

Surrounded by Science & Math

Session 3

Physical Science



**Education & Training
Connections, Inc.**

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Shetler**

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Objectives

- **To develop lessons in the areas of physical sciences.**
- **To integrate physical science and math activities in the classroom.**
- **To explore different sources of materials that assist students in achieving science literacy.**
- **To make science real!**



Interim Activity 2

Let's Share!

- What was the top health issue identified by your students?
- What was an exciting website that you used to address this health issue?
- What was your lesson idea?
- Did you try it out?



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**What Do My Students
Really Need to Know?**
Molecular Science?

Chemical Reactions?

The World of Energy?

Composition of Matter?



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ABC Brainstorm!

- List physical (physics and chemistry) science topics/words that you could teach about in your ESL/ABE/GED classroom.
- Identify a topic or vocabulary word that begins with the first letter of each letter of the alphabet.



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**"If it's green or wriggles, it's
biology.**

If it stinks, it's chemistry.

**If it doesn't work, it's
physics..."**

— *Handy Guide to Science.*



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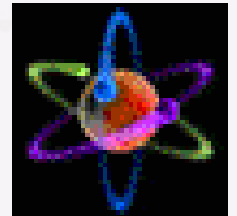
Physical science

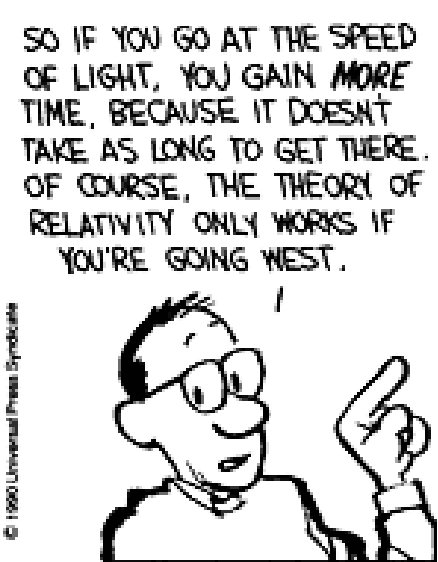
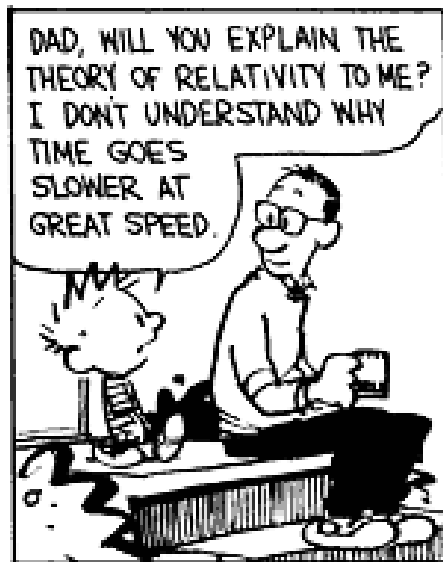
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**IT'S
ELECTRIC**

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- **Structure of atoms**
- **Structure and properties of matter**
- **Chemical reactions**
- **Motions and forces**
- **Conservation of energy and increase in disorder**
- **Interactions of energy and matter**





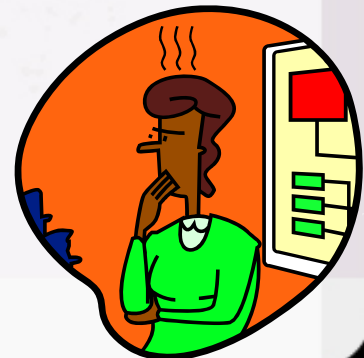
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WEBB

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What is the biggest challenge for GED candidates on the Science Test?

- Specifically, questions about mechanics – a sub-discipline of physics
- Applying knowledge of scientific concepts to specific situations
 - For example, candidates may know how to recite Newton's Laws but do NOT understand how to apply them to a specific situation (or how the laws apply).



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Why is physics so challenging for GED candidates?

- Offered at higher grade levels—after many GED candidates leave high school
- Common misconceptions reinforced in:
 - Everyday experiences
 - Media (e.g., movies, video games) representation



How Can Instructors Help?



- Use hands-on demonstrations & experiments to help students “see” physics concepts at work
- Use demos & experiments to help students apply their understanding to new situations
- Use resources to examine and/or dispel common misconceptions

Time Out for a Few Vocabulary Words

- Physics - The study of matter and energy and the relationship between them
- Mechanics – The study of the motion of objects and the action of forces on objects

Time Out for a Few Vocabulary Words

Motion of Objects - The relative change in position of an object over time.

- Speed
 - Velocity
 - Acceleration
 - Force
 - Momentum
- These are important motion concepts.
 - GED students should also know and understand Newton's Laws of Motion.

Time Out for a Few Vocabulary Words

Speed	How fast an object is moving
Velocity	Speed with direction
Acceleration	Change in speed or velocity over time
Force	Any push or pull (friction is the force that opposes the movement between two objects)
Momentum	Product of the mass of an object times its velocity (inertia is the resistance an object has to changing its motion)



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Does All of That Make Sense?

It's About Relevancy!
science = Scientia = To Know

I believe
in Physics!



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Lift is created when moving air above a wing creates lower pressure. As the surface of a real airplane is curved, the air moving above the wing moves just a little faster (as it has further to go) than the air below it causing a small pressure difference between the top and bottom surface. Since the pressure above the wing is lower than that below the wing, there is a net resultant force acting on the wing, known as the lift which causes the wing to rise.

Parts adapted from "Great Paper Airplanes" by Kittyhawk Software. ©1995.

Based on the passage, which of the following factors influences why a plane flies?

- (1) Air temperature around the plane
- (2) Increased pressure over the wing
- (3) Curve in the wing design
- (4) Decreased pressure under the wing
- (5) Less force acting on the wing

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Sample Hands-On Activities

Experiment 1

Flying Paper Strips

- Using the ruler, measure and cut-out strips of paper about 2 inches wide and 6 inches long.
- Hold the shortest end just under your mouth and blow over the paper. What happened?
- What do you think will happen if you change the size of the paper?
- Do you think the shape of the strip of paper is important? Try experimenting.
- Do you think the experiment will always work?

Experiment 2

The Swinging Ping-Pong Balls

Step 1: Use the ruler and measure and cut two thin pieces of string 12 inches long.

Step 2: Tape a ping-pong ball to one end of the string.

Step 3: Tape the other end of the string to the ruler.

Step 4: Repeat steps 2 and 3 by taping a second piece of string and the ping-pong ball to the ruler. The ping-pong balls should be hanging about 1 inch apart on the ruler.

Hold the ruler up so that the balls hang freely.

What do you think will happen if you blow in between the two balls? Try it! What did you see happen?

Source: Air and Lift. The Bernoulli Effect:

<http://www.rmsc.org/museum/kidsclub/experiments/airplay/airplay1b.htm>

Four Principles of Flight

MOTION
BASICS

Gravity: the natural force that keeps an airplane on the ground or pulls it to Earth when in flight.

Lift: the force supporting the weight of an airplane.

Drag: the resistance of air to an object moving through it. The faster an object moves, the more drag it creates.

Thrust: the force created by engine power to overcome drag.



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<http://www.youtube.com/watch?v=gk6rNFVc1Gs>

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Let's Apply!



