

Predicting Weather

Scope Planning and Overview



Student Wondering of Phenomenon

How can data from current weather conditions be used to predict future weather conditions?

Student Expectations

The student will–

- collect data to provide evidence for how the interactions of air masses result in changes in local weather conditions and how that data can be used to predict probable local weather patterns.

Scope Overview



In this instructional unit, students engage in hands-on activities to understand how air mass interactions influence local weather patterns. Through building models and using simulations, they explore atmospheric processes by creating and manipulating conditions with various materials. Additionally, they refine a weather map model to predict changes and analyze meteorological data over several days. These exercises enhance their understanding of weather forecasting and the scientific principles underlying meteorological phenomena, improving their data interpretation skills and teamwork.

Scope Vocabulary



The terms below and their definitions can be found in Picture Vocabulary and are embedded in context throughout the scope.

Air mass

A body of air extending over a large area (1,000 miles or more) that develops and retains specific characteristics of pressure, temperature, and humidity

Atmospheric movement

Global air circulation patterns within the atmosphere held to Earth by gravity and warmed as heat radiates from Earth; influenced by convection of warm, less dense air (rises and spreads out) and cold, dense air (sinks)

Cold front

The border between an advancing cold air mass and a retreating warm air mass

Front

The border between two different air masses

High-pressure air mass

An air mass with greater atmospheric pressure than the surrounding air masses; air moves away from the center of the high pressure, traveling in a clockwise direction in the northern hemisphere and a counterclockwise direction in the southern hemisphere

Humidity

Amount of water vapor or moisture content in air

Low-pressure air mass

An air mass with less atmospheric pressure than the surrounding air masses; air moves toward the area of low pressure, traveling in a counterclockwise direction in the northern hemisphere and a clockwise direction in the southern hemisphere

Meteorologist

A weather forecaster

Radar

A system for bouncing electromagnetic waves off objects to locate them; used to track weather patterns

Satellite views

Photos or images taken of Earth from space

Warm front

The boundary between an advancing warm air mass and a receding cooler air mass

Weather

The day-to-day state of the atmosphere

Weather map

A map or chart that shows the weather conditions at a specific point in time over a specific region



Home



Engage



Explore



Explain



Elaborate



Evaluate



Intervention



Acceleration



Engage Activity Summaries

APK

Accessing Prior Knowledge:

In this activity, students engage in a game of “Always, Sometimes, Never” to evaluate the validity of statements about weather and atmospheric phenomena. Through discussion and justification, they identify misconceptions and deepen their understanding of concepts like weather patterns, pressure systems, and the role of the Sun in driving weather. This interactive element helps uncover and address student misconceptions without being graded.

SP

Scope Phenomenon

Students observe a hurricane’s formation and landfall in a video, learning about air mass interactions and weather prediction. Using a provided handout, they engage in a structured activity, answering questions about the phenomenon. Through discussions and reflections on predicting future weather conditions, students deepen their understanding. This interactive element fosters knowledge expansion and connects learning to real-world weather phenomena without grading.



Explore Activity Summaries

Explore 1

Activity - On the Move

In this hands-on science activity, students work in groups to build models that simulate air mass movements and their impact on local weather. Using a variety of materials such as balloons, food coloring, ice, and a hot plate, they experiment with creating conditions that mimic real atmospheric processes. This activity involves observing, recording, and discussing their findings to deepen their understanding of meteorological concepts and enhance their teamwork skills.

Explore 2

Activity - Forecast for Omaha

In this educational activity, students use a weather map model of Omaha to understand and predict weather changes. They develop and refine their model to examine air mass interactions and their effects over five days. Through plotting the movement of weather fronts and analyzing related data, students apply cause-and-effect reasoning to forecast weather phenomena. This exercise enhances their ability to interpret meteorological data and understand underlying non-visible processes that influence observable weather patterns.

Notes



Predicting Weather

Accessing Prior Knowledge

Activity Preparation



Students will play Always, Sometimes, Never to determine whether statements or claims are sometimes true, always true, or never true. This element is designed to uncover student misconceptions. It should not be taken for a grade.

Materials

Activity Files

- 1 Always, Sometimes, Never Cards (per student)

Reusable

- None

Consumable

- None

Preparation

- If not assigning the Accessing Prior Knowledge digitally, print one class set of Always, Sometimes, Never Cards. (The print document includes a color version and a black-and-white version. Select the version that works best for your classroom.)
- Cut out one set of cards for each student.
- Consider laminating the cards for repeated use.

