

MAST ACADEMY OUTREACH

MIDDLE SCHOOL PROGRAM

Adventures Aboard

WOW

(Weather on Wheels)

Highlights Teacher Instructions / Answer Keys



MAST Academy

Maritime and Science Technology High School

Miami-Dade County Public Schools

Miami, Florida

**MAST ACADEMY OUTREACH
WEATHER ON WHEELS
MIDDLE SCHOOL PROGRAM
ON-SITE HIGHLIGHTS TEACHER INSTRUCTIONS/ANSWER KEYS
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WEATHER STATION 1

6 total points: 3 for each story

EVERY PICTURE TELLS A STORY

You will document your experience aboard Weather on Wheels by using the digital camera to take two photos of any of the Weather Stations.

Look around and find one of the weather stations you want to photograph.

Write a story about each photograph. Use complete sentences in your story. Think about who or what is in your picture. If a person is in your photograph, what is he or she doing? If a computer is in your photograph, what is on the screen? If a piece of equipment or an instrument is in your photograph, what is it used for?

FIRST PHOTOGRAPH

This is a photograph of _____ *Stories will vary.*

If digital photos were transferred to a VHS tape, these answers should be used by students to narrate the video when shown in class

SECOND PHOTOGRAPH

This is a photograph of _____

WEATHER STATION 2
WIND

17 total points: 7 for the table, 2 for each question

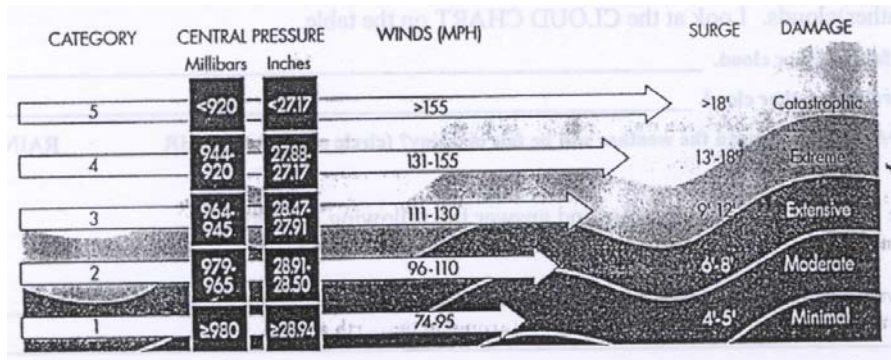
Wind is air in motion. It is caused by the unequal heating of the earth's land and water surfaces, which causes differences of pressure in the atmosphere. Follow the directions on the table for using the wind speed indicator to record the wind speed in miles per hour.

1. **Wind Speed (MPH)** _____ *Answers will vary*

A **hurricane** is a powerful tropical cyclone (rotating storm) with winds *over 74 miles per hour*. Using the hurricane plotting chart, follow the track of Hurricane Katrina in 2005. Record in the chart below Katrina's coordinates in latitude and longitude for each of the dates shown (a key to latitude and longitude is above the map).

DAT(11:00 PM)	LATITUDE	LONGITUDE
Aug. 23, 2005	23.5	76.0
Aug. 24	26.0	78.0
Aug. 25	25.5	81.0
Aug. 26	24.5	83.5
Aug. 27	25.0	86.0
Aug. 28	27.5	89.5
Aug. 29	33.5	88.5

Hurricanes are classified according to both the intensity of the winds and the damage produced by the storm. The method used to measure the intensity and damage caused by a hurricane is called the Saffir-Simpson Scale which is shown below. This system categorizes storm intensity on a scale of one to five.



2. What category hurricane has winds of 111-130 MPH? _____ *Category 3*

3. What category has a central pressure of <920 millibars? _____ *Category 5*

4. Hurricane Hugo in 1989 was a Category 4 hurricane. What type of damage did it cause? _____ *Extreme*

5. Hurricane Camille in 1969 and the Florida Keys Hurricane of 1935 are the only two Category 5 hurricanes to strike the United States. What was the storm surge? _____ *> 18 feet*

WEATHER STATION 3
RELATIVE HUMIDITY

26 total points: 2 for each question and part of table

The amount of water vapor in the air is called humidity. Relative humidity is the amount of water vapor in the air at a certain temperature; warmer air can hold more water vapor than cold air. If the relative humidity is 50%, then the air is holding half the amount of water vapor it is capable of holding. If the relative humidity is 100%, then the air contains all the water vapor it can possibly hold.

The **hygrometer** measures relative humidity.

6. What is the relative humidity reading on the hygrometer? Answers will vary %

A **sling psychrometer** (Sigh-krom-a-ter) also measures relative humidity. Follow the directions on the table for using the two sling psychrometers. Two people in your team should perform the activity at the same time. Record both the wet and dry bulb temperatures and then follow the directions on the table to calculate the relative humidity.

