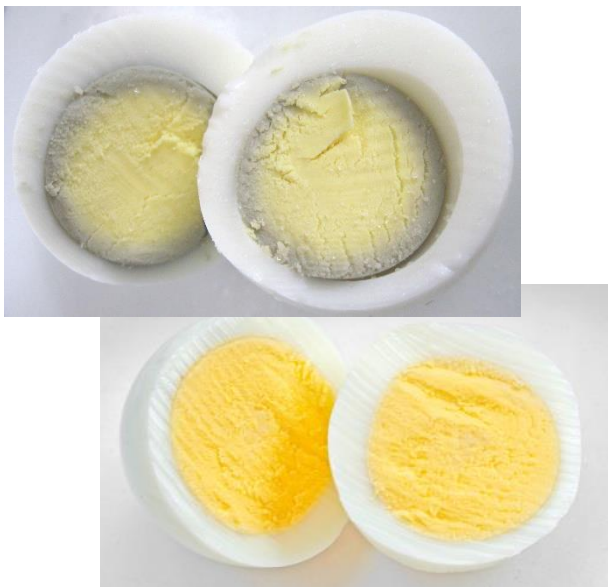


# Chemical Reaction Examples

**Tarnishing** of silver: the solid silver reacts with sulfur in the air to make **solid silver sulfide**, the black material we call *tarnish*.



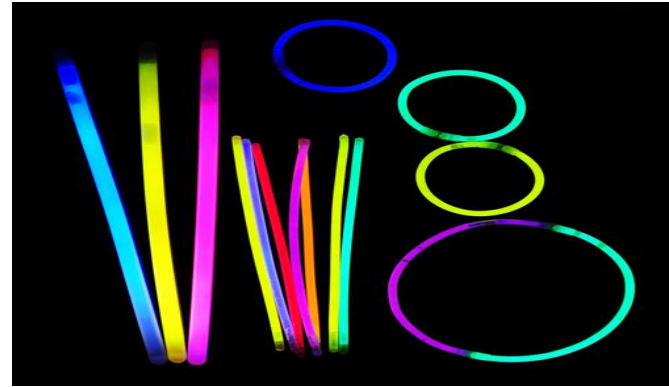
**Boiling the egg**: when you use **high heat** to boil an egg, it causes a chemical reaction between the yolk and the white that leaves a **green film around the yolk**. That film is **iron sulfide**, caused by **iron in the yolk reacting with hydrogen sulfide in the white** (*it won't hurt you to eat it, and the egg will taste the same*).

# Chemical Reaction Examples

(needs oxygen  
and moisture)



**Rust**: when exposed to “*elements*”, iron develops a red, flaky coating called rust, which is an example of an **oxidation reaction**.

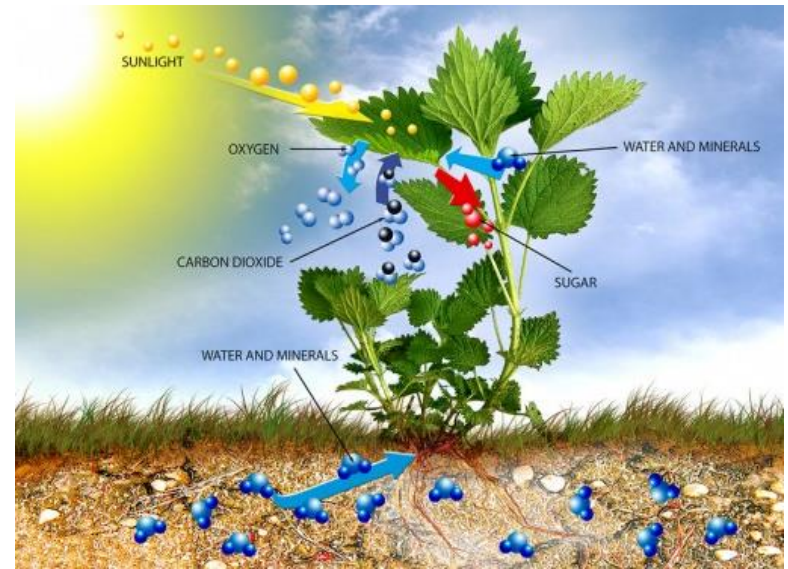


**Glow stick** is a plastic tube with a glass vial inside. When you bend it, the glass vial breaks allowing the chemicals that were inside the glass to mix with the chemicals in the plastic tube. Once these substances combine, a **light-releasing reaction** starts taking place.

