heGrade 7 Science Unit 1 Lesson 8

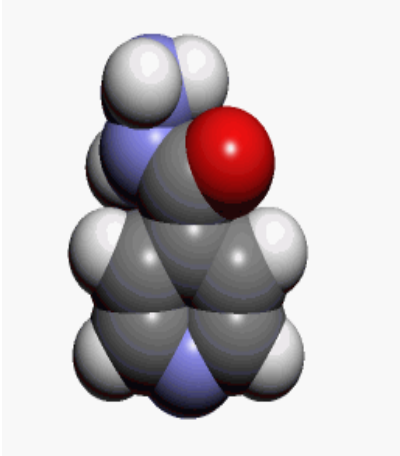
Objective & Introduction

Today's lesson objectives are:

- **Students will compare and contrast the terms hypothesis, theory, and law.**
- **Students will describe how theories can be altered as new evidence becomes available.**

Scientists are always investigating the world around us. For example, technology allows scientists to "see" things in new ways, like the animation of the molecule shown below. They even test and retest existing scientific theories and scientific laws. So what happens if a group of scientists discover new evidence to disprove a scientific theory? The existing theory is modified to reflect the new evidence. But it takes a lot of tests to qualify as new evidence to a scientific theory. Let's learn what it takes to modify an existing theory.

You will have to apply a lot of new concepts in this lesson. Some of these concepts may be difficult to remember. One way to help recall certain information is to associate it with something that is familiar. There will be some associations in this lesson for some of the concepts. If you like, you can replace those with associations that make more sense to you. Make notes in your digital notebook as we go along to help yourself remember!

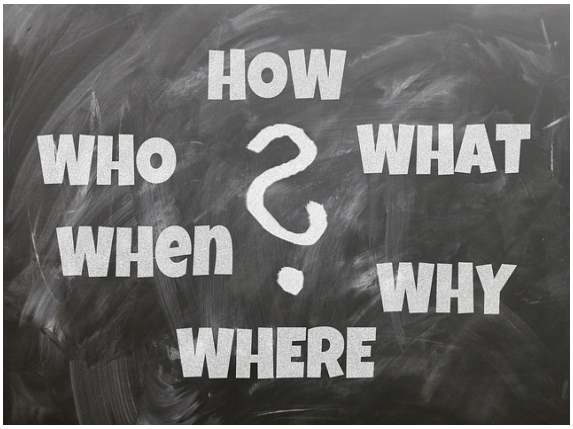


Theory and Law

In order to understand how scientific theories can be altered, or changed, we will need to define a few terms. A **hypothesis** is a statement that predicts the answer to a question and can be tested using the scientific method. When a hypothesis is supported with a lot of evidence, it can lead to the development of a scientific theory.

A **scientific theory** is a statement or group of statements that has been supported with a lot of evidence by a lot of different scientists. A theory explains ***why*** something happens and can be very broad. Many scientific

theories are made up of different statements. Some of the statements that can become a part of a theory may be well-supported hypotheses or scientific laws.



Although some of the statements that make up a theory can be scientific laws, remember that a theory won't become a scientific law. That's because a **law** describes ***how***something happens. It usually contains a mathematical equation, which makes it very easy to predict what will happen if any part of the condition changes. An example of a scientific law is Newton's second law of motion. This states that the amount of force needed to cause a change in motion will depend on the mass of the object times its acceleration. The equation for this is *Force* = *mass* × *acceleration*. We can predict what will happen to any part of the equation based on how we change another part.

Select which of the following are steps of the scientific method and which are not.

	Step of the Scientific Method	Not a Step of the Scientific Method
Conduct Research	○	○
Develop a Hypothesis	○	○
Ask Your Friends	○	○
Draw a Conclusion	○	○
Make an Assumption	○	○
Interpret Results	○	○

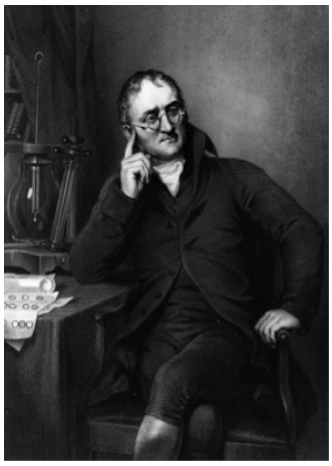
Atomic Theory

Now that we understand the difference between a hypothesis, scientific theory, and scientific law, we can learn how scientific theories are developed. Scientific theories consist of different parts, each of which has been tested many times by

many scientists. Some of these parts are well-supported hypotheses. Some of the parts are scientific laws. We constantly make new discoveries about the universe around us as technology advances.

To better understand, let's take a look at the atomic theory, which was developed in the early 1800's by a scientist named John Dalton.

