

Designation: Ontario Curriculum: Science and Technology



Earth and Space Systems: Grade 2 – Air and Water in the Environment

Written by:  
Andrea Schultz-Allison,  
Department of Earth  
Sciences,  
The University of  
Western Ontario

### **Specific Expectations Addressed:**

***Understanding Basic Concepts*** – demonstrate an awareness of air as a substance that surrounds us and takes up space, and whose movement we feel as wind

***Developing Skills of Inquiry, Design, and Communication*** – communicate the procedures and results of explorations and investigations for specific purposes, using drawings, demonstrations, and oral and written descriptions

***Relating Science and Technology to the World Outside the School*** – predict and describe how local weather conditions affect living things, including themselves (e.g., effect of wind on trees in autumn, effect of snowfall on humans' ability to travel)

### **Background:**

#### ***An Ocean of Air: The Atmosphere***

A vast “ocean” of air surrounds the earth just as vast oceans of water surround the land on earth. We know that water is present in this atmosphere, just as air is present in the depths of the oceans. But it is sometimes difficult for young students to understand the presence and importance of an atmosphere which is invisible. A few basic facts explaining “air” will provide the scientific basis for our activities here and prove that air surrounds us, affects us, takes different forms, and is a vital resource.

Atmosphere is the thin layer of gases (nitrogen, oxygen, water vapour, argon, carbon dioxide, ozone, etc.) blanketing the earth and held in place by gravity. This layer is so thin that it is analogous to the skin of an onion, with the earth represented by the rest of the onion. The “air” or space beyond this thin layer of atmosphere is outer space.

Although air is invisible, it is composed of billions of molecules and has weight (air pressure) and takes up space (mass). At sea level, air has a certain weight or pressure and this pressure decreases with height. Mountain climbers find it difficult to breathe because the air is less dense, or contains fewer oxygen molecules. Air is all around us – filling all “empty” space – and thus has mass or an amount of matter, such as the air in a balloon.

Air is constantly moving around the earth – because it is being warmed by the sun – and it distributes oxygen and water (in the eternal water cycle) for all living things. It distributes the “stuff” of life and it allows for this life to continue by protecting it from the sun's harmful radiation. Finally, it sets the stage, or creates the playing field, for the planet's weather patterns to move across.

Clean air is taken for granted and enjoyed by all living things on Earth. Polluted air is an unfortunate by-product of (mainly) human activities on the planet and is both diluted and distributed by Earth's constantly moving air masses. As clean air moves across our planet, the air collects trace amounts of different chemicals produced by human activities and even some naturally occurring events. Once in the atmosphere, these potential air pollutants mix and often react chemically with each other and gases already present in the air. Sometimes the movement of air helps to dilute the negative side effects of these reactions, but unfortunately the long-lived pollutants are distributed great distances causing great destruction.

Thus, while air may be immediately “invisible” to our young students it also surrounds us, takes up space, has mass, and may be felt as wind. Clean air is essential to all life on planet Earth.

## Procedure:

### Part 1

**Understanding Basic Concepts** – demonstrate an awareness of air as a substance that surrounds us and takes up space, and whose movement we feel as wind

**Developing Skills of Inquiry, Design, and Communication** – communicate the procedures and results of explorations and investigations for specific purposes, using drawings, demonstrations, and oral and written descriptions

Air Makes Up “Space”  and Air Takes Up Space

### Materials Needed For Activity:

- glass jar
- food colouring
- water
- modeling clay
- funnel
- pencil

- 1) “Catch” some of the air in the classroom in the empty jar. (This should help students understand that air surrounds them, no effort is needed to “catch” air)
- 2) Put the funnel in the mouth of the (empty) jar
- 3) Use the clay to seal the funnel in the centre of the jar’s mouth
- 4) Be sure to form an air-tight seal with the funnel held securely in the centre
- 5) Tint some water with food colouring and pour it slowly into the funnel
- 6) Note that NO water will pass through the funnel! The jar is full of air (provided you have an air-tight seal) and the air pushes on the water in the funnel to keep it out.
- 7) Punch an air hole in the clay and suddenly the water will drain through

You Move Me! Hot Air and Cold Air Move: We Feel Wind!



