Analyzing Weather Data

Lesson Concept Scientists analyze data gathered from weather tools to predict weather.

Link At the beginning of this unit, each measuring tools was introduced, and over time students have been collecting data. In this lesson, they learn how to graph and analyze the data they have gathered. Students then take Formative Assessment #3**.**

Teacher Note: This lesson may be used as a performance based assessment in which student work is analyzed for student understanding of science process skills (graphing and interpreting data) in addition to science content. If you wish to use it as an assessment, use R1-R2 to score the student work.

Time 80 minutes

Part I (Engage and Explore 1) = 50 minutes

Part II (Explore 2 through Explain) = 30 minutes

Materials

Whole class

Document camera

R1-R2 Rubric for scoring student work

Partners

H1 Data Analysis Sheet

4 Sheets of Graph Paper

Individual

Weather Collection Data Books

Advance preparation

1. Make sure students have observed and collected weather data 2-3 times a week throughout the unit. They should have data on amount of rain, temperature, pressure, wind speed and direction, and relative humidity.

2. Duplicate H1 (Data Analysis Sheet) for each set of partners and add 4 pieces of graph paper to each package.

Procedure:

Engage ***(5 minutes) Scientists gather data from weather tools.***

1. Ask students to complete the following sentence: When scientists are finished gathering data, the next step they take is to…
2. Discuss their responses; highlight the concept of analysis and drawing conclusions based on their findings.
3. Review with students the types of data they have collected over time: amount of rain; temperature; pressure; wind speed; wind direction; relative humidity.

Explore #1 /Explain ***(45 minutes) Scientists analyze data gathered from weather tools to predict weather***

4. Explain that in this lesson, students will use different methods to analyze different changes in factors that contribute to weather.
5. Ask students to work with a partner and distribute Data Analysis Sheets to each partner set.
6. Ask students to review their data for wind: speed and direction. Have students calculate: a) range of wind speed over the course of the data collection and b) which direction the wind came from most frequently.
7. Have partners next graph the data for the following measurements over the course of the data collection period:

   Precipitation

   Temperature

   Pressure

   Relative Humidity

Teacher Note: Students should label the x axis with the date and the y axis with the appropriate units for the measurement (e.g., ^{o}F for temperature; % for relative humidity.

8. Ask students to discuss the following questions with their partners and record their conclusions on the data analysis sheet: What patterns do you notice? What changes did you notice?
9. Ask several groups to share their graphs and observations on the document camera. Have other groups compare their data. Are the similar? Different? Why?
10. Based on the patterns that they see in their data, ask students to predict what the weather would be like over the next month. Chart their ideas.

Teacher Note: Keep this chart. If possible, have groups continue taking data on these 4 weather indicators and see if the class's prediction is correct. If you can't continue the actual data collection, allow time for the students to reflect each week as to whether

their prediction was correct. For example, did the temperature stay about the same; was there any rain this week?

Explore #2/
Explain (30 minutes) Scientists analyze data gathered from weather tools to predict weather

11. Ask students to discuss the following questions with their partners: What correlations do you observe between any two types of measurement that they graphed. For example, if the temperature is high, what is happening to the humidity, or if the amount of rain is low what is the barometric pressure doing? .
12. Have students compare their graphs to discover correlations and record their conclusions using this stem: I noticed that when _____ went up, _____ went down. I think this because, _____.
13. Ask students to share their correlations aloud. Discuss similarities amongst groups.

Teacher Note: Select Step 13 or 14 for students to interpret. Ask each student to write their explanation in their notebook.

Step 13 compares temperature and barometric pressure—using student data.

Step 16 compares temperature and relative humidity—using data from another source.

14. Choose one group's graphs of barometric pressure and temperature. Place the graphs side by side under the document camera and have students explain what the relationship is between these two weather components and why that happens.

Teacher Note: The higher the temperature of the air, the faster it rises and spreads, becoming less dense which decreases the barometric pressure. The cooler the temperature of the air, the denser the air becomes. This causes the barometric pressure to rise. Hotter temperatures generally mean lower pressure; lower temperatures generally mean higher pressure. This relationship doesn't hold true for every instance of temperature vs. air pressure.

15. Have other students compare their barometric pressure and temperature data. It is the same as the group that presented? If not, why not?
16. Show students the attached graph. Ask students to *explain what the relationship is between these two weather components and why that happens.*

Teacher Note; Relative humidity is a measure of the amount of water in the air compared to the amount of water the air could hold at a given temperature. The warmer air is, the more water vapor it can "hold." As the air cools, it holds less water. In other words, the air becomes saturated. This is 100% relative humidity and it indicates fog or rain. For a given amount of water vapor in the air, relative humidity will decrease as air temperature increases and increase as air temperature decreases.

For example

Air Temp	*Water Vapor Air Can Hold*	*Relative Humidity*
30 ^{o}F	*30 grams/cubic meter*	*30%*

20 ^{o}F	*19 grams/cubic meter*	*53%*
10 ^{o}F	*9 grams/cubic meter*	*100%*

Typically, relative humidity at a location is highest around daybreak when temperatures are coolest and lowest during the heat of the afternoon. There are exceptions to the rule as the amount of water vapor in the air doesn't remain constant throughout the day. In addition, temperatures not always lowest in the morning and highest in the afternoon

Evaluate (5 minutes) The weather can be predicted.

