Unit 1C: Theories, Laws, Models

1) What scientific tool can be used to obtain mass?
2) What scientific tool can be used to obtain volume?

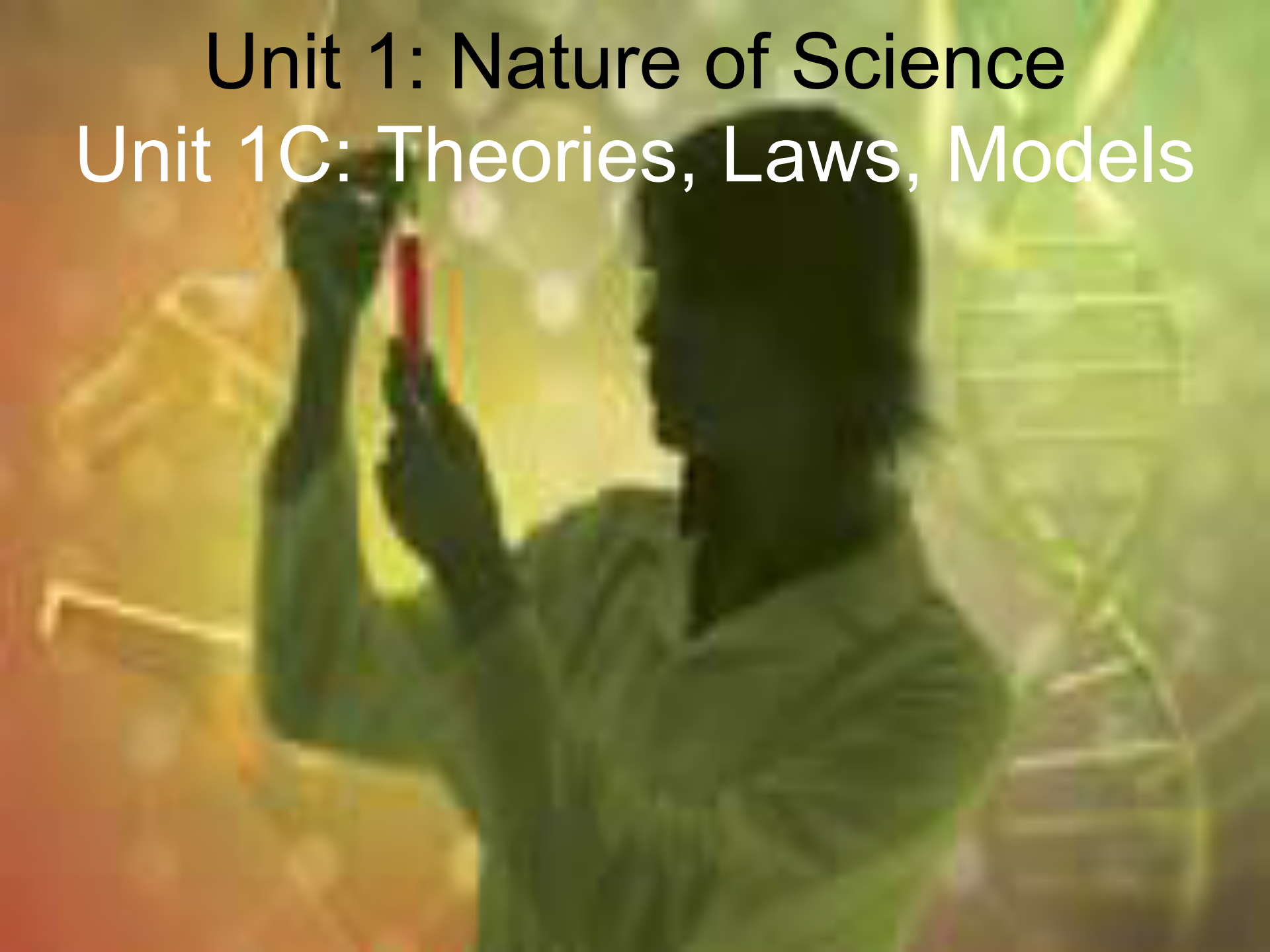
Unit 1C: Theories, Laws, Models

