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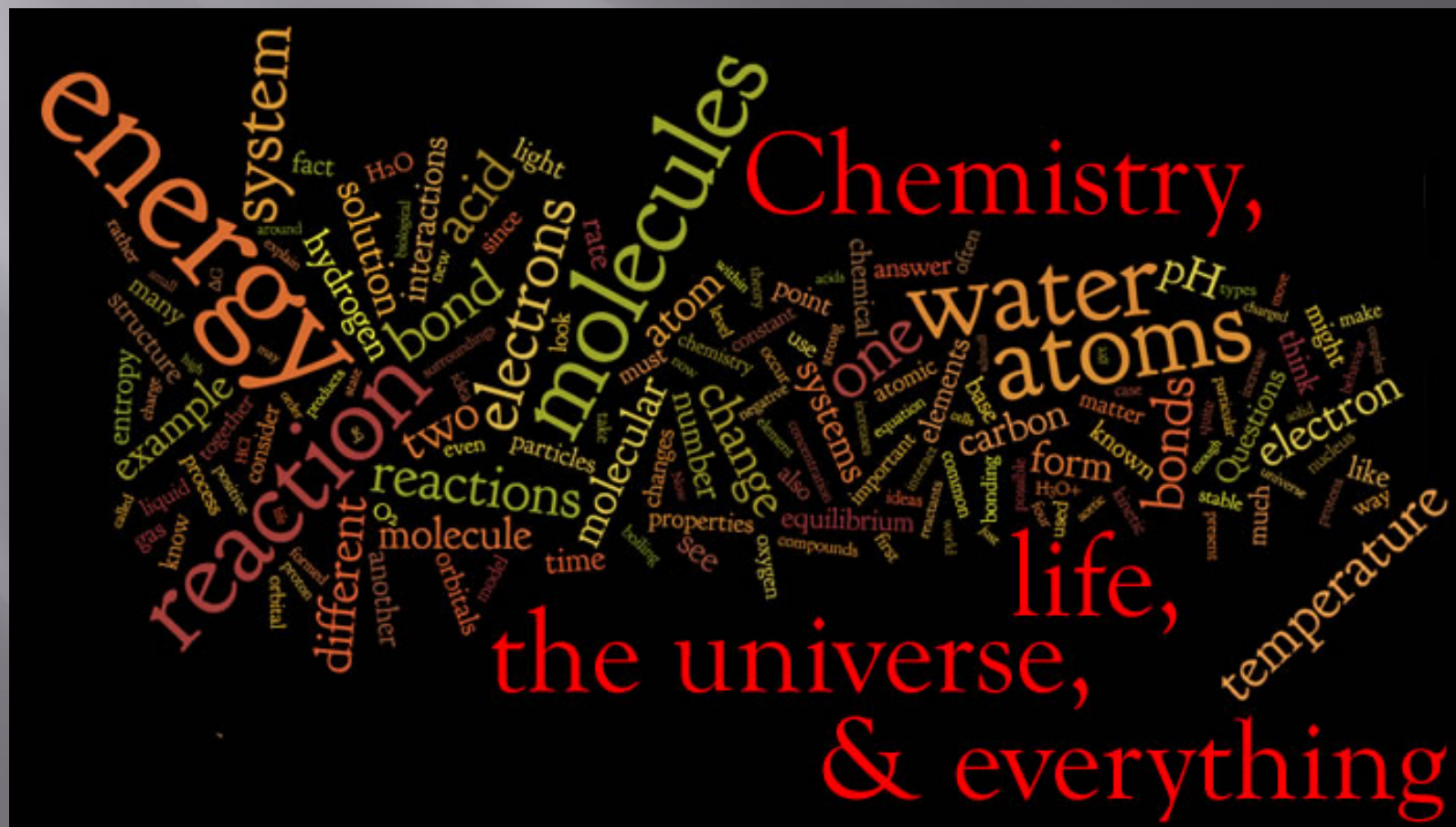
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CHEMISTRY IS A PHYSICAL SCIENCE

