

Biology
Higher level
Paper 1B

Specimen Paper

Candidate session number

2 hours [Paper 1A and Paper 1B]

--	--	--	--	--	--	--	--	--	--

Instructions to candidates

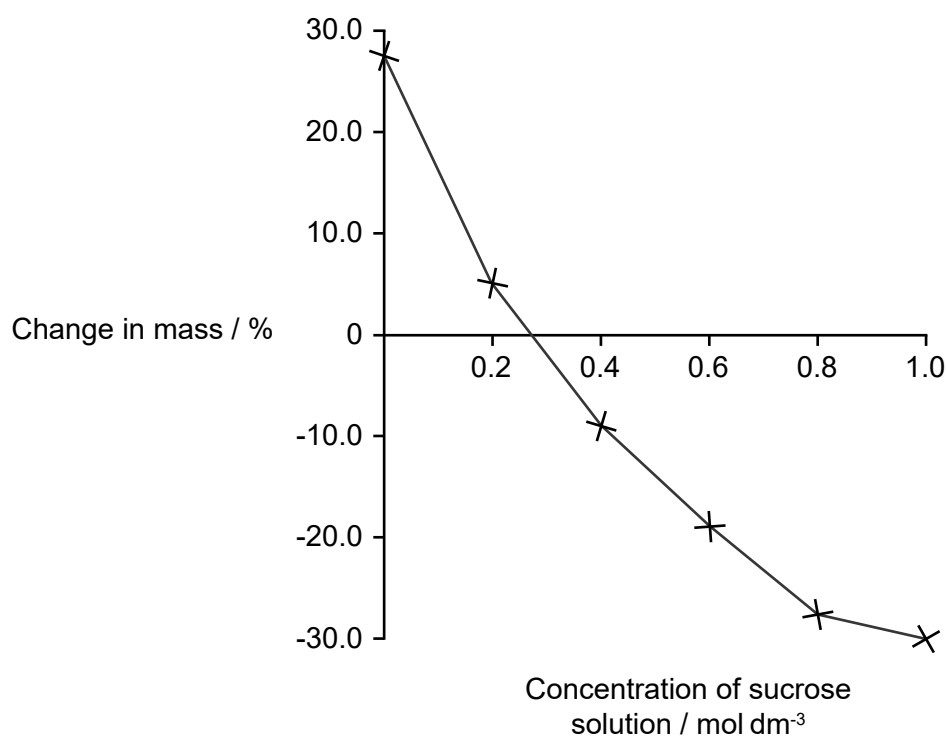
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for paper 1B is **[35 marks]**.
- The maximum mark for paper 1A and paper 1B is **[75 marks]**.



Answer **all** questions. Answers must be written within the answer boxes provided.

1. Beetroot (*Beta vulgaris*) tissue was cut into pieces of similar size and shape. The masses of the individual pieces were measured. Three pieces of beetroot were placed in each of six sucrose solutions of different concentrations.

After three hours, the pieces of beetroot were removed from the solutions, surface dried and their masses recorded. The mean percentage change in mass of the beetroot in each solution was calculated and displayed in the graph.



Concentration of sucrose solution / mol dm ⁻³	Change in mass / %
0.0	28.0
0.2	5.0
0.4	-9.0
0.6	-19.0
0.8	-28.0
1.0	-30.0

(This question continues on the following page)



(Question 1 continued)

- (a) (i) State the independent variable in this experiment. [1]

.....
.....

- (ii) Outline the reason that beetroot pieces of similar size and shape are needed in order to obtain reliable results. [2]

.....
.....
.....
.....

- (b) Suggest a reason for expressing the changes in mass as percentages. [1]

.....
.....

