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Warm-Up | Scientific Inquiry

Lesson Question How do scientists conduct scientific investigations?

Lesson Goals

Describe the process of scientific inquiry.

Identify questions that can be answered through scientific investigation.

Distinguish the three types of scientific investigations, including the benefits and limitations of each.

Distinguish between variables and controls in a scientific investigation.

Words to Know

Fill in this table as you work through the lesson. You may also use the glossary to help you.

control group	the part of an experiment that does not receive the factor being tested and is used to compare results
data	the information gathered from an observation or a scientific investigation
dependent variable	the variable that is measured and affected during the experiment and is dependent on the independent variable

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Words to Know

hypothesis	a possible explanation of or answer to a scientific question that is based on prior knowledge or research and is testable
independent variable	the variable that is changed by the researcher
observation	something that is recognized or noticed by using the senses
scientific inquiry	any process used to ask and answer questions about the natural world
scientific question	a question that is based on observations and can be answered through an investigation

How Scientists Examine Things

Predicting	Using prior knowledge to forecast what will happen next
Classifying	Grouping things together
Modeling	Creating representations of complex objects or processes
Analyzing	Looking closely at something to determine the relationship between its parts
Interpreting	Explaining what something means

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Scientific Inquiry

Scientific inquiry is any process used to ask and answer questions about the natural world.

- Involves many possible paths
- Uses similar processes and practices
- Is not used just by scientists

Scientific Inquiry

Scientific inquiry involves:

- making **observations**.
- asking a question.
- completing background research.
- performing investigations.
- collecting and analyzing data.
- providing explanations.
- communicating results.

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Scientific Questions

A **scientific question** is a question that is based on observations and can be answered through an investigation.

A good scientific question:

- has a narrow focus.
- addresses a gap in knowledge.
- does not have a simple yes or no answer.
- asks for an explanation.
- may lead to a hypothesis that can be tested.

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Descriptive Investigations

Descriptive investigations involve collecting data about a system.

- They make observations, but not comparisons.
- No experiments are conducted.
- A descriptive investigation includes:
  - a scientific question.
  - a procedure.
  - a conclusion.

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Comparative Investigations

Comparative investigations involve collecting data for comparison.

They involve either collecting data on different objects or features or collecting data under different conditions or at different times in order to make a comparison.

- A comparative investigation includes:
  - a scientific question.
  - a hypothesis (possibly).
  - an independent **variable** and a dependent **variable** (possibly).
  - a procedure.
  - a conclusion.

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Experimental Investigations

Experimental investigations involve experiments to gather [evidence] that supports or refutes a [hypothesis].

- An experimental investigation includes:
  - a [scientific] question.
  - a hypothesis.
  - independent and dependent variables.
  - a [control] **group**.
  - a procedure.
  - a [conclusion].

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Benefits and Limitations of Scientific Investigations

	Benefits	Limitations
Descriptive	• Are less expensive and less time-consuming • Usually provide large amounts of data • Can easily add knowledge	• Cannot show cause-and-effect relationships • Give results that can change over time
Comparative	• Usually provide large amounts of information • Use a wide range of variables	• Show a relationship that does not always indicate cause and effect
Experimental	• Are best for cause-and-effect relationships • Allow for control of variables • Are repeatable	• May be impractical • May not be realistic • Can make it hard to control some variables

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Results of Scientific Investigations

All three types of scientific investigations may result in:

- new ideas for study.
- new methods or procedures for investigations.
- new technologies to improve data collection.

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Summary | Scientific Inquiry

Lesson Question

How do scientists conduct scientific investigations?

Answer

(Sample answer) Scientists use the process of scientific inquiry in various ways to conduct investigations.

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Review: Key Concepts

A [scientific] inquiry is any process used to ask and answer questions about the natural world.

- Making observations
- Asking a question
- Performing investigations
- Collecting evidence
- Providing explanations
- [Communicating] results

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Review: Key Concepts

There are three types of scientific investigations.

Descriptive	Comparative	Experimental
• Collecting data and making observations, but not comparisons	• Collecting data for comparison	• Performing an experiment to gather evidence that supports or refutes a hypothesis

Use this space to write any questions or thoughts about this lesson.

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