Clouds, Clouds, Everywhere

Grade Level  1st Grade
Standards Connection(s): Earth Science: Weather can be observed, measured, and described.
  Physical Science: States of Materials. Solids, liquids, gases have different properties.
  Substances’ properties change with mixing, cooling, heating.

Teaser: Students will learn about what it’s like to be a scientist at Bayer and see how weather can be observed, measured and described. By reviewing the three states in which water is found on earth (solid/ice, liquid/water, gas/vapor) students will then see a demonstration of the forces that make clouds occur and gain an appreciation for what is happening in the atmosphere. They will then create a model of the cloud patterns.

Objective: As a result of your lesson, what will students learn? What will they be able to do?
• Student will learn about the three states in which water is found on earth (solid, liquid, gas) and how water changes between these states (freezing/melting, condensation/evaporation)
• Students to know the basic components of what makes up a cloud.
• Students to recognize different cloud weather patterns

Vocabulary/Definitions: Have vocabulary words written on the board ahead of time
• Atmosphere – A layer of gases surrounding a planet.
• Vapor: A substance diffused or suspended in the air, esp. one normally liquid or solid: "dense clouds of smoke and toxic vapor".
• Particles: A minute portion of matter.
• Condense- The change of water vapor to liquid water, as when fog or dew forms.
• Clouds - A visible collection of tiny water droplets or, at colder temperatures, ice crystals floating in the air above the surface. Clouds offer important clues to understanding and forecasting the weather.
• Cumulus Clouds – Low hanging (less than 1 mile), white, puffy clouds which chance shape very quickly and found on warm and sunny days.
• Stratus Clouds – Layered gray clouds that block the sun, sometimes covering the whole sky and may bring rain or snow.
• Cirrus – High (3+ miles above the earth), curly, wispy, feathery, white clouds made of ice usually found on fair days.
Materials:

*What will volunteers bring with them?*

Prepared kits (with material for demonstrations and activities)

For Demonstration:
- air pump
- empty 2L soda bottle and stopper
- isopropyl alcohol
- safety glasses
- cloud posters
- Word Cards: Cirrus, Cumulus, Stratus
- cloud pictures: Cirrus, Cumulus, Stratus
- Cloudette by Tom Lichteneld

For Cloud Chart Activity (replace after every presentation):
- glue (1 bottle *per volunteer*)
- cotton balls (roughly 20 *per student*)
- construction paper, folded into thirds (1 – 11x17 sheet *per student*)

*What should students have ready (pencils, paper, scissors)?*
- Writing utensils
- Markers for writing on construction paper

Classroom Set-up:

*Student grouping, Power/Water, A/V, Light/Dark, set-up/clean-up time needed*

When the volunteers arrive, have the students on a rug in the front of the room for the volunteers to do their introduction and initial demonstration (demo needs an area in the front with no children on the sides).

Then the class will be divided into 3 groups (or more if there are more volunteers – to be clarified when initially talk with volunteers). For the break-out session, the students will need to have a desk/work area for writing and glue work.

**Classroom Visit**

1. **Personal Introduction: (5 minutes)**

*Who are you? What do you want to share with students and why? How will you connect this with students’ interests and experiences?*

*(Varies by presenter)* Introduce yourselves, your interest and role in science.
2. **Topic Introduction: Read book (10 minutes) and discuss**

Tell the class: Today we’re going to talk about **clouds**, so let’s read a story that talks about clouds.

Read *Cloudette* book to classroom by Tom Lichtenheld

Now, let’s talk about what we know about clouds from our experiences and from reading *Cloudette* – we’re going to write them up on the board using the Know/Wonder model (draw a table on the board with 2 columns):

- **Know:**
  - What kinds of things did Cloudette do in the book? What about the other clouds?
  - What did you notice about Cloudette and the other clouds? What kinds of shapes did they have? Did they all have the same shape? Did you notice that some of the clouds were higher up in the sky than Cloudette? Did you notice that some of them were lower?
  - What do you think clouds are made of?

  **Activity:** Have student blow into their hands. Ask students to use their sense of touch to describe the air that comes out of their mouth. Is it warm? Do you feel moisture in the air? Use this introduction to talk about **water vapor**.

- **Wonder:** What kinds of questions do you have about clouds?

Transition to Cotton Ball Cloud activity: Earlier we discussed how there are different types of clouds; maybe you’ve observed some of them when you’ve gone outside. So, now we’ll break into small groups and talk about the characteristics of 3 of them: **Cumulus**, **Cirrus**, and **Stratus**.

3. **Activity: Cotton Ball Clouds (20 minutes)**

Now we are going to make models of cloud types we commonly see. We are going to break the classroom into 3-4 groups, 1 group per volunteer (3-4 groups), and talk about clouds and make some out of cotton balls.

