Chemistry Review for the Spring Final Exam Name: _____ per

1. Name these substances: $PbSO_4$ lead (II) sulfate

HBr hydrobromic acid Cu_2S copper (I) sulfide

K_3PO_4 potassium phosphate H_3PO_4 phosphoric acid

Mg_3N_2 magnesium nitride HNO_2 nitrous acid

PbO lead (II) oxide PbO_2 lead (IV) oxide

2. Write formulas for these: Tin (II) oxide: SnO sulfuric acid: H_2SO_4

aluminum nitrate: $Al(NO_3)_3$ hydrocyanic acid: HCN sulfurous acid: H_2SO_3

aluminum sulfate: $Al_2(SO_4)_3$ nitrogen gas: N_2 heptane: C_7H_{16} heptene: C_7H_{14}

3. How many protons, neutrons, and electrons are in $^{39}K^{+1}$ $^{15}N^{-3}$ $^{235}U^{+6}$?

	$^{39}K^{+1}$	$^{15}N^{-3}$	$^{235}U^{+6}$
P	19	7	92
N	20	8	143
E	18	10	86

4. Name three elements with the same number of valence electrons as sulfur. O, Se, Te

5. Give the symbol for four ions with the same number of electrons as argon.

P^{-3} S^{-2} Cl^{-1} K^{+1} Ca^{+2}

6. Use this data to calculate the atomic mass of magnesium:

Isotope	Natural Abundance	Mass(amu)	
^{24}Mg	78.99%	23.98504	× 0.7899
^{25}Mg	10.00%	24.98584	× 0.1000
^{26}Mg	11.01%	25.98259	× 0.1101 +
		24.30505	≈ 24.31 amu

7. Determine the products for each reaction (include subscripts) and balance it.

a. $2\,C_6H_{14\,(l)} + 19\,O_{2(g)} \longrightarrow 12\,CO_{2(g)} + 14\,H_2O_{(g)}$

b. $2\,NaOH_{(aq)} + H_2SO_{4(aq)} \longrightarrow 2\,H_2O_{(l)} + Na_2SO_{4\,(aq)}$

c. $2\,AgNO_{3(aq)} + Na_2S_{(aq)} \longrightarrow Ag_2S_{(s)} + 2\,NaNO_{3\,(aq)}$

d. $3\,Zn_{(s)} + 2\,FeBr_{3(aq)} \longrightarrow 3\,ZnBr_{2(aq)} + Fe_{(s)}$

e. $O_{2(g)} + 4\,Na_{(s)} \longrightarrow 2\,Na_2O_{(s)}$

f. $2\,Al_{(s)} + 6\,HNO_{3(aq)} \longrightarrow 3\,H_{2(g)} + 2\,Al(NO_3)_{3\,(aq)}$

g. $2\,Al_{(s)} + 3\,Cu(NO_3)_{2(aq)} \longrightarrow 2\,Al(NO_3)_{3\,(aq)} + 3\,Cu_{(s)}$

h. $C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$

i. $2H_2O_{(l)} + 2K_{(s)} \text{-------} > 2KOH_{(aq)} + H_{2(g)}$

8. A compound is 40.7% carbon, 54.2% oxygen, and 5.1% hydrogen.

a. What is the empirical formula?

$40.7\text{g C}\left(\frac{1\text{mol C}}{12.01\text{g}}\right) = \frac{3.39\text{mol C}}{3.39} = 1 \times 2$ $\quad 5.1\text{g H}\left(\frac{1\text{mol H}}{1.01\text{g}}\right) = \frac{5.0\text{mol O}}{3.39} \approx 1.5 \times 2$

$54.2\%\text{O}\left(\frac{1\text{mol O}}{16.00\text{g}}\right) = \frac{3.39\text{mol O}}{3.39} = 1 \times 2$ $\quad \boxed{C_2H_3O_2}$

b. What is the molecular formula, if the molecular weight is between 200 and 250 amu?

$C_2H_3O_2 = 59.05\text{g/mol} \times 4 = 236.2\text{ amu} = \boxed{C_8H_{12}O_8}$

9. a. What is the percent composition (by mass) of sodium in sodium oxide?

Na_2O $\quad \%Na = \frac{2(22.99)}{2(22.99)+16.00} \times 100 = \boxed{74.19\%\text{ Na}} = 25.81\%\text{ O}$

b. If 40.0 grams of sodium oxide are broken down chemically, how many grams of oxygen will be released?

