

Indraprastha Institute of Information Technology Delhi (IIITD)

Department of Computational Biotechnology

BIO211 – Cell Biology and Biochemistry

Quiz-2 (November 29, 2021)

Duration: 25 mins

Total marks: 25

1. Which of the following statements is incorrect? Justify your answer. (2 marks)
 - a) The electron-transport chain generates an electrical potential across the membrane because it moves electrons from the intermembrane space into the matrix - **Incorrect**
The potential is due to protons (H^+) that are pumped across the membrane from the matrix to the intermembrane space. Electrons remain bound to electron carriers in the inner mitochondrial membrane.
 - b) Complete oxidation of glucose to CO_2 and H_2O in aerobic organisms involve glycolysis, citric acid cycle and oxidative phosphorylation - **Correct**.
2. What are the two components that constitute the proton motive force? (2 marks)
The electrochemical proton gradient or the proton motive force consists of two components: a pH difference and an electrical potential.
3. Oxidation of sucrose has a very large and negative ΔG , but still it can be stored in a container with oxygen for indefinite time. Why? (2 marks)
Because of high activation energy barrier.
4. K_m can vary for the different substrates of the same enzyme. (Substrate/enzyme/affinity) (2 marks)
5. Which of the following statements are correct with respect to enzymes? (2 marks)
 - A. Enzymes are mainly made up of proteins.
 - B. Enzymes enhance the reaction rates by a factor of 10^5 to 10^{17} .
 - C. Enzymes lower the activation energy and increase the K_{eq} of reaction.
 - D. Enzymes do not themselves change in the reaction.
 - a. A, B, C
 - b. A, C, D
 - c. **D, A, B**
 - d. B, D, C
6. Which of the following listed effects would be brought about by an enzyme catalyzing the given reaction? (2 marks)
$$S \xrightleftharpoons[k_2]{k_1} P \quad k_{eq} = \frac{[P]}{[S]}$$
 - A. Increased k_1
 - B. Increased k_{eq}
 - C. Decreased activation energy
 - D. More negative $\Delta G'^o$
 - E. Increased k_2
 - a. **A, C, E**

- b. A, B, C
- c. B, C, D
- d. All of these

7. Name three activated carriers that carry hydrogen and high-energy electrons. How many of these activated carriers are generated as a result of oxidation of 1 molecule of glucose? (3 marks)

Three activated carriers that carry hydrogen and high-energy electrons – FADH_2 , NADH , NADPH (1 mark)

1 molecule of glucose:

FADH_2 : 2 molecules (1 mark)

NADH : 10 molecules (1 mark)

8. Which of the following statements related to glycolysis process are incorrect? (3 marks)

- A. It is a series of reactions involved in oxidative breakdown of glucose.
- B. The end products of glycolysis are pyruvate molecules and energy.
- C. Glycolysis occurs in cytosol in the presence of oxygen.
- D. The breakdown of 6C glucose into two 3C sugars is catalyzed by an isomerase enzyme.
- E. The activity of phosphofructokinase is allosterically regulated by ATP, ADP, AMP and P_i .

C and D

9. Match the following: (3 marks)

- | | |
|----------------------------|--|
| A. Citric acid cycle | i. Ubiquinone |
| B. Acetyl CoA | ii. 3 NADH , 1 GTP , 1 FADH_2 , 2 CO_2 |
| C. Fermentation in muscles | iii. Substrate level phosphorylation |
| D. Mitochondria | iv. Pyruvate dehydrogenase complex |
| E. Glycolysis | v. Oxidative phosphorylation |
| F. Mobile electron carrier | vi. Lactate |

- a. A-iv, B-vi, C-ii, D-v, E-iii, F-i
- b. A-ii, B-iv, C-vi, D-iii, E-v, F-i
- c. A-ii, B-iv, C-vi, D-v, E-iii, F-i
- d. A-i, B-vi, C-iv, D-v, E-ii, F-iii

10. Energy generated by each NADH molecule in electron-transport chain can generate about 2.5 molecules of ATP, whereas each molecule of FADH_2 can generate 1.5 ATP molecules. (2 marks)

11. Calculate the substrate concentration at which an enzyme with K_m of 5.0 mM will operate at one-quarter of its maximum rate? (2 marks)

$$V_o = 0.25V_{\max}$$

$$V_o = V_{\max}[S]/(K_m + [S])$$

$$0.25 = [S]/K_m + [S]$$

$$0.25K_m = 0.75[S]$$

$$[S] = (0.25 \times 6)/0.75$$

$$[S] = 2\text{mM} = 2 \times 10^{-3} \text{ M}$$

(Award marks even if steps have not been shown.)