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. - [ ] **Substrate**: The specific reactant an enzyme acts on. - [ ] **Active Site**: The region of the enzyme where the substrate binds. - [ ] **Allosteric Regulation**: Regulation of an enzyme by binding an effector molecule at a site other than the active site. - [ ] **Phosphorylation**: Adding a phosphate group to a molecule (often transferring energy).

Concept Check

1. The Cost of Order

- **Question**: How do we explain complex, ordered life in a universe tending toward entropy?
- **Deep Dive**: We pay for our order by creating disorder elsewhere (mostly by determining heat). Every chemical reaction releases some energy as heat. This is why you get hot when you workout (high metabolism).

2. Lock and Key vs. Induced Fit

- **Question**: How do enzymes physically work?

- **Deep Dive**: The "Lock and Key" model suggests a perfect fit. The "Induced Fit" model suggests the enzyme hugs the substrate like a handshake. Which model is more accurate? (Induced fit).

3. Energy Coupling

- **Question**: How can ATP be used to power virtually all body processes?
- **Deep Dive**: ATP hydrolysis is Exergonic (releases energy). Cells couple this with Endergonic (energy-requiring) processes. It's like using a battery (ATP) to run a toy (Cell work).

Study Tips

- **Graph it**: Draw a graph of Free Energy (G) vs. Time for an Exergonic reaction (downhill) and Endergonic reaction (uphill). Draw the "hump" for activation energy. Show how an enzyme lowers the hump but doesn't change the start or finish points.
- **The Mnemonic**: OIL RIG.
    - **O**xidation **I**s **L**oss (of electrons/Hydrogen).
    - **R**eduction **I**s **G**ain (of electrons/Hydrogen).