

Monday/Tuesday, September 30 & 31, 2019 -- Chemists and Chemistry (Chapter 1) - **KEY****I. Warm-Up** – Fill out the charts with the proper SI units and conversion factors.

Physical Property	SI or SI Derived Unit
Length	Meter (m)
Mass	Kilogram (kg)
Time	Seconds (s)
Temperature	Celsius (°C) or Kelvin (K)
Energy	Joule (J)
Amount of Substance	Mole (mol)
Pressure	Pascals (Pa)

Prefix	Conversion Factor
Kilo- (k)	1 kilo = 1000 base unit
Milli- (m)	1000 milli = 1 base unit
Micro- (μ)	10⁶ micro = 1 base
Nano- (n)	10⁹ nano = 1 base
Pico- (p)	10¹² pico = 1 base

II. Introductions

Welcome to CLAS, and welcome to CHEM 1A!

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Drop-In: Mondays 7-9pm in SRB 3274

II. Scientific Method/Scientific Practices

- Which of the following statements is most like a scientific theory?
 - A gas sample has a mass of 15.8 g and a volume of 10.5 liters.
 - When the pressure on a sample of oxygen gas is increased 10%, the volume of the gas decreases 10%.
 - A gas is composed of small particles in constant motion.**
 - The volume of a gas is inversely proportional to its pressure.

Law: what is observed to happen**Theory: an explanation for why it happens****(see also slide definitions)****III. Dimensional Analysis & Significant Figures**

2. Complete the following table.

	# of Significant Figures
0.00004520090	7
23,098,000	5
200.	3

3. The density of mercury is 13.6 g/mL. What is the mass in kilograms of a 2 L commercial flask of mercury?

$$2L \times \frac{1000 \text{ mL}}{1L} \times \frac{13.6 \text{ g}}{1 \text{ mL}} \times \frac{1 \text{ kg}}{1000\text{g}} = 27.2\text{kg}$$

4. Let's pretend we have some imaginary units called Whatsits (WI), That's (T), and Thing-a-Mabobs (TM). If 1 Whatsit =
- 3.45×10^4
- That and 0.0375 That = 1 Thing-a-Mabob, how many Whatsit's are in
- 6.022×10^{23}
- Thing-a-Mabob's?

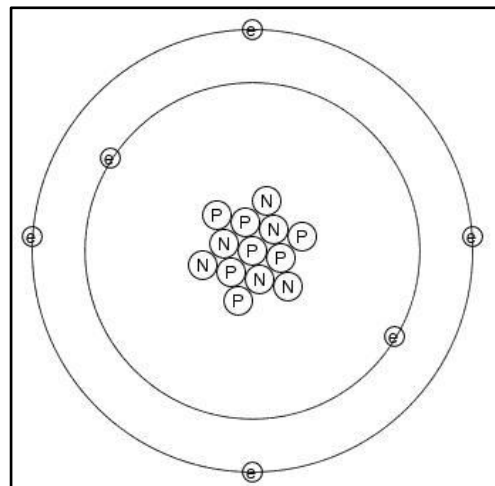
$$6.022 \times 10^{23} \text{ TM} \times \frac{0.0375 \text{ T}}{1 \text{ TM}} \times \frac{1 \text{ WI}}{3.45 \times 10^4 \text{ T}} = 6.546 \times 10^{17} \text{ WI}$$

Atoms, Molecules, and Ions (Chapter 2) - **KEY**

I. What is an atom?

What are atoms made of?

Subatomic Particle	Charge	Location	Size
Proton	+1	Nucleus	~1 amu
Neutron	0	Nucleus	~1 amu
Electron	-1	Electron Cloud	~small



II. How to Read Chemistry

1. A certain isotope of phosphorus can be written in textbooks as $^{31}_{15}\text{P}$ or P-31 or Phosphorus-31.

(a) In the first notation, what does the 31 represent? What does the 15 represent?

Phosphorus -31 has 31 total nucleons (protons and neutrons) and 15 of those nucleons are protons.

(b) How many protons, neutrons, and electrons does the atom ^{31}P have?

Protons = 15

Neutrons = 16

Electrons = 15

2. Of the five options below, which two(s) among the following represent a pair (or pairs) of isotopes? Atomic nuclei containing
- 20 protons and 20 neutrons.
 - 21 protons and 19 neutrons.
 - 22 neutrons and 18 protons.
 - 20 protons and 22 neutrons.
 - 21 protons and 20 neutrons.

I & IV are isotopes. II & V are isotopes.

Atomic Number (Z) ⇒ # of protons

10
Ne
20.180

Element Symbol

Average atomic mass in amu or g/mol

Mass Number (A) ⇒ sum of protons and neutrons
Note that mass number is NOT on the periodic table

Isotopes ⇒
atoms of the same element (same number of protons) with varying number of neutrons (different mass number)
ex: Chlorine has two naturally occurring isotopes

$^{35}_{17}\text{Cl}$

Mass Number (A)

and

$^{37}_{17}\text{Cl}$

Atomic Number (Z)

Image Credit 1 - Terri Bentzinger's CLAS Worksheets

1 H Hydrogen 1.00794																	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012182											5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.9984032	10 Ne Neon 20.1797
11 Na Sodium 22.989770	12 Mg Magnesium 24.3050											13 Al Aluminum 26.981538	14 Si Silicon 28.0855	15 P Phosphorus 30.973761	16 S Sulfur 32.066	17 Cl Chlorine 35.4527	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955910	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938049	26 Fe Iron 55.845	27 Co Cobalt 58.933200	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.61	33 As Arsenic 74.92160	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.60	53 I Iodine 126.90447	54 Xe Xenon 131.29
55 Cs Cesium 132.90545	56 Ba Barium 137.327	57 La Lanthanum 138.9055	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.078	79 Au Gold 196.96655	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98038	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
87 Fr Francium (223)	88 Ra Radium (226)	89 Ac Actinium (227)	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (263)	107 Bh Bohrium (262)	108 Hs Hassium (265)	109 Mt Meitnerium (266)	110 (269)	111 (272)	112 (277)						

58 Ce Cesium 140.116	59 Pr Praseodymium 140.90765	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92534	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93032	68 Er Erbium 167.26	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
90 Th Thorium 232.0381	91 Pa Protactinium 231.03588	92 U Uranium 238.0289	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)

Metal:

Nonmetal:

Metalloid:

Noble Gases:

Alkaline Earth Metals:

Alkali Metals:

Halogens:

Transition Metals: