Mini Meteorologists: A Look at Weather

PSS Kit Number 3

Kit Contains

Box of Straws	1 Packet of Small Paper Cups
15 Blue Pin Wheels	1 Large Packet of Pipettes
"The Wind Blew"	14 Tornado Tube Connectors
45 Rainbow Peepholes	2 1 Liter bottles
1 Package of Balloons	"Storms"
2 Foot Pumps with Red Valve and Stopper	9 Cans of Shaving Cream
1 Bottle Rubbing Alcohol	2 Plastic Ice Cube Trays
1 Plastic Bottle	6 Jars of Insta-Snow Powder
1 500mL beaker	5 Little Scoops
"What's the Weather?"	3 Wireless Wendy the Weather Wizard
3 "Freddy the Frogcaster"	Lesson Plans
59 Clear Cups	

Cedar County Extension and Outreach

Pint Size Science – Tornados and Rain

What we did

- Read a book called STORMS by Susan Canizares and Betsey Chessen

- Made a Tornado Tube
  - What you need to make one
    - 2 Plastic Bottles
    - Water
    - Food coloring or glitter if desired
    - Tornado Tube connector that can be found on Steve Spangler Science or Amazon
  - What to do
    - Fill one bottle ¾ of the way up connect the tornado tube then connect the other empty bottle.
    - Once both bottles have been connected turn it upside down so the bottle with the water is on the top.
    - Then swirl the bottle and watch the tornado happen.
  - Why do Tornados form
    - They form because cold, moist dense air gets trapped above hot, dry air. The dense, heavy air tries to sink, but the hot air is in the way. Sometimes, the cold air punches through and reaches the ground with tremendous wind and pressure. This is known as a microburst. The damage caused can be severe, including downed trees and buildings. Tornadoes move the heavy dense air in a more efficient way. Spiraling winds help the cold air aloft come down to the surface while simultaneously allowing the warm air to rise.

- Then each kid got to make Rain cloud
  - What you need
    - Clear plastic cup or jar
    - Water
    - Food coloring
    - Shaving cream
  - What you do
    - Fill the your container up with water to the top
    - Add shaving cream on top to represent your cloud
    - Then add food coloring on top of shaving cream
    - Once the shaving cream cannot hold anymore the color from the food coloring will come down like rain.

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Pint Size Science – Wind

What we did

Started off talking about wind and what kind of force it takes to blow certain items. We also talked about how we cannot see the wind but can feel it and we can see items moving from the force of the wind.

Then we read a book called – The Wind Blew, by Pat Hutchins
Other books you can read about the wind or weather would be
Gusts and Gales: A Book About Wind
Hello, World! Weather

The kids then got to explore what kind of force it takes to move certain items by blowing like the wind

What you need

- Items from around the house. I used feathers, beads, paper clips, seeds, cups (Styrofoam, plastic and paper), binder clips, cotton balls, pencil erasers and pipe cleaner.
- A flat surface
- Straws
- Lots of air!

What to do

- Let the kids explore with the different items. See which ones are easier to move and which ones take more force. They can blow using a straw and without but make sure you ask them which one was easier to get the items to move.
- Then you can let each kid pick one item and race to see who can get his or her item to the finish line the fastest.

What causes the Wind?

- **Wind** is **caused** by differences in the atmospheric pressure. When a difference in atmospheric pressure exists, air moves from the higher to the lower pressure area, resulting in **winds** of various speeds.

Pinwheels

Each kiddo received a blue pinwheel. This Pinwheel represents that all children deserve great childhoods. To give each child a great childhood we need strong communities. Strong communities start by creating connections. My challenge to you is to connect with someone new this month. You never know what that connection might mean to them. Connected communities have lower crime rates, better physical and mental health, and less money is spent on treating social problems.

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PINT SIZE SCIENCE

MINI METEOROLOGISTS
A LOOK AT WEATHER

KIT MATERIALS

- Insta-Snow
- Rainbow Peepholes (30)
- Tornado Connector Tubes (3)
  (need to provide your own plastic bottles)
- Food Coloring & Plastic Beaker
  (in *Science Sprouts* kit)
- Foot Pump w/Tube, Connector
- Rubbing Alcohol
- Ice Cube Tray
- Wireless Weather Station

INTRODUCTION

Students' experiences with weather can be the springboard for learning about the properties of energy and matter. Meteorology, the study of weather, is an opportunity to guide students through their exploration of air pressure, density, sound and electricity. Visiting weather topics throughout the year and the changing of the seasons will help to reinforce their understanding.

