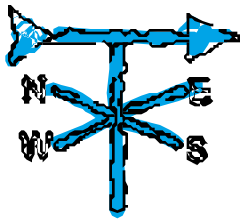


Weather and the Seasons Teacher's Guide

This Teacher's Guide is designed to help you prepare your students for the program **Weather and the Seasons** with the Northern Stars Planetarium. Your students will be taught why the Earth goes through seasonal changes along with other discussions, including a basic weather system, high and low pressure, relative humidity, cloud types, fronts, thunder storms, snow and temperature. After the Planetarium presentation, your students will learn about the instruments used in making forecasts using the Northern Stars Planetarium's own weather equipment. This will help them understand some basic elements in weather forecasting.

STUDY QUESTIONS

Here are some questions you might want to ask your students to start them thinking about weather.

1. **What sort of objects are involved in creating weather?** (Sun = Temperature, Air Movement = Wind, Water = Precipitation, Air Pressure = Weight of Air Masses)

2. **What is the water cycle?** (SIMPLIFIED: The Sun evaporates water from oceans, lakes, streams, your laundry on the clothes line and through transpiration [the loss of water by plants], turning the water from a liquid to a gas. This gas is called water vapor, which rises into the sky because of convection [hot air rising as the Sun heats the Earth and cold air sinking to take the place of the hot air]. As the water vapor rises, it cools off. When the temperature cools, the water vapor starts to condense on dust particles in the air, forming a cloud. When the cloud has so much water in it or it gets so cool that the cloud can't hold any more water, we get precipitation.)

3. **How is the Sun responsible for moving water?** (The Sun causes the water cycle. It also heats and cools the land and water unevenly, causing wind and massive movements of the air.)

4. **What are clouds made of? Why doesn't it rain every time there is a cloud in the sky? How do clouds move?**

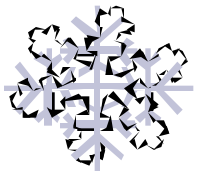
5. **What are the major groups of clouds?** (Fog = the lowest; Stratus = layered, low clouds; Cumulus = puffy, cotton ball clouds usually found higher than Stratus; Cirrus = high, wispy clouds often called mares tails. Cirrus clouds are composed of ice crystals and are usually on the leading edge of a front.)

VOCABULARY LIST

Anemometer: An instrument used to locate wind direction and speed.

Atmosphere: The outer layers of a star or planet. The atmosphere of Earth is divided into 5 layers. The troposphere is where our daily weather patterns occur and extends above Earth's surface about five miles. Above the troposphere is the stratosphere, mesosphere, thermosphere and the exosphere.

Barometer: An instrument used to measure air pressure.



Climate: Weather trends over a long period of time.

Condensation: The condition where water vapor becomes cooled and forms into water droplets.

Convection: The circulating movement of warmer and cooler fluids or gasses. Warmer gases rise as the cooler gases sink.

Cloud: A cloud is formed when the air is cooled below its saturation point and the water in the air condenses.

Evaporation: The condition where water turns from a liquid to a gas.

High Pressure: These are the cooler air masses carrying less water (less humidity). High pressure is usually associated with crisp, clear skies and no precipitation.

Low Pressure: Low pressure is associated with warmer air masses that carry with them more moisture. In the summer, low pressure systems usually bring rain; in winter, they bring snow.

Relative Humidity: The amount of water vapor in the air relative to the temperature. The warmer it is, the more water the air can hold. The cooler it is, the less water the air can hold. Relative humidity is measured in percentages.

Hygrometer: An instrument used to measure the relative humidity.

Meteorology: The science of weather.

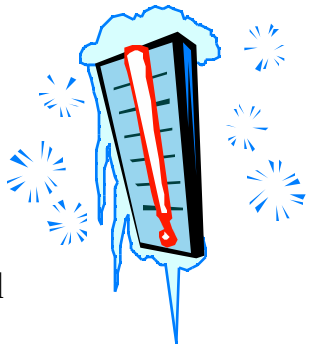
Precipitation: Water, in one of its various forms (rain, snow, sleet, hail), falling to Earth.

Saturation: The condition when the air is holding as much water as the temperature will allow. When the clouds are saturated, it typically rains.

Thermometer: An instrument that measures temperature.

Transpiration: The process where plants lose water to the air. (Interesting note: A single apple tree can move as much as 1,800 gallons of water into the air in six months!)

