Friday September 2nd
OBJECTIVES FOR TODAY'S CLASS:

On COURSE TOPICS:

- **Continue our review of the basics of MATTER**
- **Review the basics of ENERGY**
- **Tie Matter & Energy to GLOBAL CHANGE**

ON COURSE LOGISTICS:

- **Address clicker registration issues!**
- **Go over Assignment #1**

A TRIAL CLICKER QUESTION!

CHANNEL 41

Q1. What is enclosed in the chain link fence immediately to the north of BioSci West (our classroom building)?

A) The Gould-Simpson Building

B) A bike parking lot

C) A solar-powered house

D) Nothing – it's just a bunch of dirt!

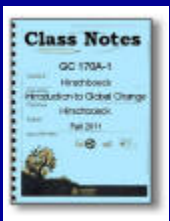
CLICKER LOGISTICS!!!

Topic #4
ENERGY & MATTER
OVERVIEW - Part II

OBJECTIVES:

To review basic physical concepts of energy and matter and some key ways in which they interact.

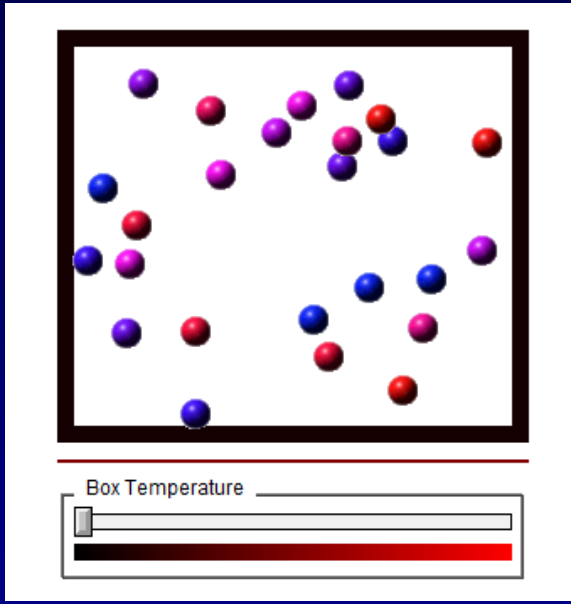
CLASS NOTES: pp 23- 28



When heat is added ➔ increase in total energy + "work" done

At lower temperatures substance gets more dense, molecules move more slowly and are more likely to bond

e.g., gas ➔ liquid



At higher temperatures, molecules move faster, collide & rebound more frequently, leading to expansion of the substance

http://www.colorado.edu/physics/2000/bec/temperature.html

WHAT DOES THIS HAVE TO DO WITH GLOBAL CHANGE & MY DAILY LIFE ?????

Listen & think ➔
(not in Class Notes)

☺


Arizona Daily Star
www.dailystar.com www.azstarnet.com
Published: 09.31.2006

Ariz. heat cheats drivers at gas pump

standard not enforced, costing $115M yearly in state, study says

spending about $115 million more a year on gasoline and diesel fuel
uel temperatures were regulated to the federal standard, according to

LAT Home | My LATimes | Print Edition | All Sections

"It's a significant number, and one that we shouldn't be paying," said Judy Dugan, research director at Santa Monica-based Consumer Watchdog, formerly called the Foundation for Taxpayer and Consumer Rights. "With every rise in the price of gas, hot fuel becomes a more important issue."

FEDERAL STANDARD:

Fuel at gas pump should be dispensed into a vehicle's tank at a temperature of 60 ºF

If temperature is not 60 º F, the cost of a gallon should be adjusted to reflect the volume of fuel at 60 º F.

The U.S. government defined volume of a gallon of gas:

At 60 degrees, a gallon is 231 cubic inches.

But when fuel is warmer than 60 degrees, the liquid expands, yielding less energy per gallon.

http://articles.latimes.com/2008/may/23/business/fi-hotfuel23

☺

Rules of physics cost us money !!

Basic physics!

Depending on the temperature, the difference can amount to a few cents per gallon . . . .

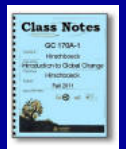
. . . . But it adds up to big money — coming straight out of consumers' pockets.

Now let’s review the atoms themselves and their internal structure . . .


I'VE DONE IT– I'VE FOUND THE MOST BASIC PARTICLE!
I'VE FOUND THE PARTICLE THAT MAKES UP THAT BASIC PARTICLE!
I'VE FOUND THE PARTICLES THAT MAKE UP THE PARTICLES...

ATOMIC STRUCTURE:

Electron
Nucleus
Proton
Neutron



ELECTRON: tiny, - charged, very low mass

circles in orbits around a positively charged nucleus of an atom

NUCLEUS: small & massive
(contains protons, neutrons . . .)

central part of an atom;
made up of elementary particles
that are even smaller →

PROTON: +charged, in nucleus
(mass > an electron)

NEUTRON: neutral charge, in nucleus,
(approximately equal in mass to a proton).

The # of neutrons can vary ➔ ISOTOPES . . . .

