

**Hydrogen** (non-metal)

(IP  
ON)

\* **Protons** = Atomic Number

~~Atomic Number~~ = <sup>Mass</sup> # protons + # neutrons = # of ~~electrons~~ → atom neutral  
< No charge! >

(+) Protons  
Neutrons  
(-) Electrons

Remember!

\* **Neutrons** =  $\frac{\text{Mass \#}}{\text{\# protons}}$

**Example!** ① F (Fluorine) has mass of 19  
Subt. Atomic Number 9 <sup>(protons/ electrons)</sup>  
= Equals # of Neutrons 10

② He (Helium) Mass of 4  
Atomic # 2 <sup>(2 Protons / 2 Electrons)</sup>  
= Neutrons 2

③ W (Tungsten) Mass # of 184  
Atomic # 74  
= Neutrons 110

**\*KNOW!** **Quark** = smallest particle in an atom.

\* **Proton** = 2 up quarks  
1 dwn quark

\* **Neutron** = 2 dwn quarks  
1 up quark

(periodic table) -

Elements within the same group have similar chemical characteristics.

(Composition of Air)

- 78% Nitrogen ( $N_2$ )
- 21% Oxygen ( $O_2$ )
- 1% Argon (Ar)
- $CO_2$  Carbon Dioxide (0.03%)

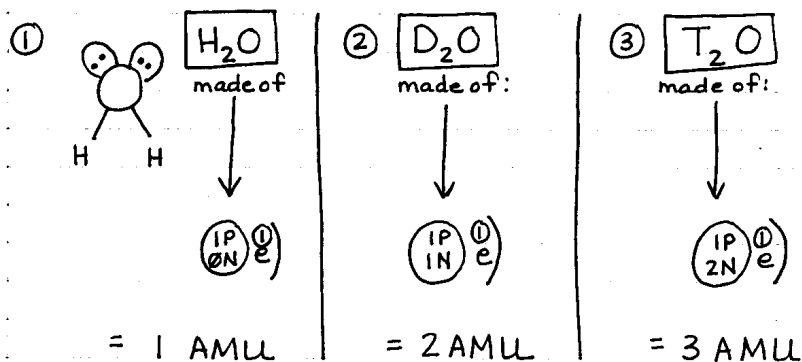
The composition of air on Earth:

- # 1: Hydrogen
- # 2: Helium

$$6.02 \times 10^{23} \text{ atoms}$$

• (2<sup>+</sup> elements having same atomic #)

### Isotopes of Hydrogen



# 27)  $\frac{1 \text{ gram H atom}}{1} \times \frac{1 \text{ mole}}{1 \text{ gram}} = \frac{1 \text{ mole H atom}}{1} \times \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mole}}$

=  $6.02 \times 10^{23}$  atoms of (H) Hydrogen.

$\frac{1 \text{ gram C}}{1} \times \frac{1 \text{ mole}}{12 \text{ gram (on periodic table)}} = \frac{0.0833 \text{ moles}}{1} \times \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mole}}$

=  $5.01466 \times 10^{22}$

Equation is calculated: "ee" or "exp" button;  
 (means  $\times 10$ ; then punch "2" "3" ( $10^{23}$ ))

~~Equation~~  $C = \lambda \nu$

$C = \text{speed of light}$   
 $\lambda = \text{wavelength}$   
 $\nu = \text{frequency}$

$C = 186,000 \text{ mi/sec (standard) OR}$   
 $3.0 \times 10^8 \text{ m/s (metric)}$

Hint:  $\nu = \frac{c}{\lambda}$  ;  $\lambda = \frac{c}{\nu}$

To convert nm to m =  $\frac{1 \text{ nm}}{1} \times \frac{1 \text{ m}}{10^9 \text{ nm}} = 1 \times 10^{-9} \text{ m}$

~~Equation~~

$\frac{100 \text{ nm}}{1} \times \frac{1 \text{ m}}{10^9} = 1 \times 10^{-7} \text{ m}$

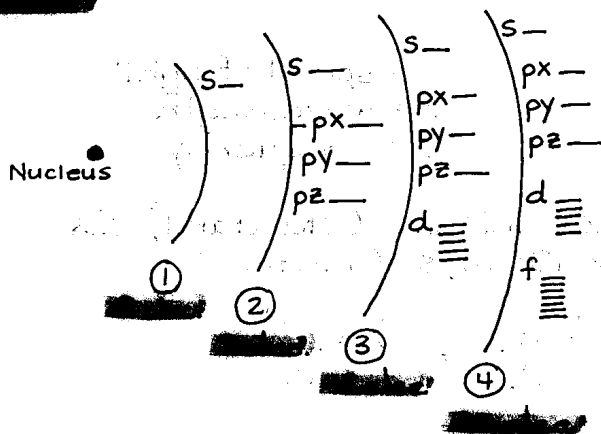
[Calc:  $100 \div 1 \text{ "exp" } 9 = 1 \times 10^{-7}$ ]

~~Equation~~  $\uparrow \text{wavelength} = \downarrow \text{frequency (energy)}$

Ex: Red light has less energy (film labs)

~~Equation~~  $\text{All objects constantly vibrate; even when appearing still to eye.}$

