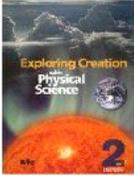
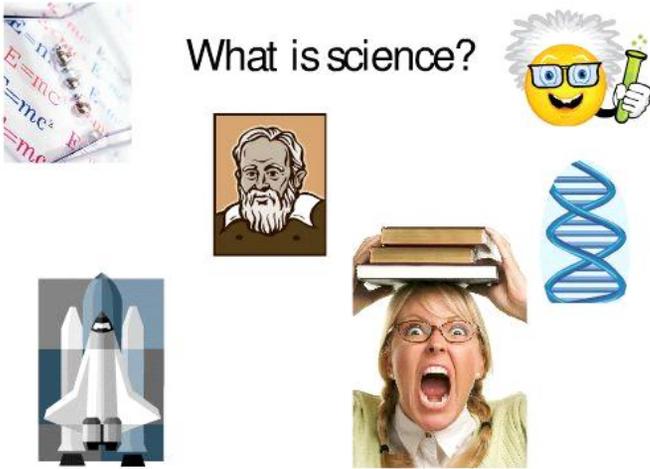


# M01 Lecture: The Basics - Verified, VT:T

Friday, May 21, 2010  
1:43 PM

VoiceThread <http://voicethread.com/share/1299834/>

Slides	Notes
 <p data-bbox="402 688 683 737">Physical Science</p> <p data-bbox="472 793 610 827">The Basics</p>	<ul style="list-style-type: none"><li><input type="checkbox"/> Meet and greet map slide can go after this one</li><li><input type="checkbox"/> Drag and drop</li><li><input type="checkbox"/> Raise hand/emoticons/poll/door</li><li><input type="checkbox"/> Whiteboard</li><li><input type="checkbox"/> Light bulb</li><li><input type="checkbox"/> Study notes</li><li><input type="checkbox"/> VoiceThread</li><li><input type="checkbox"/> Lab starters/labs</li><li><input type="checkbox"/> Quizzes</li><li><input type="checkbox"/> Exams</li></ul>
<p data-bbox="394 1161 688 1209">What is science?</p> 	<p data-bbox="932 1121 1414 1150">Brainstorm - What do you think that science is?</p>

# SCIENCE

## Definition

Endeavor dedicated to ...  
accumulation of observable facts  
classification of observable facts  
in order to ...

## Purpose

formulate general laws about the natural world

## Practice

of science involves ...  
Observation  
Experimentation  
Collection of facts

Here is Dr. Wile's definition.

## What is science? According to the dictionary.

### Webster's 1828 Dictionary

- 1. In a general sense, knowledge, or certain knowledge; the comprehension or understanding of truth or facts by the mind. The science of God must be perfect.

### Merriam-Webster Online

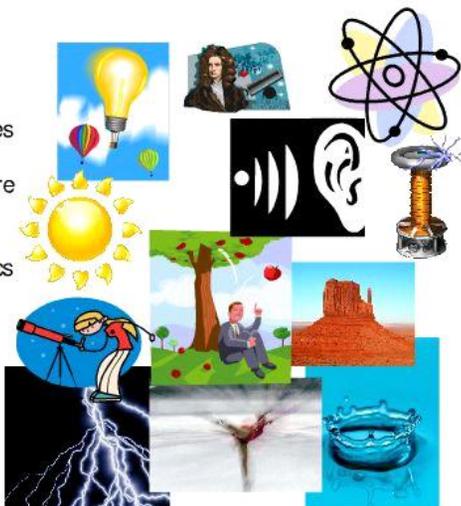
- 1: the state of knowing: knowledge as distinguished from ignorance or misunderstanding

How has the definition changed over time?

Shorter is nice. Notice the reference to God is now gone. It shows how the culture has changed.

## Our physical world.

Atoms and Molecules  
Air & Atmosphere  
Water & Hydrosphere  
Earth & Lithosphere  
Weather & Climate  
Motion or Kinematics  
Newton's Laws  
Gravity  
Electromagnetism  
Waves and Sound  
Light  
Astrophysics



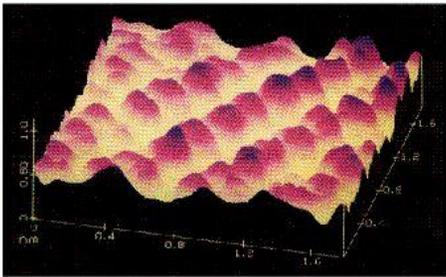
Here are the topics we will be studying in this course.

Atoms are the \_\_\_\_\_  
unit of matter.

What do you think is the answer.

Answer - smallest

- An \_\_\_\_\_ is the smallest particle of an element that has the chemical properties of the element.



Copper atoms on silica surface.

Distance across = 1.8 nanometer ( $1.8 \times 10^{-9}$  m)

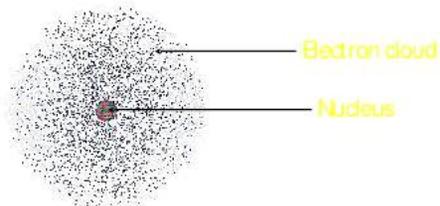
Try this one.

