TOPICS FOR TODAY'S CLASS:

- Global Change in the News!
- Review the basics of MATTER

COURSE LOGISTICS:

- ASSIGNMENT review / overview
- Try out your clickers!

GLOBAL CHANGE IN THE NEWS !!

HURRICANE ISAAC

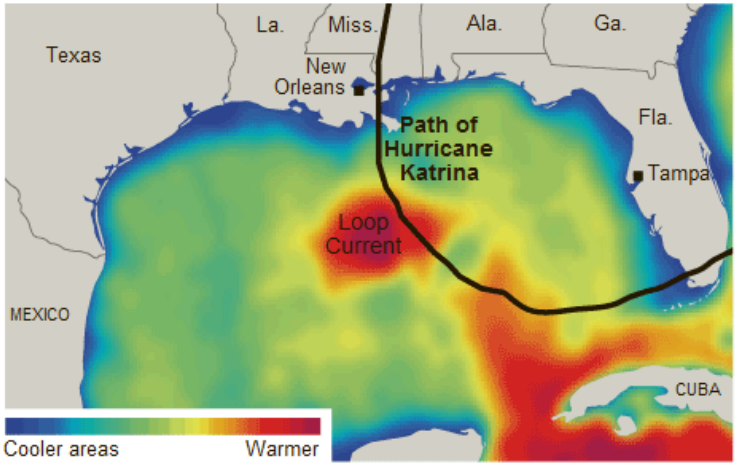
(today is the 7-year anniversary of Hurricane Katrina!)

http://www.nytimes.com/slideshow/2012/08/29/us/20120830-STORM-2.html

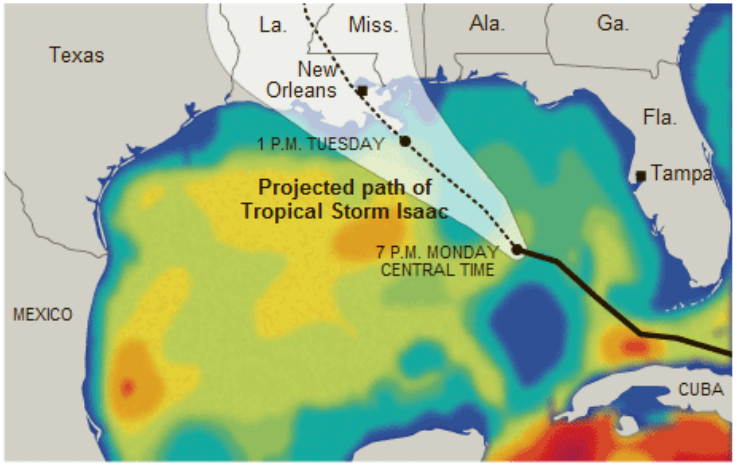
KATRINA
Landfall
Aug 29
2005

ISAAC
Landfall
Aug 28
2012

http://www.hlntv.com/article/2012/08/27/katrina-isaac



Katrina was already powerful when it reached the Gulf of Mexico. It was energized by passing directly over the band of deep, warm water known as the Loop Current. Unlike many storms, it was not impeded by the changing wind currents known as wind shear. Katrina hit the coast as a Category 3 hurricane with 145-mile-an-hour winds.



Isaac is not as large or as powerful as Katrina, and its growth has been slowed by wind shear on its southwest side. The Loop Current is farther west this year and should have little effect. Isaac is expected to slow down, which would mean less wind damage but greater potential for flooding. It is forecast to make landfall as a Category 2 storm.

http://www.nytimes.com/interactive/2012/08/28/us/isaac-follows-a-familiar-path-but-with-less-intensity.html

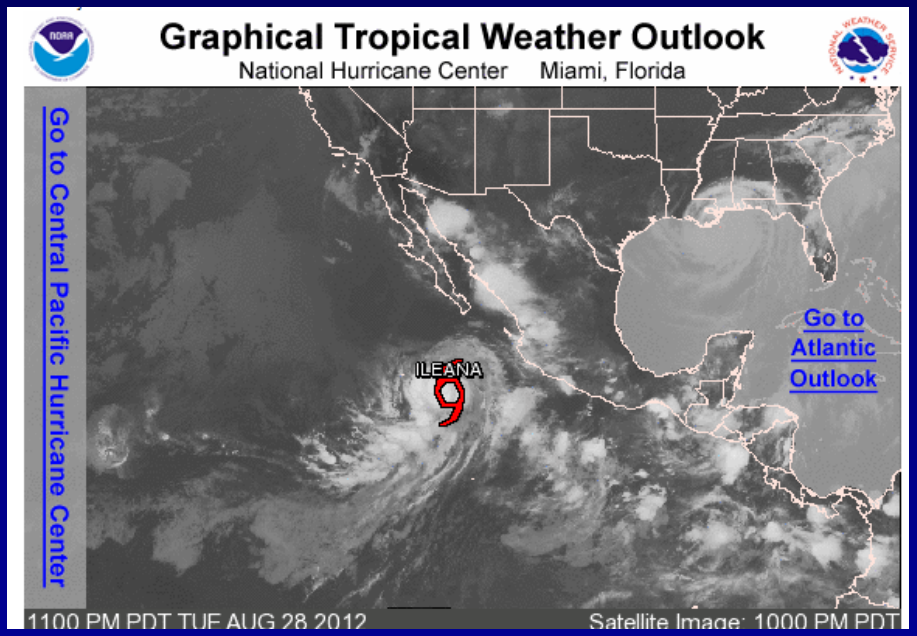
Hurricane Isaac Makes Landfall Along Gulf Coast

Jeff Haller for The New York Times

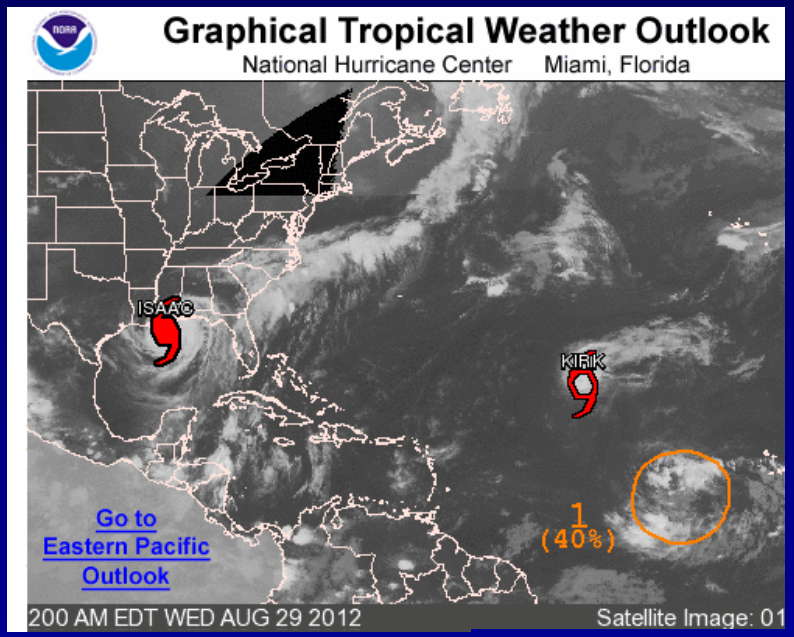
William Widmer for The New York Times

The “I-Storms”

TS Ileana
(in Eastern Pacific)



