Grade Level: 6-12

Activity Duration:
Introduction: 5-30 minutes
Activity 1: 15 minutes
Activity 2: 30-60 minutes
Wrap-up: 10 minutes

Overview:
I. Introduction to the Nature of Science
II. Sort Types of Investigative Questions
III. Observation & Investigative Question Writing

Summary: Students will explore the process and nature of science through discussion, observation of the natural world and the development of testable/observable investigative questions.

Topic: Scientific Observation and Question Development

Theme: The basis for scientific inquiry begins with the process of making observations and asking questions.

Objectives:
1. Students will describe the process of scientific investigation.
2. Students will distinguish between three different types of investigative questions.
3. Students will create detailed observations of the natural environment using pictures, numbers, words, labeled diagrams, and questions.
4. Students will use measurement tools during observation.
5. Students will suggest questions about the natural world that can be investigated.

Lesson Adapted From:
Suggested MN Science Standards:
*This lesson may partially or fully address the following standards.

**Grade K:**
0.1.1.2.1 - Use observations to develop an accurate description of a natural phenomenon and compare one’s observations and descriptions with those of others.

**Grade 1:**
1.1.1.2 - Recognize that describing things as accurately as possible is important in science because it enables people to compare their observations with those of others.
1.1.3.2.1 - Recognize that tools are used by people, including scientists and engineers, to gather information and solve problems. For example: Magnifier, snowplow, calculator.

**Grade 2:**
2.1.1.2.1 - Raise questions about the natural world and seek answers by making careful observations, noting what happens when you interact with an object, and sharing the answers with others.

**Grade 3:**
3.1.1.2.1 - Generate questions that can be answered when scientific knowledge is combined with knowledge gained from one’s own observations or investigations.
3.1.1.2.3 - Maintain a record of observations, procedures and explanations, being careful to distinguish between actual observations and ideas about what was observed.
3.1.3.2.1 - Understand that everybody can use evidence to learn about the natural world, identify patterns in nature, and develop tools.
3.1.3.2.2 - Recognize that the practice of science and/or engineering involves many different kinds of work and engages men and women of all ages and backgrounds.
3.1.3.4.1 - Use tools, including rulers, thermometers, magnifiers and simple balance, to improve observations and keep a record of the observations made.

**Grade 5:**
5.1.1.1.3 - Understand that different explanations for the same observations usually lead to making more observations and trying to resolve the differences.
5.1.1.2.1 - Generate a scientific question and plan an appropriate scientific investigation, such as systematic observations, field studies, open-ended exploration or controlled experiments to answer the question.
Grade 7:
7.1.1.2.1 – Generate and refine a variety of scientific questions and match them with appropriate methods of investigation such as field studies, controlled experiments, review of existing work, and development of models.

Grade 8:
8.2.3.3.2 - Understand that scientific knowledge is always changing as new technologies and information enhance observations and analysis of data.

Grades 9-12:
9.1.1.1.2 - Understand that scientists conduct investigations for a variety of reasons, including: to discover new aspects of the natural world, to explain observed phenomena, to test the conclusions of prior investigations, or to test the predictions of current theories.
9.1.1.2.1 - Formulate a testable hypothesis, design and conduct an experiment to test the hypothesis, analyze the data, consider alternative explanations, and draw conclusions supported by evidence from the investigation.
9.1.3.3.3 - Describe how scientific investigations and engineering processes require multi-disciplinary contributions and efforts.

Environmental Literacy Scope and Sequence

Benchmarks:
- Social and natural systems are made of parts. (K-2)
- In social systems that consist of many parts, the parts usually influence each one another. (3-5)
- The output from a social or natural system can become the input to other parts of social and natural systems. (6-8)
- Social and natural systems are connected to each other and to other larger and smaller systems. (6-8)
- Interaction between social and natural systems is defined by their boundaries, relation to other systems, and expected inputs and outputs. (9-adult)

Concepts addressed in this lesson: similarities and differences, cause and effect, ecosystem, patterns

For the full Environmental Literacy Scope and Sequence, see: [www.seek.state.mn.us/eemn_c.cfm](http://www.seek.state.mn.us/eemn_c.cfm)
Great Lakes Literacy Principles
Please note: not all Great Lakes Literacy Principles are addressed in this lesson.

