Weather, Wind, and Windsock Lab

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NOTE:

The first 2 lessons come from explorelearning.com. This is a program purchased by CCSD for use by all Jr. High and Middle Schools to support the revised Nevada Academic Content Standards for Science. If you have not already created an account, follow the instructions below:

To create an account under your school's Gizmos subscription, you will need the Registration Key (Reg-Key) that is provided by the school's appointed contact for Gizmos. Once you have received the Reg-Key, create your account by using the link posted below:

Explore Learning Registration

Entering the Reg-Key you have been provided with a single – (dash) will take you to the account creation web page. This is where you will create your username and password to access Gizmos.

For additional information on how to set up your account, please log in to your Gizmos account and visit the link below:

Getting started teaching with Gizmos

Acknowledgements: Lesson created by James Wright with support from Dr. Erica Marti and UNLV engineering students Hunter Stepanian, Abdel Rahman El Bouri, Priscilla Maiava, and Paul Oko.

Subject Area: Science 6

Topic: Unit 2, Weather and Climate

Introduction: Students know what wind is but know little about its causes and effects. In this lesson, students will learn what instruments scientists use to measure weather, before learning how wind is created. Finally, students will create their own windsock and use it to determine wind speed and direction.

Anchoring Phenomenon:
Penny got a kite from her grandparents and wants to fly it in the morning when it is cooler, but there is little to no wind until the afternoon.

Driving Question:
How can Penny have a better chance of knowing when the wind will be strong enough to fly her new kite?

Prerequisite - Unit 1 Thermal Energy: Students must have knowledge of the basics of thermal energy as taught in Unit 1: convection currents in particular.

Request the anemometer kit from Tech Trekker for Lesson 3:
http://techtrekker.egr.unlv.edu/

NGSS Objective:
MS-ESS2-5:
Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.

Lesson order	**Lesson name**	**Unit length**
Lesson 1	Observing Weather Gizmo	100-120 minutes / 2-3 days
Lesson 2	Coastal Winds and Clouds Gizmo	90-110 minutes / 2-3 days
Lesson 3	Build a Windsock	90-120 minutes / 2-3 days
	Total	280-350 minutes / 6-9 days

Lesson 1 - Observing Weather

Objective/Purpose:

Students will …

- make measurements of weather conditions using a thermometer, anemometer, rain gauge, and hygrometer;
- observe and record a variety of weather phenomena, including rain, snow, fog, thunderstorms, and aurora borealis;
- use graphs and tables to compare weather conditions during the winter and summer,
  and in different locations, including:
    - comparing weather on the Pacific coast to weather in the Great Plains;
    - comparing weather near the Arctic Circle to weather in the tropics.

Lesson length: 90-110 minutes

This lesson contains three activities and an assessment:

Day 1:

- Activity A – Students learn how to read and record weather data from each instrument.
- Activity B – Students compare weather phenomena in San Francisco and Kansas City.

Day 2:

- Activity C – Students compare weather phenomena in Yellowknife, Canada and Miami.
- Assessment

Lesson Introduction:

How do scientists measure and describe the weather? In this introductory lesson, students will practice using a thermometer, anemometer, rain gauge, and hygrometer to record weather conditions in a variety of locations and dates.

Materials/Resources Needed:

- Explore Learning (Gizmo) Account

- Explore Learning Lesson Web Site (Customary Units)
- Explore Learning Lesson Web Site (Metric Units)
- Student Exploration Sheet Customary
- Student Exploration Sheet Metric
- Teacher's Guide
- Chromebooks or equivalent

Vocabulary: anemometer, atmosphere, aurora borealis, cumulonimbus cloud, equator, evaporate, fog, humidity, hygrometer, latitude, precipitation, rain gauge, thermometer, temperature, thunderstorm, weather, weather station

Lesson 2 - Coastal Winds and Clouds

Objective/Purpose:

Students will …

- observe wind patterns and temperature variations in a coastal region;
- explain why sea breezes and land breezes occur;
- use a weather probe to observe convection currents;
- explain the origin of clouds and thunderstorms in a coastal region.

Lesson length: 90-110 minutes

This lesson contains two activities and an assessment:

Day 1:

- Activity A – Students observe temperature variations in marine air and inland air. Students can then make a connection between temperature and wind.
- Activity B – Students document temperature patterns and convection currents during the day and at night.

Day 2:

- Assessment

Lesson Introduction:

If you have ever gone for a walk near the ocean, you may have noticed a refreshing breeze blowing in from the water. This is a sea breeze, a common occurrence in warm coastal regions. Late at night, the circulation of air is reversed, resulting in a land breeze blowing out to sea. Sea breezes, land breezes, and related weather phenomena can be explored in the Coastal Winds and Clouds Gizmo.