**The Winner
Is!**

**Building a
Glider**



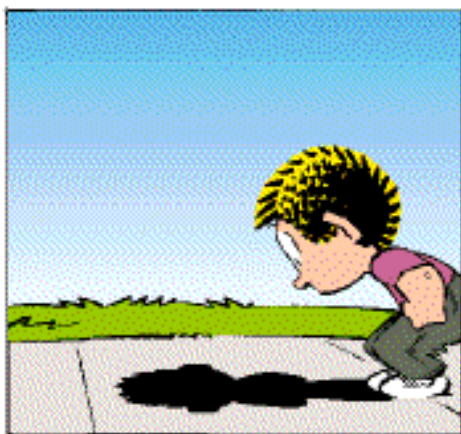
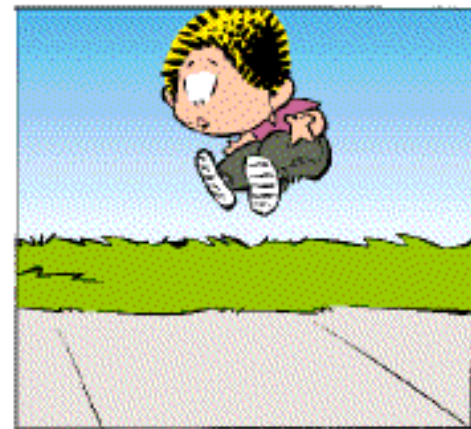
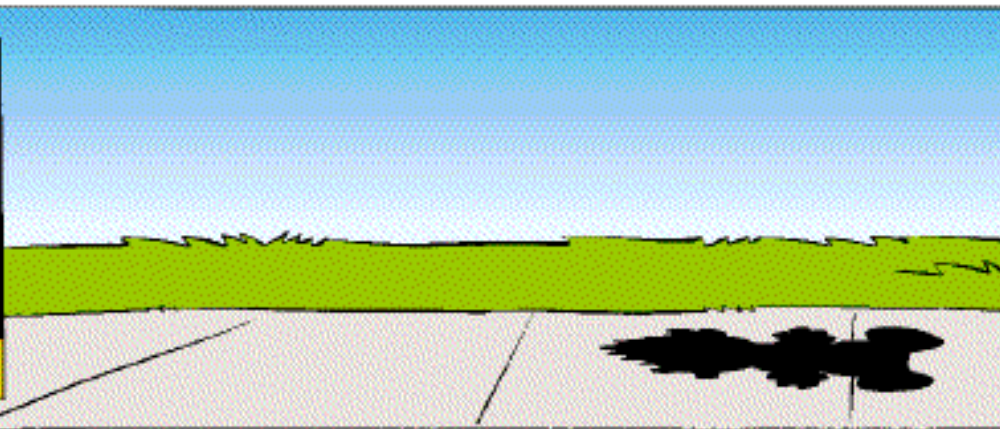
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Let's Apply!

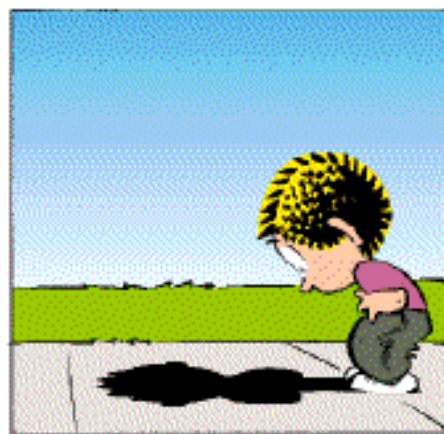
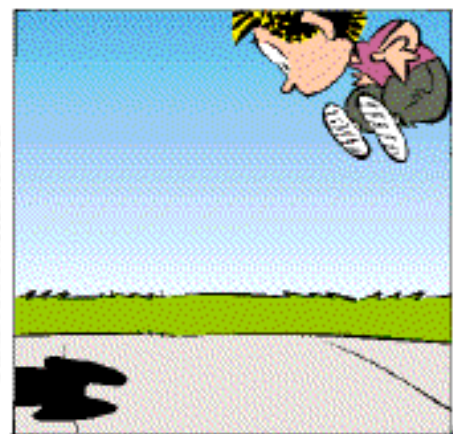
**Don't Forget the Math!
Flight Math & Graphing
Your Results**



ROSE IS ROSE



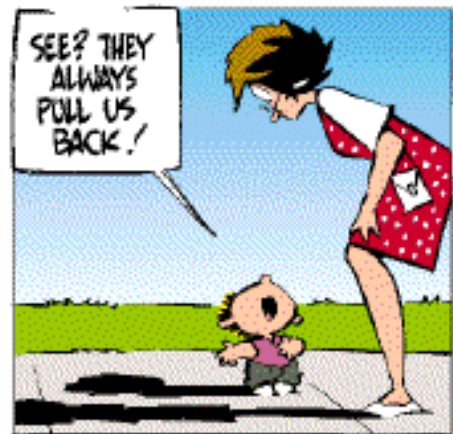
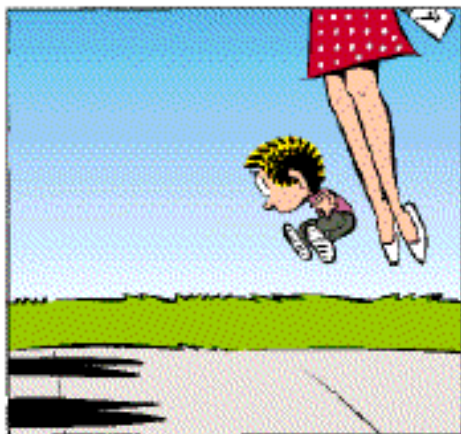
E-MAIL: PRRKRYROSE@aol.com



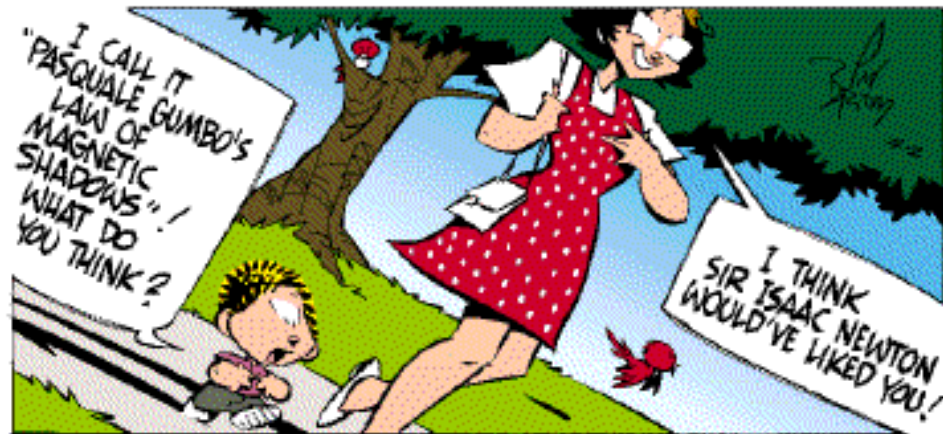
www.comics.com



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SEE? THEY ALWAYS PULL US BACK!



All Objects Fall at the Same Rate



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http://www.youtube.com/watch?v=7_fbH-muvlw

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1666 Newton's Three Laws of Motion

- Every object in a state of uniform motion tends to remain in that state of motion unless an external force is applied to it.
- The relationship between an object's mass m , its acceleration a , and the applied force F is $F = ma$.
- For every action there is an equal and opposite reaction.



