

# **MAST ACADEMY OUTREACH**

## **ELEMENTARY PROGRAM**

### **Adventures Aboard**

### **WOW**

**(Weather on Wheels)**

### **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  
ELEMENTARY PROGRAM  
ON-SITE TEACHER INSTRUCTIONS/ANSWER KEYS  
TABLE OF CONTENTS**

<b>Teacher Instructions</b>	<b>i</b>
<b>Weather Stations:</b>	
<b>1. Weather Media Center</b>	<b>1</b>
<b>2. Relative Humidity</b>	<b>2</b>
<b>3. Wind</b>	<b>3</b>
<b>4. Clouds and Precipitation</b>	<b>4</b>
<b>5. Air Pressure</b>	<b>5</b>
<b>6. Every Picture Tells a Story</b>	<b>6</b>
<b>7. Rain or Shine</b>	<b>7</b>
<b>8. The Weather Monitor</b>	<b>8</b>
<b>9. Climate</b>	<b>9</b>
<b>10. Weather Wizards</b>	<b>10</b>

## Weather on Wheels On-Site Package Teacher Instructions



**If you have not already done so, show the Weather on Wheels Pre-site DVD to your students.** Make a copy of the on-site package for each of your students. Distribute one package to each student the day of the Weather on Wheels visit. They will also need pencils or pens. Pencils will be provided only in an emergency.

Since there are ten lessons, divide the class into ten teams of equal size, and assign each team a number from 1-10. IF ESOL, ESE or other inclusion students are assigned to your class, make sure they are grouped with at least one student at grade-level reading ability. This grade-level student should be designated the team leader.



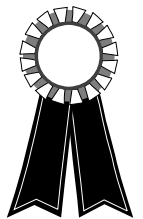
To save your student's photographs from lesson 6, you will need to provide **one** flash drive (USB drive).

Students are not to carry books, book bags, etc. to Weather on Wheels. These will get in the way. Clipboards will be provided for all students.



When your students arrive at Weather on Wheels, a brief introduction will be given. Each team will then begin at the lesson with their assigned number. **THE TEACHER MUST HELP SUPERVISE STUDENTS WORKING AT THE STATIONS SET UP OUTSIDE WEATHER ON WHEELS.**

**After the Weather on Wheels visit, grade the on-site activities, using the answer key provided in this packet. Total the points. This grade will be used to award certificates to students who score 80% or higher. A Certificate of Achievement Request Form, along with a Program Evaluation Form, will be sent to you following the Weather on Wheels visit.**



Discuss the correct answers with your students. All questions that address "critical thinking skills" are preceded by the icon to the left.

# WEATHER STATION 1

## WEATHER MEDIA CENTER

14 Total Points: 5 for each table, 1 for each question

At this station you will learn about weather forecasting by listening to a NOAA weather radio and by making observations from the newspaper's weather report.



Using the **FIVE DAY FORECAST** from today's newspaper weather map that is on the table, find the information to complete the table below.

Three Day Forecast for Miami	Today	Tomorrow	Day after tomorrow
Sky condition (sunny, cloudy, etc)			
HIGH temperature	Answers	will	depend
LOW temperature	on the	weather	conditions
Wind direction	for	that	day
Wind speed			



Look at the map of the United States, find the symbols for fronts, then answer question 1.

1. Are there any fronts in Florida? YES NO  
If yes, what kind? (circle one)

Answers will depend on weather conditions that day



Find the **SUNBURN ADVISORY**, then answer question 2

2. What is the maximum safe exposure for a high level risk person? Answers will depend on the weather conditions that day.

WARM COLD STATIONARY



Find the **MARINE OUTLOOK**, then answer questions 3 and 4.

3. In Miami Harbor, when is the next high tide? Answers will vary Next low tide? Answers will vary

4. Who would find the marine outlook important? Boaters, fishermen



Turn on the radio, and listen for a few minutes to become familiar with what is being broadcast. In the table below, place a check next to any weather and or marine forecast terms you hear on the radio. Turn off the radio when finished.

Terms	Check	Terms	Check
temperature		seas	
humidity	Answers	bays and inland water	Answers
pressure	will	precipitation	will
winds	depend	forecast	depend
lightning	on	ultraviolet index	on
clouds	the	rain	the
chance of thunderstorms	weather	moderate chop	weather
sky condition	conditions	barometer	conditions
sunrise	for	showers	for
sunset	that	mostly sunny	that
high tide	day.	tropical storm	day.
low tide		hurricane	

## WEATHER STATION 2

### RELATIVE HUMIDITY

7 total points: 4 for sling psychrometer charts,  
1 for each question

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. You will measure relative humidity using a **hygrometer** and a **sling psychrometer** (Sigh-krom-a-ter).



