

Honors

FINAL EXAM REVIEW PACKET

Honors

Metric Conversions:

A) 3.8 Km = 3800 m B) .0023 cL = .00023 dL C) 133.5 Hg = 13.35 Kg D) .0045 mL = ^ DaL

Convert into Scientific Notation:

A) 12994 = 1.2994×10^4 B) .0004405 = 4.405×10^{-4} C) 3388.55 = 3.38855×10^3 D) .0033 = 3.3×10^{-3}

Convert to Regular Form:

A) $6.033 \times 10^5 =$ 603300 B) $2.202 \times 10^2 =$ 220.2 C) $5.07 \times 10^{-3} =$.00507

Determine the correct number of significant digits:

A) 356.56 = 5 B) 0.00201 = 3 C) 23000 = 2 D) 34.000 = 5

Record your answer in the correct number of significant digits:

A) $3.5 + 2.003 =$ 5.5 B) $2.35 \times 1200 =$ 2800 C) $100.50 - 22.445 =$ 78.06 D) $80.626 / 21 =$ 3.8

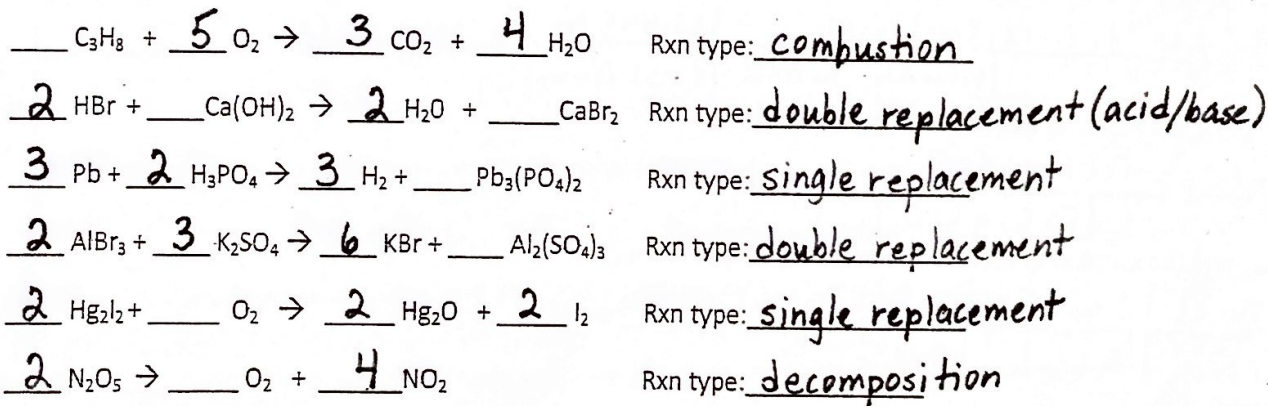
Determine the molar mass for the following compounds

A) MgCl₂ Mg = 1 × 24.31 = 24.31
 Cl = 2 × 35.45 = 70.90 +
 95.21 g/mol

B) Mg(OH)₂ Mg = 1 × 24.31 = 24.31
 O = 2 × 16.00 = 32.00
 H = 2 × 1.01 = 2.02 +
 58.33 g/mol

C) Ca(NO₃)₂ Ca = 1 × 40.08 = 40.08
 N = 2 × 14.01 = 28.02
 O = 6 × 16.00 = 96.00 +
 164.10 g/mol

Balance and classify the following Reactions:



Determine the percent composition by mass of sodium for the following two compounds.

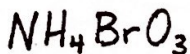
NaBr: Na = 1 × 22.99 = 22.99
 Br = 1 × 79.90 = 79.90 +
 102.89 g/mol

Na = $\frac{22.99}{102.89} \times 100 = 22.34\%$

Na₂S: Na = 2 × 22.99 = 45.98
 S = 1 × 32.07 = 32.07 +
 78.05 g/mol

Na = $\frac{45.98}{78.05} \times 100 = 58.91\%$

A compound, Ammonium Bromate has the following percent composition by mass. Determine the empirical formula for the compound.



