Module 8: Cellular Respiration

Comprehension & Critical Thinking Questions

Part 1: Core Concepts

1. **The Overview**
    - Write the balanced equation for cellular respiration: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + ATP$.
    - Name the four stages: Glycolysis, Pyruvate Oxidation, Citric Acid (Krebs) Cycle, Electron Transport Chain/Oxidative Phosphorylation.
2. **Locations**
    - Where does glycolysis occur?
    - Where do pyruvate oxidation, the Citric Acid Cycle, and the ETC occur? (Be specific about mitochondrial compartments.)
3. **Key Concepts**
    - Define chemiosmosis and oxidative phosphorylation.
    - What is the role of oxygen? Why is it called the "final electron acceptor"?

Part 2: Application

1. **ATP Accounting**
    - Starting with one glucose molecule:
        - Net ATP from glycolysis: 2
        - ATP from Citric Acid Cycle: 2
        - ATP from ETC/Oxidative Phosphorylation: 26-28
    - Why is the total ATP yield a range (30-32) rather than a fixed number?

2. **Anaerobic Options**

    - If oxygen is unavailable, cells perform fermentation.
    - Compare lactic acid fermentation (animals, bacteria) and alcohol fermentation (yeast).
    - Does fermentation produce new ATP? What is its primary purpose?

Part 3: Analysis & Evaluation

1. **Efficiency Analysis**

    - Cellular respiration captures approximately 34% of glucose's energy in ATP. Where does the remaining energy go? (Heat, entropy)

2. **Metabolic Integration**

    - Proteins and fats can enter the respiratory pathway. Where do fatty acids enter? Where do amino acids enter after deamination?