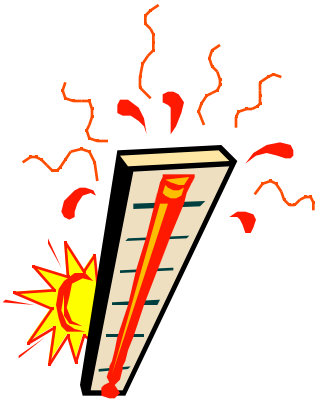
PROJECTS AND IDEAS



1. Divide your students into five groups. Assign each group one evening during the week to watch the weather that is reported on the news. Each day, a group should report to the class what the weather report is for the day. Record the weather prediction in one corner of the chalkboard. Record the actual weather happenings outside in the other corner. Was the TV meteorologist usually correct in the prediction?

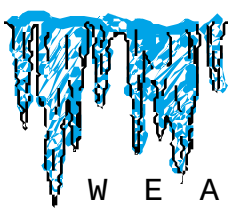
2. Have a group of students watch the weather report on TV every night for a week, concentrating on the weather satellite pictures. Ask them to try to find some patterns in the movements of the weather systems across the United States. How does the weather usually move along the east coast? Do weather systems usually move across the continent from east to west, or from west to east? Why do you think it moves the way it does?

3. On the TV and radio, what aspects of weather do they report when giving their predictions? Have your students take notes: Temperature? Wind speed? Wind chill factor? Precipitation (type and how much)? Do the different aspects of a weather report change as you move from the coast to farther inland? For example, do small craft warnings affect the farmers inland or the fishermen on the coast? Does the amount of rain affect the potato or hay harvest as much as it affects the harvest of lobsters?

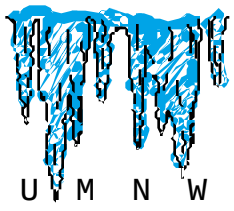


4. Have your students put together a bulletin board display of the water cycle. Using construction paper, have your students make different parts of the water cycle (lakes, ponds, trees, clouds, the Sun). Indicate with arrows the movement of water from the ground to the air and back again. Label the processes of evaporation, condensation and precipitation.

5. Have your students put together a bulletin board display on how different types of weather and storms (hot and dry, hot and humid, blizzards, tornadoes, hurricanes, cold and rainy, cold and dry) affect people living in different places.



WEATHER WORD SEARCH



W E A T H E R D B W S G K A U T U M N W
I I E C I S V J R A C N L N A G C R U E
N D H Y G R O M E T E R S E G N I T R R
D V A E H S B K T E D J L M S R Q R H U
T I I I P S G J N R D X Z O J E H S A T
S E L A R A I N I V S C U M U L U S I A
E E E E E E N E W A U A D E D A M A L R
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N I M B U S O O O R E D F R Z V I Z X M
I R R R R R R W R R R I O O O E T T T E
R R R M E T E O R O L O G Y D S Y O H T
P U W A T E R C Y C L E G A U G E Z D E
S S T R A T U S R E T E M O M R E H T S
D W R E T E M O R H C Y S P G N I L S G

In the puzzle above, find the weather words and circle them. The words can be found by looking forwards, backwards and diagonally. The following words are hidden:

WEATHER	**CIRRUS**	**STRATUS**
RAIN	**NIMBUS**	**FOG**
GAUGE	**METEOROLOGY**	**DEW**
WIND	**LOW**	**RELATIVE**
HYGROMETER	**CUMULUS**	**HUMIDITY**
HAIL	**ANEMOMETER**	**WATER VAPOR**
BAROMETER	**TEMPERATURE**	**SUN**
HIGH PRESSURE	**SUMMER**	**AUTUMN**
WATER CYCLE	**WINTER**	**SPRING**
SNOW	**SLEET**	**ICE**
THERMOMETER	**SLING PSYCHROMETER**	

WEATHER OBSERVATION CHART

You might want to use this chart to gather your own information from the TV and radio before we arrive.

DATE _____ TIME _____ OBSERVERS _____

TEMPERATURE:
Present Reading _____

Last Night's Low _____

BAROMETRIC PRESSURE:
Last Reading: _____ in.

Present Reading _____ in.

Barometer is: Rising _____

Falling _____

Steady _____

PRECIPITATION:

Rain _____ Sleet _____
Snow ____ Hail _____
None ____

Amount: _____in.