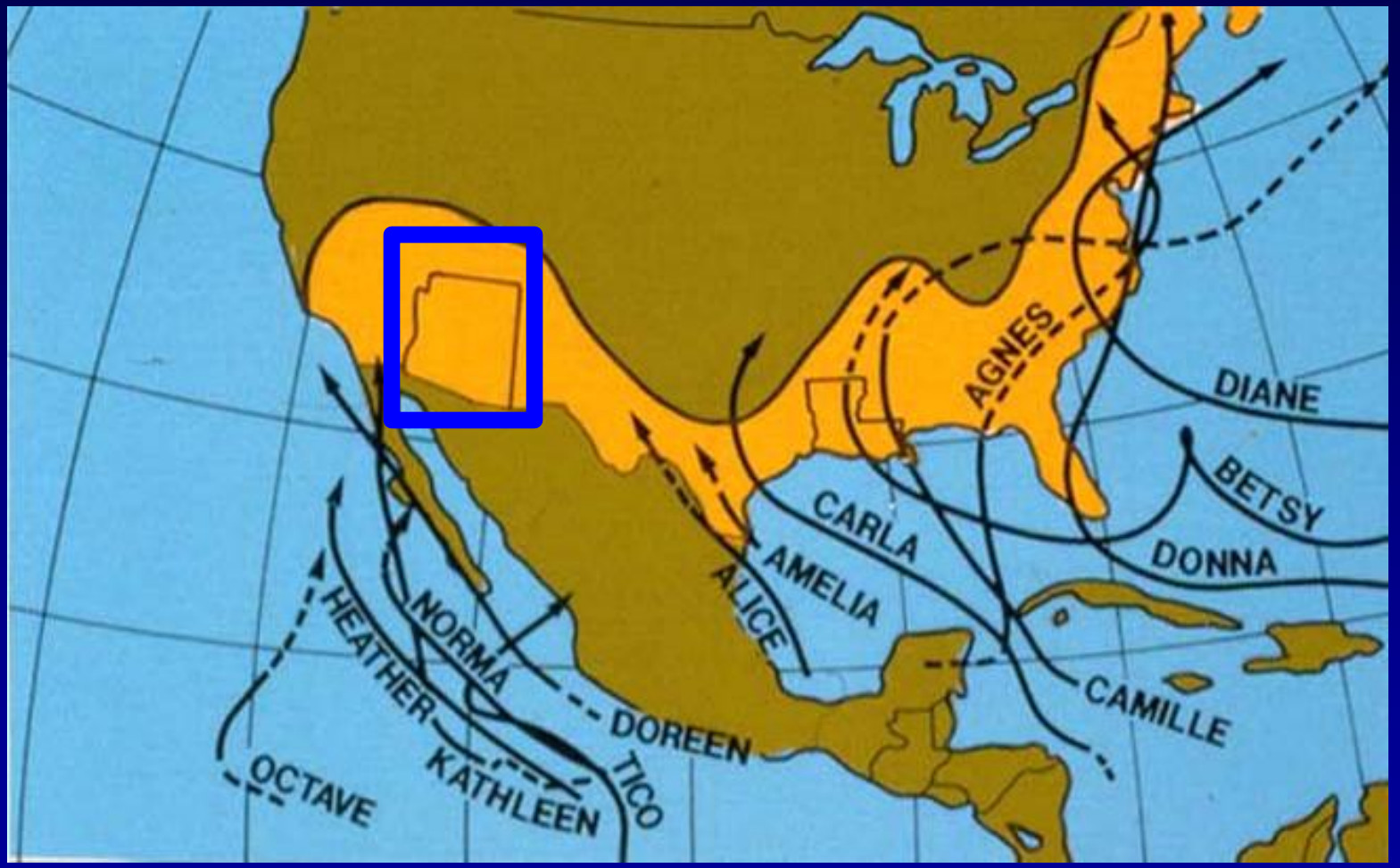
Hurricane Isaac
(in Atlantic)



