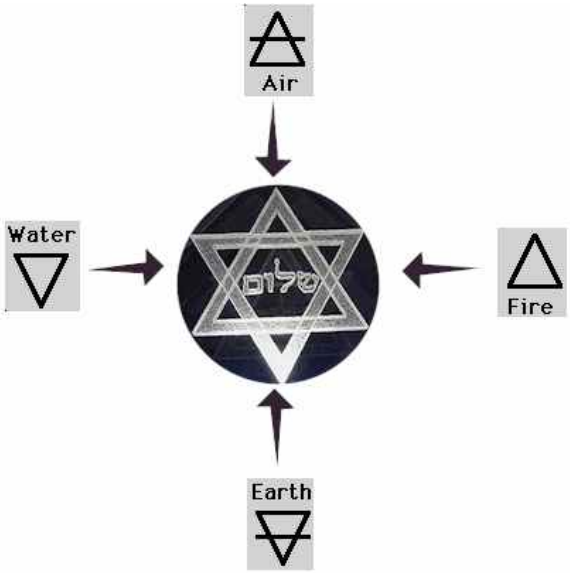
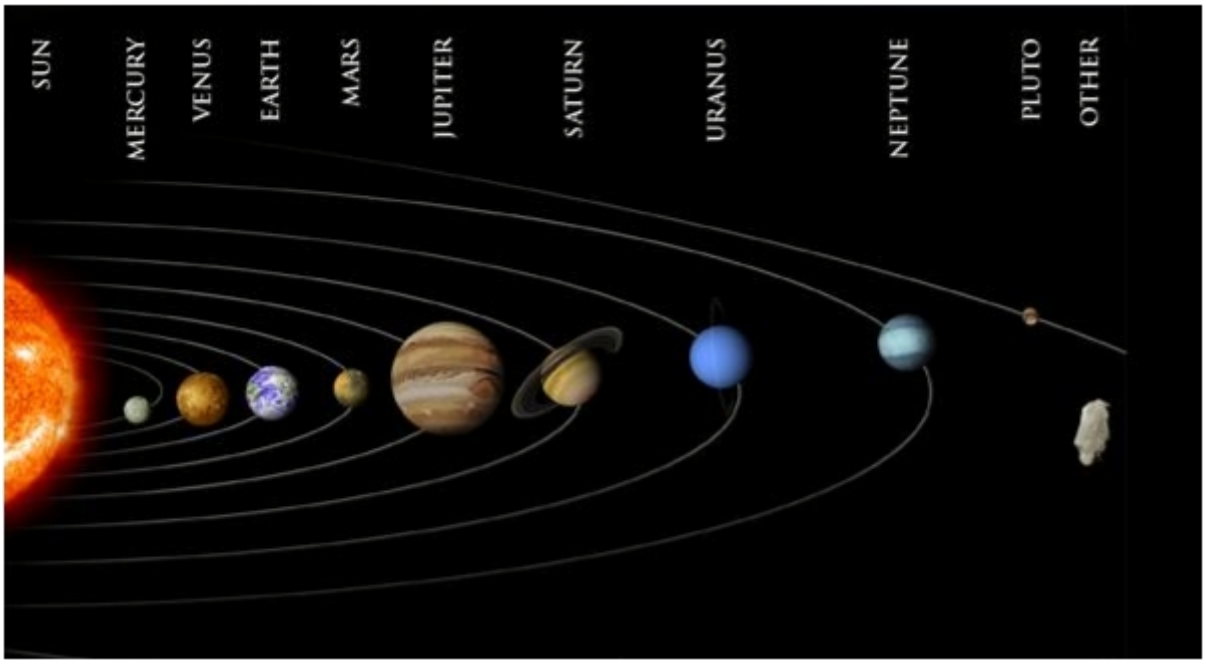
Earth, Air, Fire & Water



Earth



We call the planet on which we live **Earth**. The **Sun** is at the center of our Solar System. Earth is the third planet from the sun. Can you find it?

From space our Earth looks like a big ball.

We can see some Continents and a lot of Ocean.

Do you know any of their names?

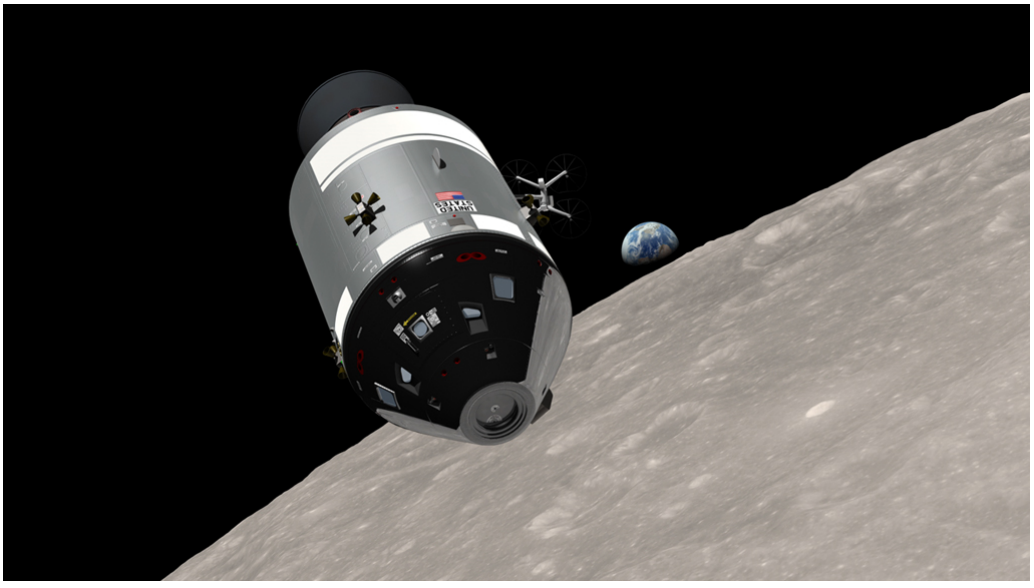
The Earth has a **Moon** in orbit around it.

It shines by reflecting light from the Sun back to us.

In this picture only half of the Moon is in the sunlight.

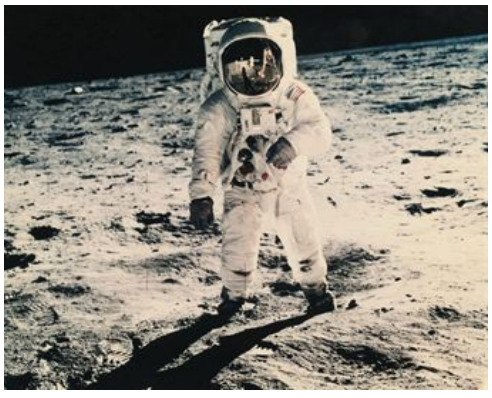
Can you take a Tennis Ball and shine a Flashlight on it so that it looks like the picture? What happens if you turn the ball?

