

Tubular Rust Lab

Purpose

In this activity you will determine the percent Oxygen in the air. You will also observe the results of lowered air pressure in a test tube.

Materials

Steel wool
Test tube
Pencil or stick
250 ml beaker
Ruler and rubber band
White vinegar
Ring stand and test tube clamp

Background information

The activity takes advantage of rusting of iron by oxygen (a chemical reaction) to determine the percent oxygen in the air. Iron is placed in an air filled test tube, which is then inverted in water. As the iron reacts with the oxygen, the pressure in the tube decreases, and atmospheric pressure pushes the water into the test tube. The decrease in volume of air in the test tube is a measure of the depletion of its oxygen content. By measuring the quantity of air in the tube before and after the rusting of the iron, the percent oxygen in air by volume can be calculated.

Procedure:

Set up your apparatus before beginning.

The test tube should be clean and dry

The clamp adjusted and beaker ready with water.

Ruler should be attached to test tube.

Prepare your wool for rusting

Measure 1 gram of steel wool.

Pull it apart gently to increase its surface area.

Dip the wool in vinegar, shake off the excess vinegar.

Begin reaction

Quickly and carefully stuff the wool into the test tube, about halfway up the tube, use the plastic stick provided.

Try not to compact the wool.

Lower the tube into the water to seal it from the air.

Once the lab has begun keep a close eye on the water / tube. You do not want any new air in the tube!

Measure the height of the water in the tube every 2 minutes.
Record on your data table.

Time	Height of water in cm	Notes and observations
0		
2		
4		
6		
8		
10		
12		
14		
16		

Continue with the experiment for 14-16 minutes.

Once your experiment is complete, clean up your equipment and return to your seats.

Carefully remove the steel wool from the tube.

Discard the used steel wool.

Empty the beaker of water.

Leave the clean and dry equipment set up for the next team.

Analyze your Results

Plot your graph.

Put Time on the X-axis and height of water in the tube on the Y-axis. Use graph paper. Tape the graph in your lab book (or you may use excel).

Calculate the fraction of oxygen in the air.

Use the height of the water in the tube at its max as your "O" value in this equation, $(O/15) \times 100 = \% \text{ oxygen in the air}$.

Discuss the following questions with your group and record in your lab book:

1. Why did the water climb up into the test tube? Explain both in terms of chemical reactions and the gas laws.
2. Why is it important that the water levels inside and outside the test tube remain fairly even?
3. Why was it important that the steel wool was not compacted into the bottom of the test tube?