Procedure and Facilitation



Activity

Part I: Always, Sometimes, Never

1. Distribute Always, Sometimes, Never Cards to students.
2. Tell students you are going to read a series of statements to them and they will determine whether each statement is sometimes true, always true, or never true.
3. Students will hold up cards with their responses, and they must be able to justify their responses.
4. Ask students to justify their responses to an elbow partner. Choose volunteers to explain their reasoning to the whole group.
5. Scenario statements and whether or not they are always, sometimes, or never true are provided below:
 - The energy from the Sun drives the weather patterns on Earth. **Always**
 - Cold fronts bring severe thunderstorms. **Sometimes**
 - Air moves from low pressure to high pressure. **Never**
 - High-pressure systems hold more moisture than low-pressure systems. **Never**
 - The jet stream occurs high in the atmosphere. **Always**
- Weather patterns change daily. **Sometimes**

ACTIVITY TIP

After each statement, facilitate small group discussions for students to debate their choices, enhancing understanding through peer interaction.

Notes

Identifying Misconceptions

- Students may have a difficult time tracking the energy that drives weather all the way back to the Sun.
- Students may think that bad weather is always associated with a cold front. Cold fronts don't always bring severe weather.
- Students may not realize that gases move from areas of high pressure to areas of low pressure.
- Students may not realize that high-pressure systems hold less moisture than low-pressure systems and are associated with fair weather.
- Students may think that the jet stream happens close to the ground. The jet stream occurs high in the atmosphere, not close to the surface.
- Students may confuse weather and climate. Weather patterns change due to interactions among the Sun, hydrosphere, and atmosphere. Sometimes, weather stays the same from one day to the next, but sometimes, it changes as atmospheric movement changes.

Notes



Predicting Weather

Scope Phenomenon

Activity Preparation



Students will watch a video of a hurricane developing over the ocean and moving onto land to learn about how the interactions of air masses can change weather conditions and be used to predict future weather patterns. Students should build on their knowledge and understanding of the phenomenon as they move through the different activities in this scope.

Materials

Printed Material

- 1 Student Handout: The Making of a Hurricane (per student)

Reusable

- None

Consumable

- None

Preparation

- If not assigning the activity digitally, print one Student Handout per student.
- Prepare to project the Student Handout.
- Brainstorm additional questions you may want to discuss beyond the Student Handout during the activity.

Procedure and Facilitation



ACTIVITY TIP

After watching the hurricane development video, have students analyze data from current weather conditions to predict future patterns, enhancing critical thinking.

ACTIVITY TIP

Discuss the real-world application of predicting weather, particularly in disaster management and planning.

Activity

1. Distribute the Student Handouts.
2. Show students the video.
3. Have students raise their pencils in the air, but they should keep their elbows on the tables.
4. Ask the class a question from the Student Handout.
5. Tell students that their pencils should remain in the air while they think of the answer.
6. Tell students that, once they have the answer, they should put their pencils down and write their answers.
7. Allow time for every student to think of an answer before calling on a student.
8. Repeat steps 2–7 for each question on the Student Handout.
9. Introduce students to the Student Wondering of Phenomenon question below:
 - How can data from current weather conditions be used to predict future weather conditions?
10. Let students know that, as they move through the scope, they will be doing a number of activities to help them answer the Student Wondering of Phenomenon question and to learn the information that is needed to describe the events in the Scope Phenomenon.
11. When the scope is completed, have students look back at the Scope Phenomenon. As you lead them in answering the question, encourage them to use the information that they learned throughout the scope.

Notes



Predicting Weather

Explore 1: Activity - On the Move

Activity Preparation



Timestamp: 45 min.–1 hr.

Students will create models to represent the movement of air masses that affect local weather.

Materials

Printed

- 1 Student Handout: On the Move (per student)

Consumable

- 2 Round balloons (per pair)
- 2 Sticky notes (per group)
- 2 Aluminum foil sheets, 3" x 3" (per group)
- 2 Resealable plastic bags (per group)
- 1 Dropper of red food coloring (per group)
- 1 Dropper of blue food coloring (per group)
- 1–2 c. Ice (per group)
- 2 Binder clips (per group)
- 2 L Water (per group)

Reusable

- 1 Red marker (per pair)
- 1 Blue marker (per pair)
- 1 Red colored pencil (per student)
- 1 Blue colored pencil (per student)
- 1 Clear, plastic shoebox or terrarium (per group)
- 2 Droppers (per group)
- 1 Hot plate (per group)
- 1 Beaker tong or heat-resistant glove (per group)

Preparation

- Print out the Student Handout for each student.
- Follow all appropriate safety procedures while using the hot plates.
- Divide students into groups of four. For Part I, students will pair up within their groups.
- Prepare a lab area for each group to access the following supplies.
 - Part I: balloons, red and blue markers, and red and blue colored pencils
 - Part II: sticky notes; ice; resealable plastic bags; red and blue food coloring; hot plates (you may choose to set up hot water in beakers for students to access or have these at lab tables); beakers; beaker tongs or heat-resistant gloves; binder clips; clear, plastic containers (you can choose to fill these halfway with water ahead of time); and droppers. You may place each group's supplies on their lab tables instead of having a general lab area.

