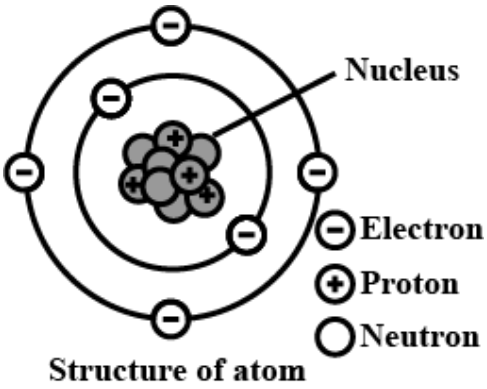
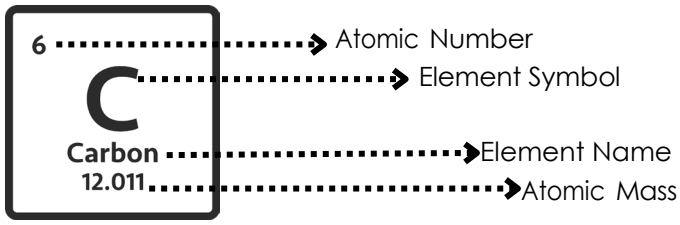
Unit 0: Review of Chemistry Concepts

Topic 1: Atom Basics



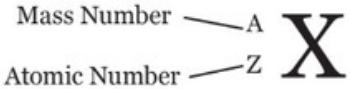
Structure of atom



Nuclear Symbol of an Element:

Mass Number= # of Protons + # of Neutrons in one atom of an element.

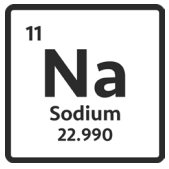
Atomic Number= # of Protons (also equal to # of electrons in a neutral atom)



How to calculate the number of subatomic particles:

Atomic Number =
Protons =
Electrons =

Mass Number =
Atomic Number =
Neutrons =



P= _____
N= _____
E= _____

P= _____
N= _____
E= _____

Practice

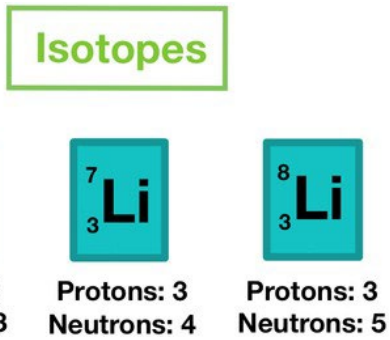
P= _____
N= _____
E= _____

Ions and isotopes

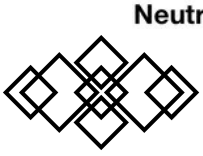
Ions are elements that have a charge due to gaining or losing electrons.

- Cations: "Paws"itively charged ion from losing electrons.
- Anions: Negatively charged ion from gaining electrons.

Isotopes are elements that have a different atomic mass due to gaining or losing neutrons. This does not change the type of element or give it a charge.



Elements and Ions Teacher Made



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Topic 2: Significant Figures

Significant Figures

Definition: each of the digits of a number that are used to express it to the required degree of accuracy.

- For Example: A scale that measures to one decimal place (ex: 9.2 g) cannot be read as 9.1889 because it is limited to the number of sig figs it can determine.

Rules for determining sig figs

1. All numbers 1-9 are significant. These are referred to as non-zero digits.
2. **Leading zeros** are never significant. Ex.: **0.000**125 only has 3 sig figs
3. **Captive zeros** are always significant. Ex.: 2,1**0**5 has 4 sig figs
4. **Trailing zeros** are only significant if there is a decimal present.
   Ex.: 12,5**00** has 3 sig figs 12.5**00** has 5 sig figs 0.02**00** has 3 sig figs

0.750 =_____ **658.0 =**_____

1000.01 = _____ **1,250,000 =**_____

0.0080050 = _____ **0.010 =**_____

Rules for calculating with significant figures

When **multiplying or dividing**, the answer has the same number of sig figs as the value with the fewest sig figs.

Ex.: 1,205 x 1.6 = 1,928 Fewest sig figs = 2 Round answer to 2 sig figs = 1,900

When **adding or subtracting** the decimal places should be rounded to the same number of decimal places as the measurement with the fewest number of decimal places.