ISOTOPE:

atoms of a given element that have different numbers of neutrons in their nuclei (hence slightly different masses)

e.g. carbon-12 (^{12}C) & carbon-13 (^{13}C)

ATOMIC NUMBER = # of protons in nucleus

Atom is neutral (no charge) when:

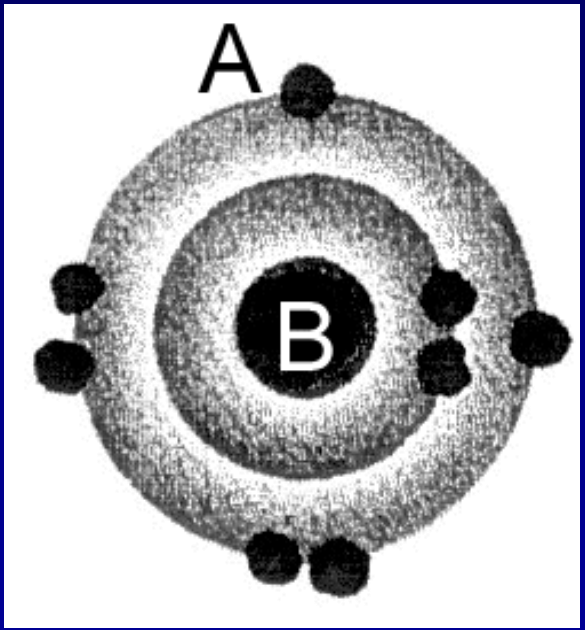
protons (+) = # of electrons (-)

ION: f the atom has a charge (+ or -) it is an **ION**

protons (+) ≠ # neutrons (-)

MASS NUMBER = # protons + # neutrons in the nucleus

Schematic “dot” diagram of an oxygen atom



What is A? _____

What is B? _____

 # electrons = _____

 # protons = _____

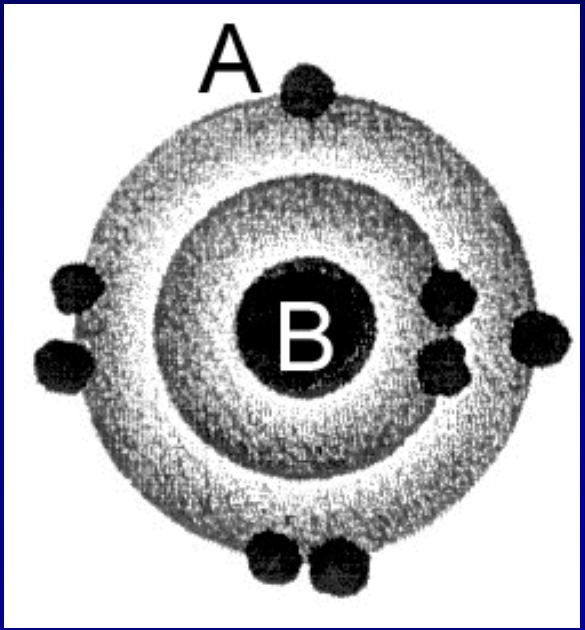
 # neutrons = _____

atomic # = _____

mass # = _____

Is ^{18}O [lighter or heavier] than ^{16}O?

