Winter and Summer Storms Scenarios

Science Standard I

Objective 3

Connections

Standard I:

Students will understand that the elements of weather can be observed, measured, and recorded to make predictions and determine and determine simple weather patterns.

Objective 1:

Observe, measure, and record the basic elements of weather.

Intended Learning Outcomes:

1. Use Science Process and Thinking Skills.

Content Connections:

Math V-1; Data to make predictions

Background Information

Winter storms and summer storms in Utah come from two different sources. However, they both have a lot in common. Both storms tend to move from the west to the east. Both have moisture in them that come from the Pacific Ocean. They have a low pressure for the moist, warm air to expand rapidly. Both have warm winds that feed into the low pressure as it is approaching. As the warm air expands rapidly it cools instantly to create cold air to make clouds and eventually could produce precipitation. Lastly, they both produce wind prior to the their storms. Usually the winds associated with the two storms are warm.

But there are some differences in the two storms. Winter storms are generally from October through April. Summer storms are generally from May through September. Winter storms have their beginnings from the north where the air is cold. Summer storms have their beginnings from the south where the air is warm. Winter storms bring in cold air from the north that can last for many days after the storm. After a summer storm the air may be cooler for a few hours but quite comfortable. Summer storms can produce violent, strong winds that can do a lot of damage. Winter storms will bring wind, but they won't do much damage. Summer storms can have thunder and lightning associated with them. Generally, winter storms don't have thunder and lightning. The whole process of a winter storm coming in can last up to a week from beginning to end. The whole process of a summer storm will only last a few hours. The barometer usually drops quite a bit before a winter storm, but the barometer doesn't drop much at all (if any) before a summer storm.

There are reasons that summer storms are different from winter storms. There are different patterns to watch for in each. Today we are going to discover these patterns.

Research Basis

Black, R. (2005). Why demonstrations matter. *Science and Children*, Vol. 44 (Number 1), page 56.

It is still a good practice to have teacher-centered demonstrations in the classroom. Children get excited when they see unfamiliar objects in front of them that they know are going to part of a science experiment. Careful planning and questions techniques give the teacher more control for the students to understand the results.

Bransford, J.D., Brown, A.L., & Cocking, R. R. (Eds). (1999). *How people learn: brain, mind, experience, and school.* Washington, DC: National Academy Press

Hands-on learning provides the students with kinesthetic, auditory, and visual learning. As students perform hands-on tasks, they make learning happen for themselves. They learn quickly from their experiences. They begin to make a connection to their world. As this approach in being taught the students learn through the process of inquiry. The teachers ask many questions during science lessons to make students' thinking process complete.

Invitation to Learn

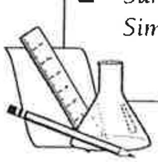
Get two bowls. Put hot water in one and cold, ice water in the other. Get an empty plastic soda bottle that has strong sides. (Most bottled water bottles won't work because their sides are too weak.) Put a nine-inch balloon over the plastic bottle so that it hangs limply. Put the soda bottle in the hot water. Notice that the balloon rises. You can ask the students to give reasons why they think the balloon is rising. *(The air in the bottle is getting hot. When air increases in temperature, the air molecules separate and need more room in the bottle. Some get pushed out the bottle and they go into the balloon. This is called expansion.)* Now, take the soda bottle out of the hot water and put it in the cold water. Notice that the air goes back into the bottle. You can ask the students to give reasons why they thing the air went out of the balloon back into the bottle. *(The air in the bottle is cooling down. When air decreases in temperature, the air molecules gather and sink and leave empty spaces in the bottle. This leaves room for the air in the balloon to go back down into the bottle. This is called contraction.)* So, when air heats up it expands and rises and when it cools it contracts and sinks. (We can associate this with summer storms.)

Have a few quart jars ready with hot water in them to place on their desks. Have the same amount of small trays with ice in them and place them on their desks. Tell the students that there is hot water in the jars. Ask what the hot water is doing to the air. *(It is heating the air, making it expand and rise.)* Ask if there is anything else in the air in the bottle. *(There is moisture in the air because the water is evaporating.)* Tell them to put the tray of ice on top of the bottle. Ask them to predict what they think will happen to the air in bottle with the ice on top. *(The moist air will hit the bottom of the ice tray and form moisture on the bottom of the tray. Water may condense on the side of the bottle. A small cloud will form near the top of the bottle next to the ice tray.)* (We can associate this with winter storms.)

Tell them that today we are going to set up a couple experiments that show the patterns of these summer and winter storms. One experiment will show how a winter storm forms and the other experiment will show how a summer storm forms. As we observe these experiments we will be able to watch for patterns.

