Ohio Standards Connection:

Scientific Ways of Knowing

Benchmark C
Explain the importance of keeping records of observations and investigations that are accurate and understandable.

Indicator 2
Record the results and data from an investigation and make a reasonable explanation.

Related Standards

Earth and Space Sciences

Benchmark D
Analyze weather and changes that occur over a period of time.

Indicator 5
Record local weather information on a calendar or map and describe changes over a period of time (e.g., barometric pressure, temperature, precipitation symbols and cloud conditions).

Scientific Inquiry

Benchmark B
Organize and evaluate observations, measurements and other data to formulate inferences and conclusions.

Indicator 2
Analyze a series of events and/or simple daily or seasonal cycles, describe the patterns and infer the next likely occurrence.

Lesson Summary:

Students will keep a record of the daily high and low temperatures and times of sunrise and sunset for three to four weeks. This information can be found in the newspaper, weather reports or on the Internet. Students may choose to measure and record high and low temperatures using outdoor thermometers. Students also will calculate number of hours of daylight for each day. Then, students will organize the daily high and low temperatures and hours of daylight into graphs. They will analyze the charts and/or graphs and make reasonable explanations about the relationship between hours of daylight and temperature.

Estimated Duration: One hour and 30 minutes (first and last lesson) 10 to 15 minutes per day for four weeks to collect and record data

Commentary:

The autumn or spring seasons are the best times to conduct this investigation of the relationship between temperature and hours of daylight. It is important to record data for at least three weeks to see a trend and make a reasonable explanation. This lesson also may be presented later in the school year, after students have learned skills for graphing. This lesson was piloted by teachers across Ohio. Some of the teachers’ comments follow:

• “I liked the idea of using a spreadsheet to enter the data in a graph and letting kids discover the relationship between hours of daylight and temperature.”
• “The hours of daylight activity was really interesting and the students gained a great deal of knowledge. They actually cheered when we would get two more minutes of daylight and applied to their day in school.”
• “The students are actually looking forward to spring and are checking out Web sites at home and television weather reports.”
• “The students were actively engaged every step of the way.”
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**Pre-Assessment:**
Instruct students to move into small groups to prepare for the pre-assessment. Give each group a container of warm water and a thermometer. Have students read and record the temperature of water every three minutes for 15 minutes. Set a timer for the three-minute intervals. Direct students to graph the collected data and write their explanations about the temperature of the water.

**Instructional Tip:**
Make sure that students have developed the skills to read thermometers and to create basic graphs. Have students read a book about weather while they are collecting data for the pre-assessment. See Attachment A, *Sample Water Temperature Graph.*

**Scoring Guidelines:**
The scoring guidelines are found in Attachment B, *Pre-Assessment Scoring Chart.*

**Post-Assessment:**
Assess students’ knowledge and skills for completeness and accuracy of data collected in the high and low temperatures and sunrise and sunset time charts. Also, assess students on how well they organized data collected and determine if the written explanation of the relationship between temperature and hours of daylight is reasonable.

**Scoring Guidelines:**
See Attachment C, *Post-Assessment Scoring Guidelines.*

**Instructional Procedures:**

**Day One**
1. Have students share their graphs and explanations from the pre-assessment with the class. Inform students that scientists keep accurate and complete records of their investigations and organize data in graphs and charts and use that data to support reasonable explanations.

**Instructional Tip:**
Make copies of the newspaper weather section that has information about high/low temperatures and sunset/sunrise times. Newspapers provide weather information for today and yesterday. Keep in mind that “today’s” weather information is the forecast and not the actual temperature. Students also may use their local news Web sites or television weather reports for more up-to-date information. Post two class charts: one to record high/low temperatures and one to record sunset/sunrise times.

**Data Collection**
2. Show students how to keep a record of high/low temperatures and sunrise/sunset times from their chosen source and record the data. Have students calculate and record the number of hours of daylight for each day. This could be assigned as morning work.
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3. Have students organize the data collected and write their explanations.
4. Give each student a copy of the weather page of a newspaper. Ask students to find the high/low temperatures and sunset/sunrise times for that day. Help students who are having difficulty finding the information.
5. Have a few students share the information with the class. Assign two students to record data in two class charts. (Create a schedule for each student to record data in the class chart.)
6. Have students record the information in their charts (See charts in Attachment D, Daily High/Low Temperature and Attachment E, Hours of Daylight or have students make their own charts.)
7. Make sure that all students understand how to calculate the hours of sunlight for each day. Again, remind students about the importance of keeping records which are accurate and clear to understand. Tell students that for the next three to four weeks they will collect and record this information in their charts and class charts.
8. Have students keep their charts in folders or collect them.
9. Collecting and Recording Data - During the next four weeks, students will take 10 to 15 minutes each day to collect and record their data