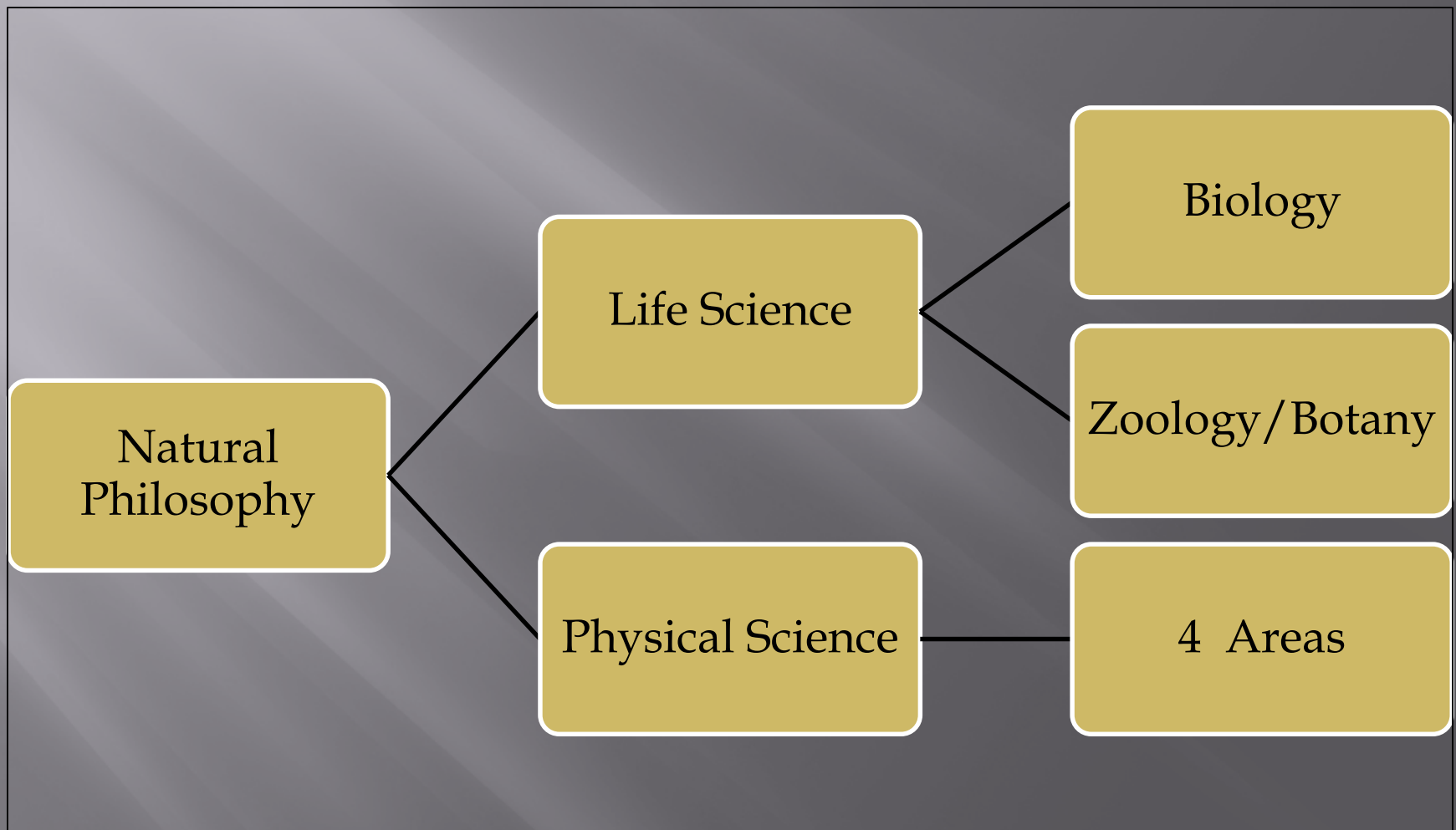
Essentials of Chemistry

Essentials of Chemistry