Scientific Models

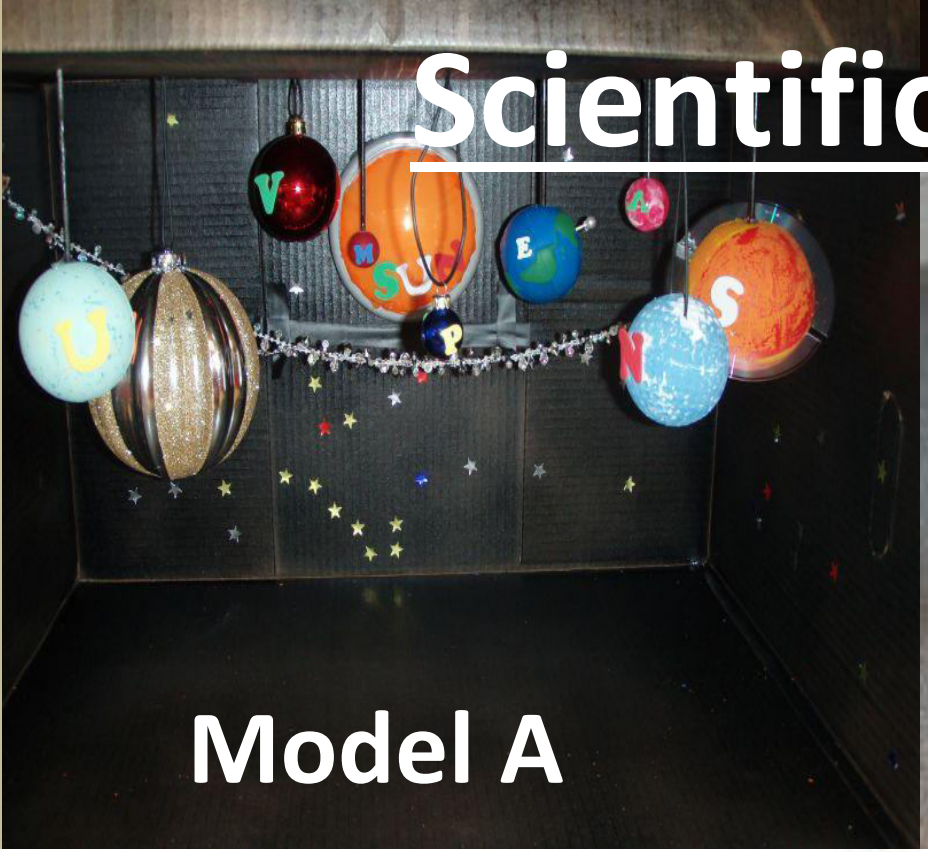
Label next page in your notes:
Unit 1C: Scientific Knowledge

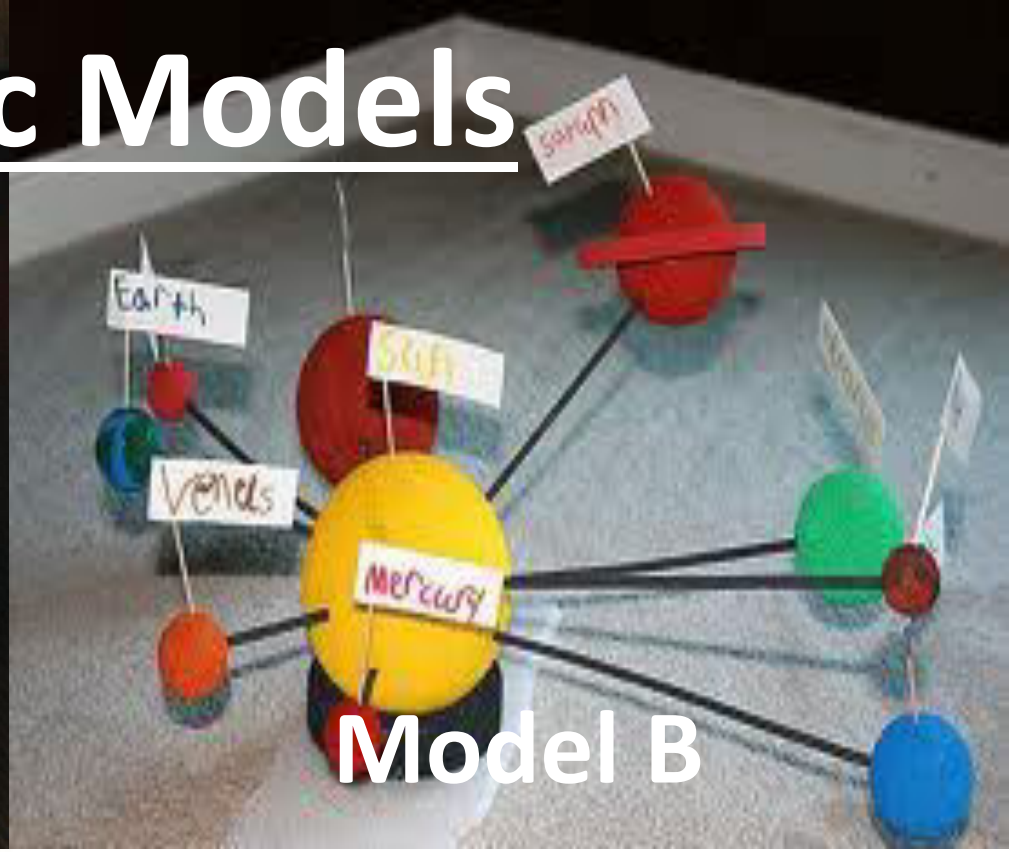
Which of the following is NOT a rule when writing a hypothesis?