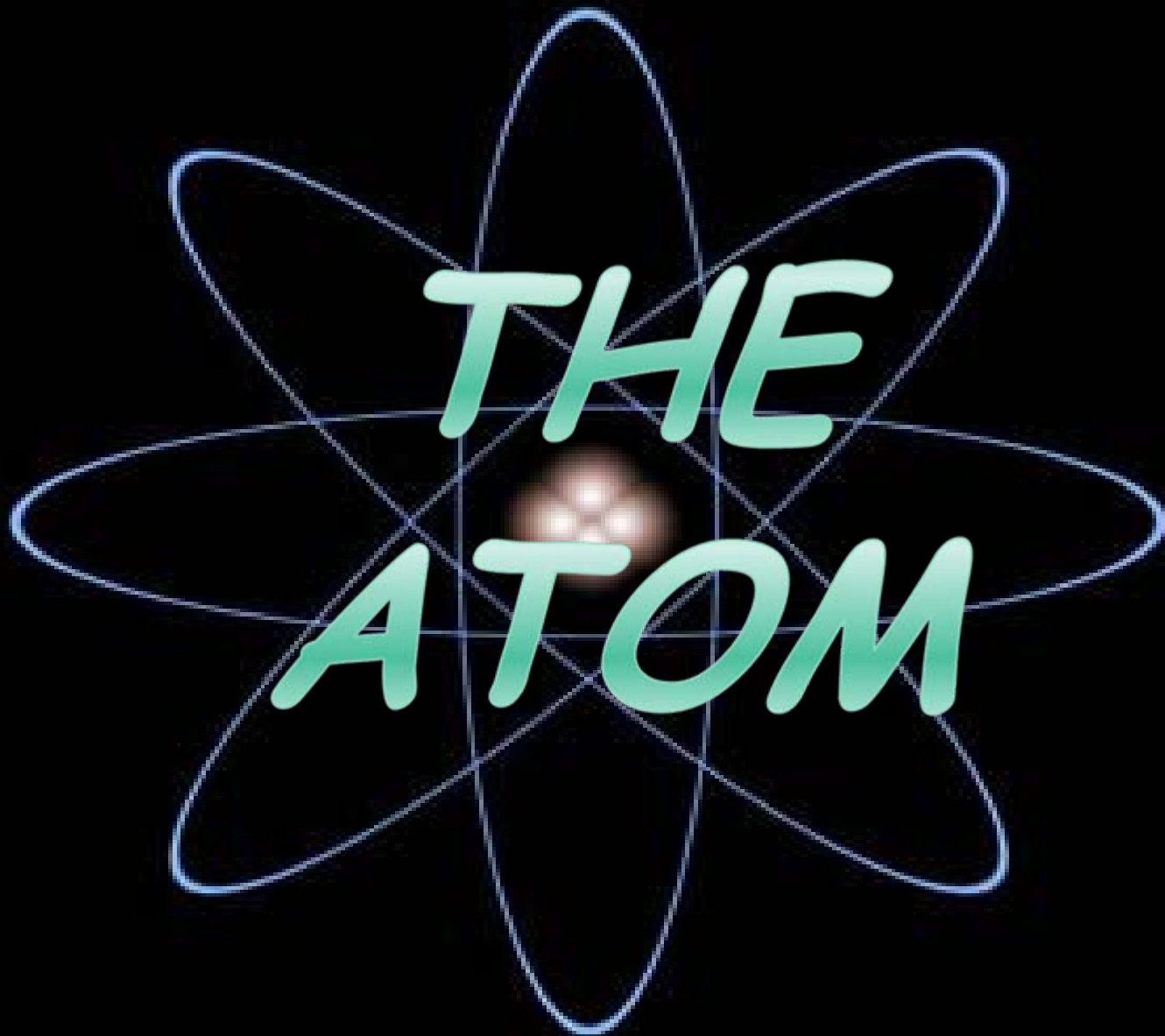
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Let's Apply!

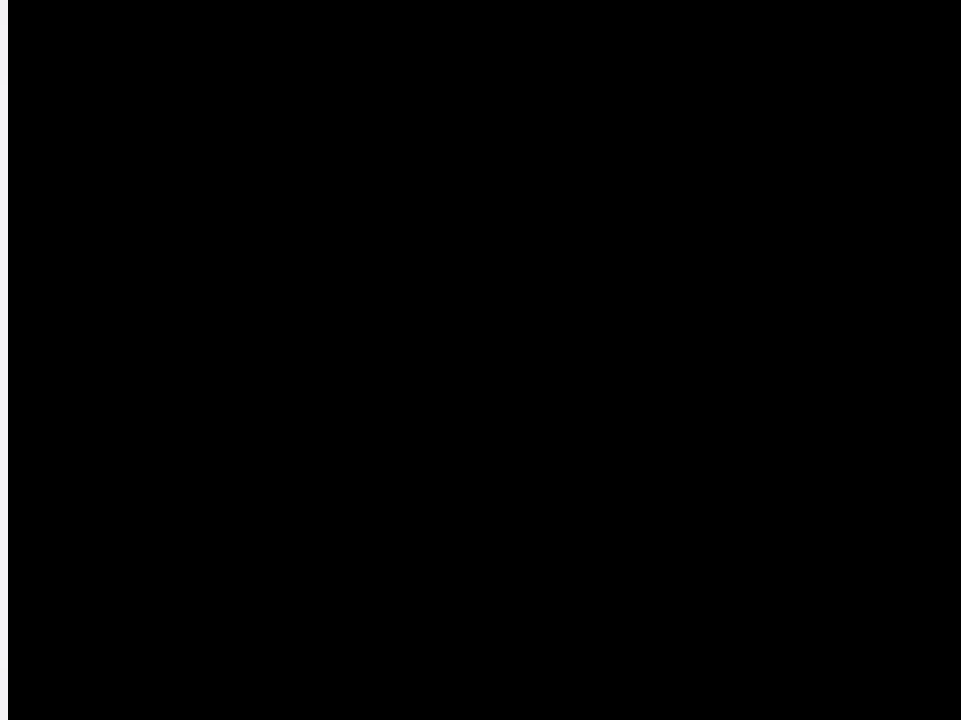


**Looking for
Newton**

(in all the wrong places)

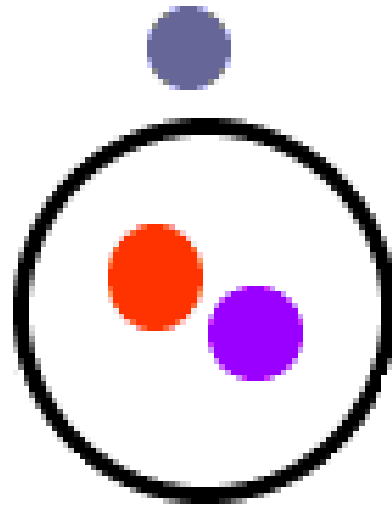





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<http://www.youtube.com/watch?v=an3Apvs1oGU>

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-  Electrons
-  Protons
-  Neutrons

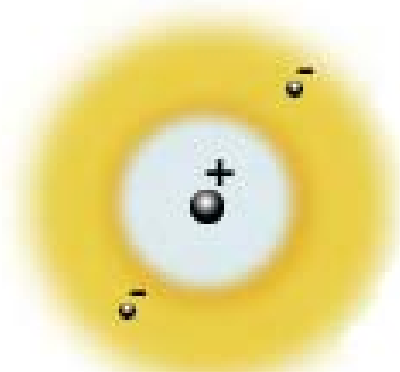
Basic Structure of the Atom

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The Changing World of the Atom!



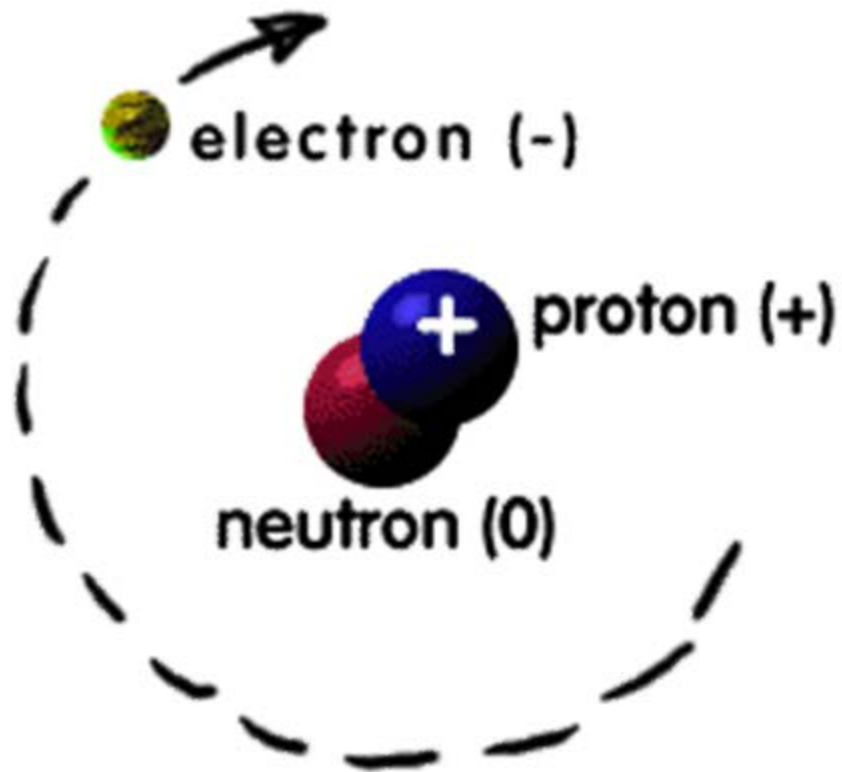
1900



Present Day

**(I am the Very
Model of a
Modern Major Atom)**

IT'S LIKE THIS...



