

This document is an excerpt of the Kindergarten Curriculum from the Science 21© program produced at Putnam Northern Westchester Board of Cooperative Educational Services in Yorktown Heights, NY. These two lessons are aligned to the New York State Science Learning Standards and the Next Generation Science Standards. Although there is a sequence of lessons that lead up to these lessons, you can use these lessons to illustrate the intention of the new standards.

As part of the students' study of weather, they must foundationally understand that the Sun warms the earth surface. This understanding of solar energy is the fuel for all weather on the earth. The investigation in Lesson 7 is an engineering activity that should be supported by several earlier learning activities focused on the core idea that the sun warms the earth.

Another important aspect of the new standards is the concept of using models to help us describe phenomena that cannot be reproduced in the classroom. In Lesson 8, students will observe objects that represent certain weather conditions. This is a foundational lesson for the Science and Engineering Practice "Develop and Use Models" to help them understand relationships to how things move and change. In this lesson the students will use models of tornadoes and blizzards/snowstorms. These objects only become scientific models when they are used to describe, predict or show relationships between components of a system.

Kindergarten students are the foundation of this change in elementary science education. Given that students come to the Kindergarten classroom with a wide range of experiences, skills, vocabulary and fine motor skills. This means that the teacher will assess each student based on growth in how they learn. These lessons are intended as a representation of a style of curriculum development for the New York State Science Learning Standards. Science 21 is based on a continuous improvement model. As we hear from teachers in the field, lessons will be adjusted in the future.



Sincerely
David Jacob
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LESSON 7: Engineering Sun Protection – Sun Shades

Grade K Unit 1 Performance Assessment Lesson

Unit Essential Question: How does the weather affect me?

Teacher Background:

Lesson Overview:

This lesson will be the student’s first attempt in the curriculum at using the ideas of engineering for the content. You should encourage the students to explore the materials before building their structure. In the next unit, we will introduce the engineering design cycle (sketch a design before they build, then build what they planned, evaluate if it works, then redesign). In this lesson, they will only have the opportunity to build their structure once and evaluate if their design worked well. The students will be using this engineering activity to get a practical understanding of what materials and structures work best to protect an object from the heat of the sun. This lesson also reinforces the concept that a change in temperature (energy) can cause a material to turn from a solid (in this case ice) to a liquid (water).

Different materials have varying properties that can shield the sun’s rays of hitting an object and thus heating it or not heating it. An opaque shield can effectively block the sun’s rays (energy) and thus prevent the warming of an object in the path of the sun’s rays

Potential Misconceptions:

The sun is not strong when it is cloudy. (The sun still produces energy and warms the Earth’s Surface even when it is cloudy.)

Lesson Goals:

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| Objective: | Students will be able to design a structure that protects an ice cube from solar energy. |
| Learning Target: | I can design and build a structure to protect an object from the sun. |

Standard Information

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| Performance Expectation (PE) | <p>K-PS 1-1. Plan and conduct an investigation to test the claim that different kinds of matter exist as either solid or liquid depending on temperature. (NYS ONLY)</p> <p>K-PS3-1. Make observations to determine the effect of sunlight on earth’s surface.</p> <p>K-PS3-2. Use tools and materials provided to design and build a structure that will reduce the warming effect of sunlight on an area.* (ETS Connection)</p> |
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| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
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| <p>Analyzing and Interpreting Data Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.</p> <ul style="list-style-type: none"> Use observations (firsthand or from media) to describe patterns in the natural world to answer scientific questions. <p>Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.</p> <ul style="list-style-type: none"> Use tools and materials provided to design and build a device that solves a specific problem or a solution to a specific problem. | <p>PS3.B: Conservation of Energy and Energy Transfer Sunlight warms Earth’s surface.</p> <p>PS1.A: Structure and Properties of Matter Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.</p> <p>ETS1.A: Defining and Delimiting an Engineering Problem Asking questions, making observations, and gathering information are helpful in thinking about problems.</p> | <p>Cause and Effect Events have causes that generate observable patterns. Simple tests can be designed to gather evidence to support or refute student ideas about causes.</p> |