\*



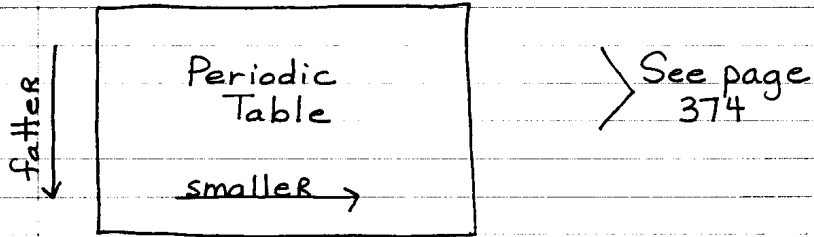
p = principal  
s = secondary  
d = diffuse  
f = faint

**Electron Configurations:**

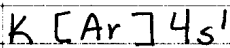
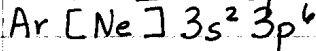
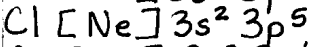
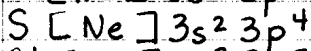
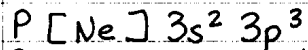
- H =  $1s^1$
- He =  $1s^2$
- Li =  $1s^2 2s^1$
- Be =  $1s^2 2s^2$
- B =  $1s^2 2s^2 2p^1$
- C =  $1s^2 2s^2 2p^2$
- N =  $1s^2 2s^2 2p^3$
- O =  $1s^2 2s^2 2p^4$
- F =  $1s^2 2s^2 2p^5$
- Ne =  $1s^2 2s^2 2p^6$  (At # = 10; happy b/c all shells (1+2) are full) Doesn't REACT!
- Na =  $1s^2 2s^2 2p^6 3s^1$  (OR)  $Na [Ne] 3s^1$
- Mg =  $[Ne] 3s^2$
- Al =  $[Ne] 3s^2 3p^1$
- Si =  $[Ne] 3s^2 3p^2$

- All Group 1 forms +1
- Group 13 forms +3

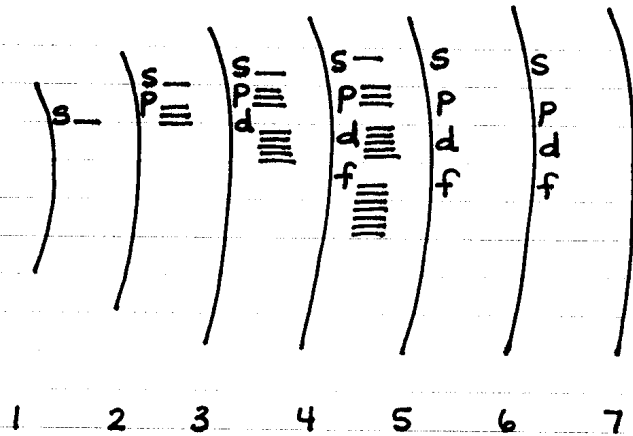
**Number of electrons in all shells = Total At # of element**



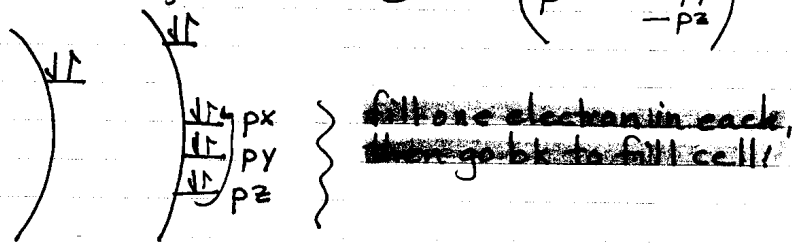
As you move from ~~left to right~~, the shells are ~~becoming smaller~~ toward nucleus.



1 orbital = ~~subshell~~



↑ Larger Scale of ② Shell ( $p \equiv \begin{matrix} -p_x \\ -p_y \\ -p_z \end{matrix}$ )



### Test Questions!

2  $3s^2$  orbital what is total # electrons possible?  
(anytime s orbital = 2)

6  $3p$  orbital = 6  
(p orbital = 6)

\* Know colors of Periodic chart!

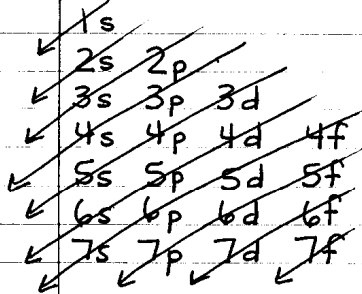
Will be passed out blank (handout) w/ test -  
Must know to use w/ test -

Know this one!

# shells



\* Fills in Order of Arrows!!