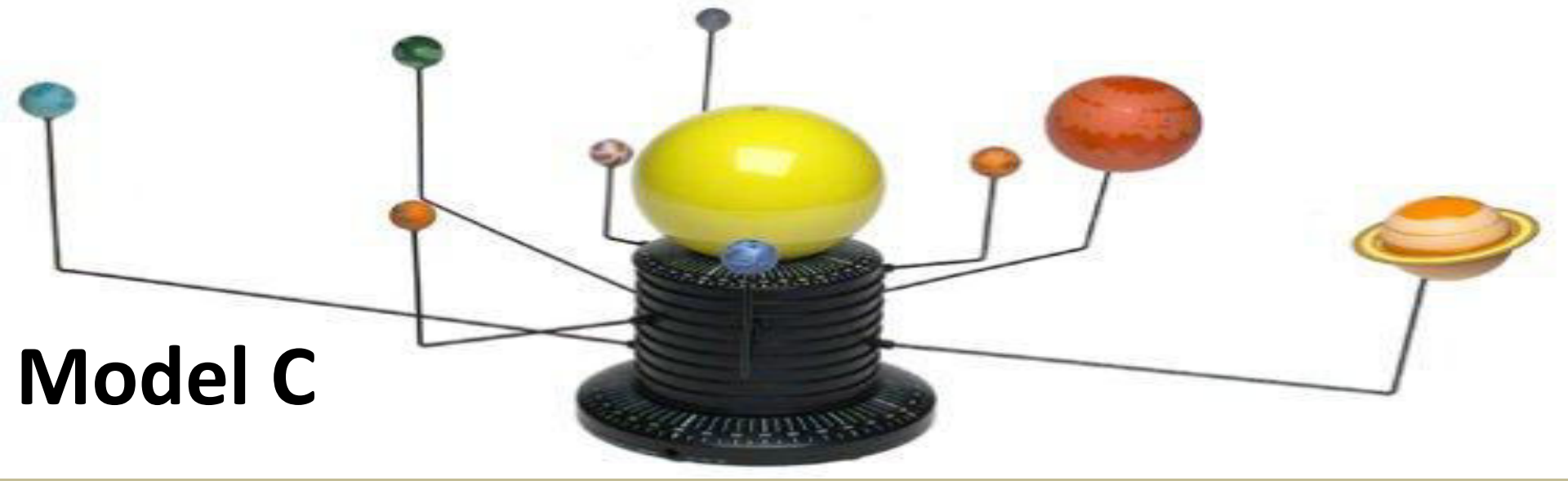
Unit 1: Nature of Science
Unit 1C: Theories, Laws, Models