9.59 % Nitrogen

$\frac{9.59\text{g N}}{14.01\text{g N}} \div \frac{1\text{mol N}}{.6845} =$ 1

2.76 % Hydrogen

$\frac{2.76\text{g H}}{1.01\text{g H}} \div \frac{1\text{mol H}}{.6845} =$ 4

54.74 % Bromine

$\frac{54.74\text{g Br}}{79.90\text{g Br}} \div \frac{1\text{mol Br}}{.6845} =$ 1

32.89 % Oxygen

$\frac{32.89\text{g O}}{16.00\text{g O}} \div \frac{1\text{mol O}}{.6845} =$ 3

You have determined that an empirical formula of a compound is CH_2O . What would be the molecular formula for glucose if its molecular mass is 180 grams/mol?

$$\text{MF} = \frac{180 \text{ g/mol}}{30.03 \text{ g/mol}} = 6 (\text{CH}_2\text{O}) = \text{C}_6\text{H}_{12}\text{O}_6$$

$$\begin{aligned} \text{C} &= 1 \times 12.01 = 12.01 \\ \text{H} &= 2 \times 1.01 = 2.02 \\ \text{O} &= 1 \times 16.00 = 16.00 + \\ & \quad \quad \quad \underline{30.03} \end{aligned}$$

An empirical formula for a compound might be CH_3 . What would be the molecular formula if the molecular mass is 150.4 g/mol?

$$\text{MF} = \frac{150.4 \text{ g/mol}}{15.04 \text{ g/mol}} = 10 (\text{CH}_3) = \text{C}_{10}\text{H}_{30}$$

$$\begin{aligned} \text{C} &= 1 \times 12.01 = 12.01 \\ \text{H} &= 3 \times 1.01 = 3.03 + \\ & \quad \quad \quad \underline{15.04} \end{aligned}$$

Molar Conversions:

Determine the number of moles in 2.5 grams of O_2

$$\frac{2.5 \text{ g O}_2}{32.00 \text{ g O}_2} \left| \frac{1 \text{ mol O}_2}{1 \text{ mol O}_2} \right. = .078 \text{ mol O}_2$$

Determine the number of grams in 2.5 moles of O_2

$$\frac{2.5 \text{ mol O}_2}{1 \text{ mol O}_2} \left| \frac{32.00 \text{ g O}_2}{1 \text{ mol O}_2} \right. = 80 \text{ g O}_2$$

Determine the number of particles in 2.5 L of O_2 (use 22.4 L/mol to convert L to mol, then calc # of particles)

$$\frac{2.5 \text{ L O}_2}{22.4 \text{ L O}_2} \left| \frac{1 \text{ mol O}_2}{1 \text{ mol O}_2} \right| \left| \frac{6.022 \times 10^{23} \text{ molc O}_2}{1 \text{ mol O}_2} \right. = 6.7 \times 10^{22} \text{ molc O}_2$$

Determine the number of grams in 2.5×10^{23} formula units of sodium chloride

$$\frac{2.5 \times 10^{23} \text{ fu NaCl}}{6.022 \times 10^{23} \text{ fu NaCl}} \left| \frac{1 \text{ mol NaCl}}{1 \text{ mol NaCl}} \right| \left| \frac{58.44 \text{ g NaCl}}{1 \text{ mol NaCl}} \right. = 24 \text{ g NaCl}$$

Determine the moles of 200 grams of calcium oxide

$$\frac{200 \text{ g CaO}}{56.08 \text{ g CaO}} \left| \frac{1 \text{ mol CaO}}{1 \text{ mol CaO}} \right. = 4 \text{ mol CaO}$$

Determine the number of atoms in 36 grams of carbon

$$\frac{36 \text{ g C}}{12.01 \text{ g C}} \left| \frac{1 \text{ mol C}}{1 \text{ mol C}} \right| \left| \frac{6.022 \times 10^{23} \text{ atom C}}{1 \text{ mol C}} \right. = 7.8 \times 10^{24} \text{ atom C}$$