**Instructional Tip:**
Review the elapsed time concept with the class so students understand how to calculate hours of sunlight by counting the hours from sunrise to sunset. Show students how to use a clock to calculate elapsed time. This may be challenging for some students. Initially, practice calculating elapsed time with the entire class. Eventually, students will work in groups to determine elapsed time. Check to see if there is a program in the community that provides newspapers to classrooms.

**Concluding Day**
10. Have students organize their data of high/low temperatures, sunrise/sunset times and hours of daylight. Students may organize the data in the chart showing high temperature and hours of sunlight for each day. Construct separate graphs for hours of sunlight, sunrise and sunset times and daily high temperature. Help student to see the patterns in their constructed graphs. Have students work in groups with each student responsible for constructing his/her own charts/graphs and writing his/her explanations.
11. Help students as needed with graph construction. While students are working, observe, ask questions to prompt thinking, clarify confusions and assist students as needed. This may act as an informal assessment about students’ abilities to organize data and write explanations.
12. After each group is finished with the graphs and explanations, have several students or groups share their graphs and explanations with the class.
13. Conclude with a class discussion. Suggested questions to guide discussion:
   - Which day had the lowest temperature? How many degrees?
   - Which day had the highest temperature? How many degrees?
   - What did you notice about the temperature each day?
   - Which day had most hours of daylight? How many hours?
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e. Which day had least hours of daylight? How many hours?
f. What did you notice about the hours of daylight each day?
g. Did you notice any relationship between the hours of the daylight and the temperature? Explain.
h. Did you find any patterns? Explain.
i. What do you think will happen next?


**Differentiated Instructional Support:**
Instruction is differentiated according to learner needs to help all learners either meet the intent of the specified indicator(s) or, if the indicator is already met, to advance beyond the specified indicator(s).
- Have students copy from the class chart.
- Inform students to work individually or in groups.
- Provide students with a variety of sources- Internet, newspaper, television and radio-to collect data.
- Instruct students, who have difficulty writing, to share orally or have partners scribe for them.
- Highlight information from the newspaper for students who have difficulty locating needed information.

**Extensions:**
- Invite a meteorologist to talk about how weather reports are produced from accurately recorded weather data and weather patterns.
- Conduct investigations to observe and record data about other weather conditions (e.g., rainfall, air pressure, etc.)
- Use the Internet to obtain high/low temperature information about another part of the state and/or country and compare data to the local data that was gathered.
- Create a Web page to post the local data as well as data gathered from other communities around the state and/or country.
- Access newspaper Web sites to show examples of weather graphs and charts.

**Homework Options and Home Connections:**
- Instruct students to collect and record high/low temperatures and sunset/sunrise information at home over the weekend.
- Have students take their graphs and explanations home and share them with parents or siblings. Parents may write journal entries about what they learned. Then, have students share entries with the class.
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Interdisciplinary Connections:
Mathematics
- Data Analysis and Probability
  Benchmark B: Read and interpret tables, charts, graphs (bar, picture, line, line plot), and timelines as sources of information, identify main idea, draw conclusions, and make predictions.
  Indicator 2: Represent and interpret data using tables, bar graphs, line plots and line graphs.

Materials and Resources:
The inclusion of a specific resource in any lesson formulated by the Ohio Department of Education should not be interpreted as an endorsement of that particular resource, or any of its contents, by the Ohio Department of Education. The Ohio Department of Education does not endorse any particular resource. The Web addresses listed are for a given site’s main page, therefore, it may be necessary to search within that site to find the specific information required for a given lesson. Please note that information published on the Internet changes over time, therefore the links provided may no longer contain the specific information related to a given lesson. Teachers are advised to preview all sites before using them with students.

For the teacher: Class chart/table to record high/low temperatures, class chart/table to record sunset/sunrise times, graph paper, books about weather (to read during pre-assessment), large clock and/or small clocks with minute and hour hands for calculating elapsed time.

For the students: Student chart/table to record high/low temperatures, student chart/table to record sunset/sunrise times, thermometer for each group, stopwatch, timer or clock with a second hand for each group.

