Lab: Test Tube Geology

FOR THE TEACHER

Summary
In this lab, students are introduced to experimental design and focus on collecting qualitative data. It also introduces students to my version of the Scientific Writing Heuristic.

Resource Type Lab Grade Level High school

Objectives
By the end of this lesson, students should be able to
- Better understand how to design an experiment themselves.
- Collect qualitative data.
- Create and defend a scientific argument

Chemistry Topics
This lesson supports students’ understanding of
- Redox reaction
- Chemical changes
- Electrochemistry

Time
Teacher Preparation: 30 minutes
Lesson: 60 minutes

Materials
For each group:
- Copper(II) sulfate, CuSO₄
- Sodium chloride, NaCl
- Nails (ungalvanized), Fe
- Water (distilled), H₂O
- Balance
- Large test tube (2)
- Test tube rack
- Weighing boat (2)
- Scoopula (2)
- Wash bottle
- Filter paper
- Permanent marker
- Scissors
- Stopper
- Other materials as needed

Safety
- Safety goggles should always be worn when working in a lab.
- Students should wash their hands thoroughly before leaving the lab.
- When students complete the lab, instruct them how to clean up their materials and dispose of any chemicals.

Teacher Notes
The lab can be used in a variety of different contexts and at a variety of levels depending on the goals of the teacher.
FOR THE STUDENT

Student Activity Sheet: Test Tube Geology
Safety Sheet: Test Tube Geology

Lesson

Prelab

Read the lab handout on the back of this sheet and complete the following questions and actions.

1. What do you think: How does geology relate to chemistry?
2. In the materials section, what is the group of letters and numbers after the chemical name (i.e. CuSO₄) called?
3. Underline each place in the procedure where an observation (qualitative data) will be made. Create an observation table that you can use during the investigation.
4. Circle each place in the procedure where a measurement (quantitative data) will be made. Create a data table that you can use during the investigation.
5. Make a labeled sketch of what you think the test tube will look like after you complete step 8.
6. Make a list of some of the specific factors you could change in the procedure that might affect the outcome. After discussing with your lab group, circle one factor you will change.
7. Complete the experimental design for this lab. Each lab table will do one experimental trial and one control trial. Each lab table will choose its own experimental question.

| Experimental Question: What affect does changing __________________ have on the outcome of the test tube geology lab? (This is a very general experimental question, but you have to start somewhere!) |
| Hypothesis: It will be very difficult to make a good hypothesis because you probably have no idea of what is going to happen. |
| Independent Variable: |
| Dependent Variable: |
| Constants: |
| Experimental Trial: | Number of Trials: |
| Control Trial: | Number of Trials: |

8. Use the materials section of the lab handout to fill in the chemical names on the safety and disposal handout.

9. ORL Rat LD₅₀ is the amount of chemical that has a 50% chance of killing a rat with a body mass of 1 kg. For instance, iron has an LD₅₀ of 30 g/kg. That means 30 g of iron has a 50% chance of killing a 1-kg rat. The other LD₅₀ values are in mg of chemical per kg of body mass (mg/kg).
   a. CuSO₄: How many grams is 300 mg?
   b. NaCl: How many grams is 3,000 mg?
   c. Which chemical requires the least mass to kill a 1 kg rat?

Introduction

Earth has an atmosphere (air), a hydrosphere (water), and a lithosphere (land). The biosphere encompasses all of the places where life exists—birds in the air, fish in water, and humans on land. All of these parts of Earth are connected by biogeochemical cycles that change and move matter throughout the planet.

In this experiment, you will focus on a very simple system that involves only a few substances to see if any changes occur when the substances are placed near one another. This experiment will help you to master a few very important learning goals:

1. design and carry out an experiment
2. make thorough and complete observations (qualitative data)
3. create and defend a scientific argument

Materials
- Copper(II) sulfate, CuSO₄
- Sodium chloride, NaCl
- Nails (ungalvanized), Fe
- Water (distilled), H₂O
- Balance
- Large test tube (2)
- Test tube rack
- Weighing boat (2)
- Scoopula (2)
- Wash bottle
- Filter paper
- Stopper
- Other materials as needed

Procedure
Half of the table will carry out the procedure below. The other half of the table will change one factor (decided by the group during the prelab) and keep the rest of the factors the same. Record observations of all materials used in this experiment. You may supplement your written observations with photos.

1. Label the top of a large test tube so you can identify it from other groups. Use permanent marker.
2. Cut two circles from a piece of filter paper that will fit inside the test tube.
3. Tare a weighing boat on a balance. Use a scoopula to measure approximately 3 g of copper(II) sulfate into the weighing boat. Record the exact mass. Transfer the chemical to the test tube.
4. Place one circle of filter paper on top of the copper(II) sulfate layer.
5. Tare a new weighing boat on the electronic balance. Use a scoopula to measure approximately 1.5 g of sodium chloride into the weighing boat. Record the exact mass. Transfer the chemical to the test tube.
6. Place the second small circle of filter paper on top of the sodium chloride layer.
7. With the wash bottle, carefully and slowly add water to the test tube until the level of water is about 2 cm above the level of the sodium chloride.
8. Carefully place a nail into the test tube. Do not puncture the filter paper.
9. Put a stopper on the test tube and place the test tube in the rack.
10. Make observations over the course of a few days.

Clearly state how the procedure was changed to test the one factor that you changed.
Test Tube Geology SWH

SWH 1 Experimental Design
This is on the front of your handout. Use the template on Edmodo to type a nice copy.

SWH 2 Procedure
Summarize your experimental procedure in no more than 3 sentences. Use no person, present tense. Be concise!

SWH 3 Data: Observations & Measurements
Organize your observations and measurements to make them clear and understandable. Attach your original data tables (qualitative and quantitative) to your SWH.

SWH 4 Claim
Make a specific inference related to the experimental question based on the information your group collected.

SWH 5 Evidence
What data (observations or measurements) support your claim? You can also include photographic evidence that you specifically describe. Including photos without explaining the evidence contained is not acceptable.

SWH 6 Scientific Communication
What does the class say? Compare your results (control and experimental) to groups who changed the same variable as you. If you are the only one who did a particular experiment, compare your control trials to other groups. Identify groups that you compared to. Is your claim still supported? Can you think of other reasons for what you observed? Did discussion with other group(s) clarify your thinking?

SWH 7 Reflection
Draw a personal particulate model (PPM) showing how the particles that make up copper(II) sulfate, salt, and the nail were arranged at the beginning of the experiment. Use a separate shape for each substance and include a legend. Write an explanation of the model.
1. Why did you decide to change the factor that you did?
2. What were your ideas to change about the experiment prior to the SWH (consult some of the answers to the prelab)? What are your ideas to change about the experiment now that you’re completing the SWH (consult SWH 4–6)?
3. What caused your ideas to change?
4. If you could redo this investigation, what things would you do differently to help it run smoother?
5. What questions arose from the investigation (minimum of 2)?