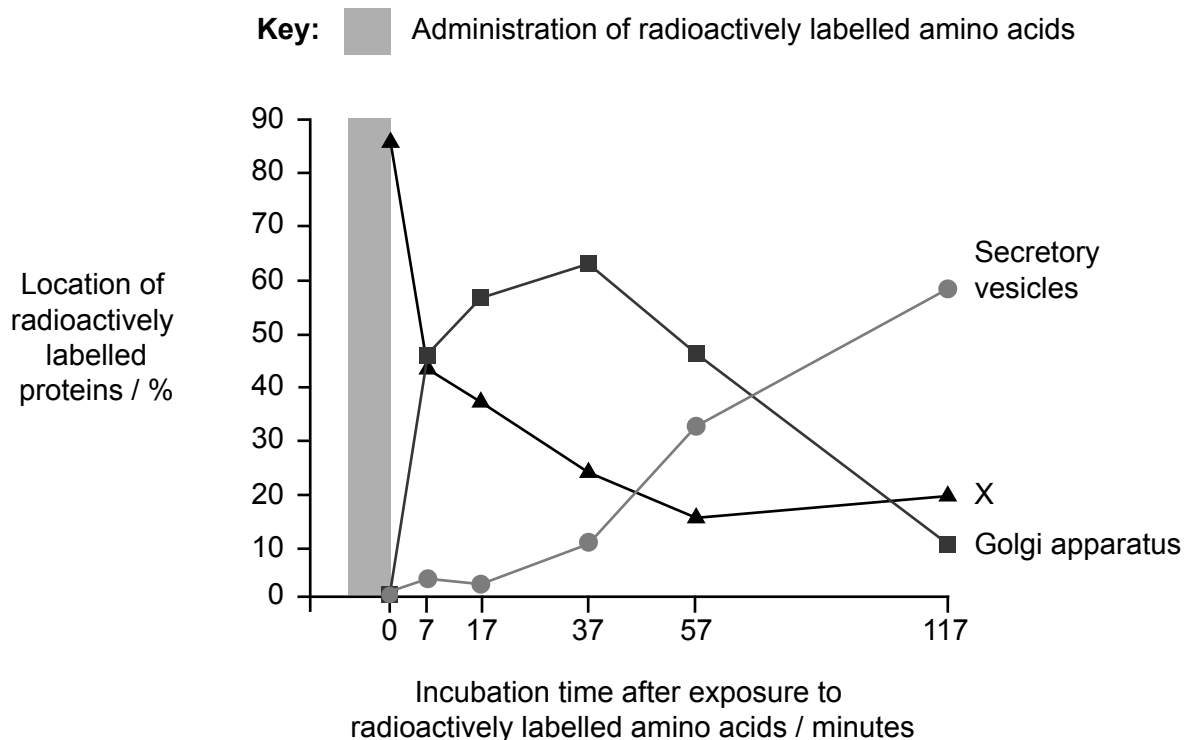
- (c) Explain the effect of the 0.0 mol dm^{-3} sucrose solution on the water potential of the beetroot pieces. [3]

.....
.....
.....
.....
.....
.....



2. In an experiment investigating the secretion of proteins by gland cells, researchers supplied radioactively labelled amino acids to a sample of pancreas cells that secrete digestive enzymes.

The graph shows the relative abundance of radioactively labelled proteins in three different organelles during the period after the cells were exposed to the radioactively labelled amino acids.



- (a) Suggest a reason for using amino acids that were radioactively labelled. [1]

.....

.....

- (b) (i) X is a membrane-bound organelle. Identify X. [1]

.....

.....

(This question continues on the following page)



(Question 2 continued)

(ii) Explain the role of ribosomes located on X.

[2]

.....

.....

.....

.....

(iii) Outline the evidence provided by the data that molecules containing radioactively labelled amino acids move from X to the Golgi apparatus.

[1]

.....

.....

(c) Gland cells that secrete large volumes of fluid typically have many aquaporins in their plasma membranes. Suggest a reason for this.

[1]

.....

.....

(d) After synthesis, globular proteins assume their final tertiary structure. Explain the relationship between the sequence of amino acids and the tertiary structure of globular proteins.

[4]

.....

.....

.....

.....

.....

.....

.....

.....



3. *Rhizobium* is a genus of bacteria that live in the roots of flowering plants in the family Fabaceae. The plants form nodules surrounding a population of *Rhizobium*. The bacteria fix nitrogen from the air into nitrogen compounds, especially ammonium, which are made available to the host plant.