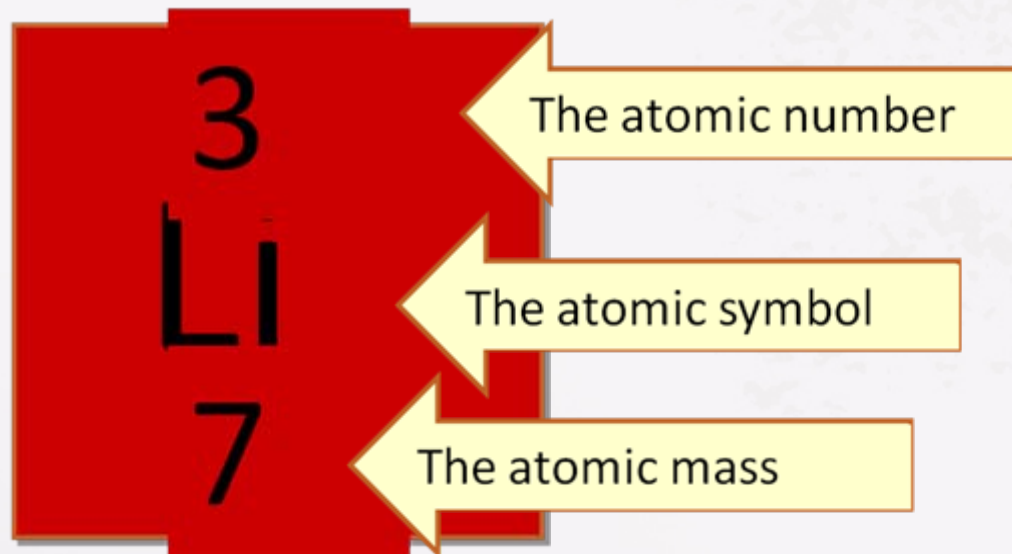
ATOM
BASICS

Vocabulary

- Atom - the smallest unit that maintains the characteristics of an element
 - Nucleus- The center of the atom, contains protons and neutrons
 - Electron Cloud – Region surrounding the nucleus containing the electrons
- Element - A chemical substance that is composed of atoms with the same number of protons in the nucleus

The Nucleus

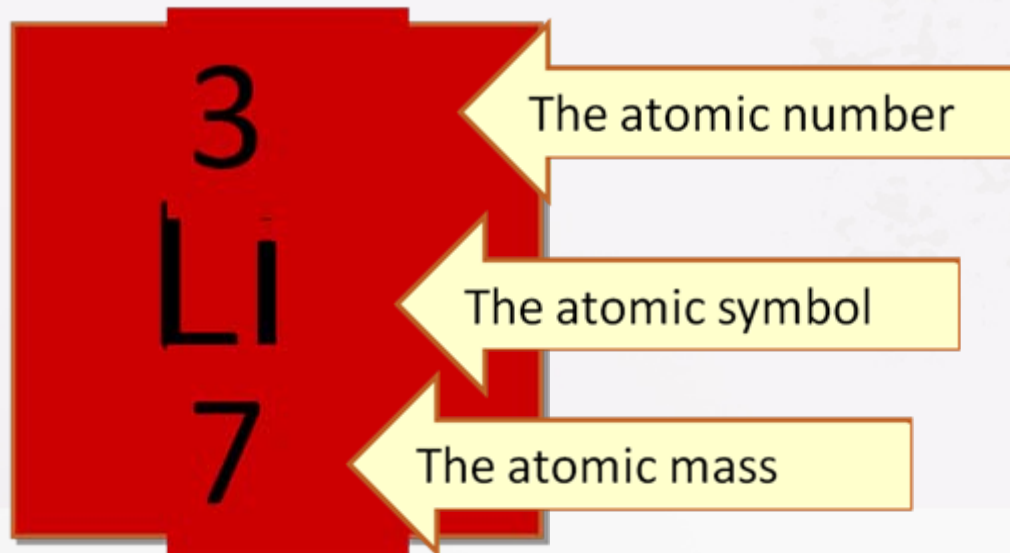
Proton - A positively charged sub-atomic particle (+). The number of protons is the same as the atomic number



The Nucleus

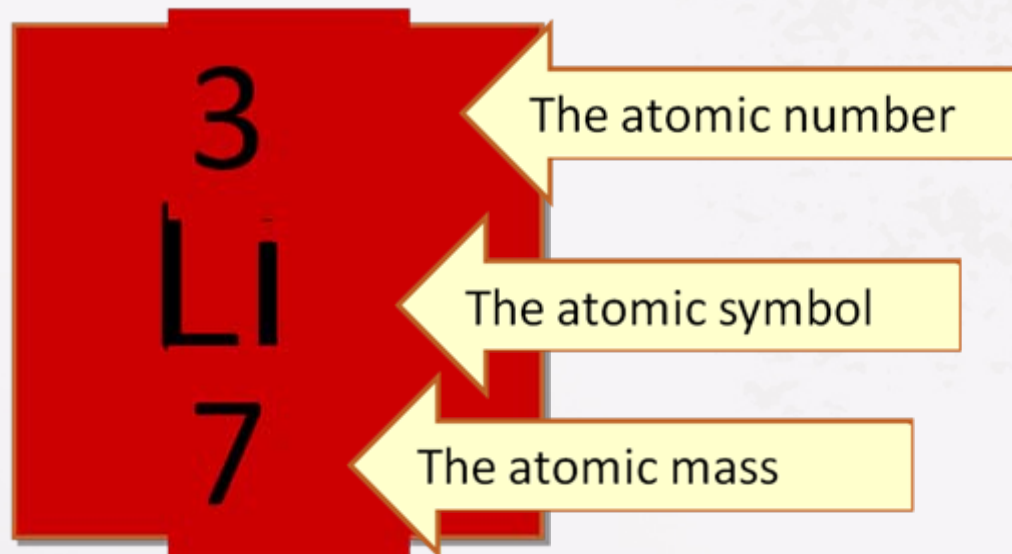
Neutrons – A sub-atomic particle in the nucleus. Neutrons do not have a charge (0). To calculate the number of neutrons in an element

$$\begin{array}{l} \text{The atomic mass} \\ - \text{The atomic number} \\ \hline \text{The number of neutrons} \end{array}$$

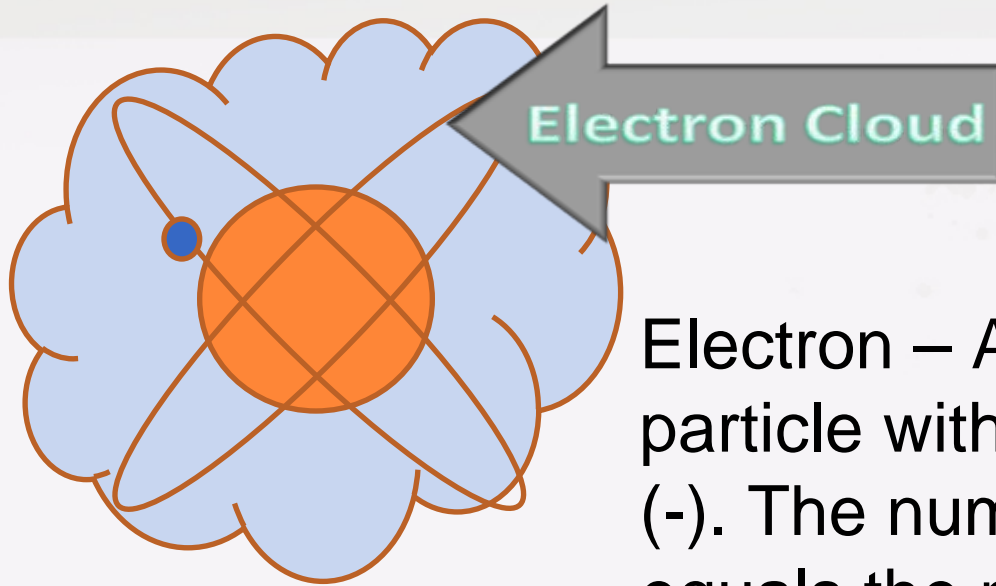


The Nucleus

Proton - A positively charged sub-atomic particle (+). The number of protons is the same as the atomic number



The Electron Cloud



Electron – A sub-atomic particle with a negative charge (-). The number of electrons equals the number of protons.