| Lesson Preparation: | | |
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| Materials: | Group Size: | Management: |
| <ul style="list-style-type: none"> A variety of materials, such as construction paper, tongue depressors, pipe cleaners, 3 oz. containers Crayola Model Magic, Tulle, Aluminum Foil, Cheese Cloth, large pieces of felt, Plastic soufflé cups (to put the ice cubes in – easier clean up) One pulp tray per group Not included <ul style="list-style-type: none"> A small baggie with one ice cube left out to melt a little. One ice cube per group for structure | Group of three | Organize materials from the Science 21 kit5. (examples: index cards, trays, cups, paper, etc.) Prepare ice cubes the night before. Try to make the ice cubes as uniform as possible so that each sun protection structure can be compared. |
| Lesson Plan: | | |
| Suggested Timing | Agenda: | |
| 5 min 10 min 15 min 10 min | Pose the problem. Show materials they can use to solve the problem. Groups meet and discuss their ideas / Sketch it in their notebooks Build the structures/Set outside Collect their designs and evaluate the results/General Class discussion | |
| Teaching Procedures: | | Teaching Notes |
| Engage <ol style="list-style-type: none"> Give each student an ice cube in a small baggie and ask them to observe the ice cube. (observe a phenomenon) Ask the question “What is happening inside the bag?” (help guide towards the idea that ice melts from an increase of temperature). Review with students the difference state of matter that water takes when it is really cold (ice) or when it starts to encounter a certain amount of heat (melts into water). Ask them “What would cause the water to turn back into ice?” Have students describe the process in terms of cause and effect. Explore <ol style="list-style-type: none"> Give students the design challenge: “Build a structure to protect an ice cube from the heat of the sun”. You may pose the question: “If I wanted build a structure to keep an ice cube from melting in the heat of the sun, what would that structure look like?” or “We have investigated how the sun warms surfaces. What would you need to build a structure that would protect us from this energy, how would I do that?” Have students make a brief sketch of what their structure could look like (you could do this in groups or individuals and then have them make a consensus all three students drawings). They must allow for the ice cube holder (the soufflé cup) to be inserted and removed before testing. Show a sample of the materials that the students will use to build their structure. You may want to give students a small sample to explore which they are planning their structure. (make sure you have enough material for the students to build their structure. Note: give them a very small piece of “model magic” to test how to attach two tongue depressors can be attached to each other) Groups will discuss what they think their structure should look like and what materials they will use to protect their ice cube from the heat energy of the sun. | | |

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| <p>Explain</p> <ol style="list-style-type: none"> 8. Students should be encouraged to make changes to their design with teacher input and make adjustments based on feedback from other students in their group. 9. Have students explain to each other how their plan will protect the ice cube from the heat of the sun. <p>Elaborate</p> <ol style="list-style-type: none"> 10. Students should then build their designs. The students should use the pulp tray as a foundation and anchor the structure to the tray with model magic. If the student uses a fabric or paper on top, they need to consider how to secure it to the structure. Since the wind can shift and affect their investigation. Remind students that they must allow for the ice cube holder (the soufflé cup) to be inserted and removed before testing. 11. You may consider building on one day and testing the structure on another. The testing must be on a full sun day. 12. When completed, bring the class outside and have the students place their structure in the sunlight. They may make some last minute adjustments. It may be best to line all the projects in a row so that they can compare the effectiveness of their solutions to other projects. 13. The teacher will provide the students with an ice cube in a soufflé cup to test the structure. <p>Evaluate</p> <ol style="list-style-type: none"> 14. Students will collect data of all the structures in the class (which ice cube melted fastest/slowest) to evaluate which design best protects and ice cube from the heat of the sun by observing the relative amounts of melt water in the soufflé cups. 15. Given the culture of your classroom, you could have students compare or discuss criteria for what makes a “good” or “best” solution. How did your design work compare with other designs that were used or compared to what they thought might happen? Which materials caused the best cooling effect? 16. Have students from each group describe what occurred in the results of their experiment and how well their design worked. What changes would they make if they were to do this again? | |
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Science Notebook:

Make sure students DATE each page of their notebook.

Have the students draw a picture of their structure in their science notebook.

Assessment:

Formative Assessment: The students will demonstrate an understanding of how to protect an object from the sun’s energy by creating a protective structure.