- Water makes the Earth habitable; fresh water sustains life on land.
- The Great Lakes support a diversity of life and ecosystems.
- The Great Lakes and humans in their watersheds are inextricably interconnected.
- Much remains to be learned about the Great Lakes.

For more information about the Great Lakes Literacy Principles, visit: http://greatlakesliteracy.net/

Materials:
Introduction – Essential Question:
- How Science Works Poster
- White board, note paper, or giant sticky notes
- Writing utensil, colorful markers recommended
- Video “Big Idea 1: Earth Scientists Study Our Planet”: http://tinyurl.com/opd8p23

Activity 1 - Questions to Investigate:
- Set of Question Sort Cards (1/group)
  - Cut cards, separate, and place in an envelope
- Handout: Three Types of Investigation Questions (1/group)
  - Answer Key: Three Types of Investigation Questions Answer Key

Activity 2 - Observation Investigation:
- Hula-hoops or bike tire inner tubes or empty frames – 1/group
  OR Lake Superior fish and stomach content images – 1 set of 3/group
- Note pad/journal/clipboard with paper – 1/student
- Writing utensil – 1/student
- Ruler or measuring tapes – 1/group
- Spring scale - 1/group
- Weighing bag – 1/group
- Magnifying equipment and/or laser infrared thermometer – 1/group

Wrap-up
- Handout: Question Reflection Sheet 1/group
- Concept maps from Introduction
Vocabulary:

**Comparative Question** – Questions focus on one measured variable in at least two different (manipulated variable) locations, times, organisms, or populations.

**Correlative Question** – Questions focus on two variables to be measured and tested for a relationship or pattern.

**Descriptive Question** – Questions involving descriptions of a natural system. They focus on measureable or observable variables that can be represented spatially in maps or as written descriptions, estimations, averages, medians, or ranges.

**Experiments** – Scientific tests that involve manipulating some factor or factors in a system in order to see how those changes affect the outcome or behavior of the system.

**Essential Question** – Main concept(s) in curriculum stated in the form of a question.

**Food Web** – A diagram of a complex, interacting set of food chains in an ecosystem.

**Hypothesis** – A proposed explanation for a fairly narrow set of phenomena, based on prior experience, scientific background knowledge, preliminary observations, and logic.

**Observation** – To make note, record, or attend to a result, occurrence, or phenomenon. Though we typically think of observations as having been made "with our own eyes," in science, observations may be made directly (by seeing, feeling, hearing, tasting, or smelling) or indirectly using tools.

**Scientific Process** – A dynamic, creative process built upon deeper and deeper investigations of the natural world. Observations, asking questions, testing ideas, peer evaluation, collaboration, and discoveries cycle repeatedly in an effort to gain a better understanding of the natural world.

**Testable Question** – A question that sets up what could explain an aspect of the natural world by stating what one would expect to observe and comparing that expectation to what one actually observes.
Instructor Background:
The information below is sourced from http://undsci.berkeley.edu/

The scientific process is a powerful method for understanding the natural world because it is based on observations of how the world works. Science relies on investigating ideas by gathering data to answer questions. One way the scientific process is often represented is as a simple, linear six step process (Fig. 1).

![Figure 1. A linear, six-step model is a simple way to begin thinking about the scientific process.](image)

This graphic represents the summarized version of content areas reported on in a paper, report or publication. It does not accurately capture the complexity of the actual process. The scientific process is rarely, if ever, linear.

For example, imagine that you were curious about what fish eat in Lake Superior. The first step might be to review scientific literature to determine what is known about food preferences for Lake Superior fish. As you conduct your review, you may learn that fish eat different foods at different stages in their life cycles. Sometimes fish eat plants, algae or invertebrates while other times they eat other fish. In fact each species has its own food preferences. Already this investigation requires asking more than one question.

