



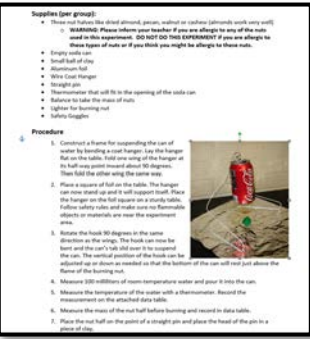
Main Topic: Scientific Method

Learning Objectives/Outcomes:

Topic 1: The Scientific Method	Topic 2: Question, Research, and Hypothesis	Topic 3: Experiment	Topic 4: Data Analysis, Conclusion, and Communication
<p>Ideas</p> <p>What is the scientific method?</p> <ul style="list-style-type: none">- A logical problem-solving approach used by scientists. <p>Do scientists always follow the scientific method exactly as it is written?</p> <ul style="list-style-type: none">- 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.	<p>Ideas</p> <p>What is the point of asking a question at the start of a scientific investigation?</p> <ul style="list-style-type: none">- To clearly define the purpose of the investigation by stating what question should be answered or what problem should be solved. <p>Should the question be broad or specific?</p> <ul style="list-style-type: none">- It should be very specific. <p>What is the problem with asking a very broad question?</p> <ul style="list-style-type: none">- There may be too many unknowns to test the question easily.	<p>Ideas</p> <p>What is an experiment?</p> <ul style="list-style-type: none">- A detailed procedure designed and carried out to test a hypothesis. <p>Besides describing how to perform the experiment, what important information should a procedure contain?</p> <ul style="list-style-type: none">- The amounts and types of material used in testing should be included. <p>How detailed should an experimental procedure be?</p> <ul style="list-style-type: none">- It should be as detailed as needed for another scientist to be able to duplicate the experiment exactly. <p>What are variables?</p> <ul style="list-style-type: none">- The things that change in an experiment. <p>What is the independent or manipulated variable?</p> <ul style="list-style-type: none">- The variable being tested or changed by the scientist.	<p>Ideas</p> <p>What are data?</p> <ul style="list-style-type: none">- The results of the experiment. <p>What kind of information can be considered data?</p> <ul style="list-style-type: none">- Measurements such as time, temperature, mass, etc. and/or observations. <p>How can data be recorded accurately?</p> <ul style="list-style-type: none">- In science journals, data tables, charts, and graphs. <p>Why should data be recorded in an organized and accurate manner?</p> <ul style="list-style-type: none">- This makes it easier to identify patterns or trends, make predictions, and draw conclusions. <p>Why do scientists analyze data?</p> <ul style="list-style-type: none">- To determine its meaning in relation to the original question or problem.

<p>What are the steps of the scientific method?</p> <ul style="list-style-type: none"> - 1. Question 2. Research 3. Hypothesis 4. Experiment 5. Analyze Data 6. Conclusion 7. Communicate 	<p>Why is it important to conduct background research?</p> <ul style="list-style-type: none"> - To determine what others have already discovered about your question. <p>What kinds of sources should be used in research?</p> <ul style="list-style-type: none"> - A wide variety of reliable sources should be used. This may include books, magazines, newspapers, journals, and websites. <p>Do all sources need to be documented?</p> <ul style="list-style-type: none"> - Yes, all sources that you use to carry out your investigation should be documented to avoid plagiarism. <p>What is a hypothesis?</p> <ul style="list-style-type: none"> - A possible explanation based on knowledge, observations, and background research. 	<p>Why do scientists generally only have one independent variable at a time?</p> <ul style="list-style-type: none"> - It helps ensure that the results in the experiment are due to that one variable. <p>What is a dependent or responding variable?</p> <ul style="list-style-type: none"> - The factor that the scientist measures or observes to see how it responds to the independent variable. <p>What does it mean if there is a direct link between an independent variable and dependent variable?</p> <ul style="list-style-type: none"> - There may be a cause and effect relationship. <p>Can there be more than one dependent variable in an experiment?</p> <ul style="list-style-type: none"> - Yes. <p>What is a controlled variable?</p> <ul style="list-style-type: none"> - Factors that a scientist keeps constant in the experiment. <p>Why is it important to have controls?</p> <ul style="list-style-type: none"> - It enables the scientist to ensure that results are due only to the independent variable. 	<p>How do scientists analyze data?</p> <ul style="list-style-type: none"> - They look for differences in the dependent variable between the control and test groups. <p>What does it mean if differences exist in the dependent variables between the control and test groups?</p> <ul style="list-style-type: none"> - The independent variable may have had an effect. <p>What does it mean if NO differences exist in the dependent variables between the control and test groups?</p> <ul style="list-style-type: none"> - The independent variable probably has no effect. <p>What is a conclusion?</p> <ul style="list-style-type: none"> - A statement based on measurements and observations made in the experiment.
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	<p>What qualities should a good hypothesis have?</p> <ul style="list-style-type: none"> - It should be clear, simple, and testable statement. <p>What are the three ways a hypothesis can be written?</p> <ul style="list-style-type: none"> - If...then statements, correlation statements, and comparison statements. <p>Can a hypothesis be wrong?</p> <ul style="list-style-type: none"> - No, a hypothesis is never right or wrong. It is either supported or rejected by the experimental data. <p>Should a hypothesis be changed if the experimental results don't support it?</p> <ul style="list-style-type: none"> - No! A rejected hypothesis can provide important information about a scientist's question. 		<p>What elements should a conclusion include?</p> <ul style="list-style-type: none"> - It should include a summary of results, whether the hypothesis was supported by the data, the significance of the study, and future research. <p>Why do scientists communicate their results?</p> <ul style="list-style-type: none"> - To advance the knowledge and understanding of the scientific community and because it improves future investigations. <p>What are some ways scientists may choose to communicate their results and conclusions?</p> <ul style="list-style-type: none"> - Journals, magazines, websites, television, radio PSAs, in-person lectures, and poster sessions.
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<p>Key Vocabulary Scientific Method: a logical problem-solving approach used by scientists to answer a scientific question.</p>	<p>Key Vocabulary Hypothesis: a possible explanation based on knowledge, observations, and background research.</p>	<p>Key Vocabulary Experiment: a detailed procedure designed and carried out to test a hypothesis.</p> <p>Independent/Manipulated Variable: the variable being tested or changed by the scientist.</p> <p>Dependent/Responding Variable: the factor that the scientist measures or observes to see how it responds to the independent variable.</p> <p>Controlled Variable: factors that a scientist keeps constant in the experiment.</p>	<p>Key Vocabulary Data: the results of the experiment.</p> <p>Conclusion: a statement based on measurements and observations made in the experiment.</p>
<p>Pictures</p>  <p>Observations...</p> <p>lead to Questions.</p> <p>Questions form Hypotheses.</p> <p>Hypotheses must be tested through experimentation.</p> <p>Analyze Data!</p> <p>Draw Conclusions!</p> <p>Share Results!</p>	<p>Pictures</p> 	<p>Pictures</p> 	<p>Pictures</p> 