This picture is of Apollo 8 in orbit around the moon. What is just starting to show on the horizon? Is it the Earth? Where is the Sun?

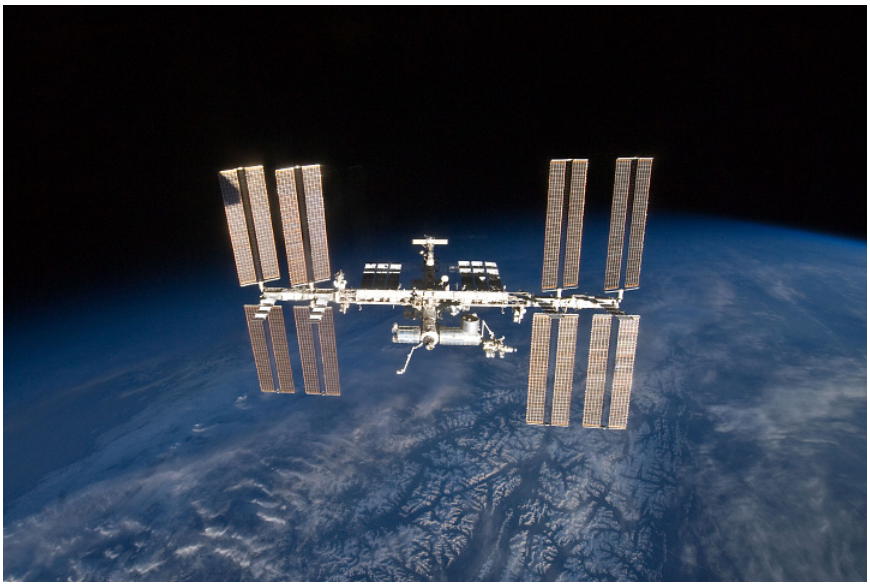


Now we have a better picture taken from Apollo. Is that Earth coming up over the horizon? Can you see clouds on the Earth? And continents? Are there craters on the Moon's surface?

Neil Armstrong and Buzz Aldrin from Apollo 11 walked on the Moon's surface. Here is a footprint they left - the first people to walk on the moon!



This picture shows the World's Continents and Oceans. Which ones were on the photograph of the Earth taken from space? Say their names!



People in the International Space Station orbiting Earth can look down and take photographs for us to see, enjoy and understand.

This is a photograph of New York city taken at night.

Look at all those lights in Manhattan

Can you see how black the Hudson river, the bay and the sea look?
They don’t have any lights.

Here are Italy and Sicily in the Mediterranean sea. The blue streak is due to the sun behind the Earth shining through the Air of our atmosphere.

This map shows all of the States in the U.S.A.
Have you visited any of them?
Where do you live?

This map shows the different land types in the country. Mountains in the West, the great plains, the Appalachians in the East and coastal regions

Mount Hood in Oregon is a Volcano.

From time to time it has an explosive eruption with gas and ash coming from its vent.

Sprague Lake is in the Rocky Mountains of Colorado. These are folds in the Earth's crust

In Southern California, the Sierra Nevada mountain can be seen from Los Angeles

Here are 2 Sierra Nevada bighorn sheep that live in the mountains

On the mountains' East side the land has less rain and desert plants grow in the lowlands

Deserts can also be cold. In Alaska there are large cold deserts. Here is a bear that lives there.

What sort of bear is it? Do you think he eats fish?

This Alaskan Bald Eagle is on a fishing trip.
Do you think the bear will be cross?

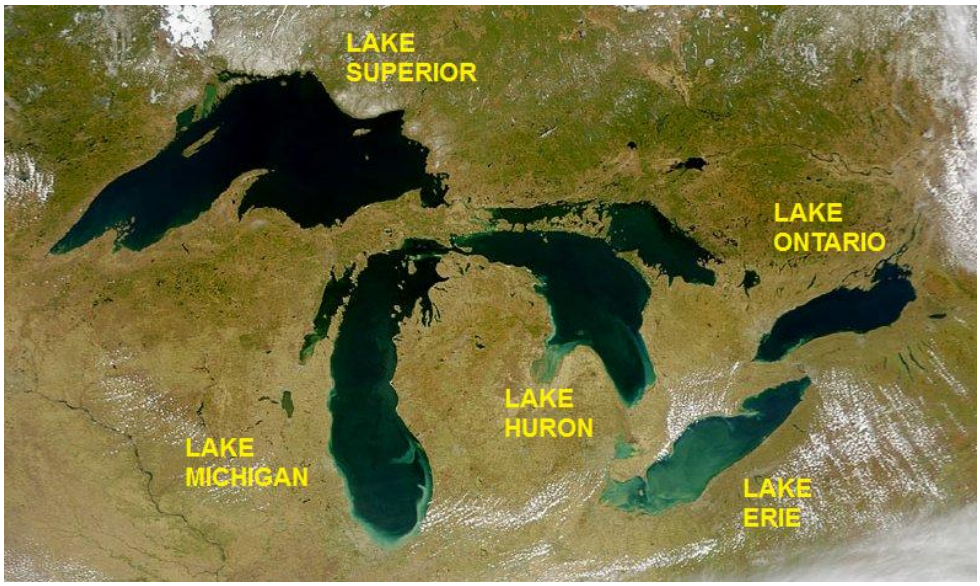
The Grand Canyon has been cut into the planes by water flowing through it. It is very deep and long.

Do you remember the Craters on the Moon?
The Barringer Meteor crater shown is in Arizona.
Can you see the roads and houses on the rim?

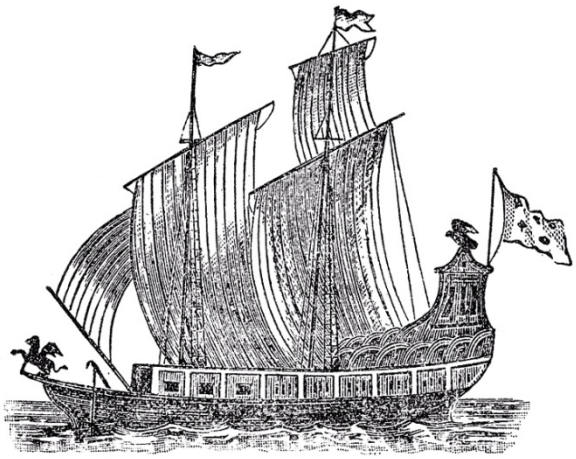
The Tall Grass Prairie Reserve in Kansas shows us how much of the American land used to look.