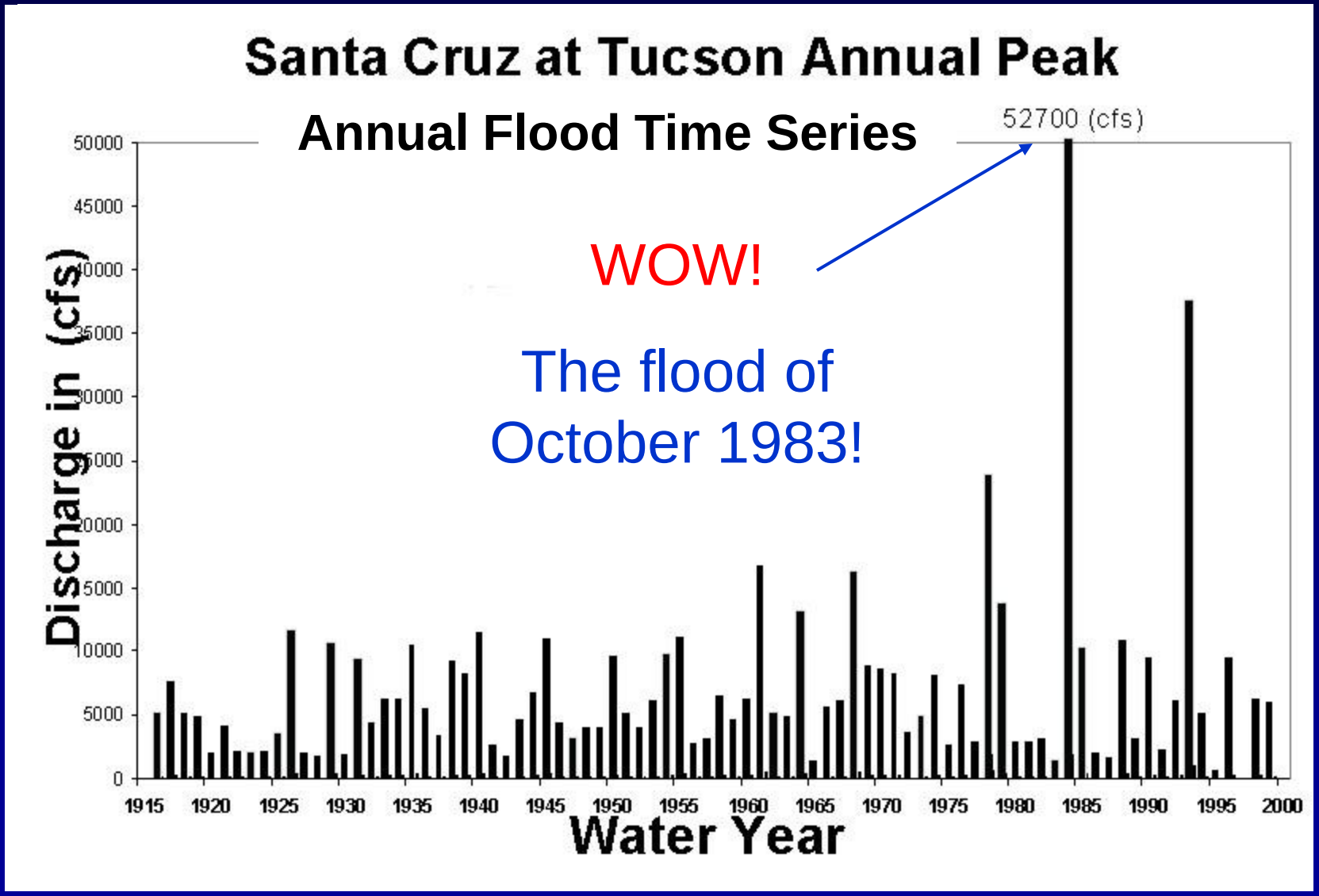
followed by

TS Kirk

IMPORTANT FLOOD-PRODUCING TROPICAL STORMS & HURICANES

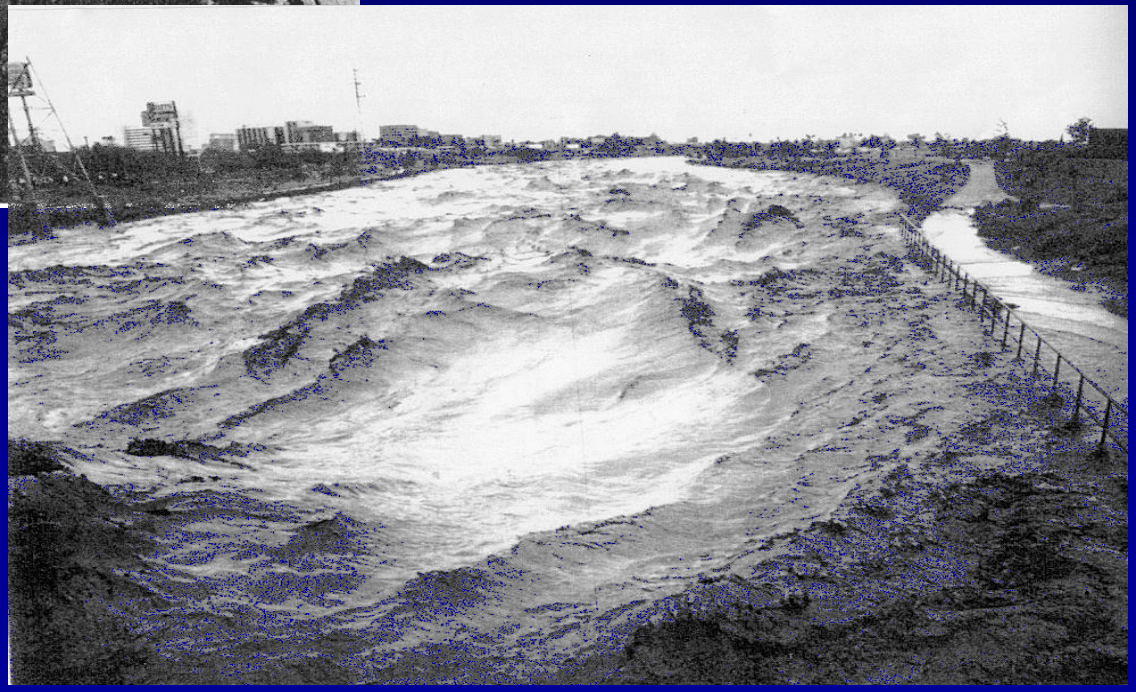


A Time Series CLOSE TO HOME!



Santa Cruz River, Tucson

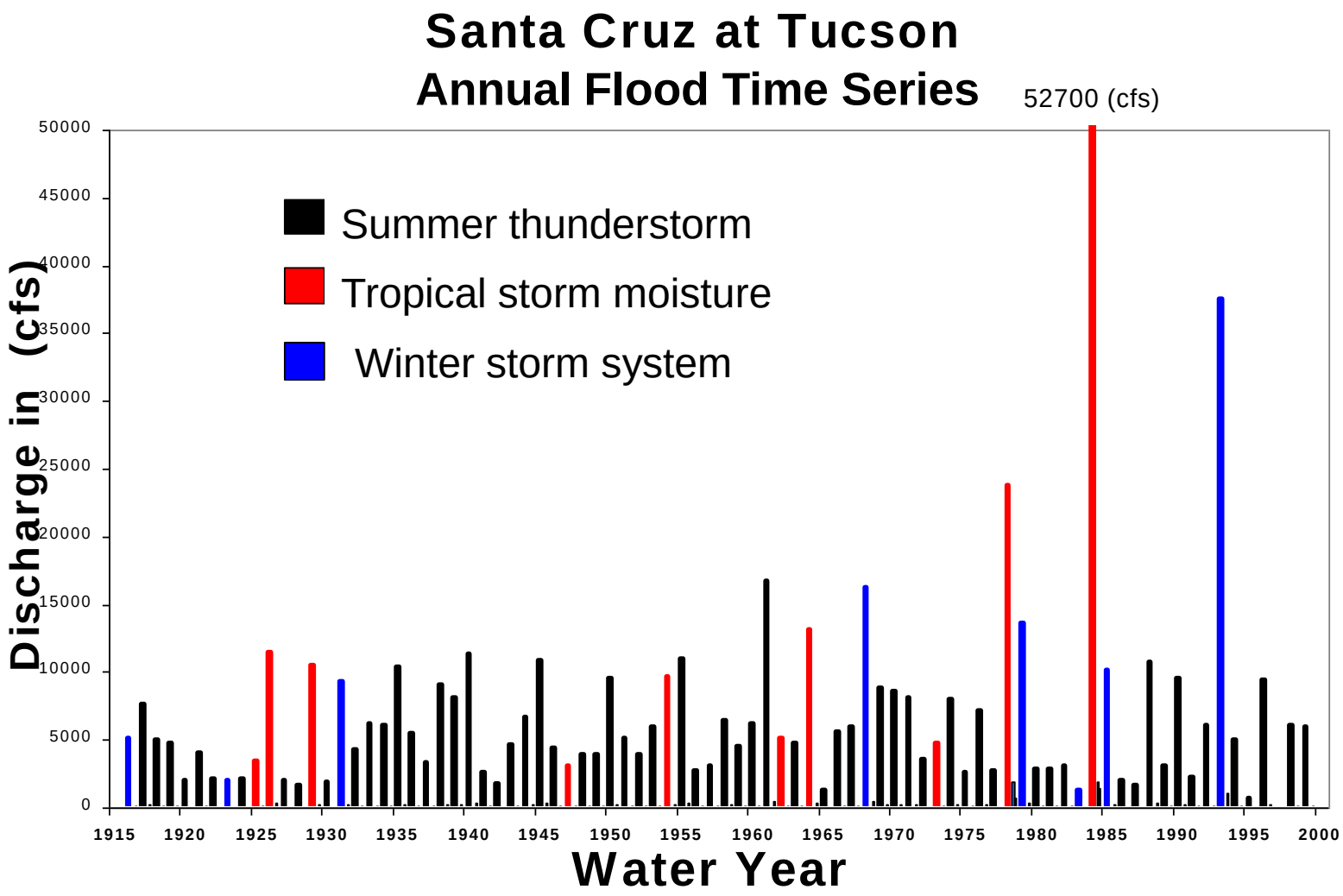
Typical dry river bed or minor trickle of stream flow



The record flood of October 1983!

Some of Dr H's research . . . .

What kind of storms caused each flood?