After doing some additional digging, you learn that a particular species of zooplankton, *Mysis relicta*, or *Mysis* for short, is a particularly important link in the Lake Superior food web. You refine your very general research question to focus on a single, testable question, “Is *Mysis* an equally important food item to all fish in Lake Superior?” From this question you formulate a hypothesis: “*Mysis* is an equally important food source for all fish species”. Intuitively, you suspect this is not the case, but now you can set up experiments or collect observational data that will either support or reject your hypothesis.
Testing ideas

After an idea is refined, researchers design experiments that test their idea or hypothesis, make observations, and collect and interpret data. Data interpretation is probably the most exciting part of the scientific process because what you learn informs your next steps. Data collected may bring you back to gathering more data, or move you into a different phase of the scientific process all together.

Going back to our example about what fish eat in Lake Superior, the methods you develop for testing the hypothesis “Mysis is an equally important food source for all fish species,” require you to collect 100 individual fish from five different species over three seasons. You learn what they have been eating by opening up their stomachs and identifying the contents. You record how many Mysis you find in each fish species, and you learn that Mysis is an important food source for all fish, but not of equal importance in all species. The diet of rainbow smelt (an invasive species) and kiyi (a native species) are almost entirely made up of Mysis. However, while you conduct this work you notice something else. Some fish seem to eat more Mysis depending on the time of year. This observation leads to an entirely different question, “Are Mysis an equally important food source throughout the entire year?” This question leads you to another iteration of the scientific process.

It is natural for other questions to arise while conducting research, “muddying” the oversimplified linear approach, and there are often confounding factors, such as other environmental influences or conditions that complicate the story. The process of science involves many layers. Science is not linear; rather it is ever-changing, and cyclical (fig 2).
Figure 2. Integral parts of the scientific process.
There are many entry points into the process. Perhaps there is a new technology to be tested, a practical problem to solve, or a surprising observation that inspires you to learn more. Within the scientific process there is an exploration and discovery phase. During this phase, a researcher finds out what other scientists have learned. This may be done by exploring previous research, sharing data and ideas with other researchers, asking questions, making more observations, and refining or expanding the scope of what is investigated based on what is learned. Researchers may revisit this phase during the scientific process, as there are many routes through the process (fig. 3).

Figure 3. Four stages of the scientific process and two potential paths through the scientific process.
Procedure:

Introduction – Big Question Concept Map

1. Provide an essential question for students to answer.
   a. This question should be largely complex and generally does not have a single answer.
   b. This could relate to your current topic of study (i.e. How did land forms affect nomadic populations prior to European settlement?, What is climate change?, etc.), local environment (What is the carrying capacity for life in Lake Superior?), or the question could be as broad as “What is Science?” or “What is the process of Science?”
   c. For the purpose of this lesson the Essential Question is “What is the process of science?”

2. Ask students to take 5 minutes to create a concept map related to the essential question.

   For information about using concept maps in the classroom visit:
   http://tinyurl.com/7zlnu5k - How to Use A Concept Map or
   http://tinyurl.com/23air9u - “The Theory Underlying Concept Maps and How to Construct and Use Them”

   Student Prompts:
   a. Use words, phrases and pictures
   b. Try to answer the big question or
   c. Describe what you think you already know on the topic

3. Within student groups encourage students to share some of the concepts from their concept map.
   a. Were you able to answer the question? Why or why not?
   b. What else do you need to know? How can you find out?

4. Discuss how big questions, like the one you have been thinking about, can be very complex to answer. The process of science is dynamic and involves asking many questions based on observations and experiments. Big questions need to be broken down into simpler questions, which are observable and testable in order to build understanding.
5. This lesson’s activities will facilitate exploration of the different types of questions that can be answered in a scientific investigation (note there are many things science cannot answer - [http://tinyurl.com/kmkawhf](http://tinyurl.com/kmkawhf) - “Science Has Limits” from UC Berkeley). The lesson will provide opportunities for students to practice developing questions based on observations.