Group 1 ends in ( $s^1$ )



Group 2 ends in ( $s^2$ )

\* Test Wed - (Chap 14/15)

## Study Guide!

~~Atomic #~~ = Atomic Number of Element

$P + N = A_{\text{mass}}$  ~~Atomic Mass~~ = # protons + # neutrons

$m\# - P = N$  ~~Atomic Mass~~ = Mass # - # of protons

- Protons (+)
- Neutrons
- Electrons (-)

Ex: F (Fluorine) Mass of 19  
Atomic # = 9 (prot/elec)  
= # of neutrons 10  
 $9 - (10N + 9P = 19 \text{ Atomic Mass})$

~~Quark~~ = smallest particle in an atom

~~Proton~~ = 2 up quarks  
1 down quark

~~Neutron~~ = 2 down quarks  
1 up quark

\*Size:  
Lg  $\rightarrow$  Proton  
Electron  
Sm  $\rightarrow$  Quark

## Composition of Air -

- 78% Nitrogen ( $N_2$ )
- 21% Oxygen ( $O_2$ )
- 1% Argon (Ar)
- .03% Carbon Dioxide ( $CO_2$ )

The ~~most abundant elements~~ on Earth:

# 1 = ~~Hydrogen~~

# 2 = ~~Oxygen~~

(same)  
~~isotope~~ - 2+ elements having same atomic number. (same Protons, diff Neutrons)  
 $\begin{matrix} H_1 & H_2 & H_3 \\ \left( \begin{smallmatrix} 1P \\ 0N \end{smallmatrix} \right) & \left( \begin{smallmatrix} 1P \\ 1N \end{smallmatrix} \right) & \left( \begin{smallmatrix} 1P \\ 2N \end{smallmatrix} \right) \end{matrix}$  ←  
~~1 mole~~ =  $6.02 \times 10^{23}$  atoms

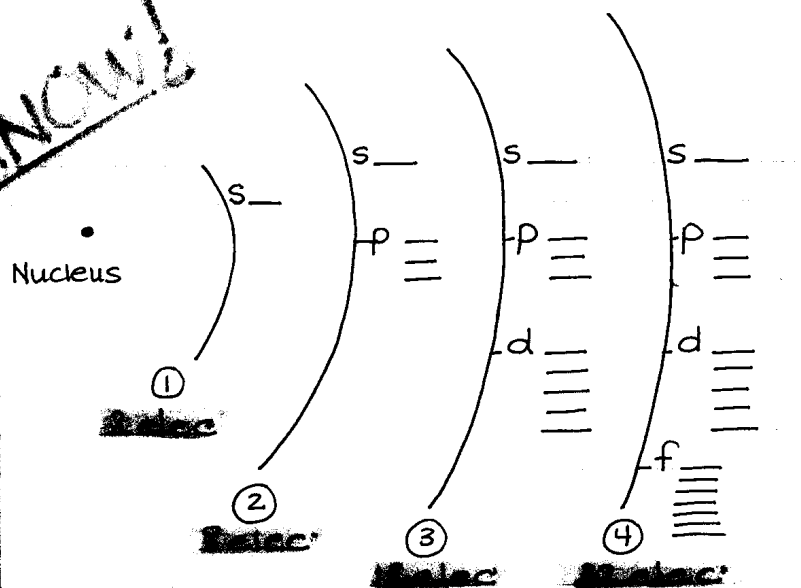
$c = \lambda \nu$

$c =$  (speed of light)  $\left[ \begin{matrix} 3.0 \times 10^8 \text{ m/s} \\ \text{or} \\ 186,000 \text{ mi/sec} \end{matrix} \right]$   
 $\lambda =$  wavelength  
 $\nu =$  frequency

The shorter the wavelength, higher frequency,  
 ↓ wavelength / ↑ frequency (energy)  
 Ex: Red light has less energy (film)

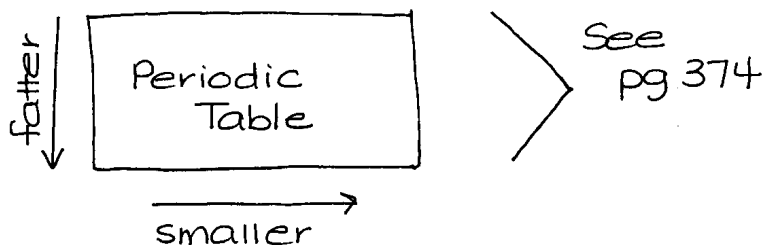
Brownium motion: all obj constantly vibrate; even when appearing still to eye  
 Ex: metal rod experiment

**KNOW!**



Add up: #electrons in all shells = Total Atomic # of Element.

As you move from ~~left~~ to ~~right~~ on table, the shells are **smaller** b/c they are ~~stronger~~ **pulled** toward nucleus.



- \* Know colors of periodic chart!
- \* See pg 351 / 352 Re: chart!

Volume of atom = comes from electrons  
Mass comes from nucleon (p + n in nucleus)

\* The farther the electron is from the nucleus, the more energy it has.

+⊖ will  
begin!

Cl<sup>⊖</sup> (same as chlorine, but add 1!  
 $\text{Cl} [\text{Ne}] 3s^2 3p^5 + 1 = 3p^6$

Na<sup>⊕</sup>  $[\text{Ne}] 3s^1 =$  take 1 away -- So --  
 $\text{Na}^+ [\text{Ne}]$  -- reverts bk to Neon!

