

PERFORMANCE BASED ASSESSMENT

Calcium Carbonate and Shell Production

How does carbon dioxide absorption impact the health of the ocean? The ocean has a natural buffering system that absorbs the carbon dioxide. As more and more carbon dioxide is produced the ocean will reach its limit and the buffering capability will decline, leading to a more acidic environment. Rising carbon dioxide levels in the atmosphere are directly harming the ocean ecosystems through ocean acidification, which is interfering with many organisms' ability to form shells. When atmospheric carbon dioxide dissolves in the ocean, it produces carbonic acid. This lab will focus on different concentrations of acid and how that plays a role in shell formation.

Focus on Science Practices

SEP 4 Analyzing and Interpreting Data

SEP 6 Constructing Explanations and Designing Solutions

Materials Per Group

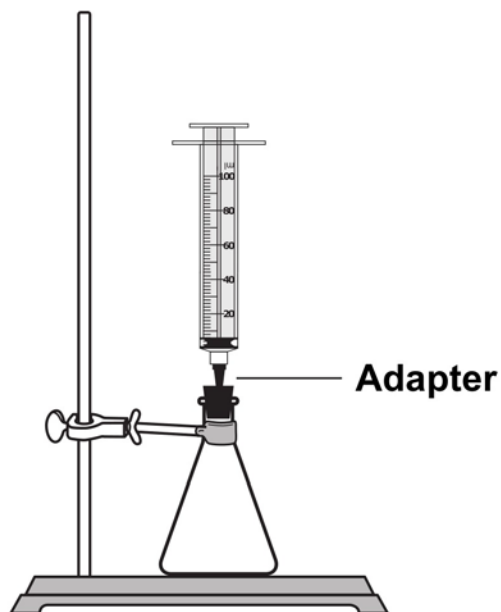
- Calcium carbonate (marble chips)
CaCO₃, 0.9 g
- Hydrochloric acid solution, 6 M, 5 mL
- Hydrochloric acid solution, 4 M, 5 mL
- Hydrochloric acid solution, 2 M, 5 mL
- Petroleum jelly, foilpac, 1
- Balance, 0.001 g precision
- Clamp, single, buret
- Erlenmeyer flasks, 125 mL, 3
- Gas collection apparatus
 - Syringe, 60 mL
 - Syringe adapter
 - Stopper, one-hole (to fit flask)
- Support stand
- Timer or stopwatch
- Wash bottle

Safety 

Hydrochloric acid is corrosive to skin and eyes and toxic by inhalation or skin absorption. Avoid contact with eyes and skin and clean up all spills immediately. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. For the gas collection experiment, do not use more than 0.3 g of calcium carbonate. The concentration of hydrochloric acid must not exceed 6 M in any experiment. Wash hands thoroughly with soap and water before leaving the laboratory. Please follow all laboratory safety guidelines.

Procedure

1. Set up the gas-collection apparatus as shown in Figure 1. Make sure the rubber stopper fits securely in the flask. Lubricate the plunger of the syringe with silicone grease or petroleum jelly to reduce friction. Apply a small dab of grease to the black rubber gasket only.

Figure 1

2. SEP Plan an Investigation Using the materials provided, develop a method to test the effects of different concentrations of hydrochloric acid on calcium carbonate. Describe your testing method and procedure in the space. Show your method to your teacher before conducting the investigation.

- a. Each test will require 0.3 g of calcium carbonate and 5 mL of hydrochloric acid.
- b. The stopper and syringe assembly must be immediately placed back on the flask to prevent any loss of gas.
- c. Data collection should occur for 10 minutes.

3. Record all data in the blank table provided and graph your results.

Calcium Carbonate and HCl			
Time	y-axis measurement: _____		
	Concentration of HCl		
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

3. SEP Construct an Explanation How does an increase in the acidity of the ocean affect calcifying organisms and their efforts to produce shells?

4. SEP Apply Scientific Reasoning How could the amount of available calcium carbonate affect the ocean food web? How could that, in turn, affect humans?