**Activity 1: Questions to Investigate – Sort Activity**

**What types of questions can be investigated in science?**

1. Introduce students to the terms on the Three Types of Investigative Questions Worksheet: descriptive, comparative, and correlative. Write these categories on a board or on pieces of presentation paper for use at the end of this activity.

2. Divide your students into groups of 3 or 4.

3. Hand one set of Investigative Questions cards and one Three Types of Investigation Questions worksheet to each group.

4. For the next 10 minutes: given the categories of Descriptive, Comparative, and Correlative – how would you categorize the set of questions in your set of cards?

5. To help foster the discussion and understanding of the process within the small groups you can ask each group some of the following questions:
   
   a. Did everyone agree? How did you come to your final decision?
   
   b. Can each person in the group come up with a justification as to why these questions fall into the categories they do?
   
   c. Do you have an uncertainty pile? If so, why? What more do you need to know?
   
   d. What questions do you have about the three categories?

6. After about 10 minutes, have the class share how they grouped their questions. Using the chart created at the beginning of the lesson, have students from various groups place a question in the category they selected and explain why their group chose that category.

7. Now that the students have an understanding of how questions can be written, they can begin to formulate their own questions.
Activity 2: Observation Investigation and Creating Questions

1. Identify an outdoor space that is safe for students to access and make observations or use the *Lake Superior Fish Food Focus* indoor alternative lesson found on page 15.

2. Gather a variety of tools for each group to use while making observations,
   a. Suggested tools include: tape-measures, spring scales, magnifying equipment, thermometers, etc.
   b. Not all groups need to have the exact same tools, but each group should have at least three tools.

3. Have each student create a journal page to use for observations and emerging questions with:
   a. Name
   b. Date
   c. Time
   d. Location
   e. Weather (if conducting a field observation)
   f. Title of Activity (making observations, or observing ____________)
   g. Columns with the headings: I observe, I wonder.

   Example:  
   
<table>
<thead>
<tr>
<th>I observe</th>
<th>I wonder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Explain that the students will be conducting an observation of an indoor or outdoor location depending on the topic or focus chosen by the teacher. (*See Lake Superior Fish Food Focus, an* indoor alternative lesson found on page 15 for a fish themed example.)

5. Students will be making observations and creating at least six questions based on their observations while conducting this activity.
6. Provide an overview of what good observation skills entail:
   a. Describing using your senses: “What does it look like (size, shape, color),
      feel like (temperature, texture), smell like, or sound like?”
   b. Including drawings that are labeled, show detail, and metric measurements.
   c. Looking up, down, in the middle, far away and close-up.
   d. Identifying relationships and connections that the object has with things that
      are around it.
   e. Writing down questions that come up while making observations

7. Ask the students to organize their observations in their journal by having
   descriptions of the observations grouped together under “I Observe” and questions
   that arise grouped together under “I Wonder” in their journal.

8. Before breaking into smaller groups and handing out tools, spend 10 minutes
   recording observations of the whole study area and have the students start writing
   down questions they may have about what they are observing.
   a. Below are prompts to help students get started
      i. I am curious about…
      ii. It surprised me that…
      iii. I wonder how this part affects another part of the system…

9. After 10 minutes are up, let the students know they will now be using scientific
   tools to observe a smaller section of the space they were just observing.

10. Briefly cover how each science tool can be used.

11. Break students into groups of 3 or 4 and identify each student’s role for the
    group. (Equipment manager, time keeper, task monitor, encourager, checker,
    reflector, etc.)

12. Hand out science tools to each group.
   a. One hula hoop, bike tire inner-tube, empty frame
   b. At least three observation tools to each group

13. Ask students to place their hula hoop, bike tire inner-tube, or empty frame around
    an area which will become their mini-observation site
14. Give your students 15 minutes to observe their mini-observation site and formulate at least 5 or 6 questions based on their observations.

15. Remind students that they can record their observations using drawings, sentences, lists or in a metric data chart.

16. Bring students back together as a large group.

17. Discuss any relationships they noticed between the large study area and the mini-observation site. What similarities and differences did you notice?