Dalton's Atomic Theory



1. All matter is made of atoms. Atoms are indivisible and indestructible.
2. All atoms of one element have the same properties, such as mass and size. These properties are different from the properties of any other atoms or any other element.
3. Atoms of two or more different kinds of atoms combine in a definite proportion to form new substances.
4. Atoms of one element cannot be converted into atoms of another element.

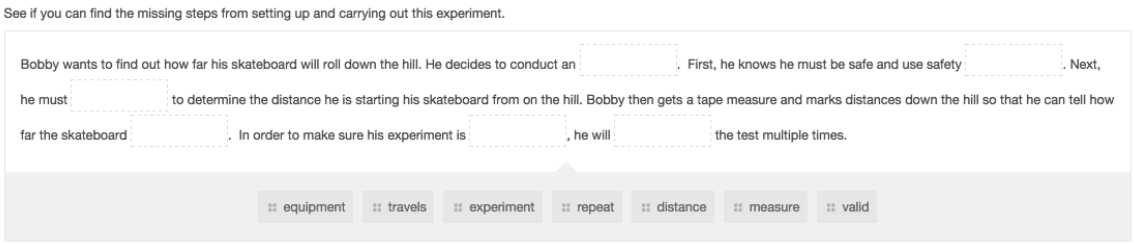
As technology advanced and more experiments were conducted, we gained a more accurate understanding of the nature of atoms.

We've also discovered that atoms of the same element are not all identical to one another. For example, carbon atoms that make up diamonds are not identical to the carbon atoms that make up the lead in your pencil, even though both carbon atoms are from the same element.

Advances in nuclear science have shown that atoms of one element can be transformed into atoms of another element. You may know the term radiation, which is one of the things

produced when one atom is transformed into another.

One way to think about new discoveries is to view a scientific theory in the same way you would look at a brick house. A brick house has a lot of different parts that, when added together, provide a description of that house as well as help it to function in a certain way. Well, a theory is very similar to that brick house. We do not tear down the whole house just because a door or window has broken. Instead, we fix the broken part and leave the rest of the house as it is. This is the same concept we apply to a scientific theory. We modify the incorrect part of the theory to reflect new evidence and leave the rest of the theory as it is. Of course, in order for the evidence to qualify to become part of a theory, it has to have been tested multiple times by many different scientists and accepted by the scientific community.

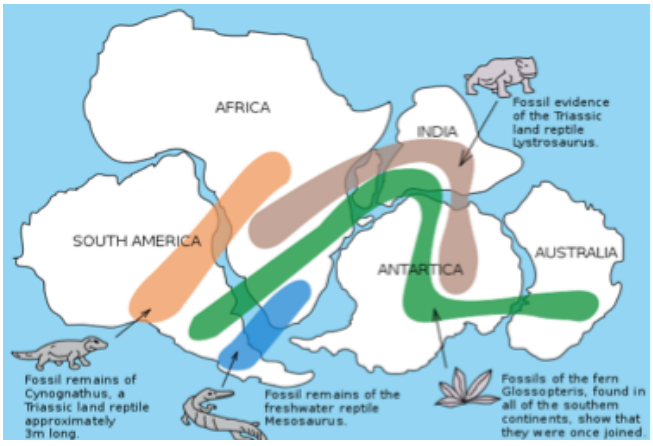


Hypotheses about Land Movement

In 1912, a scientist named Alfred Wegener hypothesized that all land on Earth was once a large mass that broke apart and drifted. His evidence for his hypothesis was the following:

- The shape of each continent appeared to fit together, similar to a jigsaw puzzle.
- Fossils from the same plants and animals were found in continents that were separated by miles and miles of ocean, such as South America and Africa.
- Mountain ranges that, if the continents were still one large land mass, would continue from one continent to another

Wegener proposed that this large land mass began at the South Pole and was broken apart by the force of the Earth's rotation. The



pieces of land slowly drifted toward the center of the Earth.

In 1929, another scientist, named Arthur Holmes, proposed that the temperatures and densities of material under the surface of the Earth caused currents that behave similarly to currents in the ocean where the constant rolling motion of the water causes objects to drift from one location to another. The currents under the surface of the Earth carried the continents away from each other. Both ideas were rejected.

We now understand that varying temperatures cause currents under the surface of the Earth, thanks to many investigations by many scientists on the movements of the Earth's surface both underwater and on dry land. These currents caused the continents to drift. It wasn't until the early 1960s, over 50 years after the first proposal, that the theory of plate tectonics was accepted.

Choose the best way to measure data for each scenario below.

Measuring the growth of violets under artificial light vs. natural light

Measuring the distance a snail travels up a tree branch

Determining whether more students prefer to read or play outside

Determining the average grade in a science class.

Summary

It is important to remember that scientific theories are often very broad and provide an explanation of why something happens. Scientists are always testing and investigating new questions, some of which will lead to new evidence that will disprove part or parts of an existing theory. Instead of throwing out the entire scientific theory, we simply modify the part that has been disproven to reflect the new evidence.