Notes



Home



Engage



Explore



Explain



Elaborate



Evaluate



Intervention



Acceleration



Connections

SEP Connection

Developing and Using Models

During this activity, students will develop and use models to develop explanations for phenomena, to go beyond the observable and make predictions or to test designs.

While students work through this activity, they should do the following:

- Use models to develop explanations for phenomena
- Use models to make predictions
- Use models to test designs

Once students have completed this activity, ask these questions:

- How did the model help to explain the phenomenon?
- What were some limitations of the model?
- How could the model be improved so that it is a better representation of the phenomenon?

CCC Connection

Systems and System Models

During this activity, students will explore systems and system models.

Ask students the following questions:

- Where do you see systems and system models in this activity?
- Where have you seen systems and system models before this activity?
- Where do you see systems and system models outside the classroom?
- Where do you think you will see systems and system models in other science lessons?



Procedure and Facilitation

1. Distribute a Student Handout to each student.
2. Divide the students into groups of four. For Part I, students will pair up within their groups; for Part II, students will work with their entire groups.
3. Review the procedures and safety expectations with the class.
4. Review where to find all the lab materials and supplies.
5. Allow 15 minutes for each part of the activity.
6. Walk around as students complete the activities to monitor their behavior and facilitate the activities.
7. Review the Questions and Reflections and Conclusions sections as a class.
8. Assign the CER individually.

Phenomenon Connection

Once students have completed this learning activity, revisit the Student Wondering of Phenomenon and use the following questions to guide a class discussion.

How can data from current weather conditions be used to predict future weather conditions?

- How does this activity connect to or answer the question above?
- How does this activity change your thinking about the phenomenon?
- Do you have any additional questions or observations about the connection between the phenomenon and the activity?

ACTIVITY TIP

Consider using a think-pair-share to facilitate student discussions and deepen understanding before moving to Part II or before starting Part 1.

CLASSROOM MANAGEMENT TIP

Have a visual timer so students know how much time they have left for each part of the activity.



Predicting Weather

Explore 2: Activity - Forecast for Omaha

Activity Preparation



Timestamp: 30–45 min.

Students will use a weather map model to collect data that provides evidence of how motions and complex interactions among air masses result in changing weather conditions and how cause-and-effect relationships can be used to predict phenomena in natural systems. Students will develop and revise the model to show relationships among variables over five days, including relationships that are not observable but help us predict observable phenomena, such as the weather conditions in a particular location.

Materials

Printed

- 1 Student Handout: Forecast for Omaha (per student)
- 2 Weather Map for Omaha (per group)

Reusable

- 1 Pack of colored pencils (per student)
- 1 Ruler (per student)

Consumable

- None

Preparation

- Print a Student Handout for each student.
- Print one Weather Map for Omaha for each pair of students. Cut apart the two weather maps so that each student has one weather map.
- Place all of the materials in a central location for students to access as needed.

Connections



SEP Connection

Constructing Explanations and Designing Solutions

During this activity, students will construct explanations and design solutions to explain phenomena or solve problems.

While students work through this activity, they should do the following:

- Construct explanations to explain phenomena
- Construct explanations to solve problems
- Design solutions to solve problems

Once students have completed this activity, ask these questions:

- What phenomena were witnessed in the activity?
- How were explanations constructed to explain the phenomena?
- What problems were presented in the activity?
- In what ways did you explain or solve these problems?

CCC Connection

Patterns

During this activity, students will explore observations and explanations of patterns.

Ask students the following questions:

- Where do you see observations and explanations of patterns in this activity?
- Where have you seen observations and explanations of patterns before this activity?
- Where do you see observations and explanations of patterns outside the classroom?
- Where do you think you will see observations and explanations of patterns in other science lessons?