Wrap-up – Discussion Question Suggestions:

1. Hand out one Question Reflection Sheet to each group of students.
   a. Categorize the questions students created during their observations as descriptive, comparative, correlative, essential, why, or testable.
   b. Have students share their observations and questions with their group or a partner.

2. Engage in a group discussion using the following questions:
   a. Are their similarities in their observations/questions among all of the groups?
   b. Are their differences in their observations/questions among all of the groups?
   c. What made observations/questions different? Did the tools provide a different perspective (also considered a bias - were there any other bias from different groups or individuals?)

3. Out of the six categories the questions were sorted into, which category of questions are we able to conduct further scientific study to try and answer them. (Descriptive, comparative, correlative)

4. If outside, return to the classroom.

5. Have the students revisit their concept maps and take 3-5 minutes to add new ideas to the concept map.
Assessment:

Review student’s journal observations for a range of representational forms including numbers, words, labeled diagrams, and drawings. Descriptions might include size, shape, color, texture, or smell.

As you review student work you can look for:

- Did observations fill the notebook page?
- Were drawings detailed, with small objects enlarged to show details?
- Parts of drawings are labeled.
- Measurements are recorded in metric units.
- Student was able to correctly categorize questions from their observation.

Example Indoor Alternative Activity (for Activity 2 of the lesson plan):

If unable to go outside to conduct an observation identify an object or set of objects to observe, such as leaves, shoes, rocks, preserved organisms, etc., and collect enough specimens to conduct the observation in your classroom.

**LAKE SUPERIOR FISH FOOD FOCUS:**

Follow procedure for Introduction, Activity 1 and Activity 2 outlined in the main lesson plan substituting the included fish and fish stomach content images as the focus of student observation.

1. Print out enough sets of three Lake Superior fish and stomach content images so that each student will have a copy of one fish and that the students will be divided into groups of three or four by matching their spring/summer/fall fish together. (These fish represent 3 of 48 species living in the lake. Groups will have different fish, some of which spend most of their time in shallow water (Kiyi), deep water (Lake Whitefish) or at the bottom of the lake (Siscowet). One side of for each species includes representative stomach contents for the particular fish in the spring, summer and fall.)
2. Provide each student one fish poster from the **Lake Superior fish and stomach content images**.

3. View video of live fish at:
   
   a. Lake Trout swimming in Great Lakes Aquarium exhibit
      
      http://www.youtube.com/watch?v=cvA-arTc84I
   
   b. Divers swimming with Lake Trout in Lake Superior at night
      
      http://www.youtube.com/watch?v=f0K6W -nyPU

4. For the “whole study area” portion of the observation have the students look at the image of the fish that does not show the stomach contents and the videos. Prompt students to make and record their observations and questions about the fish in front of them in their journals as described in the lesson plan.

5. Have the students turn their images to the stomach content side and match up their fish with the other students in the class. Each group should have one fish of the same species for each season. (One Kiyi spring, summer, and fall, etc.)

6. Follow the instructions for the “mini-observation site” portion of the observation using the fish that show the stomach contents.

7. Continue to the Wrap-up from lesson plan.

**Extensions:**

1. Additional kits are available through the Great Lakes Aquarium Teacher Resource Library to support the further extension of this lesson.

   Recommended pre-lesson: MinnAqua Program: Get in the Habitat! – Lesson 2:1 – Fish Families

   Recommended post-lesson: Lake Superior: Who lives there and what do they eat?

2. Have students identify 1 testable question to develop a research plan or experimental design.
3. Show this video (an Earth Science Example) and have students add to their concept map about the nature of science:

“Big Idea 1: Earth Scientists Study Our Planet”: http://tinyurl.com/opd8p23

4. Compare these two graphical descriptions of the process of science

http://tinyurl.com/nk2o4ut - Complex flow chart for the scientific process
http://tinyurl.com/pnzsoew - Simple flow chart for the scientific process

5. Compose an argument for which question can be answered most accurately, easily, ethically, safely, etc.

6. Given a curriculum topic, have students develop a descriptive, comparative, and correlative question that relate to your current topic of study.