Schematic “dot” diagram of an oxygen atom



What is A? electron

What is B? nucleus

 # electrons = 8

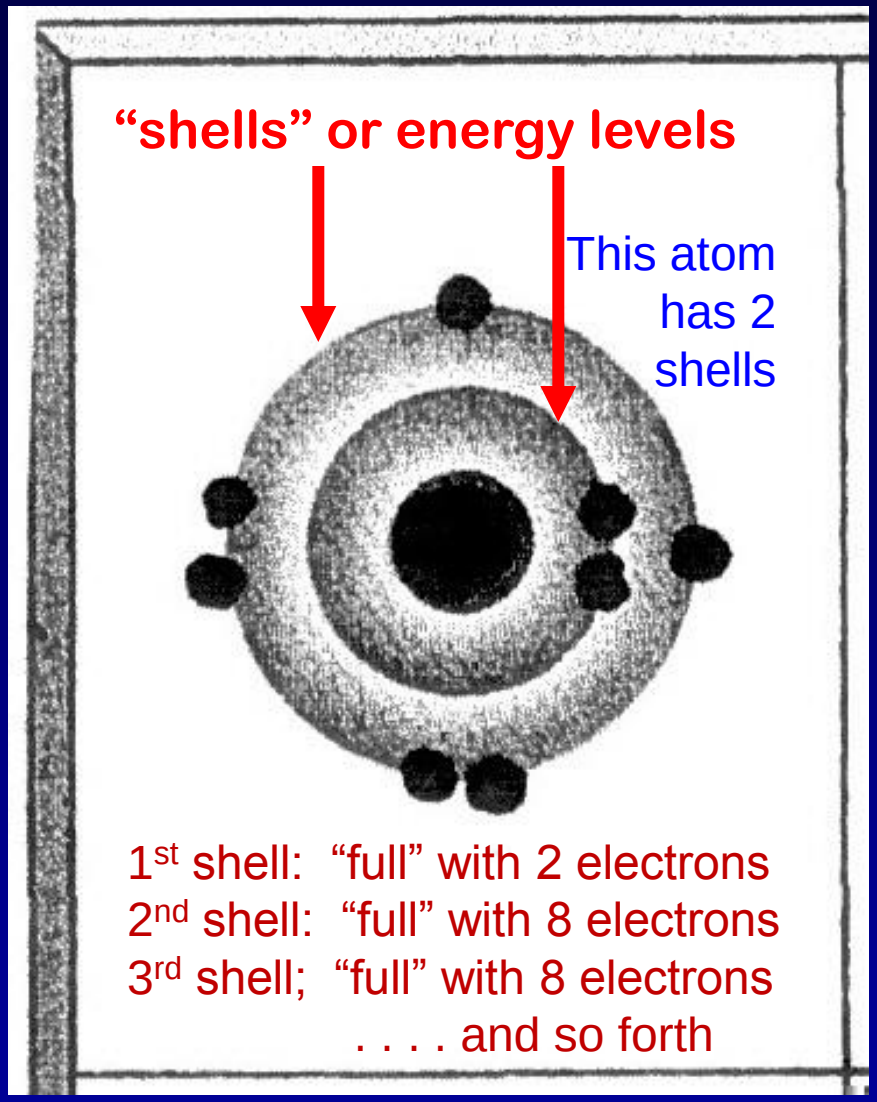
 # protons = 8

 # neutrons = 8

atomic # = 8

mass # = 16

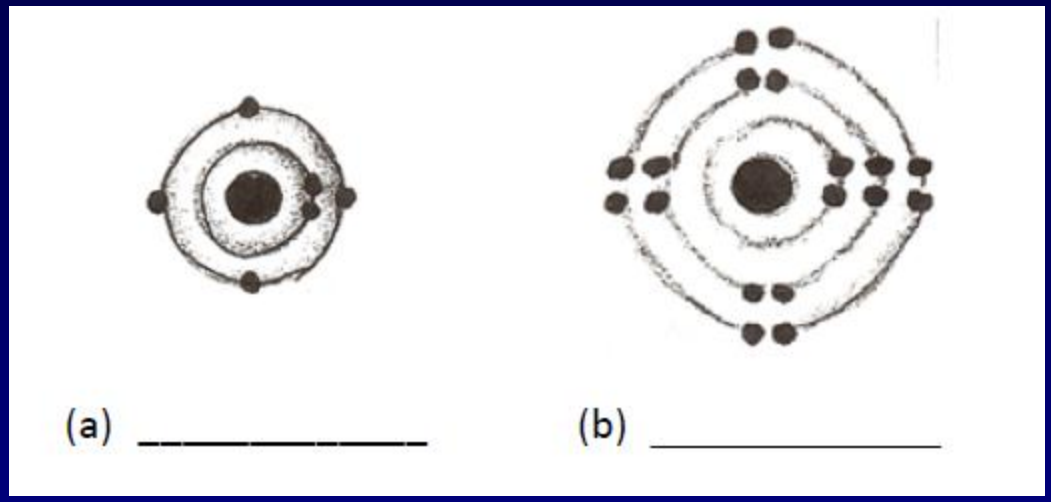
Is ^{18}O [lighter / heavier] than ^{16}O?



Electron Configuration in Shells
(for Elements 1 to 18)

Atomic #	*Element & Symbol*	Number of Electrons in Each Shell			*Total # of Elec-trons*
		1st	2nd	3rd	
1	*Hydrogen, H*	1			*1*
2	*Helium, He*	2 (Full)			*2*
3	*Lithium, Li*	2	1		*3*
4	*Beryllium, Be*	2	2		*4*
5	*Boron, B*	2	3		*5*
6	*Carbon, C*	2	4		*6*
7	*Nitrogen, N*	2	5		*7*
8	*Oxygen, O*	2	6		*8*
9	*Fluorine, F*	2	7		*9*
10	*Neon, Ne*	2	8 (Full)		*10*
11	*Sodium, Na*	2	8	1	*11*
12	*Magnesium Mg*	2	8	2	*12*
13	*Aluminum, Al*	2	8	3	*13*
14	*Silicon, Si*	2	8	4	*14*
15	*Phosphorus, P*	2	8	5	*15*
16	*Sulfur, S*	2	8	6	*16*
17	*Chlorine, Cl*	2	8	7	*17*
18	*Argon, Ar*	2	8	8 (Full)	*18*

Q2. Using the Table on p 24, figure out which elements these dot diagrams represent:



1) a = Beryllium and b = Neon

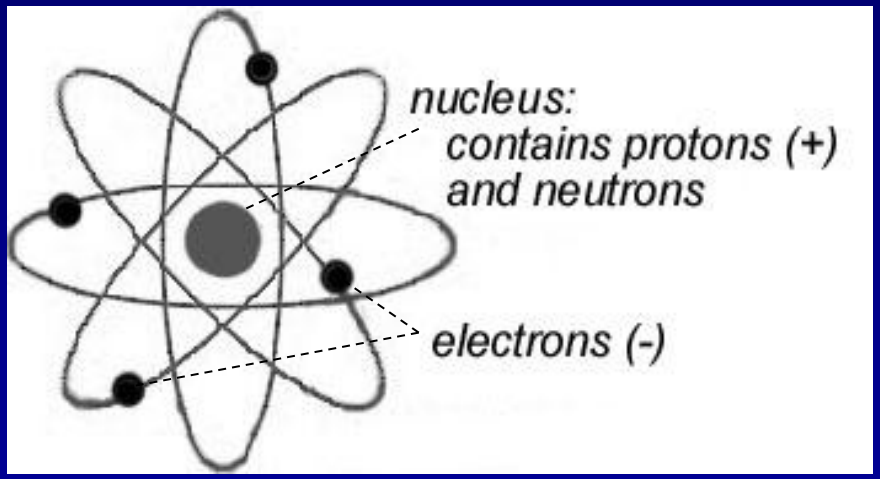
2) a = Oxygen and b = Sulfur

3) a = Neon and b = Silicon

4) a = Carbon and b = Argon

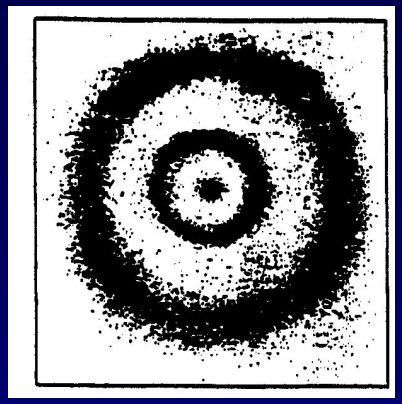
THE EARLY PLANETARY MODEL OF THE ATOM . . . .

Electrons "orbiting" the nucleus



VS. . . . .

The BOHR MODEL OF THE ATOM:



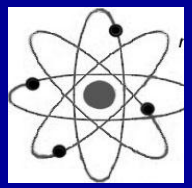
According to Neils Bohr's model of the atom,

electrons circling the nucleus cannot maintain their orbits at just *any* distance from the center of the atom (the early model). . . .

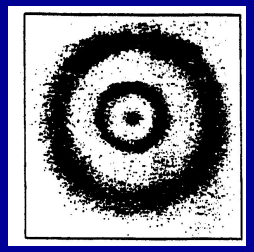
. . . .there are only certain "allowed orbits"

- in which an electron can exist for long periods of time without giving off radiation (energy).

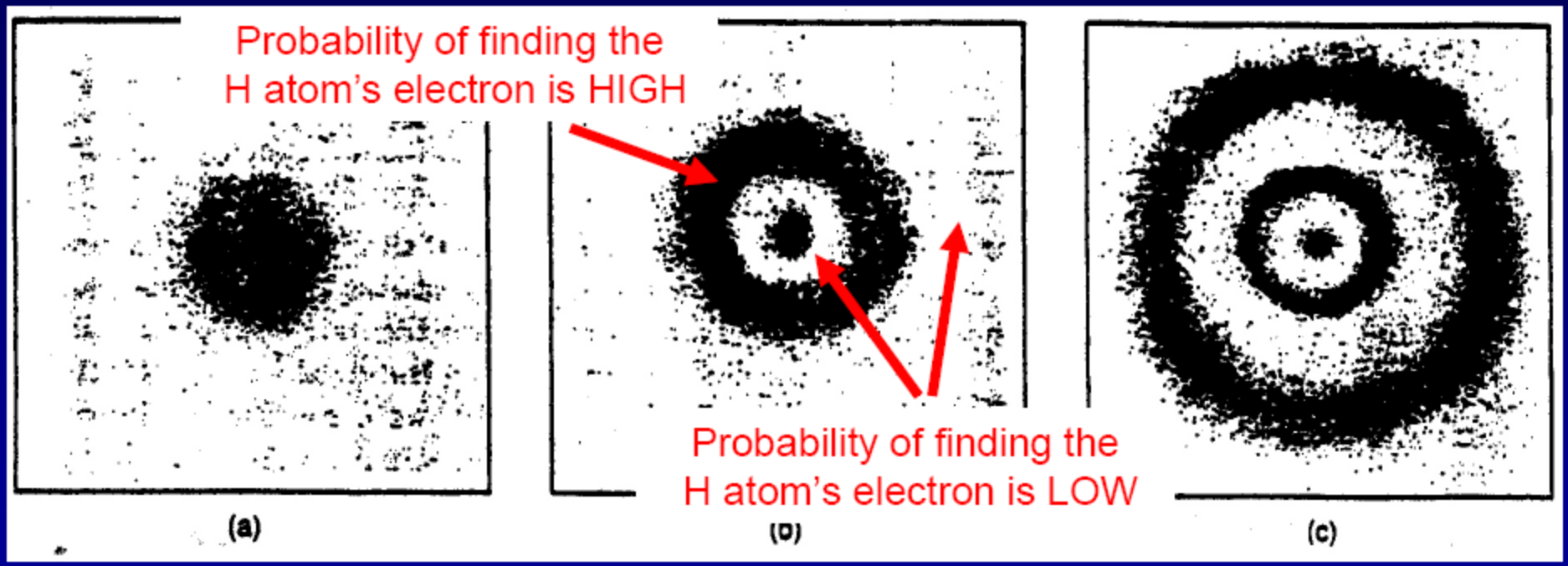
- As long as the electron remains at one of these distances, its energy is fixed.



vs.



