



NEW SOUTH WALES

# PRIMARY ACTIVITY

# OCEAN

# ACIDIFICATION

- Syllabus Reference
- Resources
- Worksheet



# SYLLABUS REFERENCE

- **ES3** People use scientific knowledge to evaluate claims, explanations or predictions in relation to interactions involving the atmosphere, biosphere, hydrosphere and lithosphere. (ACSHE160, ACSHE194)
- **Students:**
  - c. evaluate scientific evidence of some current issues affecting society that are the result of human activity on global systems, eg the greenhouse effect, ozone layer depletion, effect of climate change on sea levels, long-term effects of waste management and loss of biodiversity

## ADDITIONAL RESOURCES



- Readworks: [What is ocean acidification](#)
- Ocean acidification and shell building [worksheet](#)
- Ocean acidification ted ed [Ocean Acidification | Castell Alun | TEDxGwE](#)
- Data in the classroom: [Ocean acidification](#)

DATA IN THE CLASSROOM: LEVEL 1  
How Does Rising CO<sub>2</sub> Impact Ocean pH?

1. **Calculate Ocean pH Over Time:** How much have CO<sub>2</sub> levels in the ocean changed over time? Use the graph to answer the question.

How much has CO<sub>2</sub> in the ocean increased since 1980?  
To calculate percent change, find the difference between the starting and ending values, and then divide by the starting value.

2. **Make a Prediction:** Observe the graph showing CO<sub>2</sub> measurements at Mauna Loa Observatory, Hawaii, from 1958 to 2018. Then predict the likely effect of rising CO<sub>2</sub> on ocean pH by completing the table below.

CO<sub>2</sub> level (ppm) of the ocean over approximately 50 years (or predict)  
pH of the water is likely?  
Explain why your prediction is likely. Use evidence from the graph (that might show trends in atmospheric CO<sub>2</sub> and ocean CO<sub>2</sub> could lead to predict pH change).

What are the primary chemical reactions that may explain your prediction? (Use chemical equations or words or both.)

3. **Submit Your Prediction:** Write your prediction for a blank line on the graph below. See instructions.

4. Compare the logarithmic scale to a linear scale.  
5. Ocean pH will continue to drop as the CO<sub>2</sub> level of the graph. Note: Do NOT make your scale from 0 to 14. Keep a constant interval for prediction.  
6. Find the year 1980 on the x-axis. Draw a vertical line to 1980. Place a blank dot at this location on the graph.  
7. Starting from the dot, make a line that shows your predicted change in ocean pH from 1980 to 2018.

9-12 GRADE BAND

Ocean Acidification and Shell Building

**Georgia Standards of Excellence:**

- **SEW.4.** Obtain, evaluate, and communicate information to analyze human impact on natural resources.
  - **b.** Design, evaluate, and refine solutions to reduce human impact on the environment (including, but not limited to, smog, ozone depletion, urbanization, and ocean acidification).

**Next Generation Science Standards:**

- **HS-ESS3-4.** Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

**Learning Objective:**

- Students will discover how increasing carbon dioxide amounts in the atmosphere impact acidification in the ocean.
- Students will investigate the impacts that ocean acidification has on shell and skeleton building organisms.

**Essential Question:**

- What would be the result of a long-term exposure to low pH on an organism with a calcium carbonate structure?

**Key Vocabulary:**

- pH
- Argonite
- Ocean Acidification
- Carbonic Acid
- Calcium Carbonate

**Materials:**

- Internet connection
- Writing Utensil
- Ocean Acidification and Shell Building Worksheet