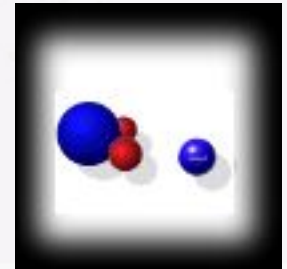
Electrons behave as if in a very large 3-D orbit.

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Let's Apply!



**How Big Is an
Atom?**



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How Big Is an Atom?

How Far Did You Get? Here are some comparisons to think about as you are cutting.

Cut 1	14.0 cm	5.5"	Child's hand, pockets
Cut 2	7.0 cm	2.75"	Fingers, ears, toes
Cut 3	3.5 cm	1.38"	Watch, mushroom, eye
Cut 4	1.75 cm	.69"	Keyboard keys, rings, insects
Cut 6	.44 cm	.17"	Poppy seeds
Cut 8	1mm	.04"	Thread. Congratulations if you are still in!
Cut 10	.25 mm	.01"	Still cutting? Most have quit by now.
Cut 12	.06 mm	.002"	Microscopic range, human hair
Cut 14	.015 mm	.006"	Width of paper, microchip components
Cut 18	1 micron	.0004"	Water purification openings, bacteria
Cut 19	.5 micron	.000018"	Visible light waves
Cut 24	.015 micron	.0000006"	Electron microscope range, membranes
Cut 31	.0001 micron	.0000000045"	The size of an atom!

Reading a Periodic Table

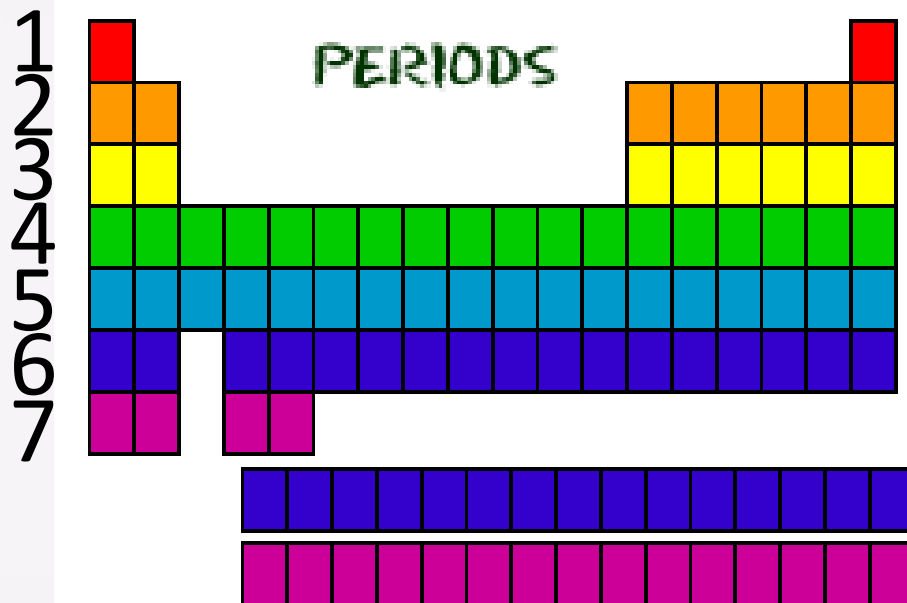
The Periodic Table is organized like a big grid.

- Rows are considered to be different PERIODS (like in PERIODic Table). All of the elements in a period have the same number of atomic SHELLS.

Example: Every element in the top row (the first period) has one shell for its electrons, the second row (the second period) have two shells for their electrons, etc.

- Columns that go from top to bottom are called GROUPs. The elements in a group have the same number of electrons in their outer shell.
- *Example: Every element in the first column (group one) has one electron in its outer shell, second column (group two) has two electrons in the outer shell, etc.*
- **Exceptions:** Hydrogen and Helium are TRANSITION elements because they have special electron rules.

Periodic Table



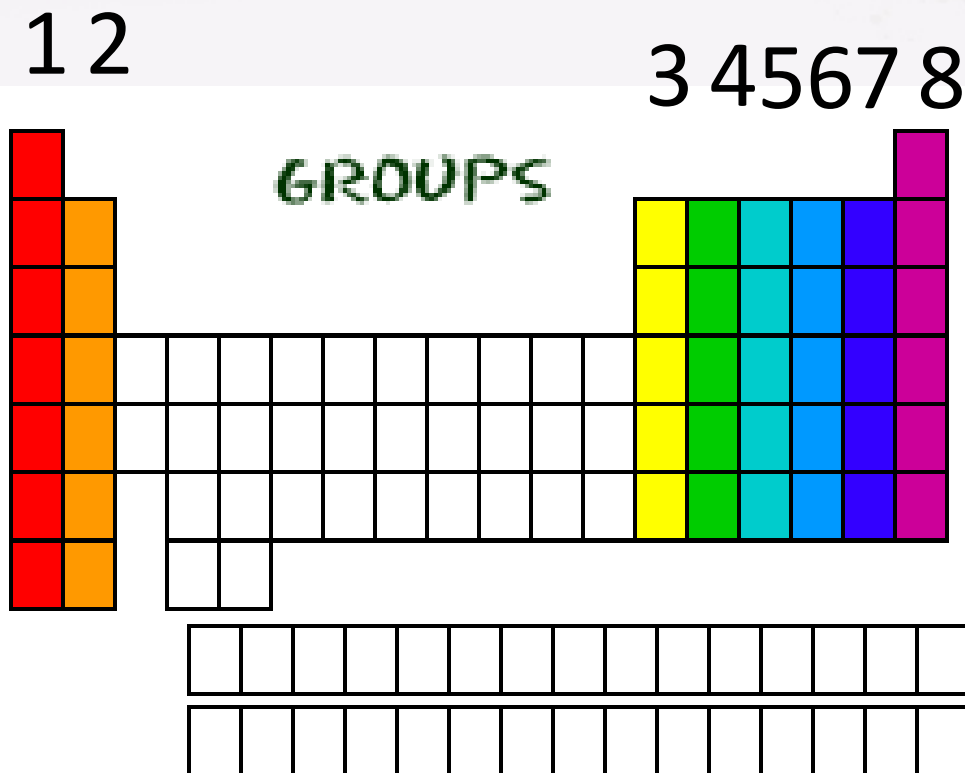
Periods go across on the periodic table.

Periods have the same number of “shells.”

