

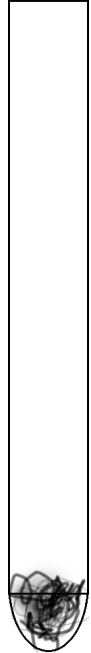
Percent Oxygen in Air

Trap some gas

Figure out the percent of oxygen in the atmosphere by using steel wool's ability to rust.

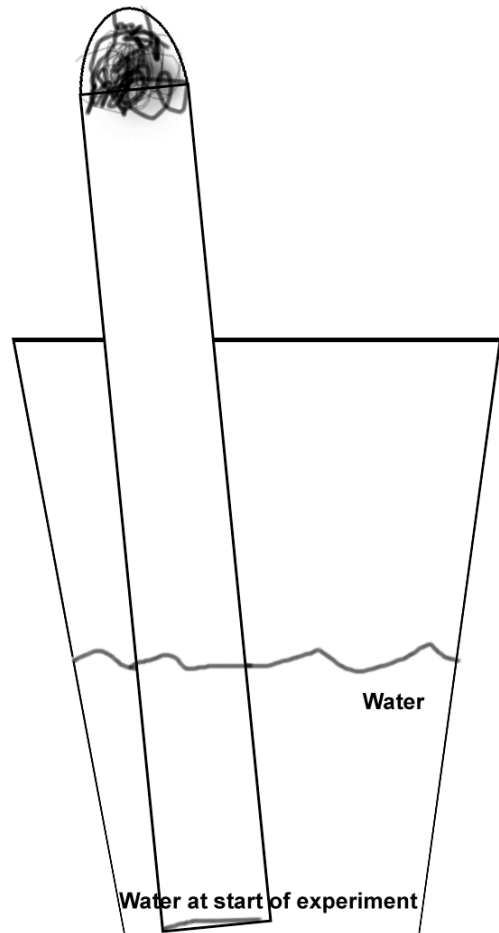
Materials:

- Test tube- standard size (actually any container will work)
- Clear glass of water
- Soap or vinegar
- Water
- Graduated cylinder
- Fine mesh steel wool - 00 or finer
- Tape or marker pen



To do and notice:

1. Tear of a small amount of steel wool (less than a gram will work fine) and push it to the bottom of a test tube.
2. The steel wool must be wedged into the base. Push it in hard enough so that it will not slide out when the test tube is flipped upside down.
3. Measure the volume of the test tube. This can be done with a graduated cylinder and some water (You are measuring the volume of how much water it can hold. This in turn, measures the amount of air in the empty test tube (There is so little steel wool, its volume is negligible).
4. Enter this data in the worksheet.
5. Your steel wool probably got wet when measuring volume in step 3. However, to insure you got rid of the thin protective oil coating on the steel wool, rinse your test tube out with either soapy water or vinegar. This will help to facilitate the rusting of the steel wool.
6. Fill a clear cup about half way with water.
7. Place the empty test tube (with steel wool inside) upside in the water.
8. Place your experiment in a calm protected spot for at least 2 days.



After at least 2 days:

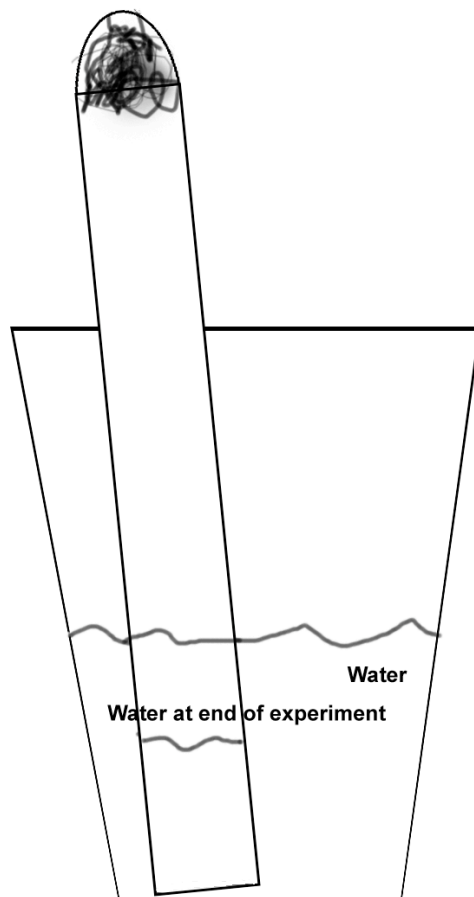
9. Notice that the water level has risen inside the test tube.
10. Without letting the water leak out of the inverted test tube, mark the water level on the outside of the tube with a pen or piece of tape.

11. Measure the volume of gas in the tube now. You can do this by taking the test tube out of the glass (The water inside the test tube can leak out at this point). Fill the test tube up to the marking from step 9. Now, measure this amount of water.
12. Enter this data on the worksheet.
13. Figure out the percent change in gas in the test tube (see worksheet).
14. This volume change is the percent Oxygen that was in the test tube.
15. Collect data from as many experiments as possible and average the percentage.

What's going on?

Air is composed of Nitrogen - about 78%, Oxygen about 21%, Argon about 1% and other gasses. These gasses compose 100% of the air so they exert 100% of the pressure. IN the test tube, at the beginning, there was the same pressure inside the test tube as outside. As the steel wool started to rust*, the oxygen was taken out of the air, therefore the pressure was reduced. Over time, the pressure was reduced by the percentage of oxygen removed.... about 21%. As the pressure drops, the pressure on the outside of the test tube pushes the water level up inside the test tube.

*The iron in the steel wool became an iron oxide. The darker steel wool probably became Fe_3O_4 or Fe_2O_3 . The orange colored steel wool probably became $\text{FeO}[\text{OH}]$



Percent of Oxygen in Air Work Sheet

A. Volume of empty test tube (V_{empty}) = _____ ml

B. Volume of test tube after rusting (V_{rust}) = _____ ml

C. Percent of Oxygen in Air (in 2 steps):

1. Percent of remaining gas (P_{remain}) =

$$\text{_____ ml } (V_{\text{rust}}) / \text{_____ ml } (V_{\text{empty}}) \times 100 = \text{_____ \%}$$

2. Percent of Oxygen in Air =

$$100 - \text{_____ \% } (P_{\text{remain}}) = \text{_____ \%}$$

D. Class Average of the percent
of Oxygen in the Air = _____ %