GUIDING QUESTIONS

- What do you know about weather?
- How does the weather change?
- How can scientists predict the weather?

INVESTIGATIONS

Experiments marked with (*) take extra preparation. Use trays to minimize clean-up.

Insta-Snow Powder Investigation *

Pour a spoonful of Insta-Snow Powder into a 250 mL plastic beaker. *What does the powder looks like? What color is it? What do you think will happen if you pour liquid water into the solid powder?* Let the children add about 250 mL of water into the beaker. *How did the powder change? What do you think happened to the water? Were the results different than you expected?* Have them turn the beaker over onto a paper towel, a bowl or pie tin, and allow the students to feel the powder. *How does the powder feel different after adding the water? Can you make a snowball?*

Rainbow Peepholes

What do you know about rainbows? When do you see them? Rainbow Peepholes have special lenses that bend and separate light into the colors of the spectrum. Give each of the students a peephole, and allow them to investigate how things appear when looking through them. *What do you see when you look through the peephole? How would it look different if you looked out the window? At the lights? How does it look different if the lights are turned off?*

Tornado Tubes

When do tornadoes happen? Why do they cause so much damage? How do you know that? Fill one of the plastic bottles ¾ of the way full with water. Screw on the tube connector. Screw the other bottle on top of the connector. You can assemble the bottles before you work with the students or you can have them do it. *What is in the bottom bottle? What is in the top bottle? Why does the water stay on the bottom and the air stay on the top? How do you know? What do you think would happen if we turned the bottles upside down?* Swirl the water in the bottle when you turn it upside down. *How does the water move differently when you swirl it? Why do you think that is? How could we make it go even faster?* Allow the students to repeat the experiment with different sizes of bottles. Make predictions, and then compare the results.

SCIENCE STANDARDS

IELS 9.1
Curiosity & Initiative

IELS 9.4
Play and Senses

IELS 10.1
Self

IELS 12.1
Comparison & Number

IELS 12.2
Patterns

IELS 12.4
Scientific Reasoning

IELS 12.5
Scientific Investigations & Problem Solving

**Iowa Common Core Standards and Next Generation Science Standards also available in Appendix E*

VOCABULARY

Meteorology
science dealing with the atmosphere, including weather and climate

Weather
outside air observed over a short period of time

Temperature
measure of the amount of heat

Season
a time of year with its own kind of weather (spring, summer, autumn and winter)

BOOKS

Freddy the Frogcaster
by Janice Dean (Fiction)

What's the Weather?
by Scholastic Inc. (Fiction)

*Appendix B contains other suggested books to enhance this module

Online Resources

Log in to find resources and extensions designed specifically for Mini Meteorologists!
http://www.sciowa.org/pss/

National Weather Service/ NOAA Temperature Data for Cities in Iowa
http://www.nws.noaa.gov/view/states.php?state=IA&map=on

Be sure to view the following:
- Pint Size Science Intro
- Cloud in a Bottle
- Heat Rises, Cold Sinks
- Tornado in a Bottle

Appendices

A – *Vocabulary*

B – *Books, Games, Songs and Videos*

C – *Assessment Checklist*

D – *Anecdotal Note Pages*

E – *Science Standards*

F – *Boom's taxonomy*

Cloud in a Bottle

What things are necessary for a cloud to form? Are there different types of clouds? What do they look like? Fill the bottle with 50 mL of water. Add 50 mL of rubbing alcohol for a more dramatic effect. Put the stopper with the red valve connected to the tube and air pump into the top of the bottle. Make sure that there is a good seal and no air escapes. Push down on the tire pump 10 times. *What do you think is happening inside of the bottle? What do you think will happen when the stopper is removed? Explain.* (There will be a loud sound, so make sure that the students are prepared.) Remove the stopper, and observe what happened inside the bottle. *What do you see in the bottle? How is it the same or different from the clouds in the sky?* Experiment with different temperatures of water and various amounts of pressure in the bottle. *How would the results be different if we pushed on the air pump five times instead of ten? Why do you think that?* Compare the results to their predictions.

