Name: **Date:** **Section:**

Ocean Acidification Simulator Activity: pH Effects on Marine Life

Investigating Ocean Acidification: When CO_2 Meets the Sea

Background: _____

The ocean absorbs approximately 30% of atmospheric CO_2, initiating a series of chemical reactions that lower ocean pH. This process, ocean acidification, threatens marine organisms that build calcium carbonate structures.

Phase 1: ENGAGE (10 minutes)

Getting Started:

Open peebedu.com and navigate to Ocean Acidification Simulator

Initial Exploration:

1. Click "Introduction" and explore the chemistry section
2. Note the key chemical equations displayed
3. Identify all molecule types in the legend

Pre-Assessment Questions:

1. What is the current atmospheric CO_2 concentration (2026)? _____ ppm

1. What was the pre-industrial CO_2 level (1850)? _____ ppm

1. Predict: How will increasing CO_2 affect ocean pH? _____

1. Hypothesis: How might pH changes impact coral growth? _____

Phase 2: EXPLORE (25 minutes)

Investigation 1: Pre-Industrial Baseline (1850)

1. Start with the "1850 Pre-Industrial" scenario
2. Observe for 2 minutes (simulation time = 12 years)

Data Collection Table 1:

- ---------- 280

Parameter ---------

CO_3^{2-} Conc. (mol/L) Initial ----------

Ca^{2+} Conc. (mol/L) Coral Growth? ----------

Critical threshold: _____ ppm CO_2

1. **Ecosystem Cascade Effects:**

Beyond coral reefs, predict impacts on:

- Shell-forming organisms: _____
- Carbon sequestration: _____

1. **Mitigation Strategies:**

Propose three evidence-based solutions:

1. _____
2. _____

Phase 5: EVALUATE (10 minutes)

Quantitative Assessment

1. **Data Analysis Question:**

Using your data, calculate the percentage decrease in coral growth rate per 0.1 pH unit drop:

Growth rate decrease = _____ % per 0.1 pH unit

Show your work:

1. **Prediction Challenge:**

If current CO_2 emission rates continue (2.5 ppm/year increase):

- Year when pH drops below 8.0: _____
- Assumptions made: _____

1. **Critical Thinking:**

The simulation shows immediate chemical responses. Real oceans have additional factors.

List three factors that might:

Accelerate acidification:

1. _____
2. _____

Slow acidification:

1. _____
2. _____

1. **Model Evaluation:**

Strengths of this simulation:

- _____

Limitations:

- _____

1. **Application Question:**

A marine protected area shows pH = 8.05 and decreasing by 0.015 units/year.

Local corals need pH > 7.95 to survive.

Calculate:

- Years until critical pH: _____

- NOAA Ocean Acidification Program
- IPCC Special Report on Oceans
- Scripps Institution CO_2 Program
- Local marine research stations