Here are prairie grasses in flower in Illinois. The first Europeans to come and live here built cabins like this one, Cragg Cabin, in Goose Lake Prairie.

Would you like to come and live in this Little House on the Prairie?



The Great Lakes shown in this satellite picture separate Canada and the United States. They formed 20,000 years ago at the end of an ice age.



This ship, Le Griffon, was built in 1679 and was the first to transport people and goods in the lakes above Niagara Falls.

Chicago is a port city on Lake Michigan and has a river linking it to the Mississippi river.

Toronto on Lake Ontario is a Canadian port city

In the winter ice can form on these fresh water lakes. Special ice-breaker boats are needed to break the ice to help other ships reach their port

On the East coast there many big ports for ships coming across the sea. Here is New York.

Philadelphia in Pennsylvania is also a port city

Independence Hall in Philadelphia was the home of the first congress in the new United States.

The Liberty Bell celebrates the ideals of the USA

“Proclaim liberty throughout all the land unto the inhabitants thereof”

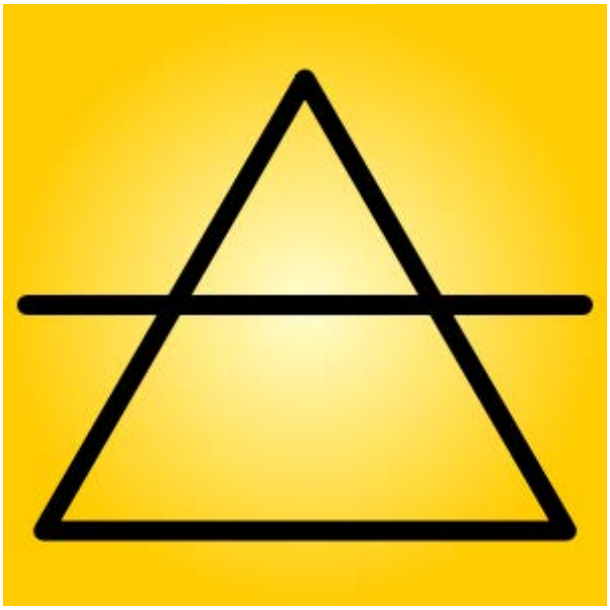
The Federal Government is now in Washington, DC. Look down the Mall and say what you see.

Is the first building the Lincoln Memorial?

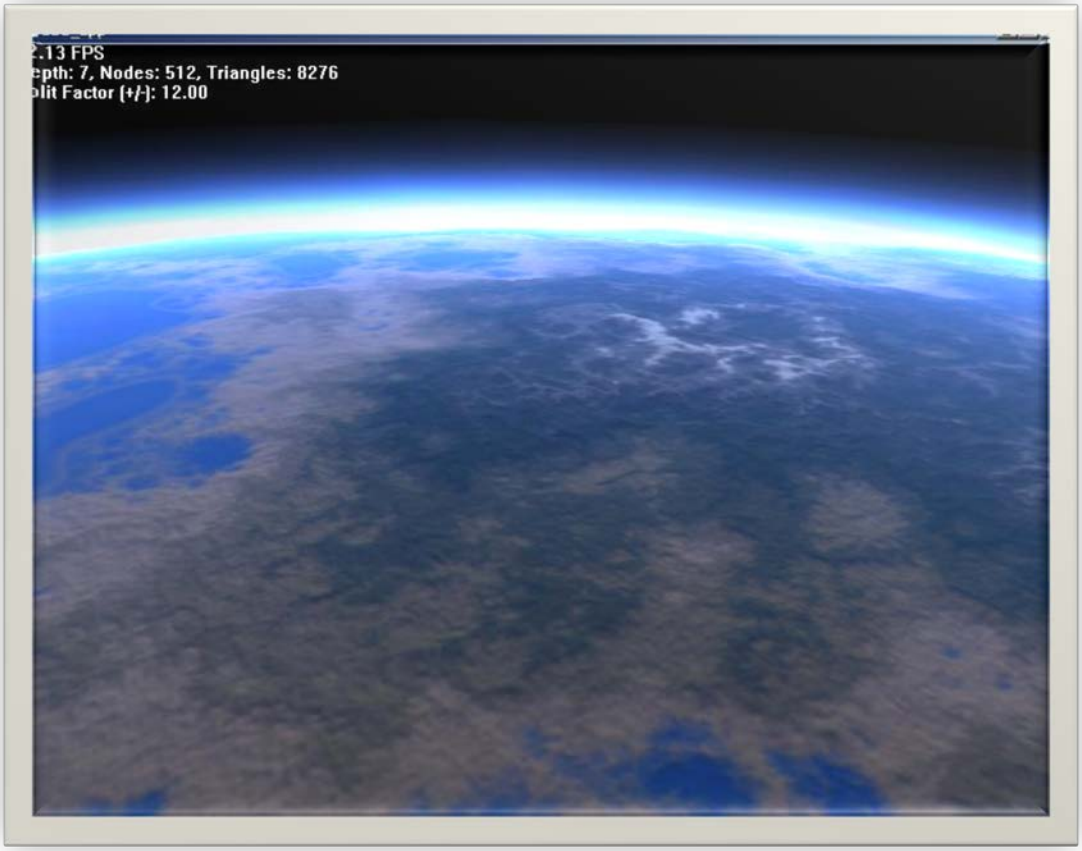
Did you see the Capitol at the far end?
What is that tower in the middle?

Air

Our Earth is surrounded by air that we call the **Atmosphere**. It is kept in place by the Earth's gravity which also stops us from floating in space.



The atmosphere is what we breathe all the time to stay alive. It keeps us warm, brings us rain, snow and the wind, allows birds and insects to fly as well as balloons and airplanes that carry people.

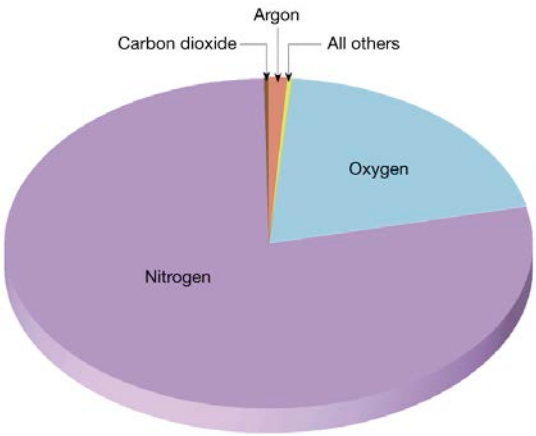


Do you remember seeing a picture like this before? What is that bright line on the horizon? Is it the atmosphere of the Earth with the Sun shining through it?