During the Activity: Spend some time discussing how scientists spend a good part of their jobs: observing, measuring and describing what they research. Please elaborate on that in terms of why these are important skills for scientists and how you might use those skills at Bayer and in your lab.

**Activity:** **Use the poster of the clouds to discuss the cloud types and review to pictures when building cotton cloud model.**

1. Take 11 x 17 piece of pre-folded paper.
2. Have students expose only top rectangle.
3. Have them write **Cirrus** on the bottom of this rectangle.
4. Give each student approximately 2 cotton balls
   a. For **Cirrus** – since it these are the highest clouds – put them in the top space. Review **Cirrus** clouds are wispy so they should pull the cotton balls apart and they will not need
many balls for this (approx. 1-2). Glue these on. (**It may be useful for the adults to put the glue on the paper for each section and then the students can apply the cotton balls)  

b. In the middle section, write Cumulus clouds as they are in the middle layer and are the full clouds so approximately 10-12 cotton balls in this section  
c. On the lowest section, write Stratus and explain they are the lowest and are layered. Have the students try to unwrap the cotton balls (approx. 4/student) and layer the clouds.

If time, maybe students can go outside after they’ve cleaned up their tables to observe what kinds of clouds are in the sky that day.

4. Activity: Cloud demonstration (10 minutes) – See more detailed explanation at end of lesson.

Models:

Now we are going show you a model of a cloud. Models are used often in science to understand how things work and to test out different principles of them. We are going to use a bottle (show bottle) to demonstrate our atmosphere. Clouds are made from vapor. In our model, we will add a liquid with vapor and we will increase the pressure of the vapor by using an air pump. The two important things we need to create the clouds in this model are: vapor and the change in air pressure.

We are going to push a lot of air into the bottle so that the vapor particles will get really close together and condense. Notice that we still can’t see the vapor when we push all the air into the bottle because it’s actually pretty warm inside.

We need 2 things to make a cloud: **Water Vapor** and a **Change in Pressure**

**Cloud in a bottle:**

Steps: BE SURE TO TEST THIS PRIOR TO YOUR CLASSROOM VISIT (PER YOUR PUMP)

1. **Put on your safety glasses** and start by pouring just enough alcohol in the bottle to lightly cover the bottom (about 2 tablespoons).

2. Swirl the alcohol around and have one person hold the bottle (parallel to the students with the pump stopper away from the students). Then put the rubber stopper in the bottle and hold the stopper in tightly.

3. Have the second person pump the pump 10 times (approximately). You will notice that as you start to pump, the rubber stopper will want to pop right out. Hold it in the bottle tightly, being very careful not to let it fly out of the bottle (have the 1st person do this while holding the bottle).

4. **Warn the class that there might be a loud popping noise.**
5. “Now, watch what happens when we take the cap off”. (take the cap off)
   1. When we take the cap off we release some of the pressure on the particles inside so they expand, cool and then condense into clouds.

6. After 10 pumps, the first person pulls the stopper out of the bottle. When you remove the rubber stopper, you should see a good cloud.

Repeat a couple times per students’ enthusiasm and review what is happening in the bottle. If you have multiple bottles, you can cap the bottle with the cloud in it and pass it around.


5. **Connections and Close (10 minutes)**
   What else might kids relate this to from their real-life experience? How can they learn more?
   Thanks and good-bye! Clean-up.
   - Ask students, name one type of cloud we learned about today:
   - Then ask them some special characteristics of these types of clouds (look, height, etc.)
   - Then show them the photograph of that type of cloud
   - Review questioning and review for each of the 3 cloud types
   - Thank you and good-bye

   **Total 60 Minutes**

---

**More Detailed Explanation of Cloud Demonstration**

Even though we don't see them, water molecules are in the air all around us. These airborne water molecules are called water vapor. When the molecules are bouncing around in the atmosphere, they don't normally stick together.

Pumping the bottle forces the molecules to squeeze together or compress. Releasing the pressure allows the air to expand, and in doing so, the temperature of the air becomes cooler. This cooling process allows the molecules to stick together - or condense - more easily, forming tiny droplets. Clouds are nothing more than groups of tiny water droplets! (Try to relate the experiment to something that students may have experienced. When you go outside on a cold day you can see your breath in clouds. When the water vapor in your breath leaves your body it is very warm but when it hits the cold air it causes the vapor to condense.)

The reason the rubbing alcohol forms a more visible cloud is because alcohol evaporates more quickly than water. Alcohol molecules have weaker bonds than water molecules, so they let go of each other more easily. Since there are more evaporated alcohol molecules in the bottle, there are also more molecules able to condense. This is why you can see the alcohol cloud more clearly than
the water cloud. (This explanation will be a bit advanced for most first graders but useful to know if many students ask why you use alcohol.)