# STUDENT WORKSHEET

## Learning Intention

To investigate the causes and effects of ocean acidification

## Success Criteria:

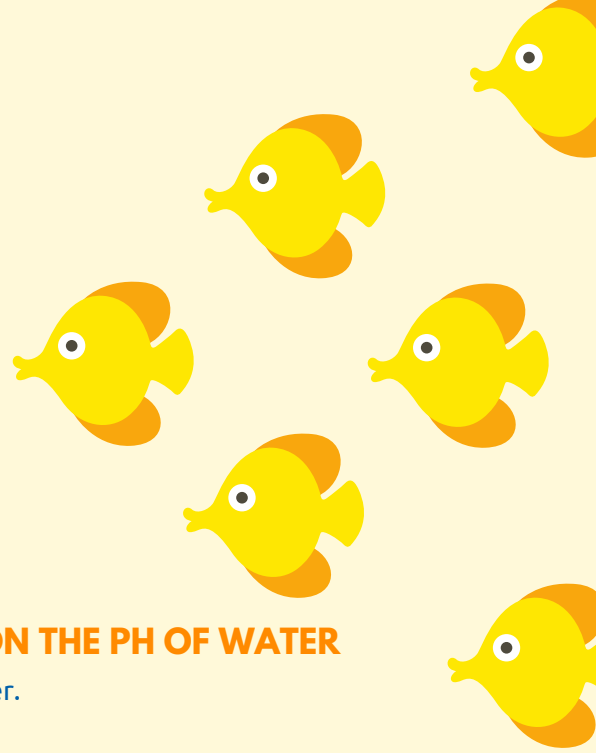
- Describe the relationship between ocean acidification and increased atmospheric levels of carbon dioxide
- Investigate the effect of ocean acidification on calcium carbonate shells
- Explain the impact of ocean acidification on shelled organisms and describe how this impacts oceanic ecosystems

**COMPLETE THE  
HYPOTHESIS BY  
SELECTING ONE OF  
EACH OF THE  
TERMS IN BLUE**

**Hypothesis: As the amount of carbon dioxide in water increases the water will become MORE/ LESS acidic  
Shells will dissolve FASTER/SLOWER in more acidic environments.**



# AIM TO INVESTIGATE OCEAN ACIDIFICATION



## METHOD

### EXPERIMENT 1: THE EFFECT OF CARBON DIOXIDE ON THE PH OF WATER

1. Add 50mL of water and 2 drops of universal indicator to a beaker.
2. Record the initial pH of the water
3. Using a clean straw, blow bubbles through the water. The carbon dioxide in your breath will dissolve into the water
4. Record the change in pH of the water

## METHOD

### EXPERIMENT 2: THE EFFECT OF ACIDIC WATER ON CALCIUM CARBONATE SHELLS

1. Weigh and record the mass of 3 shells
2. Place the shell in the acidified water from experiment 1 (soda water could also be used)
3. Leave the shell in the acidified water overnight
4. Remove the shell from the water and allow to dry completely
5. Weigh and record the final mass of the shell

### MATERIALS NEEDED

- Universal indicator
- Straws (1 per student)
- 100mL beakers
- Shells or marble chips (egg shells can also be used)
- Mass balances

## RESULTS

Initial pH of water: \_\_\_\_\_

Final pH of water: \_\_\_\_\_

	Initial Mass (g)	Final Mass (g)
Shell 1		
Shell 2		
Shell 3		

**DISCUSSION**  
**OCEAN**  
**ACIDIFICATION**

**HOW DID ADDING  
CARBON DIOXIDE  
TO WATER  
CHANGE ITS PH?**

**WHAT EFFECT DID  
LEAVING SHELLS IN  
ACIDIC WATER  
OVERNIGHT HAVE?**

**HOW COULD  
THE VALIDITY  
OF THIS  
EXPERIMENT  
BE IMPROVED?**

**USING THE  
OBSERVATIONS  
FROM THIS  
EXPERIMENT,  
PREDICT WHAT  
IMPACT INCREASED  
CARBON DIOXIDE  
LEVELS MIGHT HAVE  
ON SHELLED  
MARINE ANIMALS**





NEW SOUTH  
WALES

**CHECK OUT MORE  
PRIMARY TEACHER  
RESOURCES ON  
OUR HUB!**



[beachsafetyhub.org.au](https://beachsafetyhub.org.au)