It is easy to find relative humidity using the **hygrometer** on the table by reading the number at the end of the pointer.

1. What is the relative humidity reading on the hygrometer? Answers will vary day to day %



Follow the directions on the table for using the two **sling psychrometers** which require more steps to use. Two people in your team should perform the activity at the same time. Record both the wet and dry bulb temperatures in the table below.

Psychrometer	Dry Bulb Temperature	Wet Bulb Temperature
# 1	<i>Varies</i>	<i>day to day</i>
# 2	<i>Varies</i>	<i>day to day</i>



Use the **relative humidity table** to find the relative humidity for each sling psychrometer. Follow the directions to the left of the table. Record both relative humidities in the chart below.

Relative Humidity from Sling Psychrometer 1	<i>Varies day to day</i>
Relative Humidity from Sling Psychrometer 2	<i>Varies day to day</i>



Now find the average relative humidity, then answer questions 2 and 3.

Find the sum of the two numbers above (add them together).	<i>Varies day to day</i>
Divide this sum by 2. This is the average humidity.	<i>Varies day to day</i>

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



3. Which instrument do you think gives you the less accurate reading? (Hint: Think about the number of steps you must follow to use each one.) (circle one) **hygrometer** **sling psychrometer**  
Why? Sling psychrometer introduces human error (speed of rotation, math errors, etc.)

## WEATHER STATION 3 WIND

12 total points: 7 for the table, 1 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 on the table, 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).

DATE (11:00 PM)	LATITUDE	LONGITUDE
<b>Aug. 23, 2005</b>	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.



CATEGORY	CENTRAL PRESSURE		WINDS (MPH)	SURGE	DAMAGE
	Millibars	Inches			
5	<920	<27.17	>155	>18'	Catastrophic
4	944-920	27.88-27.17	131-155	13'-18'	Extreme
3	964-945	28.47-27.91	111-130	9'-12'	Extensive
2	979-965	28.91-28.50	96-110	6'-8'	Moderate
1	≥980	≥28.94	74-95	4'-5'	Minimal

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 4

## CLOUDS AND PRECIPITATION

9 total points: 1 for cloud type, 1 for drawing  
1 for each question

At this station, we will learn about different types of clouds and record the cloud types present in the sky today, as well as record whether there has been any precipitation (rain).



Observe the sky in all directions as well as overhead. Using the CLOUD CHART on the table, decide what kind of clouds you see. Write the cloud type on the line provided. Draw the clouds you see in the box below. If there are no clouds, write "no clouds" for today's cloud type, and go on to question 1.

### TODAY'S CLOUD TYPE

Answers will vary

Cloud drawings will vary

1. What is the current CLOUD COVER? (circle one) *Answers will vary*  
CLEAR PARTLY CLOUDY MOSTLY CLOUDY OVERCAST



Some types of clouds are associated with rain while other types are considered "fair-weather" (sunny weather) clouds. Look at the CLOUD CHART on the table.

2. Name a fair weather cloud. Cumulus, cirrus  
3. Name a rainy weather cloud. Stratus, cumulonimbus, altostratus, nimbostratus  
4. Do TODAY'S clouds mean the weather will be fair or rainy? (circle one) FAIR RAINY



Look at the WATER CYCLE diagram and answer the following questions.

5. Name two ways water is returned from the land to the air. Transpiration from vegetation, evaporation from lakes/rivers, evaporation from ocean  
6. Name two places where RUNOFF goes after returning to the earth as rain. To lakes/rivers, to vegetation, to the ocean, to ground storage



Follow the directions on the poster for reading the RAIN GAUGE.

7. According to the rain gauge, how much rain has fallen today? Answers will vary. inches.  
8. Based on your answer to Question 4, did you expect rain today? Answers will vary

## WEATHER STATION 5

### AIR PRESSURE

10 total points: 1 for each question; 3 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)? \_\_\_\_\_

Hurricanes are areas of very low pressure (below 1000mb.) Typically the lower the air pressure, the more intense the hurricane and its winds.



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

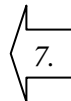
Hurricanes are areas of very low pressure (below 1000mb.) The lower the air pressure the more intense the hurricane.

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 29<sup>th</sup>. 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.