Periodic Table

Groups go down on the periodic table

Elements in the same group, have the same number of valence electrons

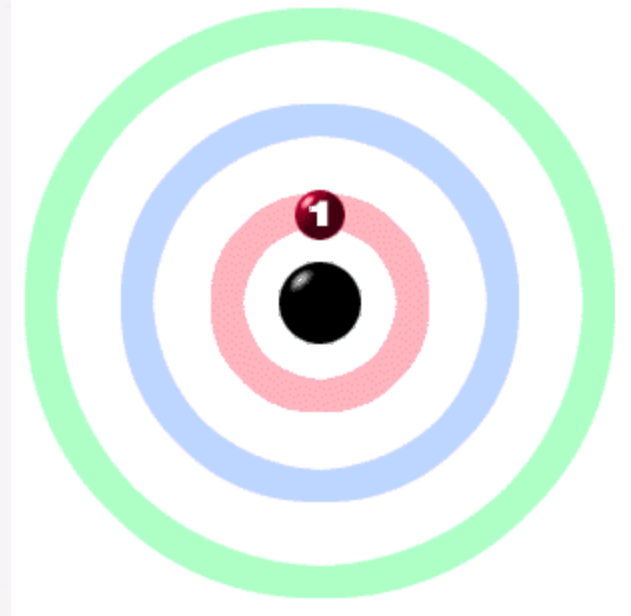
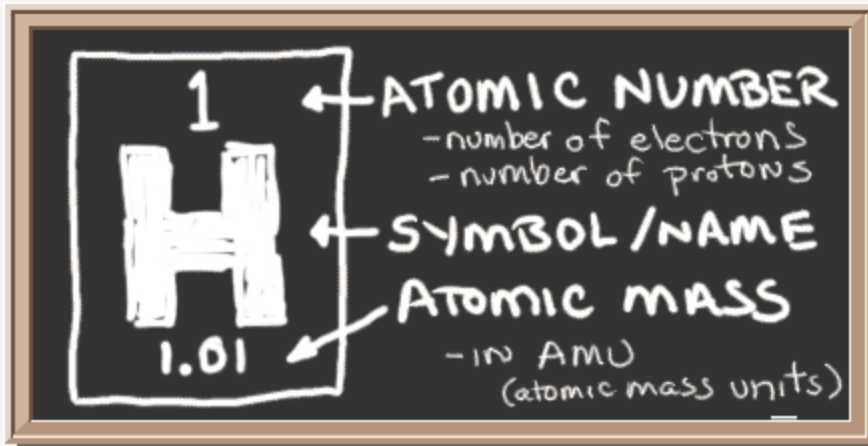


Let's look at a few elements . . .

Hydrogen

1 = proton

1 = electron

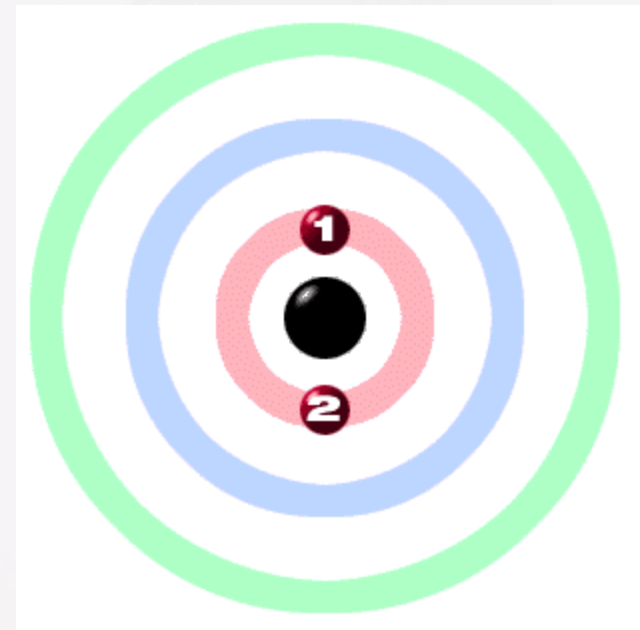
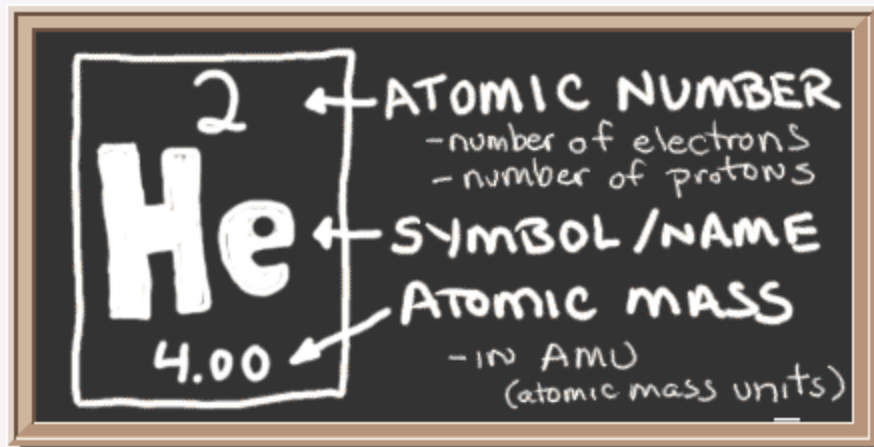


Let's look at a few elements . . .

Helium

2=protons
2=electrons

2=neutrons

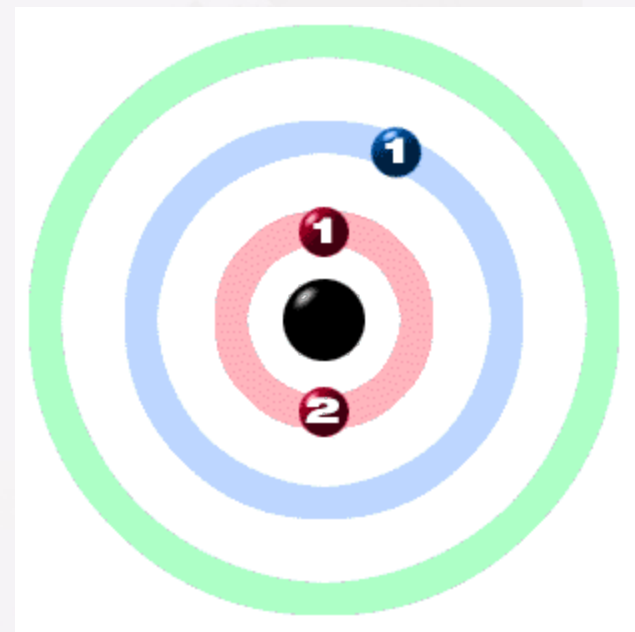
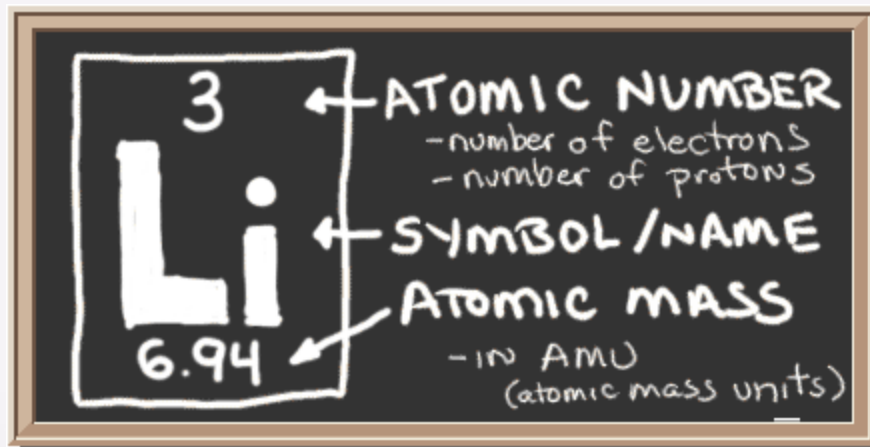


Let's look at a few elements . . .

