Warm-Up | Hypotheses, Theories, and Laws

Lesson Objectives

By the end of this lesson, you should be able to:

- Examine the _____ between observations, hypotheses, theories, and laws.
- Explain how hypotheses are _____ and tested.
- Explain how theories may _____ as new areas of science and technology develop.

Science Practice: Give examples of how hypotheses lead to new _____ methods.

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Warm-Up | Hypotheses, Theories, and Laws

Words to Know

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

hypothesis	a [ ] explanation of a scientific problem that is based on research and observation
law	a statement of [ ] that is generally [ ] to be true and universal because it has always been observed to be true
theory	a hypothesis or group of related hypotheses that can be accepted as true based on [ ] and repeated [ ] with similar results

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Slide 1

Lesson Question

Observations and Data

An _____ is an act of recognizing and noting an occurrence using the senses.

- Observation yields _____.
- The data can be _____ or quantitative.
- The data can be analyzed to reveal _____.

Observations are the basis of hypotheses, theories, and laws.

Slide 2

Hypotheses and Theories

- A _____ is a possible explanation of or answer to a scientific question that is based on prior knowledge or research and is _____.
- A _____ is a hypothesis or group of related hypotheses that can be accepted as true based on observation and repeated experimentation with _____ results.

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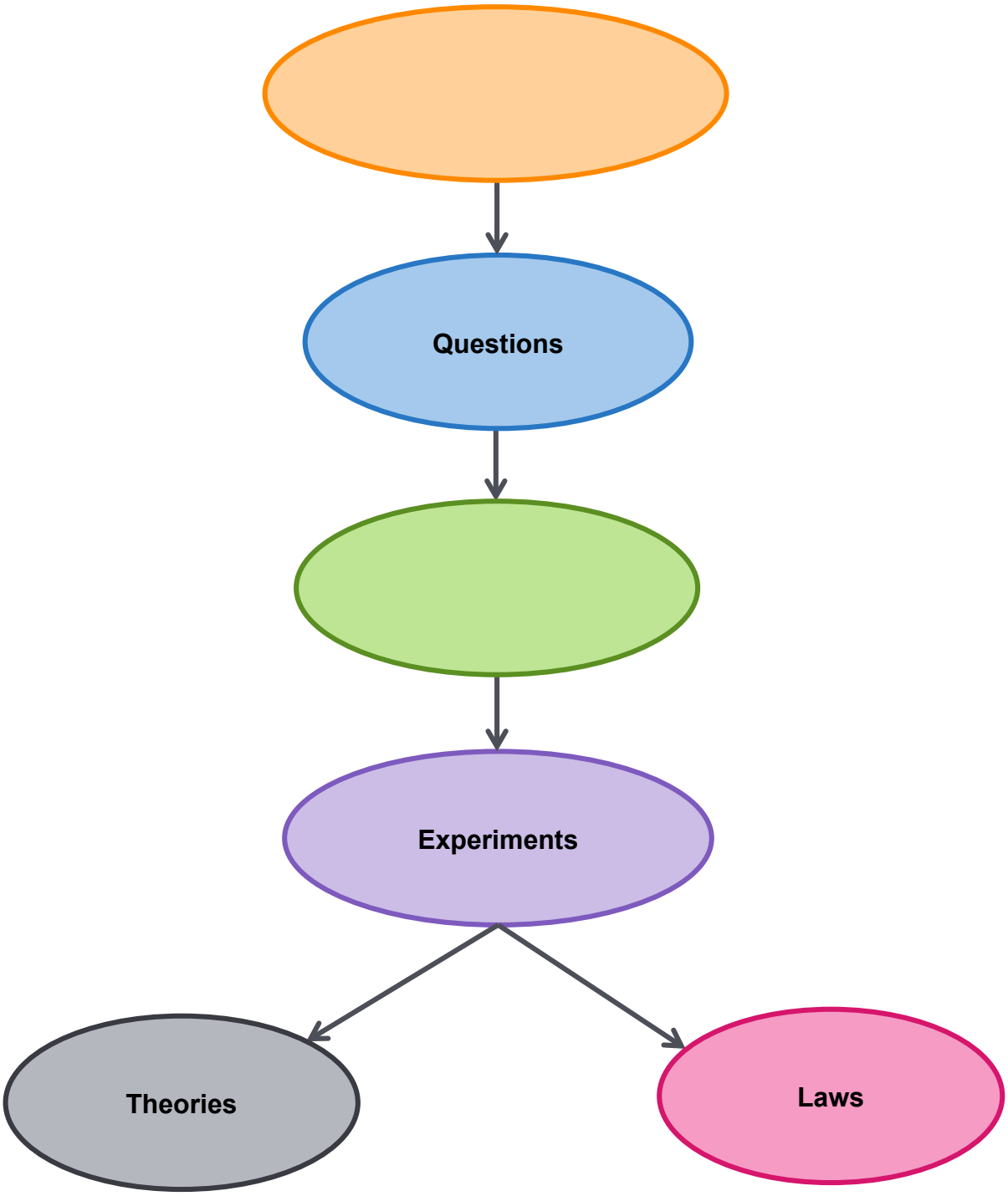
Slide 2

Complete the flow chart.