CLOUDS:
% of Overcast _____

Cloud Type _____

HUMIDITY:
Dry Bulb _____

Wet Bulb _____

RELATIVE HUMIDITY:_____ %

WIND:

Speed _____m.p.h.

Direction _____

Last Recorded Direction _____

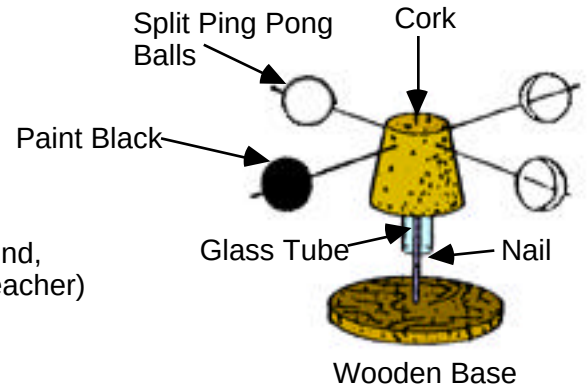
General description of the day:

My prediction for the next 24 hours:

Actual forecast:

EASILY MADE WEATHER INSTRUMENTS

Anemometer or Wind Speed Indicator



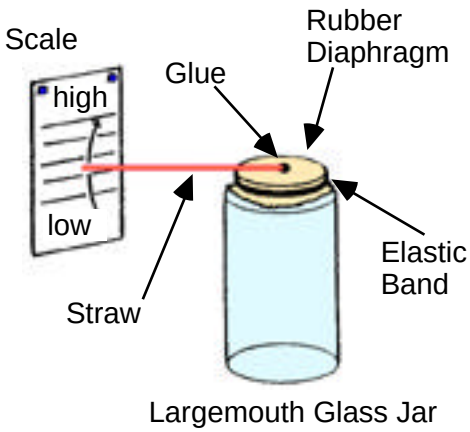
Materials Needed:

- 2 Ping Pong balls
- Cork
- Small Wooden Board
- Nail
- Glass Tube--Heated to close one end, (perhaps ask a chemistry teacher)
- Thin stiff wire
- Black Paint and Glue

Assemble as shown. Cut the ping pong balls in half and insert the stiff wire through the edge and glue. Paint one of the ball halves black, or some distinct color. Drive the nail through the board as a base. Insert the closed end of the glass tube into the cork – this will slide over the nail as a low friction bearing.

To calibrate, hold your anemometer out of the window of a car while traveling at 10 miles per hour. Count the number of times the colored cup goes around in one minute. Using this information, you can calculate wind speed elsewhere. If you find the colored cup only turns half as fast per minute as when driving, the wind speed is 5 miles per hour; if it turns twice as fast, the wind speed is 20 m.p.g., and so on.

ANEROID BAROMETER

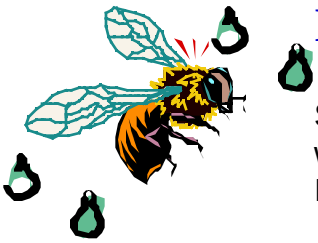


Materials needed:

- Large-mouth glass jar
- Balloon
- Elastic Band
- Straw or small stick
- Glue and paper

Assemble as shown. Cut the balloon to get a large enough piece of rubber to stretch over the mouth of the jar, making a diaphragm. Use elastic band to secure. Glue end of straw to the center of diaphragm. Make a paper scale as shown.

The change of air pressure (the weight of the air) associated with different weather systems will press to varying degrees on the rubber diaphragm. This will cause the straw to move up and down, measuring the air pressure.

