Shally Ackerman Younghye Bessette Jennifer Massengill

4th grade Weather Science Circus Cards

Shally Ackerman
Younghye Bessette
Jennifer Massengill

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The College of William and Mary

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Demonstration Teacher Card

Weather Science Circus

Title: How are clouds made?

SOL: 4.6 The student will investigate and understand how weather conditions and phenomena occur and can be predicted. Key concepts include
a) weather phenomena;

Key concepts of this activity: Water is a very important part of life. 60% of the human body is water. Also, living things need water to grow and to survive. The most important fresh water source is rain. Water on land is the source of rain. The water circulates in the water cycle. How clouds are made is directly related with the water cycle. When land water gets heated, this addition of heat energy makes water evaporate and liquid water turns into its gas form, water vapor. A piece of aluminum foil with ice cubes cools down heated water vapor, and this removal of heat energy helps water vapor stick to tiny dust particles in the air and thus turns water vapor into its liquid form, water droplets. This is condensation. In this demonstration, aerosol spray will provide tiny particle for water vapor to stick to. Condensed water droplets become a mass of droplets, which is a cloud.

Materials

A glass jar and its lid
Hot water
A piece of aluminum foil
A rubber band
Two ice cubes
A needle
Aerosol spray

Notes: Before beginning the demonstration, gather students close but not too close to the demonstration station. This demonstration illustrates the concepts of heat energy, evaporation, condensation, and water cycle. Students will have the opportunity to observe the process of cloud forming. This demonstration connects with the thunderstorm activity because students will observe heat being transferred and condensation at the thunderstorm station. **Safety note:** Students are not allowed to be as close as an arm's length to the jar because the jar will be hot. Also be sure to place aerosol spray away from students before, during, and after the demonstration.

Guiding questions:

Do you think it is possible to make clouds? What do think you need to make a cloud? Do we need only water?

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Are clouds solids, liquid, or gas? What are clouds made of?

For the forum:

What do you need to make a cloud? Do you need to add or remove heat energy to evaporate water? What state of matter does water become when it evaporates? What is a gas form of water?

Do you need to add or remove heat energy to condense water vapor? What state of matter does water vapor become when it condenses? What does water vapor stick to?

Have you ever seen this looking cloud? Do you always see the same looking clouds? When you find clouds in the sky, does always rain soon? Can you predict weather by looking at clouds? Do you know different clouds' names?

Activity modified from:

National Weather Service Weather Forecast Office (2011). Cloud in a jar with Calvin. Retrieved October 13, 2012, from http://www.prh.noaa.gov/hnl/kids/activities.php

Sources of information:

WeatherQuestions.com (2010). How do clouds form?. Retrieved October 15, 2012, from http://www.weatherquestions.com/How_do_clouds_form.htm

International Satellite Cloud Climatology Project (2009). Cloud climatology: How clouds form and travel. Retrieved October 15, 2012, from http://isccp.giss.nasa.gov/role.html

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Activity #1 Teacher Card

Weather Science Circus

Title: What was the weather like?

SOL: 4.6 The student will investigate and understand how weather conditions and phenomena occur and can be predicted. Key concepts include
c) use of weather measurements and weather phenomena to make weather predictions.

Key concepts of this activity: There are many ways to predict weather, and observation of clouds is one way. Different types of clouds will give different information about the weather. Types of clouds are categorized by their height from the ground and their appearance. Clouds names are the mixture of Latin words, which provide clues about clouds. All high clouds have names that start with cirro. The prefix alto in a cloud name indicates its position in the middle level of height. Strato means layer and so strato types of clouds have flat appearance. Nimbo means rain and thus clouds with nimbo in their names result in rain. Cumulo means heap and so cumulo types of clouds are aligned in rows. Thus we can easily guess the height and shape of clouds and the weather in some cases by clouds names such as cirrus, cirrocumulus, cumulus, cumulonimbus, altocumulus, stratocumulus, and nimbostratus. These clouds provide further information about the weather than their names do. Practicing to observe clouds and predict weather can be helpful when you cannot check weather report. And it is fun and rewarding to predict weather by looking at clouds and learn that you were right.

Materials

Two Cloud Spotter frames
Cardboard
Double sided tape
Paper clip
Actual photos of clouds
A computer with a weather report website
Circus worksheet packet

Notes: This activity illustrates the concept that clouds affect weather and thus are good indicators of weather. Students will have opportunities to look at actual photos of clouds taken in different cities in Virginia where they can relate to. By predicting weather with clouds and then check a weather report website, student will learn observation of clouds is a good weather predictor and thus actually helpful for them.