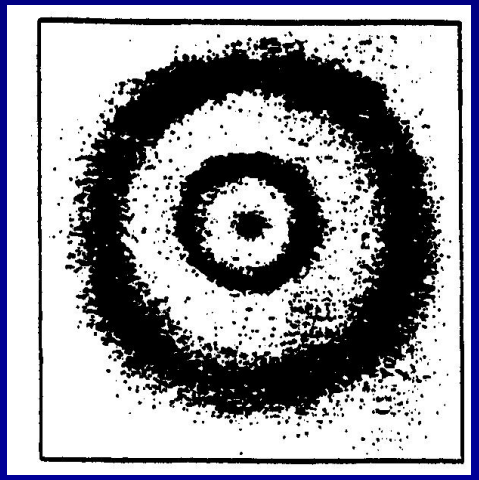
Schematic Diagrams representing ELECTRON ENERGY STATES (Shells) for Hydrogen H in the Bohr model :

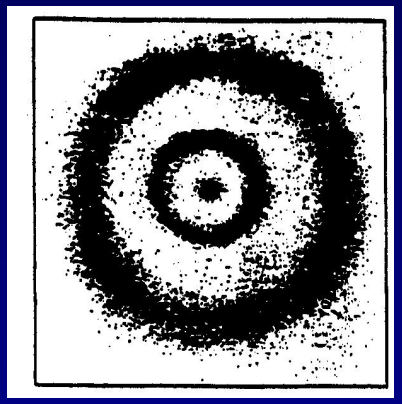


GROUND State **Excited State 1** **Excited State 2**

The quantum model of the atom states that:

electrons can exist only in
discrete allowed places within shells
(or energy levels)
and not in between.





-- The “empty” spaces represent areas with *little likelihood* of finding an electron

-- Dark areas represent places (or energy levels) where electrons are “allowed” to be

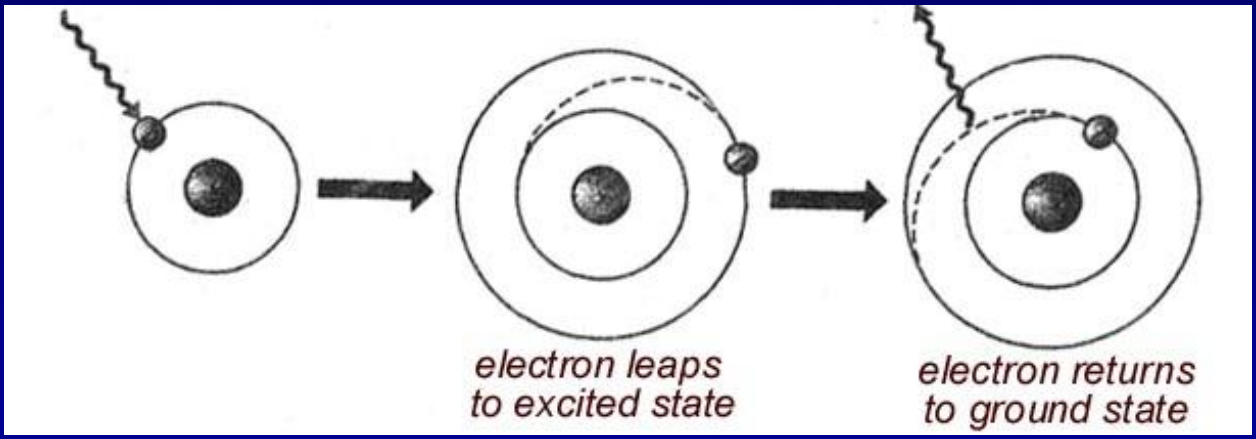
. . . BUT HOW DO THEY GET FROM ONE ENERGY LEVEL TO ANOTHER???

The electrons move -- NOT according to Newtonian laws of motion

-- but according to

quantum mechanics.

Energy Absorbed → Energy Released



MORE on how this happens and what it has to do with GLOBAL CLIMATE CHANGE in upcoming lectures!!

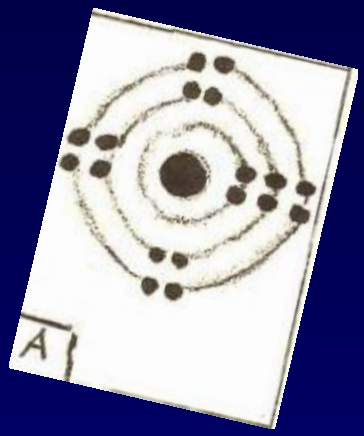
"We Are All Connected"

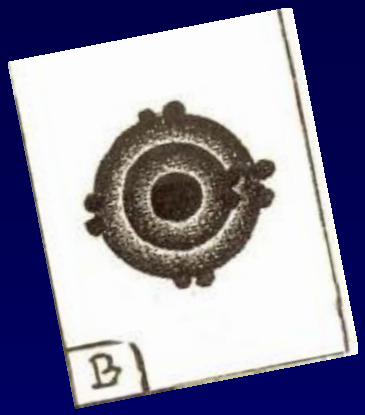
(video is posted in today's Class Follow Up)

A little rusty on atoms, elements, shells, and the Periodic Table?