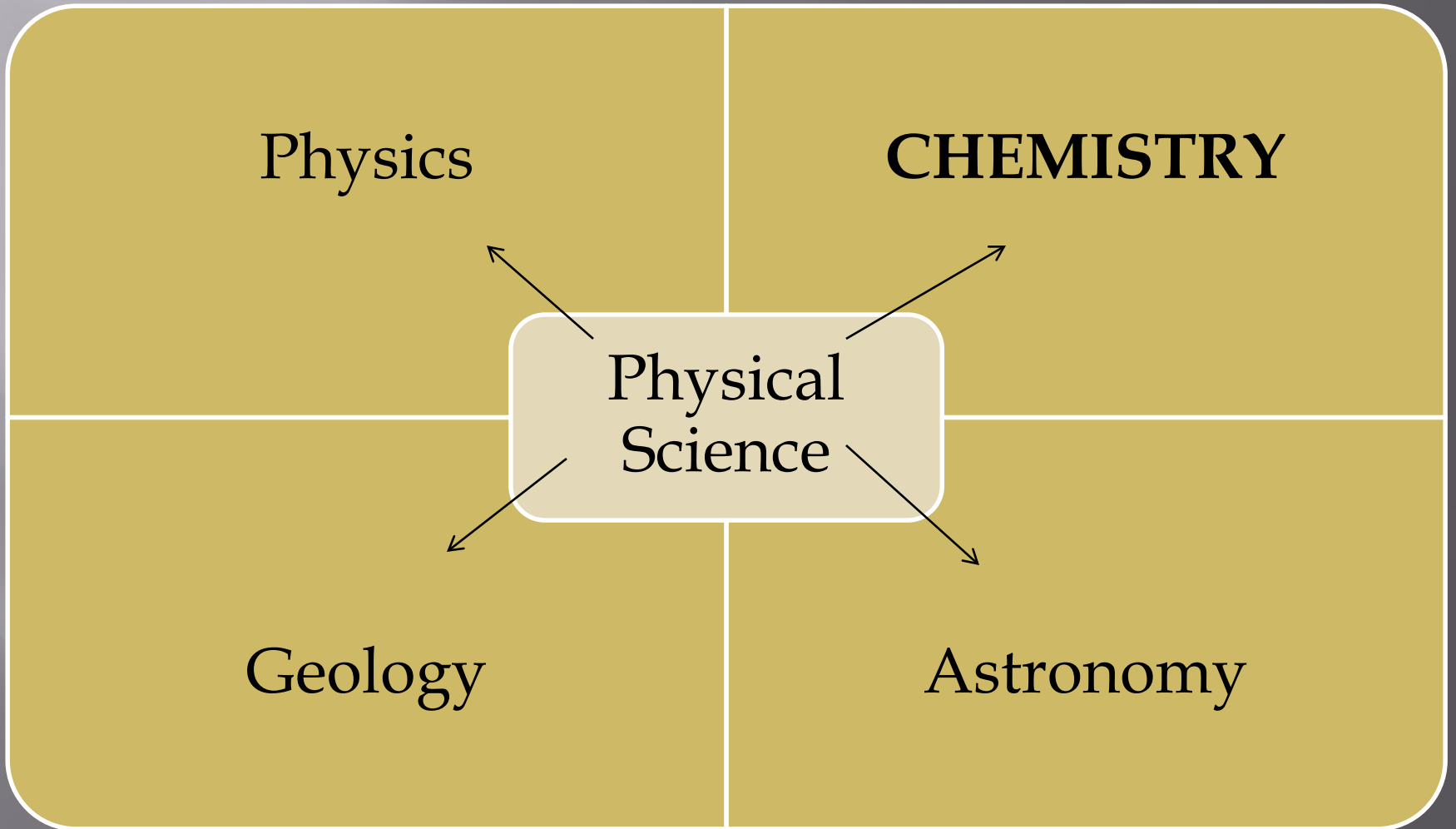
- ▣ We are building the base upon which you may build a future.