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Slide 2

History of Cell Theory: Example

Is based on many _____ and has been revised over time:

- Theodore Schwann (1839) stated all _____ are made of _____ and cell products and that cells form spontaneously.
- Rudolph Virchow (1855) stated cells come from _____ cells.
- Original cell theory said:
  - _____ living things are made of _____.
  - cells _____ from pre-existing cells.
  - the cell is the _____ unit of _____ and function for all organisms.
- Modern cell theory adds:
  - The cell contains _____ information that is passed from cell to cell during cell division.
  - All cells are _____ in composition and metabolic activities.

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Slide 2

Laws and Theories

A [ ] is a statement of fact that is generally accepted to be true and [ ] because it has always been observed to be true.

- Theories and laws are both based on [ ].
- [ ] explain observations; laws do not because they are factual statements.
- Theories can be [ ] or replaced, but laws cannot.
- Theories can [ ] be proven, but laws can.

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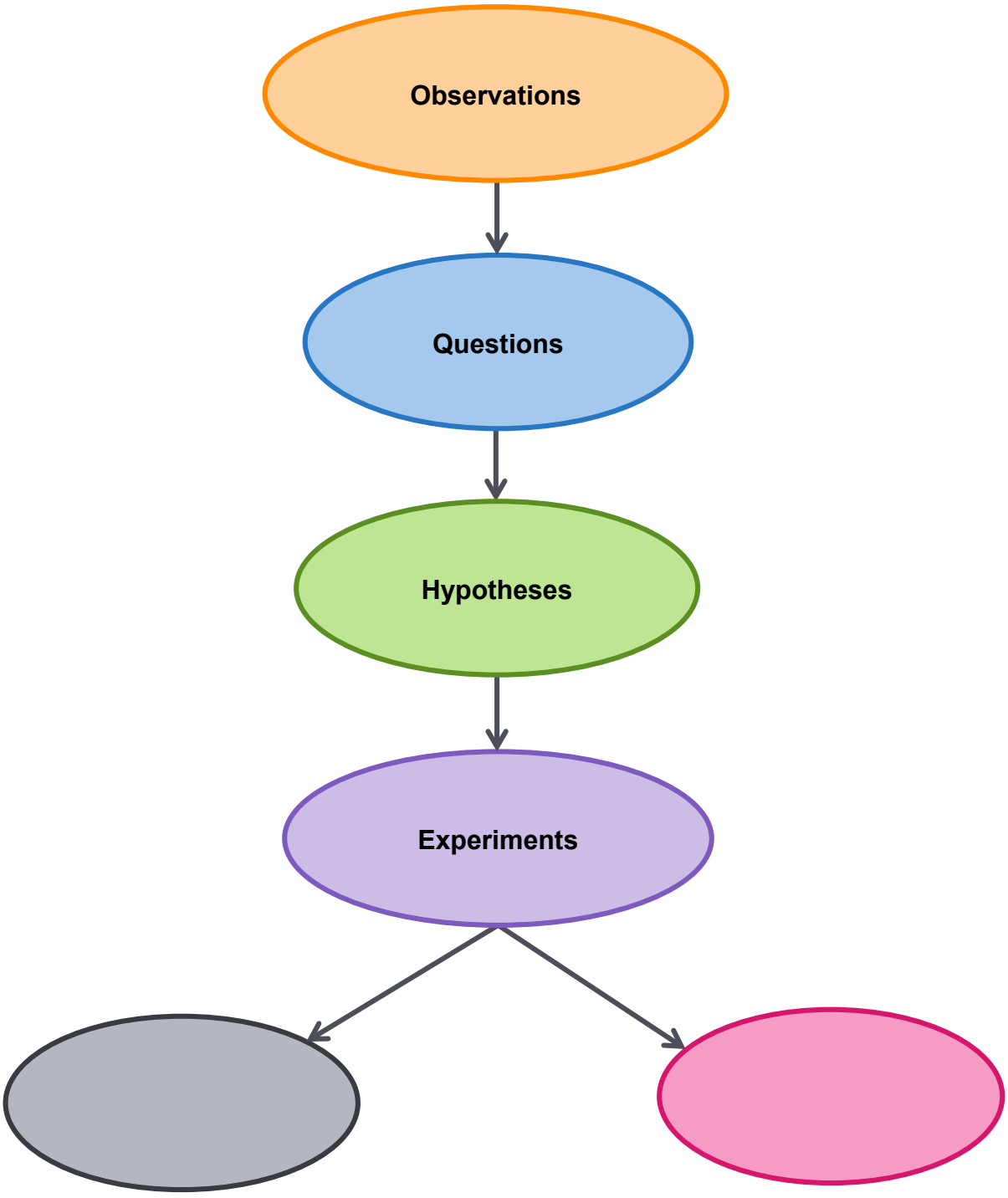
Slide 2

Complete the flow chart.