Solutions

1. How many moles of AlCl_3 are required to make a 2.25M solution in 30.0 mL of solution?

$$M = \frac{\text{mol}}{\text{L}} \quad 2.25 \text{ M} = \frac{\text{mol}}{.0300 \text{ L}} \quad \text{mol} = .0675 \text{ mol AlCl}_3$$

2. A solution contains 8.3 moles of NaCl in 1250 mL of water. What is its molarity?

$$M = \frac{\text{mol}}{\text{L}} \quad M = \frac{8.3 \text{ mol}}{1.25 \text{ L}} = 6.6 \text{ M}$$

3. How many mL of solution are required to make a 2.25M solution with 120.0 g of AlCl_3 of solution? (two step)

$$\frac{120.0 \text{ g AlCl}_3}{133.33 \text{ g AlCl}_3} \left| \frac{1 \text{ mol AlCl}_3}{1 \text{ mol AlCl}_3} \right. = .9000225006 \text{ mol} \quad M = \frac{\text{mol}}{\text{L}} \quad 2.25 \text{ M} = \frac{\text{mol}}{\text{L}} = .400 \text{ L} = 400 \text{ mL}$$

4. What volume of 12M HCl is needed to prepare 250 mL of 0.20M HCl ?

$$\begin{aligned} M_1 V_1 &= M_2 V_2 \quad (12 \text{ M}) V_1 = (.20 \text{ M})(250 \text{ mL}) \\ V_1 &= 4.2 \text{ mL} \end{aligned}$$

What is the m...
60g NaCl

What is the molarity of 60 grams of NaCl dissolved in 250 ml of water?

$$\frac{60g \text{ NaCl}}{58.44g \text{ NaCl}} \times \frac{1 \text{ mol NaCl}}{\text{mol}} = 1.026694045 \quad M = \frac{\text{mol}}{L} = \frac{1.026694045}{.25 L} = 4 M$$

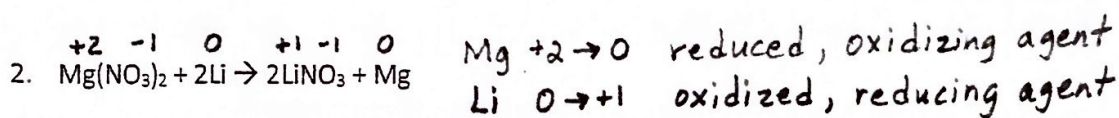
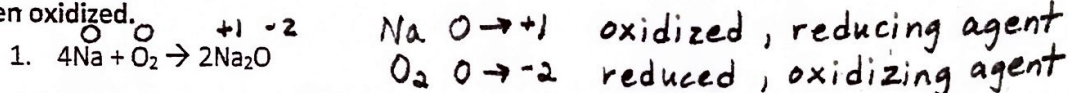
6. Describe the difference between an unsaturated, saturated, and supersaturated solution in terms of the amount of solute dissolved as well as how to determine them from the solubility graph.

unsaturated: soln holding less solute than it could @ that temp. (point below curve)

saturated: soln holding max solute @ that temp. (point on the curve)

supersaturated: soln holding more solute than it should @ that temp. (point above curve)

For the reactions below, identify the oxidizing agent, the reducing agent, what has been reduced, and what has been oxidized.



Use the Activity series to determine if the reaction will take place. If so, predict products, and write reaction; If NOT, then just write "NR" for "NO RXN".