# Chemical Reaction Examples

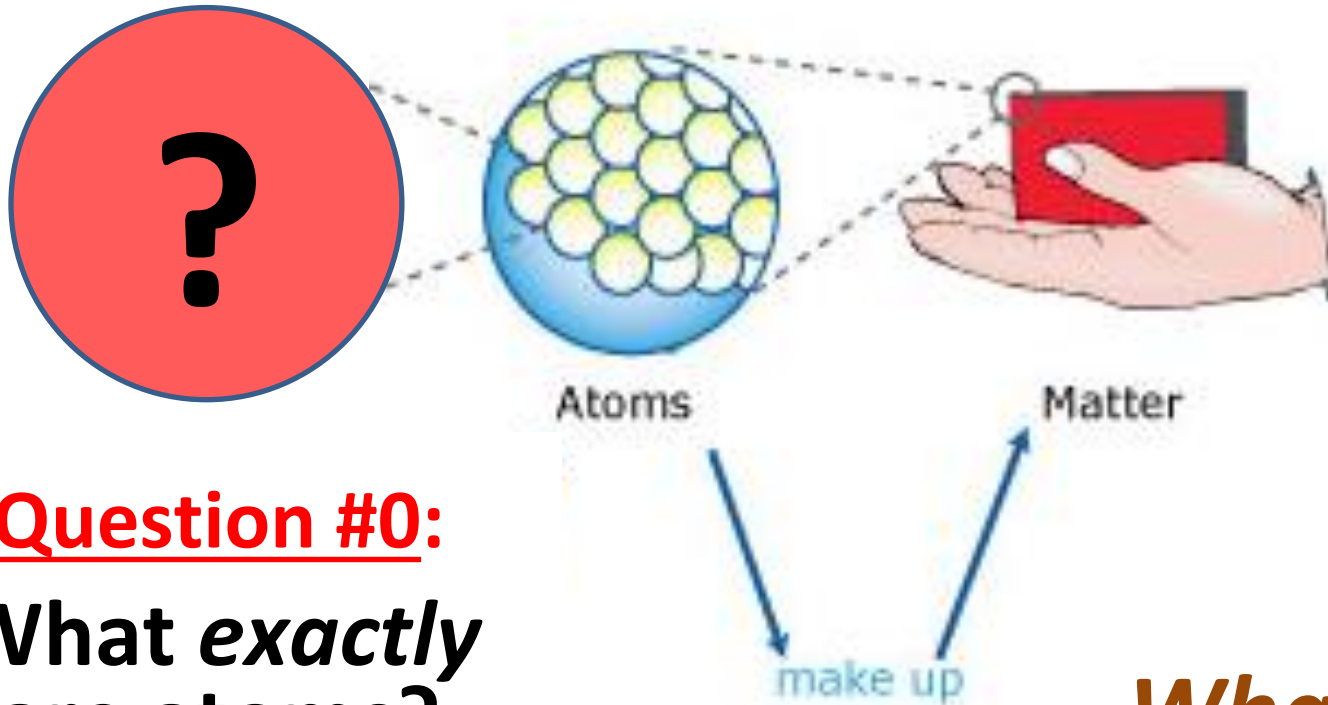


**Combustion**: every time you strike a match, burn a candle, build a fire, or light a grill, you see the combustion reaction; it combines energetic molecules of fuel with oxygen to produce carbon dioxide and water.



**Photosynthesis**: plants apply a chemical reaction called photosynthesis to convert carbon dioxide and water into food (glucose sugar) and oxygen.

# Structure of Matter



**Question #0:**

**What *exactly*  
are atoms?**

**Are they all the same?  
NO they are NOT!**

***What  
makes  
them  
different?***

# Atomic Theory Development

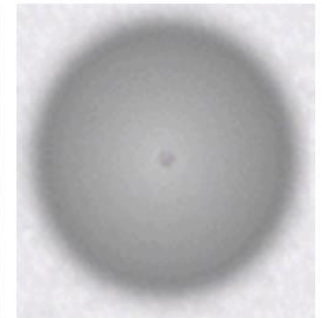
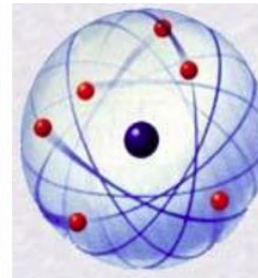
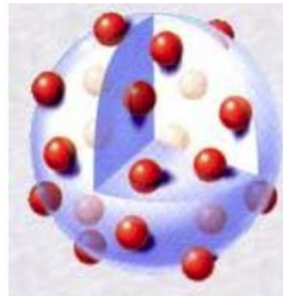
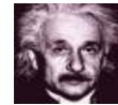
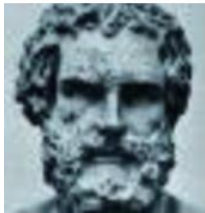
Democritus 460 BC  
and Dalton 1803 AD

