

# All About Clouds!

Compiled By: Nancy Volk

# MOST\*

## Pre-Lesson Activity

Read one of the following poems:

“Shapes in Clouds” by Kinbria Stimmel

“When The Clouds Came Flying By” by Judyth Very Baker



These pictures focus on the same cloud over time as it floats through the sky.

## Activity 1

### Open Your Eyes to the Skies!

Go outside or from inside, look out a window. Take a look at the clouds.

What shapes do you see? Do the clouds look like other objects? What other objects? Find a cloud and follow the cloud in the sky for a minute or so. What happens to the shapes of the cloud?

Find a jet trail. How far does it go in the sky? What happens to the jet trail over time? Can you draw a picture of the sky (try using black paper with a white crayon for the clouds)? Try your hand at writing a poem about the sky or clouds.

Clouds are a major part of weather and also provide clues for forecasting the weather. Clouds form when air saturated, or filled to capacity with water vapor, reaches the temperature we call the dew point and condenses onto dust particles. The dew point temperature is the temperature at which the air condenses.

Condensation occurs when the water vapor turns into liquid water. When an air mass becomes saturated and it cools it reaches the dew point temperature. When an air mass reaches the dew point temperature the moisture condenses onto cloud nuclei, or dust particles, and a cloud forms. Explain to a friend how clouds form.



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## New York State Standards

New York State Standards:  
Intermediate Science

### Standard 1:

Math Analysis: M1.1a, M1.1b, M1.1c  
Key Idea 2: M2.1b  
Key Idea 3: M3.1a

Standard 1: Science: Key Idea 1: s1.2c  
Key Idea 2: s2.1a, s2.1d, s2.2a, s2.2d  
Key Idea 3: s3.1a, s3.1b, s3.2b, s3.2f, s3.2h

Standard 4: Key Idea 2; 2.1a, 2.1b, 2.1j, 2.2k, 2.2l, 2.2m, 2.2n, 2.2o, 2.2p, 2.2q

Standard 6: Key idea 2: 2.2  
Key Idea 5; 5.2

General skills: Thermometer, Recognize and analyze patterns and trends, classify objects according to characteristics, cause and effect relationships, and measure weather variables.

## MATERIALS NEEDED

### Activity 2

Sponge

Eyedropper

Container of Water

Paper Towels

## MATERIALS NEEDED

### Activity 3

Cup of water

Scissors

Small piece of cotton

String

Two simple air temperature thermometers

**Students should be able to:**

## Activity 2

### Saturation

#### What to do?

Your goal is to saturate the sponge.

Using the eyedropper, place water on the sponge and watch it become absorbed. How many eyedroppers does it take to completely fill up the sponge with water? How do you know that the sponge is filled to its capacity with water? Your sponge became saturated at what point?

## Activity 3

### Finding the Dew Point

When moisture is on your skin and it evaporates do you feel cooler or warmer? What is the purpose of perspiration? Evaporation of water is a cooling process. When the thermometer, with the moisture on it, swings in the air it cools due to evaporation. The dryer the air the more cooling occurs so the temperature will lower significantly compared to the dry bulb temperature. The more moist the air the less the wet bulb thermometer cools providing a temperature closer to the dry bulb temperature.

#### What to do?

Determine the wet bulb and dry bulb temperatures.

1. Take one thermometer and tie a string securely around this. Keep the thermometer dry. This will be called the dry bulb thermometer.
2. Tie a piece of cotton around the bulb of the second thermometer.
3. Moisten the piece of cotton by dunking it into the cup of water. This thermometer will be called the wet bulb thermometer.
4. Design a data table that will record dry bulb and wet bulb thermometer readings every minute.
5. Two people are needed to swing the thermometers. Record the temperature on the dry bulb and wet bulb thermometers every minute.

#### Discussion Questions

1. In general, what happened to the dry bulb temperatures? Why?
2. In general, what happened to the wet bulb temperatures? Why?
3. If the air is really dry what will happen to the wet bulb temperature?
4. If the air is very humid or moist what will happen to the wet bulb temperature?