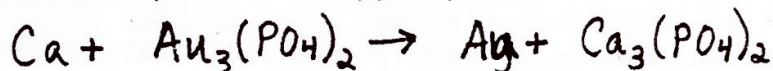
1. Lithium reacts with Magnesium Sulfide \rightarrow



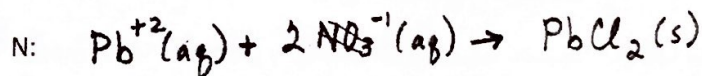
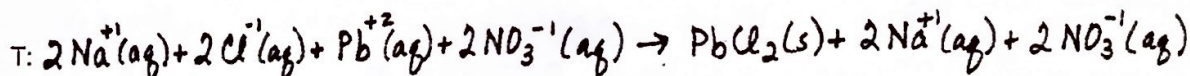
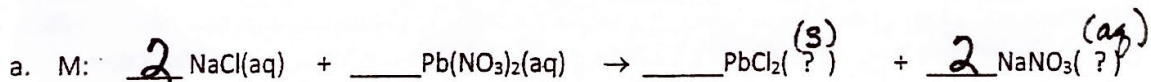
2. Zinc reacts with Aluminum Phosphide \rightarrow

NR

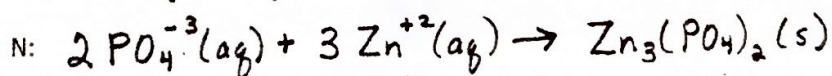
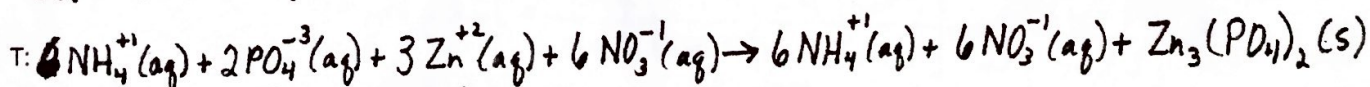
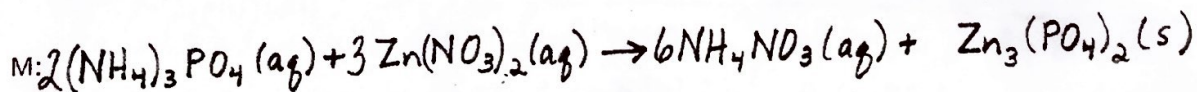
3. Calcium reacts in the presence of Gold (II) Phosphate \rightarrow



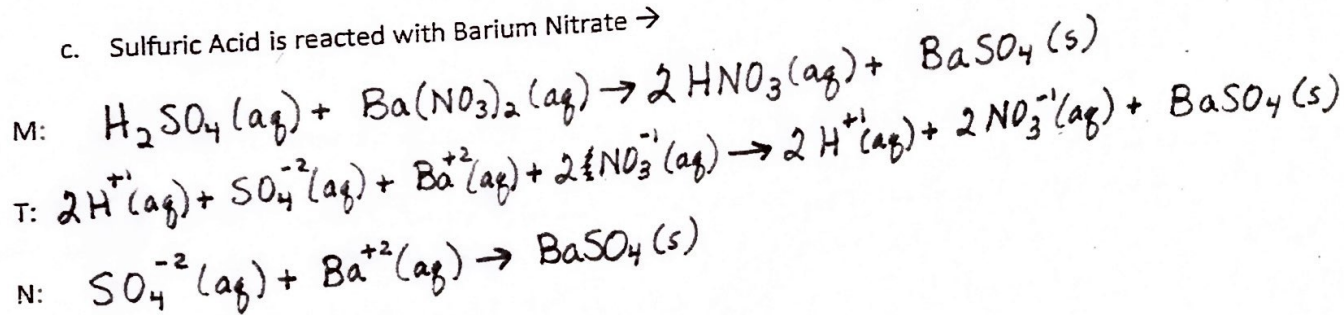
Use the Solubility Table to write the Total and Net Ionic Equations for the following reactions:



b. Ammonium Phosphate plus Zinc Nitrate \rightarrow

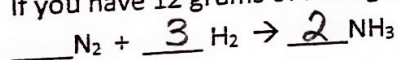


c. Sulfuric Acid is reacted with Barium Nitrate →



Stoichiometry

1. If you have 12 grams of Nitrogen, how many moles of Ammonia (NH₃) will you produce?

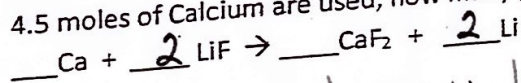


$$\frac{12g N_2}{28.02g N_2} \times \frac{1 mol N_2}{1 mol N_2} \times \frac{2 mol NH_3}{1 mol N_2} = .86 mol NH_3$$