Guiding questions:

What can you tell from clouds name? Are clouds in the photo high, middle, or low in the sky? Does that help you to decide what clouds they are?

What is the shape or texture of clouds in the photo? (Students will be able to tell the height and the texture of the clouds) Does that help you decide the name of clouds?
What does the cloud spotter say about that type of clouds? Do you agree with weather prediction made by the cloud spotter when you look at the photo?
What information do you need when you want to look up the weather report website for this photo? Where was it taken? When was taken?
Can you locate appropriate information for the weather on the web page? Does the prediction from the website match to the prediction from the clouds spotter?

For the forum: When do you need clouds spotting skills? Can we just check the weather on our smart phones all the time? Does everybody have a smart phone? Do those who have smart phones never need clouds spotting skills?
Which is more accurate, the clouds spotter or the weather report website? Why do you think it is?

Activity modified from:
Content Area ESL. (no date). Cloud wheel. Retrieved October 15, 2012, from http://www.livebinders.com/media/get/Mjg0MTg1NQ==

Information source:
Funk, T. National Weather Service Weather Forecast Office (2004). Cloud classifications and characteristics. Retrieved October 15, 2012, from http://www.crh.noaa.gov/lmk/soo/docu/cloudchart.pdf

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Station 1- What was the weather like that day?

Part 1- The Clouds Spotter

1) Pick one cloud photo.

2) Record the number of the photo, the city where the photo was taken, and the date when the photo was taken.

3) Look carefully at the clouds in the photo and find the name of the clouds using the clouds spotter.

3) Write down the name of the clouds and predict what the weather was like in that city on that day the photo was taken using the characteristics of the clouds given by the clouds spotter.

Part 2- The Weather Report Website

4) Take turns and search on the weather report website on the computer for the city and the date each photo was taken. Others wait for their turns and work on the second photo with the clouds spotter and on the questions on the page 5.

5) Locate appropriate information for the weather on the web page and write the weather down for each photo. Record how hot it was, if it rained or snowed, and if there was any events.

6) Compare the recorded weather on the website to your prediction. Does it match to your prediction? If not, what is different? Write your answers.

Questions:

-Have you seen such clouds in person? Where? When? What was the weather like that day?

-What characteristics did you look for to match them?

-Is the weather information for the past you found on the website a prediction or a record?

-Between the clouds spotter and the weather report website, which gives a more accurate prediction for the weather?

-Does weather forecast always make correct predictions?

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Station 2: How fast does the wind blow?

Build your own **anemometer!** An anemometer is a tool that scientists use to measure the speed of the wind in a particular area. They use that information to calculate how quickly a storm or other weather event will travel to another area.

You will need:

3 white cups with one hole in the side
1 colored cup with one hole in the side
1 cup with four holes in the sides
2 straws
1 pencil
1 straight pin

What to do:

Step 1: Gather your materials

Step 2: Using the model as a guide, push a straw through the hole of the colored cup. Fold down the tip of the straw inside the cup, and staple it to the cup on the side opposite the hole.

Step 3: Push the straw through two opposite holes in the four-hole cup. Attach another cup to the opposite end of the straw. Make sure that the second cup faces the opposite direction from the first cup.

Step 4: Repeat the above step with the other two cups and straw.

Check: Are all four cups facing either clockwise or counterclockwise? If not, fix them now. Make sure the cups are all the same distance from the center.

Step 5: Push the eraser end of the pencil through the hole in the bottom of the center cup.

Step 6: VERY CAREFULLY: Push the pin through the intersection of the two straws. Then push it into the eraser as far as possible.

Test it:

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Calculate wind speed: Using your breath and the low and high speeds on the hair dryer to simulate the wind, hold your anemometer in the airstream and calculate the speed of the wind.

Step 1: Find the revolutions per minute (RPM):While one of you times exactly one minute on the watch, the other counts how many times the colored cup goes by in one minute. (The watch is on the table)

Step 2: Convert your answer for RPM to miles per hour (MPH) using this formula: **RPM X 0.2142 = MPH** (You can use the calculator)

Step 3: Record your findings in the chart.

Step 4: Repeat the tests for Trial 2 and Trial 3.

Questions:

Have you felt the wind blowing on a windy day? Have you ever wondered how fast it was going?

How fast did it blow when you used your breath? the hair dryer? Do you think that would be a strong wind or a gentle breeze if it were wind?

Did you get the same MPH in all three trials? Why do you think that is?