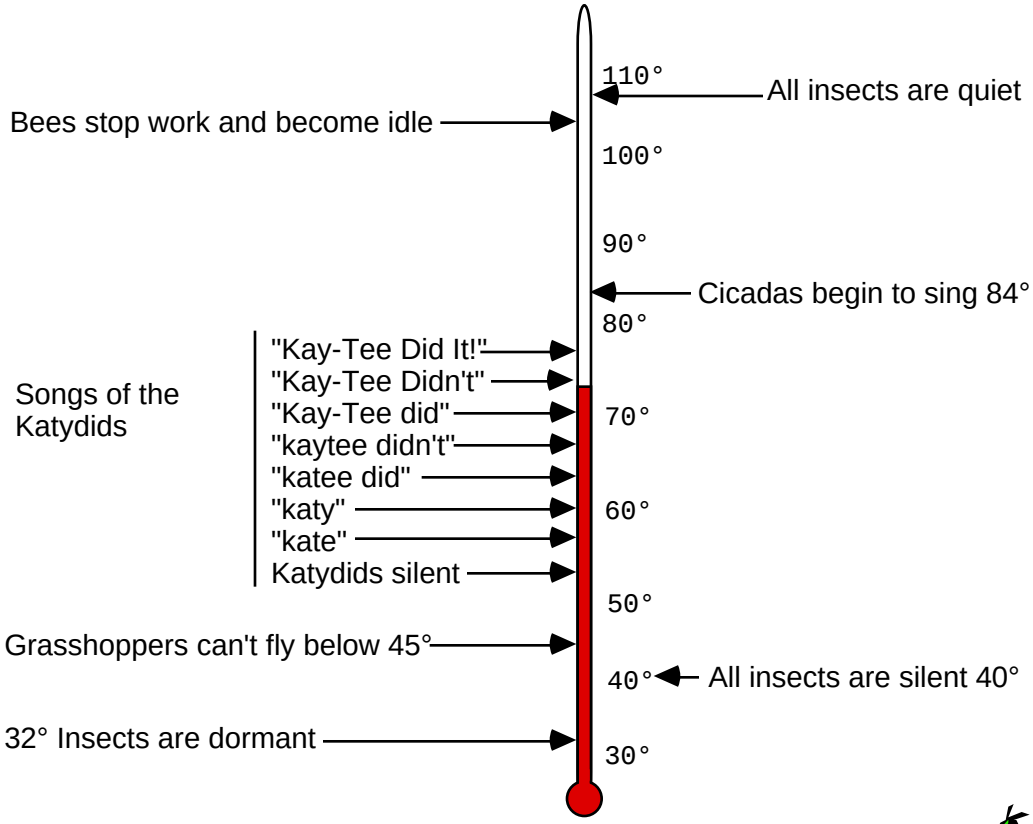


INSECTS AND THE WEATHER

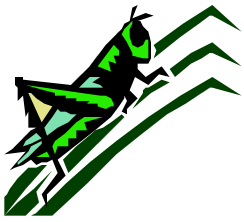
Sometimes the weather really 'bugs' some people. Well, the weather affects all creatures, perhaps most noticeably THE INSECTS!

1. **Flying insects in the rain.** Think about it! Imagine yourself as a mosquito and you've just got caught in the rain. To such an insect, rain drops are really BIG. Studies have shown that flying insects actually dodge raindrops while flying!

2. **The heat makes many insects sing.** Use insects to tell the temperature!



3. **Cricket Temperature Conversion.** If you count the number of chirps a black cricket makes in 14 seconds, then add 40, the number you get is the temperature in degrees Fahrenheit.