Lithium

3=protons
3=electrons

4=neutrons

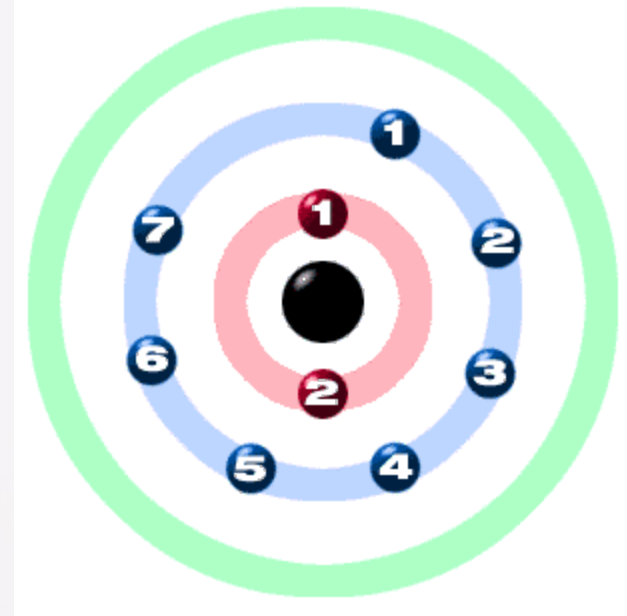
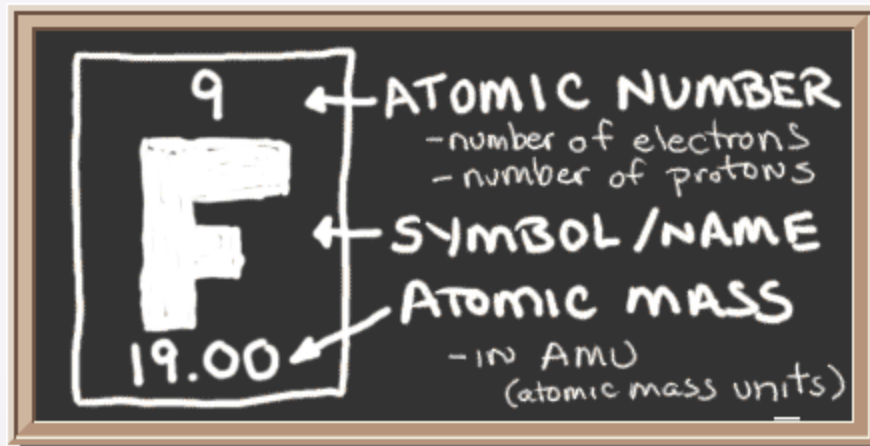


Let's look at a few elements . . .

Fluorine

9=protons
9=electrons

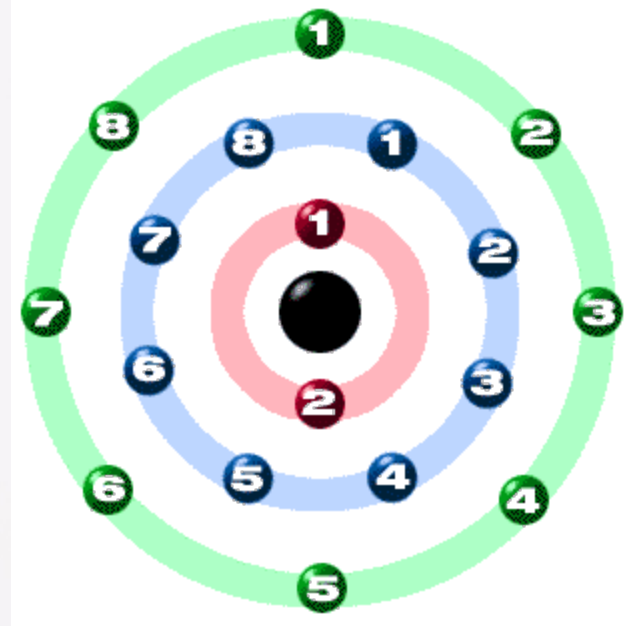
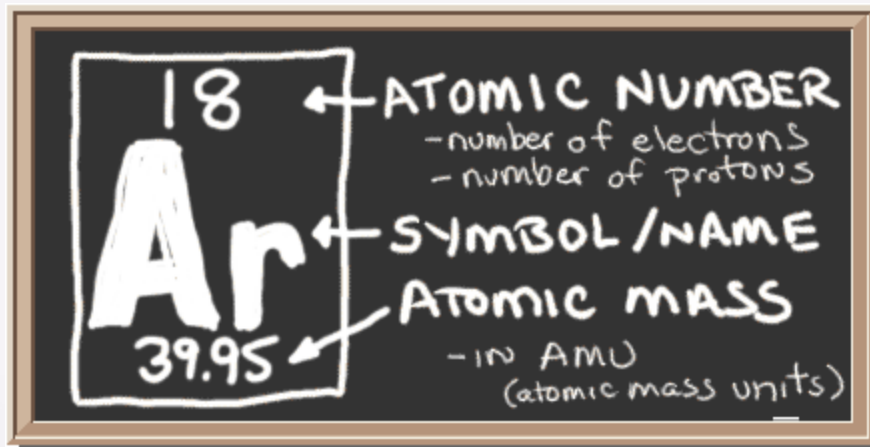
10=neutrons



Let's look at a few elements . . .

18=protons 22=neutrons
18=electrons

Argon



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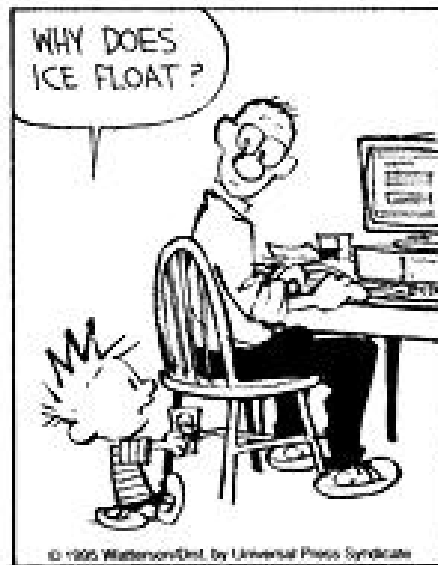
Let's Apply!



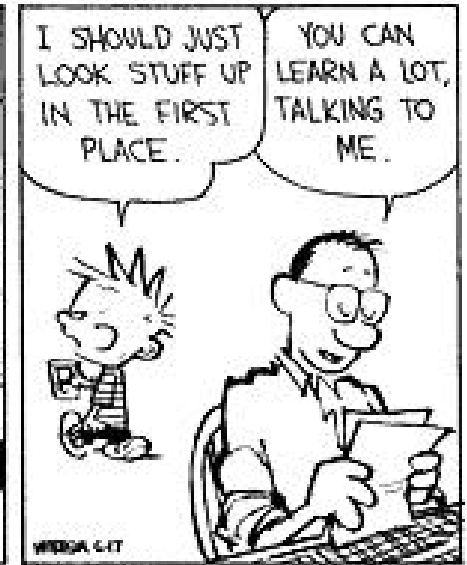
Periodic Table of the Elements

	1A (1)	2A (2)											3A (13)	4A (14)	5A (15)	6A (16)	7A (17)	8A (18)
1	H																	He
2	Li	Be											B	C	N	O	F	Ne
3	Na	Mg	3B (3)	4B (4)	5B (5)	6B (6)	7B (7)	8B (8)	9B (9)	10B (10)	11B (11)	12B (12)	Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
6	Cs	Ba	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
7	Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub	Uut	Uuq	Uup	Uuh	Uus	Uuo
lanthanides			La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb		
actinides			Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No		

It's All About Matter!



BECAUSE IT'S COLD. ICE WANTS TO GET WARM, SO IT GOES TO THE TOP OF LIQUIDS IN ORDER TO BE NEARER TO THE SUN.



Let's Take a Look!



<http://www.youtube.com/watch?v=KxtqzApPAfc>

It's All About Matter!

- Everything is made of MATTER!
- Matter is anything that has volume and mass.
- Volume is the amount of space an object takes up or occupies.