Materials

- ❑ 2 large plastic bowls
- ❑ Empty plastic soda bottle, 50 ml
- ❑ Nine-inch balloon
- ❑ Ice
- ❑ Shoe-sized plastic box with lid
- ❑ Small bowl
- ❑ Barometer
- ❑ Thermometer
- ❑ Goose-necked lamp
- ❑ 2" masking tape
- ❑ Quart-sized plastic baggie
- ❑ Two-liter bottle
- ❑ Thermometer
- ❑ #4 rubber stopper with 2 small holes
- ❑ Ball needle
- ❑ Air pump
- ❑ Wood matches
- ❑ *Winter Storm Simulation Box*
- ❑ *Summer Storm Simulation Bottle*



Instructional Procedures

Part One: Winter Storm Simulation

1. Get a shoe-sized, see-through plastic box with a lid. This will be your Winter Storm Simulation Box.
2. Tape a thermometer on the side of the inside of the Simulation Box so it can be read. With the lid on the table, place the barometer on the inside of the lid and tape it down.
3. Put water in the bowl and place the bowl next to the barometer.
4. Put the box on top of the lid so lid is the bottom of the box.
5. Carefully tape the lid to the box by going around the box so air cannot get in or out of the box.
6. Take the readings of the thermometer and the barometer in the beginning and then take readings of the two weather instruments for the rest of the experiment every 10 minutes.
7. Place a goose-necked lamp over the Simulation Box so it shines onto the box. Leave it over the box for about one hour. *(This creates heat and a high air pressure inside.)*
8. After an hour, ask the students what they noticed about the temperature and the barometer inside the Winter Storm Simulation Box. *(They both went up because the heat causes the molecules to move more rapidly but are trapped inside because of the lid.)*
9. At this time take away the light and put some ice in a quart-sized plastic baggie and lay it on top of the box. *(This creates a lower temperature causing the air molecules to move slower reducing the air pressure.)*

10. After about a half-hour look to see what is happening inside the box. Ask the students what they observe happening inside the Winter Storm Simulation Box. *(The temperature dropped, the barometer dropped, and water drops have formed on top on the top of the box.)*
11. Ask the students where the water came from. *(The water on top of the box came from the water that had evaporated from the water. When the ice was put on the top it cooled the water vapor and turned in back into water.)*
12. Keep the ice on for another half-hour until most of the water vapor has turned into water. Continue to keep track of the temperature, air pressure, and precipitation inside the Winter Storm Simulation Box.

In real life most winter storms come in from the north. They bring with them cold air, low pressure, and generally moist air. This is usually a huge storm system that stretches the width of Utah. When it comes in it usually travels across the whole state and continues west. When this low pressure is approaching us from the north, winds begin to blow from the south since the pressure is higher in the south than the low pressure coming in. The wind coming in from the south is warmer and will raise our temperatures up many degrees. As the warm air approaches the low pressure, the air rises up and quickly expands and then cools. The moisture in the cooled air turns into clouds. As these clouds approach us, they could produce snow. It could drop between an inch to two feet of snow. The wind generally dies down but the snow keeps coming until the storm system passes over us. Afterward there is a lot of cold air behind it that can linger on for days.

Part Two: Summer Storm Simulation Bottle

1. Get a two-liter bottle. We will call it the "Summer Storm Simulation Bottle".
2. Put a ball needle in one of the holes of the rubber stopper so that it sticks all the way through.
3. Stick the pointed end of the thermometer through the other hole of the rubber stopper.
4. Put about one inch of room temperature water into the Simulation Bottle.
5. Light a wooden match, blow it out, and stick the smoking end into the Simulation Bottle so the smoke goes into the bottle. When water vapor condenses into water droplets, they need dust particles to form around called condensation nuclei. (You

may have to do this a couple of times to get enough smoke in the bottle.)

6. Put the stopper on the opening of the Simulation Bottle by twisting it on so it is tight.
7. With a ball pump, put about 5 pumps of air into the Simulation Bottle. *(This creates a high pressure.)*
8. Look at the temperature gauge. What is happening to the temperature inside the Simulation Bottle? *(It is going up.)*
9. Ask why they think the temperature is going up. *(Because the bottle is under pressure the air molecules need more room in the bottle. They cannot escape and are hitting each other and creating heat. Then in turn because they are creating more heat they want more room and it will get warmer and warmer inside.)*
10. Tell the students that just like the Simulation Bottle, there is high pressure over us in the summer that creates a lot of heat. The air molecules are hitting against each other making the air warmer and warmer around us.
11. Let's see what happens when the rubber stopper is taken off. (Twist off the rubber stopper.)
12. Ask the students what happened in the bottle? (A cloud formed.)
13. Ask the students why a cloud formed? *(High pressure quickly went into a lower pressure area. When this happened the air molecules expanded and produced cold air. Because there was moisture in the air, the water vapor condensed and turned into tiny water droplets forming a cloud.)*

In real life, most summer storms come in from the south because the air pressure in Utah is a little less than in Arizona a New Mexico. As the winds move in from the south it can bring in moisture from the Pacific Ocean. As the hot air in Utah is rising because of convection currents it creates a low pressure in the upward current. The winds that come in from the south carrying moisture get caught in this convection current and move up. As the moist air moves up it expands. When the air expands it cools turning the moisture into a cloud. As more and more air comes in, the cloud gets bigger and bigger turning it into a huge cumulonimbus cloud. These clouds can rise up as far as 25,000 feet. They are also known as thunderheads. These are the clouds that cause thunder and lightning, produce hail and/or heavy rainfall, and violent winds. The violent winds are caused by the air rushing into the low pressure of the convection current. The huge storm clouds gradually move on. The storm turns into a summer rain caused by the lingering clouds behind the storm clouds. It will rain less and less and the thunder and lightning can only be heard and seen off into the distance. The storm leaves behind it cooler, comfortable air.