A Central Science - Chemistry



4 areas of Physical Science



Chemistry- deals with:

- ▣ Matter
- ▣ Processes of change
- ▣ Structure of Atoms
- ▣ Chemical bonding
- ▣ Phases of Matter
- ▣ Solutions
- ▣ Acids and bases
- ▣ Reactions
- ▣ Fires and explosions
- ▣ ...and more
- ▣ Math can help explain Physics and Chemistry
- ▣ Physics explains Chemistry, and Chemistry explains Physics
- ▣ Chemistry explains Biology
- ▣ Biology explains processes of life

6 Branches of Chemistry:

- ▣ *Organic Chemistry*: study of compounds containing carbon [food scientist, textile production & engineering]
- ▣ *Inorganic Chemistry*: study of non-organic substances (some of which have organic fragments bonded to metals) [mining industry; environmental science]

6 Branches of Chemistry:

- ▣ *Physical Chemistry*: the study of properties and changes of matter; energy [chemical engineer; pharmacologist; toxicology; research]

6 Branches of Chemistry (cont'd):

- ▣ *Analytical Chemistry*: identification of the makeup of materials and substances [medicine development; forensics]
- ▣ *Biochemistry*: study of the makeup and chemical processes of living things [physician; medical research; toxicology]

6 Branches of Chemistry (cont'd):

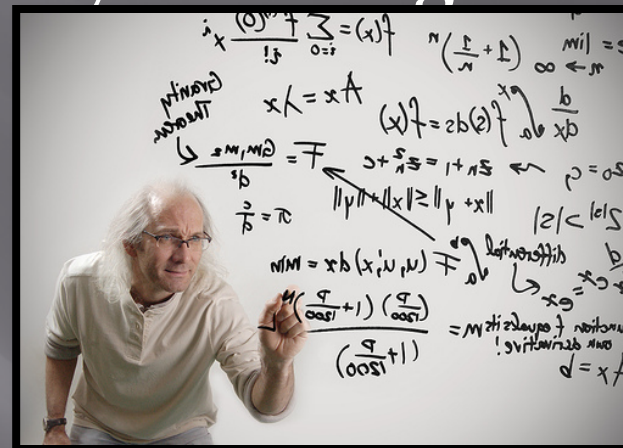
- ▣ *Theoretical Chemistry*: using math to understand what has been observed and to predict outcomes and properties of new substances
[professor/teacher; research engineering; laboratory research]

So what is Chemistry?

- ▣ **Chemistry** is the study of the composition, structure, and properties of matter, the processes that matter undergoes, and the energy changes that accompany these processes.
- ▣ **Short definition:** chemistry is the study of matter and its interactions.

Why do we need math for Chemistry?

- ▣ We can explain a great deal by attaching a number to an idea.
- ▣ Is it hot or cold outside?
- ▣ Is that surface slippery?
- ▣ Is that object heavy?



▣ ALL NUMBERS MUST HAVE UNITS

Numbers help us to understand!!

Any math that you need to know will be taught to you!!