Group 1	Group 2	Group 3	Group 4	Group 5
Alkali metals	Alkaline-earth metals	Chalcogens	Halogens	Noble Gases

### Review Questions—Chapter 14

- How many different elements are in a water molecule? **Two: hydrogen / oxygen**
- Atoms heavier than Hydrogen were made by: **nuclear fusion**
- If we doubled the magnifying power of the most powerful microscope in the world, we would: **still not be able to see an atom (small wavelength)**
- Which of these statements are true? **Atoms are the smallest subdivision of matter that still retain chemical properties of a substance.**
- What makes an element distinct? **The number of protons (or atomic number).**
- Brownian motion has to do with the: **random motion of atoms and molecules.**
- What is the smallest particle listed? **Quark** (molecule has 2 atoms—atoms—protons—neutrons—quarks)
- A molecule has: **structure, mass, and energy.**
- Solid matter is mostly empty space. The reason solids don't fall thru one another is because: **of electrical forces.**
- Which of these forces determines the chemical properties of an atom? **Electrical** (from electrons).
- The air in this room has: **mass, weight, and mass.**
- Assuming all atoms exhaled by Julius Caesar in his last dying breath are still in the atmosphere, then we probably breathe one of those atoms with each: **breath.**
- Nuclei of atoms that make up a newborn baby were made in: **ancient stars.**
- The reason a granite block is mostly empty space is because the atoms in the granite are: **mostly empty space.**
- Which of the following are electrically neutral? **Neutron.**
- In an electrically neutral atom, the number of protons in the nucleus is balanced by an equal number of: **orbiting electrons.**

17. Which has the greatest number of protons in its nucleus? **Lead (#82) (P = Atomic #)**.
18. The weight of matter comes from mostly its: **protons & neutrons** (nucleus).
19. The volume of matter comes mostly from its: **electrons**.
20. The chemical properties of matter come mostly from its: **electrons**.
21. Compared to the mass of a Hydrogen atom, the mass of an oxygen atom is: **16 times** **greater** (Atomic # difference)
22. What is the total number of protons in a water molecule? **10 protons**  
( $H_2O = (2)H + (1)O = \text{Total H protons } (2) + \text{Total O protons } (8) = 10$ )
23. If two protons are removed from an oxygen nucleus, the result is: **carbon**
24. To change mercury into gold: **only ONE neutron (not pair) must be removed from the nucleus**.
25. If a pair of helium nuclei are fused together, the result is: **beryllium**  
( $He \#2 + He \#2 = Be \#4$ )
26. The nucleus of an electrically *neutral* iron atom contains 26 protons. How many electrons does this iron atom have? **26** ( $P = E \dots$  so no charge..neutral!)
27. Which has more atoms? A 1 gram sample of carbon-12 or a 1 gram sample of carbon-13? **same amount of carbon-12**  

$$\frac{1 \text{ gram}}{1} \times \frac{1 \text{ mole}}{13 \text{ gram}} = \frac{0.0833 \text{ mole}}{1} \times \frac{6.02 \times 10^{23} \text{ atom}}{\text{mole}} = 5.01466 \times 10^{22} \text{ atoms}$$

$$\frac{1 \text{ gram}}{1} \times \frac{1 \text{ mole}}{12 \text{ gram}} = \frac{0.076923 \text{ m}}{1} \times \frac{6.02 \times 10^{23} \text{ atom}}{\text{mole}} = 4.63 \times 10^{22} \text{ atoms}$$
28. The element Bromine (Br #35) has *two major isotopes* of similar abundance, both around 50%. The atomic mass of Bromine is reported in the periodic table as 79.904 atomic mass units. Choose the most likely set of mass numbers for these two bromine isotopes: **79 & 81**
29. Which of these atoms has the most mass? **Francium** (highest atomic mass given)
30. Strontium (Sr #38) is especially dangerous to humans because it tends to accumulate in calcium-dependant bone marrow tissues (Ca-Calcium #20). The fact relates to the organization of the periodic table in that Strontium and Calcium are both: **in Group 2**.
31. Why are the atomic masses listed in the periodic table not whole numbers? **because of isotopes**

1. How can a Hydrogen atom, which has only 1 electron, have so many spectral lines?  
**One electron can be boosted to many different energy levels.**
2. Suppose that a certain atom possesses only 4 distinct energy levels. Assuming that all transitions between levels are possible, how many spectral lines will this atom exhibit? **6**
3. An electron de-excites from the 4<sup>th</sup> quantum level to the 3<sup>rd</sup>, then directly to the 1<sup>st</sup>. Two frequencies of light are emitted. How do their combined energies compare to the energies of the single frequency that would be emitted by de-excitation from the 4<sup>th</sup> level directly to the 1<sup>st</sup> level? The combined energies of the 2 frequencies emitted by 1 electron is: **equal to the energy of the single frequency.** Frequency =  $\frac{\text{Speed of Light}}{\text{Wavelength}}$
4. Which color of light comes from the higher energy transition? Red or blue? **Blue is higher frequency and therefore, corresponds to a higher energy level.**
5. How does the wave model of electrons orbiting the nucleus account for the fact that the electrons can have only discrete energy values? **When an electron wave is confined, it is reinforced only at particular frequencies.**
6. How might the spectrum of an atom appear if its electrons were not restricted to particular energy levels? **A broad spectrum of all colors would be observed.**
7. An electron in a 7s orbital has more energy than one in a 1s because: **it is farther away from the nucleus.**
8. The number of elements in a period is: **equal to the electron capacity of its shells.**
9. How many electrons are there in the outermost shell of Strontium (Sr #38) **2**—Group 2
10. How many electrons are in the outermost shell of Phosphorus (P #15) **5**—Group 15.
11. How many electrons are *unpaired* in the outermost shell of aluminum (Al #13)? **1**  
Al = (Ne) 3s<sup>2</sup> 3p<sup>1</sup> (1 because only 1 "p" filled).
12. How many electrons are *unpaired* in the outermost shell of Sulfur (S #16)? **2**  
S = (Ne) 3s<sup>2</sup> 2p<sup>4</sup> (8 to fill - 6 = 2)
13. How is it possible that as atoms get more massive, they become larger in size? **The more massive atoms have more shells.**
14. As atoms get more massive, they become smaller in size because: **more mass means more protons, which act to pull electrons in closer to the nucleus.**