Literacy Connections:

| Vocabulary | | Included or Suggested Texts (Title; <i>Author</i> , Year, Type (book/article), Grade, LEXILE) |
|----------------------------|----------------|---|
| New or Recently Introduced | Familiar Terms | |
| structure | | |
| protect | | |
| design | | |

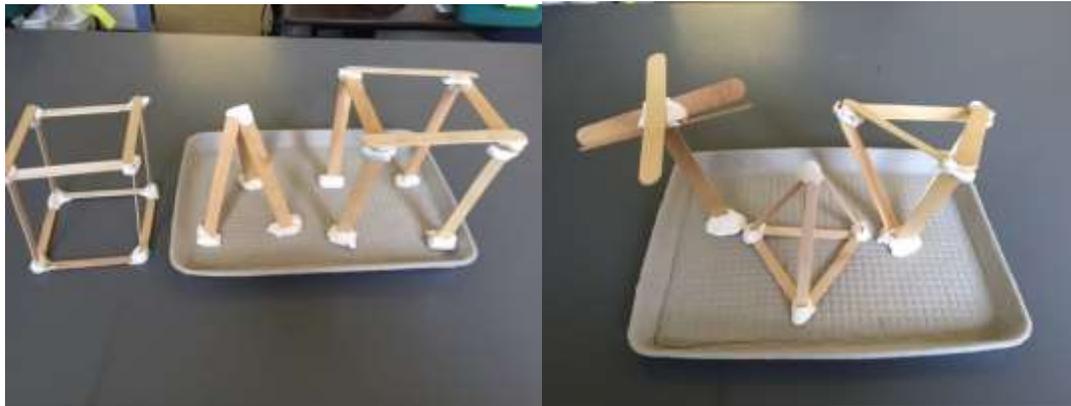
Differentiation:

Below are some suggestions for modifying lessons for individuals or groups of students.

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| <p>Students that may need more challenge: Students choose their materials from around the room and create their structure. Accelerated students can also study the effects of using transparent materials vs. opaque materials, aluminum foil vs., cardboard, etc.</p> | <p>Students that may need more support:</p> |
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Reproducible Student Materials:

Sample structures below. You may not want to share the exemplars since the student may mimic what they see rather than design from their experiences. The culture of your classroom will determine if you show exemplars or not.



LESSON 8: Severe Weather vs. Normal Weather

Grade K Unit 1

Unit Essential Question: How does the weather affect me?

Teacher Background:

Lesson Overview:

Students will create a model to show the difference between normal and severe weather. Students are shown two snow globes and asked how they are the same and how are they different. The teacher explains what a model is and why a scientist creates models. Then the teacher will explain about creating models for snowstorms today. The students will either create a snowstorm or blizzard snow globe. Students will be shown another model of a tornado tube. Students will compare their snow globe to a partner's globe and tell them what they think their partner has – normal or severe weather.

Potential Misconceptions:

- Severe weather only happens during the summer.
- Thunderstorms are really angels bowling.
- It's not raining here, and skies above me are clear. Therefore, I am safe from lightning.
- Since I am inside my house and out of the storm, I am completely safe from lightning.
- Large and heavy vehicles, such as SUVs and pickups, are safe to drive through flood waters.

Lesson Goals:

Objective: Students will be able to identify the difference between normal and severe weather through the Science and Engineering Practice of Developing and Using Models.

Learning Target: I can tell the difference between normal weather and severe weather.

Standard Information

Performance Expectation (PE) K-ESS3-2. Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
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| Developing and Using Models Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. <ul style="list-style-type: none">• Use a model to represent relationships in the natural world. | ESS3.B: Natural Hazards Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events. | Cause and Effect Events have causes that generate observable patterns. |

Lesson Preparation:

| Materials: | Group Size: | Management: |
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| Book – “What is the Weather Today?” Snow globe materials: <ul style="list-style-type: none">• glass jar with a screw-on lid• water• glitter• small figurines• ¼ teaspoon measuring spoon Severe weather picture cards Tornado Tube Not included in kit: | Small groups, Whole group, Solo | ****1-2 days before the lesson: The teacher should prepare for this lesson by using a strong glue (glue gun or super glue – not included in kit) to glue a small figurine to the lid of each glass jar included in the kit the day before the lesson. This will allow enough time for the glued figurine to set before it is immersed in water. The teacher should also prepare one snow globe as a model to show students. As the students finish their snow globe, you may consider using glue to seal the lid, so the students are unable to unscrew the lid of the snow globe. There is enough material in the kit for each student to make either a snowstorm OR a blizzard. The snow globe is a consumed item and by be kept by the students. |