# of cricket chirps in 14 seconds + 40 = Temperature F

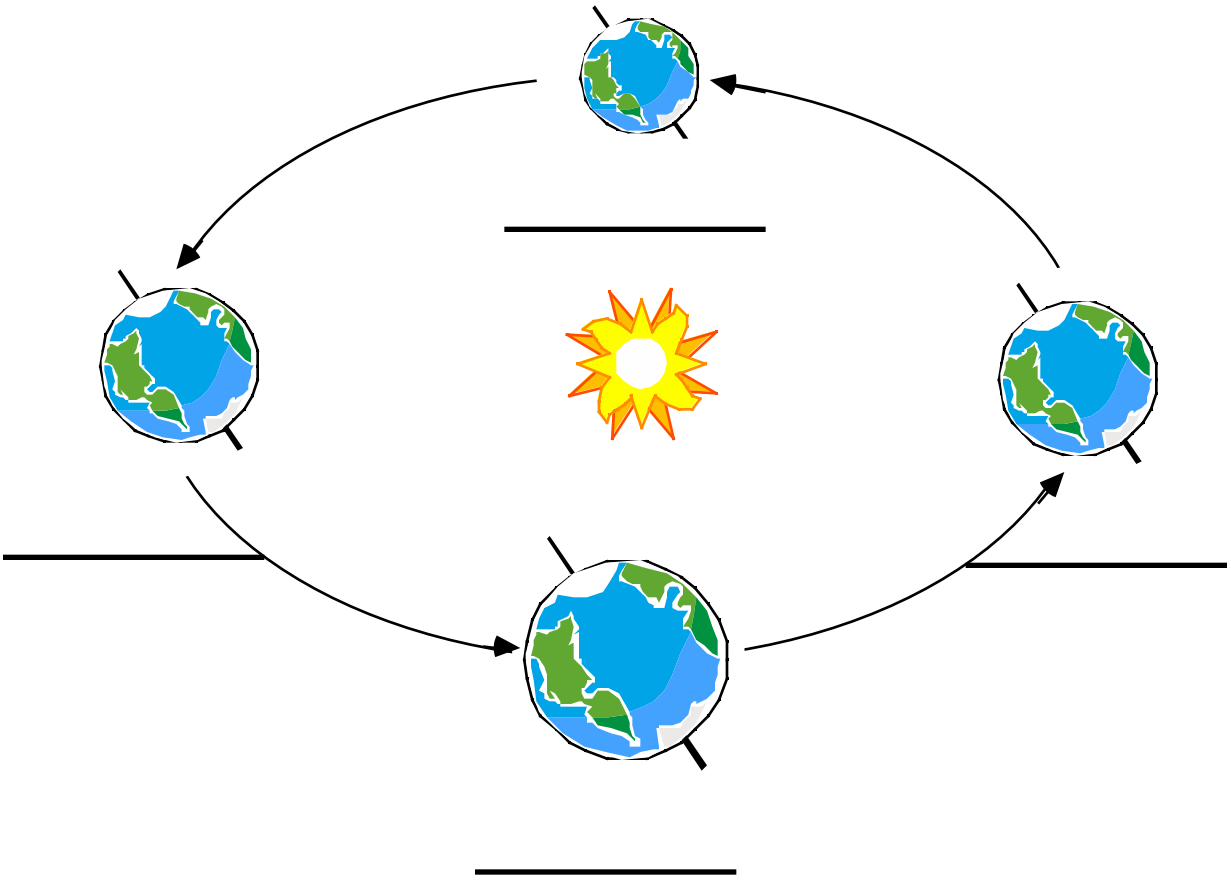
Scientists have found this to be an extremely accurate thermometer. But remember, the cricket's temperature is accurate for where it is, not necessarily where you are.

THE TILT OF THE EARTH AND THE SEASONS

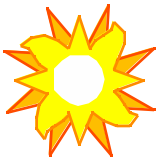
How is the sunlight in our hemisphere different in the summertime than in the winter time? (The answer to this question tells us why we have different seasons.) The Earth is tilted 23.5 degrees off its orbital plane as it moves around the Sun. In the winter, the northern hemisphere is tilted away from the Sun, resulting in fewer daylight hours. Also, the sunlight in the winter doesn't hit the northern hemisphere as directly as it does in the summer, lessening the intensity of the heat reaching us.

In the summertime, the northern hemisphere tilts toward the Sun, resulting in longer daylight hours. This gives the Sun more time to warm up Earth. The Sun's rays reach the northern hemisphere more directly in the summer than in the winter. So, it is the amount of exposure and the angle of the Sun's rays that determine how hot or cold Earth gets. It is <u>not</u> the distance between the Earth and the Sun that causes the seasons. Actually, Earth is closer to the Sun during winter than summer.

Label the Seasons:



BIBLIOGRAPHY



(Usage Guide: Y=Young Student Book / T=Teacher Resource / A=Adult or Older Student Level)

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Planetarium Presentation Evaluation

After the Northern Stars Planetarium has visited your class, please take a moment to fill out this evaluation. Your suggestions are very valuable to us!

Mail the completed evaluation to :.....Northern Stars Planetarium
P.O. Box 302
Fairfield, Maine 04937
Or Email To :.....info@northern-stars.com

1. Show Name: _____

2. Group grade/age level:_____

3. Was the material presented at an appropriate level for your class? _____

_____

4. Was the amount of material discussed: Enough Overwhelming Not Enough

5. Should any parts of the presentation be developed further? _____. If so, which parts?

6. Was there sufficient time for questions and answers? Yes No

7. Were you studying astronomy or another related subject at the time of the planetarium's visit?
Yes No
If so, was the planetarium visit helpful? _____

8. Was the Teacher's Guide helpful in preparing your class for the planetarium visit? Yes No
Which parts were most helpful? _____
Which parts were least helpful? _____

9. Did the presenter present the material in a clear and understandable fashion? _____

10. How would you rate the overall program given to your class in the planetarium? _____

_____

11. (Optional) Your name & school:_____

Thank you for your time! Your Comments Make a Difference!