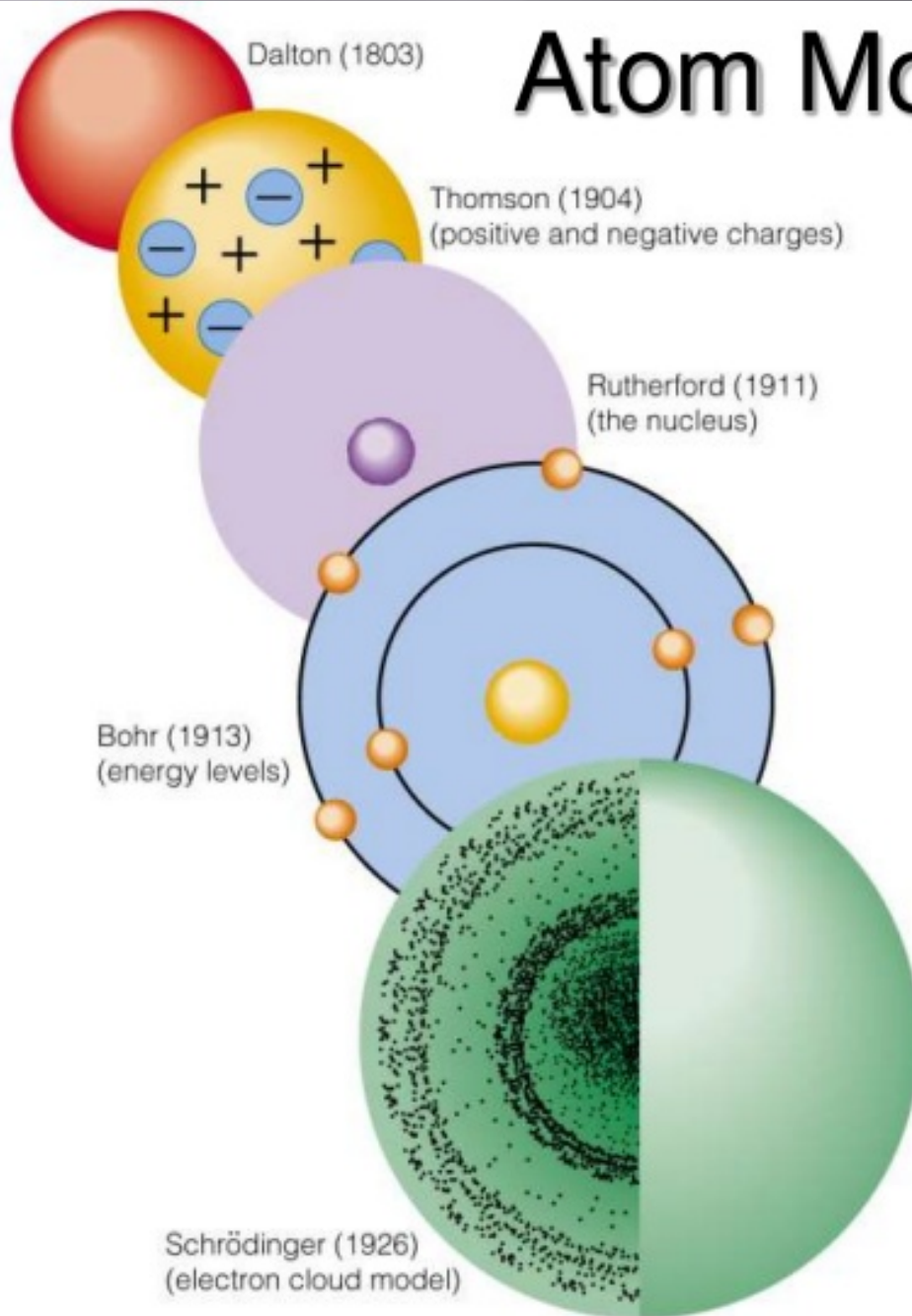
Scientific Method

1. Make observations
2. Make an educated guess – a hypothesis – about the situation
3. Perform experiments to test hypothesis
4. Collect and analyze data
5. Draw conclusions based on the data
6. Evaluate it against known evidence
7. Repeat it

Scientific Attitude/Approach

- ▣ Science cannot answer everything.
- ▣ In your education it is not enough to be aware that other people may try to fool you, but mainly to be aware of your own tendency to fool yourself.
- ▣ Trust the process...but don't trust everything you hear!

Atom Models in History



The last 200 years have seen ideas about the atom develop from Dalton's "indivisible atom" where it is the smallest thing possible; to the discovery of sub-atomic particles (electrons, protons & neutrons); to sophisticated understandings about where these particles are found and how they behave.

Each model has allowed hypotheses to be made & predictions tested. This has led to the development of our knowledge as the technology has improved.



[video link](#)

How has chemistry changed?

