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

Ocean Acidification Simulator Activity: pH Effects on Marine Life

Ocean Acidification: The CO_2 Ocean Mystery

Phase 1: ENGAGE (5 minutes)

Getting Started:

Open peebedu.com and navigate to Ocean Acidification Simulator

First Look:

Click "Introduction" and explore!

Quick Quiz:

1. Where does CO_2 come from? _____
2. What marine animal is shown in the simulation? _____

Big Question: 🤔

How can invisible gas hurt ocean animals? _____

Phase 2: EXPLORE (18 minutes)

Mission 1: The Past (1850) 🏰

1. Click "1850 Pre-Industrial"

2. Watch the molecules for 1 minute
3. Focus on the coral reef

Observation Station:

- CO_2 level: _____ ppm (parts per million)
- Coral growth: Fast / Medium / Slow / None
- Molecule counts:
- Lots of carbonate (CO_3^{2-})? Yes / No
- Many H^+ ions (acid)? Yes / No

Draw what you see: (Label molecules)

[Box for drawing]

Mission 2: Today (2026)

1. Reset and click "Today (2026)"
2. Watch for 1 minute
3. Compare to 1850

What Changed?

- CO_2 level: _____ ppm (increase of _____ ppm)
- Coral growth: Fast / Medium / Slow / None
- Carbonate ions: More / Same / Less
- H^+ ions: More / Same / Less

Coral Health Check:

The corals look: Healthy / Stressed / Dying

Because: _____

Mission 3: The Future (2100) 🚀

1. Reset and click "2100 Worst Case"
2. Watch for 1 minute
3. Record the disaster!

Future Shock:

- CO_2 level: _____ ppm (OMG!)
- Coral growth: Fast / Medium / Slow / None

Pattern Detective: 🕵️

As CO_2 goes UP ↑, ocean pH goes _____ ↓

As pH goes DOWN ↓, coral growth goes _____ ↓

Phase 3: EXPLAIN (12 minutes)

The Chemistry Story 🧪

1. **CO_2 Meets Water:**

```

$CO_2 + H_2O \rightarrow H_2CO_3$ (carbonic acid)

```

This makes the ocean more acidic!

1. **The Acid Problem:**

```
```

$H_2CO_3 \rightarrow H^+ + HCO_3^-$

```

More $H^+$ = More acid = Lower pH

1. **The Coral Crisis:**

Corals need:

- Calcium ($Ca^{2+}$) ✓
- Carbonate ($CO_3^{2-}$) ✓
- Together they make: $CaCO_3$ (coral skeleton)

But $H^+$ ions steal carbonate!

```

$H^+ + CO_3^{2-} \rightarrow HCO_3^-$

```

No carbonate = No coral growth! 😢

**pH Scale Adventure:**

```

14 --

8 --

2 -- Your Rating (1-5) 300 ppm ★★★★☆ 450 ppm ★☆☆☆☆

Danger zone starts at: _____ ppm

1. **Real-World Connections:**

Where does extra CO_2 come from? _____

- 🚗 Cars and trucks: _____

- ✈️ Airplanes: _____

Phase 5: EVALUATE (7 minutes)

Check Your Understanding ✅

1. **Multiple Choice:**

Ocean acidification happens because: _____

a) People pour acid in the ocean

b) CO_2 from air dissolves in water

c) Fish produce too much waste

d) The sun heats the water

1.
2. **Fill in the Blanks:**

When CO_2 enters the ocean, it forms _____ acid.

This releases H^+ ions that make the water more _____.

H^+ ions react with _____ ions that corals need.

Without these ions, corals can't build their _____.

1. **Math Connection:**

If pH drops from 8.2 to 8.1:

- Change = _____ pH units

- Percent more acidic = 30%

If pH drops to 8.0:

- Total change = _____ pH units

1. **Problem Solving:**

A coral reef has pH 8.1 today.

It drops 0.1 every 50 years.

When will it reach pH 7.9?

Today + _____ years = Year _____

Action Plan! 💪

List 3 things YOU can do to help:

1. _____
2. _____

Design Challenge:

Draw a poster warning about ocean acidification: _____

[Box for drawing]

Exit Ticket:

In your own words, explain ocean acidification to a younger student:

- --

Fun Facts! 🌊

- The ocean has absorbed 525 billion tons of CO_2!
- That's like 52.5 million blue whales of gas!
- Coral reefs support 25% of all ocean species
- Some corals glow under UV light!
- The Great Barrier Reef can be seen from space!

Take It Home:

Calculate your family's car CO_2:

- Miles driven per week: _____
- CO_2 per mile: ~400 grams
- Ocean absorbs 30%: _____ grams

Key Vocabulary:

See activity for vocabulary specific to this topic.