Psychrometer	Dry Bulb Temperature	Wet Bulb Temperature	Relative Humidity
Student 1	<i>answers</i>	<i>vary</i>	<i>day to day</i>
Student 2	<i>answers</i>	<i>vary</i>	<i>day to day</i>

7. Find the average relative humidity (add two relative humidities above, divide by 2) varies %

8. Is the reading from the hygrometer (circle one) **higher than** **lower than** (it should be the same) the average relative humidity you calculated using the sling psychrometers?



9. Which instrument do you think gives you the more accurate reading? Hygrometer
 Why? Sling psychrometer introduces human error (speed of rotation, math errors, etc.)

10. Does today's relative humidity feel comfortable to you? **YES** **NO** *Answers based on opinion*
 Why, or why not? Answers based on opinion

11. What does your body do to cool off when temperatures and humidities are higher than those in the "comfort zone" your body sweats, or increases blood flow to the extremities



12. What does your body do to warm up when temperatures and humidities are lower than those in the "comfort zone" your body shivers, or decreases blood flow to the extremities

WEATHER STATION 4 AIR PRESSURE

15 total points: 1 for each question, 8 for map

Air (barometric) pressure is the force exerted by the weight of the air above us. This weight creates a force on you much like the weight or force on a diver at the bottom of the ocean. The **barometer** is an instrument that measures changes in air pressure.

Read the directions on the poster for reading the **aneroid** ("without liquid") **barometer**. Look at the aneroid barometer on the table, and answer question 1 below.

1. What is the current barometric pressure in millibars (mb)? *Answers will vary.*

Hurricanes are areas of very low pressure (below 1000mb.) The lower the air pressure the more intense the hurricane.

Look at the graph called "Air Pressure During Hurricane Katrina" and answer the following questions.

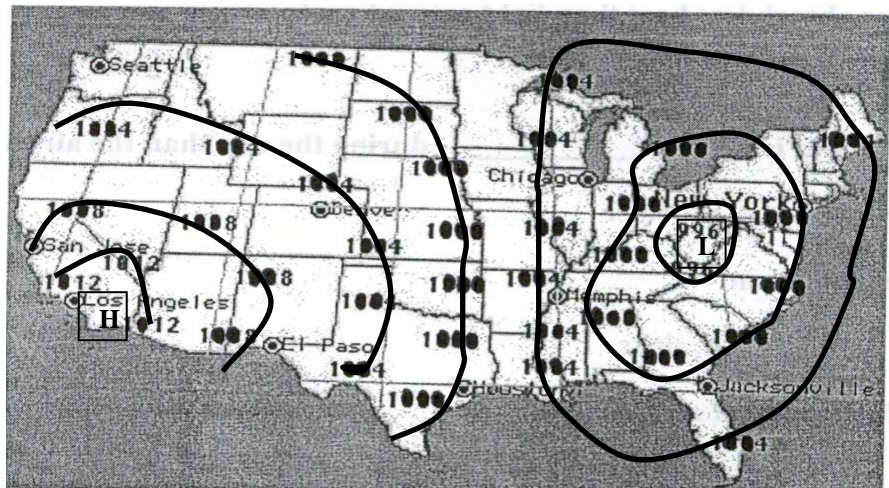
2. On what day was the air pressure the highest? 8/24/2005
3. What was the air pressure on that day? approximately 1007 mb
4. Hurricane Katrina hit New Orleans on August 29th. Was Katrina more or less intense the day before it hit New Orleans? (circle one) More Less

5. Explain your answer to #4. The air pressure was lower so the hurricane was more intense.

6. If Katrina had hit New Orleans on August 28th, do you think it would have caused (circle one) more or less damage?

7. Explain your answer to #6. Because it was more intense it would have done more damage.

Look at the *sample* weather map on the table. The thick black lines are called isobars. These lines connect locations of equal barometric pressure and form sets of curves that do not cross each other. On the map to the right (*a different map than the sample map*), use the yellow highlighters to draw in the isobars by connecting numbers of equal pressure.



Isobars can be used to identify "Highs" and "Lows". The pressure in a high is greater than the surrounding air and usually brings clear, sunny weather. The pressure in a low is lower than the surrounding air and usually means cloudy or rainy weather. On the map above, label with an "H" the center of a high pressure area, and label with an "L" the center of a low pressure area.

WEATHER STATION 5
WEATHER WIZARDS

15 total points: 3 points for each question

Weather Wizards contains experiments that ask you to make adjustments to the weather to solve a problem. You will use an “**atmosphere transmogrifier**” to solve a problem involving thunderstorms in the city of Sherman, Florida. Begin as a **Novice Weather Wizard**. Read the directions below.