Answer: atom

## The Atom

An atom consists of a

- **nucleus**
  - (of **protons** and **neutrons**)
- **electrons** in space about the nucleus.

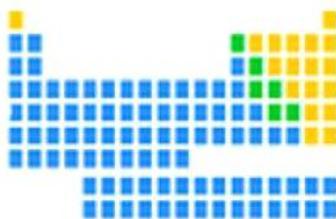


The yellow words will have a red cover. Ask the students to try their luck at answering what is under the red rectangles.

The modern theory is that the electrons are in a cloud around the nucleus.

## The Language of Chemistry

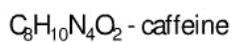
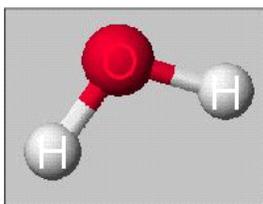
- The elements, their names, and symbols are given on the **PERIODIC TABLE**
- How many elements are there?



Scientists noticed patterns in characteristics of atoms.. This let them build the periodic table. They are even able to predict elements that have not been discovered yet.

Answer: 118 elements (not on quiz)  
Some have a very short life because they are radioactive and have a very short half-life. They are manufactured in a lab.

A **MOLECULE** is the smallest unit of a compound that retains the chemical characteristics of the compound.  
Composition of molecules is given by a **MOLECULAR FORMULA**



Point out that there are two hydrogens for each oxygen in the diagram and how that relates to the formula.

**CHEMICAL COMPOUNDS** are composed of atoms and so can be decomposed to those atoms.

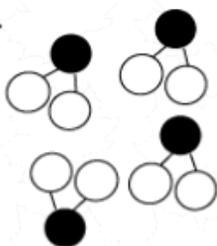


The red compound is composed of  
nickel (Ni) (silver)  
carbon (C) (black)  
hydrogen (H) (white)  
oxygen (O) (red)  
nitrogen (N) (blue)

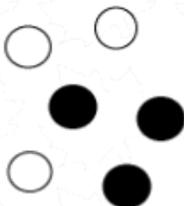
This substance can be broken down into these elements.

Which image represents a bunch of molecules?

A.



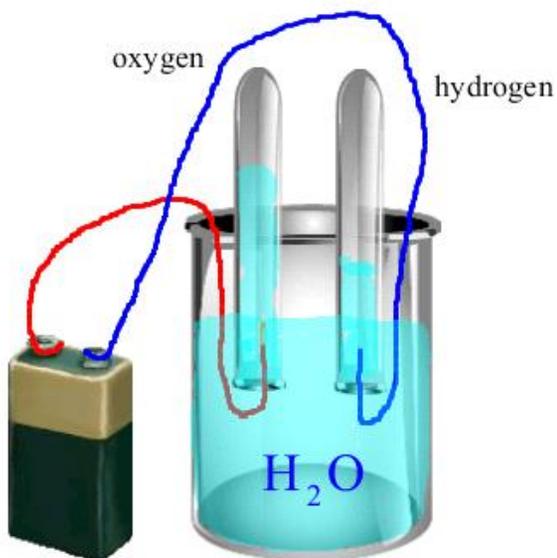
B.



Choose one answer.



Answer - A



You can break molecules down into atoms, but how did they figure out what elements are in a compound. Let's look at one example.

You will do an experiment similar to this one in module 4. Electricity will split the hydrogen and the oxygen from each other in the molecule.

Notice that there is twice as much hydrogen as oxygen. How does that relate to the formula?



Copper and Oxidized Copper

Copper is a pure element. The coin is made out of copper.

Notice the green stuff. That is oxidized copper. It mixed with oxygen and became a molecule. Notice how the properties have changed.

## ACTIVE INGREDIENT: hydrochloric acid



## Concentration

In chemistry we express concentration in several different ways ...

Concentration:

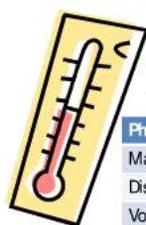
Let's say a husband and a wife notice that the toilet bowl is getting a buildup that they haven't been able to get off.

The wife picks up The Works from the grocery store.

The husband picks up muriatic acid from the hardware store.

They both try their product and they find the muriatic acid does better. They compare ingredients and find that they have the same substance. The only difference is the concentrations. The active ingredient was more concentrated in the muriatic acid.

You are changing the number of molecules in a given volume when you change concentration.



## Measurement and Units

Physical Quantity	Basic Metric Unit	Basic English Unit
Mass	Gram (g)	Slug (sl)
Distance	Meter (m)	Foot (ft)
Volume	Liter (L)	Gallon (gal)
Time	Second (s)	Second (s)
Temperature	Kelvin (k) or Celsius (C)	Fahrenheit (F)



Measurement	Relationship
Distance	1 inch = 2.54 cm
Mass	1 slug = 14.59 kg
Volume	1 gallon = 3.78 L



Topic Change! Measurement and units.