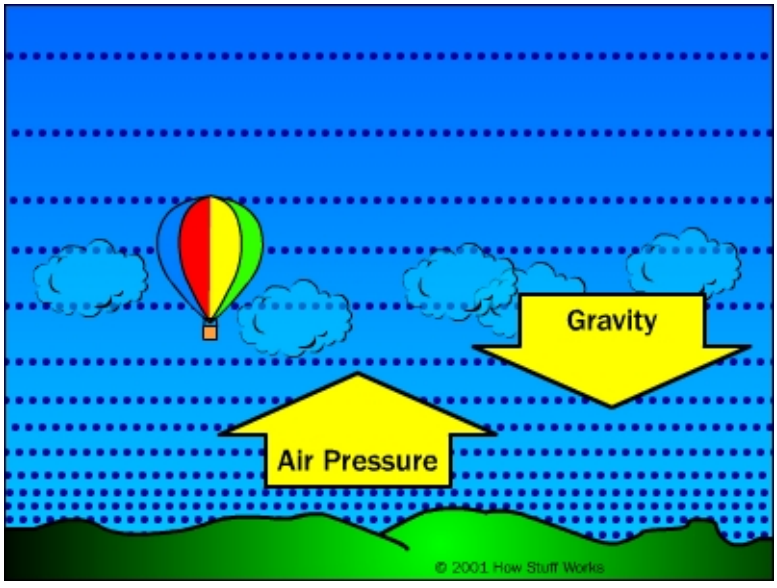
Although the atmosphere is deep compared to us, houses, skyscrapers and mountains, it is still very thin compared to the size of the Earth. If the Earth was only as big as an apple, the atmosphere would only be as thick as the apple skin.

That means that we have to take good care of it and not use it as a free waste dump!

You will remember that won't you?



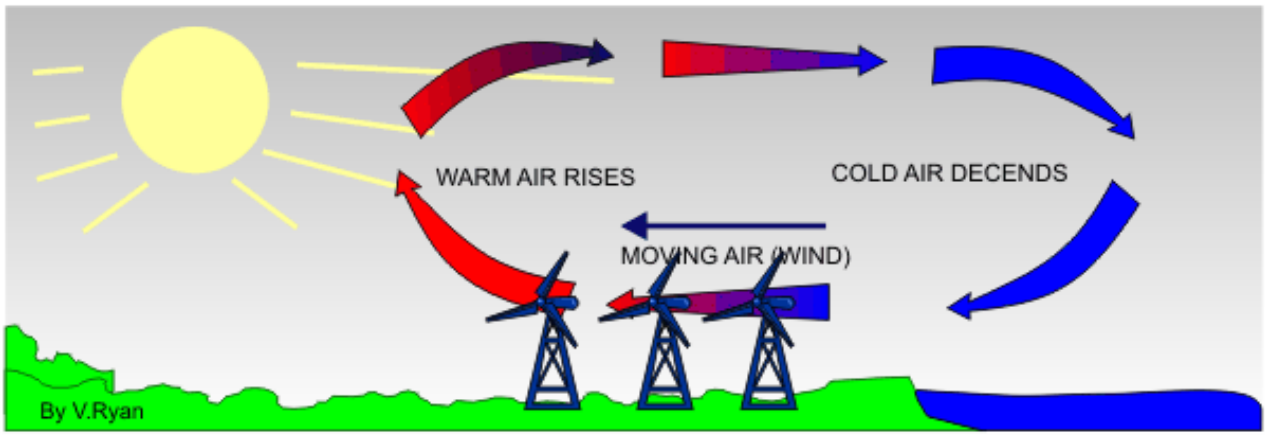
This picture shows the names of gases in our air, most of which is Nitrogen. The Oxygen we need to live is the blue section, the Carbon Dioxide we breath out is only a thin slice in the brown sector.



The pressure in the atmosphere is due to the amount of gas above it and gets less as we go up higher. The balloon balances its Weight due to gravity and its Buoyancy due to air pressure so as to float just like a boat floating on the water.

Where does the wind that is blowing the dandelion seeds come from?
Not only from your mouth when you play with the seeds!

Here is a picture to show how it can happen.



When air gets warmed by sunlight it goes up and heavier cold air then can move to take its place.

This movement of the air is the Wind we can feel.

If you run into the wind pulling your kite in the air, the wind feels faster to the kite which then can go higher into the sky.

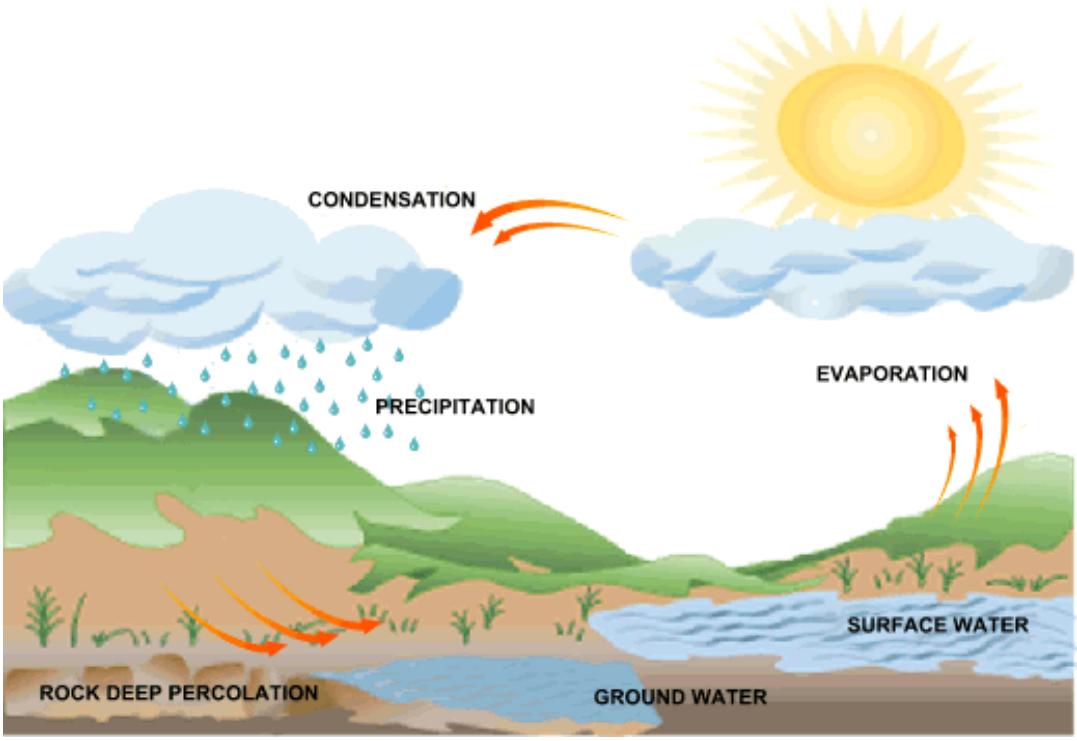
This Dutch tulip field has windmills to make electricity that can light and heat homes and run trains without polluting our atmosphere.

