Module 06: Metabolism — Study Questions

Energy and Metabolism

1. What is metabolism? How are catabolism and anabolism related?
2. How do the laws of thermodynamics apply to living organisms?
3. Why is ATP called the "energy currency" of the cell?
4. Describe the structure of ATP. Where is the energy stored?
5. What is the ATP cycle, and why is it important for continuous cellular activity?

Enzymes

1. What are enzymes, and why are they essential for metabolism?
2. How do enzymes lower the activation energy of a reaction?
3. Describe the induced fit model of enzyme action.
4. What is the relationship between an enzyme's active site and its substrate?
5. How does temperature affect enzyme activity? What happens if it gets too high?
6. Why do different enzymes work best at different pH levels?
7. What is the difference between competitive and noncompetitive enzyme inhibition?
8. Explain how feedback inhibition helps regulate metabolic pathways.
9. Many poisons and drugs work by inhibiting enzymes. Give an example and explain how it works.

Cellular Respiration

1. Write the overall equation for cellular respiration. What are the inputs and outputs?
2. What are the three main stages of cellular respiration, and where does each occur in the cell?
3. What happens during glycolysis? How much ATP is produced?
4. The citric acid cycle produces very little ATP directly. Why is it still essential?
5. How does the electron transport chain produce the majority of ATP?
6. What is the role of oxygen in cellular respiration?
7. How many ATP molecules are theoretically produced from one glucose molecule through complete aerobic respiration?
8. What does it mean when we say electrons are passed "downhill" through the electron transport chain?

Fermentation

1. What happens in cells when oxygen is not available?
2. Compare lactic acid fermentation and alcoholic fermentation. Where does each occur?
3. Why does fermentation produce much less ATP than aerobic respiration?
4. How does lactic acid fermentation relate to muscle fatigue during intense exercise?
5. How is alcoholic fermentation used in food and beverage production?

Integrative Questions

1. Why can't our muscles rely on fermentation alone during extended exercise?
2. How are photosynthesis and cellular respiration connected in terms of energy flow?

3. A person claims to have discovered an organism that creates energy from nothing. Based on thermodynamics, why is this impossible?