Materials/Resources Needed:

- Explore Learning (Gizmo) Account
- Chromebooks or equivalent
- Explore Learning Lesson Web Site (Customary Units)
- Explore Learning Lesson Web Site (Metric Units)
- Student Exploration Sheet Customary
- Student Exploration Sheet Metric
- Teacher's Guide

Vocabulary: condensation, convection, convection current, land breeze, sea breeze

Lesson 3 - Build a Windsock

Objective/Purpose:

Students will …

- learn that air has mass and moves at different speeds;
- determine that speed by using a student-made wind sock and an anemometer.

Lesson length: 90-110 minutes

Lesson Overview: What is a low-tech way of determining wind speed?

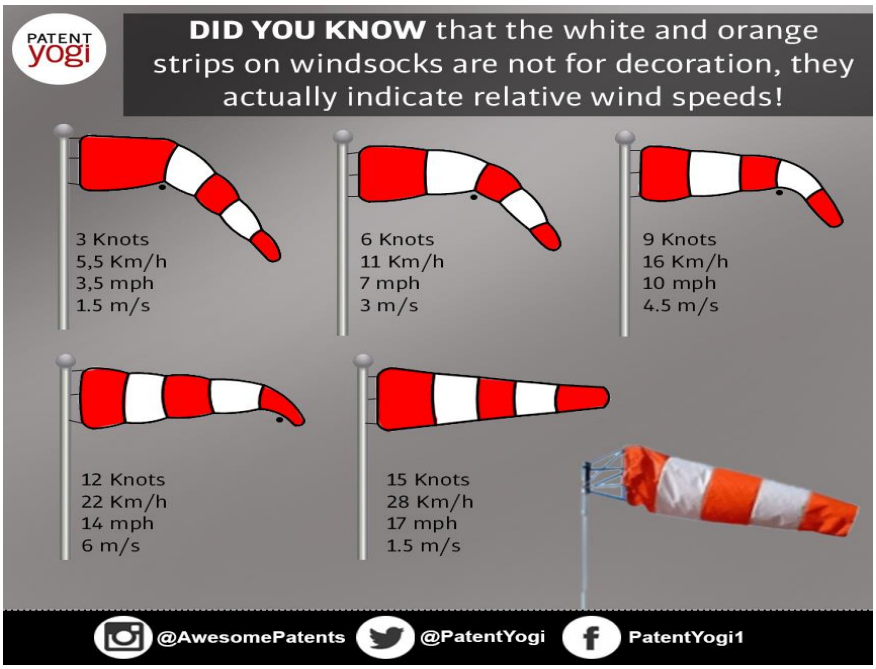
Materials/Resources Needed:

- Construction paper or printer paper
- Glue, tape, or stapler
- Plastic grocery bags, tissue paper or crepe paper
- Hole puncher or an awl
- Yarn, string, or pipe cleaners
- Fan (the bigger the better)

Background:

http://www.softschools.com/facts/weather_instruments/wind_sock_facts/3126/

The 8 & 12-foot windsocks are calibrated for Aviation use, fitted with an internal hoop and four large attach eyelets, and supplied with heavy duty cable ties to attach to a 2-ft. diameter frame for the 8ft windsock, or a 3-ft. frame for the 12-ft version. (Display graphic below on projector.)



Prior to lesson:

- As a warm-up, have students track wind speed and direction using a local weatherbug station.
- These can be found by entering city or zip code in the weatherbug web site: https://www.weatherbug.com/
- Obtain an anemometer by filling out the interest form (Tech Trekker links below):
    - http://techtrekker.egr.unlv.edu/
    - http://techtrekker.egr.unlv.edu/docs/UNLV-Tech-Trekker-Interest-Form.pdf

Activity:

https://www.wikihow.com/Make-a-Windsock-for-Children

1. Decorate your windsock. Get out a sheet of construction paper, printer paper, or cardstock. Set it down on a flat surface, then decorate it to your heart's content with markers, crayons, paint, or stickers. If you use paint, be sure to let the paint dry.
    a. Make spots or stripes for a simple design.
    b. Draw a pattern, such as hearts, stars, or fish.
    c. Decorate the windsock to look like an animal, such as a fish or owl.