Heat Rises, Cold Sinks *

How can water be heated? How can the lakes, rivers or the ocean be heated? Does hot water look different than cold water? How do you know? Pour approximately 500 mL of hot water into the large plastic beaker. *Can you tell if this water is hot or cold by looking at it?* Add the red food coloring to show it is hot water. *How can water be cooled? How can lakes, rivers or the ocean be cooled? Does cold water look different than hot water? How do you know?* Show the ice cube, and explain the blue color represents the cold temperature. *What do you think will happen to the ice cube when it is put into the warm water? Explain. What do you think will happen to the warm water?* Drop the ice cube into the warm water. Observe the change in the water and ice cube. *How did the results compare to your predictions? Why do you think the water moved the way it did?*

What's the Weather?

The digital weather station needs to be set up ahead of time. There is a wireless thermometer that must be placed outside. The receiver can be kept inside the classroom. *How do you know what the weather is going to be like each day? How do you use this information to make choices about the clothes that you wear?* Give each student a copy of the Weather Data Collection sheet to keep in a journal or at a Science/Writing Center. Each day for a given amount of time, they will fill in the data for temperature based on the information that Wendy the Weather Wizard gives them. You also can have them make observations about the sky conditions. Generate discussion questions based on their data. *If it is sunny out, does that mean it will be warm? If it was cold today, will it be cold tomorrow? Do you think next week's data will be the same as this week's data?* You can do this activity one week a month or throughout the year. Compare your results to see how they are different in the fall vs. winter and then change in the spring. You can extend the activity by making simple line graphs to track the temperature or bar graphs to see how many days you needed to wear a hat and scarf.

Assessment

Appendix C, D and F contain assessment tools to be used with this module. Appendix C provides a checklist for students containing Iowa Early Learning Standards and GOLD objectives. In Appendix D, you will find anecdotal note pages for individual students. Finally, Appendix F contains each lesson placed into a Bloom's taxonomy table. Refer to online resources.

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PINT SIZE SCIENCE

MINI METEOROLOGISTS

What's the Weather?

MATERIALS NEEDED:

- Digital Weather Station
- Data Collection Sheet (found on website)
- Paper & Pencil (record questions & results)
- Assessment Recording Sheet

- The digital weather station needs to be set up ahead of time. There is a wireless thermometer that must be placed outside. The receiver can be kept inside the classroom.
- *How do you know what the weather is going to be like each day? How do you use this information to make choices about the clothes that you wear?*
- Give each student a copy of the Weather Data Collection sheet to keep in a journal or at a Science/Writing Center. Each day for a given amount of time, they will fill in the data for temperature based on the information that Wendy the Weather Wizard gives them. You also can have them make observations about the sky conditions.
- Generate discussion questions based on their data. *If it is sunny out, does that mean it will be warm? If it was cold today, will it be cold tomorrow? Do you think next week's data will be the same as this week's data?*
- You can do this activity one week a month or throughout the year. Compare you results to see how they are different in the fall vs. winter and then change in the spring. You can extend the activity by making simple line graphs to track the temperature or bar graphs to see how many days you needed to wear a hat and scarf.

Explanation of the What's the Weather? Investigation:

There is a general correlation between temperature and the amount of sunlight. More sunlight means warmer air temperatures. Cloudy days can still be warm due to radiant heat. On sunny days, heat absorbed by the ground while the sun is shining radiates into the atmosphere. On overcast days, that heat will escape into the upper atmosphere, causing the ambient temperature to be cooler. If there are clouds in the sky, they will trap this heat, keeping the ambient temperature warmer.