The basic metric unit is grams. The basic unit in English is slugs. Slugs?! I thought it was pounds. Well, grams and slugs are independent of gravity. Pounds depends on gravity. If you weigh yourself on your bathroom scale on earth and then on the moon, you would be less on the moon. Great way to diet! No, it doesn't work to diet that way.

The basic unit of distance is a meter. A benchmark for a meter is the distance from the floor to a doorknob plus a piece of chalk. You are probably pretty familiar with a foot.

Volume. The liter is the base unit of metric system. It is about half of a two liter bottle of soda. A gallon is the base in the English unit. That would be like a gallon of milk.

Time is the same in both systems.

Temperature - The metric system is based on Kelvin, but we will use the Celsius scale the most often. Fahrenheit is the one they typically will be using on the weather part of your news broadcast because we use the English system most often in everyday life here in the US.

The US is one of the last countries to still use the English system. Even the English don't use it anymore. Most of everyday life in other countries will be the Celsius, gram, liter, and meter.

## Common Decimal Prefixes Used with SI Units

Base Units: gram, meter, liter

Prefix	Prefix Symbol	Number	Word	Exponential Notation
tera	T	1,000,000,000,000	trillion	$10^{12}$
giga	G	1,000,000,000	billion	$10^9$
mega	M	1,000,000	million	$10^6$
kilo	k	1,000	thousand	$10^3$
hecto	h	100	hundred	$10^2$
deka	da	10	ten	$10^1$
base unit		1	one	$10^0$
deci	d	0.1	tenth	$10^{-1}$
centi	c	0.01	hundredth	$10^{-2}$
milli	m	0.001	thousandth	$10^{-3}$
micro	$\mu$	0.000001	millionth	$10^{-6}$
nano	n	0.000000001	billionth	$10^{-9}$
pico	p	0.000000000001	trillionth	$10^{-12}$
femto	f	0.000000000000001	quadrillionth	$10^{-15}$

You will be expected to master the prefixes in the orange circles.

Mew, lets get used to the prefixes and how they are added on to the base units.

The orange circled ones will be the ones we will use most often. Computers have pushed up into megabytes, gigabytes, and terabytes of data, but most devices in our everyday use don't measure things that large.

If you divide a base unit up into a hundred parts, you have a centi-meter, or centi-liter, or centi-gram. Divide it up into a thousand and you will use the milli prefix. Notice that the ones listed below the base unit on the chart are dividing up the unit into smaller parts.

Above the unit, you are having more than one unit. Kilo means 1000, so if you have a kilometer, you have 1000 meters. See how the prefixes add in the front of the base unit?

## Unit Conversions Factor-Label Method Dimensional Analysis

Many names for the same thing

Make up your own interesting conversion using the factor-label method.

given	X	conversion ratio fact	X	conversion ratio fact	=	goal unit
1		canceling!		canceling!		

Time	Length	Weight	Area	Volume	Mols and Mass
	12in = 1 ft	3ft = 1yd		5280ft = 1mi	2.54cm = 1in
	mm = 1m	cm = 1m		m = 1km	

Make up your own interesting conversion using the factor-label method.

5'8" (68") in  $\rightarrow$  cm

given	X	conversion ratio fact	X	conversion ratio fact	=	goal unit
1		canceling!		canceling!		

$$\frac{68 \text{ in}}{1} \times \frac{2.54 \text{ cm}}{1 \text{ in}} = 1.7 \times 10^2 \text{ cm} = 172.72 \text{ cm}$$

Time	Length	Weight	Area	Volume	Mols and Mass
	12in = 1 ft	3ft = 1yd		5280ft = 1mi	2.54cm = 1in
	mm = 1m	cm = 1m		m = 1km	

Make up your own interesting conversions using the factor label method

$\frac{\text{given}}{1} \times \frac{\text{conversion ratio fact}}{\text{canceling!}} \times \frac{\text{conversion ratio fact}}{\text{canceling!}} = \text{goal unit}$

Time Length **Weight** Area Volume Mols and Mass

1 kg - 2.2 lb | 1000 g - 1 kg | 1 lb - 454 g | 16 oz - 1 lb

Make up your own interesting conversions using the factor label method

$\frac{\text{given}}{1} \times \frac{\text{conversion ratio fact}}{\text{canceling!}} \times \frac{\text{conversion ratio fact}}{\text{canceling!}} = \text{goal unit}$

$\rightarrow \frac{20 \text{ lbs}}{1} \cdot \frac{1 \text{ kg}}{2.2 \text{ lbs}} = 9.1 \text{ kg}$

9.09090909

Time Length **Weight** Area Volume Mols and Mass

1 kg - 2.2 lb | 1000 g - 1 kg | 1 lb - 454 g | 16 oz - 1 lb

Quiz: <http://www.virtualhomeschoolgroup.com/mod/quiz/view.php?id=15963>