17. Ask students to complete an exit card: The most interesting thing I learned from analyzing the weather data is_____. I want to know more about_____because_____.

Data Analysis Sheet

Use data from your weather data collection notebook to answer these questions:

a) What is the range of wind speed over the course of the data collection_____

b) Which direction did the wind come from most frequently_____

Use the 4 pieces of graph paper to create a separate graph for each of the following: Amount of Rain, Temperature, Pressure, and Relative Humidity.

After you have completed a graph, write a summary statement of the data (including the range of each measurement) here for each graph.

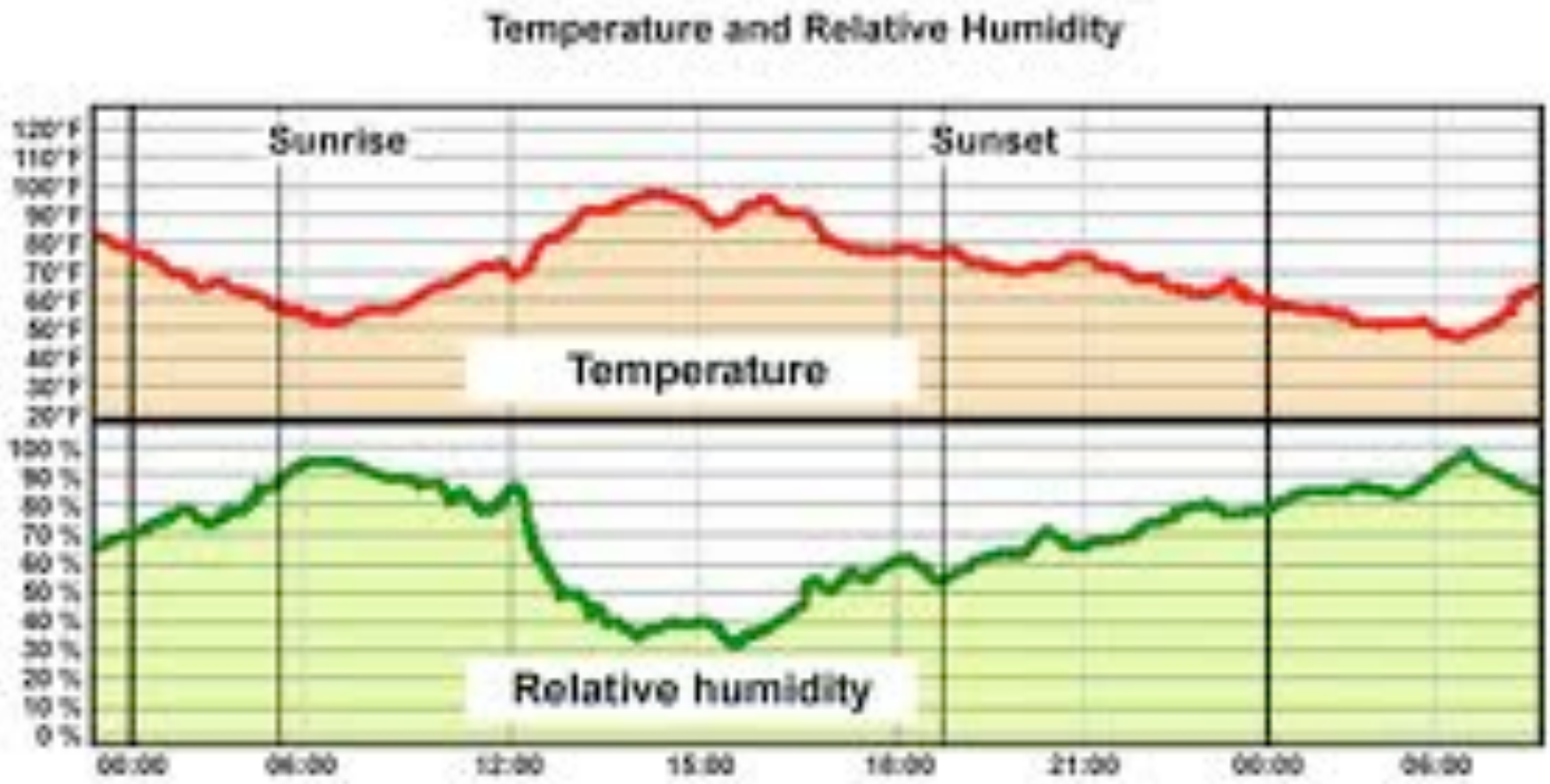
Amount of Rain

Temperature

Pressure

Relative Humidity

What changes do you notice in the two graphs?
How do the two correlate?
What might cause this relationship?



Criteria for Constructing a Graph

- The correct graph is chosen to represent the data (e.g., line, bar, pie).
- Graph has a title that indicates the relationship between the variables.
- Labels, interval scale, and units of measurement are clearly and accurately displayed on each axis.
- Independent (manipulated variable) is displayed on the x-axis.
- Dependent (responding variable) is displayed on the y-axis.
- Data points are clearly and accurately displayed on the x and y-axes.
- If appropriate, a key is used to identify data on the graph.

Criteria for
Writing a Summary of the Data

- Statement(s) include the actual data (e.g, number, mean, median, mode, etc.)
- Provides the range of data for highest and lowest values.
- Describes the shape of the line.
- Describes the change between the data points.
- Summarizes the relationship between the variables.