Module 6: Metabolism

Keys to Success & Study Guide

Learning Objectives

By the end of this module, you should be able to:

1. **Differentiate** between kinetic/potential energy and exergonic/endergonic reactions.
2. **Explain** how enzymes catalyze reactions and how they are regulated by environmental factors.
3. **Describe** the ATP cycle and its role in energy coupling.
4. **Analyze** metabolic control via feedback inhibition and redox reactions.

Key Terminology Checklist

Define these terms in your own words to ensure mastery.

- [ ] **Entropy**: A measure of disorder or randomness in a system.
- [ ] **Substrate**: The specific reactant on which an enzyme acts.
- [ ] **Active Site**: The region of an enzyme where the substrate binds.
- [ ] **Allosteric Regulation**: Regulation of enzyme activity by binding of an effector molecule at a site other than the active site.
- [ ] **Phosphorylation**: The addition of a phosphate group to a molecule, often transferring energy.

Concept Check

1. Thermodynamics and Life

- **Question**: How can complex, ordered life exist in a universe tending toward entropy?
- **Key Answer**: Living organisms are open systems that maintain order by increasing entropy elsewhere. Metabolism releases heat, which increases overall entropy. Life obeys the Second Law of Thermodynamics.

2. Enzyme Mechanism

- **Question**: How do enzymes work?
- **Key Answer**: Enzymes lower activation energy by stabilizing the transition state. The Induced Fit Model describes how the enzyme active site conforms to the substrate upon binding.

3. Energy Coupling

- **Question**: How is ATP used to power cellular processes?
- **Key Answer**: ATP hydrolysis is exergonic ($\Delta G < 0$). This energy is coupled to endergonic reactions ($\Delta G > 0$) through phosphate transfer or conformational changes in proteins.