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The dew point temperature can be calculated knowing the dry bulb temperature and the difference between the dry bulb temperature and the wet bulb temperature. We use charts for helping to calculate the dew point temperature. If you would like to try this you can do an internet search for Dew Point Temperature charts or find some charts here:

<http://www.iowadot.gov/erl/current/IM/content/378.pdf>

As the dry bulb temperature and wet bulb temperature get closer together the more moist the air is. The measure of moisture in the air is called relative humidity. As the dry bulb and wet bulb temperatures get farther apart the relative humidity decreases.

Draw a graph that shows what happens to relative humidity when the difference between the dry bulb temperatures and wet bulb temperatures increase.

Draw a graph that show what happens to the saturation of the air with water vapor as the difference between the dry bulb temperature and wet bulb temperature decreases.

## Activity 4 How Do Clouds Form?

What happens to air as it moves up in altitude in our atmosphere? When you hike up a mountain is it cooler or warmer at the top?

That is right, air cools as it moves upwards in the atmosphere. Cooler air can hold less water vapor and warmer air can hold more water vapor. So as air cools it begins to saturate the air with water vapor. It reaches the temperature at which water condenses that we have defined as \_\_\_\_\_.

There are three main reasons that air rises.

### Sunshine

Heat from the sun or warm ground warms the air and makes it lighter. It therefore rises into the sky.



### Terrain

Air may rise as it is forced upwards due to changes in the terrain (landscape). This often occurs when wind blows air either over mountains, or over cliffs onto land from the sea.



### Fronts

Air can also rise at a weather front. At cold fronts, cold air is pushed under warm air, forcing it upwards. A warm front, warm moist air is forced up and over the cold air.



In all three cases the air moves upward in the atmosphere, cooling as it rises, reaching dew point temperature and forming clouds.

<http://www.rcn27.dial.pipex.com/cloudsrus/clouds.html>

Clouds tend to form when air rises into the atmosphere and the sky tends to clear when air descends from above to the ground.

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## Activity 5

### Name That Cloud!

Clouds have different names. Different looking clouds form at different levels. Just like naming other objects the names are based on qualities of the clouds. The height at which a cloud forms is important and ends up being part of the name.

<http://eo.ucar.edu/webweather/cloud3.html>

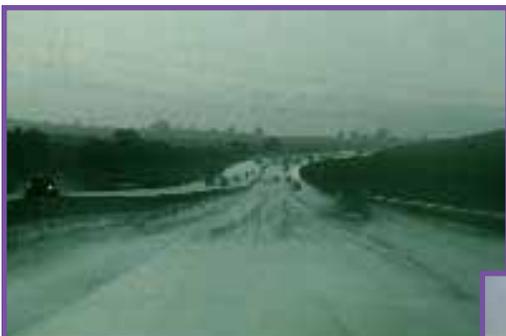
### Stratus Clouds

Stratus clouds are low level, grayish clouds that often cover the entire sky. They resemble fog that does not reach the ground. Usually no precipitation falls from stratus clouds, but sometimes they may drizzle. When a thick fog "lifts" the resulting clouds are low stratus.



### Nimbostratus Clouds

Nimbostratus clouds form a dark gray, "wet" looking cloudy layer associated with continuously falling rain or snow. They often produce precipitation that is usually light to moderate. Here are some examples of nimbostratus clouds:



## Alto Clouds

Clouds with the prefix “alto” are middle level clouds that have bases between 2000 and 7000 m (6500 to 23,000ft.)