Vocabulary:
- collect
- elapsed time
- explanation
- investigation
- reasonable
- record
- relationship
- temperature
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**Technology Connections:**
- Assist students in using the Internet to access weather information.
- Guide students who wish to use spreadsheets to create graphs and/or charts of the high/low, sunrise/sunset data.
- Work with the school media specialist to use a word-processing program and/or portable keyboards in place of paper and pencil.

**Research Connections:**

Learning strategies used in the lessons make connections to students’ past and present learning experiences. Students are given the opportunity to engage in guided and open explorations. Discussions are the integral part of the lessons. Students develop understanding of the concept being taught in the lesson. Teacher’s questioning, student journals and discussions are woven throughout the lesson.


According to the learning cycle, it takes five to six experiences before a concept becomes a permanent part of a person’s knowledge. This lesson gives students opportunities to engage, explore, explain, and apply the concept being taught.


Cooperative-learning grouping has a powerful effect on student learning. This type of grouping includes the following elements: positive interdependence, face-to-face interaction, individual and group accountability, interpersonal and small-group skills and group processing.

**General Tips:**
- Additional resources may be necessary to collect data because some daily newspapers give a forecast, but not the actual data. Other newspapers provide weather information for today and yesterday. Remind students to record the correct data. Today’s weather information is a forecast, not the actual data.
- Many students have difficulty with the concept of elapsed time. In order to calculate hours of sunlight, they will need to know how to figure out elapsed time.
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Attachments:
Attachment A, Sample Water Temperature Graph
Attachment B, Pre-Assessment Scoring Chart
Attachment C, Post-Assessment Scoring Guidelines
Attachment D, Daily High/Low Temperature
Attachment E, Hours of Daylight
Attachment F, Temperature and Hours of Daylight
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Attachment A
Sample Water Temperature Graph

*This data is a sample of possible results. Your results will vary depending upon the initial temperature of the water and the room temperature.

![Water Temperature Graph]

<table>
<thead>
<tr>
<th>Temperature in Fahrenheit</th>
<th>0 min.</th>
<th>3 min.</th>
<th>6 min.</th>
<th>9 min.</th>
<th>12 min.</th>
<th>15 min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>80</td>
<td>79</td>
<td>77</td>
<td>74</td>
<td>72</td>
<td>72</td>
</tr>
</tbody>
</table>
### Attachment B

#### Pre-Assessment Scoring Chart

<table>
<thead>
<tr>
<th></th>
<th>Exceeds Expectations</th>
<th>Meets Expectations</th>
<th>Needs Improvement</th>
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<tbody>
<tr>
<td>Data is accurately collected and recorded in a chart or table.</td>
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<td>Data is accurately graphed.</td>
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<tr>
<td>Explanations are supported by the collected data.</td>
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Temperature and Hours of Daylight – Grade Four

Attachment C
Post-Assessment Scoring Guidelines

Four
• The records of observations are complete, accurate and understandable.
• Data is accurately and neatly organized.
• Explanation of the relationship between the hours of daylight and temperature is reasonable and consistent with collected data.

Three
• The records of observations are complete, accurate and understandable.
• Data is accurately organized.
• Explanation of the relationship between the hours of daylight and temperature is reasonable.

Two
• The records of observations are mostly accurate and complete.
• Data is mostly organized.
• Explanation of the relationship between the hours of daylight and temperature is unclear.

One
• The records of observations are incomplete and inaccurate.
• Organized data is not clear.
• Explanation has no relationship to collected data.

Zero
• No attempt is made.
Temperature and Hours of Daylight – Grade Four

Attachment D

Name _______________________________
Date ________________________________

Daily High/Low Temperature

<table>
<thead>
<tr>
<th>Date</th>
<th>High Temperature in Fahrenheit (°F)</th>
<th>Low Temperature in Fahrenheit (°F)</th>
<th>Difference in Temperature</th>
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Temperature and Hours of Daylight – Grade Four

Attachment E

Name ______________________________
Date _______________________________

Hours of Daylight

<table>
<thead>
<tr>
<th>Date</th>
<th>Sunrise Time</th>
<th>Sunset Time</th>
<th>Hours of Daylight</th>
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<tbody>
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Temperature and Hours of Daylight – Grade Four

Attachment F
Temperature and Hours of Daylight

<table>
<thead>
<tr>
<th>Date</th>
<th>High Temperature in Fahrenheit (°F)</th>
<th>Hours of Daylight in hours and minutes</th>
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