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MINI METEOROLOGISTS

Tornado Tubes

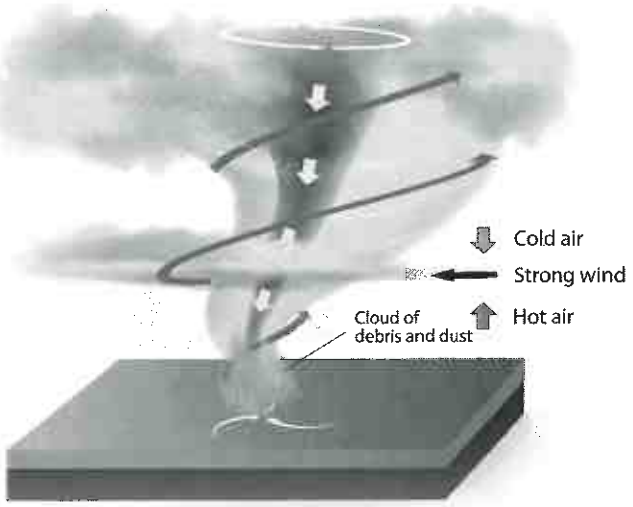
MATERIALS NEEDED:

- Tornado Connector Tube
- Plastic Bottles with Labels Removed (not provided)
- Water
- Food Coloring
- Paper & Pencil (record questions & results)
- Assessment Recording Sheet

- *When do tornadoes happen? Why do they cause so much damage? How do you know that?* Create a tornado in a bottle. Fill one of the plastic bottles 3/4 of the way full with water. You can add food coloring for more contrast
- Screw on the tube connector. Screw the other bottle on top of the connector. You can assemble the bottles before you work with the students or you can have them do it. *What is in the bottom bottle? What is in the top bottle? Why does the water stay on the bottom and the air stay on the top? How do you know that? What do you think would happen if we turned the bottles upside down?*
- Swirl the water in the bottle when you turn it upside down. *How does the water move differently when we swirl it? Why do you think that is? How could we make it go even faster?*
- Allow the students to repeat the experiment with different sizes of bottles. Make predictions, and then compare the results.

Explanation of the Tornado Tubes Investigation:

Tornados form because cold, moist, dense air gets trapped above hot, dry air. The dense, heavy air tries to sink, but the hot air is in the way. Sometimes, the cold air punches through and reaches the ground with tremendous wind and pressure. This is known as a microburst. The damage caused by a microburst can be severe, including downed trees and damaged buildings. Tornadoes move the heavy dense air in a more efficient way. Spiraling winds help the cold air aloft come down to the surface while simultaneously allowing the warm air to rise. When using the tornado tube, you will see that the swirling water from the top bottle always moves down the outside of the vortex. Even though you can't see it, air from the bottom bottle is moving up through the center of the vortex. This is why you move the bottles in a circular motion to create the swirling movement. An actual tornado is very similar, except that the cold, dense air drops down through the center and the hot, dry air swirls around, making its way upward.



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MINI METEOROLOGISTS

Insta-Snow Powder

MATERIALS NEEDED:

- Spill Trays
- Insta-Snow Powder
- 250 mL Beaker
- Water
- Paper & Pencil (record questions & results)
- Assessment Recording Sheet

***This investigation takes preparation. Use the trays to minimize clean up.**

- Have a student measure out one scoop of Insta-Snow Powder and put it in the 250 mL beaker. *What does the powder look like? What color is it? What do you think will happen if you pour liquid water into the solid powder?*
- Have another student pour approximately 200 mL of water into the beaker. *How did the powder change? What do you think happened to the water? Were the results different than you expected?*
- Pour out the beaker onto the spill tray, and allow the students to feel the powder. *How does the powder feel different after adding the water? Can they make a snowball?*
- You can add food coloring to the water for colored snow.
- Insta-Snow can be dried out and reused again. When finished with, throw away the end product in the garbage NOT down the drain.

Explanation of the Insta-Snow Powder Investigation

The Insta-Snow Powder is a super absorbing polymer. A polymer is just a long chain of molecules. It is very similar to the Sodium Polyacrylate used in baby diapers. The polymer is able to absorb the water through a process called osmosis. Osmosis is the ability of water to move from where it is in high concentration to where it is in low concentration. The Insta-Snow powder can absorb 100 times its weight in water instantly. The resulting 'snow' often feels cold in your hand because the water evaporates into the air, taking with it some of your body heat. If the snow is left out over a few days, the water will completely evaporate, leaving the powder polymer behind. When you are done with the snow, you should throw it into the garbage not in the sink. Since it is a super absorber, it will create clogs in the water pipes.

