



## **Science Unit: *Weather and Seasons***

### **Lesson 3: *Rain and Rainbows***

School Year:	2009/2010
Developed for:	Sir Guy Carleton and Sir Sandford Fleming Elementary Schools, Vancouver School District
Developed by:	Catriona Gordon (scientist), Karin Bernauer, Maria Maragos, Anita Bramhoff and Ken Kilback (teachers)
Grade level:	Presented to grades K and 1/2; appropriate for grades K - 5 with age appropriate modifications
Duration of lesson:	1 hour and 20 minutes* This lesson can be divided into two lessons to allow for more time: one lesson on rain, the second on rainbows

### **Objectives**

1. Learn about rain and how to measure it.
2. Learn how to capture raindrops and measure their droplet size.
3. Explore what makes a rainbow and make your own.

### **Background Information**

Rain is one form of precipitation, which can also include snow, fog, sleet and hail. Rain is given to water droplets more than 0.5 mm in diameter, falling from the atmosphere to the ground. Water droplets form when water vapour condenses around tiny particles such as dust, smoke, salt, pollen or sulphate. These tiny particles are called condensation nuclei. Without them, rain would not form, and the air would just become very humid. Over land there can be up to 1000 condensation nuclei in every cubic centimeter of air. Water droplets that have formed around condensation nuclei collide and merge inside a cloud. This makes them bigger and heavier, until they are too heavy to be supported by air currents and drop from the cloud as rain. Rain drops range in size from 0.1 mm (drizzle) to 10 mm in diameter (tropical rain).

Rainbows are caused by sunlight shining through raindrops. As sunlight enters a raindrop, it bends (refraction) and the white light is separated into the full spectrum of visible light. The spectrum, based on wavelength includes: red (longest wavelength), orange, yellow, green, blue, indigo and violet (shortest wavelength). Red is always at the top edge of the rainbow, and violet is always at the bottom edge of the rainbow. Multiple rays of sunlight breaking into the colours of the spectrum and refracting and reflecting off many raindrops create a curved rainbow.

### **Vocabulary**

<u>Seasons:</u>	Four periods of the year, each with specific weather conditions, called spring, summer, fall and winter, experienced in the temperate and polar regions.
<u>Atmosphere:</u>	The envelope of gases that surrounds a planet. Earth's atmosphere is made up of mostly nitrogen and oxygen.
<u>Weather:</u>	Condition of the atmosphere in a specific place at a particular time.
<u>Climate:</u>	The average weather in a region over a long period of time.
<u>Precipitation:</u>	Liquid or solid particles that form in the atmosphere and then fall to the ground. These



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	may be in any form (including rain, fog, snow, sleet, hail)
<u>Rain:</u>	Water droplets greater than 0.05 cm that form in the atmosphere and then fall to the ground.
<u>Rainbow:</u>	An arc of colour in the atmosphere that one can see when the sun shines through falling rain.
<u>Condensation:</u>	Process by which a vapour or gas turns into a liquid. Eg. Breathing warm air onto a cold window, droplets will form, “fogging” up the window.
<u>Condensation nuclei:</u>	Small particles such as dust or salt on which water vapour in the air condenses to form rain drops.
<u>Spectrum:</u>	A range of colours representing light of various frequencies. (seen in a rainbow)

### **Materials**

- Electric Kettle
- Ice
- Cake pan, placed in a freezer, half an hour before demonstration
- Mixing bowl or large jar
- Cotton balls
- Clear 2 liter pop bottles
- Sharp knife
- Tape
- Rulers
- Coffee Cans
- Small mirrors
- Mixing Bowls
- Flashlight or a sunny day
- Sheets of white paper
- Shallow tray
- Icing sugar or flour
- Sieves
- Bowls
- Magnifying glasses

### **In the Classroom**

#### **Introductory Discussion**

How is rain formed? Where does it come from? What are the key things you need to make rain? In what season is it the rainiest in Vancouver? When do we have the least amount of rain?

Demo here using a kettle, ice and a large jar. Boil the kettle and then place the boiled water in a large mixing bowl or jar. Put the ice cubes in a cake pan and place the pan over the bowl or jar. Watch the “rain” droplets form on the bottom of the pan and drop back into the bowl. (These are condensation droplets). Using the same bowl, when the water has cooled, let the students soak a cotton ball in the water, and then lift it above the bowl and slowly squeeze out the water, until droplets are heavy enough to “rain” down, back into the bowl.



After it rains, if we are lucky, what might we see in the sky? What are rainbows made of? Why do they form?

### Science Activity/Experiment

#### 1. Make rain gauges

Using a clear 2 liter pop bottle, cut off the neck, where the pop bottle starts to angle upward. (This can be done ahead of time for younger students). Insert the neck upside down like a funnel into the bottom half of the bottle. Put measuring lines on the outside of the bottle, then stand it up inside a coffee can for stability and find a good location to put it outside, away from buildings and overhangs, but safe from getting knocked over. This is your rain gauge. Let students make predictions about how much rainfall will fall over a one-week period. Over the course of the next few lessons, you can check on your rain gauge and see how much rain has fallen. Record this in your science journal.

#### 2. Observing Rain droplet size

Working in groups of 4, take a tray, and gently sieve a layer of flour or icing sugar so that it covers the bottom of the tray to a depth of about 1 cm. Use a piece of cardboard or spatula to flatten the flour. Put the tray outside in the rain until some raindrops have splattered into the flour. Bring the tray back into the class and carefully observe the surface of the tray. Magnifying glasses might help to see the tiny indentations where the rain has fallen into the flour. Gently pour the contents through a sieve. Any lumps caught in your sieve are preserved raindrops. Using a ruler, try to measure them! Sometimes rain droplets are very large, and sometimes, when it is drizzly, they are very small.

#### 3. Make rainbows

Using the sun (if there is any) or flashlights, a mirror and a bowl of water, students can make "rainbows" on the wall. If there is no sun on the lesson day, then we will need a very dark classroom, and flashlights. Working in groups of 4, students can set up their bowl with water and a small mirror, angled about 45 degrees. Using the flashlight, students can shine the light from above directly down on the mirror. A "rainbow" should appear on a white wall or sheet of white paper held up by another student. It is easier to do this experiment on a sunny day, using the sun.

### Closure Discussion

What did you learn about rain? What is condensation? Condensation nuclei? What makes a rainbow?

### References:

Levine, Shar and Leslie Johnstone. 2003. Wonderful Weather: First Science Experiments. Sterling Publishing Co. New York.

VanCleave, Janice. 1995. Weather: Spectacular Science Projects. John Wiley and Sons, Toronto.

Wyatt, Valerie. 1990. Weather Watch. Kids Can Press, Toronto.



## How to Make a Rainbow

Name of Weather Scientist \_\_\_\_\_

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

### I need:

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\_\_\_\_\_

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### I set up:

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I observed: (draw, label and colour)



I learned:

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