Chemistry Concept Challenge #4: Solutions & Precipitation

The concepts addressed in this week's Challenge most closely relate to these sections in your textbook:
Chapter 3.5, 4.1, 4.2, 4.4

Have you ever explored caves? Have you seen cone shaped formations suspended from the ceiling and growing from the floor? These formations are called *stalactites* and *stalagmites*. How do you think they are created?

Stalactites and stalagmites are formed when water that is rich in minerals evaporates, leaving behind a solid precipitate. The two formations are usually seen in pairs. The stalactite is suspended from the ceiling of the cave while the stalgmite appears to grow upward from the floor beneath. As the stalactite is formed on the ceiling, mineral-rich water that has not yet evaporated drips to the floor. The water then evaporates, leaving behind a precipitate (calcium carbonate and other minerals).

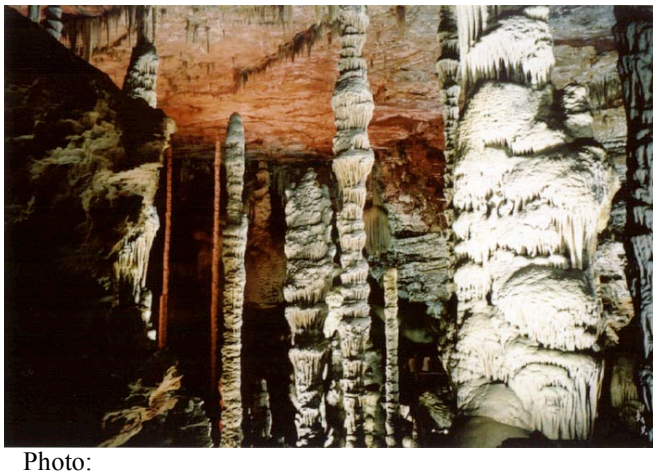


Photo: http://lebihanj.free.fr/Mon%20Site/Rei%20do%20Mato/pages/Gruta%20Rei%20Do%20Mato%201.htm

The longest stalactite and stalagmite formation in the world is found in a cave near Minas Gerais, Brazil. In the Gruta Rei do Mato Cave, a stalactite and stalagmite have connected, forming a pillar stretching 20 meters high.

Stalactites and stalagmites are examples of precipitates found in nature. In this Challenge, you will consider what happens when you form precipitates by mixing two solutions in the lab.

Your Challenge:
To represent the concepts of dissolved ions and precipitation reactions in multiple ways.

Note: *We encourage you to work with other students; however, THE FINAL PRODUCT MUST BE YOUR OWN, WRITTEN IN YOUR OWN WORDS.*

As you complete this Challenge, note that you are using skills and concepts developed in the three previous Challenges. You'll need to translate names into chemical formulas and draw submicroscopic representations of matter. You'll also be prompted to think about limiting reactants. You're starting to build up your chemistry knowledge, and you'll need to understand these basic ideas as you apply them to more difficult chemistry problems and concepts later on. If you're struggling with any of these skills or concepts, the key is to get help now.

Solubility rules: Use Table 4.1 (page 116) from your textbook

Challenge Extension:

Stalactites and stalagmites are only two of many examples of precipitates you may have encountered in nature. Where else do you see precipitates (and solutions) in nature and in your home? How is stalactite/stalagmite formation similar to problems associated with hard water (buildup of scale in pipes, tea kettles, and hot water heaters)? Next time you put a pinch of salt into boiling water, try to visualize the solution at the submicroscopic level.

Chemistry Concept Challenge #4 Name: _____

September 22, 2006

Due: Friday, September 29 at 9 a.m. (in your TA's mailbox) Lab Section #: _____

Scenario: You have two beakers. One contains a solution of **silver nitrate**; the other contains a solution of **calcium chloride**. You mix them together. Describe what happens using chemical symbols (formulas and equations) AND submicroscopic representations.

Part I: Represent what happens using chemical formulas and equations

→ Write a balanced *molecular equation*.

✓ Check the formulas you wrote for reactants and products *before* balancing the equation. Do they make sense given the charges on ions that make up each compound?

✓ Check to make sure you've designated whether each compound is dissolved in water (aq) or is insoluble in water (s). Use the solubility rules (page 116 of your textbook) to do this.

→ Compose the *total ionic equation*. Circle the spectator ions (on both sides of the equation).

→ Compose the *net ionic equation*. What does this represent?

Part II: Represent what happens using submicroscopic drawings

Below is a representation of 100 mL of a 1 M silver nitrate solution. (Water molecules are not included). Based on that representation (and the drawing key to the left):

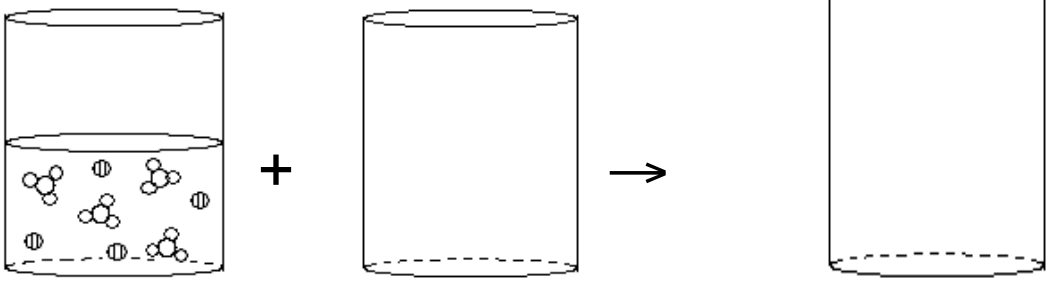
- Draw a representation of 100 mL of a 1 M calcium chloride solution (Beaker B).
- Draw the results of mixing the two solutions (Beaker C).

Key: Ag^+ = ◑

NO_3^- = 

Ca^{2+} = ○

Cl^- = ●



Beaker A **Beaker B** **Beaker C**

How did you know what to draw in Beakers B and C? (Briefly describe your reasoning.)

Questions to think about (no need to write an answer here):

How does Part II relate to the concept of limiting reactants? Is there a limiting reactant? How do you know?