Investigating Weather Concepts through Weather Lab Stations

Title IV Grant Money

By: Anna Swenty, 8th Grade HS Earth Science, LDMS

WHY... Weather Lab Stations???

*Middle school students struggle with the abstractness of weather and its concepts.

*Weather is an important topic for End of Course Earth Science SOL.

*Students need to know HOW to apply the concepts and NOT just the vocabulary.

*Labs give hands on experience and then help students answer thought provoking questions based on the lab experience.

Let's go through the 5 lab activity stations together...

BACKGROUND

Activity A. Tornado Tube

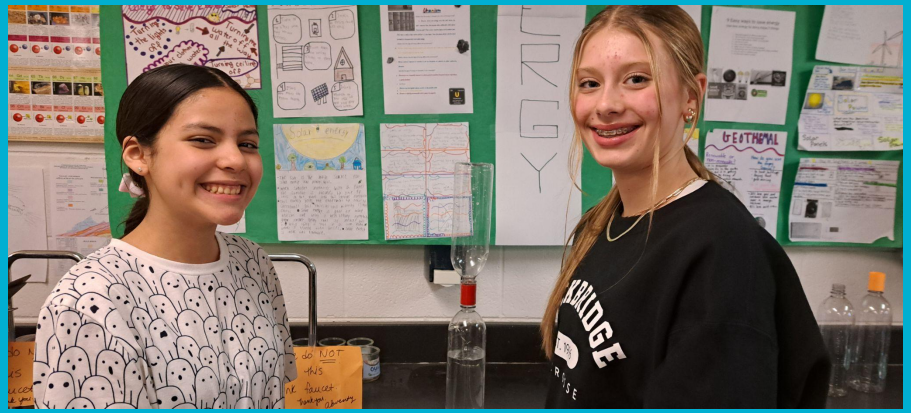
The purpose of the Tornado Tube is to cause the water in the top bottle to empty into the lower bottle as quickly as possible. The lower bottle, however, is not empty—it is filled with air. Air takes up space, so in order for the water to flow from the upper bottle into the lower bottle, the air has to be displaced to the upper bottle. The way to do this is to create a vortex in the water.

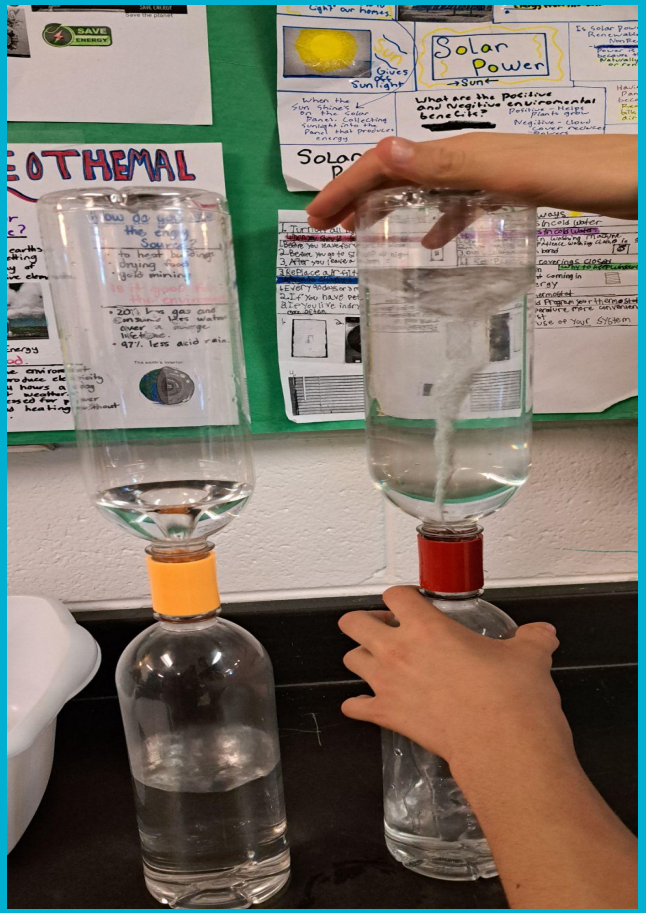
Sample Questions from Activity A. Tornado Tube

*What is causing the vortex to form?

*How does the formation of the vortex compare to how tornadoes occur?

ACTIVITY A: TORNADO TUBE





BACKGROUND

Activity B. Pet Tornado & Fujita Scale

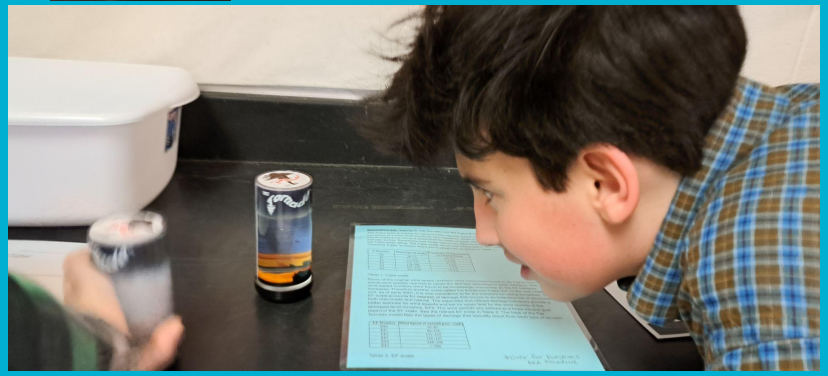
The Fujita scale is a scale for rating tornado intensity based on damage caused by the tornadoes on human-built structures and vegetation. When a tornado occurs, the official Fujita scale rating is determined by meteorologists after a ground or aerial damage survey. Eyewitness and media reports are also considered when determining the Fujita scale rating. Today, the Enhanced Fujita scale accounts for degrees of damage that occurs to an extensive list of structures, both man-made and natural. The expanded and refined damage indicators provide a better estimate for wind speeds and set no upper limit for the wind speeds of the strongest level tornados, EF5. The wind speeds are defined at a 3-second gust (mph) in the EF scale.