Scientific Models







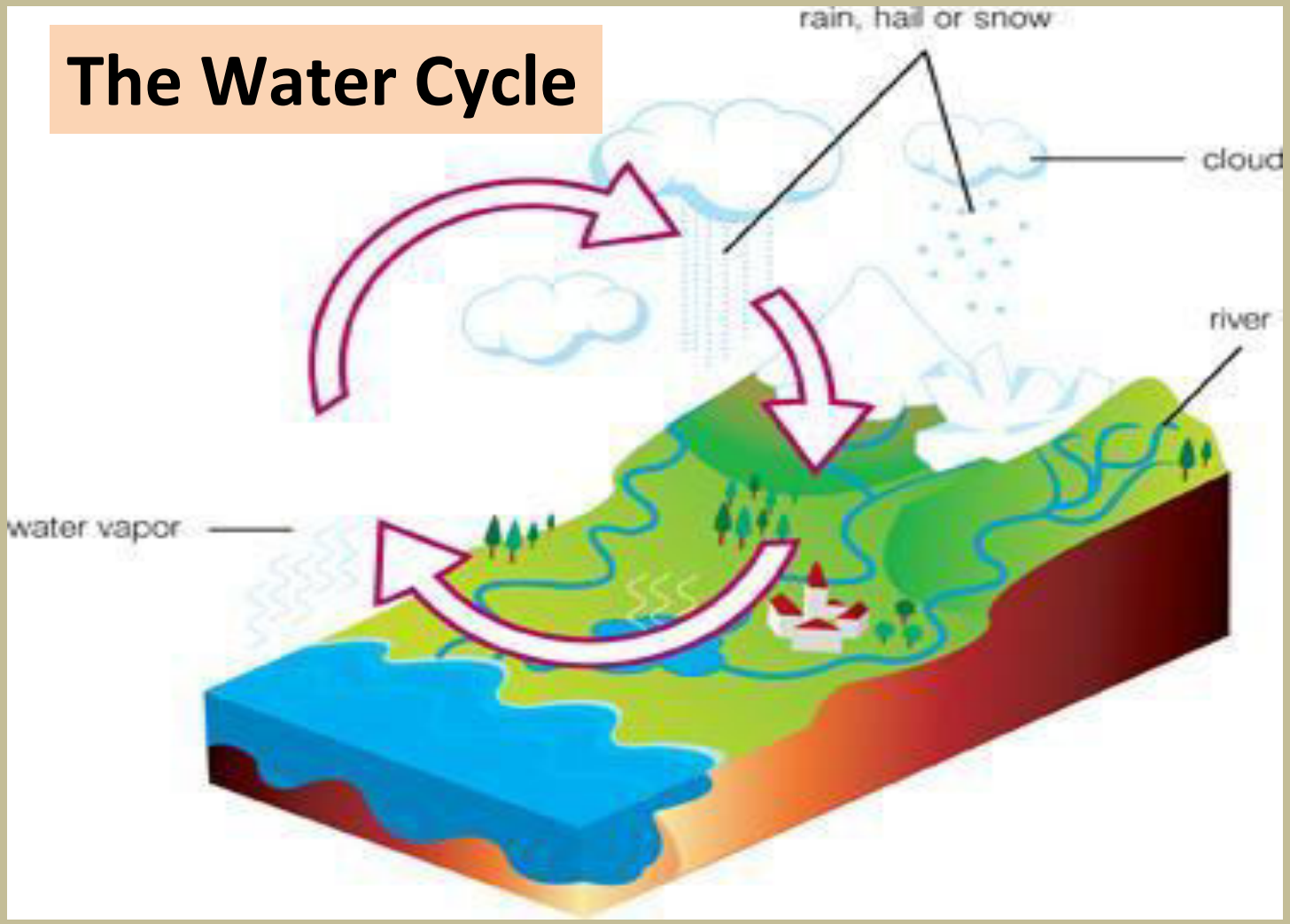
Scientific Models

Model – A visual representation of an object, idea, process, or system

***Used to understand things too big or too small to observe directly**

Scientific Models

*2 dimensional (2D) – a drawing



*2 dimensional (2D) – a drawing

Architect's Rendering Provided by studio seven

ARCHITECT'S RENDERING

Scientific Models

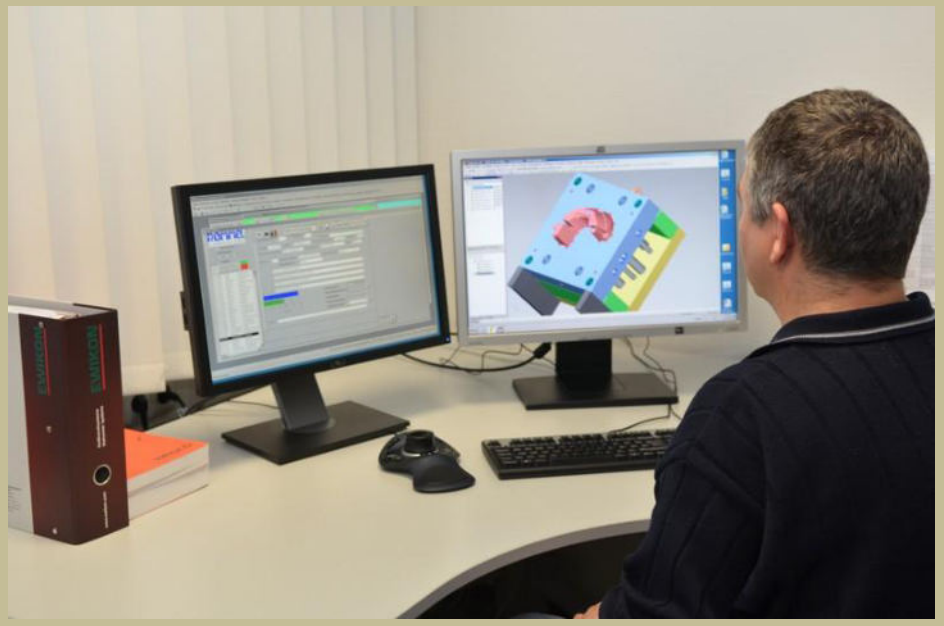
***3 dimensional (3D) – a physical replica of the object**