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| Glue for figurines Water for snow globes (approximately 1 gallon) Two empty 2-liter bottles for the tornado tube experiments | | <p>You will need to create an example of both a normal snowstorm and a blizzard as examples for students to see what they will be creating. This task should be done before the class.</p> <p>The teacher also needs to prepare the tornado tube model by getting two empty 2-liter soda bottles, fill with water and screw each bottle into each end of the tornado tube. Practice swirling the water to create a tornado before trying with students. A drop or two of food coloring may make it easier to see but is not necessary.</p> |
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Lesson Plan:

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| Suggested Timing | Agenda: This lesson has three parts that are dependent on each other. These lessons should be done within 2 days of each other. |
| <u>Part 1</u> | <u>Part 1: (40 min)</u> |
| 10 min | Literacy picture walk “What is the Weather Today?” |
| 10 min | Explain about models and decide if snowstorm or blizzard model |
| 5 min | Difference between normal snowstorm and a blizzard |
| 15 min | Make the snow globe |
| <u>Part 2</u> | <u>Part 2: (20 min)</u> |
| 5 min | Review with students why scientists make models |
| 10 min | Tornado tubes – Explain what is happening |
| <u>Part 3</u> | <u>Part 3 (30 min)</u> |
| 5 min | Pair students that have snowstorm models with students that have blizzard models. Have them compare their models. |
| 5 min | What are the similarities they notice? What are the differences? |
| 10 min | Have students cut out and paste |
| 10 min | Science notebooks – Draw a picture of their snow globe and what they noticed |

Teaching Procedures:

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| <p>The three parts of this lesson will need to be completed over several designated time periods. It is important to do the four parts within two days to keep student interest and continuity of the concepts. All parts must be completed but can be shortened at teacher discretion.</p> <p>Part 1 Engage</p> <ol style="list-style-type: none"> 1. Do a picture walk through the “What is the Weather Today?” book, with a special focus on normal vs. severe weather. 2. In today’s lesson, students will explore the severe weather phenomena of blizzards and tornados. As you do the picture walk, focus on thunderstorms and hurricanes since the last step will have students sort all four types of severe weather in this unit. 3. Explain to the students that Scientists use MODELS to explain how some things work. Today you are going to be creating and using a model of snow to show the difference between a snowstorm or a severe snowstorm - a blizzard. Show them an example of the blizzard model that they will create. Assign each student to create EITHER a snowstorm or a blizzard. 4. While students study the two models explain to them that one is a snowstorm, and the other is a blizzard (severe snowstorm). Have them to watch as you turn the two snow globes over so that the “snow” falls. 5. Ask them what they see happening when the snowstorm is just turned over and blizzard is swirled. Are they the same? 6. [CONTENT NOTE: The major difference between a snowstorm and a blizzard is the amount of snow | <p>Teaching Notes</p> <p>Visual instructions on how to make a snow globe are available at: http://www.pbs.org/parents/crafts-for-kids/homemade-snow-globes/</p> <p>*** to construct “Snowstorm Snowglobe”</p> <ul style="list-style-type: none"> • Use white glue (long dry time), hot glue gun or super glue to attach a plastic figurine on the inside of each lid ahead of time. Use a generous supply of glue. Some pilot teachers found Gorilla Glue worked well. LET DRY • Be sure the figurine parts do not overlap the lid when they are glued to the inside surface of the lip of the lid. • Add ¼ teaspoon of glitter for a snowstorm and 1 full teaspoon for a blizzard r to the jar. <p>CAUTION – careful to not let students get the glitter on their fingers or near their eyes.</p> |
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and the wind speed. This is the intended use of this model. Students may observe many other attributes but try to guide them toward this specific content idea]

Explore

7. Students go to their tables to create a blizzard model (either as a whole class or in small groups). You can either assign the students to make a blizzard or snowstorm globe or have students select.
8. Teacher construction note: As the teacher, you know the best way to manage your class on the snow globe construction. SEE TEACHING NOTE FOR SPECIFICS TO MAKE THE GLOBES.***
9. Have students explore what is happening in their snow globe.