Why do you think scientists use anemometers? When do you think it is important to know the speed of the wind?

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Activity #2 Teacher Card

Title: How Fast Does the Wind Blow?

SOL: 4.6 The student will investigate and understand how weather conditions and phenomena occur and can be predicted. Key concepts include b) weather measurements and meteorological tools;

Key Concepts of this Activity: An anemometer is an instrument that is used by scientists to determine the wind speed. It is one of several instruments used together to determine weather conditions and forecast future weather events. This information is used to determine local conditions as well as how quickly a storm or other weather event will travel from one area to another.

Materials: plain cups with one hole in the side
Decorated cups with one hole in the side
Cups with four holes in the side
Straws
Stapler
Pencils with erasers
Straight pin
Stopwatch or timer
Hair dryer
Wind Speed Recording Chart
Calculator

Notes: Because of time constraints, all holes will be pre-punched in the cups. One anemometer will be pre-assembled and available at the station to serve as a model. The safety concerns are for the straight pin and, to a lesser degree, the staples. A talk about responsible behavior will precede students released to the stations. This station will need to be set up near an outlet so that the hair dryer can be plugged in without the cord becoming a hazard. Students will also be cautioned to handle the hair dryer by the handle only, not other areas which may grow hot.

Guiding Questions:

What is an anemometer?
How do you calculate wind speed?
How is wind speed different from RPM?
Why do we need to know about wind speed?

For the Forum:

Why is it important for scientists to study weather?
What kind of weather do we associate with increased wind speed?

Activity Adopted From: Scholastic Weather Watch (2012) Retreived October 15, 2012 from: http://teacher.scholastic.com/activities/wwatch/gather_data/anemometer.htm

Information Source:
http://teacher.scholastic.com/activities/wwatch/gather_data/anemometer.htm

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Station 3: Updrafts in Action

When a cool front pushes into the warm, moist air of a warm front, the warm air is lifted up in what is called an **updraft**. As the air in the updraft gets up into cooler, drier air higher up, the moisture condenses into clouds. (Remember our opening activity?) Rain and hail will be suspended by the updraft inside a thunderstorm until the weight of the hail and water can no longer be supported. Simulate the action of an updraft as you see if you can keep the hail from falling to Earth!

Materials:

Hair Dryer
Ping-pong balls
Observation sheet

Step 1: Being careful to touch only the handle, turn on the hair dryer.

Step 2: Point the hair dryer at the ceiling.

Step 3: Have a team member carefully place a ping-pong ball in the air stream and let go. Watch what happens.

Step 4: Experiment: try angling the hair dryer, changing the speed on the dryer, or adding another ball

Step 5: Repeat your tests to make sure your results are accurate.

Questions: What happened when you put the ball in the air stream? Did the speed of the dryer make a difference? How can you relate what you saw here to real storms (think about air speed, number/size of balls, size of storm).

Make sure that you take turns holding the hair dryer, placing the PingPong balls, and recording results.*

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Activity #3 Teacher Card

Title: Updrafts in Action

SOL: 4.6 The student will investigate and understand how weather conditions and phenomena occur and can be predicted. Key concepts include
a) weather phenomena;

Key Concepts of This Activity: Updrafts keep rain and hail suspended in a thunderstorm until they grow too heavy and fall to the ground. Usually, the stronger the updraft, the more intense the storm and the larger the hail that will be introduced.

Materials: Hair dryer
Ping-Pong balls
Observation sheet

Notes: Students will need to be careful to touch only the handle of the hair dryer as other parts can grow hot with use. Attention should also be paid to the cord lest anyone trip. In this case, adding more balls to the airstream is representative of hail growing large as well as there being more rain or hail suspended.

Guiding Questions: What happens when rain/hail is caught up in an updraft?
Does wind speed affect the results?
Are there limits to what the updraft can suspend?

For the Forum: What happens when moisture (Ping-Pong balls) get caught in an upstream? Does the speed of the updraft matter? How does this relate to the anemometer station? Does this give you any more information about variables we can relate to the cotton ball cloud station?

