

Atmospheric Gases

Driving Question: What is our atmosphere made of?

In this activity you will:

1. Explore the variety and ratio of compounds and elements that make up the Earth's atmosphere.
2. Understand volumetric measurements of gases in the atmosphere.
3. Visually depict the composition of the atmosphere.



Background Information: Understanding Concentration Measurements

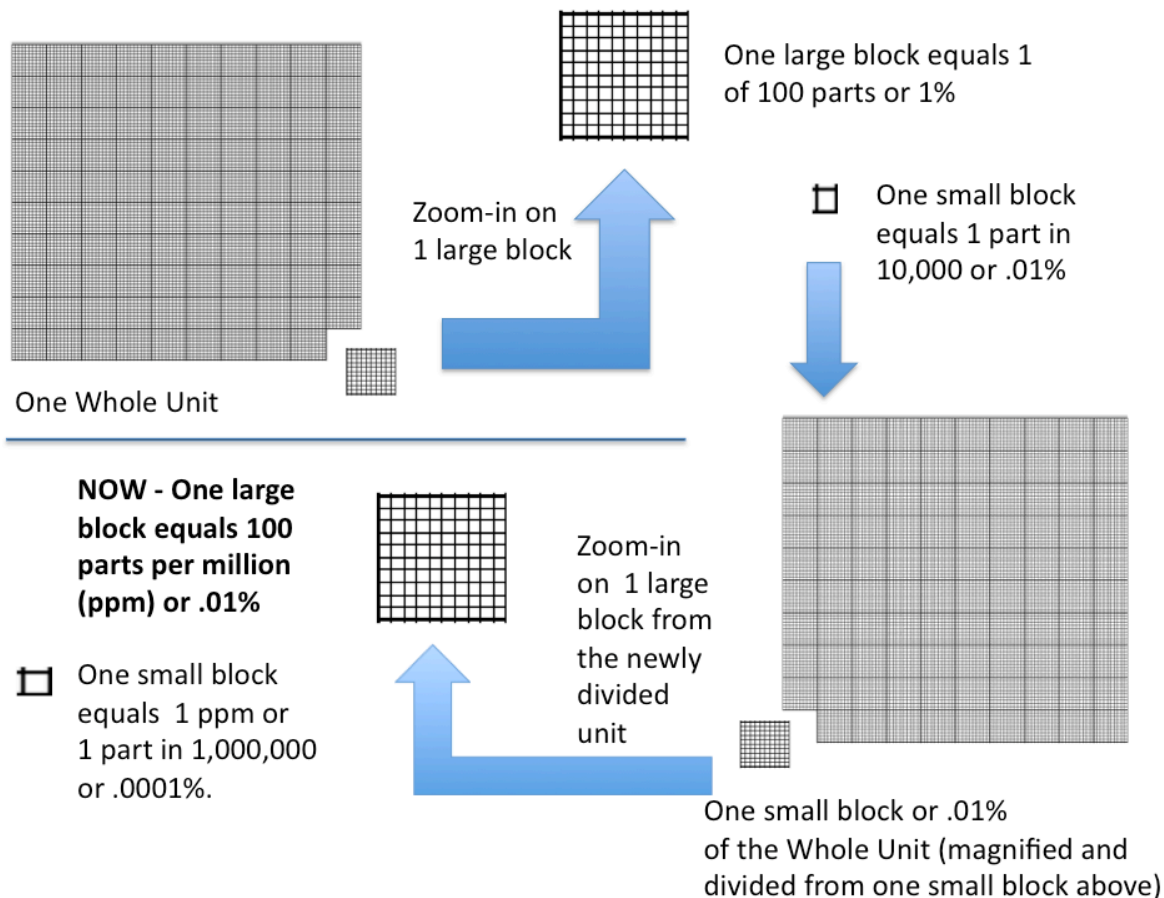
In this activity, we will investigate the gas composition of our planet's atmosphere. We use percentages to represent units of gas composition. A percent (%) is equivalent to 1 part out of 100 equal units.

1% = 1 part out of 100

For smaller concentrations scientists use parts per million (ppm) to represent concentrations of gases (or pollutants) in the atmosphere). One ppm is equivalent to 1 part out of 1,000,000 if the volume being measured is separated into 1,000,000 equal units.

1 ppm = 1 part out of 1,000,000

In this activity, you will use graph paper to represent the concentration of different gases in the atmosphere.