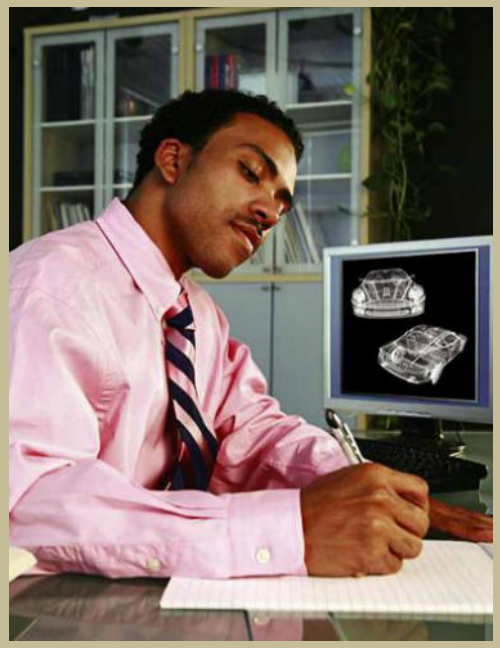
Advantages of 3D model:

-Can see all around it
-Can touch it
-Can alter it

Scientific Models

*Computer simulation – animation showing what is how something works or will work

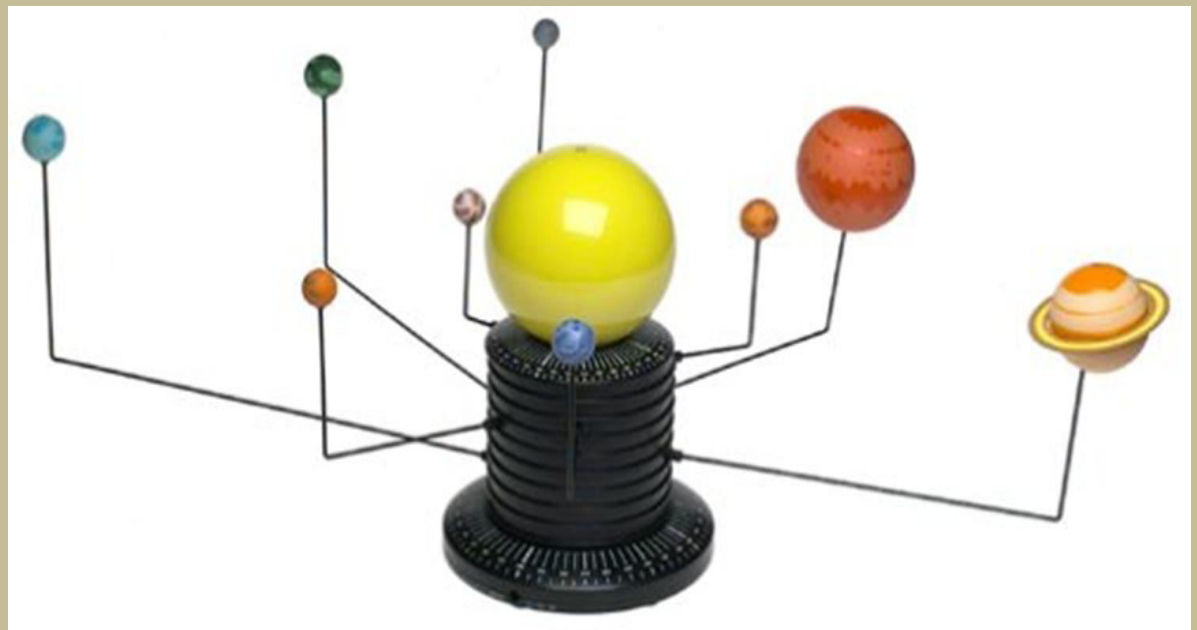




Scientific Models

Limitations

- Not made to actual scale
- Cannot provide every single detail
- Only as useful as the data put into it



Scientific Theories & Laws

I can identify and differentiate between a scientific theory and scientific law.

Essential Question:

- What is the difference between a scientific theory and a scientific law?
- Why are scientific theories modified over time, but rarely discarded?