15. The alkali metals (Group 1) tend to form 1+ ions while the alkali-earth metals (Group 2) tend to form 2+ ions because: the charges of these ions corresponds to the number of valence electrons that may be lost.

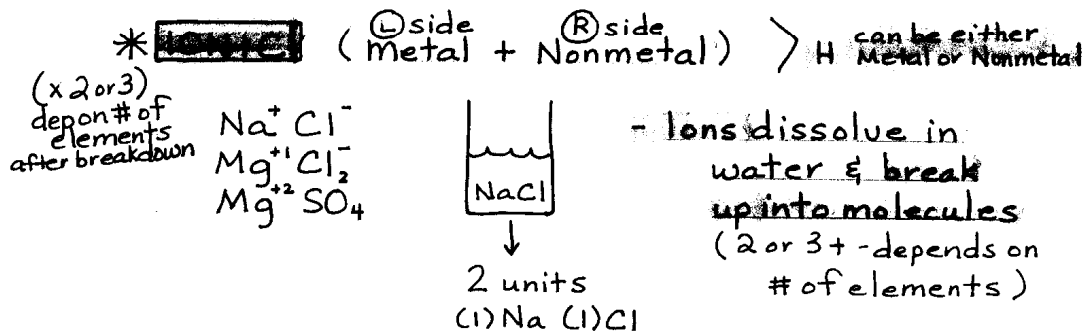
16. How many shells are completely filled for the chlorine ion  $\text{Cl}^{-1}$  (Cl #17)? 3  
 $\text{Cl}$  (Ne)  $3s^2 3p^5$  (7 total---3 of 4 filled)

17. Which of the following shows elements in order of increasing atomic size?  
Cl #17—K #19—Br #35—Rb #37? K < Br < Rb < Cl

18. Another interesting periodic trend is the density of the elements. We find that Osmium (Os #76) has the greatest density of all elements, and with some exceptions—the closer an element is positioned to Osmium, the greater the density. Based upon this trend, list the following elements in order of increasing density: Copper/Cu, Gold/Au; Platinum/Pt; and Silver/Ag. Cu < Ag < Pt < Au < Os (Bottom left = higher density)

## molar masses

- Convert moles to grams
- Convert grams to moles
- Calculate # molecules/ions from moles.

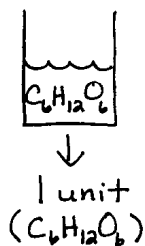
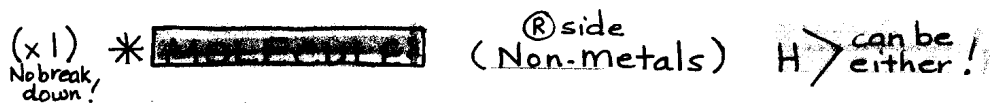


- How much does  $\text{Na}^+ \text{Cl}^-$  weigh?

Na - 23

Cl - 35.45

58.45 grams per mole



- does not break apart  
- or dissolve in water

- How much does  $\text{C}_6\text{H}_{12}\text{O}_6$  weigh?

C (6) - # 12 → 72

H (12) - # 1 → 12

O (6) - # 16 → 96

(#) - (mass #) 180 grams/mole

• How much does  $MgCl_2$  weigh?

$$Mg - 24.31 \quad 24.31$$

$$Cl_2 - 35.45 (2) \rightarrow \underline{70.9}$$

$$95.21 \text{ g/mole}$$

$6.02 \times 10^{23}$  } what a mole represents

\* How many moles in:

- 88g of  $CO_2$

$$C - 12 \rightarrow 12$$

$$O_2 - 16 (2) \quad \underline{32}$$

$$44 \text{ g/mole}$$

$$\frac{88 \text{ g}}{1} \times \frac{1}{44 \text{ g}} = \boxed{2 \text{ moles}}$$

\* How many molecules of  $CO_2$  in 2 moles?

$$\frac{2 \text{ moles } CO_2}{1} \times \frac{6.02 \times 10^{23} \text{ molecules}}{\text{mole}} = 12.04 \times 10^{23} \text{ molecules}$$

$$= (\text{Calculator}) 6.02 \text{ "exp" } 23 \times 2 = \boxed{1.204 \times 10^{24}}$$

\* 116g of NaCl (Ionic!!)  
→ What is the total # of ions/molecules if placed in water?