Part 2 – Explain

1. Gather the students on the meeting rug but leave the snow globes on the table. (they will be back with the snow globes shortly)
2. Explain that scientists often make models to see something in nature on a small scale and to learn about science.
3. Show the students the tornado tube. Ask the students, **“What is happening in these bottles?” “What does this look like?” “Can you explain what is going on?”**
4. Try not to explain what is happening but let them continue to wonder how to explain this phenomenon.

Part 3 - Elaborate

1. Distribute the snow globes and have students investigate how the snow (glitter is used in this model to represent snow) moves within the model. Have the students turn the globes upside down and swirl the water inside the globes.
2. Pair one student with a “Snowstorm” to a student with a “Blizzard”. Direct them to compare with their partners what differences they notice between the two snow globes. After students explore for some time there should be two major difference that they are looking for
 - a. The amount of snow - The snowstorm globe should have visibly less (snow) than the blizzard globe.
 - b. Wind speed – if you give a gentle flip of the snowstorm globe and swirl the snow in the blizzard, they should see that the snow falls gently, but the blizzard models a fast wind that moves the snow around the figure.

Evaluate

3. Ask the students **“What do you think the effect on humans or animals that are in a snowstorm? What do you think the effect on humans or animals that are in a Blizzard?”**
4. Have the students take out their Science Notebooks. On the next available page:
 - a. Draw a picture of the two snow globes and what they noticed. (have students show a difference in amount of snow and the difference in wind speed)
 - b. Under each Snow Globe drawing write either Snowstorm or Blizzard.
 - c. Draw or write what the difference was between the two globes or ask “Check or circle the one that would be listed as Severe Weather.”
5. Distribute the Lesson 8 assessment
6. Have the students cut out the four picture (or have them pre-cut for time)
7. Match the severe weather squares with the “normal weather” counterpart.
8. Have the students discuss with each other or with the teacher to check for understanding and accuracy.
9. Past the squares down on handout
10. Then paste the completed handout in the science notebook.

- Fill the jar to the top with water.
- Screw the lid on the jar tightly. You may consider putting a drop of glue on the rim of the jar for a “lockable” seal.

This could be pre-set during activity time in small groups.

In Part 2 - the tornado tube - remove the plastic ring that remains when the top is taken off of the plastic bottle. This will result in a tighter the connection between the tube and the bottle. Add some drops of liquid soap and beads to the bottle also. They will help in visualizing the tornado when the bottles are swirled.

<https://www.youtube.com/watch?v=FWBeuoKyywqU>

NOTE: When speaking of severe weather help students understand that we should PREPARE for the weather events and avoid language that severe weather is something that must be feared.



Sample of a snow globe model

Science Notebook:

Make sure students DATE each page of their notebook.

Have students paste the work page that differentiates normal weather from severe weather into their notebooks. Ask the students to draw a picture of a normal type of weather (snow globe) and the severe weather – Blizzard (Snow Globe) type of the same kind of weather. Ask them to label their pictures. Have them circle the Severe Weather and Label it “Severe Weather”.

Assessment:

Formative Assessment: Teacher will evaluate the students' ability to represent normal and severe weather through acting out types of weather, with body movements, and by matching normal and severe weather in their science notebooks. The teacher will also review Science Notebook journal entry for appropriate models of “Snowstorm” and “Blizzard”.

Literacy Connections:

| Vocabulary | | Included or Suggested Texts (Title; Author, Year, Type (book/article), Grade, LEXILE) |
|----------------------------------|---|---|
| New or Recently Introduced | Familiar Terms | |
| hurricane tornado blizzard | rainy windy snowy thunderstorm | |

Differentiation:

Below are some suggestions for modifying lessons for individuals or groups of students.

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| Students that may need more challenge: | Students that may need more support: |
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Think Outside the BOX!

Here is a website for other representations (or models) of weather that could be created as a center. REMEMBER that a scientific model is an artifact that:

- Shows relationships
- Is used to generate predictions or explanations
- Compare concepts and more.