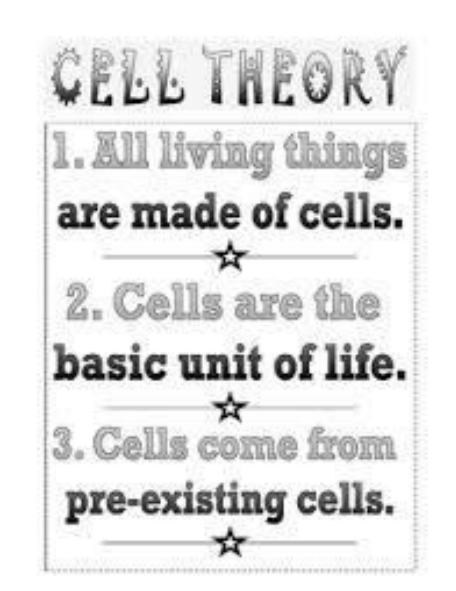
Today's Thoughts and Discussion

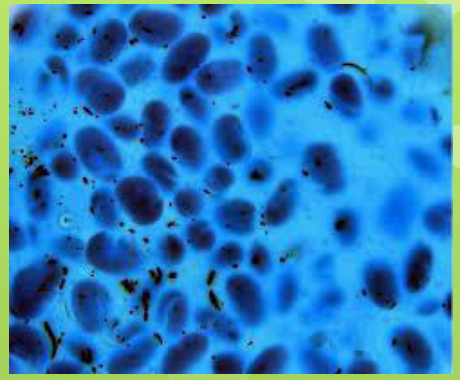
Your favorite shirt has gone missing from your bedroom. After giving it some thought, you tell your parents you have a theory about what happened to it. What do you mean by having a "theory?"

Just a Theory
https://www.youtube.com/watch?v=1uzsuCFUQ68

Part 1: What is a scientific theory?

- A well-tested explanation for a wide range of observations and experimental results
- Repeated experiments leading to a consensus of agreement amongst investigators
- Wide range of observations and experimental results
- Multiple trials leading to similar conclusions
- EXPLAINS how and why something happens.





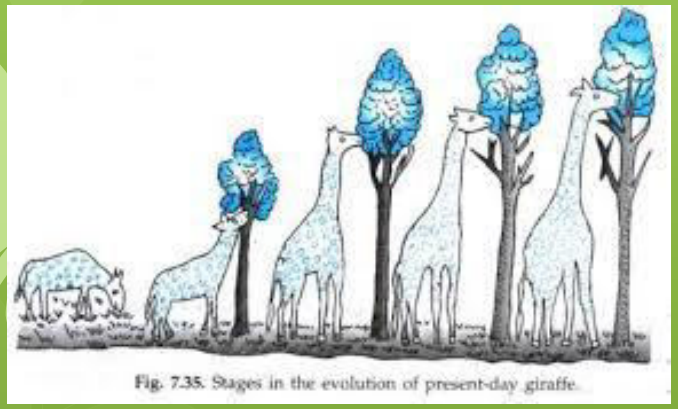
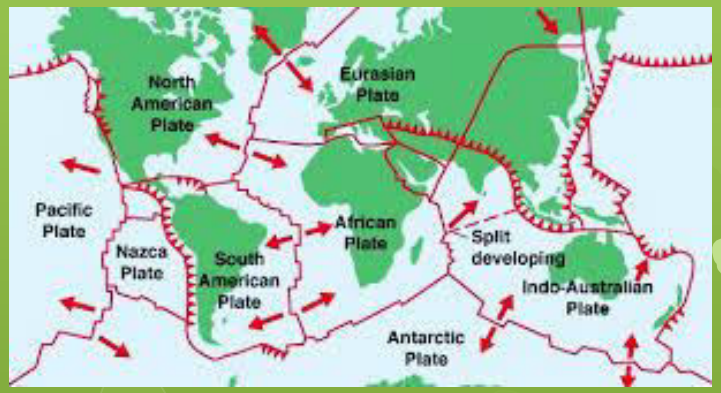


Fig. 7.35. Stages in the evolution of present-day giraffe.



What are some recent theories?

- Germ Theory: Germs can be passed person to person
- Theory of evolution: Organisms change over time
- Theory of Plate Tectonics: How continents shift
- Big Bang Theory: Start of universe.
- Cell Theory: Living things are made of cells
- Atomic Theory: Our understanding of the atom has changed

Jean-Baptiste Lamarck proposed that species change because of use and disuse. Charles Darwin later changed the ideas about how species change with his ideas of natural selection. What did the theories on how species change show about scientific knowledge?