Ex.: 22.457 + 1.23 + 2.5671 = 26.2541 Number with fewest decimal places = 1.23
Round answer to 2 decimal places= 26.25

32.567 + 135.0 + 1.4567 =_____

45.76 * 0.010 =_____

1.678 / 0.42 =_____

25.771 / 0.012 =_____

9.088 + 456.2 + 13.99 =_____

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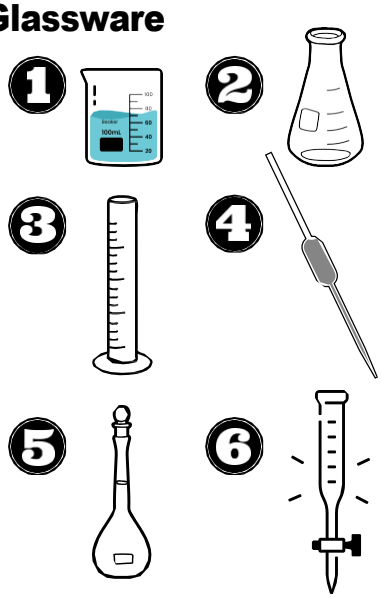
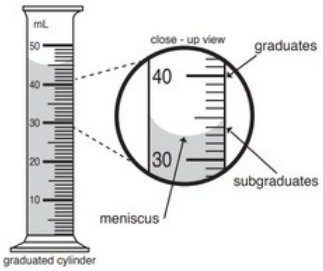
Topic 3: Reading and Understanding Science Glassware



1. Beaker: Can be glass or plastic; common sizes are 50 mL, 100 mL, 250 mL, and 400 mL; glass beakers may be heated. Not to be used to measure out specific volumes of solution.
2. Erlenmeyer flask: glass; common sizes are 100 mL, 250 mL, and 500 mL; may be heated and used in titrations.
3. Graduated Cylinder: glass or plastic; common sizes are 10 mL, 50 mL, and 100 mL; used to measure approximate volumes; must not be heated.
4. Volumetric Pipette: usually glass; it allows only for a very specific (or fixed) amount of solution to be transerred
5. Volumetric Flask: glass; common sizes are 25 mL, 50 mL, 100 mL, and 250 mL; carefully calibrated to a specific volume and marked with a graduation.
6. Buret: glass; common sizes are 25 mL and 50 mL; used to measure volumes of solutions in titrations

Reading glassware:

When reading glassware or thermometer make sure you read from eye level. Read from the bottom of the meniscus (the curve of the liquid). The degree of accuracy is unique to each piece of graduated glassware. You may read the direct measurement using the markings, and then estimate one additional significant figure. The estimate is typically a 0 or 5.



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Topic 4: Atom "Stability", and Ionic & Covalent Bonding Basics

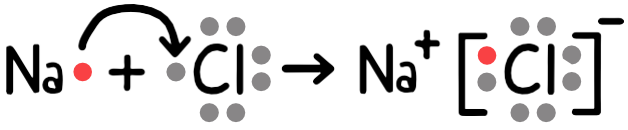
- Octet Rule: This rule refers to the tendency of atoms to prefer to have eight electrons in the valence (outermost) shell to achieve "stability".
  - When discussing the octet rule, d or f electrons are not considered.
- This is an overly simplistic explanation of atomic behavior. However, for introductory chemistry, it is a good rule to use to explain certain trends and behaviors.

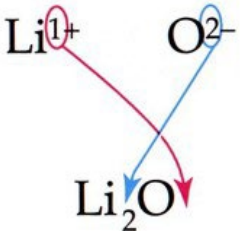
The Octet Rule and Bonding

- In order to satisfy the octet rule atoms can either share or transfer valence electrons. This results in two main types of bonds.

Ionic Bonds

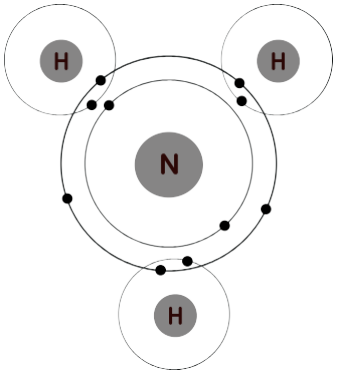
- Ionic bonds are formed through a transfer of electrons between a metal and a nonmetal.
- Metals will lose electron(s) resulting in a positively charged ion, a cation.
- Nonmetals will gain electron(s) resulting in a negatively charged ion, an anion.





