A Simple Experiment to Find the Percentage of Oxygen in the Air

««« Leonard Bega and Keith Gale
Leonard Bega, B.Sc., B.Ed. is a Teacher Candidate in the Faculty of Education at the University of Windsor. Keith Gale, B.Sc., M.Sc., B.Ed. is a Science Teacher at General Amherst High School in the Greater Essex County District School Board (GECDSB).

We believe that hands-on activities and inquiry-based teaching are essential tools to help students engage, construct their own scientific knowledge and apply these new concepts to everyday problem-solving.

Curriculum Connection: SNC1D, SNC2D, SCH3U, SCH4U, SCH4C.

This lab determines the percentage by volume of oxygen in the air. We do this by allowing the oxygen in the air to rust iron contained in an iron wool. This causes the volume of the air to decrease as oxygen is reduced, converting from a gas into solid iron oxide (rust).

The reaction takes three to four days to complete. When done, the decrease in the air’s volume will be equal to the volume that oxygen previously occupied in the air.

This is the same principle used by Joseph Priestley and Antoine-Laurent Lavoisier in their experiments during the 1700s, which led to the discovery of oxygen.

The purpose of this experiment is to encourage thinking and the inquiry process and to help students, especially junior ones, reflect on their hypothesis and predictions, find relationships between observable variables, make observations and practice recording skills. It also allows them to analyse this data, interpret and connect findings to the curriculum idea that is applied for the experiment.

The goal of inquiry instructions is to engage students, provide exploring grounds where — with guidance from their teachers — they will be able to explain and elaborate their findings.

This experiment support that spirit of inquiry by creating a lab focused on questions that can be answered by collecting observational data, using available knowledge of science and applying process of reasoning.

Percentage of Oxygen in the Air

Volume 44 • 4 April 2013
The Procedure

**Equipment**
- A long glass tube opened on both sides (1 cm in diameter and around 1.25 m (4 ft.) long)
- Iron wool
- Stand and clamps
- Water
- A beaker
- Food color
- A stopper

This experiment is suitable for a high school lab or a classroom demonstration.

**Applications, Topics**
Corrosion, oxidation, rust, household chemicals, gases identification, evidence of chemical change.

**Instructions**
1. Wash the glass tube, making sure no residues are left inside (you might want to use some acid to wash it and make sure it is clean).
2. Have a piece of clean iron wool big enough to stay put inside the tube and place it on the top side of the glass tube.
3. Use a stopper to close the opening of the side where the iron wool is placed (you might want to soak the stopper into water before using it in order to create a better isolation).
4. Place the glass tube on the stand using utility clamps.
5. Half fill the beaker with water.
6. Put a few drops of food color to the water inside the beaker (just to make it more impressive).
7. Place the beaker at the base of the stand and insert the glass tube inside the water in the beaker so the glass tube reaches the bottom of the beaker.
8. Measure the height the water has reached inside the tube and mark it.
9. Allow 2-3 days for the oxygen inside the tube to react with the iron wool, create iron oxide and appear to vanish from the air.
10. Measure the height the water has reached at the end of experiment.
11. The formula for measuring the amount of oxygen in the air would be:

\[
\frac{\text{height of water inside the cylinder}}{\text{total height of cylinder}} \times 100
\]
Advice to teachers

- Various textbooks suggest this experiment be done with graduated cylinders. From our experience a long (4 feet) glass tube offers super resolution and is a more memorable student experience.
- Teachers can easily create an inquiry lesson plan applying the 5Es instructional model
  Visit: [http://faculty.mwsu.edu/west/maryann.coe/coe/inquire/inquiry.htm](http://faculty.mwsu.edu/west/maryann.coe/coe/inquire/inquiry.htm) for more details.

Resources

Determination of the Percent Oxygen in Air
[chemlabs.uoregon.edu/Classes/Exton/CH228/PercentOxygen.pdf](http://chemlabs.uoregon.edu/Classes/Exton/CH228/PercentOxygen.pdf)

Determination of the Percentage Oxygen in Air
[infohost.nmt.edu/~jaltig/Air.pdf](http://infohost.nmt.edu/~jaltig/Air.pdf)

Percent Oxygen In Air Fin
[http://www.exo.net/~emuller/activities/Percent%20Oxygen%20in%20Air%20Fin.pdf](http://www.exo.net/~emuller/activities/Percent%20Oxygen%20in%20Air%20Fin.pdf)