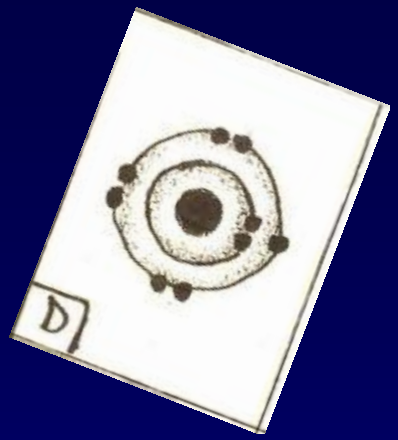
"HANDS ON"
LEARNING ACTIVITY

Go to the Class Notes Appendix pp 107-111


A


B


C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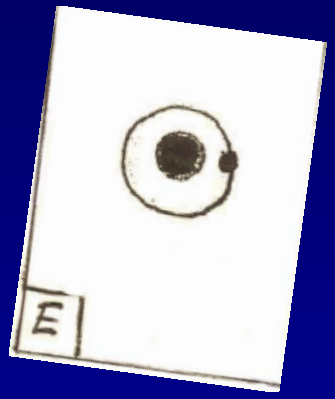
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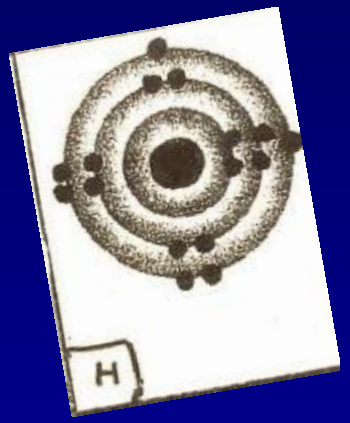
F


G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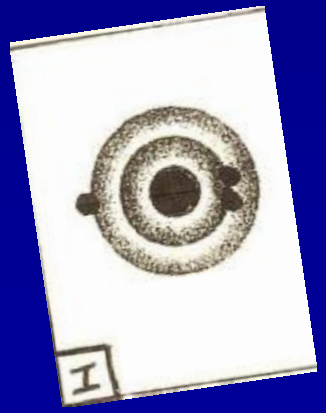
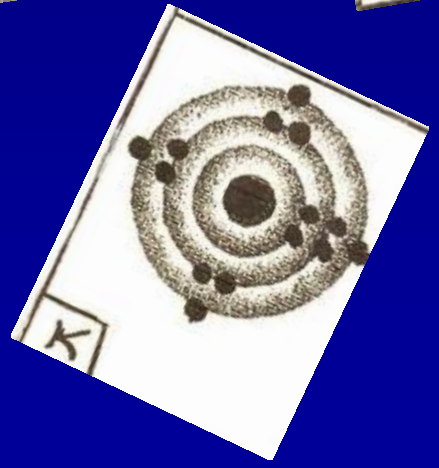

I


J


K

PLACE THE ATOMS
ON THE BLANK PERIODIC TABLE
in the right location,
then answer the rest of the questions on p 107

GAP

1							2
3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18

Try the activity on your own or with a friend and bring your answer in next Wednesday to check how you did!

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ASSIGNMENTS

Fall 2011 Semester

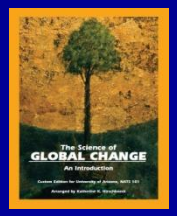
These are graded in-class and homework assignments.
See the D2L CHECKLIST for assignments on reading, quizzes, etc.

[Links and details to be posted as each assignment takes place or is assigned.]

NOTE: If you have questions about a grade, see D2L to find out who graded the assignment and talk to or email that TA *directly* about your grade.

GROUP ASSIGNMENTS *(in-class activities)*	INDIVIDUAL ASSIGNMENTS *(homework assignments)*
assignment Complete directions to be posted on Saturday	assignment **I-1 Thinking More Deeply** *(will be posted Sep 3rd)* **Due Monday Sep 12th**
assignment	assignment

I-1 Write a short 1-page essay (1-2 paragraphs) in YOUR OWN WORDS about any ONE of the following:



- SCIENCE QUOTES (pp 14-15)
- PIRSIG ESSAY
- Symphony of Science video
- E-Text Cover
- a topic in Dire Predictions

Then: SAVE it as a PDF file and SUBMIT it to the D2L DROP BOX

QUICK
ENERGY REVIEW

Energy Terms & Units

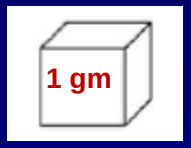
Energy (def) = the quality of an object that enables it to do “work;” the ability to do work.

Force (def) - A push or pull that, acting alone, causes a change in acceleration of the object on which it acts.

Energy Unit Review

Joule (or J) is the physical measurement for work.