- ▣ This kind of change in our ability to grasp the ideas in science happens in the world of Chemistry also...
 - The way we view the atom
 - How 2 substances interact with each other
 - The development of nuclear chemistry – focusing on warfare and using nuclear reactions for energy purposes
 - Advancements in medicine combines changes in understanding of chemistry and biology

Interpreting our observations...

- ▣ How can several people perform the “exact” same exercise but get such noticeably different results?

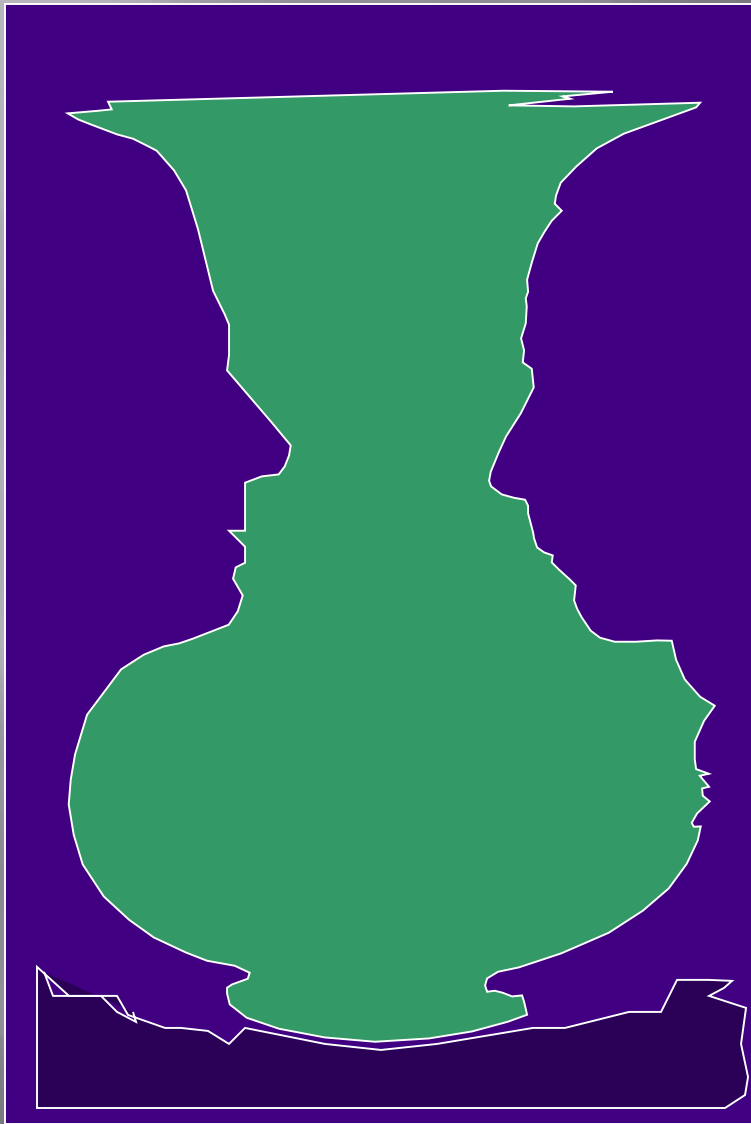
- ▣ How do we miss some details when they are so easy or obvious?
 - Sometimes, things are what they appear to be.
 - Sometimes, things that are unseen are actually what we’re looking for.
 - Sometimes, our minds fool us into seeing things that aren’t really there.
 - Sometimes, there are things that are real and present, but we can’t see them...but we see their effects.

Interpreting our observations...

- ▣ Take a look at the next few slides and see how our skills of observation are different from one person to another. Have fun!



Dual Perceptions



Don't confuse yourself!