This picture shows air pollution due to smoke from a fire. We see the smoke and smog because they scatters light. Can you point to them?

Clouds and mist are water vapor in the sky. They give shade and rain to water the ground.

The drops of water in a mist or rain can scatter light in a special way to give a Rainbow which shows all of the colors making white light.

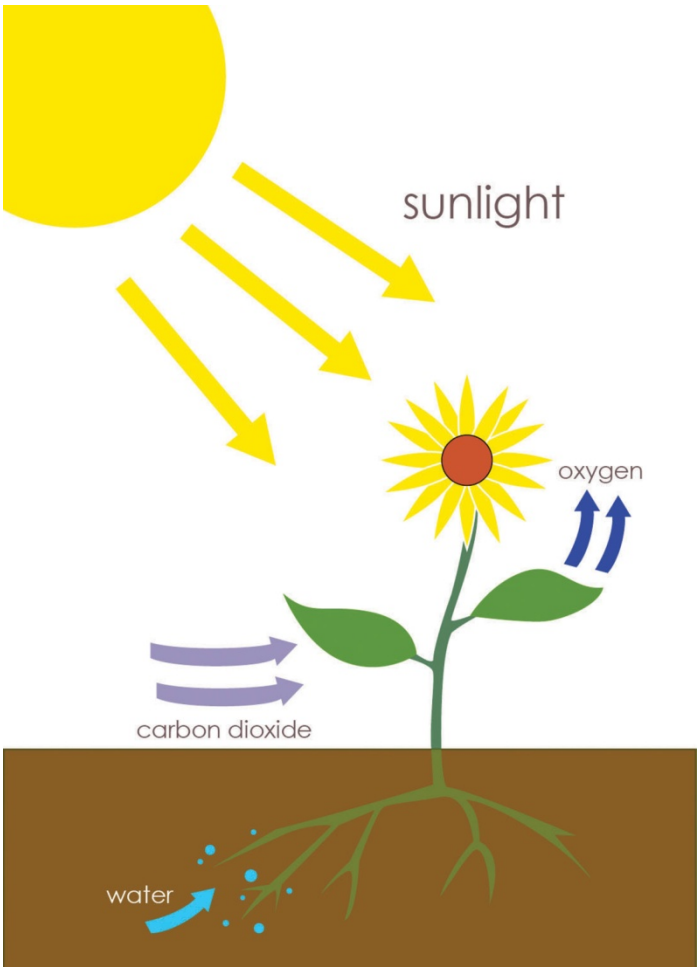
In cold weather, clouds can bring snow which is frozen water. Snow is white because it reflects all the colors in white light.



This picture shows the things that happen to make rain or snow from water on the Earth's surface.

These children are going home from school in a flood that the Monsoon rains brought to India. Do you think that would be fun?

Trees and plants help us look after our Air by using water and sunlight to produce the oxygen for us to breath and taking the carbon dioxide to make them grow.

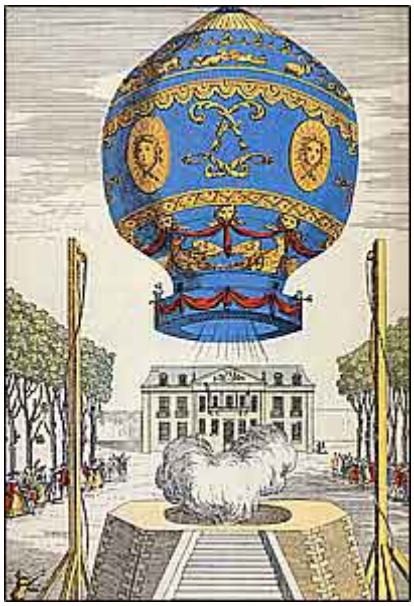


We must be careful not to upset this balance by doing things that make it hard for the plants to live a healthy life.

Wasting energy and making lots of garbage are things we need to avoid.

Everyone on the Earth and its animals and plants need to be treated with respect.

People dreamed of being able to fly in the air. In 1783 two types of balloons in France made this possible for the first time.



The first to fly in November was a hot-air balloon made by the Montgolfier brothers.

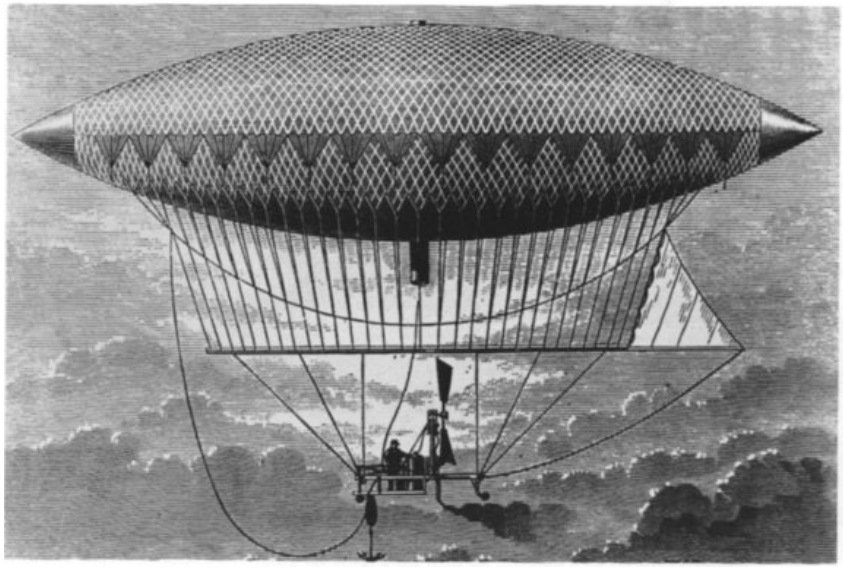
Making the air hot increased the Buoyancy of the balloon and enabled it to carry two people.

Two weeks later, in December, a Hydrogen filled balloon carried Jacques Charles and Nicholas-Louis Robert into the sky above Paris.