2. Roll the paper widthwise into a tube, then glue, tape, or staple it shut. Bring the narrow ends of the paper together to form a tube. Overlap them by 1 inch (2.5 cm). Secure the tube with glue, tape, or staples.

    a. Make sure that the decorated side is on the outside of the tube.
    b. You can use a glue stick or liquid school glue. If you use liquid school glue, use clothespins or paper clips to hold the paper together until the glue dries

3. Cut a plastic grocery bag, tissue paper or crepe paper into streamers. The streamers should each be about 15 inches (38 cm) long. Crepe paper is already cut into narrow strips, so you can leave it as-is, or you can cut it narrower. If you are using tissue paper, however, you should cut it into 1 to 2 in (2.5 to 5.1 cm) strips, and make them about 15 inches (38 cm) long.
    a. Cut enough strips to glue all around the inside edge of your windsock. Plan on using 5 to 10 strips.
    b. The streamers don't all have to be the same color. Make each one a different color for a rainbow windsock!

4. Tape or glue the streamers to inside bottom edge of the windsock. Place the end of your first streamer into the windsock by 1 inch (2.5 cm). Tape or glue the streamer down, then move onto the next streamer. Keep going until you covered the entire inside edge with streamers. A glue stick or liquid school glue will work the best for this, but you can use a stapler too if you have nothing else.

5. Punch 2 holes in the top of the windsock, directly across from each other. Turn the windsock so that the streamers are facing away from you. Use a hole puncher to make 2 holes in the top of the windsock. Make sure that the holes are across from each other.

6. Thread a piece of string or yarn through both holes, then tie the ends together. Cut a piece that is about 3 to 4 times the width of your windsock. Feed the end through both holes. Bring both ends together, then tie them into a knot. Rotate the handle so that the knot is inside the windsock. Alternatively, you can feed the end of a pipe cleaner through each hole, then bend the ends to hold them in place

7. Have the students “try out” their windsocks by holding onto the yarn in front of a fan. Change the speeds on the fan and have students observe how close to horizontal their windsock and streamers are.

8. Put a strip of masking tape on the floor with marks every ¼ to ½ , starting at 5 meters going toward the fan. Students should use the Windsock Calibration Data Table to “calibrate” their windsock.

Windsock Calibration Data Table

Name:_____

Date:_____

Directions:

1. Start far enough away from the fan that your streamers are hanging vertically (straight down).
2. Walking on the tape with the measurements, move towards the fan until the streamers start moving.
3. Record the distance you are from the fan on the data table below.
4. Predict how fast you believe the wind is blowing.
5. Repeat for each streamer position.
6. Record the actual speed for the measurements as the teacher announces the wind speed.

Fan in classroom

Streamer position	**Distance from Fan**	**Predicted speed**	**Actual speed**
Streamers start moving			
¼ of streamers horizontal			
½ of streamers horizontal			
¾ of streamers horizontal			
All streamers horizontal			

Closure:

On a somewhat windy day (5-15 km/h), review the wind speed data collected and discuss how windy those days seemed. Go outside and have the students hold up their windsocks. They should predict wind speeds and record them in their data tables. Using the wind meter (anemometer) to record approximately four actual speeds, and any gusts. Return to the classroom and help students find their actual wind speed averages and ranges. Announce the “official” numbers from the anemometer. Ask for volunteers to share their predictions and how they came up with them.

Windsock Data Table

Name:_____
Date:_____

Directions:

1. Refer to your Windsock Calibration Data Table.
2. Take 4 measurements with your windsock by comparing what it looked like in the classroom to what it looks outside.
3. If you have a sudden gust, you may record it in the next column. Do not include in final results.
4. When you have all your measurements, add together and divide by 4. This is your average wind speed. Enter below the table.
5. Record actual wind speed average and range from the teacher.
6. Share your results.

Streamer position	**Predicted speed**	**Gusts (if any)**
1st measurement		
2nd measurement		
3rd measurement		
4th measurement		

Avg Wind Speed =_____

Range: _____ to _____

Actual average and speed range from anemometer

Avg Wind Speed =_____

Range: _____ to _____

Assessment: Collect prediction sheets.

Rubric:

Grade	Wind Speed data	Windsock design
1	Not accurate	Fragile or non-operative
2	Somewhat accurate and/or wrong unit labels used	Give some reliable data
3	Mostly accurate/ labels mostly complete and correct	Gives mostly reliable data
4	Very accurate/labels complete and correct	Gives completely reliable data

Extension: Repeat on various days with varying wind speeds, or have students hang up their windsocks at home and record wind data.

Extension: mark four lines, equally spaced on the streamers. Determine the wind speed value of each section, as illustrated in the picture at the beginning of the lesson.