Thomson  
1897

Rutherford  
1912

Bohr  
1913

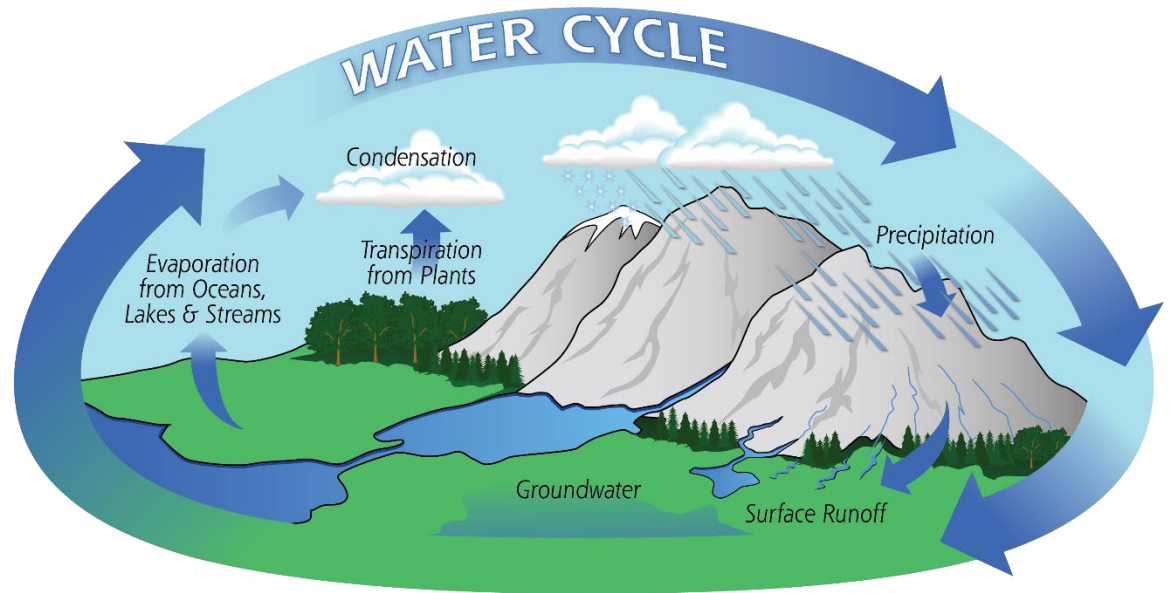
Modern  
Quantum  
Cloud Model  
post 1930



Born **as early as 400 BC**, it took more than 2000 years before Science was ready to accept the idea of atomic structure of matter...and another 150 years to develop a good *model!*

# What is a Model?

In Science, a model is a physical, mathematical, or conceptual (abstract) representation of a real phenomenon that is difficult to observe directly – that is, a *convenient substitute*.

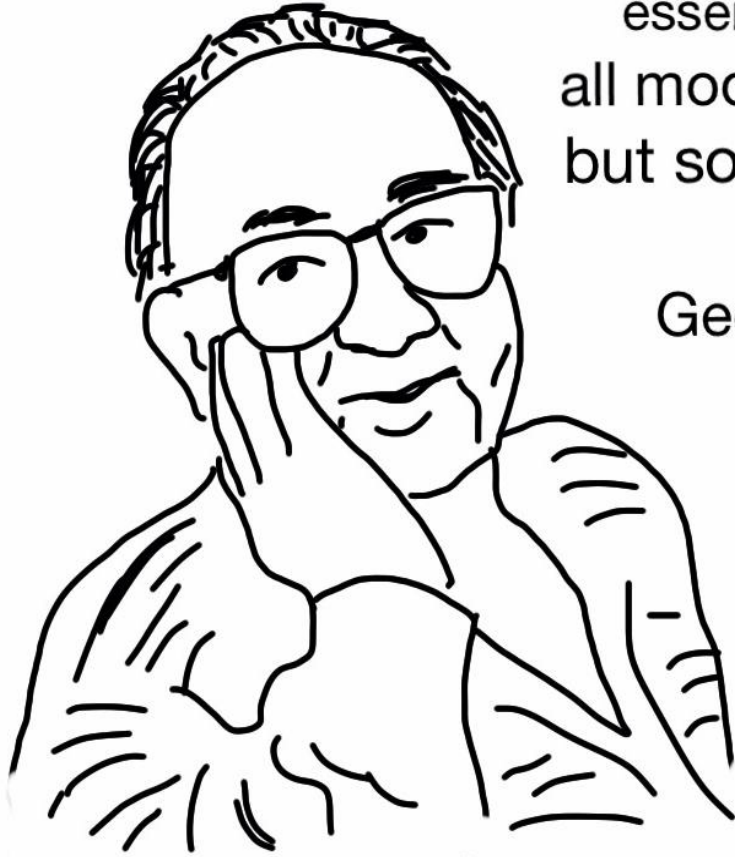


Scientific **models** are used in a variety of scientific disciplines to explain and predict the behavior of real objects or systems.

# A Model is Never Perfect

essentially,  
all models are wrong,  
but some are useful

George E. P. Box



*(one of the most  
influential  
statisticians of  
the 20<sup>th</sup> century)*



Scientific models  
are **approximations**  
of the objects and  
systems that they  
represent!

Scientists are constantly working to **improve and refine** models.