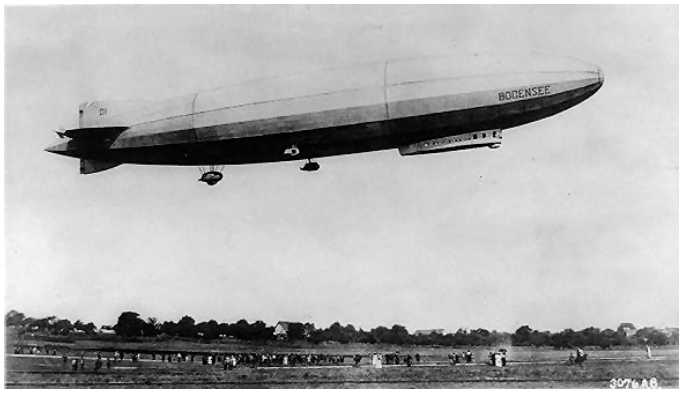
Hydrogen is lighter than air at the same temperature and it gave the balloon enough buoyancy to lift the two men into the air.

Balloons can't go where they want as they are just blown by the wind. A new shape and a way to push it through the air was needed to make travel possible.

Another French engineer, Jules Giffard, solved the problem by making the balloon cigar shaped with a steam engine powered propeller to push it through the air. It first flew in September 1852.



By 1936 the German Zeppelin was able to fly from Europe to America carrying 97 passengers and crew.



This picture shows the Hindenberg flying over Princeton in 1937 just before it's Hydrogen caught fire as it was trying to land at Lakehurst, N.J.

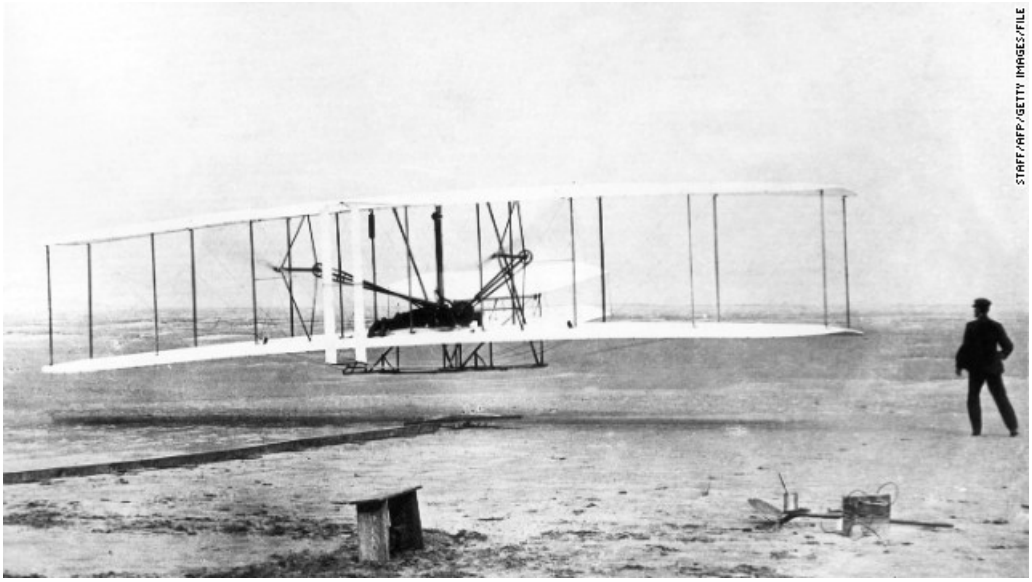
Zeppelin flights then ended.

Birds have wings to let them fly and these were imitated by people wanting to do the same thing.

In 1885 the German, Otto Lilienthal invented the hang glider.

The picture shows his Derwitzer glider in flight.

To glide, he ran and jumped off a hill with the air passing over the wings providing lift against the falling force due to gravity.



Powered flight using propellers to push the ‘plane was first demonstrated by the Wright brothers in 1903 and the age of air travel could then begin.

This 4 motor Handley Page biplane is in Palestine after a flight from London in 1930

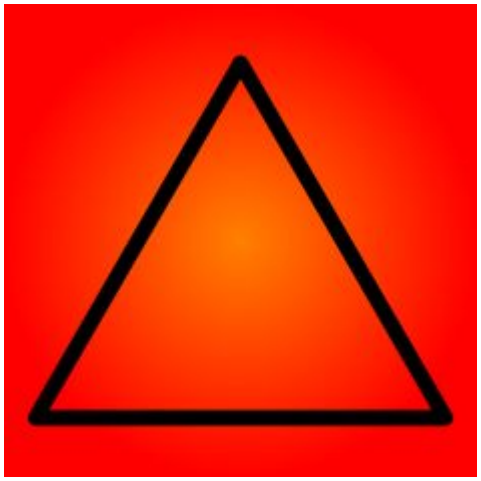
The first jet passenger plane was the DeHaviland Comet which entered service in 1958. Instead of propellers its engines blew out jets of air to move it forward.

People wanted more speed to make long journeys quicker. The Concorde made by the French and English was the first supersonic passenger plane.

It used a lot of fuel and was not competitive with slower planes made by Boeing and Airbus except for very busy or wealthy people.

This Boeing 737 is now one of the workhorse for the airlines.

Fire



Fire is something that makes the way we live possible. These Fire symbols are from the Alchemists and the Chinese name.

Do you think Dragons breathe fire?

Fire is a way of using energy from the Sun stored for many years in wood, coal, oil and natural gas.

People started using fire about 400,000 years ago.

The things that are burnt with the oxygen in the air give off heat, but this also puts more carbon dioxide into the air.

Fires can be started in nature when lightning in a thunder storm hits dry wood or grass.

That is the way this fire at Bass Lake in California was started.

The water in the lake will stop the fire at its shore.

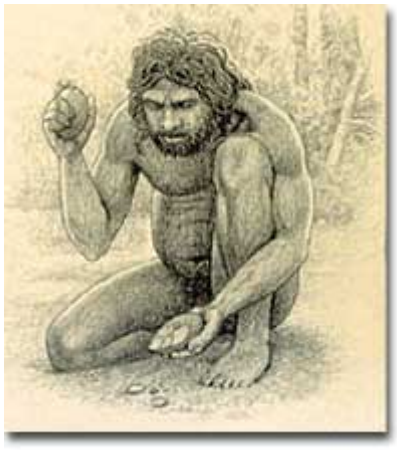
New trees will soon grow on the burned land, but it will take a long time for them to grow big.

To start a fire you need to make something hot.

These people in Botswana are rolling a stick between their hands and pushing it onto another piece of wood to make each hot and catch fire.

Can you try this to see how much hard work it is?

Another way that can be used is to make a hot spark by hitting one flint stone against another. This spark can set some dry grass on fire and this can then get some sticks to burn.



Hunters once used sparks from flints to fire the gunpowder in Flintlock Muskets and Pistols.

In countries that don't have electricity or gas with which to cook, women may spend many hours each day collecting wood for their cooking.

As more wood is used they have to walk longer distances to find what they need.

Using the wood for indoor cooking pollutes the air in the house and this causes health problems.