Covalent Bonds

- Covalent bonds are formed through a sharing of electrons between two nonmetals.
- The sharing is not always equal. This results in a polar bond.
- Nonpolar Covalent= Equal sharing of electrons; small/no difference in electronegativity.
- Polar Covalent= Unequal sharing of electrons; large difference in electronegativity. The electrons are displaced towards the more electronegative atom.



Directions: Identify the following examples as ionic or covalent bonds.

1. NH_3 = _____
2. CaF_2= _____
3. CO_2 = _____
4. Al_2O_3= _____
5. $CuCl_2$= _____

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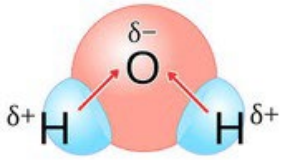
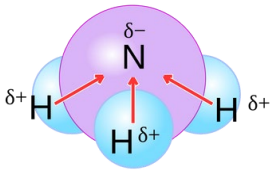
Topic 5: Determining Polarity

Polar and nonpolar are terms used to describe the distribution of electrical charge within molecules.

Polar Substances



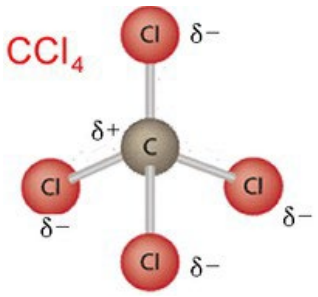
- Contain an uneven distribution of electrons, resulting in regions of partial positive and partial negative charges.
- Caused by the atoms in a molecule having significantly different electronegativities
- The shared electrons are pulled closer to one atom, creating a dipole moment.



Electronegativity

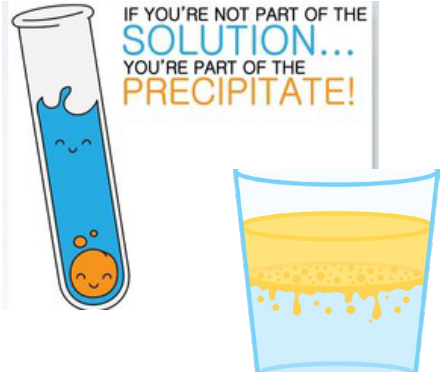
1A												3A	4A	5A	6A	7A	8A
H 2.1	2A																He
Li 1.0	Be 1.5											B 2.0	C 2.5	N 3.0	O 3.5	F 4.0	Ne
Na 0.9	Mg 1.2											Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0	Ar
K 0.8	Ca 1.0	Sc 1.3	Ti 1.5	V 1.6	Cr 1.6	Mn 1.5	Fe 1.8	Co 1.9	Ni 1.9	Cu 1.9	Zn 1.6	Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8	Kr
Rb 0.8	Sr 1.0	Y 1.2	Zr 1.4	Nb 1.6	Mo 1.8	Tc 1.8	Ru 2.2	Rh 2.2	Pd 2.2	Ag 1.9	Cd 1.7	In 1.7	Sn 1.8	Sb 1.9	Te 2.1	I 2.5	Xe
Cs 0.7	Ba 0.9	La 1.1	Hf 1.3	Ta 1.5	W 1.7	Re 1.9	Os 2.2	Ir 2.2	Pt 2.2	Au 2.4	Hg 1.9	Tl 1.8	Pb 1.9	Bi 1.9	Po 2.0	At 2.1	Rn

Nonpolar Substances



- Contain a symmetrical distribution of electrons, with no significant difference in electronegativity between the atoms involved.
- Nonpolar molecules do not have permanent dipole moments and do not exhibit charged regions

Polarity and Substance Behavior



- The polarity of a substance dictates its interactions with other substances.
- For example, polar substances dissolving in polar solvents and nonpolar substances dissolving in nonpolar solvents (like dissolves like)
  - This is one reason why oil (nonpolar) and water (polar) don't mix!