

Topic: Scientific Method

Learning Objective/Outcome:

Keywords/Questions	Notes
What is the scientific method?	A logical problem-solving approach used by scientists.
Do scientists always follow the scientific method exactly as it is written?	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.
What are the steps of the scientific method?	Question, research, hypothesis, experiment, analyze data, conclusion, and communicate.
What is the point of asking a question at the start of a scientific investigation?	To clearly define the purpose of the investigation by stating what question should be answered or what problem should be solved.
Should the question be broad or specific?	It should be very specific.
What is the problem with asking a very broad question?	There may be too many unknowns to test the question easily.
Why is it important to conduct background research?	To determine what others have already discovered about your question.
What kinds of sources should be used in research?	A wide variety of reliable sources should be used. This may include books, magazines, newspapers, journals, and websites.
Do all sources need to be documented?	Yes, all sources that you use to carry out your investigation should be documented to avoid plagiarism.
What is a hypothesis?	A possible explanation based on knowledge, observations, and background research.
What qualities should a good hypothesis have?	It should be a clear, simple, and testable statement.

<p>What are the three ways a hypothesis can be written?</p>	<p>If...then statements, correlation statements, and comparison statements.</p>
<p>Can a hypothesis be wrong?</p>	<p>No, a hypothesis is never right or wrong. It is either supported or rejected by the experimental data.</p>
<p>Should a hypothesis be changed if the experimental results don't support it?</p>	<p>No! A rejected hypothesis can provide important information about a scientist's question.</p>
<p>What is an experiment?</p>	<p>A detailed procedure designed and carried out to test a hypothesis.</p>
<p>Besides describing how to perform the experiment, what important information should a procedure contain?</p>	<p>The amounts and types of material used in testing should be included.</p>
<p>How detailed should an experimental procedure be?</p>	<p>It should be as detailed as needed for another scientist to be able to duplicate the experiment exactly.</p>
<p>What are variables?</p>	<p>The things that change in an experiment.</p>
<p>What is the independent or manipulated variable?</p>	<p>The variable being tested or changed by the scientist.</p>
<p>Why do scientists generally only have one independent variable at a time?</p>	<p>It helps ensure that the results in the experiment are due to that one variable.</p>
<p>What is a dependent or responding variable?</p>	<p>The factor that the scientist measures or observes to see how it responds to the independent variable.</p>
<p>What does it mean if there is a direct link between an independent variable and dependent variable?</p>	<p>There may be a cause and effect relationship.</p>

Can there be more than one dependent variable in an experiment?	Yes. However, there should only be one independent variable.
What is a controlled variable?	Factors that a scientist keeps constant in the experiment.
Why is it important to have controls?	It enables the scientist to ensure that results are due only to the independent variable.
What are data?	The results of the experiment.
What kind of information can be considered data?	Measurements such as time, temperature, mass, etc. and/or observations.
How can data be recorded accurately?	In science journals, data tables, charts, and graphs.
Why should data be recorded in an organized and accurate manner?	This makes it easier to identify patterns or trends, make predictions, and draw conclusions.
Why do scientists analyze data?	To determine its meaning in relation to the original question or problem.
How do scientists analyze data?	They look for differences in the dependent variable between the control and test groups.
What does it mean if differences exist in the dependent variables between the control and test groups?	The independent variable may have had an effect.
What does it mean if NO differences exist in the dependent variables between the control and test groups?	The independent variable probably has no effect.
What is a conclusion?	A statement based on measurements and observations made in the experiment.

<p>What elements should a conclusion include?</p>	<p>It should include a summary of results, whether the hypothesis was supported by the data, the significance of the study, and future research.</p>
<p>Why do scientists communicate their results?</p>	<p>To advance the knowledge and understanding of the scientific community and because it improves future investigations.</p>
<p>What are some ways scientists may choose to communicate their results and conclusions?</p>	<p>Journals, magazines, websites, television, radio PSAs, in-person lectures, and poster sessions.</p>

Summary

There are seven steps to the scientific method: Question, Research, Hypothesis, Experiment, Data Analysis, Conclusion, and Communication. Although scientists may modify, reorder, or revisit steps on occasion, scientists generally use this basic logical approach.