# Bay Area Scientists in Schools Presentation Plan

**Lesson Name** Clouds Everywhere

**Presenter(s)** Kristi Closser and Tara Yacovitch

**Grade Level** 5th **Standards Connection(s)** Earth science (cloud formation, air pressure), Physical science (air is made of molecules), Scientific method

**Teaser:**
*Your opportunity to tell teachers and kids what's going to be fun and interesting about your visit!*

Look up in the sky…what do you see? If you don't see anything does that mean there is nothing there? If there are clouds do you know what makes them? We will explore what is in the air and what causes clouds to form there. Students will also have the opportunity to make a cloud in a jar right on their desks!

**Objective:** *As a result of your lesson, what will students learn? What will they be able to do?*

Students will learn that air consists molecules including oxygen, nitrogen, carbon dioxide and *water*. They will also learn the elements required for cloud formation (water, nucleation sites, change in pressure). Furthermore, students will have the opportunity use the scientific method to ask testable questions and explore the effect of changing variables.

**Vocabulary/Definitions:**
*3 – 6 important (new) words*

**Molecule***:* smallest particle of a substance that has all the characteristics of the substance
**Water *Vapor***: water in the gas phase
**Air Pressure***:* the force exerted by the molecules in the air
**Nucleation***:* formation around a small cluster
**Condensation***:* transformation of the gas phase to the liquid phase
**Hypothesis***:* an educated guess
**Experiment***:* the process of testing the hypothesis
**Conclusion**: the final decision reached by reasoning

**Materials:**
*What will you bring with you?*

Jars
Balloons/scissors
elastic bands
dust/matches/sand
Yarn/rock for demo
Cup for demo

*What should students have ready (pencils, paper, scissors)?*

**Pen or pencil**

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

**Clear desks**
**Groups of 2 or 3**
**A source of water (we will bring a container)**

# 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?*

We are graduate students at Berkeley in the chemistry department. We study the molecules in the world around us using computers (Kristi) and lasers (Tara)

**Topic Introduction:** 15 **Minutes**

*What questions will you ask to learn from students? Big Idea(s), vocabulary, assessing prior knowledge...*

What's in the air? (nothing, clouds, etc). Air is made of something so we can use it to do things like blow up a balloon, hold up a piece of paper, or make wind (cup and paper demo, blow up balloon). Air consists of molecules [write on board], like Oxygen, Nitrogen, Carbon Dioxide and water. When these molecules crash into things they create a force known as air pressure [write on board].

One of these molecules, water is in the air as a gas (what is a gas?) which is called water vapor [write on board]. This water can become a liquid (what is a liquid?) through a process known as condensation [write on board] (use examples such as a glass of ice water, the mirror after a bath or shower) Can anyone think of other examples? (breath, etc.) When water condenses clouds form. What happens when the little drops of water get big? (rain, snow, hail).

There are some things that are necessary for condensation to start. First, we need water vapor, Second we need a nucleation site. Sometimes you need little things to start big things this is known as nucleation [write on board]. Clouds can be nucleated by particles (get two volunteers for ball of yarn formation) in the air. Third we need a change in pressure.

Now we are going to be scientists and explore these elements of cloud formation. Scientists use a particular method of figuring things out. We start with a question: "Where do clouds come from?" then we make a guess about what we think will happen (called hypothesis) [write on board]. Can you make a guess about where clouds come form? Once they have the hypothesis, scientists have to test their idea. Testing something is called experimenting [write on board]. We are going to do an experiment with a model, which is something scientists use to study things that are too big or too small to study directly, to see where clouds come from. After we're doe with our experiment we will make a conclusion [write on board]. Can anyone define conclusion? (something that summarizes the experiment, and answers the question). Scientists also record what they do in a notebook [Pass out notebooks]

**2. Learning Experience(s):** 25 **Minutes**

*What will you do, what will kids do? Demonstrations, hands-on activities, images, games, discussion, writing, measuring... Describe in order, including instructions to kids.*

In your lab notebook, you will see three questions. Today we are going to answer these questions. First we are going to test whether or not we need water, then we will test the effects of different sized particles on cloud formation, and finally we will test the effects of changing the pressure.

Pass out jars, balloons and rubber bands and demonstrate how to position them [Have one (two if groups of 3) person from each team pick up supplies].

1. Water

   Question: Is water vapor necessary for cloud formation?

   Experiment: Have students test empty jar by just changing the pressure. Have 1 student go put water in the jar. Have students change pressure by pushing on the balloon. Do you see anything?

   Conclusion: Water is definitely needed because the amount of vapor in the air is usually very small, and we won't be able to see anything without it.

2. Nucleation

   What else do you need? (nucleation sites)

   Question: What is needed for a good nucleation site?

   Experiment: Have students add sand and repeat experiment. Then use chalk dust and/or smoke (we will distribute dust, light matches for kids) and repeat.

   Conclusion: Clouds are easier to form when there is nucleation. We need something very small like smoke or dust to nucleate, sand is too big.