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Slide 2

Law of Universal Gravitation: Example

"Every object in the universe attracts every other object with a force that is proportional to the product of their masses and inversely proportional to the square of the distance between the two objects."

Plants and animals are living examples of the law of _____ in action.

- _____ keeps animals from floating away from Earth's surface.
- Plant roots grow _____ in response to gravity when seeds germinate.

Slide 5

Hypotheses Are Based on Observations

Hypotheses are based on _____ types of observations:

- Those obtained _____ an experiment
- Those obtained _____ an experiment

From Observation to Hypothesis to Experiment

- Observations lead to _____.
- Questions may or may not be _____.
- _____ are formed from testable questions.
- Hypotheses are _____ using _____ experiments.

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Slide 5

Jenner's Experiment (1796): Formation and Testing of a Hypothesis

REAL-WORLD CONNECTION

- Jenner based his _____ on a statement he overheard.
- He used fluid from _____ vesicles on a dairymaid's hand to inoculate a young boy.
- When the boy was _____ with smallpox, he had no symptoms.

Jenner's Experiment (1796): Results of the Experiment

REAL-WORLD CONNECTION

- Jenner _____ that smallpox can be prevented by inoculation with cowpox.
- He showed that _____ to smallpox could be deliberately transmitted from one person to another.
- His work began the _____ of smallpox from the world's population.

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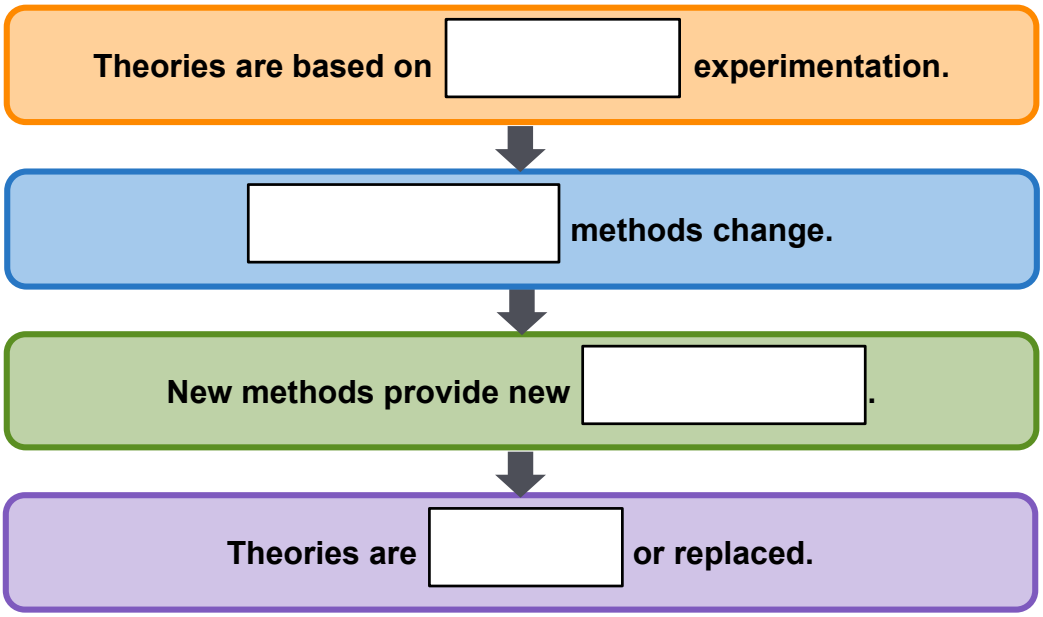
Slide 8

Why Theories Change

Complete the flowchart to show how theories can change.



Why Experimental Methods Change

Experimental [ ] change because:

- a hypothesis might require a new [ ] to be tested.
- new [ ] is developed, including:
  - new or improved [ ].
  - [ ] and software.

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Slide 8

Evolution and Modern Science

REAL-WORLD CONNECTION

The theory of [ ] has been influenced by the development of new areas of science.

- Genetics
- Paleontology

It has also been influenced by the development of new [ ].

- [ ] dating
- [ ] analysis

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Summary | Hypotheses, Theories, and Laws

Lesson Question

What is the relationship between observations, hypotheses, theories, and laws?

Answer

2

Review: Relationships Between Observations, Hypotheses, Theories, and Laws

- _____ lead to questions.
- Hypotheses are _____ answers to those questions.
- Theories are hypotheses _____ on repeated experimentation.
- Laws are statements of _____ that are generally accepted to be true and universal.

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Slide 2

Review: How Hypotheses Are Formed and Tested

- [ ] are based on:
  - prior [ ].
  - observations.
  - previous [ ].
- Hypotheses are formed from [ ] questions.
- Hypotheses are tested using [ ] experiments.

Review: How Theories Change

- Theories change when:
  - a hypothesis requires the [ ] of new experimental methods, yielding new information.
  - new or improved [ ] causes changes in experimental [ ], yielding new information.
- Theories may be [ ] or [ ] with new theories.

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

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