

# **Main Topic:** Scientific Method

## Learning Objectives/Outcomes:

<b>Topic 1:</b> The Scientific Method	<b>Topic 2:</b> Question, Research, and Hypothesis	<b>Topic 3:</b> Experiment	<b>Topic 4:</b> Data Analysis, Conclusion, and Communication
<p><b>Ideas</b></p> <p><b>What is the scientific method?</b></p> <ul style="list-style-type: none"><li>- A logical problem-solving approach used by scientists.</li></ul> <p><b>Do scientists always follow the scientific method exactly as it is written?</b></p> <ul style="list-style-type: none"><li>- No. The exact steps may vary depending on the problem being addressed by the scientists. Steps may be repeated, modified, or reordered, although scientists generally follow the same basic process.</li></ul>	<p><b>Ideas</b></p> <p><b>What is the point of asking a question at the start of a scientific investigation?</b></p> <ul style="list-style-type: none"><li>- To clearly define the purpose of the investigation by stating what question should be answered or what problem should be solved.</li></ul> <p><b>Should the question be broad or specific?</b></p> <ul style="list-style-type: none"><li>- It should be very specific.</li></ul> <p><b>What is the problem with asking a very broad question?</b></p> <ul style="list-style-type: none"><li>- There may be too many unknowns to test the question easily.</li></ul>	<p><b>Ideas</b></p> <p><b>What is an experiment?</b></p> <ul style="list-style-type: none"><li>- A detailed procedure designed and carried out to test a hypothesis.</li></ul> <p><b>Besides describing how to perform the experiment, what important information should a procedure contain?</b></p> <ul style="list-style-type: none"><li>- The amounts and types of material used in testing should be included.</li></ul> <p><b>How detailed should an experimental procedure be?</b></p> <ul style="list-style-type: none"><li>- It should be as detailed as needed for another scientist to be able to duplicate the experiment exactly.</li></ul> <p><b>What are variables?</b></p> <ul style="list-style-type: none"><li>- The things that change in an experiment.</li></ul> <p><b>What is the independent or manipulated variable?</b></p> <ul style="list-style-type: none"><li>- The variable being tested or changed by the scientist.</li></ul>	<p><b>Ideas</b></p> <p><b>What are data?</b></p> <ul style="list-style-type: none"><li>- The results of the experiment.</li></ul> <p><b>What kind of information can be considered data?</b></p> <ul style="list-style-type: none"><li>- Measurements such as time, temperature, mass, etc. and/or observations.</li></ul> <p><b>How can data be recorded accurately?</b></p> <ul style="list-style-type: none"><li>- In science journals, data tables, charts, and graphs.</li></ul> <p><b>Why should data be recorded in an organized and accurate manner?</b></p> <ul style="list-style-type: none"><li>- This makes it easier to identify patterns or trends, make predictions, and draw conclusions.</li></ul> <p><b>Why do scientists analyze data?</b></p> <ul style="list-style-type: none"><li>- To determine its meaning in relation to the original question or problem.</li></ul>

<p><b>What are the steps of the scientific method?</b></p> <ul style="list-style-type: none"> <li>- 1. Question</li> <li>- 2. Research</li> <li>- 3. Hypothesis</li> <li>- 4. Experiment</li> <li>- 5. Analyze Data</li> <li>- 6. Conclusion</li> <li>- 7. Communicate</li> </ul>	<p><b>Why is it important to conduct background research?</b></p> <ul style="list-style-type: none"> <li>- To determine what others have already discovered about your question.</li> </ul> <p><b>What kinds of sources should be used in research?</b></p> <ul style="list-style-type: none"> <li>- A wide variety of reliable sources should be used. This may include books, magazines, newspapers, journals, and websites.</li> </ul> <p><b>Do all sources need to be documented?</b></p> <ul style="list-style-type: none"> <li>- Yes, all sources that you use to carry out your investigation should be documented to avoid plagiarism.</li> </ul> <p><b>What is a hypothesis?</b></p> <ul style="list-style-type: none"> <li>- A possible explanation based on knowledge, observations, and background research.</li> </ul>	<p><b>Why do scientists generally only have one independent variable at a time?</b></p> <ul style="list-style-type: none"> <li>- It helps ensure that the results in the experiment are due to that one variable.</li> </ul> <p><b>What is a dependent or responding variable?</b></p> <ul style="list-style-type: none"> <li>- The factor that the scientist measures or observes to see how it responds to the independent variable.</li> </ul> <p><b>What does it mean if there is a direct link between an independent variable and dependent variable?</b></p> <ul style="list-style-type: none"> <li>- There may be a cause and effect relationship.</li> </ul> <p><b>Can there be more than one dependent variable in an experiment?</b></p> <ul style="list-style-type: none"> <li>- Yes.</li> </ul> <p><b>What is a controlled variable?</b></p> <ul style="list-style-type: none"> <li>- Factors that a scientist keeps constant in the experiment.</li> </ul> <p><b>Why is it important to have controls?</b></p> <ul style="list-style-type: none"> <li>- It enables the scientist to ensure that results are due only to the independent variable.</li> </ul>	<p><b>How do scientists analyze data?</b></p> <ul style="list-style-type: none"> <li>- They look for differences in the dependent variable between the control and test groups.</li> </ul> <p><b>What does it mean if differences exist in the dependent variables between the control and test groups?</b></p> <ul style="list-style-type: none"> <li>- The independent variable may have had an effect.</li> </ul> <p><b>What does it mean if NO differences exist in the dependent variables between the control and test groups?</b></p> <ul style="list-style-type: none"> <li>- The independent variable probably has no effect.</li> </ul> <p><b>What is a conclusion?</b></p> <ul style="list-style-type: none"> <li>- A statement based on measurements and observations made in the experiment.</li> </ul>
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<p><b>Key Vocabulary</b>  <b>Scientific Method:</b> a logical problem-solving approach used by scientists to answer a scientific question.</p>	<p><b>Key Vocabulary</b>  <b>Hypothesis:</b> a possible explanation based on knowledge, observations, and background research.</p>	<p><b>Key Vocabulary</b>  <b>Experiment:</b> a detailed procedure designed and carried out to test a hypothesis.</p> <p><b>Independent/Manipulated Variable:</b> the variable being tested or changed by the scientist.</p> <p><b>Dependent/Responding Variable:</b> the factor that the scientist measures or observes to see how it responds to the independent variable.</p> <p><b>Controlled Variable:</b> factors that a scientist keeps constant in the experiment.</p>	<p><b>Key Vocabulary</b>  <b>Data:</b> the results of the experiment.</p> <p><b>Conclusion:</b> a statement based on measurements and observations made in the experiment.</p>
<p><b>Pictures</b></p>  <p><b>Observations...</b></p> <p><b>lead to Questions.</b></p> <p><b>Questions form Hypotheses.</b></p> <p><b>Hypotheses must be tested through experimentation.</b></p> <p><b>Analyze Data!</b></p> <p><b>Draw Conclusions!</b></p> <p><b>Share Results!</b></p>	<p><b>Pictures</b></p> 	<p><b>Pictures</b></p> 	<p><b>Pictures</b></p> 