Stoves cost too much for many families to buy.

Most of us don’t need to cook on a fire, but on special occasions we do enjoy cooking around a campfire.

Do you know what these children are cooking?

Does this picture help?

We also use fire to celebrate special things.

What is this young person up to?

More than 1200 years ago gunpowder and Fireworks were invented in China and used for special celebrations and to get rid of Evil Spirits.

4th of July fireworks over New York City

14th of July, Bastille Day, fireworks in Paris, France.

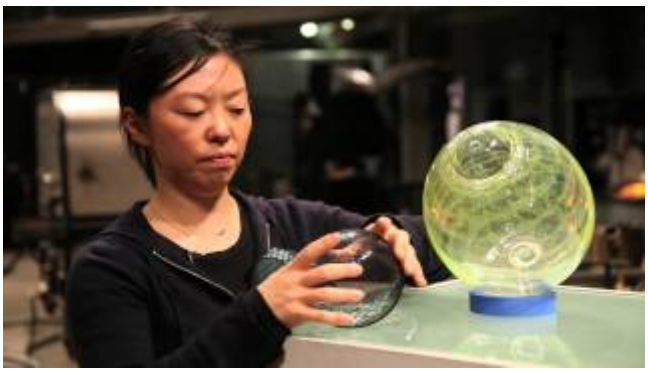
That is the Tour Eiffel

The Big Ben clock in London, England with fireworks to celebrate the New Year

Fire can help us make good things to eat. This brick oven is heated by burning wood and can cook pizza and bread

Glass can be heated in a hot flame to make it soft enough to blow into shapes we can use.

Here are some things to enjoy:



People who make pots from clay use fire to make it hard and durable after it has been shaped.

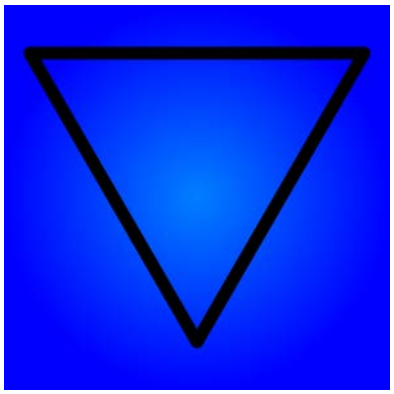
Potters use their hands to shape the wet clay.

This potter in Delhi, India is using a stick to turn his potter's wheel and make a cylindrical pot.

Firing finishes the pot which can have a glaze to give a surface pattern.

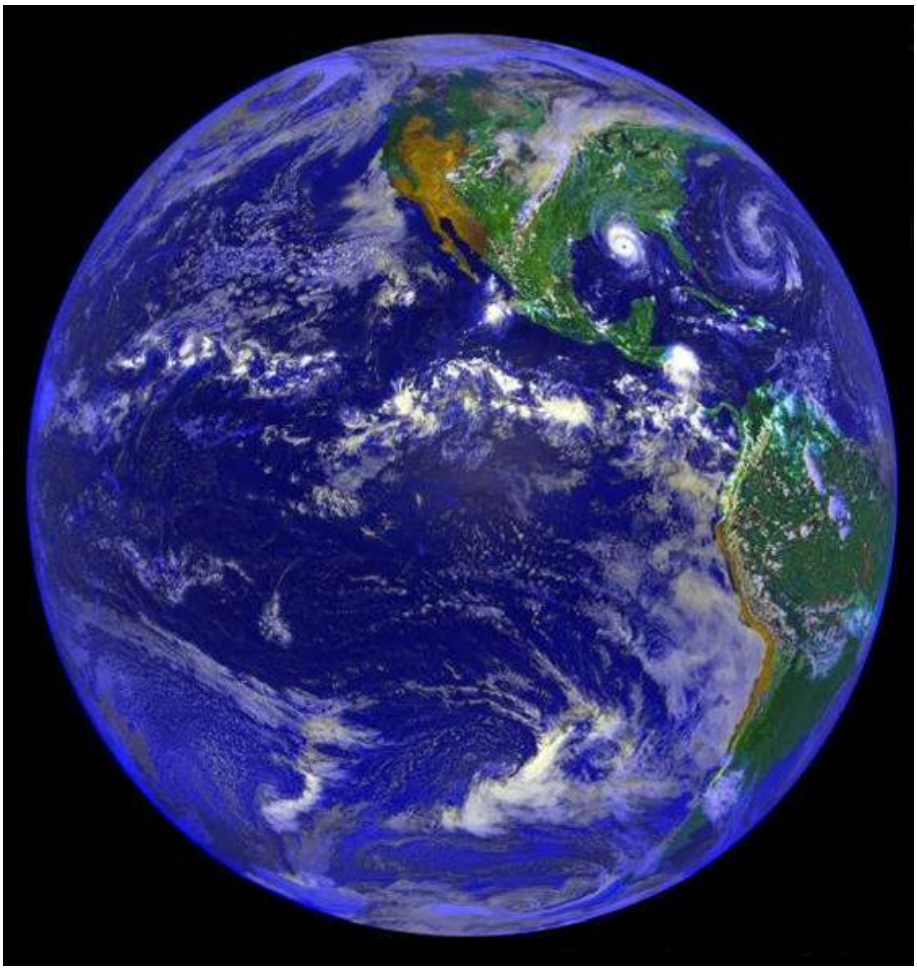
Water

Water is essential for life on our Earth.