Solid



Liquid



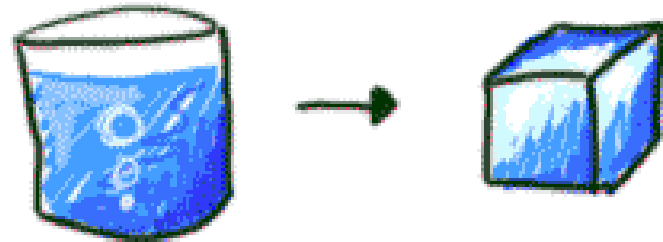
Gas



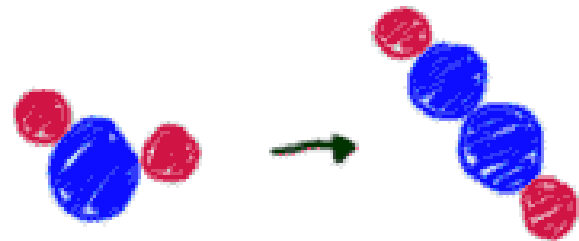
States of Matter

Everything is either a:

- Solid
- Liquid
- Gas



PHYSICAL CHANGE OF
WATER INTO ICE



CHEMICAL CHANGE OF
WATER INTO
HYDROGEN PEROXIDE

Vocabulary of Matter

particle

freeze

contract

liquid

melt

pour

solid

boil

squash

gas

condense

state

diffuse

expand

boiling

melt

shape

point

dissolve

ice

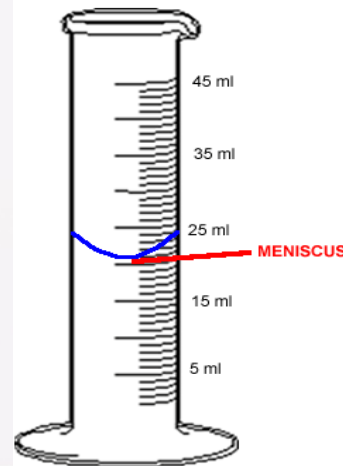
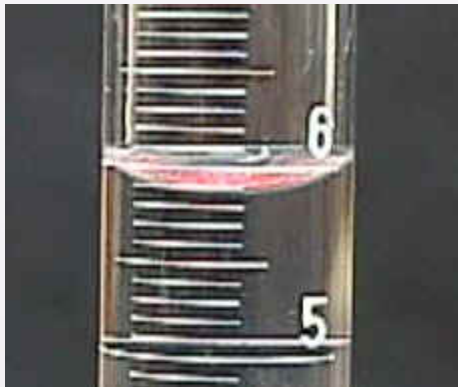
melting

point

Math and Matter!

Measurement of Liquids

- Liquids have volume. We measure that volume with a graduated cylinder.
- Liters (L) and mL (milliliters) are most often used to express the volume of liquids.

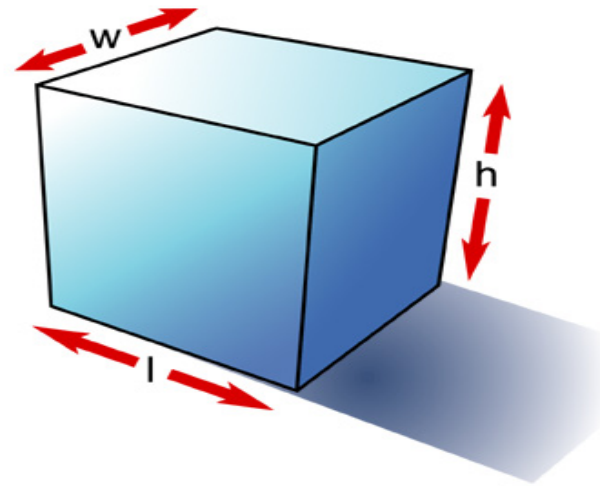


Math and Matter!

Measurement of Solids

- The volume in a solid is always expressed in cubic units.
- Cubic means having “three dimensions.”
- Cubic meters(m^3) or cubic centimeters(cm^3) are most often used to express the volume of a solid.
- The 3 in m^3 signifies that three quantities were used to get the final result.

- If each side in the cube below is 2m, what is the volume of the cube?



Math and Matter!

Measurement of the Volume of Gases

- To measure the volume of a gas, you need to know the pressure of the gas, the amount of gas present, and the temperature of the gas.

Ideal Gas Law Formula:

General Gas Equation: $PV = nRT$

Pressure(P) = nRT / V

Volume(V) = nRT / P

Temperature(T) = PV / nR

Moles of Gas(n) = PV / RT

where,

P = pressure,

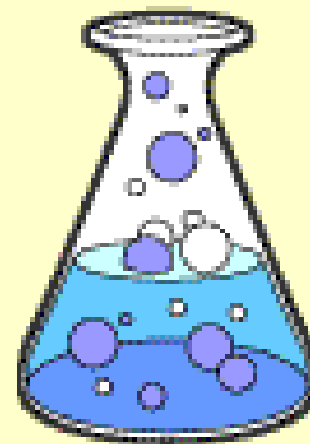
V = volume,

n = moles of gas,

T = temperature,

R = $8.314 \text{ J K}^{-1} \text{ mol}^{-1}$, ideal gas constant.

**Definitely not a
GED Test question!**



Physical Changes in Matter

- A physical change is a change that affects one or more physical properties of a substance.
- Physical changes do not form new substances!
Example: ice melting or sugar dissolving
- Physical changes are easy to undo.



Chemical Changes in Matter

- A chemical change occurs when one or more substances are changed into entirely new substances with different properties.
- Chemical changes are not usually reversible!
- May see color change, fizzing/bubbling, heat, production of light, sound, or odor.
- Examples of chemical changes: baking a cake, rusting, burning items



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A cook decides to recover some table salt that has been completely dissolved in water. Which of the following processes would be the most effective method of extracting salt from the solution?

- (1) spinning the solution in a mixer**
- (2) boiling away the water**
- (3) pouring the solution through cloth**
- (4) dripping the solution through a paper filter**
- (5) bubbling oxygen through the solution**

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Let's Apply!



Goop!

*(critical thinking at
its finest)*

Surrounded by Science

On the Web!



**Time Out
to
Explore and Discover!**

Websites to Explore

Chem4Kids /Biology4Kids/Physics for Kids – These may say for kids, but they're great beginning sites for everyone.

- <http://www.physics4kids.com/>
- <http://www.chem4kids.com/>
- <http://www.biology4kids.com/>

Websites to Explore

The Basics of Physical Science

- <http://particleadventure.org>

Fear of Physics – Neat activities

- <http://www.fearofphysics.com/>

The Franklin Institute – lots of science sites

- <http://www.fi.edu/learn/hotlists/physical.php>

Science Friday (NPR)

- <http://www.sciencefriday.com/>

Websites to Explore

Ten Cool Sites – explore the latest “cool” sites from the Exploratorium

- <http://apps.exploratorium.edu/10cool/index.php>

Science Online – Harcourt Classroom

- <http://classroom.jc-schools.net/sci-units/matter.htm>

Surrounded by Science

On the Web!



One More Site!

http://www.exploratorium.edu/learning_studio/sciencesites.html

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On the Web!



**Science Videos – They're
Everywhere!**

Videos

Newton's Apple

- <http://www.newtonsapple.tv/>

Bill Nye the Science Guy

- <http://www.billnye.com>

ABC Science

- <http://www.abc.net.au/science/broadband/>

Periodic Table – Videos on the Elements

- <http://www.periodicvideos.com/#>

Play Some Games!

Periodic Table

- <http://www.funbrain.com/periodic/index.html>

Science Odyssey

- <http://www.pbs.org/wgbh/aso/>

Try Science

- <http://tryscience.org/home.html>

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The Solution Is ... !

**What Should
I Teach?
The Top Ten!**



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My Interim Activity Portfolio

Create a file folder for your final assignment. Label the folder with your full name. The following items should be included in your file for submission as your final project.

- **Interim Activity 1 – Let's Take a Look at the Research**
- **Interim Activity 2 – Creating a Health Lesson Based on Student Surveys**
- **Final Activity –**



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