Liquid + Solid = Solid

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MINI METEOROLOGISTS

Heat Rises, Cold Sinks

MATERIALS NEEDED:

- Spill Trays
- Hot Water
- Red Food Coloring (in Science Sprouts kit)
- Ice Cubes Made with Blue Food Coloring Ahead of Time
- 500 mL Beaker
- Paper & Pencil (record questions & results)
- Assessment Recording Sheet

***This experiment takes preparation. Use the trays to minimize clean up.**

- Prepare blue ice cubes ahead of time, using ice cube tray and blue food coloring.
- *How can water be heated up? How can the lakes, rivers or the ocean be heated up? Does hot water look different than cold water? How do you know?*
- Pour approximately 500 mL of hot water into the large plastic beaker. (The beaker can be filled with water and put in a microwave for 30 – 45 seconds) *Can you tell if this water is hot or cold by looking at it?*
- Add the red food coloring to show it is hot water. *How can water be cooled? How can lakes, rivers or the ocean be cooled? Does cold water look different than hot water? How do you know?*
- Show the ice cube, and explain the blue color represents the cold temperature. When using colors with the water, make sure the students know the color change is NOT the result of the temperature change. We are just using it as an indicator. *What do you think will happen to the ice cube when it is put into the warm water? Why do you think that? What do you think will happen to the warm water?*
- Drop the ice cube into the warm water. Observe the change in the water and ice cube. Remind the students that the hot water is red and the cold water is blue. *How did the results compare to your predictions? Why do you think the water moved the way it did? What do you think would happen if the ice cube was left in the water for 30 minutes? Why do you think that?*
- This activity can be done on a larger scale using a glass bowl or tank and multiple ice cubes.

Explanation of the Heat Rises, Cold Sinks Investigation:

When molecules are colder, they move closer together, causing the substance to be more dense. When molecules are warmer, they spread out, causing the substance to be less dense. Substances that are more dense sink while substances that are less dense float. As the ice cube melts, the colder blue water is more dense than the warmer red water, so it sinks.

This experiment demonstrates an interesting phenomenon: The ice is a solid, which is colder than the liquid water it floats upon. Water is unique in its ability to do this. Because of the structure of water (H_2O), the molecules don't fit together very well when they freeze. The solid, or crystalline, structure of water spreads out and takes up more space, which is why water expands when it freezes. The same number of water molecules in the liquid form will take up less space than those in the solid form. The less dense solid water floats upon the more dense liquid water. If this were not the case, rivers and ponds would freeze from the bottom up, killing most of the living things every winter. Instead, the ice floats on top, allowing the liquid world to remain below.

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Cloud in a Bottle

MATERIALS NEEDED:

- Foot Pump with Red Valve and Stopper
- Rubbing Alcohol
- Plastic Bottle (not included)
- Water
- 50 mL & 500 mL Beakers
- Paper & Pencil (record questions & results)
- Assessment Recording Sheet

- *What things are necessary for a cloud to form? Are there different types of clouds? What do they look like?* Fill the bottle with 500 mL of water.
- Add 50 mL of rubbing alcohol for a more dramatic effect.
- Put the stopper with the red valve connected to the air pump into the top of the plastic bottle. Make sure that there is a good seal and no air escapes.
- Push down on the tire pump 10 times. *What do you think is happening inside of the bottle? What do you think will happen when the stopper is removed? Why do you think that?* When the stopper is removed, there will be a loud sound. Make sure that the students are prepared for this.
- Remove the stopper, and observe what happened inside the bottle. *What do you see in the bottle? How is it the same or different from the clouds in the sky?*
- Experiment with different temperatures of water and various amounts of pressure in the bottle. *How would the results be different if we pushed on the air pump five times instead of ten? Why do you think that?* Compare the results to their predictions.

Explanation of the Cloud in a Bottle Investigation:

Clouds form when water molecules, known as water vapor, condense onto particles in the air. When the air gets colder, the air molecules move closer together, forcing the water molecules out to settle on dust or ash particles in the air. In this experiment, we are increasing the air pressure so much that we force the water molecules together. Rubbing alcohol is used because it evaporates much faster than water, creating even more vapors in the bottle. When the stopper is pulled out, the pressure is released and the volume decreases. The temperature of the air also decreases (this can be explained with Gas Laws). The colder temperature of the air forces the vapors to condense onto particles in the air creating a cloud.

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