

## IB Style Test - Topic 8 HL Metabolism, respiration and photosynthesis

### Multiple choice questions

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1. Enzyme inhibition can occur by an inhibitor doing which of the following?

- I an inhibitor binding to the enzyme's active site
- II an inhibitor binding to the allosteric site
- III an inhibitor causing a change in the conformation of the enzyme

- A I only
- B I and II only
- C I and III only
- D I, II and III

2. Which of the following describes a process that occurs in both respiration and photosynthesis?

- A. NADP is reduced
- B. A high concentration of protons is generated
- C. Electrons oxidise electron carriers
- D. Reactions occur in the cytoplasm

3. Which of the following describes features of a metabolic pathway?

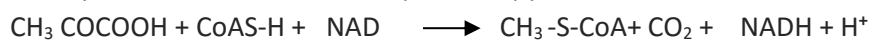
- I It can be regulated to suit the needs of the cell
- II It can be cyclic in nature
- III It can be inhibited by an end-product
- IV It can be anabolic or catabolic in nature

- A I only
- B I and II only
- C I, III and IV only
- D all of the above



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4. The following equation represents the link reaction of respiration. CoAS-H represents acetyl coenzyme A and CH<sub>3</sub> COCOOH represents pyruvate:



Which of the following processes occur?

- I NAD is reduced
- II CoAS-H is reduced
- III Pyruvate is decarboxylated
- IV Protons are formed

- A I only
- B II and III only
- C I, III and IV only
- D All of the above

5. Which new development in scientific technique assisted Calvin in working out the steps of the Calvin cycle?

- A. Chromatography
- B. Electron tomography
- C. Autoradiography
- D. Artificial enzyme inhibitors

6. The first step in glycolysis is the phosphorylation of glucose.  
What does this cause to happen?

- A. The oxidation of glucose
- B. The production of pyruvate
- C. The gain of ATP energy
- D. Instability in the glucose molecule

7. The production of most of the ATP in aerobic respiration is associated with which of the following processes?

- A. Reduction of NAD
- B. Chemiosmosis
- C. Active transport
- D. Decarboxylation



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8. Oxygen in aerobic respiration is needed in order to
- A. Oxidise NADH
  - B. Decarboxylise pyruvate
  - C. Provide energy for active transport
  - D. Accept protons and electrons
9. Which of the following statements best explains the reason why enzymes increase reaction rates?
- A. Substrate binds according to the induced fit model
  - B. The enzyme lowers the activation energy
  - C. The enzymes has a transition state
  - D. The allosteric site lowers the activation energy
10. Which of the following is the source of electrons for chlorophyll in photosystem II of photosynthesis?
- A. NADPH
  - B. Water
  - C. Light
  - D. ATP

### Structured answer questions

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11. Glycolysis produces pyruvate and 2 molecules of  $\text{NADH} + \text{H}^+$ . Describe how, in aerobic conditions, the ATP yield of respiration is higher than in anaerobic conditions. (2 marks)

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12. Dehydrogenase enzymes have a hydrogen acceptor as a coenzyme. Outline an example of a dehydrogenation reaction during aerobic respiration. (2 marks)

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13. State the main difference between images produced by electron microscopy and those produced by electron tomography? (1 mark)

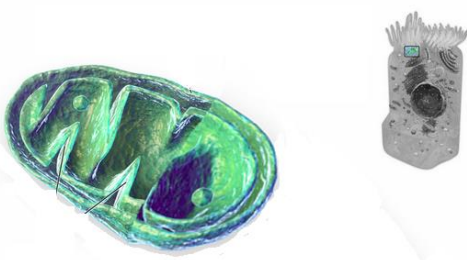


Image adapted from: Blausen.com staff CC BY 3.0, "Blausen gallery 2014".  
Wikiversity Journal of Medicine. DOI:10.15347/wjmi/2014.010. ISSN 20018762

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14. In the space below, draw a diagram of the structure of a mitochondrion. Annotate the diagram to describe three ways in which the structure of a mitochondrion is related to its function. (6 marks)



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15. Explain why two-way paper chromatography was an important technique used in the experiments undertaken by Calvin to identify the components of the Calvin Cycle. (2 marks)

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16. Amino acids can be respired to make ATP. The amino acid is deaminated (the  $\text{NH}_2$  group is removed) in the liver and the remaining organic acid residue is incorporated into the respiratory pathway. This occurs in a stage of the pathway between pyruvate and a point in the Krebs cycle. The following table gives the yield of ATP from 3 kinds of amino acids and the number of hydrogen and carbon atoms in their structure:

Amino acid	Number of carbon atoms in the organic acid residue	Number of hydrogen atoms in the organic acid residue	ATP yield per molecule
Glycine	1	3	6
Aspartame	3	5	13
Glutamine	4	7	18

Suggest an explanation for the variation in ATP yield from these molecules. (3 marks)

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17. In the table below, give two differences between competitive and non-competitive inhibitors. (2 marks)