Calorie (def) = the amount of **heat** required to raise 1 gram of room-temperature water 1 degree Celsius in temperature



~ 1 cubic centimeter H_2O

1 calorie = 4.186 joules
1 calorie per second = 4.186 watts

HOW MUCH ENERGY IN A HURRICANE?

http://www.aoml.noaa.gov/hrd/tcfaq/D7.html

1.3×10^{17} Joules / day

Work - is done whenever a force (F) is exerted over a distance (d).

Work is equal to the **force** that is exerted times the **distance** over which it is exerted:

$$W = F \times d$$

Power of a Hurricane!

POWER = work done divided by the time it takes to do it:

P = W / t

The POWER of A Hurricane!

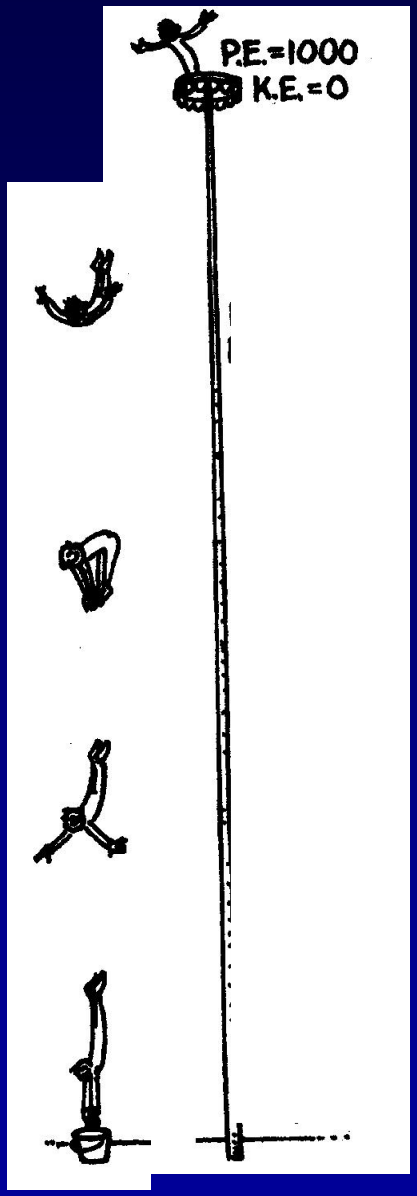
http://www.nhc.noaa.gov/

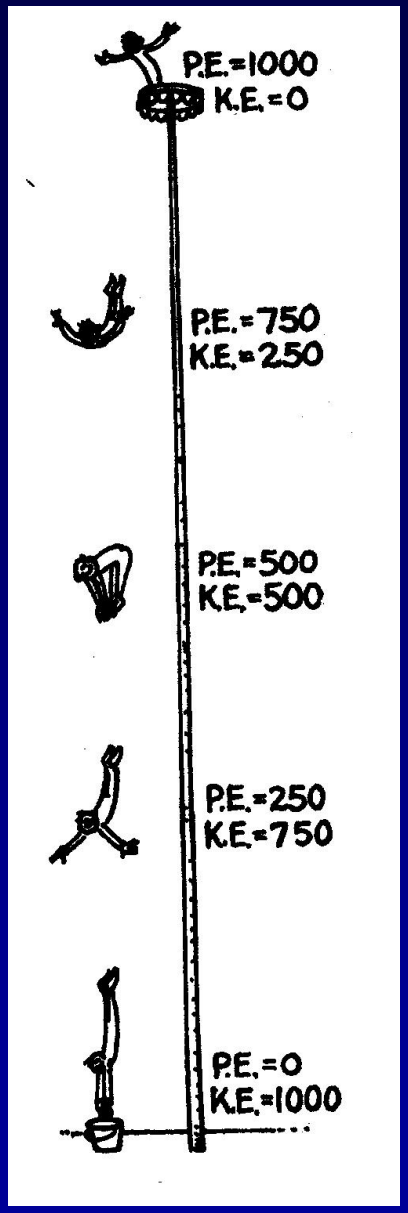
Different Forms of Energy

- **Kinetic** (KE or KinE) = energy of *motion*; the ability of a mass to do work.

  KE = ½ (mass x velocity^2) or KinE = (1/2) ms ^{2}

- **Potential** (PE) = energy a system possess if it is capable of doing work, but is *not* doing work now


P.E.=1000
K.E.=0


P.E.=1000
K.E.=0
P.E.=750
K.E.=250
P.E.=500
K.E.=500
P.E.=250
K.E.=750
P.E.=0
K.E.=1000

POTENTIAL ENERGY (PE) – The energy a system possesses if it is capable of doing work, but is not doing work now.

Quick summary of different forms of potential energy:

Gravitational - Energy associated with the position of a mass in a gravitational field; *energy stored by virtue of its position*.

Elastic - Energy stored in a flexed muscle, a coiled spring, a stretched rubber band, etc.

Chemical - Energy stored in the electrical bonds that bind together the molecules or atoms of a substance. In any process in which atoms rearrange to form different molecules, a chemical reaction occurs, during which energy is absorbed or released by matter.