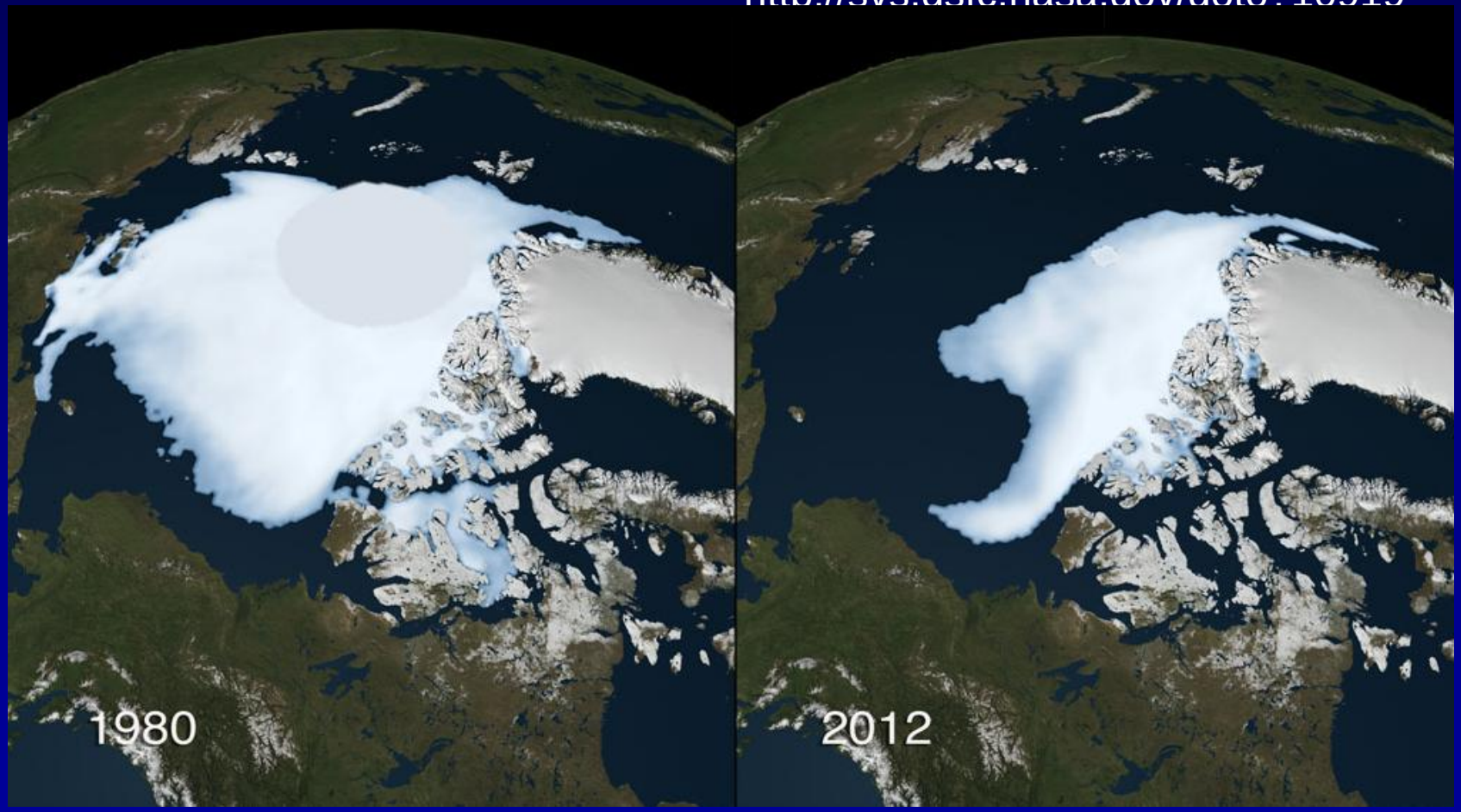


27 August 2012

Arctic Sea Ice Hits New and Early Summer Low for Satellite Era

The area covered by older and thicker sea ice in the Arctic diminished by almost 50 percent between 1980 and 2012.

Webpage source:
http://svs.gsfc.nasa.gov/goto?10919

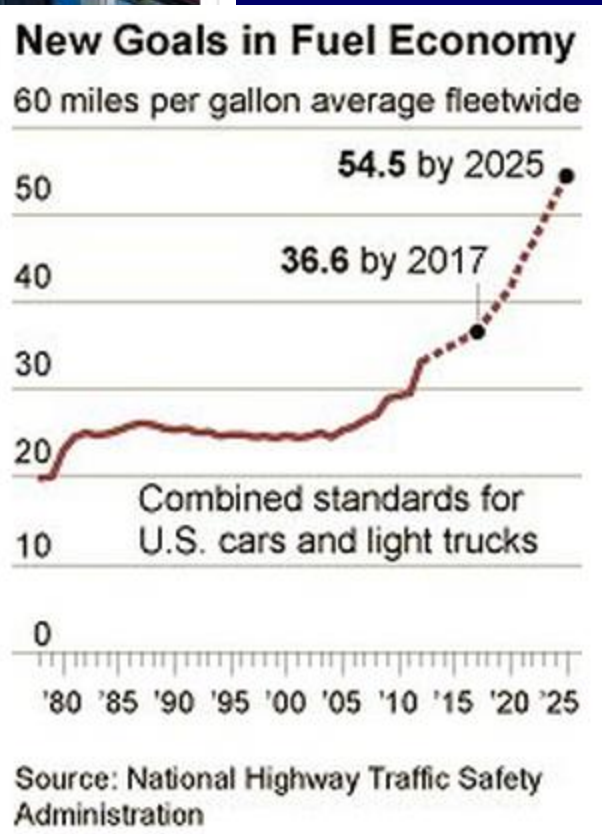


http://svs.gsfc.nasa.gov/vis/a010000/a010900/a010919/3915_music-540-MASTER_high.mp4

AUGUST 28, 2012

U.S. Sets Higher Fuel Efficiency Standards

A Chevrolet Volt electric vehicle, front. Consumers so far have been slow to buy electric cars.



ASSIGNMENT REVIEW / OVERVIEW

IN CLASS

GROUP ASSIGNMENTS *(In-Class Activities)*	INDIVIDUAL ASSIGNMENTS *(Short Writing Assignments)*
G-1 Understanding Absorption Curves	**I-1 Climate Science Basics** Lesson 1 CO_2 & the GH Effect
G-2 Energy Efficiency	**I-2 Climate Science Basics** Lesson 2 Mother Nature's Influence
G-3 Tree-Ring Activity Parts I & II	**I-3 Climate Science Basics** Lesson 3 Observable Changes
G-4 Applying the Energy Balance Terms	**I-4 Climate Science Basics** Lesson 4 Intro to Climate Modeling
G-5 Volcanism & Climate	**I-5 Class "Climate Action Debate" Preparation**

WE'LL BEGIN IN NEXT FEW WEEKS

LINKING-TO-LIFE PROJECT

(Individual Term Project in 4 Parts)

OVERVIEW OF THE TERM PROJECT

(read this overview first)

Part A Your Ecological Footprint

due in the D2L dropbox Friday Aug 31st
no later than 30 minutes before class

DUE FRIDAY!

Part B Thinking More Deeply

WILL BE ASSIGNED THIS FRIDAY & Due Sep 10th

Part C Film Review Discussion Posts

Part D Final Project Report

CLICKER START UP:

1) Remove plastic strip (if you haven't yet)
2) Press any key to turn it on
3) Select Menu: Change Channel? Y
4) Press #'s for Channel 41
5) Hit ENTER / then hit Menu a couple times
6) Be sure you are in Presentation Mode & Channel 41 / wait for screen to go blank

YOU ARE READY TO BEGIN!

Q1. I am a . . .

1 - FRESHMAN

2 - SOPHOMORE

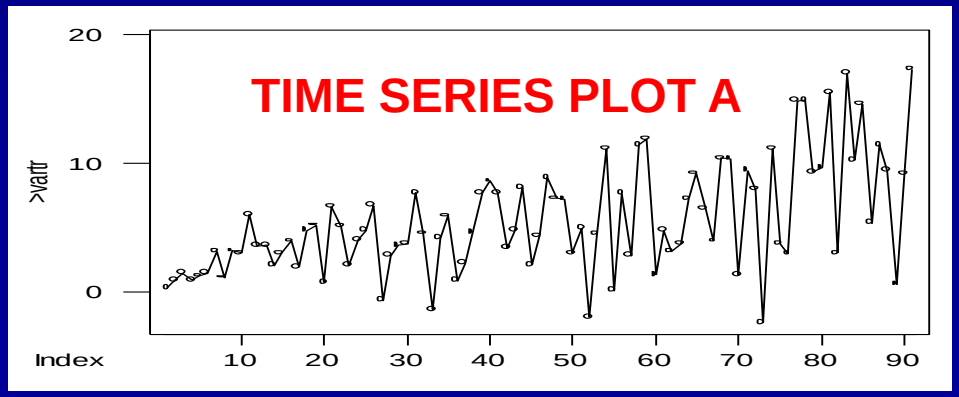
3- JUNIOR

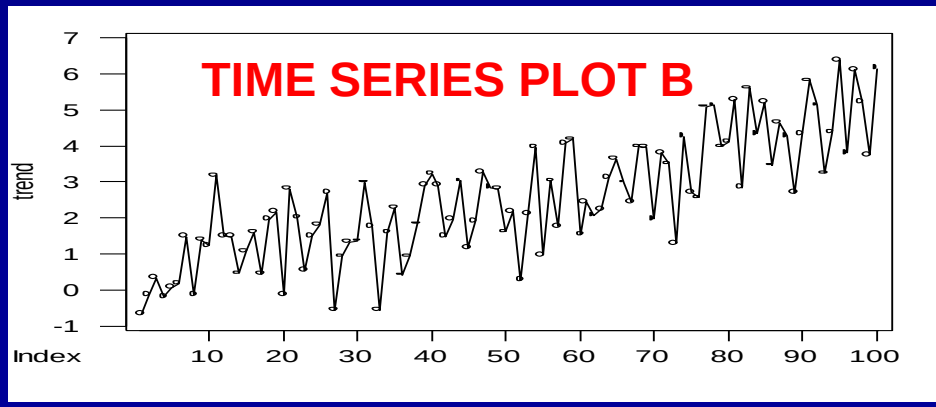
4 – SENIOR

5 - OTHER

Q2. What is the difference between Time Series Plots A & B?