3. Air Pressure

   When we push down very far on the balloon, there is very high pressure inside the jar. When we let go it goes back to normal.

   Question: Does pushing just a tiny bit or pushing harder create a better cloud?

   Experiment: Slightly tap on top of jar, then push harder.

   Conclusion: Clouds form when there is a big decrease in air pressure [This is tricky, it isn't the absolute pressure that matters, but the change in pressure].

## 3. Wrap-up: Sharing Experiences ___10___ Minutes

*Putting the pieces together – how will students share learning, interpret experience, build vocabulary?*

What is in the air? (Molecules, water vapor, nucleation sites)
What makes clouds? (water, change in pressure, nucleation sites)
How do these affect cloud formation?

Water: need enough water vapor to condense
Nucleation: is it easier to make with or without nucleation sites? (with) Does sand work? Why not? (too big) Can you give examples of events that nucleate real clouds? (volcanoes, forest fires, etc)
Pressure: Do big or small changes in pressure make better clouds? Why does the cloud go away when you push down again? Higher pressure pushes water out of the air.

**4. Connections & Close:** ___5___ **Minutes**

*What else might kids relate this to from their real-life experience? How can they learn more? Thanks and good-bye! Clean-up.*

What other things could you test? One would be temperature, does warm or cold water make better clouds? (if you do this at home make sure an adult helps you with the matches)

Next time you go outside look at the clouds and see if you can see different types of clouds

**Total 50 – 60 Minutes**

## Follow-up – After Presentation

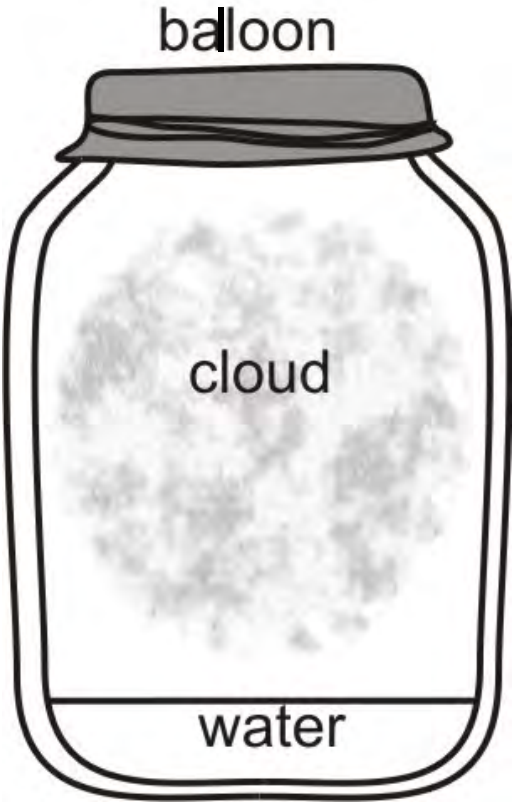
*Suggest students write a letter explaining "How we learned about _____?"*
*List or attach examples of activities, websites, connections for additional learning.*
*Attach worksheets, hand-outs, visuals used in classroom presentation.*

Learn about different types of clouds
www.mbgnet.net/fresh/cycle/clouds.htm
http://eo.ucar.edu/webweather/cloud3.html

Make fog (clouds on the ground)
http://eo.ucar.edu/webweather/cloudact1.html

Explore other types of weather
http://eo.ucar.edu/webweather/index.html

# My Science Notebook




Name:_____

# Nucleation

**Question:** How does the presence and size of nucleation sites (like sand, smoke, chalk dust) affect cloud formation?

**Hypothesis:**

_____ nucleation sites _____

small / large — help / hinder / do not affect

cloud formation.

**Experiment:**

Make a cloud with different types of nucleation sites. Color in the jars to record the amount of cloud formation.

| 1. No nucleation sites | 2. Sand | 3. Chalk Dust | 4. Smoke |
|---|---|---|---|
|  |  |  |  |

**Conclusion:**

Clouds are _____ to form when _____

easier / harder — small / large

nucleation sites like _____ are present.

sand / chalk dust / smoke

**Further Exploration:**

What are some sources of nucleation sites for real clouds?

# Air Pressure

**Question:** How does air pressure help cloud formation?

**Hypothesis:**

The air pressure must _____

stay the same / change

in order to form clouds.

**Experiment:**

Try to make a cloud with a large change in air pressure by pressing down hard on the balloon. Try the same thing with only a gentle push on the balloon.

| large decrease | small decrease |
|---|---|
| 1. Large decrease in air pressure: press hard | 2. Small decrease in air pressure: press gently |

Color in the jars to record the amount of cloud formation.

**Conclusion:**

Clouds form when there is _____

a small decrease / a large decrease / no change

in air pressure.

Clouds are present when there is _____

An increase / a decrease

In air pressure

# Resources

More weather experiments to try at home

(ask a grown-up before using matches)

http://eo.ucar.edu/webweather/activities.html