**K-5 Options**

1. For K-2 audiences – do a large-group introduction on how to ask a question. Conduct Activity 2 – outdoor observation or indoor alternative and have a large group discussion about questions that may arise from the observations.

2. For 3-5 audiences – The introduction and Activity 1 may need to be conducted as a large-group guided activity before embarking on Activity 2.
References:

1. Isaac, Edmund Jacob. “An Evaluation of the Importance of Mysis relicta to the Lake Superior Fish Community.” A thesis submitted to the faculty of the Graduate School of the University of Minnesota. (2010)


Three Types of Investigation Questions

**Descriptive Questions**

Descriptive field investigations involve describing parts of a natural system. Descriptive questions focus on measurable or observable variables that can be represented spatially in maps or as written descriptions, estimations, averages, medians, or ranges.

- How many _____ are there in a given area?
- How frequently does _____ happen in a given period?
- What is the [temperature, speed, height, mass, density, force, distance, pH, dissolved oxygen, light density, depth, etc.] of ______?
- When does _____ happen during the year? (flowering, fruit, babies born)
- Where does_____ travel over time? (What is an animal’s range?)

**Comparative Questions**

In comparative field investigations data is collected on different groups to make a comparison. Comparative questions focus on one measured variable in at least two different (manipulated variable) locations, times, organisms, or populations.

- Is there a difference in ______ between group (or condition) A and group B?
- Is there a difference in ______ between (or among) different locations?
- Is there a difference in ______ at different times?

**Correlative Questions**

Correlative field investigations involve measuring or observing two variables and searching for a pattern. Correlative questions focus on two variables to be measured and tested for a relationship.

- What is the relationship between variable #1 and variable #2?
- Does _____ go up when _____ goes down?
- How does _____ change as _____ changes?
Descriptive Questions

9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20

Descriptive field investigations involve describing parts of a natural system. Descriptive questions focus on measurable or observable variables that can be represented spatially in maps or as written descriptions, estimations, averages, medians, or ranges.

- How many _____ are there in a given area?
- How frequently does _____ happen in a given period?
- What is the [temperature, speed, height, mass, density, force, distance, pH, dissolved oxygen, light density, depth, etc.] of ______?
- When does _____ happen during the year? (flowering, fruit, babies born)
- Where does_____ travel over time? (What is an animal’s range?)

Comparative Questions

1, 2, 3, 4, 5, 6, 7, 8, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30

In comparative field investigations data is collected on different groups to make a comparison. Comparative questions focus on one measured variable in at least two different (manipulated variable) locations, times, organisms, or populations.

- Is there a difference in ______ between group (or condition) A and group B?
- Is there a difference in ______ between (or among) different locations?
- Is there a difference in ______ at different times?

Correlative Questions

31, 32, 33, 34, 35, 36, 37, 38, 39, 40

Correlative field investigations involve measuring or observing two variables and searching for a pattern. Correlative questions focus on two variables to be measured and tested for a relationship.

