

Precipitation of Calcium Carbonate activity

STANDARDS

See summary of National Science Education Standards.

Original: <http://books.nap.edu/readingroom/books/nses/>

Standard Concept	General standard	Specific standard	General standard	Specific standard	General standard	Specific standard
Grade Level		K-4		5-8		9-12
Science as inquiry (A)	Abilities ... to do ... inquiry	A.1.4.1	Abilities ... to do ... inquiry	A.1.8.1	Abilities ... to do ... inquiry	A.1.12.1
		A.1.4.2		A.1.8.2		A.1.12.2
		A.1.4.4		A.1.8.4		A.1.12.4
		A.1.4.5		A.1.8.5		A.1.12.5
				A.1.8.6		A.1.12.6
				A.1.8.7		
	Understandings about ... inquiry	A.2.4.1	Understandings about ... inquiry	A.2.8.1	Understandings about ... inquiry	A.2.12.1
		A.2.4.2		A.2.8.2		A.2.12.2
		A.2.4.4		A.2.8.5		A.2.12.5
		A.2.4.5				
Physical Science (B)	Properties of ... materials	B.1.4.2	Properties and changes of properties in matter	B.1.8.1		
		B.1.4.3		B.1.8.2		
					Chemical Reactions	B.3.12.1



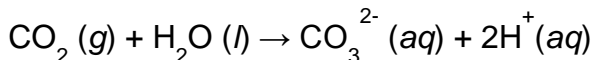
Earth Science (D)	Properties of Earth Materials	D.1.4.1	Structure of Earth system	D.1.8.4		
				D.1.8.7		
				D.1.8.8		
			Earth's History	D.2.8.1	Geochemical Cycles	D.2.12.1
						D.2.12.2
					...Evolution of Earth system	D.3.12.3



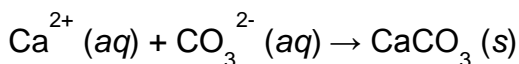
PRECIPITATION OF CALCIUM CARBONATE ACTIVITY

INTRODUCTION:

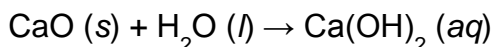
Limestone is made of calcium carbonate (CaCO_3). This mineral precipitates from solutions that contain calcium ions (Ca^{2+}) and carbonate ions (CO_3^{2-}). The carbonate ion can enter the solution in the form of carbon dioxide (CO_2) from the air that is dissolved in the water:



This carbonate ion can then react with calcium ions that are already in the water:



The reaction can be illustrated through the introduction of carbon dioxide gas (exhaled air) into a saturated solution of calcium oxide (lime, CaO). Calcium oxide dissolves only slightly in water to form a solution of calcium hydroxide:



Caution: Wear goggles. The solution of calcium hydroxide is basic and should be kept away from eyes. If solution gets into the eyes, wash thoroughly with water (15 minutes in eye wash).

OBJECTIVE

Students will observe the precipitation of calcium carbonate from solution in order to gain an understanding of geologic processes of precipitation.

MATERIALS:

- Lime
- Drinking straw
- 25 mL vial or other small container
- Bottle or beaker in which to make lime solution
- Water

PROCEDURE: (Teacher instructions)

- 1) For a class of about 25, make a saturated solution of lime by adding about one quarter of a cup (about 250 mL) of powdered lime to about 1 quart (one liter) of water.
- 2) Let the solution sit undisturbed until the solid settles to the bottom.
- 3) Carefully decant about 10 mL of the clear calcium hydroxide solution into each of the vials for participants.
- 4) Have participants blow through a straw until they notice a white precipitate forming.



EXPLANATION:

- 1) The air blown into the calcium hydroxide solution contains carbon dioxide. That reacts with the water to form carbonate ion. The carbonate ion reacts with the calcium ions in solution to form the white calcium carbonate precipitate. Calcium carbonate is the chemical composition of the mineral calcite that makes up limestone
- 2) These reactions also cause changes in the acidity (pH) of the solution that can be followed by adding a solution of red cabbage juice or other universal indicator, or by testing with pH paper.

EVALUATION

- 1) How might such a reaction be important to the global climate?
- 2) What might the atmosphere have been like in times of large amounts of deposition of limestone?