①

Na	22.99
Cl	35.45
	58.44 g/mole (or 58.5 g/mole)

②  $\frac{116g}{1} \times \frac{1}{58.44g} = 2 \text{ moles}$

③  $\frac{2 \text{ moles NaCl}}{1} \times \frac{6.02 \times 10^{23}}{\text{mole}} = (\times 2 \text{ (elements)}) = \boxed{2.408 \times 10^{24}}$

~~When Ionic → 1 substance but 2~~ (breaks down)

< So you multiply equation by 2 >  
→ Multiply by 3 if 3 elements!

atoms/molecules ( $\frac{\circ}{\circ}$ )  
grams (x)

### Calculations!

~~AM + AM~~ ① Determine weight of element.  
(add atomic masses = g/mole)

~~Total weight~~ ② Determine # moles in given weight: (x)  
Ex: 88g of CO<sub>2</sub> (given)  
$$\frac{88g}{1} \times \frac{1}{44g} = \boxed{2 \text{ moles}}$$
  
(weight)

~~# moles x 6.02 x 10<sup>23</sup>~~ ③ Determine # molecules of CO<sub>2</sub> in 2 moles:  
(given) (worked out)  
$$\frac{2 \text{ moles CO}_2}{1} \times \frac{6.02 \times 10^{23} \text{ molecule}^\circ}{1 \text{ mole}} = 12.04 \times 10^{23} \text{ molecule}$$

~~Calculator~~ • Calculator → \*Use this one!!  
$$6.02 \text{ "exp" } 23 \left( \times 2 \right) = 1.204 \times 10^{24}$$

④ Determine # ions/molecules if element placed in water.

116 g of NaCl → (Ionic → dissolves)

- ① Get weight
- ② Get # moles
- ③ Get # molecules X # elements

~~Notes~~ [ Ionics → Breakdown (x # elements)  
Molecules → Ø Breakdown! (x 1) ]

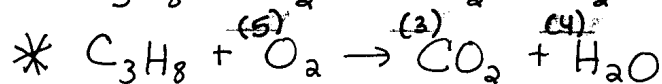
grams → moles  
moles → grams  
ions  
atoms  
molecules

→  $6.02 \times 10^{23}$  atoms/mole  
 $6.02 \times 10^{23}$  molecules/mole  
 $6.02 \times 10^{23}$  ions/mole  
 $6.02 \times 10^{23}$  ANYTHING/mole

} moles  
can be  
anything!

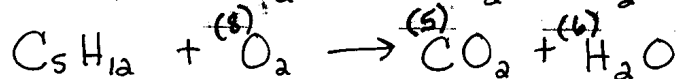
\* 1 mole of gas = 22.4 L @ STP 0°C / atm \*

Handout (Ch 21)



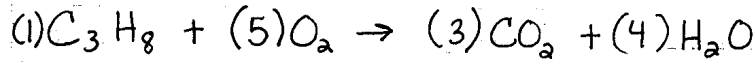
\* Balancing

- ① Get same # elements on both sides
- ② Keep co-efficients lowest whole # possible
- ③ Understand what a balance Rx (react) means  
A) How many grams of each?



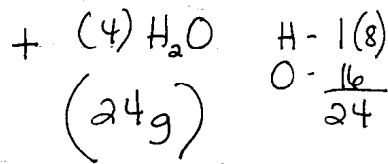
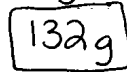
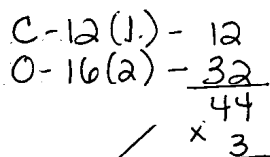
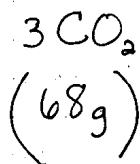
\* Know how to  
balance +  
calculate  
for final

3A) How many grams of each?



should balance!

$$\rightarrow \frac{44g}{1} \times \frac{1 \text{ mole}}{44g} = 5 \text{ moles } (O_2) \times \frac{32g}{\text{mole}} = 160g$$

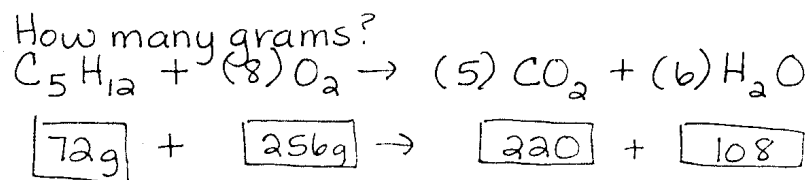


$$\frac{44g}{\text{mole}} \times \frac{3 \text{ moles}}{1} = 132$$

$$H - (1) 2 = 2$$

$$O - 16 = \frac{16}{18}$$

$$18(4) = 72$$

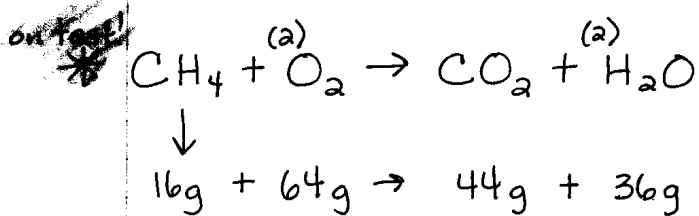
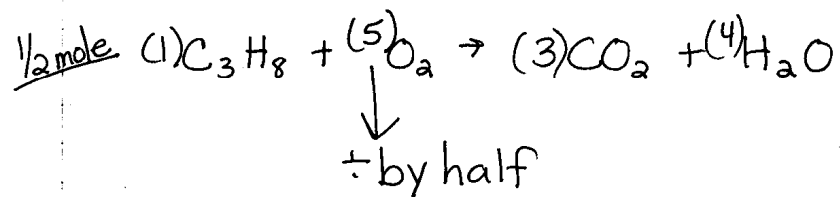