- A. Put on headphones. To listen to a weather newscast and look for the “Desired Conditions” for preventing a thunderstorm, first click on the **Novice** button. Next, click on **Thunderstorms** from the Experiments List.
- B. Read the Objective and First Challenge. Click on the answer you think is the best. If your response is correct, answer question 1 below. Then click on **Continue** to go to the next challenge. If incorrect, click on **Continue** to try again until you get the correct answer. Do the same for the next two challenges. After answering question 3 correctly, **don’t click on the Continue button**. Instead, read the directions in **red** at the bottom of the screen. Click on the flashing **Level** button at the top right of the screen to show the weather map.

1. You can reduce the likelihood of lightning by
a. reducing the humidity *good answer* b. increasing the wind c. reducing the temperature *best answer* d. increasing the cloud cover
2. Thunderheads are
a. cumulus clouds b. cirrus clouds c. stratus clouds d. cumulonimbus clouds

Remember, after answering question 3 correctly, **don’t click on the Continue button**. Instead, click on the flashing **Level** button at the top right of the screen to show the weather map.

3. Thunderstorms are usually associated with
a. strong low pressure systems b. weak low pressure systems c. moderate high pressure systems

You are now an **Advanced Weather Wizard!** Your objective now is to change different weather factors to prevent a thunderstorm from hitting the city of Sherman, Florida. Read the directions below. Use your answers from the questions above to decide how to make adjustments to the weather.

- C. If you decide to remove the low pressure system, click on the yellow **LOW** button. If you decide to add a high pressure system, click on the green **HIGH** button. Click and drag the pressure system if you decide to move it to a new location.
- D. If you decide to change the temperature, moisture (humidity), or strength of the pressure systems, slide the red buttons to the right (to increase) or left (to decrease.)
- E. If you decide to change the cloud cover, click on one of the sky pictures.
- F. After making all your desired adjustments, click on the **Engage** button (the **orange** button to the far right) to start the “atmosphere transmogrifier.” Watch to see if your objective has been achieved.

4. Was your objective achieved? Yes No (If yes, click on **Continue** for the weather newscasters final report. If no, click on **Continue** to make adjustments until time runs out or you achieve your objective.) *Objective achieved if: low pressure system moved to east, high pressure system added, temperature decreased, sky clear or with Cumulus clouds.*



5. If a thunderstorm didn’t hit, explain why your adjustments worked. If a thunderstorm did hit, explain why? (Hint: Use information from the weather newscasters’ final report.) _____

If a thunderstorm was averted, it was because lower temperatures decreased evaporation; winds resulting from the position of the air masses slowed the formation of thunderclouds.

If a thunderstorm hit, it was because of a failure to lower the temperature, causing air masses to rise, forming thunderclouds.

**WEATHER STATION 6
CLIMATE**

22 total points: 6 for each data table, 2 for each question

How does one distinguish weather from climate? One simple way to think of it is that climate is what we expect; weather is what we get. To describe climate, researchers look at the average weather over a number of years in a particular region during a particular season. In this activity, you will be comparing the subtropical climate in Miami to a desert climate in Phoenix, Arizona by using temperature, precipitation and relative humidity as your data.

1. Click on the book with the title “U.S. Climate Data.”
2. Click on the bar at the bottom right that says “List All Cites.”
3. Scroll down and click on **Miami, FL**. (Cities are listed alphabetically by state.)
4. Click on the bar that says “City Information.” There is a **yellow arrow** pointing to the month of January indicating that the information listed is for that month.
5. Record the **high temperature, precipitation (rain)** and **relative humidity** in the box for January in the data table below.
6. Click on March and record the data. Repeat for May, July, September, and November.

Miami	January	March	May	July	September	November
High Temperature	74	77	82	87	86	78
Precipitation (rain) in Miami (inches)	2.10	2.26	6.54	5.44	8.24	3.03
Relative Humidity	72	70	73	76	78	74

7. Click on the small square above the word “Miami.”
8. Scroll up to Phoenix, AZ and click on this city. Click on “City Information.”
9. Find and record the high temperature, precipitation (rain) and relative humidity for each month.

Phoenix	January	March	May	July	September	November
High Temperature	66	75	92	105	99	75
Precipitation (rain) in Phoenix (inches)	0.88	0.54	0.05	0.55	0.38	0.41
Relative Humidity	53	40	25	36	38	46

Using the data above, answer the following questions.

1. What city has the highest temperature for any month? (circle one) MIAMI **PHOENIX**
2. What city has the highest rainfall for any month? (circle one) **MIAMI** PHOENIX
3. What city has the highest humidity for any month? (circle one) **MIAMI** PHOENIX
4. Describe the climate in Miami? (circle all that apply) **HOT** **RAINY** **HUMID** DRY
5. Describe the climate in Phoenix? (circle all that apply) **HOT** RAINY HUMID **DRY**



How would your use of water be affected if the climate in Miami changed to that of Phoenix? You may need to conserve water year round

Click on the “Home” button to return to the main screen.

