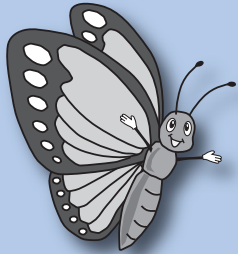


# Air Soup

ACTIVITY

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## Learning Objectives:

- Demonstrate the composition of air.
- Introduce the concept of percentages.

## Subjects

- Math
- Science

## Materials

- Bowl
- Spoon
- Different ingredients for each gas  
(You can use different colored beans, crackers, cereal, candy, paper balls, marbles, etc. Just make sure you have 78 “Nitrogens,” 21 “oxygens,” 1 “argon,” etc.)
- Air Soup student worksheet

## Teacher’s Background Information

Your students may think about air as oxygen, the gas that they breathe to live. In this activity, students will learn there is more to air than just oxygen. Air is a “soup” made up of different ingredients, each important and necessary to the recipe.

Explain to the students that there are only 11 elemental gases (hydrogen, helium, nitrogen, oxygen, fluorine, neon, chlorine, argon, krypton, xenon, and radon), but when mixed together those 11 gases can create endless compounds. Sort of like phone numbers; there are only 10 digits that can be used for phone numbers (0, 1, 2, 3, 4, 5, 6, 7, 8, 9), but when all mixed up, create many, many different phone numbers. (Then add area codes to the phone numbers and you get even more combinations.)

### Air is composed of the following gases:

Nitrogen	(N <sub>2</sub> )	78%
Oxygen	(O <sub>2</sub> )	21%
Argon	(Ar)	0.9%
Carbon Dioxide	(CO <sub>2</sub> )	0.033%
All other gases combined		0.067%



**Nitrogen** is a colorless, odorless, tasteless, inert gas. All plants and animals need nitrogen to live. Although nitrogen makes up 78% of the air we breathe, most of it is in a form we can't use ( $\text{N}_2$ ). Before plants and animals can use the nitrogen in the air it has to be converted into forms that plants and animals can use like nitrates ( $\text{NO}_3$ ), nitrites ( $\text{NO}_2$ ), and ammonia ( $\text{NH}_4$ ). This is done by nitrogen-fixing bacteria. These bacteria take the nitrogen ( $\text{N}_2$ ) out of the air and convert it to  $\text{NO}_3$ ,  $\text{NO}_2$ , and  $\text{NH}_4$ . Plants then take up these new forms of nitrogen from the soil. Animals, including humans then get most of the nitrogen they need to live from the plants they eat. Our bodies use the nitrogen from the food we eat to make proteins, DNA, and RNA – the building blocks of life



**Oxygen** is the gas that we all need to live: though we do not breathe pure oxygen when we breathe in air. Oxygen is a very reactive gas and will react to just about any element or compound. The free  $\text{O}_2$  in our atmosphere comes from green plants – one of the byproducts of photosynthesis.



**Argon** is an odorless, colorless, and nonreactive gas. In fact argon is considered non-toxic. Argon is so nonreactive it is used in light bulbs to surround the filament. It seems that argon is such a small component of air, but it is still the 3rd largest “ingredient” in “air soup.”



**Carbon Dioxide** is a compound made of one carbon atom and two oxygen atoms. Animals breathe out  $\text{CO}_2$  all day long. Luckily, we have plants that use  $\text{CO}_2$  in the photosynthesis process. Plants use  $\text{CO}_2$  to create their own “food.” As we learned before, they then give back oxygen for animals to breathe.

**Make sure you give the students the Ingredient Key.** For instance, if you are using “soup ingredients” you could write the ingredients key as this:

### Ingredient Key

$\text{N}_2$	=	<u>macaroni noodle</u>
$\text{O}_2$	=	<u>pea (dried)</u>
Ar	=	<u>barley</u>
$\text{CO}_2$	=	<u>lentil</u>
Other	=	<u>rice</u>

You can use any ingredients such as candy, crackers, cereal, paper balls, marbles, etc. Just make sure you have enough of each “ingredient” for each student or for one bowl if you do this as a class activity. For ingredients like  $\text{CO}_2$  or other gases you may want to supply small pieces if the main ingredient you choose cannot be broken apart.

This activity can be extended with a graphing component.

### Remember:

- Teachers, please remember to post or make available the **bold-faced** vocabulary word definitions in each activity (*see the glossary on page 65 for definitions*).

# Air Soup



Think about your favorite soup. Soup has a whole list of ingredients. Can you list some of the ingredients in your favorite soup?

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Air is like soup, it has lots of different ingredients too!

### Let's make our own soup!

Use the recipe below to make your air soup. Have your teacher give you the ingredient key. Make sure to measure out the correct amount of each ingredient. Are you ready? OK, let's prep our kitchens. You'll need a bowl, a spoon, and a supply of all of your ingredients listed below. Add all your ingredients to the bowl and don't forget to mix your soup!



Ingredients:	Amount:
N <sub>2</sub>	78 pieces
O <sub>2</sub>	21 pieces
Ar	1 piece
CO <sub>2</sub>	tiny crumb of a piece
Other Gases	half of one piece

Ingredient Key:	
N <sub>2</sub>	= _____
O <sub>2</sub>	= _____
Ar	= _____
CO <sub>2</sub>	= _____
Other Gases	= _____

### Questions:

1. Now what do you notice about your soup? \_\_\_\_\_
2. What is there a lot of? \_\_\_\_\_
3. What is there a little of? \_\_\_\_\_
4. If you add up all the pieces how much do they equal? \_\_\_\_\_
5. About what percentage (%) of air is made up of:

**Nitrogen** \_\_\_\_\_

**Oxygen** \_\_\_\_\_

**Argon** \_\_\_\_\_

5. What would happen if we took out one of the ingredients? Would we have the same air? Which ingredients do you think are most important to plants and animals, including people?



**Hint:** All animals including people need oxygen (O<sub>2</sub>) to live! And all plants need carbon dioxide (CO<sub>2</sub>) to survive! Nitrogen is also really important to both plants and animals.