$$\begin{array}{r}
 \downarrow \\
 C - 12(5) = 60 \\
 H - 1(12) = 12 \\
 \hline
 72
 \end{array}
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 \begin{array}{r}
 \searrow \\
 O - 16(2) = 32 \\
 \hline
 8 \\
 256
 \end{array}$$

$$\begin{array}{r}
 C - 12 \quad 12 \\
 O - 16(2) = 32 \\
 \hline
 244 \\
 \hline
 5 \\
 220
 \end{array}
 \qquad
 \begin{array}{r}
 H (1)(2) = 2 \\
 O (16) = 16 \\
 \hline
 18 \\
 \hline
 6 \\
 108
 \end{array}$$

$$\begin{array}{r}
 CK \ 108 \quad 72 \\
 \hline
 220 \quad 256 \\
 \hline
 328 \quad 328
 \end{array}$$

you have  $\frac{1}{2}$  mole propane ( $C_3H_8$ ) -  
how many oxygen will it take  
to convert?



→ Standard Temp/Pressure

<sup>(of any gas)</sup>  
\* 1 mole = 22.4 L @ STP 0°C 1 atm

\* 1 atm = 14.69 psia = 760 mmHg = 76 cmHg = 760 torr  
= 29.92 in Hg = 101,325 Pascal = 101.325 kPa

### Power Equations

~~\* PV = nRT~~

$$P = \frac{nRT}{V}$$

$$V = \frac{nRT}{P}$$

$$n = \frac{PV}{RT}$$

$$T = \frac{PV}{nR}$$

$$S(\text{speed}) = \sqrt{\frac{3RT}{m(\text{mass})}}$$

T = Kelvin temp  
R = 8.314  $\frac{\text{kg m}^2}{\text{sec}^2}$

\* FIRST!  
Put all in applicable units!

$$V = \frac{nRT}{P}$$

same →  
✓ R = 0.0821 L/atm mole K  
✓ P = atm (pressure)  
✓ T = K (Kelvin) temp  
✓ R = 0.0821 (gas constant)  
✓ n = # moles (convert to)  
✓ V = Volume (Liters)

Ex (#13 Handout Quiz)

13.7g of Cl<sub>2</sub> @ 45°C & 745 mmHg

$$\frac{13.7\text{g}}{71\text{g}} \times \frac{1\text{mole}}{71\text{g}} = 0.193\text{ moles}$$

$$45^\circ\text{C} + 273 = 318\text{ K}$$

$$\frac{745\text{ mmHg}}{760\text{ mmHg}} \times \frac{1\text{ atm}}{760\text{ mmHg}} = 0.980\text{ atm}$$

→

NEXT (a) → plug into equation!

$$V = \frac{(0.193 \text{ moles}) \left( \overset{R}{0.0821} \frac{\text{L atm}}{\text{mol K}} \right) (318 \text{ K})}{(0.980 \text{ atm})} = 5.142 \text{ L}$$

# \*DIRECTIONS!

## Objectives:

- ① Pick Pervert Equation needed.  $PV = nRT$
- ② If grams (or any but moles) must convert to MOLES!  $P_1 V_1 = P_2 V_2$
- ③ All units converted to match equation! (EX:  $PV = nRT$ )  $\frac{P_1}{T_1} = \frac{P_2}{T_2}$
- ④  $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$

Any time  
in blue use  
Pervert  
Equation  
 $PV = nRT$

$$13.7g \text{ Cl}_2 \quad 45^\circ\text{C} \quad 745 \text{ mmHg}$$

$$45^\circ\text{C} \rightarrow \text{convert to K} = 45^\circ\text{C} + \frac{273}{\text{std!}}$$

$$13.7g \rightarrow \text{convert to moles}$$

$$\frac{13.7g}{1} \times \frac{1 \text{ mole}}{71g} = \boxed{0.193 \text{ moles}}$$

$$\frac{745 \text{ mmHg}}{1} \times \frac{1 \text{ atm}}{760 \text{ mmHg}} = 0.980 \text{ atm}$$

\* Equation

$$\boxed{PV = nRT}$$
$$V = \frac{nRT}{P}$$

$$V = \frac{\underset{\text{(was grams)}}{0.193 \text{ moles}} \times \underset{\text{mol} \cdot \text{K}}{0.0821 \frac{\text{Latm}}{\text{mol} \cdot \text{K}}} \times \underset{\text{K}}{318}}{\underset{\text{(above)}}{0.980 \text{ atm}}} = \boxed{5.14 \text{ L}}$$

$$R = 0.0821 \frac{\text{Latm}}{\text{molK}}$$

} use for searching for:  
 • volume  
 • moles  
 • temp

$$R = 8.314 \frac{\text{kgm}^2}{\text{sec}^2 \text{molK}}$$

} use for:  
 • pressure  
 • energy

1 mole = 22.4 liters @ STP 0°C & 1 atm

#14 ↑ mass = ↑ density

\* Air weighs 29 amu  
 - Anything less than  
 will float!