If you have 3.5 moles of Hydrogen, how many grams of Ammonia (NH₃) will you produce?

$$\frac{3.5 mol H_2}{3 mol H_2} \times \frac{2 mol NH_3}{1 mol H_2} \times \frac{17.04g NH_3}{1 mol NH_3} = 40g NH_3$$

2. 4.5 moles of Calcium are used, how many grams of Lithium will be produced?



$$\frac{4.5 mol Ca}{1 mol Ca} \times \frac{2 mol Li}{1 mol Ca} \times \frac{6.94g Li}{1 mol Li} = 62g Li$$

45.8 grams of Lithium Fluoride will produce how many grams of Calcium Fluoride?

$$\frac{45.8g LiF}{25.94g LiF} \times \frac{1 mol LiF}{1 mol LiF} \times \frac{1 mol CaF_2}{2 mol LiF} \times \frac{78.08g CaF_2}{1 mol CaF_2} = 68.9g CaF_2$$

If an experiment yields 3.56 grams of product, and the mass expected from calculations is 4.2 grams, what is your percent yield?

$$\% Y = \frac{\text{actual}}{\text{theoretical}} \times 100 = \frac{3.56g}{4.2g} \times 100 = 85\%$$

LIMITING REACTANT

Given the following equation: $Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$

1. If 185 grams of Silver (I) Nitrate and 36.0 grams of Copper reacted together, how many grams of Silver metal would be produced?

$$\frac{185g AgNO_3}{169.87g AgNO_3} \times \frac{1 mol AgNO_3}{1 mol AgNO_3} \times \frac{2 mol Ag}{2 mol AgNO_3} \times \frac{107.87g Ag}{1 mol Ag} = 117g Ag \text{ (limiting reactant)}$$

$$\frac{36.0g Cu}{63.55g Cu} \times \frac{1 mol Cu}{1 mol Cu} \times \frac{2 mol Ag}{1 mol Cu} \times \frac{107.87g Ag}{1 mol Ag} = 122g Ag$$

2. When the above experiment was performed in the lab, 95.5 grams of silver metal was collected. Determine the percent yield.

$$\% Y = \frac{\text{actual}}{\text{theoretical}} \times 100 = \frac{95.5g}{117g} \times 100 = 81.6\%$$

is & Base
 late whether the
 1. Have a SO
 2. Has
 3. B
 4. P

Acids & Bases

State whether the following relate to acids, bases, both, or neutral solutions.

- | | |
|----------------------------------------|-----------------------------------------------------|
| A 1. Have a sour taste. | A 7. Produces hydronium ions according to Arrhenius |
| A 2. Has a pOH of 8.5 | B 8. Produces hydroxide ions according to Arrhenius |
| B 3. Feel slippery | N 9. $[H^+] = 1 \times 10^{-7}$ |
| B 4. Has a pH of 8.5. | B 10. Accepts protons according to Bronsted-Lowry |
| AB 5. Damaging to skin if concentrated | A 11. We reacted it with Zn to produce hydrogen gas |
| A 6. Turns litmus paper red | B 12. Found in Milk of Magnesia |

13. A solution has an H^+ concentration of $1.27 \times 10^{-12} M$. What is the pOH of the solution? Is it an acid or base?

$$[H^+] = 1.27 \times 10^{-12} M \quad -\log [1.27 \times 10^{-12} M] = 11.9 \text{ pH} \quad 14 - 11.9 = 2.1 \text{ pOH}$$

BASE

14. A solution has a pOH of 3.46. What is the pH of the solution?

$$14 - 3.46 = 10.5 \text{ pH}$$

15. Find the pH of 0.75M HCl solution. (conc of H^+ is 0.75 M)

$$-\log [0.75 M] = .12 \text{ pH}$$

16. Find the molarity of a KOH solution with a pH of 9.5.

$$14 - 9.5 = 4.5 \text{ pOH} \quad 10^{-4.5} = 3.2 \times 10^{-5} [OH^-]$$

Is the solution acidic or basic?