Activity Adapted From: National Weather Source (2010) : Jetstream- Online School for Weather. Retreived October 20, 2012 http://www.srh.noaa.gov/jetstream/tstorms/ll_updrafts.htm

Information Source:

Malles, C. News Weather 8 (2009). Where do thunderstorms come from? Retreived October 20, 2012 from: http://weather.blogs.wkbt.com/News8/La-Crosse-WI/Weather/where-do-thunderstorms-come-from/05/12/2009

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Activity #4 Teacher Card

Weather Science Circus

Title: Tumultuous Thunderstorm

SOL: 4.6 The student will investigate and understand how weather conditions and phenomena occur and can be predicted. Key concepts include

a) weather phenomena;

Key concepts of this activity: Thunderstorms are naturally occur weather events caused by a shift in the type of air. Unstable, warm air is lifted by cold air. This is caused by convection. When the warm air and the cold air meet, the moisture in the warm air condenses. This water vapor, which will eventually turn into rain, fuels the storm. A cumulonimbous cloud forms and a downdraft, cold air quickly descending to the ground, creates the rainfall.

Materials:

Clear plastic container the size of a shoebox
Red food coloring
Warm water
Ice cubes colored with blue food coloring
Colored pencils
Index cards or half sheets of paper

Notes: Students will use the sense of sight to see what happens to the warm, red air and the blue, cold air. They should not shake the container while the activity is occurring. Because this activity is not as time consuming as other activities, students will be provided with paper and red and blue colored pencils to draw what they observed. They will also be asked to apply what this activity shows by drawing a thunderstorm and showing the cold front and the warm air.

Safety notes: Students should be given water that is warm but not hot to protect them from burns. Students should be reminded to not eat the ice cubes. Students should be reminded to not play in the water. If students' hands turn colors from the food coloring, they should be allowed to wash their hands before going to the next station. Students should be provided with paper towels to clean up any spills before progressing to the next station.

Guiding questions:

What does the blue color represent?
What does the red color represent?
What happens to the red colored water when ice cubes are placed in the container?
What is convection?

For the forum:

What causes a storm to occur? What caused the blue water to sink and the red water to rise?

While we did not see lightning, what do you think causes lightning to form?

What are the basic ingredients to a storm?

Activity adapted from:

Make a thunderstorm. (n.d.). Retrieved from http://www.weatherwizkids.com/experiments-make-thunderstorm.htm

Make convection currents. (n.d.). Retrieved from http://eo.ucar.edu/webweather/tornact2.html

Information sources:

Thunderstorms. (n.d.). Retrieved from http://www.weatherwizkids.com/weather-thunderstorms.htm

What causes thunderstorms? (2010, November 28). Retrieved from http://www.weatherquestions.com/What_causes_thunderstorms.htm

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Station 4: Tumultuous Thunderstorm

What causes a thunderstorm?

At this station, you will be looking at what causes a thunderstorm. Use the steps provided to create your own storm.

1. Place warm water into the plastic container. Fill ⅔of the container with the warm water.
2. Let the warm water sit for 45 seconds.
3. At one end of the container, place a blue ice cube.
4. Place **2** drops of red food coloring at the opposite end of the container.
5. **DO NOT SHAKE THE CONTAINER!**
6. Observe what happens.
7. Using the paper and pencils provided, draw what you saw.

Questions:

As a group, answer these questions:

- What does the red, warm water represent?
- What does the blue ice cube represent?
- What happened when the blue ice cube and the warm water collided?

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Activity #5 Teacher Card

Weather Science Circus

Title: Cotton Ball Clouds

SOL: 4.6 The student will investigate and understand how weather conditions and phenomena occur and can be predicted. Key concepts include

a) weather phenomena;

Key concepts of this activity: Raindrops fall during a storm because the cloud can no longer hold any more water. The strength of the updraft determines how much water a cloud can hold. Once that limit is reached, rain begins to fall.

Materials:

Cotton ball
Eyedropper
A small cup of water
Paper Towels
Scraps of paper and pencil

Notes: While doing this activity, students should think either about a torm or the thunderstorm activity if they already participated in that station. This activity connects directly to the thunderstorm activity because it focuses on why raindrops fall. The thunderstorm activity focuses on why and how a storm forms and this activity extends that thinking by focusing on why raindrops fall. This individual activity can be extended even further. Students can be instructed to change the shape of the cotton ball to represent different types of clouds and focus on why those clouds are not good rain clouds. They can also hold two cotton balls together to see how the size of the cloud also affects how much water can be stored before rain falls. This activity can also access student's prior knowledge. Students who have been through the cloud spotter activity should be encouraged to think about and remember what rain clouds look like.

Safety notes: Students should not play with the materials that they have been provided. They should not splash water on each other. They should also be given time to clean up any spills before moving on to the next station. This will prevent students from slipping and falling.

Guiding questions:

What happens when one drop of water is added to the cotton ball?
How many drops of water can fit into a cotton ball?
Why did the water drop out of the cotton ball?

