were not able to clearly express the concept that the degree of inhibition is reduced with an increase in the substrate concentration. Instead, they stated that 'an increase in the substrate concentration increases the rate of reaction'.</p> <p>Performance was very good.</p> <p>A number of students did not read the question carefully and note that 'The experiment was carried out at the same temperature and the same concentration of diphenol oxidase was used.' They still gave 'temperature' or 'concentration of enzyme' as the factors to be kept constant. In addition, many students did not go on to explain why a denatured enzyme / a change in the active site will lower the reaction rate or stop the reaction.</p>
9.	<p>Quite a number of students just put down 'phototropism' without specifying the part of the flowering plants which shows the phototropic response, nor did they specify whether the response is positive or negative. Hence, they could not illustrate the importance of the phototropic response of the specific part of the plant for its survival. Some students gave wrong examples such as 'the flowers are positively phototropic'. In addition, many students wrote a lengthy account of the mechanism of phototropic response (i.e. how the phototropic response is brought about by the redistribution of auxins under the influence of unilateral light), which was not required in answering the question.</p> <p>Instead of contrasting the nature and process of tropic response and reflex action, a lot of students gave a separate account of each of them without any comparison.</p> <p>The performance of students who gave a comparative account of the nature of tropic response and reflex action was satisfactory. However, their performance in contrasting the processes of the two was quite poor. A weakness that was common among the students was that they were unable to express their ideas using appropriate terms or precise wording. Another weakness was that lots of students elaborated at length on a particular point (e.g. tropic response being mediated by auxins while reflex is mediated by nerve impulses) with little relevance to the question (e.g. giving a detailed description of the origin of auxins and how an impulse is set up). Few students presented their answers in an organised way.</p>