Clouds on Earth form when warm air rises and its pressure is reduced. The air expands and cools, and clouds form as the temperature drops below the dew point. Invisible particles in the air in the form of pollution, smoke, dust or even tiny particles of dirt help form a nucleus on which the water molecules can attach.

Can be seen at  http://www.stevespanglerscience.com/experiment/cloud-in-a-bottle-experiment

**Background Information on Clouds**

**What are clouds?**
A cloud is a large collection of very tiny droplets of water or ice crystals. The droplets are so small and light that they can float in the air.

**How are clouds formed?**
All air contains water, but near the ground it is usually in the form of an invisible gas called water vapor. When warm air rises, it expands and cools. Cool air can't hold as much water vapor as warm air, so some of the vapor condenses onto tiny pieces of dust that are floating in the air and forms a tiny droplet around each dust particle. When billions of these droplets come together they become a visible cloud in our atmosphere.

**Why are clouds white?**
Clouds are white because they reflect the light of the sun. Light is made up of colors of the rainbow and when you add them all together you get white. The sun appears a yellow color because it sends out more yellow light than any other color. Clouds reflect all the colors the exact same amount so they look white.

**Why do clouds turn gray?**
Clouds are made up of tiny water droplets or ice crystals, usually a mixture of both. The water and ice scatter all light, making clouds appear white. If the clouds get thick enough or high enough all the light above does not make it through, hence the gray or dark look. Also, if there are lots of other clouds around, their shadow can add to the gray or multicolored gray appearance.
Cloud types

Cirrus: These are the highest clouds in the sky, so tell the children to paint these clouds in the top section of their paper. They look like "whispy feathers". Some people think they look like a horse's tail. That's what their name Cirrus means, "horse's tail". Cirrus clouds usually mean good weather.

Cumulus: These clouds are closer to the ground than the cirrus clouds, so tell the children to paint them in the space "under" the cirrus clouds. They look very full and billowy, much like "cotton or cauliflower". Little cumulus clouds mean good weather. Some cumulus clouds grow very large ...and that may mean a thunderstorm is coming.

Stratus: These clouds are very close to the ground. Tell the children to paint them in the space "on the bottom" of the blue paper. These clouds sometimes block out the sunshine and all the blue in the sky. Stratus means "Layers". Stratus clouds often mean that rain is likely.

Reference materials: http://www.weatherwizkids.com/weather-clouds.htm
Follow-up Activities

Activity #1: Construct a Cloud Key

Activity # 2: Track weather patterns in a weather journal
To get the most out of this activity, have student record the daily observations in a notebook. At the end of a month or season, the student can create a graph or tally chart of the different types of weather that was examined. Consider extending this activity even further by encouraging students to orchestrate a nightly weather report, discussing the day's weather and making predictions for the following day.

Directions:
2. Show students how to use the key. Move the wheel until the cloud you want appears then read the name and weather information in the box.
3. Have students make a table with five headings:
   • Date/Time
   • Cloud Type
   • A.M. Weather
   • P.M. Predicted
   • Weather
   • Actual P.M. Weather/Time
   *Invite students to fill in the chart every morning for a week, comparing their predictions*
4. Observe the weather outside and record it
5. If you had time before class, look up the weather the next couple days or print out weather reports for the past few days and discuss what these clouds were like or are going to be like. http://teacher.scholastic.com/lessonrepro/reproducibles/profbooks/cloudkey.pdf

Follow-up 3: Shaving Cream Clouds:
This activity can be a little messy, it’s helpful to use a plastic table cloth or give each child a plastic/waterproof placemat to work on.
1. Talk about the characteristics of different cloud types. Explain that the clouds do not always look the same.
2. On each child’s workspace, spray a little puddle of shaving cream. Explain that they may use their fingers to paint clouds. Model on the chalkboard with shaving cream, different variations of cloud shapes and designs.
Clouds, Clouds, Everywhere

Vocabulary & Definitions

Atmosphere - A layer of gases surrounding a planet

Condense - The change of water vapor to liquid water, as when fog or dew form

Vapor - A substance diffused or suspended in the air, especially one normally liquid or solid: “dense clouds of smoke and toxic vapor”

Clouds - A visible collection of tiny water droplets or, at colder temperatures, ice crystals floating in the air above the surface. Clouds offer important clues to understanding and forecasting the weather

Particles - A minute portion of matter
Clouds, Clouds, Everywhere

Cirrus

**Cirrus Clouds** - High (3+ miles above the Earth), curly, wispy, feathery white clouds made of ice and usually found on fair days.

Stratus

**Stratus Clouds** - Layered grey clouds that block the sun, sometimes covering the whole sky and may bring rain or snow.

Cumulus

**Cumulus Clouds** - Low hanging (less than 1 mile), white, puffy clouds which change shape very quickly and are found on warm, sunny days.