Powerhouse Activity: Cellular Respiration

AP Biology/College Level Teacher Guide

Overview

This guide supports implementation of the Powerhouse Activity: Cellular Respiration using the 5E instructional model.

Learning Objectives

- Students will model the complete pathway of cellular respiration
- Students will trace energy flow through glycolysis, Krebs cycle, and oxidative phosphorylation
- Students will analyze the interdependence of respiration stages
- Students will compare aerobic and anaerobic metabolism

Standards Alignment

- **ESSENTIAL KNOWLEDGE 3.3.A.1:** Energy is stored and released via the breaking and forming of chemical bonds.
- **ESSENTIAL KNOWLEDGE 3.3.B.1:** Cellular respiration includes the metabolic pathways of glycolysis, the Krebs cycle, and the electron transport chain.
- **ESSENTIAL KNOWLEDGE 3.3.B.2:** Cellular respiration captures the chemical energy in glucose to produce ATP.

Prerequisites

- ATP structure and function
- Redox reactions
- Enzyme catalysis
- Mitochondrial structure

Time Estimate

90 minutes

Materials Needed

- Computer/tablet with internet access
- Student worksheet

Teaching Tips by Phase

Phase 1: ENGAGE (5-10 minutes)

- Start with the phenomenon or problem presented
- Elicit student predictions and prior knowledge
- Create cognitive dissonance if possible
- Build excitement for investigation

Phase 2: EXPLORE (15-20 minutes)

- Allow students to investigate with minimal guidance
- Circulate and ask probing questions
- Encourage systematic data collection
- Note common discoveries and difficulties

Phase 3: EXPLAIN (10-15 minutes)

- Have students share their findings first
- Build on their observations to introduce concepts
- Address misconceptions directly
- Connect to broader biological principles

Phase 4: ELABORATE (10 minutes)

- Apply knowledge to new scenarios
- Make real-world connections
- Encourage deeper investigation
- Support transfer of learning

Phase 5: EVALUATE (5-10 minutes)

- Use varied assessment strategies
- Focus on conceptual understanding
- Provide immediate feedback
- Plan follow-up based on results

> **Remember:**
>
> The goal is student discovery through guided inquiry. Resist the urge to explain concepts before students have explored them!