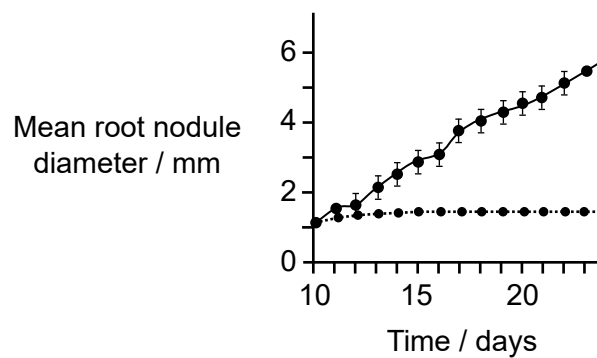


The graph shows changes in the diameter of root nodules for plants grown in a nitrate-enriched environment and a control group grown in a nitrate-free environment.

Key:

— control

..... nitrate-enriched environment



- (a) Outline the concept of mutualism with respect to this example.

[2]

.....

.....

.....

.....

(This question continues on the following page)



(Question 3 continued)

- (b) Distinguish between the cells in *Rhizobium* and Fabaceae.

[2]

.....

.....

.....

.....

- (c) Suggest a reason that mutualistic relationships often involve species from distantly related groups of organisms.

[1]

.....

.....

- (d) Analyse the results of the experiment.

[3]

.....

.....

.....

.....

.....

.....



4. Before the structure of DNA was known, researchers analysed the ratios of the DNA bases found in cells of different species. The tetranucleotide hypothesis, formulated in 1910, proposed that DNA was made up of equal amounts of adenine, guanine, cytosine and thymine.

This hypothesis was revised following the publication of Chargaff's paper in 1951, from which data is shown in the table.

Source	Ratios				
	A:G	T:C	A:T	G:C	purines:pyrimidines
Ox	1.29	1.43	1.04	1.00	1.10
Human	1.56	1.75	1.00	1.00	1.00
Chicken	1.45	1.29	1.06	0.91	0.99
Salmon	1.43	1.43	1.02	1.02	1.02
Wheat	1.22	1.18	1.00	0.97	0.99
Yeast	1.67	1.92	1.03	1.20	1.00

- (a) State **one** example of a purine.

[1]

.....

- (b) Explain how these results falsify the tetranucleotide hypothesis.

[2]

.....

- (c) Using these data, evaluate the hypothesis that the ratio of purines to pyrimidines in DNA in all organisms is 1.00.

[1]

.....

(This question continues on the following page)



(Question 4 continued)

- (d) Discuss how these results are consistent with the existence of a last universal common ancestor (LUCA). [2]

.....

.....

.....

.....

- (e) Discuss the evidence of the relationship between genome size and the complexity of organisms. [4]

.....

.....

.....

.....

.....

.....

.....

.....



Disclaimer:

Content used in IB assessments is taken from authentic, third-party sources. The views expressed within them belong to their individual authors and/or publishers and do not necessarily reflect the views of the IB.

References:

2. Jamieson, J.D. and Palade, G.E., 1967. Intracellular transport of secretory proteins in the pancreatic exocrine cell. *Journal of Cell Biology*, 34, pp.597–615.
3. **image**
Ninjatacoshell, 2009. *Medicago italica root nodules 2*. [image online] Available at: <https://commons.wikimedia.org/wiki/File:Medicago_italica_root_nodules_2.JPG> [Accessed 16 July 2020].
graph
Fujikake, H., Yamazaki, A., Ohtake, N., Sueyoshi, K., Matsuhashi, S., Ito, T., Mizuniwa, C., Kume, T., Hashimoto, S., Ishioka, N.-S., Watanabe, S., Osa, A., Sekine, T., Uchida, H., Tsuji, A. and Ohyama, T., 2003. [Soybean root nodule growth]. *Journal of Experimental Botany*, 54(386), pp.1379–1388. REFERENCE REDACTED.
4. Chargaff, E., 1951. Structure and function of nucleic acids as cell constituents. *Federation proceedings*, 10(3), pp.654–659.



Please **do not** write on this page.

Answers written on this page
will not be marked.



12EP11

Please **do not** write on this page.

Answers written on this page
will not be marked.



12EP12