- What is the relationship between variable #1 and variable #2?
- Does _____ go up when _____ goes down?
- How does _____ change as _____ changes?
<table>
<thead>
<tr>
<th>1</th>
<th>Does more purple iris grow in riparian, forest, or field habitats?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Are more insects found in the schoolyard in September, October, or November?</td>
</tr>
<tr>
<td>3</td>
<td>Is wind speed greater near the building or out on the playground in March?</td>
</tr>
<tr>
<td>4</td>
<td>Where do you find the most pill bugs (isopods): under a log, under a pot, or under bushes?</td>
</tr>
<tr>
<td>5</td>
<td>Which habitat (in the forest, in a field, or by a stream) has the greatest percentage of sand in the soil?</td>
</tr>
<tr>
<td>6</td>
<td>Are soil temperatures the coolest at a depth of 5cm, 10cm, or 15cm?</td>
</tr>
<tr>
<td>7</td>
<td>In April, which twigs grow faster, those on maple trees or those on oak trees?</td>
</tr>
<tr>
<td>8</td>
<td>Are traffic sounds louder in front of the school or behind the school?</td>
</tr>
<tr>
<td>9</td>
<td>How many Pileated Woodpeckers live in our neighborhood?</td>
</tr>
<tr>
<td>10</td>
<td>How many deer live in my city?</td>
</tr>
<tr>
<td></td>
<td>Question</td>
</tr>
<tr>
<td>---</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>11</td>
<td>How many eggs does a bluegill lay in my local lake?</td>
</tr>
<tr>
<td>13</td>
<td>What is the depth of (a creek near you) by (a road or access point near you) in September?</td>
</tr>
<tr>
<td>15</td>
<td>What kinds of plants grow in ___ Forest?</td>
</tr>
<tr>
<td>17</td>
<td>When do robins in Minnesota nest?</td>
</tr>
<tr>
<td>19</td>
<td>What is the range of black bears living in Superior National Forest?</td>
</tr>
<tr>
<td></td>
<td>Question</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>21</td>
<td>Is there a difference in the size of the range of an osprey or American bald eagle along Lake Superior’s north shore?</td>
</tr>
<tr>
<td>23</td>
<td>Which location (under bushes, open grass, or on black top) has the highest temperature at 7:00 a.m. at your school?</td>
</tr>
<tr>
<td>25</td>
<td>Are there more black maple near streams or away from streams in _______?</td>
</tr>
<tr>
<td>27</td>
<td>Do more ferns grow close to the water or away from the water?</td>
</tr>
<tr>
<td>29</td>
<td>Do temperatures differ between forested and non-forested streams in___?</td>
</tr>
<tr>
<td>31</td>
<td>How does walleye spawning timing change from southern Minnesota to northern Minnesota?</td>
</tr>
<tr>
<td>32</td>
<td>How does dissolved oxygen change as water temperature goes up in ____ stream?</td>
</tr>
<tr>
<td>33</td>
<td>How do mouse populations change as hawk populations increase in ______?</td>
</tr>
<tr>
<td>34</td>
<td>How do heron populations change as eagle populations increase in the Lake Superior watershed?</td>
</tr>
<tr>
<td>35</td>
<td>As the sun rises and sets, how does the location of Mysis (a plankton) in the water column in Lake Superior change?</td>
</tr>
<tr>
<td>36</td>
<td>What is the relationship between number of days over 60°F in the spring and germination of _____ seeds (or time of flowering)?</td>
</tr>
<tr>
<td>37</td>
<td>What is the relationship between the amount of sunshine and red color in leaves in fall?</td>
</tr>
<tr>
<td>38</td>
<td>How does pH affect the number of brook trout eggs hatching in a stream?</td>
</tr>
<tr>
<td>39</td>
<td>Is there a difference between the structure of aquatic plants found along a shoreline and underwater?</td>
</tr>
<tr>
<td>40</td>
<td>How does lake trout population change as Mysis (a plankton) population changes?</td>
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<td>Type of Question</td>
<td>Examples</td>
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<td>------------------------------------------------------</td>
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<tr>
<td>Book/Internet Research</td>
<td>What is the name of this aquatic invertebrate? How long does this fish live? Where does this aquatic plant live?</td>
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<tr>
<td>Essential-Life Pondering, Aways Wonder</td>
<td>How do lakes alter climate?</td>
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<tr>
<td>Descriptive</td>
<td>What do cattails look like in winter? What insects live on this aquatic plant? How do fish use this aquatic plant? How does this aquatic invertebrate reproduce?</td>
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<tr>
<td>Comparitive</td>
<td>Which type (species of aquatic invertebrate) mature to adults the fastest? What is different between the life cycles of a mosquito and a dragonfly?</td>
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<td>Correlative</td>
<td>How does air temperature affect the life cycle of (species of fish)? How does the location of plankton in the water column related to dissolved oxygen?</td>
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<tr>
<td>Why Questions</td>
<td>Why do fish migrate?</td>
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