

# Froth Flotation of Minerals Simulation

**GRADE LEVEL: 6-8**

**INTRODUCTION:**

Froth flotation is the separation of valuable minerals from non-valuable minerals in ore using the three major phases of matter (solid, liquid and gas). Flotation is a common process for recovering copper, iron, molybdenum, zinc, and many other metals in their mineral forms

This process in the minerals industry involves the following steps:

1. Metal-bearing rocks are crushed.
2. Then the crushed rock is ground down finer using water and chemicals, making a slurry. These chemicals are called collectors because they have a surface charge that attracts the desired mineral.
3. A soapy chemical, called “frother,” is then added to the slurry.
4. Next, fine air bubbles are blown into the mixture creating a froth on top.
5. The collector chemical that is attached to the particles of desired mineral attaches to the bubbles so that it can float away.
6. The ground waste material that does not attach to the bubbles (due to not being attracted to the collector chemical) stays in the slurry and is disposed of. *Froth flotation of copper pictured here.*



7. To produce the pure metal, further treatments such as melting furnaces are needed. Melting can further separate the recovered minerals to produce pure metal for use in cell phones, cars, plumbing, electricity, and many other things we use daily.

## LEARNING OUTCOMES

Students will demonstrate flotation, a typical process used for removing valuable minerals (represented here by glitter) from rock.



**MATERIALS NEEDED (24 is assuming a class size of 24, adjust recipe for more or less.)**

- 3 cups of playground sand
- 2 tablespoons of glitter (any size but preferably bright)
- 24 5-oz small paper cups
- 24 flexible straws
- 24 paper plates
- 1 teaspoon of liquid soap (dish soap or hand soap)
- Regular tap water
- Paper towel or napkins for cleaning

## PROCEDURE:

### Teacher Prep:

1. Add 2 tablespoons of glitter to the 3 cups of playground sand and mix well.
2. Measure 2 tablespoons of sand glitter mix into each 5-oz cup (or equally divide into 24 cups).
3. Gently mix (swirl) 6 teaspoons of soap with 6 cups of water in a pitcher.

### Student Activity:



1. Set a cup with glittery sand on top of a paper plate. This simulates the ore that has already been crushed and ground.
2. Pour soapy water on top of sand mixture until 1 inch from the cup rim.
3. Stir the sand and water well with a straw to create a slurry.
4. When well mixed, blow air with the straw into the bottom (since the sand and glitter mixture settles fairly quickly).
5. Observe the separation of glitter into the growing froth and away from the sand.
6. It is okay to overflow the froth from the cup into the paper plate--this is how it is separated.



**DISCUSSION:**

As discussed in the introduction, *Froth flotation is the separation of valuable minerals from non-valuable minerals in ore using the three major phases of matter (solid, liquid and gas).*

- Identify each phase of matter in the process you went through to collect the glitter.

The glitter in the above procedure represents the valuable minerals in the ore. The sand represents the waste minerals in the rock known as **gangue** (pronounced "GANG").

- In the actual mineral process, what causes the valuable minerals to end up in the froth, and the gangue to go elsewhere?
- In the actual mineral process, why does the ore need to be ground down first?
- What is the difference between a rock and a mineral?
- Why might the result of the froth flotation process still require melting to result in the pure metal that is needed?



Watch [From Ore to More](#) to reinforce this lesson.