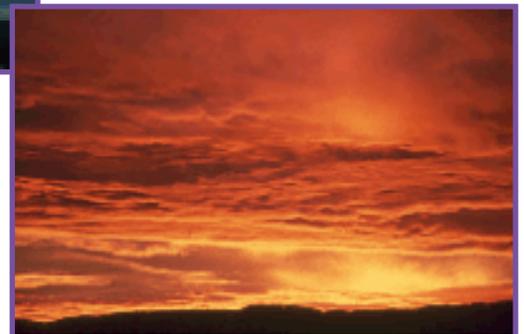
## Alto cumulus Clouds

Alto cumulus clouds are middle level clouds that are made of water droplets and appear as gray, puffy masses, sometimes rolled out in parallel waves or bands. The appearance of these clouds on a warm, humid summer morning often means thunderstorms may occur by late afternoon.



## Altostratus Clouds

Altostratus clouds are gray or blue-gray middle level clouds composed of ice crystals and water droplets. These clouds usually cover the entire sky. In the thinner areas of the cloud, the sun may be dimly visible as a round disk. Altostratus clouds often form ahead of storms that will produce continuous precipitation.



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## Cirrus Clouds

Cirrus clouds are thin, wispy clouds blown by high winds into long streamers. They are considered “high cloud” forming above 6000 m (20,000 ft). Cirrus clouds usually move across the sky from west to east. They generally mean fair to pleasant weather.



## Cirrostratus Clouds

Cirrostratus clouds are thin, sheet like high clouds that often cover the entire sky. They are so thin that the sun and moon can be seen through them.



## Cirrocumulus Clouds

Cirrocumulus clouds appear as small, rounded white puffs. The small ripples in the cirrocumulus sometimes resemble the scales of a fish. A sky with cirrocumulus clouds is sometimes referred to as a "mackerel sky."



## Cumulus Clouds

Cumulus clouds are puffy clouds that sometimes look like pieces of floating cotton. The base of each cloud is often flat and may be only 1000 m (330 ft) above the ground. The top of the cloud has rounded towers. When the top of the cumulus resembles the head of a cauliflower, it is called cumulus congestus or towering cumulus. These clouds grow upward, and they can develop into a giant cumulonimbus, which is a thunderstorm cloud.



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## Cumulonimbus Clouds

Cumulonimbus clouds are thunderstorm clouds that form if cumulus congestus clouds continue to grow vertically. Their dark bases may be no more than 100m (1000 ft) above the Earth's surface. Their tops may extend upward to over 12,000 m (39,000 ft). Tremendous amounts of energy are released by the condensation of water vapor within a cumulonimbus. Lightning, thunder, and even violent tornadoes are associated with the cumulonimbus.



# Name That Cloud Worksheet

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Directions:** Place the correct name of the cloud near the picture..



1. \_\_\_\_\_



2. \_\_\_\_\_



3. \_\_\_\_\_



4. \_\_\_\_\_

### MATERIALS NEEDED

#### Demo 1

Beaker

Cake metal pan/bread pan

Container of warm water

Dry ice or Liquid Nitrogen

Goggles

Thick protective hand gloves

Tongs

### Demo 1: Dry Ice!

#### Dry Ice Safety Instructions

1. **Do not taste, eat or swallow!** Dry ice is very cold and can damage your body.
2. **Wear heavy, insulated gloves.** Since dry ice is cold, it can damage even your skin, giving you frostbite.
3. **Do not store in sealed container.** Because dry ice constantly sublimates into carbon dioxide gas, storing it in a sealed container will cause pressure to build up. If it builds up enough, the container could explode.
4. **Use only in ventilated space.** In a poorly ventilated area, the build up of carbon dioxide could create a suffocation hazard. This is of great danger when transporting the dry ice in a vehicle.
5. **Carbon dioxide is heavier than air.** It will sink to the floor. Keep this in mind when thinking about how to make the space well ventilated.

#### Demonstration

Place some dry ice in a cake pan or large bread pan, pour some warm water over the top of the dry ice and watch the clouds roll off – reapply warm water as needed to see the cloud form. Do not allow students to touch the dry ice (-109.3°F or -78.5°C.). They can touch the cloud that forms without being injured and it should feel like a cold cloud. Protect eyes from potential splashes. Ask the students what is happening? How is the cloud being formed?