1. Plot A depicts a constant mean over time, but Plot B does not
2. Plot A doesn't depict any trend, but Plot B does
3. Plot A depicts increasing variance over time, but Plot B does not
4. Plot A is periodic but Plot B is not
5. There is no difference – they are both random plots with no trends





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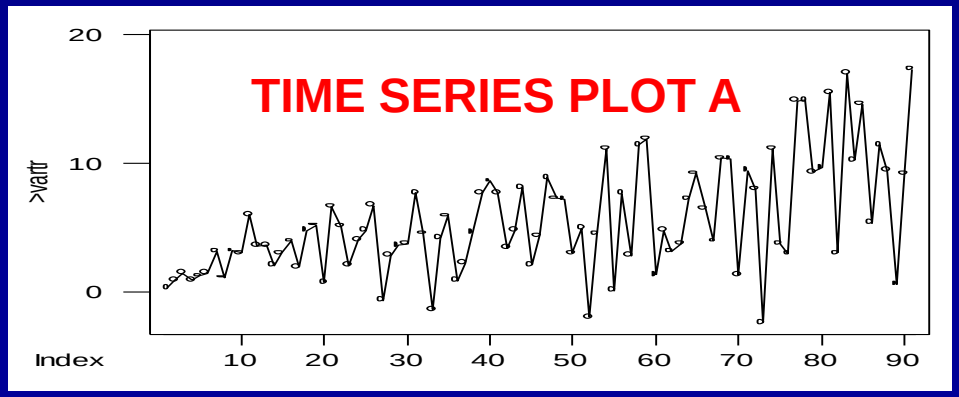
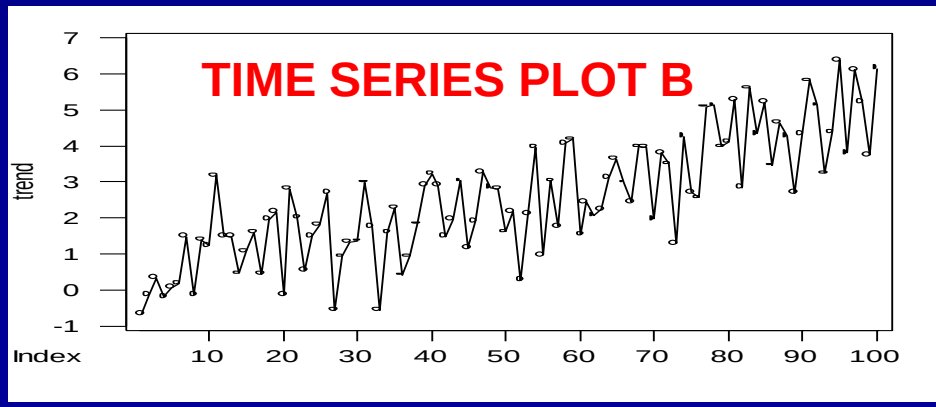




Topic #4
ENERGY & MATTER
OVERVIEW – PART I

OBJECTIVES:

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

"Science shows us that the visible world is neither matter nor spirit;

the visible world is the invisible organization of energy."

Heinz R. Pagels (b. 1939), U.S. Physicist

QUICK
MATTER REVIEW

Matter:

Whatever occupies space & is perceptible to the senses; made up of atoms; matter can be in form of solids, liquids, or gases

Atom:

-- Fundamental building blocks for all matter

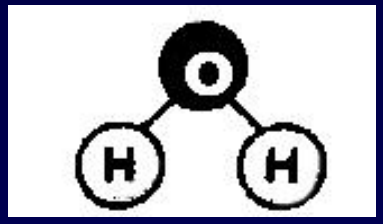
-- the smallest representative sample of an element.

Element:

A chemical substance (material) made from a single type of atom that cannot be broken down any further – and still maintain its identity as that element

. . . as in the *Periodic Table of the Elements*

Molecule:



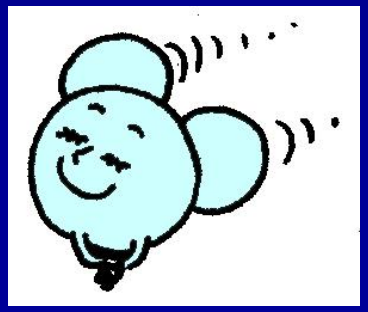
-- Any collection of two or more atoms bound together

-- a cluster of atoms bound together

MOLECULES are the basic constituent of different kinds of materials.

-- the smallest part of any substance that has all the chemical properties of the substance

e.g., a water molecule = H_2O



STATES OF MATTER

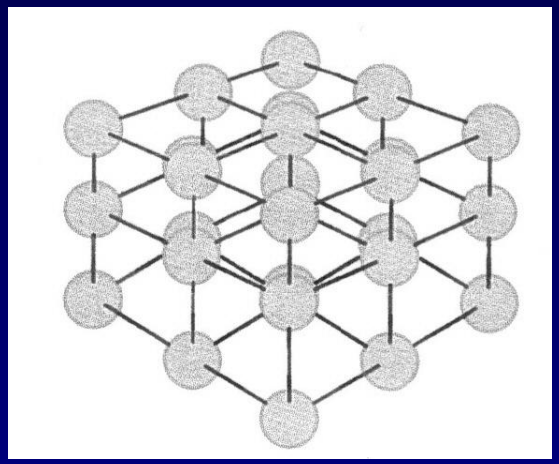
Solid:

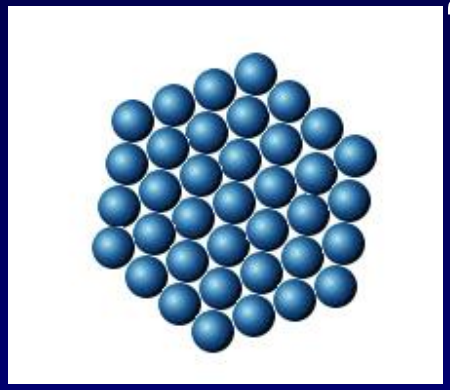
-- a substance that resists changes of shape and volume

-- characterized by *structure* in the particular order and bonding of atoms that make up the material

Example = a crystal in which the molecules are locked into a strict geometrical order.

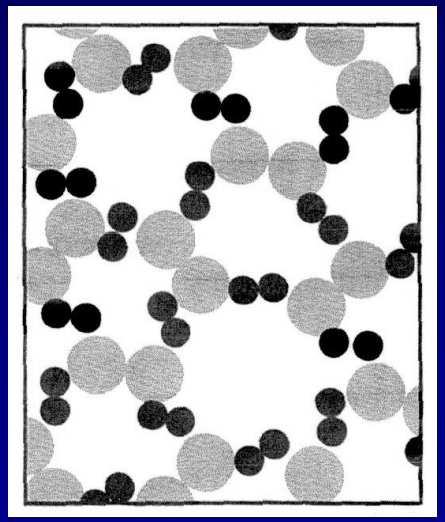
Various Representations of Molecules arranged in a SOLID



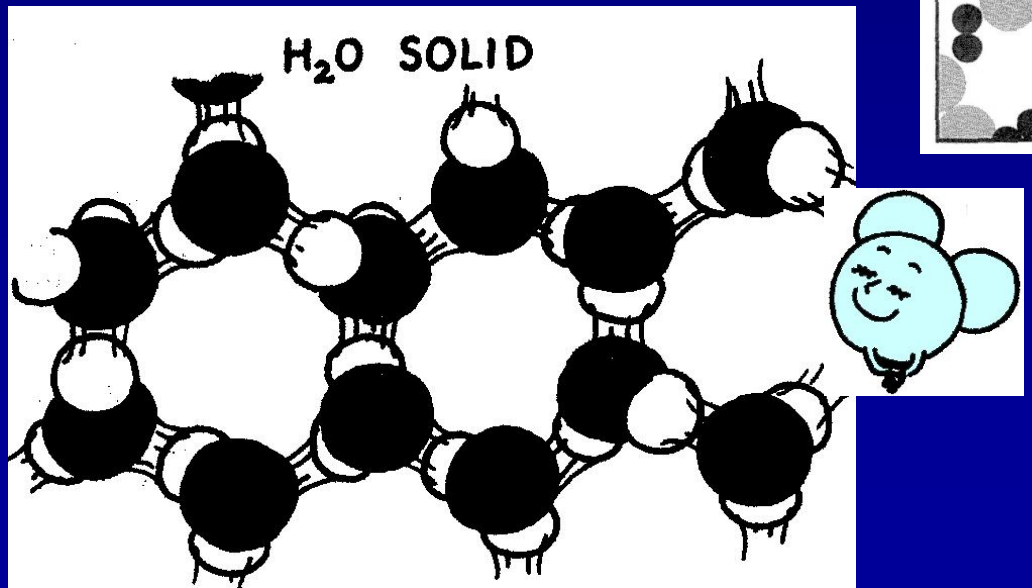


"top down" view of water (H_2O) arranged in solid (ice) form

"top down" view of a Neon crystal



3-D view of a solid crystal structure



Liquid:

