Name: _____ **Date:** _____

Section: _____

Yeast Respiration Activity

Metabolic Flexibility in Saccharomyces cerevisiae

Background: _____

Yeast cells demonstrate remarkable metabolic flexibility, switching between aerobic respiration and alcoholic fermentation based on oxygen availability. This simulation models real-time ATP production rates, substrate consumption, and metabolic byproduct formation under varying conditions.

Phase 1: ENGAGE (10 minutes)

Getting Started: Open peebedu.com and navigate to Yeast Respiration Simulator

Initial Exploration: What yeast strains are available? _____ What substrates can yeast use? _____ What environmental factors can you control? _____ What happens when you seal the vessel? _____

Pre-Assessment Questions: What are the products of aerobic respiration? _____ What are the products of alcoholic fermentation? _____

Which process produces more ATP? _____ Why? _____

When would yeast switch to fermentation? _____ _____

Phase 2: EXPLORE (30 minutes)

Investigation 1: Oxygen Effects

Using Baker's yeast with glucose at 25°C:

Open Vessel Observations: Run with vessel open and observe:

- Which metabolic pathways are active? _____

- What changes occur? _____

Sealed Vessel Experiment: Sealed Vessel Observations: Seal vessel and watch what happens:

- What changes when oxygen runs out? _____

- What new product appears? _____

Key Discovery: At what point does fermentation start? _____

Investigation 2: Temperature Effects

Using Champagne yeast with glucose, test different temperatures:

Temperature Observations:

- Cold (15°C): How active is the yeast? _____

- Warm (35°C): Is it faster or slower? _____

Optimal temperature: _____ **Why does temperature matter?** _____

Investigation 3: Substrate Comparison

Using Ale yeast at 30°C, compare glucose vs starch:

Observations:

- Which substrate is used faster? _____

- What must happen to starch first? _____

Phase 5: EVALUATE (15 minutes)

Assessment Questions

Process Understanding:

Put these in order: ___ Yeast uses oxygen for respiration ___ Oxygen runs out ___ Fermentation begins ___ Alcohol is produced ___ Glycolysis speeds up

Concept Application:

Why does bread dough rise? _____

Why does beer bubble? _____

Problem Solving:

A brewery notices slow fermentation. What might be wrong? _____

- Temperature issue? _____
- Sugar availability? _____

Critical Thinking:

Why don't yeast cells just wait for oxygen to return? _____

Synthesis Question:

Explain how yeast's metabolic flexibility helps it survive in nature: _____