For the forum:

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How is a cotton ball like a cloud?

Which cloud does the cotton ball represent?

How does the amount of water and the cotton ball connect to the thunderstorm activity?

Activity adapted from/Informational Source:

Learning lesson: How much water is in that cloud?. (2012, January 5). Retrieved from http://www.srh.noaa.gov/jetstream/tstorms/ll_h2ocontent.htm

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Station 5: Cotton Ball Clouds

How much rain can a cotton ball cloud hold?

At this station you will focus on how much rain a cotton ball cloud can hold. While doing this experiment, think about the thunderstorm activity. If you have not seen the thunderstorm activity, think about a rainstorm that you have seen before.

1. Find a partner in your group.
2. Give each pair of partners a cotton ball, an eyedropper, and a cup of water.
3. Examine the cotton ball and talk with your partner about how many drops of water can fit in the cotton ball. Write this down on the paper provided.
4. Once you have estimated how many drops can fit into the cotton ball, drop as many drops of water into the cotton ball as you can. The goal is to fit as much water into the cotton ball.
5. Count each drop of water that you put in the cotton ball until water begins to drop out.
6. **DO NOT SQUEEZE THE COTTON BALL!**
7. Record the number of drops of water that fit into the cotton ball.

Questions:

As a group answer these questions:

- How many drops of water and fit into a cotton ball?
- Why did the water drop out of the cotton ball?
- How does this connect to rain storms and clouds?

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Extension Teacher Card

Weather Science Circus

Title: Smell like fruit punch?

SOL: 4.6 The student will investigate and understand how weather conditions and phenomena occur and can be predicted. Key concepts include
a) weather phenomena;

Key concepts of this activity: Matter has three phases: solid, liquid, and gas. When liquid becomes gas, we call it evaporation. As any phases of matter, liquid has molecules. Molecules in liquid move around. Molecules reach the surface and fly away only to become gas, which is evaporation. And what we smell is molecules mixed in the air. If liquid is heated, molecules move much faster and thus escape into the air faster. In this extension, molecules of heated fruit punch reach the surface of fruit punch and escape in the air. The molecules hit the cold surface of plastic wrap with ice cubes and turn into water droplets, which is condensation. Fruit punch molecules include smell and they will still have the smell when they become water droplets.

Materials

Three sets of small beakers and big beakers
Hot fruit punch, warm fruit punch, and cold fruit punch
Three piece of plastic wrap
Three rubber bands
Six ice cubes

Notes: Before beginning the extension, gather students close to but keep them at an arm's length from the extension station. This extension illustrates the concepts of heat energy, evaporation, condensation, water cycle, molecules, and smell. Students will have the opportunity to investigate the plastic wrap and the process of water cycle. This extension connects with the How are clouds made demonstration because students will observe the water cycle. **Safety note:** Students are handed out big beakers which have small beakers of fruit juice in them. Thus they do not directly touch small beakers, one of which will have heated fruit punch.

Guiding questions:

What do you see on the surface of the plastic wrap? Are they solids, liquid, or gas? Where do they come from? How do we know if they are from the air in the beaker or fruit juice?

For the forum:

How did you know the water droplets came from fruit punch? Do you need to add or remove heat energy to help evaporate fruit punch? What state of matter does fruit punch become when it

evaporates? Do you need to add or remove heat energy to condense water vapor? What state of matter does water vapor become when it condenses?

Activity modified from:
Created by the presenter.

Sources of information:
Berkheimer, G. W., Anderson C. W., & Blakeslee T. D. (no date). Explaining evaporation and boiling. Retrieved October 21, 2012, from http://ed-web3.educ.msu.edu/reports/matter-molecules/Sciencestu/scistu8.pdf

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Learning lesson: How much water is in that cloud?. (2012, January 5). Retrieved from http://www.srh.noaa.gov/jetstream/tstorms/ll_h2ocontent.htm

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Make convection currents. (n.d.). Retrieved from http://eo.ucar.edu/webweather/tornact2.html

Malles, C. News Weather 8 (2009). Where do thunderstoms come from? Retreived October 20, 2012 from: http://weather.blogs.wkbt.com/News8/La-Crosse-WI/Weather/where-do-thunderstorms-come-from/05/12/2009

Thunderstorms. (n.d.). Retrieved from http://www.weatherwizkids.com/weather-thunderstorms.htm

What causes thunderstorms? (2010, November 28). Retrieved from http://www.weatherquestions.com/What_causes_thunderstorms.htm