Here are some examples to help visualize parts per million:

- The common unit **mg/liter** is equal to ppm concentration
- Four drops of ink in a 55-gallon barrel of water would produce an "ink concentration" of 1 ppm.
- 1 12-oz can of soda pop in a 30-meter swimming pool
- 1 3-oz chocolate bar on a football field



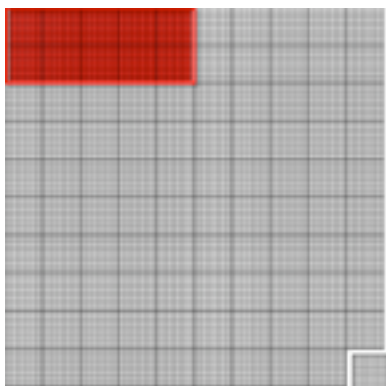
Atmospheric Composition Activity

You will be creating a graphic model of the atmosphere composition using the Atmospheric Composition of Clean Dry Air activity sheet.

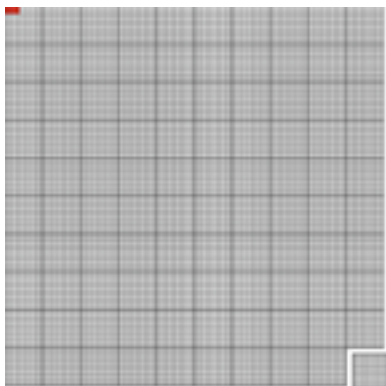
Part 1

1. Page 1 contains a section of graph paper that contains 100 bold grid blocks and 10,000 small blocks. One bold block on the graph paper represents 1% of the volume of the atmospheric composition of clean dry air. Note the **Atmospheric Composition** box on this page. This box contains the percent of the major atmospheric gases nitrogen, oxygen, argon, and the trace gases.
2. Select a different **color** for nitrogen, oxygen, argon, and the trace gases in the **Atmospheric Composition** box. Fill in the four empty blocks next to each gas name with a different color to create a key for the atmospheric composition graph.
3. Color one bold grid block for **each** percentage of the Major Atmospheric Composition gases in the graph paper section. For example, if a gas volume is 1% or 1 part out of 100, you would color 1 large block on the graph paper. A volume of 1% = 10,000 ppm.

If a gas volume is 10% or 10 parts out of 100, you would color 10 large blocks on the graph paper. A volume of 10% = 100,000 ppm.



- If a gas volume is less than 1%, one small block is colored for each .01% of a gas volume. For example if a gas' volume is .08%, you would color 8 small blocks on the graph paper. A volume of .08% = 800 ppm.



Part 2

- Look at **page 2** of the activity sheet. The graph on **page 2** is labeled **Argon and Trace Gases**.
- Page 2 contains another section of graph paper that contains 100 bold grid blocks. One bold grid block on the graph paper now represents .01% or 100 parts per million of the volume of the Atmospheric Composition of Clean Dry Air. Note the **Argon and Trace Gases** box on this page. This box contains the parts per million (ppm) values of argon and the other trace gases.
- Select a different **color** for carbon dioxide, neon, helium, methane, krypton, hydrogen, and nitrous oxide in the **Argon and Trace Gases** box. You can insert a "v" slash mark for the box next to argon. Fill in the empty blocks next to each gas name with a different color. This will serve as a color key for the trace gases that have volumes large enough to depict on the graphical representation.

Important Note: You will **not** select individual colors for carbon monoxide, ozone or nitrogen dioxide; these concentrations are too small to accurately depict on this graph; they have concentrations in the parts per billion. These are bulleted (•) in the **Argon and Trace Gases** box.

Important Note: The units represented by the blocks on this page have now changed from percentage (parts per hundred) to parts per million. Each square now represents an even smaller portion of the area measured. One large block is 100 parts in one million or 100 ppm or .01%. **Each small block is now 1 part in one million or 1 ppm or .0001%.**

- Color one bold block for **each** 100 ppm of the trace gases on the graph paper. For example, if a gas concentration is 100 ppm, you would color 1 large block on the graph paper.
- For values less than 100 ppm, you should color in the appropriate number of the smallest squares on the graph paper.

Concluding the Activity:

The trace gases carbon dioxide, methane, carbon monoxide, ozone, and nitrous oxide are referred to as **greenhouse gases**. They are called greenhouse gases because they are involved in the Earth's natural greenhouse effect that keeps the planet livable and ~30°C warmer than it would be without the atmosphere. Scientific data has shown that the increase of these trace gases concentrations in the atmosphere has led to an increase in the average annual global temperature.

- Answer the **Analysis Questions** on the Activity Sheet.