# Powerhouse Activity: Cellular Respiration

## High School (NGSS Aligned) Teacher Guide

### Overview

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

### Learning Objectives

- Students will model how cells break down glucose to produce ATP
- Students will trace the path of molecules through cellular respiration
- Students will compare aerobic and anaerobic processes
- Students will explain why cells need oxygen

### Standards Alignment

- **HS-LS1-5:** Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy
- **HS-LS1-7:** Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy
- **HS-LS2-3:** Construct and revise an explanation based on evidence for the cycling of matter and flow of energy

### Prerequisites

- Basic understanding of cells and mitochondria
- Concept of chemical energy
- ATP as cellular energy currency

## Time Estimate

50 minutes

## Materials Needed

- Computer/tablet with internet access
- Student Activity Sheet
- Calculator
- Colored pencils (optional)

## 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

## NGSS Three-Dimensional Learning

- **Science Practices:** Developing and using models, analyzing data, constructing explanations
- **Crosscutting Concepts:** Patterns, cause and effect, systems thinking
- **Disciplinary Core Ideas:** See standards alignment above

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

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