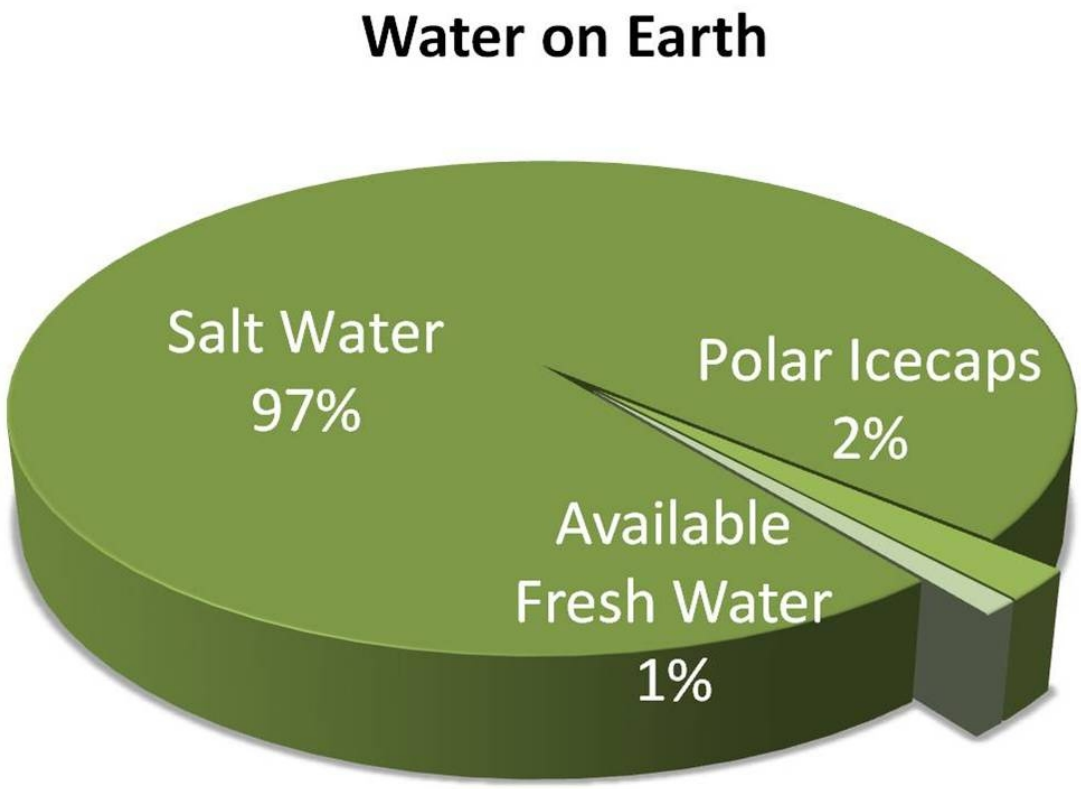
These two symbols for water were used by the Alchemists and by the Chinese.

Water covers almost three-quarters of our Globe.



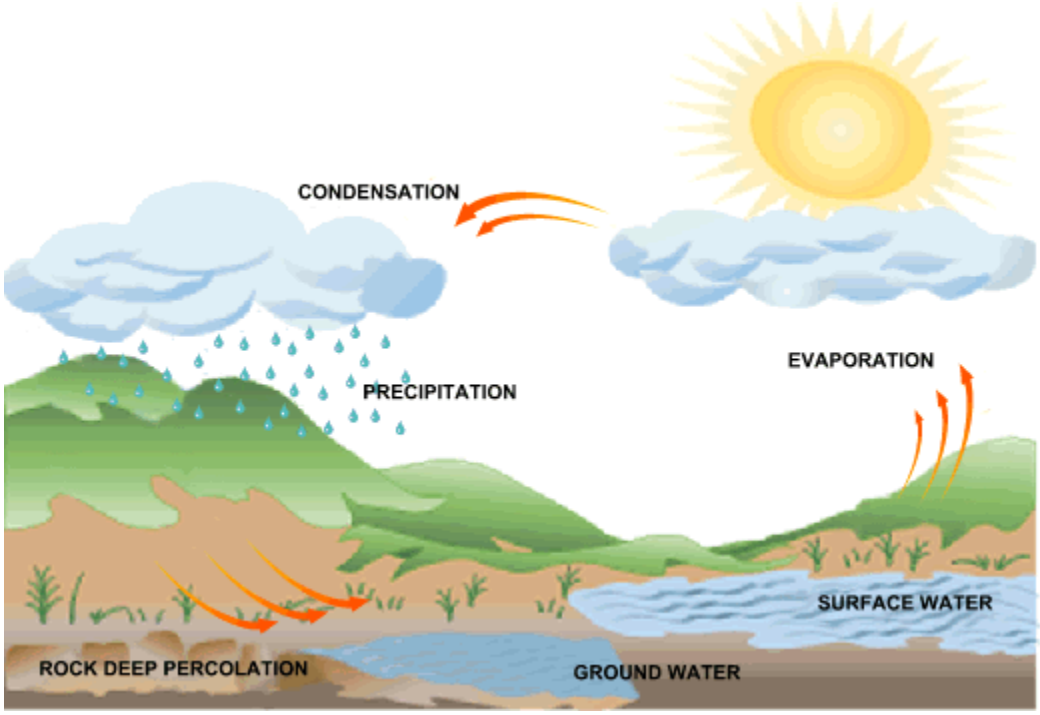
Most water is salty Ocean water, some is frozen as Ice at the North and South poles and on mountain tops, and fresh water is a rare resource.

This pie-diagram shows the size of each of these amounts compared to all there is (the whole pie).



Most of the fresh water is Antarctic ice, the rest is in lakes, rivers, the air and clouds.

This picture shows how water moves around on the Earth. Not only do rivers, lakes and the sea have moving water but it also moves through the



ground. It can evaporate from each of these places and go into the sky to form clouds or fog.

As it gets colder, the water vapor can condense into drops of water which are not buoyant enough to stay in clouds and fall as rain to return to the rivers lakes and the sea.

We can drink rain water as it left salt and other dissolved things behind when it evaporated to make clouds.
We can do the same thing if we boil salty water and condense the steam.

Not everyone is lucky enough to be able to get fresh water in their home or a drinking fountain.

This boy in Zimbabwe has to walk a long way to a well or clean stream to find water for his family each day.

Fresh water is precious. Each of us has to take care not to waste it or to do things that will pollute it so that we, birds, animals and plants can drink it without becoming sick.

This pond is not polluted. It has fish and insects swimming in it, water lilies and reeds growing from its bottom,
land plants near its edge getting water to help them grow and a surface that ducks can float on and eat things in the water.

A polluted pond looks very different.

Can you see down through the water?

Are there water plants growing in it?

Is there a lot of junk thrown on its banks and floating in the water?
We must make sure that we don’t do things that make this happen.

Water is Life

We can find out more about water by doing **Experiments** and understanding what they say.

Do things float in water?

Here is a Duckling swimming on water. Do you see those webbed feet which make moving easy?

Can you get a dish of water and find some things to see if they float or sink?

Does wood float, a cork, an ice cube, a stone, a piece of pumice, a metal, a small metal can, a tennis ball, an apple?

Why do some float and others sink? Is it the same reason that a balloon floats in air?

What happens when we mix things with water?

Could we do some experiments to find out?

Let's take some plastic cups and use a spoon to mix things we want to try to dissolve in water.

What things should we try?

Here are some suggestions: Sugar, salt, sand, instant coffee, laundry soap, apple juice, cooking oil, food colors.

Make a list of which things dissolve and which don't.

If you have several different food colors you can have fun mixing the solutions to see what color the new mixture will have.

The color of the solution is the color of that part of the rainbow of white light that can pass through the solution. White light has all the colors we see.

Experiments can be fun and perhaps you should think of something that you would like to find out and an experiment that might be helpful.

Are these children finding out about waves?

These glasses have different amounts of water. If they are tapped gently, do they make the same sound?

Can you find out?