2 – What are Scientific Laws?

- A statement that describes what scientists expect to happen every time under similar conditions.
- Describes what happens.
- A description of observed phenomenon. It does not explain why it exists or does not exist. It just is.
- Many are written as formulas

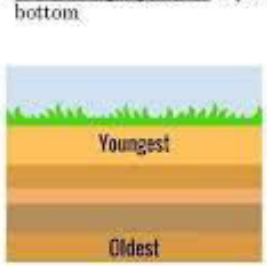
First Law
Objects at rest remain at rest and objects in motion remain in motion in a straight line unless acted upon by an unbalanced force.

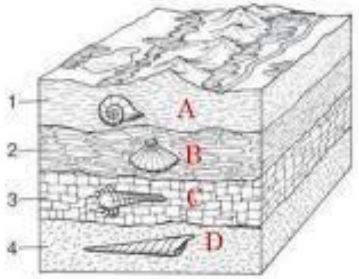
Second Law
Force equals mass times acceleration (or f = ma).

Third Law
For every action there is an equal and opposite reaction.

ROCK LAYERS

- Law of Superposition → younger rocks are on top, older rocks are on bottom





Examples of Scientific Laws

- Universal Law of Gravitation
- Newton's laws of motion
- Kepler's Laws of Planetary Motion
- Law of Thermodynamics
- Law of Conservation of Mass
- Law of Conservation of Energy

Part 3 – Can a Theory be Modified?

- As scientists learn more about the natural world, their theories evolve to explain their new observations.

Ex: Theory of Continental Drift of Plate Tectonics

Can a Law be Modified?

- Yes, a law can be modified if new evidence suggests it needs to be changed.
- Laws definitely resist change and this doesn't happen often.

TED ED: What's the difference between laws and theories

https://youtu.be/GyN2RhbhiEU

Law vs. Theory

Now that you know that….

Can a theory become a law once "proven"?

Since it is a theory, does it make it just an opinion of a scientist?

Today's Thoughts Revisited

Your favorite shirt has gone missing from your bedroom. After giving it some thought, you tell your parents you have a theory about what happened to it. What do you mean by having a "theory?"

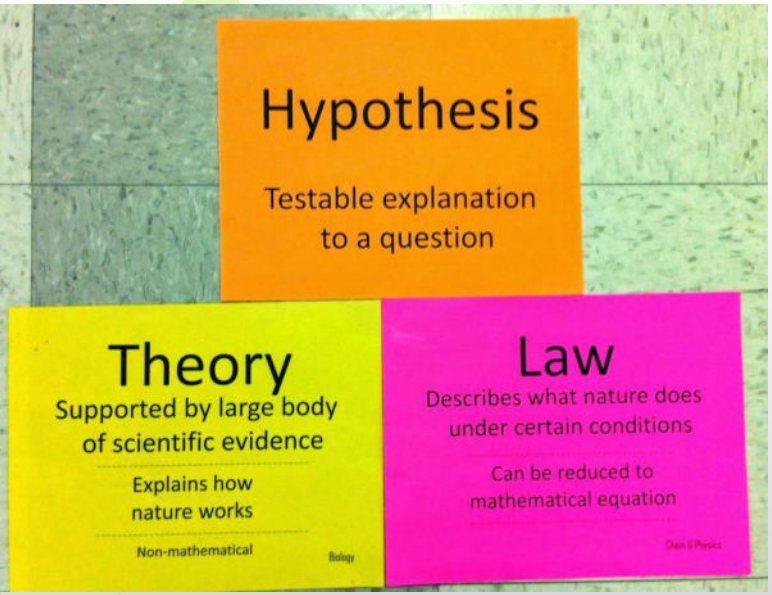
WHY IS IT INCORRECT TO SUGGEST THAT YOU HAVE A "THEORY" ABOUT WHAT HAPPENED TO YOUR MISSING SHIRT?