BASIC

KMT/Gas Laws

1. Briefly list/describe the motions of particles, relative strength of attraction between particles, relative density, ability to flow, and compressibility of solids vs. liquids vs. gases. What is the effect of temperature? increase movement

	MOTION	ATTRACTION	DENSITY	FLOW	COMPRESS
SOLID	vibrate	strong	high	little	low
LIQUID	sliding	medium	medium	medium	medium
GAS	easily	weak	low	high	high

2. Write out Boyle's Law, Charles' Law, Gay-Lussac's Law, and the combined gas law.

$$P_1 V_1 = P_2 V_2 \quad \frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \frac{P_1}{T_1} = \frac{P_2}{T_2} \quad \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

4. What is the Ideal Gas Law? What units do you have to use when using the Ideal Gas Law?

$$PV = nRT$$

$P = \text{usually atm}$ $R = 0.08206 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$
 $V = \text{liters}$ $T = \text{Kelvin}$
 $n = \text{moles}$

5. A gas has a volume of 400.0 mL at 3.00 °C and 120.0 torr. What would the volume of the gas be at 117.0 °C and 335.0 torr of pressure?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \frac{(120.0 \text{ torr})(400.0 \text{ mL})}{276 \text{ K}} = \frac{(335.0 \text{ torr}) V_2}{390 \text{ K}} \quad V_2 = 202 \text{ mL}$$

6. If there is a gas at 440.0 mmHg with a volume of 350.0 mL, what volume does this change to when the pressure is changed to 1140 mmHg?

$$P_1 V_1 = P_2 V_2 \quad (440.0 \text{ mmHg})(350.0 \text{ mL}) = (1140 \text{ mmHg}) V_2$$

$$V_2 = 135 \text{ mL}$$

7. If a gas is closed in a container at 23.0 °C then pressurized from 855 torr to 1422 torr, what will the new temperature of the gas be?

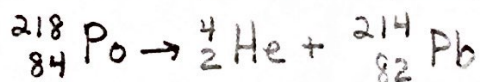
$$\frac{P_1}{T_1} = \frac{P_2}{T_2} \quad \frac{855 \text{ torr}}{296 \text{ K}} = \frac{1422 \text{ torr}}{T_2} \quad T_2 = 492 \text{ K}$$

8. How much pressure would 0.389 moles of Neon gas exert on a 275 mL container at 32 °C?

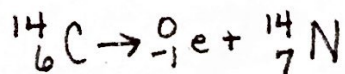
$$PV = nRT \quad P = \frac{nRT}{V} = \frac{(0.389 \text{ mol})(0.08206 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}})(305 \text{ K})}{0.275 \text{ L}} = 35.4 \text{ atm}$$

Nuclear Chemistry

1. What causes radioactivity? *unstable nucleus due to a large difference between # protons and # neutrons*
2. What are the 3 types of radiation? What is the charge of each type?
alpha +2
beta -1
gamma 0
3. What changes during Beta radiation? *atomic number*
4. What does a radioactive elements half-life refer to?
amount of time needed for half of a radioisotope to become a more stable element
5. What is the main difference between fission and fusion? *fission splits atoms; fusion joins atoms*
6. Where is fission utilized? *nuclear power plants, atom bombs*
7. Where is fusion utilized? *sun's energy, thermonuclear bombs*
8. Write the nuclear equation for the alpha decay of polonium-218.

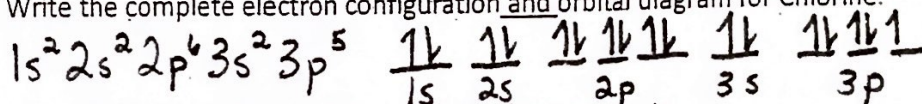


9. Write the nuclear equation for the beta decay of Carbon-14.



Electrons

1. Write the complete electron configuration and orbital diagram for Chlorine.



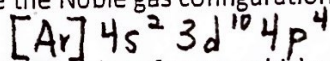
2. $2p^2$ Tell what each part of this configuration represents.

big 2 = energy level p = shape of orbital little 2 = # electrons

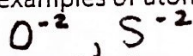
3. How does energy level relate to distance from the nucleus?

higher E level = further from nucleus

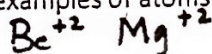
4. Write the Noble gas configuration for Selenium.



