

# How Does Mining Produce Acid Runoff?

**Objective:** Students will learn how mining and other industrial operations can lead to acidic runoff when sediments combine with water and air in a process known as weathering.

**Time required:** This lesson requires about 15 minutes to view portions of a video and approximately 30 minutes of lab work in class following the video (over a two-day period), plus time spent by students outside of class gathering materials for the lab.

**California State Science Standard(s):** Grades 9 through 12, Chemistry #5: Acids, bases, and salts are three classes of compounds that form ions in water solutions.

**Materials:** Litmus paper or pH meter; containers to hold samples of water (recycled film canisters work well); tap water; crushed limestone, crushed coal, various metal ores; and sediments from other areas of the community (gravel roads, construction sites, parks, school grounds) collected by the students.

## Procedure:

- Ask students to collect a variety of sediments from around their neighborhoods in advance of this lesson (i.e. gravel, topsoil, crushed rock, etc.)
- Use the K-W-L technique (*what I KNOW, what I WANT to know, what I LEARNED*) to introduce the topic and to find out what students already know about weathering and how it relates to acids and bases. Record students' responses on the board and return to them during the discussion following the viewing of the video and the lab activity.
- Show the two sections of the video "The Sacramento River of Life" that describe California's mining history and acid runoff from a defunct mine.
- Following the video, pair up students to conduct experiments to determine how the quality of tap water changes when it is contaminated by a variety of sediments (see attached Lab Instructions.)
- Following the lab, conclude by engaging the class in a discussion about the results of their experiments, and by considering some of the reflection questions below.

## Questions for Reflection:

1. How do the sediments from your neighborhood affect the quality of the tap water, compared to how the sediments provided by your teacher affect it?
2. What are some possible sources of pollution in your neighborhood or region that may lead to acid runoff in local streams?
3. How are your local streams connected to the Sacramento River?
4. Who or what do you think is harmed when rivers become contaminated with acid runoff from mining or other industrial operations?

# How Does Mining Produce Acid Runoff? – Lab Instructions

**Purpose:** The purpose of this experiment is to determine what happens to plain tap water when it is contaminated by a variety of sediments, including sediments provided by your teacher and those you have collected in your own neighborhood. This experiment will help you understand how river water can be similarly contaminated by the sediments released during a mining operation. *Read this entire page before starting the lab activity.*

## Instructions:

1. You will use five small containers in this lab. Begin by filling two containers with one sediment each that you have collected from your neighborhood, and filling two containers with one sediment each that is provided by your teacher. Set aside one container that contains no sediments and will serve as your control. Number each container and label it with the name (or source) of the sediment inside; label the fifth container “control.”
2. Add tap water to each of the containers.
3. Immediately test the pH of the water in each of the containers, using litmus paper or a pH meter, and record it below.

Container #1 \_\_\_\_\_ | \_\_\_\_\_      Container #2 \_\_\_\_\_ | \_\_\_\_\_  
Container #3 \_\_\_\_\_ | \_\_\_\_\_      Container #4 \_\_\_\_\_ | \_\_\_\_\_  
Control \_\_\_\_\_ | \_\_\_\_\_

4. Leave the containers to sit overnight. The next day, test the pH of each of the samples again to see how the pH of the water has changed. Record the pH above.

## Answer the following questions:

Which samples have the highest and lowest pH?

How long did it take for the water to become contaminated by the sediments? Did some sediments dissolve into the water more so than other sediments?

How did the sediments in your neighborhood affect the quality of the tap water, compared to how the sediments provided by your teacher affected the water?