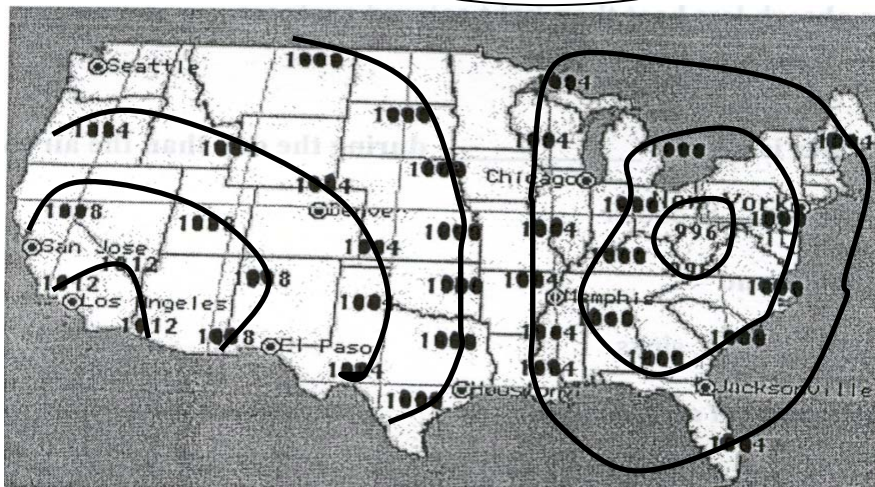
6. If Katrina had hit New Orleans on August 28th, do you think it would have caused (circle one) more or less damage?



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



The map on the table is a sample of an air pressure map. 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 below, use the yellow highlighters provided to draw in the isobars by connecting numbers of equal pressure.





## WEATHER STATION 6

8 total points; 4 for each story

### EVERY PICTURE TELLS A STORY



1. You will document your experience aboard Weather on Wheels by using the digital camera to take two photos of any of the Weather on Wheels stations and then writing about your photographs.
2. Look around and find something you want to photograph. If you are waiting to use the camera, you can look around, decide on what you want to photograph and start writing your story (see #3 below) before you take your photographs.
3. Write a story about each photograph. Use complete sentences. 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 an instrument is in your photograph, what is it used for?

#### FIRST PHOTOGRAPH

This is a photograph of \_\_\_\_\_ *Stories will vary.*

---

---

---

---

---

---

---

#### SECOND PHOTOGRAPH

This is a photograph of \_\_\_\_\_

---

---

---

---

---

---

---

**WEATHER STATION 7**  
**RAIN OR SHINE**

*9 total points: 1 for each question*



*Put on headphones. Click on scenes 10 – 18. Click on picture 18 in the lower right hand corner of the screen. While watching the DVD, answer the following questions.*

1. **Rather than heating the air directly, sunlight heats the ground first, and the ground then heats the air.**  
a. TRUE      b. FALSE
2. **Dark surfaces absorb less heat than light colored surfaces.**  
a. TRUE      b. FALSE
3. **The air over water is usually \_\_\_\_\_ during the day than the air over land.**  
a. warmer      b. cooler
4. **Heated air expands and**  
a. rises      b. sinks
5. **A large uniform body of air is called**  
a. a front      b. an air mass      c. a thunderstorm      d. a tornado
6. **The boundary between 2 air masses is called a:**  
a. edge      b. front      c. thunderstorm      d. line
7. **A cold front usually brings cool, dry weather, but sometimes causes:**  
a. hurricanes      b. snow      c. tornadoes
8. **Which moves faster?**  
a. a cold front      b. a warm front
9. **What instruments do meteorologists use to predict the weather?**  
a. computers      b. satellites      c. weather balloons      d. all of these



*Before moving to the next station, click on the “Menu” button.*

## WEATHER STATION 8 WEATHER MONITOR

10 total points: 4 for data; 1 point for each question



The "Weather Monitor" collects information about the weather from the Weather Station set up outside. Using the poster on the wall to help you find the information on the computer screen, fill in the data table below.

Answers will vary.

Time		Date		Moon Phase		New Moon          First Quarter          Full Moon          Last Quarter          New Moon	
Outside Temperature °C		Inside Temperature °C		Outside Humidity %		Inside Humidity %	
Dew Point °C		Heat Index °C					
Wind Chill °C		Wind Speed mph					
CURRENT Day	Rainfall in	CURRENT Rain Rate in	Barometer mb				
Sunrise	_____ AM	Sunset	_____ PM	Forecast (Circle one)		Mostly Clear          Partly Cloudy          Mostly Cloudy          Rain Likely          Snow          Scattered Showers	

**Wind Direction (draw an arrow)**



At the top of the screen, click on the 5<sup>th</sup> icon from the left. (The icon with 2 small graphs.) If the graph is not showing the current time on the horizontal axis, then click on the arrow at the bottom right of the scroll bar to move the graph to the current time. One click moves the graph forward one hour.

1. What does the red line represent? outside temperature
2. What does the blue line represent? dew point

**Dew point** is the temperature at which the atmosphere becomes 100% saturated (filled) with water. If the outside temperature falls to the dew point temperature, water vapor in the air will condense, and **dew** will form on the windows or grass. The dew evaporates once the outside temperature rises above the dew point.