-- a substance that flows freely in response to unbalanced forces

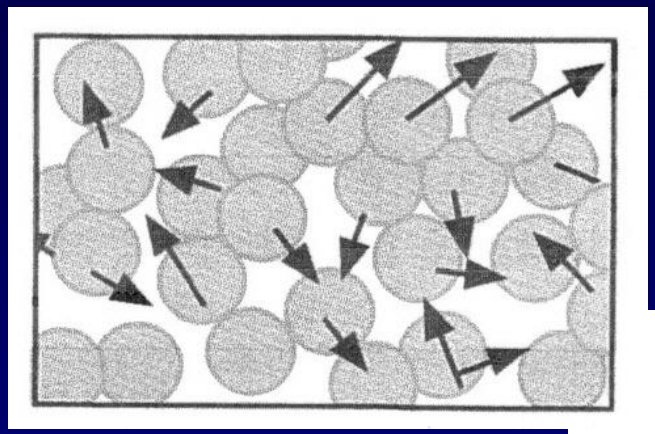
-- molecules more or less move freely past one another as individuals or small groups
-- are not confined to fixed positions (as in solids)

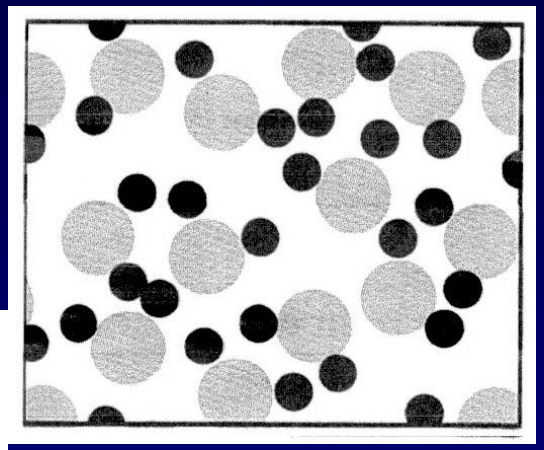
-- LIQUIDS CAN EXHIBIT PRESSURE

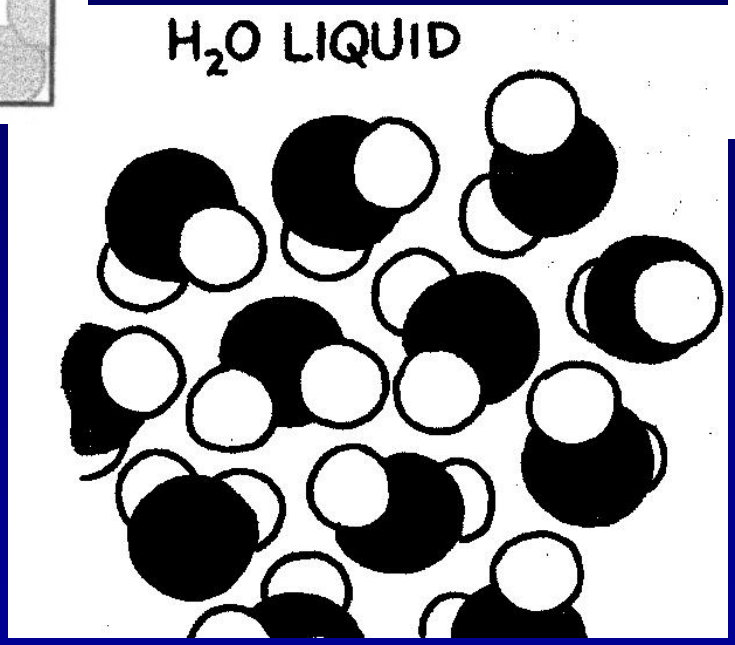
(pressure = a force per unit area)

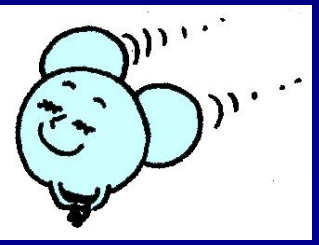
. . . and will take the shape of the container they are in.

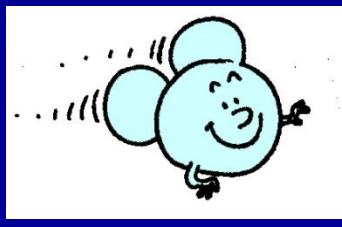
Various Representations of Molecules arranged in a LIQUID











Gas:

-- a substance that expands (and contracts) easily, rapidly, and indefinitely

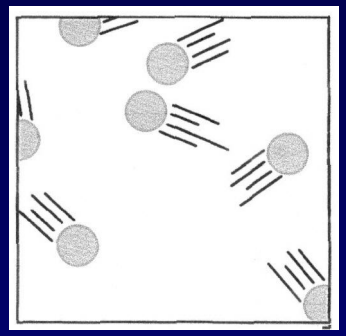
-- fills all space available to it

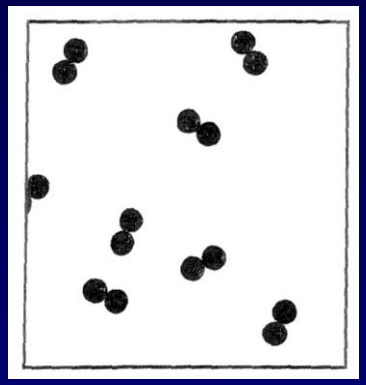
-- takes the shape of its container

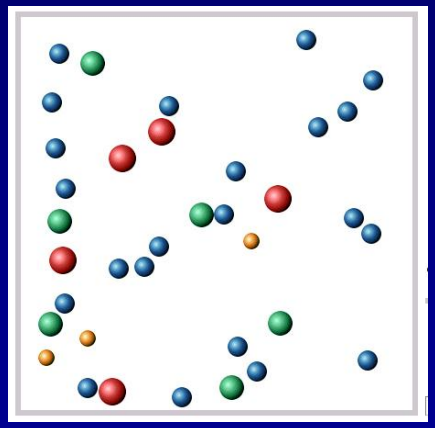
- -- the distance between molecules is such that no cohesive forces exist
- -- atoms or molecules are in high speed motion
- -- many collisions and rebounds occur

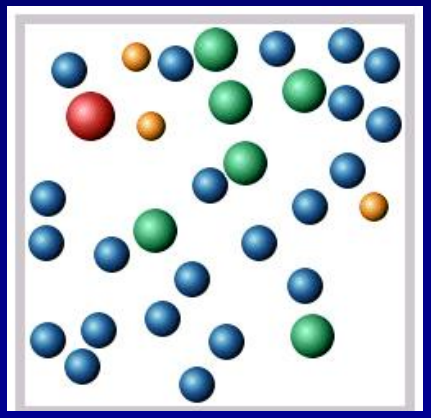
-- **GASES ALSO EXHIBIT PRESSURE**

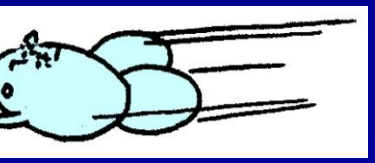
Various Representations of Molecules arranged in a GAS