You can use these “Weather in a Bottle” representations as a focus point for discussion, or tangible reminders of what a weather phenomenon looks like, but used like that they are **representations and not scientific models**.

<http://www.two-daloo.com/weather-sensory-bottles-circle-time/>

Here are some insights into thinking about modeling in the K-2 progression of Modeling as a Science and Engineering Practice (would you include this in the “Think Outside the Box” as well, or somewhere else):

Modeling in K–2 builds on prior experiences and processes to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. This might involve:

- Distinguish between a model and the actual object, process, and/or events the model represents.
- Compare models to identify common features and differences.
- Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).
- Develop a simple model based on evidence to represent a proposed object or tool.

Taken from the NGSS@NSTA website (<http://ngss.nsta.org/Practices.aspx?id=2>)

Reproducible Student Materials:

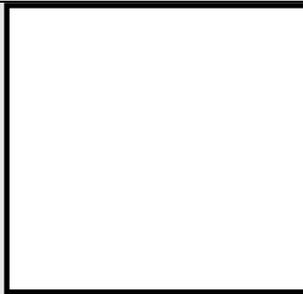
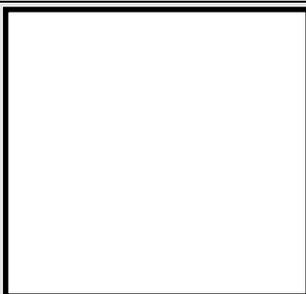
See next pages

Name:

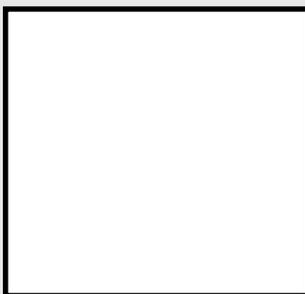
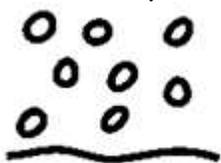
Normal

Severe

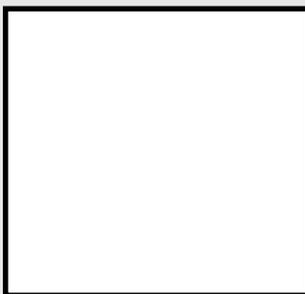
rainy



snowy



windy



Cut Pieces to Match Severe
Weather



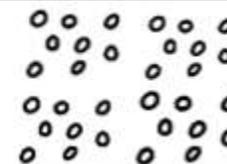
Tornado



Thunderstorm



Hurricane



Blizzard

Appendix A: Weather Themed Resources for Emergent Readers

As we all know, our favorite website links can disappear on us like a snowman in summer. Below is a list of links that our summer designer teachers found as support for emergent readers. **All of these links were checked on May 22nd, 2016.**

If you find a broken link or a link to add, please email an alert to the Regional Science Coordinator at PNW BOCES. Please remember to include the grade level and unit number.

Make Learning Fun weather emergent reader

<http://www.makinglearningfun.com/themepages/WeatherEmergentReader.htm>

Scholastic Weather Emergent Reader Play

<http://printables.scholastic.com/shop/prcontent/Stormy-Weather-An-Emergent-Reader-Play/9780590189453-009>

Make Learning Fun Wind emergent reader

<http://www.makinglearningfun.com/themepages/WeatherWindEmergentReader.htm>

Make Learning Fun Snow Day emergent reader

<http://www.makinglearningfun.com/themepages/SnowdayEmergentReader.htm>

Rainy day emergent reader

<http://twistynoodle.com/rainy-day-7-minibook/>

What Can We Do In the Snow? emergent reader

http://files.hubbardscupboard.org/Teacher_Version_21_-_What_Can_We_Do_In_the_Snow.pdf

Umbrella emergent reader

<http://waddleahcha.com/wp-content/uploads/2010/04/Umbrella-Day.pdf>

Weather themed poetry for emergent readers

<https://www.bcpss.org/bbcswwebdav/institution/CURRICULUM/Early%20Learning/School%20Year%202011-2012/PreK%20Literacy%20Curriculum/PreK%20Unit%203/Addition!%20Documents/SCHOLASTIC%20BOOK%20RESOURCES/101%20Thematic%20Poems%20for%20Emergent%20Readers.pdf>