Competitive inhibitor	Non-competitive inhibitor

18. Using a specific example, describe one way in which enzyme inhibitors can be used in the treatment of disease. (2 marks)

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19. List three ways in which the structure of the thylakoid is related to its function. (3marks)

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20. Sucrase is an enzyme which hydrolyses the disaccharide sucrose. In an experiment, 10 cm<sup>3</sup> of 1% sucrase was added to 10 cm<sup>3</sup> of a 1% sucrose solution in a 50 cm<sup>3</sup> beaker. Every minute, the concentration of glucose was measured using a glucose meter. The meter gives direct readings of glucose concentrations in mmol/dm<sup>3</sup>. The raw data is given in the table below:

Time in seconds (+/- 1s)	0	60	120	180	240	300	360	420	480
Glucose concentration mmol/dm <sup>3</sup> (± 0.01)	0.01	0.15	0.29	0.41	0.50	0.55	0.59	0.62	0.62

a. Explain why glucose is formed in the reaction mixture. (2 marks)

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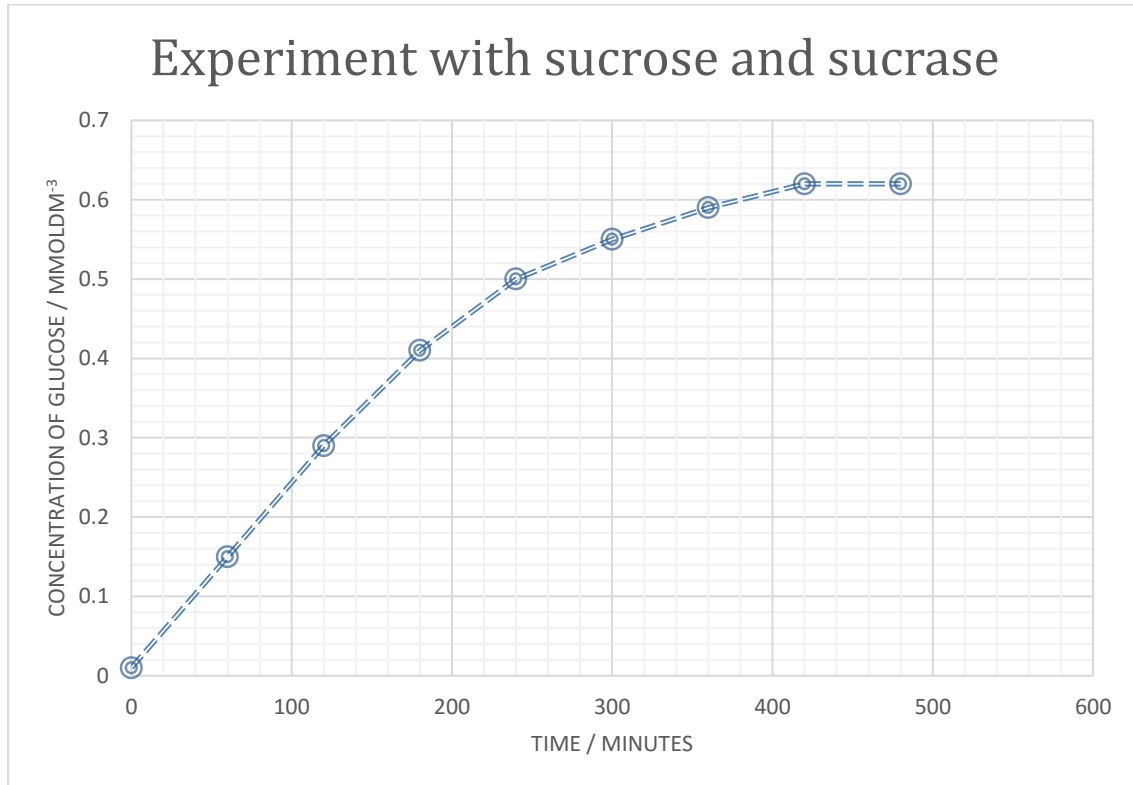
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b. List two variables that should be controlled in this experiment. (2 marks)

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c. The Graph above shows the data for these results as a scatter graph.  
Using the table of results as well as the graph discuss if the data collected indicate that the rate of the reaction is constant during the first three minutes (180 seconds)?  
(2 marks)

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- d. Calculate the rate of reaction in the first 3 minutes. Show your working (2 marks)

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- e. Describe the trend in the rate of reaction from 320 seconds to the 480 seconds. (2 marks)

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- f. Why was it not necessary to collect data after the 480 seconds? (1 mark)

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- g. Predict, with a reason, the fructose concentration in the reaction mixture at 360 secs. (2 marks)

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- h. L-Arabinose inhibits sucrase activity in a non-competitive manner. On the graph above sketch a graph of your prediction of the results of the same reaction with  $1\text{cm}^3$  of 1% inhibitor added. Explain any differences between the two graphs. (3 marks)

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