YELLOW	BLUE	ORANGE
BLACK	RED	GREEN
PURPLE	YELLOW	RED
ORANGE	GREEN	BLACK
BLUE	RED	PURPLE
GREEN	BLUE	ORANGE

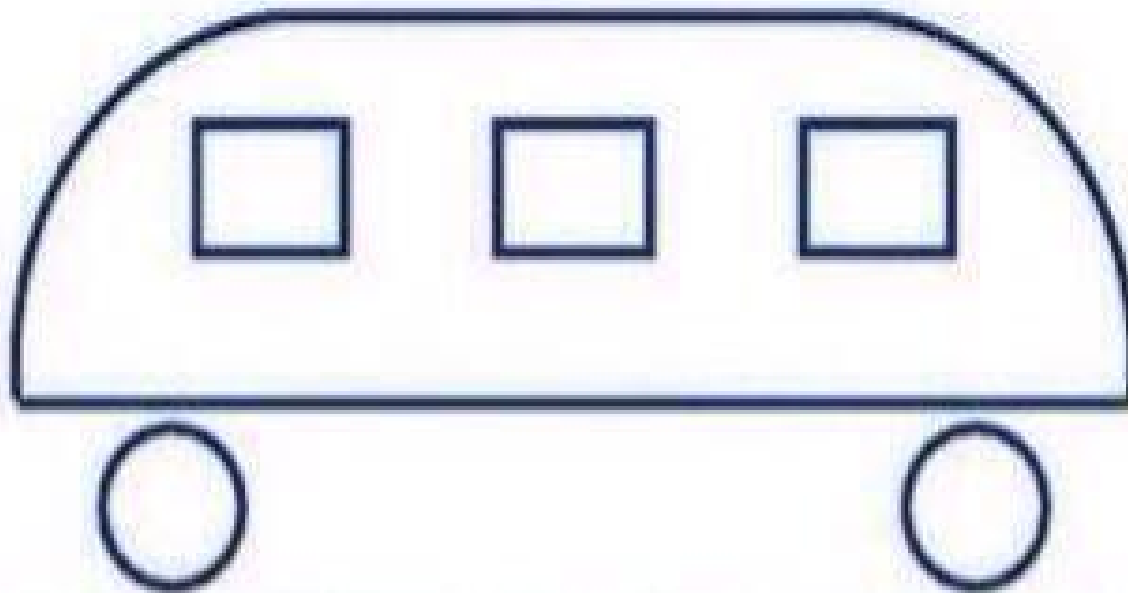
Find: The Hidden Tiger



Which way?

Which way is the bus going?

Right or left?









Interpreting our observations...

- ▣ We are going to perform many experiments/exercises this semester.
- ▣ We are not going to all get the same results. Why not????
- ▣ How do you know if you are right????
- ▣ It is OK to make mistakes – mistakes are part of learning.
- ▣ Sometimes we miss the mark...repeating mistakes is when trouble comes! (see video on next slide)



Top 8 Chemicals Manufactured in the US

Rank	Name	Formula	Uses
1	sulfuric acid	H_2SO_4	production of fertilizer; metal processing; petroleum refining
2	ethene	C_2H_4	production of plastics; ripening of fruits
3	propylene	C_3H_6	production of plastics
4	ammonia	NH_3	production of fertilizer; refrigeration
5	chlorine	Cl_2	bleaching fabrics; purifying water; disinfectant
6	phosphoric acid (anhydrous)	P_2O_5	production of fertilizer; flavoring agent; rustproofing metals
7	sodium hydroxide	NaOH	petroleum refining; production of plastics
8	1,2-dichloroethene	$\text{C}_2\text{H}_2\text{Cl}_2$	solvent, particularly for rubber

Source: *Chemical and Engineering News*.

LAB - Drops on a penny



- ▣ First lab activity
- ▣ The only reason that we are doing this lab is to be sure that you **FOLLOW INSTRUCTIONS.**
- ▣ There are some chemistry concepts that are embedded into the lab.
- ▣ Small groups, all observations are recorded.

- ▣ Cohesion –Molecules are attracted to ones like themselves. Water molecules are attracted to other water molecules. (The hydrogens of one water molecule are attracted to the oxygen from another water molecule).
- ▣ Adhesion –The force of attraction that causes two different substances to join. Ex. adhesion causes water to spread out over glass.
- ▣ Surface tension – the elastic-like force existing in the surface of a body, especially a liquid.