Name: _____

Lesson 3
Forming a precipitate

STUDENT ACTIVITY SHEET

Meet the scientist

Country: Republic of Peru
Scientist: Adriana Garcia

Sera, from Fiji, told you about the problems of ocean acidification. Here in Peru, my main interest is another kind of water problem—cleaning wastewater.

I live and work in a region that includes the city of Lima and the surrounding area. This metropolitan region extends from mountain valleys all the way to the coast. Even though it's very humid here, it almost never rains. So we need to be very careful about how we use water. We get most of our water from glacier ice high in the Andes Mountains. This supply of clean water isn't going to last forever—not with one-third of Peru's population living here!

My work involves trying to preserve this resource by reducing our use of glacier water. If we reuse water that is poured down drains and flushed down toilets, we would use less water from the glaciers. If we clean this water well, we can even use it to water plants in parks and maybe even on farms.

How do we "clean" dirty water? Basically, we use filters and chemistry. Filters catch waste particles and allow the rest of the water to flow through. But some waste is so small that it can slip right through the filters. With help from chemistry, we make these tiny particles bigger. Then our filters can catch them!

In your activity, you will use a chemical reaction and a filter to remove some very small dissolved particles.

Activity

Remove chemicals that are dissolved in water.

You will need

- Goggles
- Calcium chloride
- Sodium bicarbonate
- Water
- 2 small spoons
- Coffee filter or paper towel
- Small metric measuring cup
- 2 small plastic cups
- Tall plastic cup

Procedure

Make solutions

1. Make a sodium bicarbonate solution by placing 1 spoon of sodium bicarbonate into a clean plastic cup.
2. Add 10 mL of water and swirl until as much sodium bicarbonate dissolves as possible.
3. Make a calcium chloride solution by placing 1 spoon of calcium chloride into a clean plastic cup.
4. Add 10 mL of water and swirl until as much calcium chloride dissolves as possible.

Do the chemical reaction

5. Pour one solution into the other.
6. Swirl to see if you can get the white substance to dissolve. This is the precipitate.

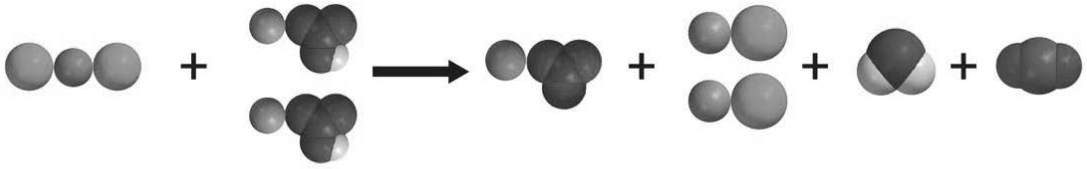
Filter the precipitate

7. Use a coffee filter and a tall plastic cup to make a filter as shown.
8. Pour the contents of the cup into the coffee filter and letthe liquid drip though. Let it sit overnight and observe the next day.

The big chemistry idea

You combined two liquids, and a solid formed. They may be small particles. But they are solid and do not dissolve in the solution. This solid that forms during a chemical reaction between two liquids is called a *precipitate*. This solid is calcium carbonate, which is the main substance in chalk and sea shells.

Refer to this chemical equation to complete the chart and answer the following questions.



$CaCl_2$	$2NaHCO_3$	$CaCO_3$	$2NaCl$	H_2O	CO_2
calcium chloride	sodium bicarbonate	calcium carbonate	sodium chloride	water	carbon dioxide

How many of each type of atom is on either side of the chemical equation?

Types of atoms	Number of each type of atom in the... reactants	products
calcium atoms		
chlorine atoms		
sodium atoms		
hydrogen atoms		
carbon atoms		
oxygen atoms		

What do you think was in the bubbles?

What is the precipitate?

What will be left in the liquid after you filter the precipitate?

Question to investigate

Is the precipitate different from the reactants?

You will need

- Goggles
- Precipitate, calcium carbonate
- Water
- Small metric measuring cup
- Small clear plastic cup
- Small spoon

Spoon

Procedure

1. Place one spoonful of the precipitate into a clean plastic cup.
2. Add 10 mL of water and swirl until as much of the precipitate dissolves as possible.

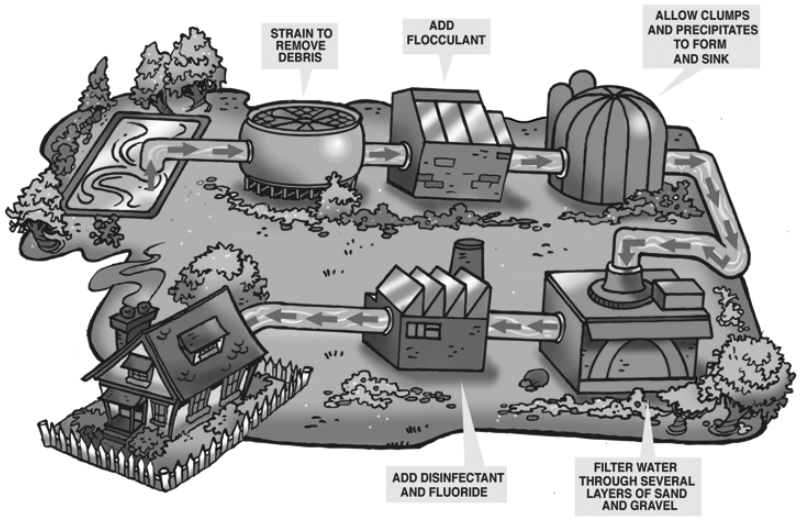
Does the precipitate dissolve in water?

How do you know that the precipitate is different from the reactants?

Real-world application!

In Peru, Adriana works on treating the wastewater that *leaves* people's homes. But what about the water that *comes into* homes? In most places, this needs to be treated, too. Here's a little more information about how water gets purified before it flows through pipes to your home.

In order for water to be made safe to drink, the water must go through a step-by-step purification process. The first step is straining, which involves removing large objects like trash, leaves, and other debris. Even after straining, there are still smaller particles that are either suspended or dissolved in the water. Many of these are removed in the next step of the process.



Special chemicals called flocculants are added to the water, which is then sent to a sedimentation tank. Here, the added chemicals interact with tiny dirt particles suspended in the water, causing them to clump together and sink to the bottom. The chemicals also react with substances that are dissolved in water. This chemical reaction forms a precipitate, which is solid and will not dissolve in water. The precipitate also sinks to the bottom. The cleaner water from the top of the sedimentation tank goes to a series of filters, where it flows through layers of sand and gravel. These filters collect particles that did not sink.

Finally fluoride and a disinfectant are added to make the water healthy and safe to drink.