Home



Engage



Explore



Explain



Elaborate



Evaluate



Intervention



Acceleration



Procedure and Facilitation

1. Lead the class in a pre-activity discussion.
 - a. Meteorologists are scientists who study weather patterns and make forecasts about upcoming weather. What would a meteorologist analyze when predicting the weather? *The movements of fronts*
 - b. A meteorologist is predicting cooler weather tomorrow. What must be happening to support that prediction? *A cold front must be near the area and likely to move in our direction.*
 - c. Why do meteorologists track the weather over long periods of time? *They track and collect weather data so that they can make predictions about the weather before it happens.*
 - d. Why are meteorologists' predictions sometimes incorrect? *Their predictions are based on patterns that are observed over long periods of time. Sometimes, things change due to unforeseen events. Weather is affected by so many factors that it is impossible to accurately predict it every time.*
2. This activity can be completed in groups or individually.
3. Distribute a half-sheet of Weather Map for Omaha and a Student Handout to each student. If you want students to work in groups, place them in groups at this time.
4. Review the data table on the Student Handout, and discuss with students the information that you are searching for. Students will predict the temperature and precipitation symbols based on the movements of the fronts.
5. Discuss with students what *probability* means, and have them list the probability of rain as high or low. As a way to double-check their math, have students record how many miles that the fronts move each day. Weather Map for Omaha (as printed) should be used for Monday.
6. Distribute a ruler and a pack of colored pencils to each student. Have students use the rulers, map scales, and their knowledge of fronts to track the paths of fronts and predict the weather for one week.
7. To determine the number of miles that are traveled by the cold front, instruct students to multiply 15 by 24. The cold front moves 360 mi. each day. To determine the number of miles that are traveled by the cold front, instruct students to multiply 10 by 24. The warm front moves 240 mi. each day. Students need to plot the fronts on their copies of Weather Map for Omaha before predicting the weather.
8. An optional ending for this activity is to project Weather Map for Omaha on the board and have each student come to the board and act as a weatherperson to share their predictions and the paths of the fronts.

ACTIVITY TIP

Before diving into the activity, spend time explaining how to read weather maps, focusing on symbols, patterns, and what they represent.

ACTIVITY TIP

Reinforce the concept of weather fronts and how they affect weather patterns before the activity.

Notes

Explore 2: Activity - Forecast for Omaha

9. Lead the class in a post-activity discussion.
 - a. Why did the weather conditions for Omaha change? The movements of warm and cold air masses along frontal boundaries caused Omaha's weather conditions to change.
 - b. What cause-and-effect relationship allowed you to predict the weather for Omaha? The movements of warm fronts or cold fronts into an area result in typical changes in weather conditions. The effect of a warm front moving into an area typically causes an increase in temperature and moisture in the air with cloud cover. The effect of a cold front moving into an area typically causes a decrease in temperature and moisture in the air with clear skies. This typical cause-and-effect relationship allowed me to make a prediction.
 - c. What data was most important in making your prediction? Answers may vary. Possible student responses could include the following: the movement rates of the air masses or fronts, the air temperature on each side of a front, and the moisture level (rain or no rain) behind a front.

Once students have completed this learning activity, revisit the Student Wondering of Phenomenon and use the following questions to guide a class discussion.

How can data from current weather conditions be used to predict future weather conditions?

- How does this activity connect to or answer the question above?
- How does this activity change your thinking about the phenomenon?
- Do you have any additional questions or observations about the connection between the phenomenon and the activity?

Notes

Notes



Predicting Weather

Scope Resources and Assessment Planner

Scope Resources



Explain

- ☐ **Picture Vocabulary**
A slide presentation of important vocabulary terms along with a picture and definition.
- ☐ **STEMscopedia**
Reference materials that includes parent connections, career connections, technology, and science news.
- ☐ **Linking Literacy**
Strategies to help students comprehend difficult informational text.



Elaborate

- ☐ **Math Connections**
A practice that uses grade-level appropriate math activities to address the concept.
- ☐ **Reading Science - Meteorologists**
A reading passage about the concept, which includes five to eight comprehension questions.
- ☐ **Engineering Connections**
A creative, kinesthetic extension into engineering and design that uses concepts addressed in the scope.



Evaluate

- ☐ **Claim-Evidence-Reasoning**
An assessment in which students write a scientific explanation to show their understanding of the concept in a way that uses evidence.
- ☐ **Open-Ended Response Assessment**
A short-answer and essay assessment to evaluate student mastery of the concept.
- ☐ **Multiple Choice Assessment**
A standards-based assessment designed to gauge students' understanding of the science concept using their selections of the best possible answers from a list of choices



Intervention

- ☐ **Guided Practice**
A guide that shows the teacher how to administer a small-group lesson to students who need intervention on the topic.



Acceleration

- ☐ **Extensions**
A set of ideas and activities that can help further elaborate on the concept.

Notes



Home



Engage



Explore



Explain



Elaborate



Evaluate



Intervention



Acceleration



Assessment Planner

Use this template to decide how to assess your students for concept mastery. Depending on the format of the assessment, you can identify prompts and intended responses that would measure student mastery of the expectation. See the beginning of this scope to identify standards and grade-level expectations.

Student Learning Objectives

What Prompts Will Be Used?

What Does Student Mastery Look Like?

collect data to provide evidence for how the interactions of air masses result in changes in local weather conditions and how that data can be used to predict probable local weather patterns.