Electrical - Energy associated with the position of a charge in an electric field; an electric charge is an excess or deficit of electrons on an object. .

Magnetic - Energy stored in a magnetic field. Magnetic fields can be created by the motion of electrical charges.

Different forms of POTENTIAL ENERGY

Review these definitions on your own . . .

Coming up this semester. . . .

2 Important forms of POTENTIAL ENERGY that are keys to Global Change Issues:

Electromagnetic Energy

(Topic #5)

&

Thermal energy

(Topic #8)

Related to Topic #8:

Energy Transformations & Conservation of Energy:

"Everything that happens can be described as energy transformation."

ENERGY IS CONSERVED!

The Law of Conservation of Energy:

Energy cannot be created or destroyed.

It can be transformed
from one form to another . . . . but

THE TOTAL AMOUNT OF ENERGY NEVER CHANGES.

Same as : 1st Law of Thermodynamics
(Topic #8)

➔ ***Link to GREEN TECHNOLOGIES & SOLUTIONS for addressing climate change:***

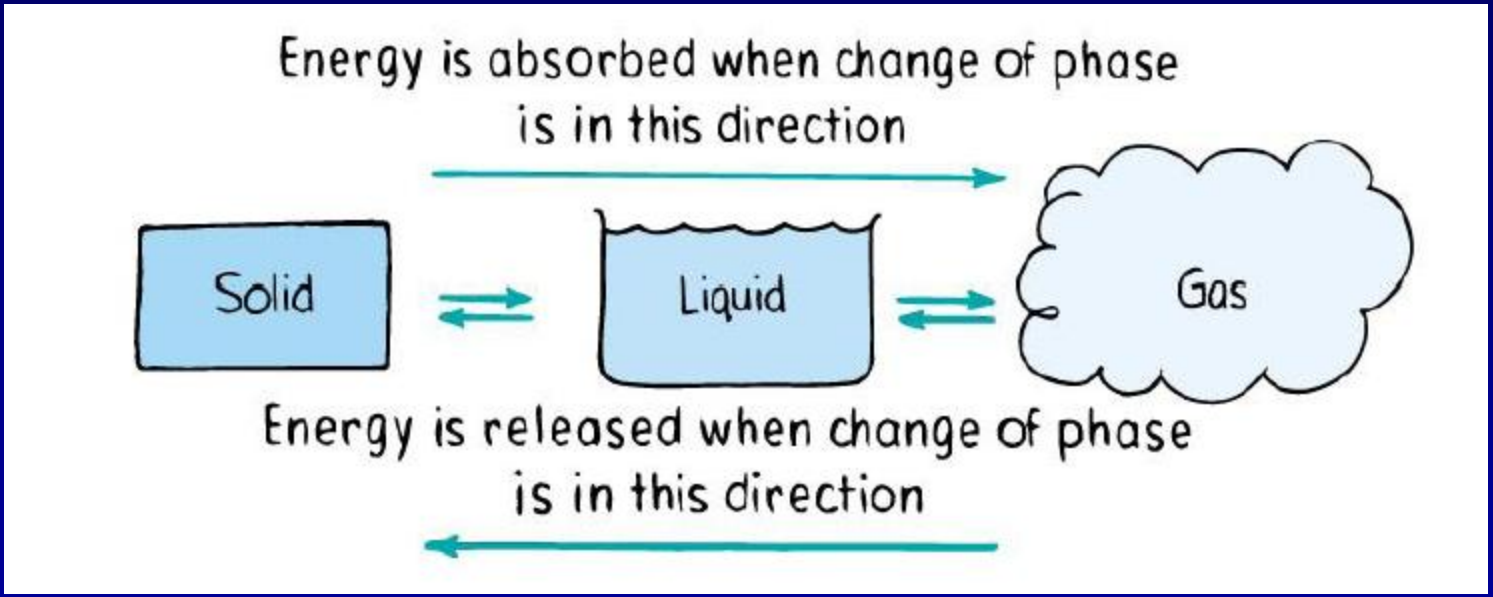
Although energy may not be destroyed, it can become **INEFFICIENT**

i.e., is not easily used or available to do work!

Efficiency = work done / energy used

Also coming up under Topic #8:

ENERGY & MATTER INTERACT IN PHASE CHANGES



Have a great Labor Day Weekend!

Go CATS!

RECAP OF ANNOUNCEMENTS

- **RQ-1 was cutoff today 30 minutes before class! If you missed it . . . Submit an ABSOLUTION FORM online (Find out how at FAQ #22)**

- **The CLASS NOTES PACKETS are available! (Purchase CLASS NOTES in the ASUA Bookstore at the Kiosk on the lower level next to the textbooks.) Please bring to every class!**

- **ASSIGNMENT I-1 will be introduced in class today, posted on Saturday, and is DUE a week from Monday (Sep 12th).**

OBJECTIVES FOR TODAY'S CLASS:

On COURSE TOPICS:

- Continue our review of the basics of MATTER
- Review the basics of ENERGY
- Tie Matter & Energy to GLOBAL CHANGE

ON COURSE LOGISTICS:

- Address clicker registration issues!
- Introduction to Assignment #1