5. Give 2 examples of atoms which will gain 2 electrons to become stable.



6. Give 2 examples of atoms which will lose 2 electrons to become stable.



7. What element is this? $(Kr)5s^2 4d^3$ Nb Niobium

8. How many electrons can occupy each orbital? $2 = s$ $6 = p$ $10 = d$ $14 = f$

Periodicity

Development of the Modern Periodic Table

1. Who is the father of the periodic table? How did this scientist arrange his table?

Dmitri Mendeleev by atomic mass

2. What characteristic about his periodic table made it so widely accepted?

repeating patterns

3. Explain how the periodic table is arranged in groups, families, and periods.

groups/families = # valence e- periods = # E levels

4. What are the 3 families of metals?

alkali metals, alkaline earth metals, transition metals

5. What are the last 2 families of nonmetals? Explain how reactive each family is and why.

halogens - very reactive - has 7 valence e-

noble gases - not reactive - has full octet

6. Which elements have characteristics of both metals and nonmetals? Give 2 examples.

metalloids B, Si

7. Which group of metals and nonmetals are the most reactive? Explain your answer.

alkali metals halogens
(lose 1e- for octet) (gain 1e- for octet)

Classification of elements

1. How do periods correspond to valence electrons for representative elements?

they do not

2. How does an element's group correspond to the number of valence electrons? = to (for metals)
8 - group # (for non-metal)

3. What are the 4 blocks of elements? Where can they be located on the periodic table?

s, p, d, f

s = groups 1+2 d = transition metals

p = groups 13-18 f = inner transition metals

4. Why do atoms in the same group have similar chemical properties?

same # of valence e-

5. Alkali Metals and Alkaline Earth Metals represent which block? s

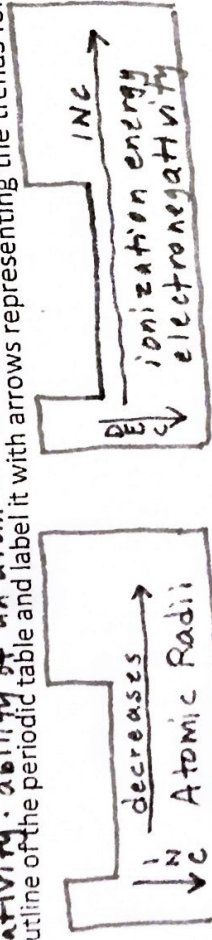
6. Why does the s block only span 2 groups? it only has one orbital which can only hold 2 e-

7. List 4 properties of metals?

shiny, malleable, ductile, electron sea (bonding)

Periodic Trends

1. Give the definitions of Atomic Radius, Ionization Energy and Electronegativity.
atomic radius: one half distance between nuclei of two atoms of same element
ionization E: energy required to remove an e⁻ from an atom
electronegativity: ability of an atom of an element to attract e⁻ when in a compound



above.

2. Draw an outline of the periodic table and label it with arrows representing the trends for each of the above.
3. Explain Ionic radii.
cations form smaller ionic radii while anions form larger ionic radii
4. What element on the periodic table has the highest electronegativity? **Fluorine**
5. What is the shielding effect?
occurs when inner E levels shield the valence e⁻ from the nuclear pull
6. How does the shielding effect relate to periodicity?
shielding increases as you move downward through a group of elements, due to added E levels.
7. What is the octet rule? How does it apply to periodicity?
atoms become stable when they have 8 valence e⁻
periodicity occurs as each group of elements move toward creating an octet of valence e⁻