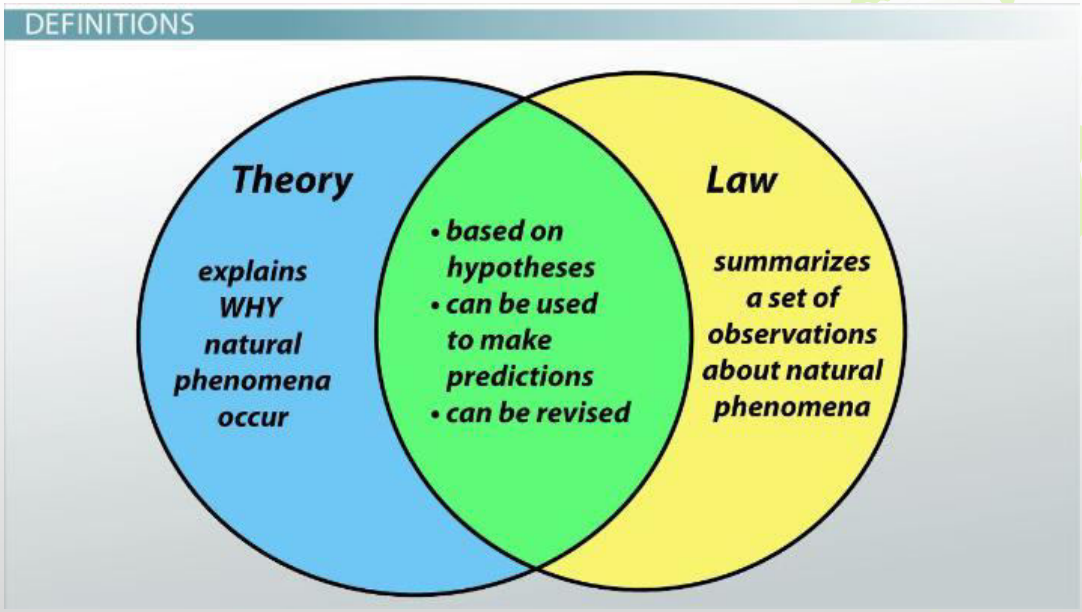
Main Concept

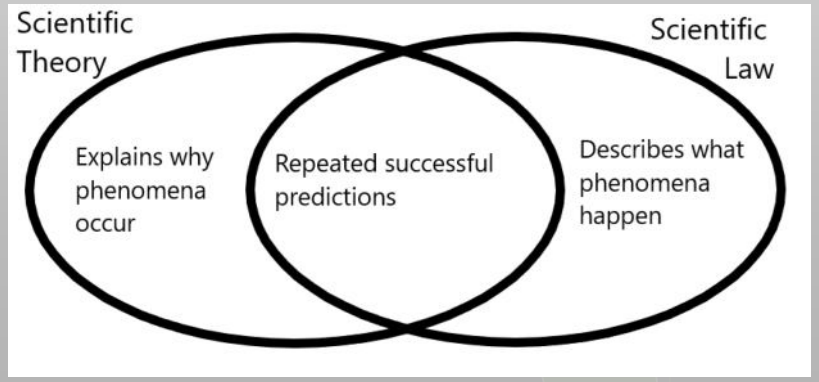
Scientific explanations are based on empirical evidence, logical reasoning, predictions, and modeling.

Theories explain, laws describe!

Theory & Law


Hypothesis
Testable explanation to a question
Theory
Supported by large body of scientific evidence
Explains how nature works
Non-mathematical
Law
Describes what nature does under certain conditions
Can be reduced to mathematical equation


DEFINITIONS
Theory
explains WHY natural phenomena occur
• based on hypotheses
• can be used to make predictions
• can be revised
Law
summarizes a set of observations about natural phenomena


Scientific Theory
Scientific Law
Explains why phenomena occur
Repeated successful predictions
Describes what phenomena happen

Observing

- What is observing?
- **Observing**- using one or more of your senses to gather information.
- Observation also includes using tools to help enhance your senses

- Two types of observation:
  - **Quantitative observation**
  - **Qualitative Observation**

Organizing Data

- **Classifying-** grouping together items that are alike in some way
- Is there only one way to classify things?

- Why is classifying items important to science research?

Inferring

- **Inferring**- when you explain or interpret things that you observe
- Inferring is NOT guessing!!!!!!
- **Inferences are based on reasoning from your prior knowledge and from what you observe**

1. There is a representation of a face on one side of the coin.
2. The Latin word "Dei" means "God."
3. The coin was made by deeply religious people.
4. The date 1722 is printed on one side of the coin.
5. The coin was made in 1722.
6. The face on the coin is a representation of the nation's president.

Predicting

- **Predicting-** making a statement or claim about what will happen in the future based on past experience or evidence

- Predictions and inferences are related, but are not the same thing.
- *Which one is used to create your hypothesis?*

Analyzing

- Analyzing- evaluating observations and data to reach a conclusion
- Taking all of your results comparing them to see if your results are consistent, inconsistent, slanted, etc.
- Why is this step important in a scientific investigation?

CFU

Mrs. Byrd walks in her class and sees the floor near the doorway is wet.

Name an observation and inference from this scenario.