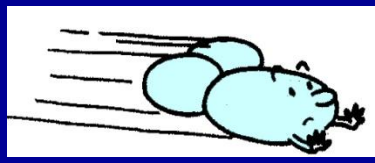








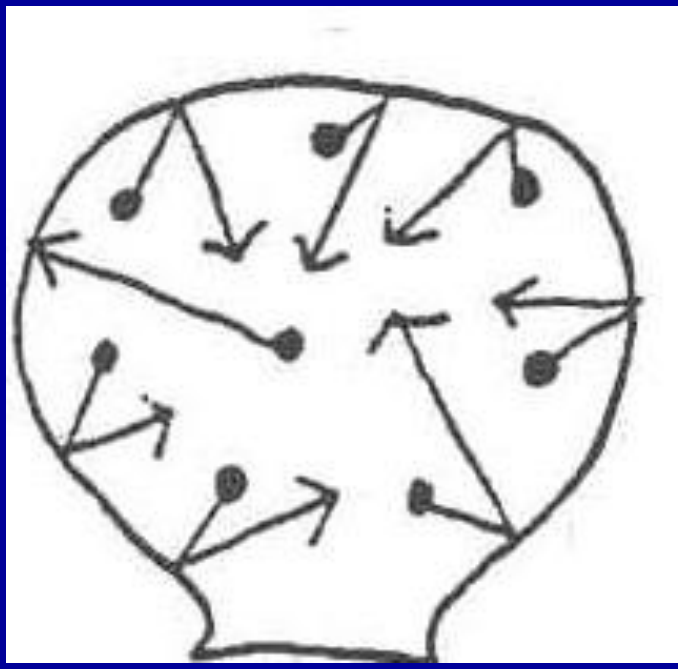


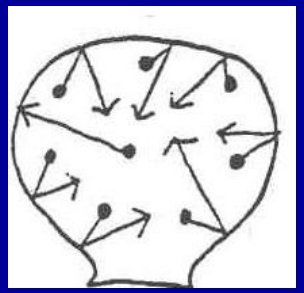


Heat added = increase in total energy + work done against outside pressure

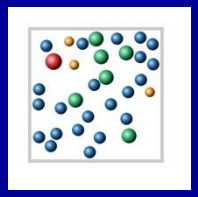
With increasing T (temperature)

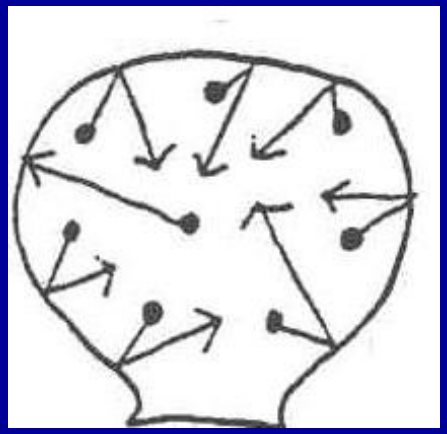
➔ Volume increases &
Density decreases



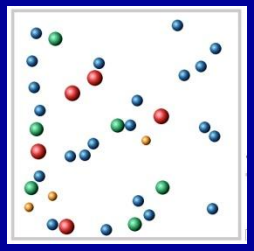


COLD

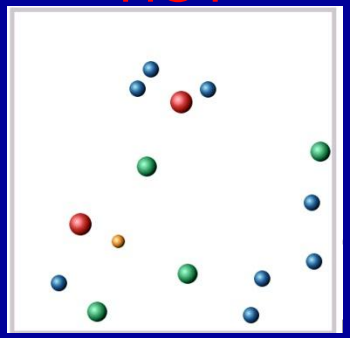


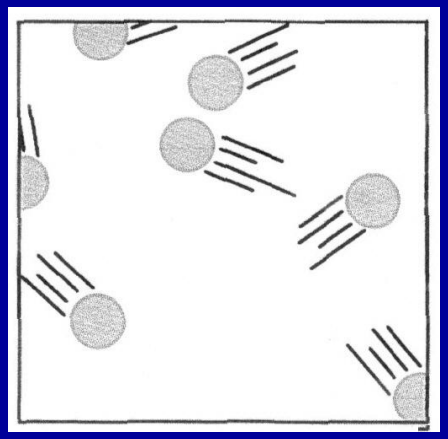


WARM



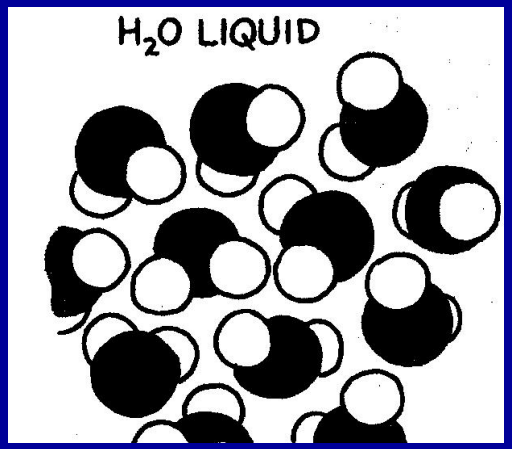
HOT



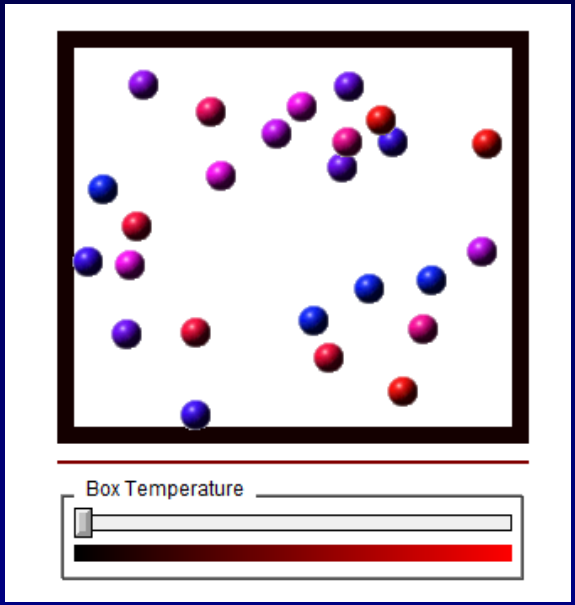


At higher air temperatures, H_2O molecules collide & rebound more frequently, leading to expansion of the air & the water vapor in the air.

At lower air temperatures as air gets more dense, H_2O molecules are more likely to bond so that a phase change to liquid water or even solid ice can occur.