Bonding

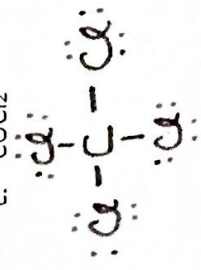
1. List 3 properties of each type of bond: Metallic, Covalent, and Ionic.
Ionic - transfer e⁻; metal + non-metal, high conductivity **metal - share e⁻**
Covalent - share e⁻; non-metal + non-metal, low conductivity **- metal + metal**
- conductivity varies
2. List the 3 types of intermolecular forces from strongest to weakest?
hydrogen bonding ... dipole-dipole ... London dispersion forces
3. Give an example of a molecule for each of the above.
London dispersion **dipole-dipole** **hydrogen**
O₂ **SO₂** **H-F**

4. What is polarity? How does it create surface tension in water? → **oppositely charged areas on water molecules hold together tightly**
5. What is a hydrogen bond?
areas of a molecule with opposite charges.
What is a hydrogen bond?
a chemical bond between H and a highly electronegative atom

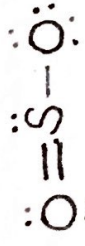
VSEPR (molecular shape)

6. What does VSEPR stand for?
valence shell electron pair repulsion
7. Draw Lewis structures to determine molecular shape, polarity of the molecule and polarity of the bond.

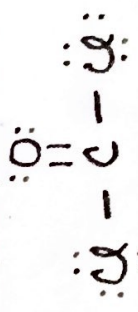
- a. CCl₄
- b. Sulfur Dioxide
- c. COCl₂



tetrahedral
non-polar symm
polar bond



linear
polar symm
polar bond



trigonal planar
polar symm
polar bonds

8. What two things are considered areas of high electron density in VSEPR?

1. lone pairs of electrons

2. double or triple bonds

9. What takes up more space a lone pair or a bond? Explain how we know? (think bond angles)

A lone pair takes up more space than a bond because

the electrical field pushes the atoms in a bond into

various shapes depending on the electronegativity differences.

Name the following compounds: Determine if they are ionic and if a Trans. Metal is present, Covalent or an Acid.

A) CaBr_2 = calcium bromide NIP = nickel (III) phosphide C) N_3O_7 = trinitrogen heptoxide

D) AlF_3 = aluminum fluoride E) H_2S = hydrosulfuric acid F) CuBr_2 = copper (II) bromide

G) KNO_3 = potassium nitrate H) CCl_4 = carbon tetrachloride I) S_2F_5 = disulfur pentafluoride

J) H_2SO_4 = sulfuric acid K) ZnI_2 = zinc (II) iodide L) H_2PO_3 = phosphorous acid

M) B_2Br_5 = diboron pentabromide N) $\text{Mn}(\text{ClO}_4)_2$ = manganese (II) perchlorate O) HCl = hydrochloric acid

Write the correct formulas for the following compounds:

A) Lithium Sulfite = Li_2SO_3 B) Iron (II) Phosphide = Fe_3P_2 C) Tetrasulfur Pentafluoride = S_4F_5

D) Phosphoric Acid = H_3PO_4 E) Barium Nitride = Ba_3N_2 F) Hydronitric Acid = H_3N

G) Copper (III) Iodide = CuI_3 H) Aluminum Phosphate = AlPO_4 I) Calcium Oxide = CaO

J) Barium Oxide = BaO K) Gallium Hydroxide = $\text{Ga}(\text{OH})_3$ L) Silicon Heptabromide = SiBr_7

List the three subatomic particles, their location, their charge, and their relative size compared to each other:

proton inside nucleus (+) 1 amu

neutron inside nucleus (0) 1 amu

electron in electron cloud (-) $\frac{1}{1846}$ amu

Name the group each element is a part of, write the number of valence electrons and determine the oxidation number.

A) Nitrogen

B) Calcium

C) Chlorine

D) Neon

E) Phosphorus

group 15

group 2

group 17

group 18

group 15

nitrogen

alkaline earth metals

halogens

noble gases

nitrogen

5 valence e-

2 valence e-

7 valence e-

8 valence e-

5 valence e-

-3

+2

-1

0

-3