Sample Questions from Activity B. Pet Tornado & Fujita Scale

* Once Activities A and B have been completed, compare and contrast the vortexes formed in each device.

*How does the Enhanced Fujita Scale (EF) differ from the Fujita Scale?

ACTIVITY B: PET TORNADO & THE FUJITA SCALE



Enhanced Fujita Scale (Implemented February 2007)		
Rating	**Winds**	**Expected Damage**
EF0	65-85 mph	**Minor damage.** Shingles or parts of roof peeled off; damage to gutters/siding; branches broken off; shallow-rooted trees toppled.
EF1	86-110 mph	**Moderate damage.** More significant roof damage; windows broken; exterior doors damaged or lost; mobile homes badly damaged or overturned.
EF2	111-135 mph	**Considerable damage.** Roofs torn off well-constructed homes; homes shifted off their foundation; mobile homes completely destroyed; large trees snapped or uprooted; cars may be tossed.
EF3	136-165 mph	**Severe damage.** Entire stories of well-constructed homes destroyed; significant damage to large buildings; homes with weak foundations may be blown away; trees begin to lose bark.
EF4	166-200 mph	**Extreme damage.** Well-constructed homes leveled; cars thrown significant distances; top story exterior walls of masonry buildings likely collapse.
EF5	> 200 mph	**Incredible damage.** Well-constructed homes swept away; steel-reinforced concrete structures critically damaged; high-rise buildings sustain severe structural damage; trees usually completely debarked, stripped of branches, and snapped.

BACKGROUND

Activity C. Relative Humidity & Dew Point

A sling psychrometer can be used to measure the relative humidity of the air. *Relative humidity* is the percentage of moisture air is holding compared to the maximum it can hold. When water in the air evaporates, a certain amount of heat is required to convert the air into water vapor. Therefore, a cooling effect takes place when evaporation occurs. A *sling psychrometer* consists of two thermometers; a dry-bulb and a wet-bulb. The dry-bulb thermometer measures the temperature of the surrounding air while the wet-bulb thermometer records the amount of cooling that is required for the water to evaporate at that specific temperature. The dew point is an important measurement used to predict the formation of dew, frost and fog. Since atmospheric pressure varies only slightly at the Earth's surface, the dew point is a good indicator of the air's water vapor content.

Sample Questions from Activity C. Relative Humidity & Dew Point

*Given your lab results, how do relative humidity and dew point compare?

*Compare your relative humidity and dew point values with your local weather station or Internet weather site. How do your values compare to the actual or reported values?

ACTIVITY C: RELATIVE HUMIDITY & DEW POINT

BACKGROUND

Activity D. A Cloud In The Hand

This activity provides a rough analogy for cloud formation in the atmosphere. Water is added to a 1-liter plastic bottle along with smoke from a burning match and then capped. Squeezing the bottle dramatically increases the pressure (and slightly increases the temperature) inside the bottle. At this higher pressure some of the water that was in the vapor phase returns to the liquid phase until a new equilibrium state is reached. When the pressure on the bottle is released the pressure (and temperature) within the bottle drops suddenly, creating a partial vacuum. To re-attain equilibrium, water now goes from the liquid phase to the vapor phase. At this point the area above the liquid becomes saturated with water vapor which condenses on the “airborne” smoke particles (condensation nuclei) to form a cloud. This saturation is caused by unequal pressures of the liquid and vapor phases upon expansion of the bottle.

Sample Questions from Activity D. A Cloud In The Hand

*What causes the cloud to form in the bottle?

*What would happen if the smoke from the match was not present? Why?

ACTIVITY D: A CLOUD IN THE HAND

BACKGROUND

Activity E. PolySnow

Snow is a type of precipitation in the form of crystalline ice consisting of numerous snowflakes that fall from clouds. Snow is composed of small ice particles and is a granular material. It has an open and soft structure, unless packed by external pressure. In this activity, an artificial snow made of a chemical known as PolySnow will be studied. PolySnow is an example of a super absorbent polymer. Superabsorbents operate on the principle of osmosis—the passage of water through a membrane permeable only to water. In PolySnow, osmotic pressure results from a much greater concentration of sodium ion inside of the polymer lattice membrane than in the solution in which it is immersed. This osmotic pressure forces water into the solid polymer lattice in an attempt to equilibrate sodium ion concentration inside and outside the polymer membrane. The electrolyte concentration of the water will affect the osmotic pressure, subsequently affecting the amount of water absorbed by the polymer.

Sample Questions from Activity E. PolySnow

*Compare and contrast PolySnow to real snow.

*What happens when salt is added to the PolySnow? Give an example of how this process is commonly used.

ACTIVITY E: POLYSNOW

FUN Things I learned from the Weather Labs with Students!

Tornado Tube & Pet Tornado: Students are FASCINATED by tornados--the force, the damage, the capability to destroy anything in its path!

Relative Humidity & Dew Point: I thought students understood these vocabulary words…BUT the lab proved to me that they had to learn the vocab through experiencing. They didn't know….until they DID it in lab.

A Cloud in the Hand: Most students do NOT know how to light a match from a match book.

Polysnow: Students LOVED watching Polysnow form and playing with it!

THANK YOU for supporting me in my attempt to make science learning FUN for ALL of my students!