### Materials Needed For Activity:

- plastic or other type of thin bowl
- ice cubes

- 1) Fill bowl full of ice cubes
- 2) Allow bowl to sit in classroom for 5-7 minutes
- 3) Have student volunteer hold their hand above the bowl and describe the “air” temperature (Still at room temperature)
- 4) Have the same volunteer hold their hand under the bowl and feel the air below (Air feels cold here because the lighter, warmer air rises above the bowl pushed up by the cold air at the bottom. This is how air moves around the earth, warmed by the sun. When cold air rushes in and pushes warm air up, we feel this rushing movement as wind)

The Fact of the Matter is: Air Has Mass



**Materials Needed For Activity:**

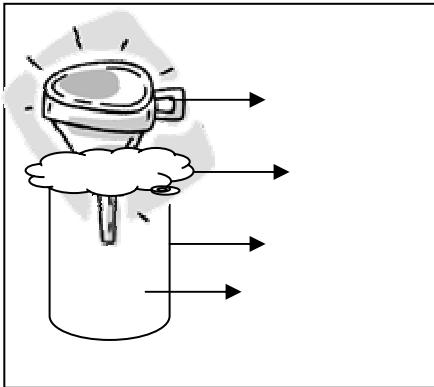
- 2 identical, large, deflated balloons
  - metre stick
  - string
- 1) Tie one (deflated) balloon to each end of the metre stick, using string.
  - 2) Tie one long piece of string to light fixture / flag pole at front and centre of classroom.
  - 3) Hang the metre stick at its centre on this string. (Adjust for balance).
  - 4) Once you've established equilibrium for the class to see, carefully untie one balloon and inflate it.
  - 5) Replace the inflated balloon on the metre stick in its original location. (Now the balloon filled with air is heavier on our metre stick "scale" because it has more matter or "stuff" inside of it).

At the conclusion of these three activities, you may wish to use HANDOUT #1 as a review.

Explain to a younger student how to “catch” air in a jar.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

How does our funnel experiment prove there is air in an “empty” jar?  
Label this picture and add the water to prove it.



Describe your picture:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

The air in a beach ball,



a tire,



or in a balloon,



takes up \_\_\_\_\_, just like the air in our jar.



The sun



warms the air all over the Earth, but especially near

the Equator.



Warm air is lighter than cold air.

\_\_\_\_\_ air stays closer to Earth and helps push \_\_\_\_\_ air up

into the sky.

Air is always moving around the Earth and we feel \_\_\_\_\_



Word List:      wind      cold      space      warm

## Procedure:

### Part 2

***Relating Science and Technology to the World Outside the School*** – predict and describe how local weather conditions affect living things, including themselves (e.g., effect of wind on trees in autumn, effect of snowfall on humans' ability to travel)

Resources to Use:

- **Weather Bear** Velcro Activity Board (dress bear in weather-appropriate items)
- Costume / Dress-Up Box with hats / gloves / scarves / umbrellas / snow pants, etc. for drama
- Books / magazines on seasons and natural resources including air and water
- Green plants : classroom duties to water and keep in sunlight

Recording Weather:

- Rain Gauge: use to measure rainfall as a classroom activity. A simple glass jar or measured beaker placed in a safe place during a rainy day at school. Record measurement. Review water cycle information and discuss all the uses for this fresh water. *Discuss appropriate clothing and activities for rain and thunder and lightning storms.*
- Wind Mill: use to show how hard the wind is blowing outside the classroom windows. *What good uses are there for wind?* (drying wet things on clothes racks; flying flags and kites; spreading pollen and seeds; blowing dead leaves off trees for winter; old-fashioned wind-mills and new wind turbines are good, clean ways to produce electricity)
- Weather Vane: use to show which direction the wind is blowing. *Who can use this information?* (Meteorologists and weather specialists will see if storms or warm / cold fronts are blowing in; sailors; farmers checking for storms)
- Thermometer: use to show temperature inside and outside of classroom. *Discuss appropriate clothing and activities for temperatures across the range of the thermometer.*
- Hygrometer: use to gauge the amount of moisture in the air. When the pointer tilts up on the scale, the air is moist and rain may be on the way. *Why is it important for scientists and farmers and weather specialists to know when rain may be forecasted? Why is rain so important?*

Air and Water in the Weather: How do they Effect Plants and Animals? (Class discussion)

- Hot / Warm Air : causes plant growth and photosynthesis, creating most of our oxygen
- Hot / Warm Air: causes animals to migrate towards it; causes molting, shedding of skin/fur
- Cold / Cool Air: causes some green plants to become dormant and shed leaves or die
- Cold / Cool Air: causes some animals to hibernate or grow extra fur or fat layers
- Clean Air: is good for plant growth and animals to breathe in
- Polluted Air: blows harmful, toxic chemicals which may kill plants and animals with disease or respiratory problems
- Fresh Water: good for agriculture, plants, and animals to drink
- Salt Water: fills the oceans and provides a home for marine life; also crucial part of the water cycle in which evaporated ocean water returns to the atmosphere for precipitation
- Three States of Water: as a SOLID – snow is an insulating blanket over plants in winter to allow for rest and recuperation for growth in spring; ice stores drinking water for animals  
as a GAS – plant leaves give off water vapour that animals need  
as a LIQUID – rain feeds plants and animals; provides water habitats