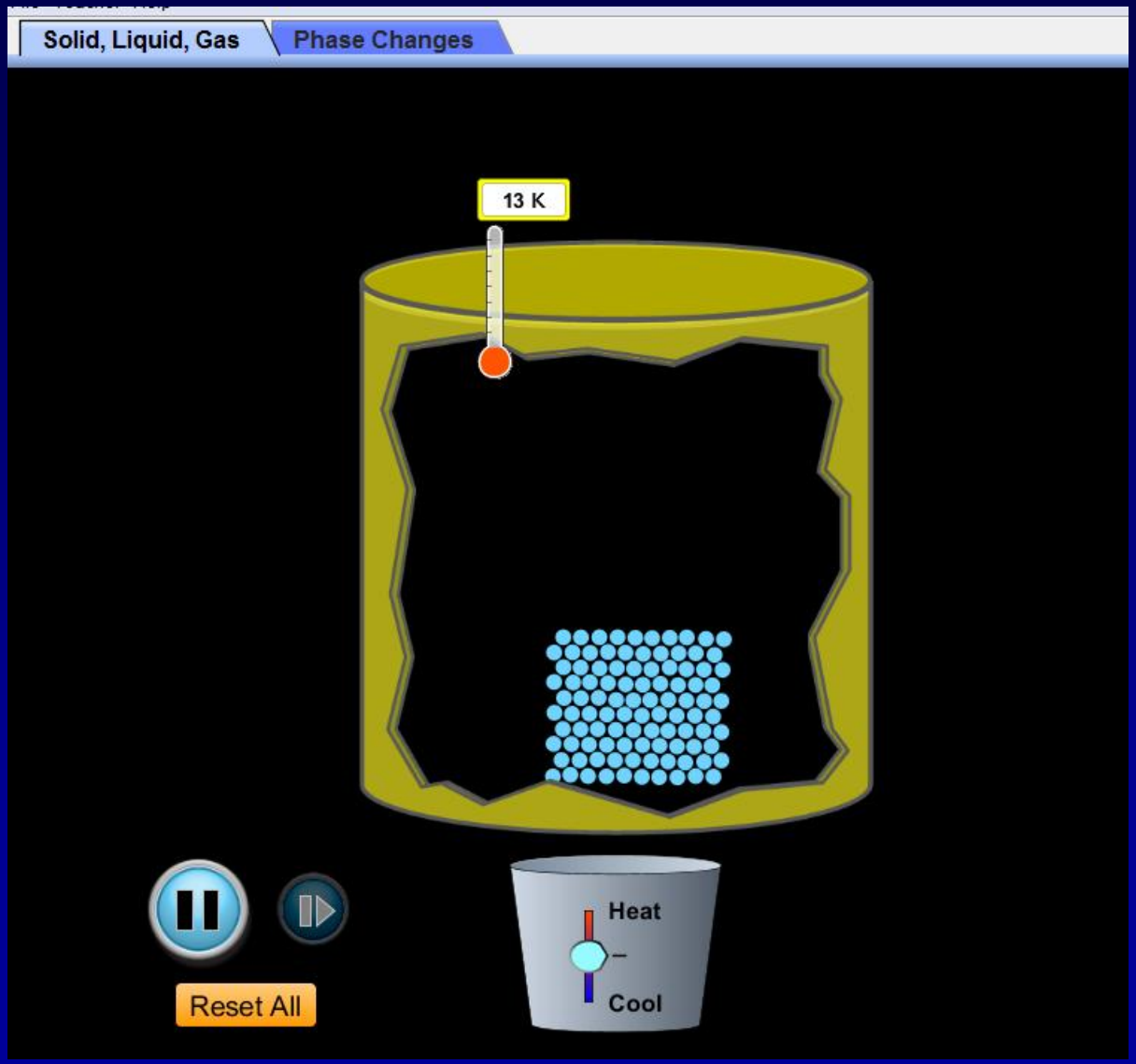
A Simple Demo :



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

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

A better demo:




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

Laws 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 . . .

The Higgs Boson?

What's Next?

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:

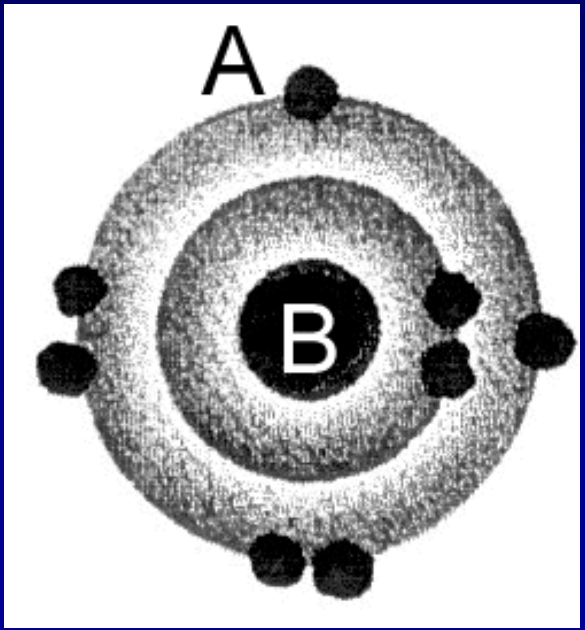
protons (+) = # of electrons (-)

ION: if 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 = _____

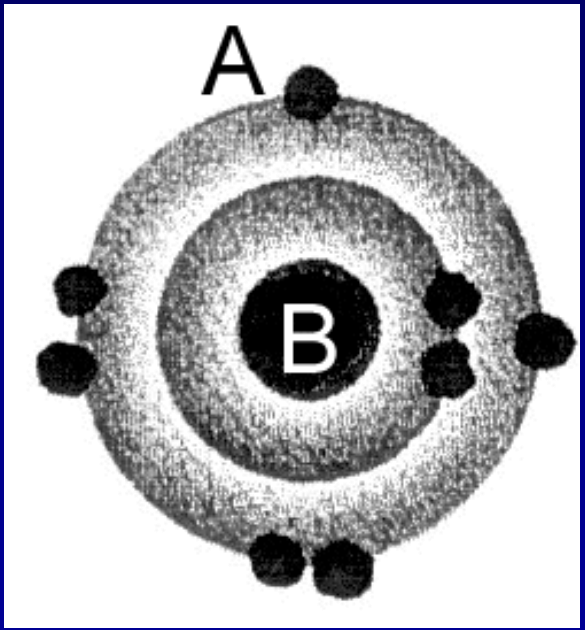
 # neutrons = _____

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

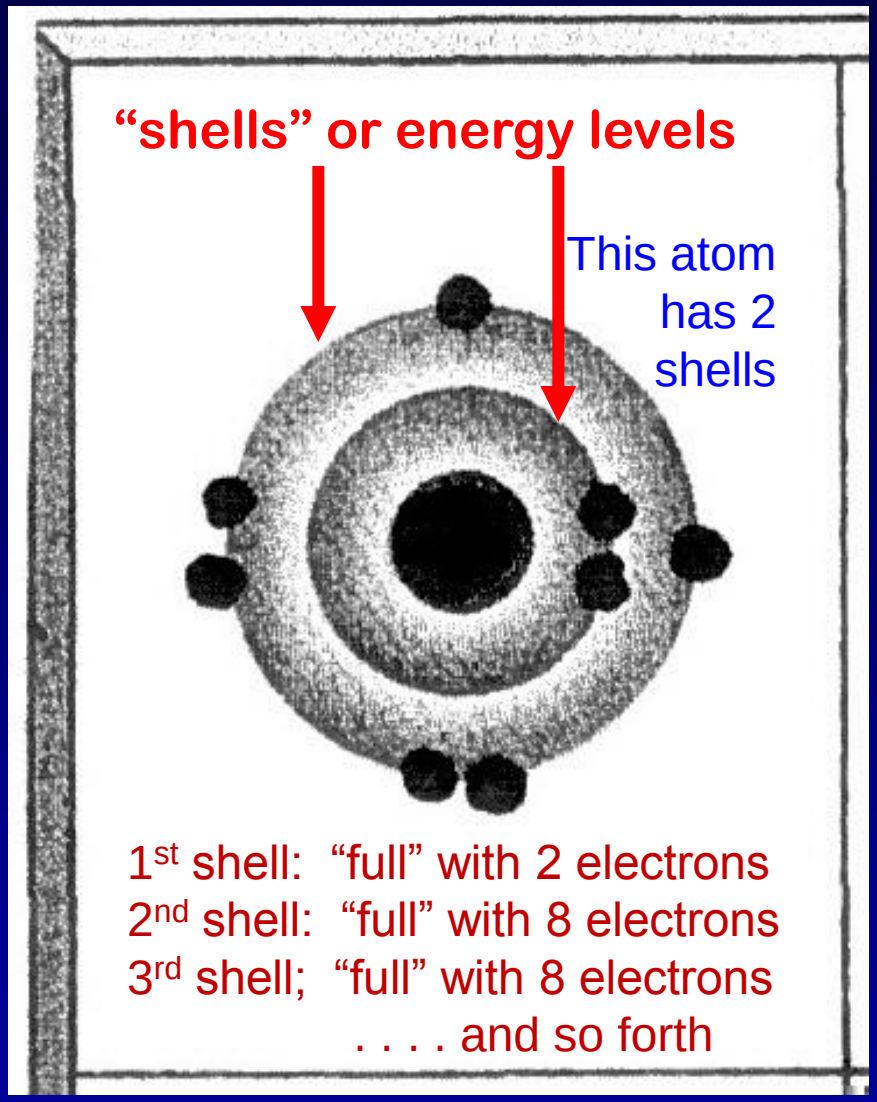
 # protons = 8

 # 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*

Lecture Break!

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