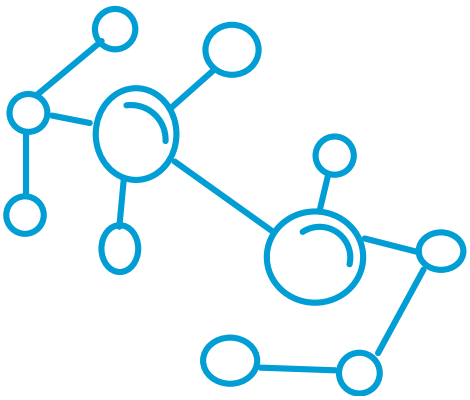
ACTIVITY 4: CLEANING WATER WITH CHELATING AGENTS

The purpose of this activity is for students to investigate how chelation can be used to remove harmful metals from water, using a simple model.



Materials:

- 2 clear plastic cups
- 1 teaspoon of iron filings (or small iron nails)
- 1 teaspoon of Epsom salt (magnesium sulfate)
- 1 teaspoon of baking soda
- Water
- Measuring spoons
- Stirring rods or wooden coffee stirrer sticks

First, explain to/review with students that some of the byproducts of mining metal ore is that metals can enter the waterways when metal remains in the stamp sands and they end up in the water. Inform them that chelating agents, which are special chemicals that can act like a magnet pulling metals out of water, are often used to remove harmful metals from water. In this lab, they will be investigating this process with a simple chelation experiment. Their job is to remove metal from water using chelation.

Then, have students form groups of 4 and obtain the materials needed to perform the experiment. Review the procedure with students before they begin their experiment.

Next, allow students to begin their procedure and set up the experiment. Invite them to draw particle diagrams* that represent what they think is happening at the molecular level before the chelation process begins.

**Note: They'll make particle diagrams before, during, and after the lab to compare later.*

***Teaching Tip*: you can perform this experiment ahead of time to show the before and after as a demonstration of the power that chelation has to remove metals.**

Day 1 Procedure:

- Fill one plastic cup halfway with water.
- Add 1 teaspoon of iron filings to the water and stir well.
- Observe and record what the iron filings look like in the water.
- Fill the second plastic cup halfway with water.
- Add 1 teaspoon of Epsom salt to the water and stir until it dissolves completely.
- Be sure to draw particle diagrams for both cups, representing what's happening at the smallest possible level inside of each.
- Record visual observations of each cup
- Slowly pour the Epsom salt solution into the cup with the iron filings.
- Stir the mixture gently and observe what happens. Record any changes you see.
- Allow the mixture to sit over night.

Day 2 Procedure:

- After leaving the mixture to sit over night, observe the changes in the cup with the iron and Epsom salt solution. Record what you see.
- Add 1 teaspoon of baking soda to the cup with the iron and Epsom salt solution.
- Stir the mixture gently and observe any changes. Record your observations.
- Let the mixture sit for 30-60 minutes and then observe the final state. Record what you see.
- Draw a particle diagram to represent the cup after the entire experiment is complete.
- Connect your particle diagrams from before, during, and after the experiment to your visual observations of each stage and be prepared to tell the story of what happened.

Last, facilitate a class discussion to debrief the results of the lab, focusing on what they observed, what their particle diagrams show, and what that represents about the chelation process that took place throughout the lab.

- What happened to the iron when the Epsom salts were added? The baking soda?
- What roles did the Epsom salt and baking soda each play? How do you know?
- How did our experiment show chelation?
- How might scientists use a process like this to remove harmful metals from the water?