**Answer:** The water provides the moisture. As the warm water hits the very cold ice it causes sublimation of the carbon dioxide. Sublimation is a term that refers to going from a solid to a gas phase without turning into a liquid. The cold ice cools the surrounding warmer air to the dew point temperature creating condensation of the water molecules. The cloud forms from the condensed molecules of water vapor on the particles in the air.

## Activity 6 Discovering the Sky

Have you ever heard the amount of cloud coverage reported in percent of the sky covered? This is a typical meteorological tool to help with forecasting and describing weather at a location. Approximating the percentage of the sky that is covered by clouds can be a tricky skill. Here is an activity that will help you determine this.

### Directions

1. Fold one sheet of the white paper so that there are ten equal size parts represented. This may take some time to determine how to complete this task. Use the two pieces of white paper for trials on this problem and the third to make the final solution.
2. Cut the paper up into the ten equal sections.
3. Determine how much cloud coverage you want to have represented on your blue sky (blue paper)- keep this in even ten percentage points.
4. Use the number of white paper parts to equal this percentage. For example, 40% cloud coverage would be 4 of the equal pieces of white paper.
5. Tear up the white paper into cloud like pieces
6. Glue these piece to the blue paper using the glue stick, to represent the percent of cloud cover.
7. Place the amount of cloud coverage your picture represents on the back of the blue paper along with your name.
8. Share papers with each other and see if you can guess the cloud coverage represented by the paper. Check your answer on the back of the page.
9. Describe what you have learned.
10. Now, set up a system to track percentage of cloud coverage daily as a class. Track this information for at least a month.

## Activity 7 Cloud Coverage: An Outdoor Analysis

This activity helps a group to come up with the amount of cloud coverage in an open area outside on a day with a fair amount of clouds.

Divide into teams of four students. Once outside, place the four participants all backs facing towards one another. Each participant should face one quadrant of the sky: one to the north, one to the east, one to the west, and one to the south. Have participants extend arms upward to mark out their quadrant of sky. Each person should determine about what percent of the sky is covered with clouds up to 25% of the sky (each person has 25% of the sky that they are observing).

As each person in the quadrant shares how much sky they see covered with clouds add them up around the quadrants to get the final total up to 100%.

## Tornado Connections

Tornadoes form from very large and strong cumulonimbus clouds that begin to have a strong upward draft and begin a vortex motion. It is a process of multiple cloud levels. Tornadoes form from funnel clouds that form from wall clouds which form along the base of the cumulonimbus cloud.

## Surface Indicators

There are a few surface indicators that could signal the approach of a strong storm or tornado in the forecast.

### Barometric Pressure (sharp drop in air pressure)

A barometric pressure of 850 mb (25.17 inches) was recorded in a tornado near Manchester, S.D., which is likely the lowest pressure ever recorded in a tornado. The tornado occurred on June 24, 2003, and caused F4 damage. The measured pressure drop of 100 mb as the tornado passed is a record listed in the Guinness Book of World Records

**Winds:** Increase in speeds and changes in directions (see a list of speeds on the enhanced fujita scale).

**Temperatures:** Rapid change in temperature.

**Precipitation:** May vary in amount and intensity.

**Cloud coverage:** Cumulonimbus with a vortex, wall clouds, increasing percentage of coverage of the sky.

## Signs of a Possible Tornado:

<http://library.thinkquest.org/03oct/01352/tornadosigns.htm>

-  A strong, continuous rotation in the clouds
-  Whirling dust and/or debris on the ground beneath a layer of clouds
-  Hail or heavy rain followed by extreme shifts in wind
-  A loud, continuous rumble that doesn't fade over time
-  Bright, blue-green flashes near the ground of power lines breaking
-  Lowering of the clouds in a spiraling fashion

For activities and information on tornadoes, including create a tornado in a bottle, fujita scale, make a barometer, math and tornadoes, and other pictures and information, download the Tornado Alley K-12 Educator's Guide from [www.most.org/educators/imax-teachers-guides/](http://www.most.org/educators/imax-teachers-guides/).