14. Look at the temperature in the Simulation Bottle. *(It is low again because the pressure is gone and the fast moving air caused it to drop.*
15. Twist the rubber stopper on the top of the Simulation Bottle again. Pump in some more air. What is happening to the cloud? *(It is disappearing. There is a high pressure inside the bottle making the air heat up and turning the cloud back into water vapor.)*

Assessment Suggestions

- Look at the notes in their journals to see if they wrote down the proper events that happened in the two experiments.
- Look at the question sheets about the experiments to see if they are answered correctly.
- Have the students write a summary about the two experiments.
- Have the students explain which experiment simulates a summer storm.
- Have the students explain which experiment simulates a winter storm.
- Have the students draw pictures of the experiments and label the pictures.

Curriculum Extensions/Adaptations/ Integration

- Advanced learners can do research about winter storms from the north.
- Advanced learners can do research about moisture that comes up from the south in the summer that creates storms.
- Special learners are able to do these experiments and see what is happening with help. Let them do the experiments to see and feel what is happening in each storm. Have them tell what they see happening.
- Have the students read about lightning and thunder and how they are created.

- Have the students read about the clouds that are associated with winter storms.
- Have the students read about the clouds that are associated with the summer storms.
- Have the students learn about hail and other severe weather phenomena, and tell others what they have learned.

Family Connections

- Send home directions to make a Simulation Summer Storm by making a cloud in a bottle. Have the students explain to their families what is happening.
- Have the students look on the Internet about winter storms and summer storms to write about them and share the information with their families.

Additional Resources

Books

How the Weather Works, by Michael Allaby; Reader's Digest; ISBN 0-7621-0234-9

The Amateur Meteorologist, by H. Michael Mogil and Barbara G. Levine; ISBN 0-531-15696-6

The Best Weather Book, by Simons Adams; ISBN-10: 0-753-45368-1

Clouds, Rain, and Fog, by Fred and Jeanne Biddulph; USBN 0-7802-1372-6

Wind and Storms, by Fred and Jeanne Biddulph; USBN 0-7802-1375-0

Hot and Cold Weather, by Fred and Jeanne Biddulph; USBN 0-7802-1378-5

Media

Storms, DVD, by SVE/CHURCHILL MEDIA 2004

Web sites

http://www.weatherwizkids.com/winter_storms.htm

http://www.nws.noaa.gov/om/brochures/wntrstm.htm

http://www.fema.gov/hazard/winter/index.shtm

http://www.nws.noaa.gov/om/winterstorm/winterstorms.pdf

http://weatherpix.com/OllaPod/?p=28

Winter Storm Simulation Box

Keep track of what is happening inside the Winter Storm Simulation Box with this sheet. Take temperature and air pressure readings ever 15 minutes.

Time Weather Elements	Initial Read-ings	10 min heat on	20 min heat on	30 min heat on	40 min heat on	50 min heat on	60 min heat on	70 min ice on	80 min ice on	90 min ice on	100 min ice on	110 min ice on	120 min ice on
Temperature													
Air Pressure													
Precipitation Observation													

After the first hour, answer these questions.

1. What do you notice about the temperature? ______

2. What do you notice about the air pressure? ______

3. Is there any precipitation on top? ______

Describe what you see. ______

After the first hour and a half, answer these questions.

4. What do you notice about the temperature? ______

5. What do you notice about the air pressure? ______

6. Is there any precipitation on the top? ______

Describe what you see. ______

After two hours answer these questions.

7. What do you notice about the temperature? ______

8. What do you notice about the air pressure? ______

9. Is there any precipitation on the top? ______

Describe what you see. ______

Summer Storm Simulation Bottle

Prepare the Summer Storm Simulation Bottle. Pump air into the bottle.

1. Describe what the Simulation Bottle feels like when air is pumped into it.

____

2. What is happening to the temperature inside the Simulation Bottle?

____

3. Why is the temperature doing this?

____

After the rubber stopper is taken off the Simulation Bottle answer these questions.

4. What happened inside the bottle?

____

5. Why did this happen?

____

6. Feel the Simulation Bottle now. Describe what it feels like.

____

7. What is the temperature inside the Simulation Bottle? Describe what happened to the temperature.

____

8. Why did the temperature do this?

____