PEEBEDU

Ocean Acidification Simulator

Name: _____ **Period:** _____ **Date:** _____

> Open **peebedu.com** and navigate to **Ocean Acidification Simulator**. Read the introduction popup, which describes the chemistry of ocean acidification and how corals build their skeletons. Select the **Today (2026)** scenario to begin.

Part 1 — Model Evaluation (MAPP Framework)

Scientific models are simplified representations of complex biological phenomena. Use the MAPP framework below to evaluate the Ocean Acidification Simulator as a scientific model.

M — Mode

What type of model is the Ocean Acidification Simulator? Describe how this computational simulation represents the relationship between atmospheric CO_2 and ocean chemistry. In your answer, identify at least three specific simulation elements and explain what each one is designed to show about ocean acidification.

A — Accuracy

(a) Identify two things this simulation represents **accurately** about ocean acidification. For each, name the specific simulation feature and explain what aspect of ocean chemistry or coral biology it demonstrates.

(b) Identify two things this simulation **oversimplifies or leaves out** about ocean acidification. Consider what you cannot observe in the simulation that would be important for a complete understanding of how rising CO&sub2; affects marine ecosystems.

P — Purpose

What is the learning goal of this simulation? Explain how the Ocean Acidification Simulator is designed to help you understand how human-driven increases in atmospheric CO_2 disrupt ocean chemistry and threaten marine organisms. In your answer, connect at least one specific simulation feature to a biological consequence for coral reef ecosystems.

P — Permanency

Could this model change with new scientific evidence? Describe one way that new discoveries might change or improve a simulation like the Ocean Acidification Simulator. Explain why scientific models, including computational simulations, are revised as new evidence becomes available.

Small-Group Discussion

With your group, discuss the following:

- What are the strengths of this simulation as a model for ocean acidification?
- What are its limitations?
- If you could add one feature to improve this simulation, what would it be and why?
- How does the simulation help you connect human activity at a global scale to molecular-level changes in ocean chemistry?

Part 2 — Free Response Questions

Conceptual Analysis

Question 1 — The Carbon Cycle and Human Impact on Ocean Chemistry

> *Simulation Task: Set the CO_2 Concentration slider to 280 ppm (1850 Pre-Industrial) and click Start. Record the pH Level and Carbonate Conc. readouts. Then slowly increase the slider to 600 ppm (2100 Worst Case) and observe how the pH Level, H^+ Ions, and Carbonate Conc. change. Note the Coral Health indicator at each setting.*

(A) (1 pt) **Describe** how the carbon cycle connects atmospheric CO_2 to ocean chemistry.

(B) (1 pt) **Explain** why increasing atmospheric CO_2 concentration from pre-industrial levels (280 ppm) to projected levels (600 ppm) leads to a decrease in ocean pH.

(C) (1 pt) **Predict** what would happen to coral reef ecosystems if atmospheric CO_2 levels continued to rise beyond the simulator's 2100 projection.

(D) (1 pt) **Justify** your prediction by explaining how human impact on the carbon cycle accelerates changes in ocean ecosystems, and how the loss of coral reef habitat could lead to cascading effects on biodiversity.

EK 8.2.B.5, EK 8.7.C.1

Analyze Model / Visual Representation

Question 2 — Ocean Acidification as an Ecosystem Disruption

> *Simulation Task: Click Reset. Set Initial Carbonate Ions to the maximum value and Initial Calcium Ions to the maximum value. Click Start and observe coral growth at the default CO_2 level (425 ppm). Then increase CO_2 to 600 ppm and observe how Coral Height, Carbonate Conc., and Coral Health change over time. Use the Real-Time Tracking charts to compare conditions.*

(A) (1 pt) **Describe** how human activities that increase atmospheric CO_2 can drive changes in marine ecosystems.

(B) (1 pt) **Explain** the relationship between atmospheric CO_2 concentration, ocean carbonate ion availability, and coral skeleton formation ($Ca^{2+} + CO_3^{2-} \rightarrow CaCO_3$).

(C) (1 pt) **Represent** the process of ocean acidification and its effect on coral reef organisms.

Draw your diagram here.

(D) (1 pt) **Connect** the ecosystem disruption shown in this simulator to how ocean acidification could act as a selective pressure on marine populations.

EK 8.7.C.1, EK 7.1.B.2