#15 Calculate speed of H molecule @ 25°C

$$S(\text{speed}) = \sqrt{3 \frac{RT}{m(\text{kg})}}$$

$$R = 8.314 \frac{\text{kgm}^2}{\text{sec}^2 \text{moleK}}$$

T = temp (Kelvin!)

m = mass (IN Kg!)

$$\text{Speed} = \frac{\sqrt{3(8.314 \frac{\text{kgm}^2}{\text{s}^2 \text{moleK}})(298\text{K})}}{0.002 \text{ kg mole}}$$

$$\text{H mole: } \frac{2\text{g}}{1} \times \frac{1\text{kg}}{1000\text{g}} = 0.002 \text{ kg}$$

convert to kg

$$\text{Speed} = 1.92 \times 10^3 \text{ m/s}$$

$$25^\circ\text{C} + 273 = \underline{298}$$

Calculate speed of AIR molecule →

air = 29 amu

$$\text{Speed} = \sqrt{\frac{3(8.314)(298)}{0.029}} = 506 \text{ m/s}$$

$$\frac{29 \text{ g}}{\text{mole}} \times \frac{1 \text{ kg}}{1000 \text{ g}} = 0.029$$

→ (multiply 8.314 x 298  
Then result x 3  
Divide result by 0.029  
Hit  $\sqrt{\quad}$  Key then enter ~~0.029~~ result.

$\text{NH}_4^+$  - ammonium ion

$\text{NaHCO}_3$  - baking soda (sodium bicarbonate OR  
sodium hydrogen carbonate)

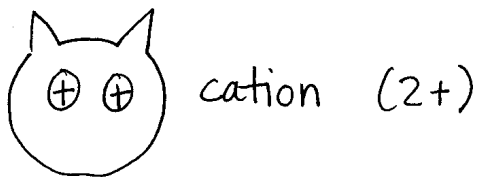
$\text{NH}_3$  - Ammonia

metal + Nonmetals (ions) } do not use di or tri  
to name

Ex:  $\text{Al}_2\text{O}_3$

"Aluminum oxide" not dialuminium-tri oxide!

Best Book  
Hill & Petrucci:  
General Chemistry  
3rd edition



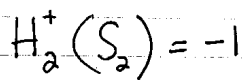
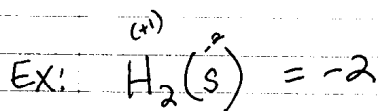
Anion → Bromine

~~Calculation~~

$\overset{+5}{\text{N}}\overset{-1}{\text{O}}_3^{-1} = +5$  What is oxidation state of this polyatomic ion? (1 element hooked to another)

If Group 1 A (+1)  
2 A (+2)

Rule 1: Look for any 1 A or 2 A elements?  
Any Fluorine?  
Any Oxygen? (Always -2!)



⑧ ~~part Handout~~ [on sheet!]

$$P_1 - 752 \text{ mmHg}$$

$$T_1 - 21^\circ\text{C} + 273 = 294 \text{ K}$$

$$P_2 - 89 \text{ mmHg}$$

$$V_2 - ?$$

$$T_2 - 0^\circ\text{C} + 273 = 273 \text{ K}$$

$$V_1 - 75 \text{ L}$$

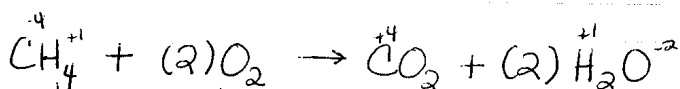
$$\frac{T_2}{P_2} \frac{P_1 V_1}{T_1} = \left( \frac{P_2 V_2}{T_2} \right) \frac{T_1}{P_1}$$

$$\frac{(273)(752 \text{ mmHg})(7.5 \text{ L})}{(89 \text{ mmHg})(294) \text{ K}} =$$

$$\frac{1539720}{26166} = 58.8 \times 10^2$$

OR  
588L

LEO goes GER  
Loss of electrons goes Gain of electrons  
oxidation reduction



Leoxidation  
gereduction

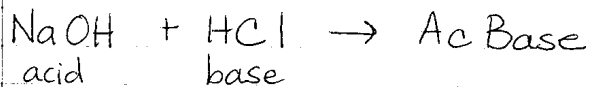
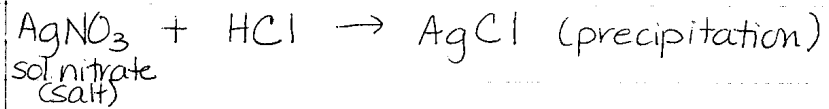
Nothing!

H - stays the same  
b/c H + O balance

\* Final Handouts < Hints > \*

Hydroxides - Insoluble exc Ca St Ba (slightly sol)

If metal + nonmetal + not acid or base -  
it is a salt



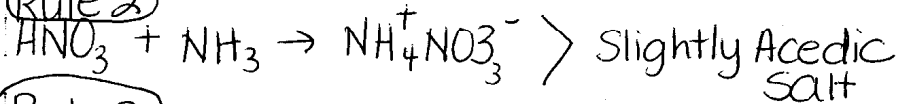
① Acid + Sbase

Rule 1



#2  
chap 7

Rule 2



||

Rule 3