3. On the graph shown on the computer screen, the outside temperature is higher than the dewpoint temperature. Under these conditions, would dew be able to form? \_\_\_\_\_ Yes ☒ No

4. Why or why not? Because the outside temperature is higher than the dewpoint temperature.

5. If both the dew point and the outside temperature were the same, what would happen to the water vapor in the air? Water vapor in the air would condense to form dew.

6. If there was dew on the bus window early this morning but it is now gone, what happened to it? It evaporated as the outside temperature increased.

## WEATHER STATION 9 CLIMATE

11 total points: 5 for data tables, 1 for each question

What is climate? 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 use monthly **precipitation** data to compare the subtropical climate in Miami to a desert climate in Phoenix, Arizona.



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 Cities."
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 **precipitation (rain)** in the box for January in the data table.
6. Click on March and record the data. Repeat for May, July, September, and November.

Month	January	March	May	July	September	November
Precipitation (rain) in Miami (inches)	2.10	2.26	6.54	5.44	8.24	3.03



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 precipitation (rain) for each month.

Month	January	March	May	July	September	November
Precipitation (rain) in Phoenix (inches)	0.88	0.54	0.05	0.55	0.38	0.41



Using the precipitation data above, answer the following questions.

1. What is the wettest month for Miami? September For Phoenix? January
2. What is the driest **SEASON** (spring, summer, fall, winter) in Miami? Winter In Phoenix? Spring
3. How would you describe the climate in Miami? **WET** **DRY**
4. How would you describe the climate in Phoenix? **WET** **DRY**
5. Pretend that Miami has the same climate as Phoenix? Would it rain (circle one) more? or less?
6. If Miami had the same climate as Phoenix, how would we need to change how we use water?  
You would have to conserve water or use less water.



Click on the "Home" button to return to the main screen.

## WEATHER STATION 10 WEATHER WIZARDS

10 total points: 2 points each for questions 1-3; 4 points for question 5

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.



- A. Put on headphones. To listen to a weather newscast, and read “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.
- C. Do the same for the next two challenges. After answering question 3, **don’t click on the Continue button.** Instead, read the directions in **red** at the bottom of the screen and click on the flashing **Level** button 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 advanced weather map.

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



- D. Your objective now is to change different weather factors to prevent a thunderstorm from hitting the city of Sherman. Use your answers from the questions above to decide how to make adjustments to the weather.
- E. 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.
- F. 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.)
- G. If you decide to change the cloud cover, click on one of the sky pictures.
- H. After making all your desired adjustments, click on the **Engage** button (the **orange** button to the far right) to start the “atmosphere transmogrifier” 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.

The School Board of Miami-Dade County, Florida, adheres to a policy of nondiscrimination in employment and educational programs/activities and strives affirmatively to provide equal opportunity for all as required by:

**Title VI of the Civil Rights Act of 1964** - prohibits discrimination on the basis of race, color, religion, or national origin.

**Title VII of the Civil Rights Act of 1964, as amended** - prohibits discrimination in employment on the basis of race, color, religion, gender, or national origin.

**Title IX of the Education Amendments of 1972** - prohibits discrimination on the basis of gender.

**Age Discrimination in Employment Act of 1967 (ADEA), as amended** - prohibits discrimination on the basis of age with respect to individuals who are at least 40.

**The Equal Pay Act of 1963, as amended** - prohibits sex discrimination in payment of wages to women and men performing substantially equal work in the same establishment.

**Section 504 of the Rehabilitation Act of 1973** - prohibits discrimination against the disabled.

**Americans with Disabilities Act of 1990 (ADA)** - prohibits discrimination against individuals with disabilities in employment, public service, public accommodations, and telecommunications.

**The Family and Medical Leave Act of 1993 (FMLA)** - requires covered employers to provide up to 12 weeks of unpaid, job-protected leave to "eligible" employees for certain family and medical reasons.

**The Pregnancy Discrimination Act of 1978** - prohibits discrimination in employment on the basis of pregnancy, childbirth, or related medical conditions.

**Florida Educational Equity Act (FEEA)** - prohibits discrimination on the basis of race, gender, national origin, marital status, or handicap against a student or employee.

**Florida Civil Rights Act of 1992** - secures for all individuals within the state freedom from discrimination because of race, color, religion, sex, national origin, age, handicap, or marital status.

**School Board Rules 6Gx13- 4A-1.01, 6Gx13- 4A-1.32, and 6Gx13- 5D-1.10** - prohibit harassment and/or discrimination against a student or employee on the basis of gender, race, color, religion, ethnic or national origin, political beliefs, marital status, age, sexual orientation, social and family background, linguistic preference, pregnancy, or disability.

*Veterans are provided re-employment rights in accordance with P.L. 93-508 (Federal Law) and Section 295.07 (Florida Statutes), which stipulate categorical preferences for employment.*

REVISED 8/1/01