$40.0\text{g } Na_2O \times 0.2581 = \boxed{10.3\text{ g O}}$

10a. Write a reaction for the combustion of acetylene (ethyne), C_2H_2.
Balance with whole number coefficients.

$2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$

11. Given: $2\,C_8H_{18} + 25\,O_2 \text{-------} > 16\,CO_2 + 18\,H_2O + 10242\text{ kJ}$

a. What is the ΔH for the above reaction?

$\Delta H = -10,242\text{ kJ}$

b. If 15.0 grams of octane burn, how much energy will be produced?

$15.0\text{g } C_8H_{18}\left(\frac{1\text{mol } C_8H_{18}}{114.26\text{g}}\right)\left(\frac{10242\text{ kJ}}{2\text{mol } C_8H_{18}}\right) = \boxed{672\text{ kJ}}$

d. What mass of oxygen gas is required to produce 8500 kJ?

$8,500\text{ kJ}\left(\frac{25\text{mol } O_2}{10,242\text{ kJ}}\right)\left(\frac{32.00\text{g}}{1\text{mol } O_2}\right) = \boxed{660\text{ g } O_2}$

12. a. Write out the balanced chemical reaction for photosynthesis (carbon dioxide + water yields glucose ($C_6H_{12}O_6$) + oxygen gas)

$2{,}800\text{ kJ} + 6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

b. ΔH for this reaction is +2800 kJ/mole. Is this reaction exo- or endothermic?

c. Write the heat term into the equation on the correct side.

d. This reaction requires an energy source. Where does the energy come from? Sun

e. Rewrite your photosynthesis reaction, but reverse the reactions and products.

$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + 2{,}800\,kJ$

f. What is the ΔH for this reaction? $-2{,}800$ kJ g. Is this reaction exo- or endothermic? exo

h. Write the heat term into the equation on the correct side.

i. When this reaction occurs in your body it is called respiration.

13. Potassium nitrate, or "saltpeter" is used in many types of fireworks.
It decomposes according to the following reaction: $4\,KNO_{3(s)}$ -------> $2\,K_2O_{(s)} + 2\,N_{2(g)} + 5\,O_{2(g)}$

a. If 10.0 grams of potassium nitrate decompose, how many grams of oxygen gas will be produced?

$$10.0\,g\,KNO_3\left(\frac{1\,mol\,KNO_3}{101.11\,g}\right)\left(\frac{5\,mol\,O_2}{4\,mol\,KNO_3}\right)\left(\frac{32.00\,g}{1\,mol\,O_2}\right) = \boxed{3.96\,g\,O_2}$$

14. a. Determine the wavelength (in meters and in nm) and the photon energy of light with a frequency of 1.55×10^{15} Hz. $c = \lambda \cdot \nu$ $E = h \cdot \nu$

$$\lambda = \frac{c}{\nu} = \frac{3.00\times10^{8}\,m/s}{1.55\times10^{15}\,Hz} = \boxed{1.94\times10^{-7}\,m = 194\,nm}$$

$$E = 6.626\times10^{-34}\,J\cdot s\,(1.55\times10^{15}\,1/s)$$

$$\boxed{E = 1.03\times10^{-18}\,J}$$

b. Determine the energy and frequency of light with a wavelength of 444 nm. $= 4.44\times10^{-7}\,m$

$$\nu = \frac{c}{\lambda} = \frac{3.00\times10^{8}\,m/s}{4.44\times10^{-7}\,m} = 6.76\times10^{14}\,Hz$$

$$E = 6.626\times10^{-34}\,J\cdot s\,(6.76\times10^{14}\,1/s)$$

$$E = 4.48\times10^{-19}\,J$$

c. Put these types of electromagnetic radiation from highest to lowest energy: red, green, infrared, gamma, ultraviolet, microwave, radio.

highest E — lowest E

gamma > UV > green > red > infrared > microwave > radio

d. Of the types in (c), which has the highest frequency? gamma

e. Of the types in (c), which has the longest wavelength? radio

f. Which type of EM radiation is most commonly associated with skin cancer? UV

15. If one electron leaves an atom, what charge of ion will form? +1

16. How is an electron orbital different from an orbit?

- orbital is a 3D shape around nucleus in which e^- is probably found in.
- orbital cannot predict motion or path of electron.

17a. Rank Na, Cl, F, and Ba according to electronegativity.

low — Ba, Na, Cl, F — high

b. List the formulas of any ionic compounds that could form between the four elements in (a).

$BaCl_2$ NaCl BaF_2 NaF

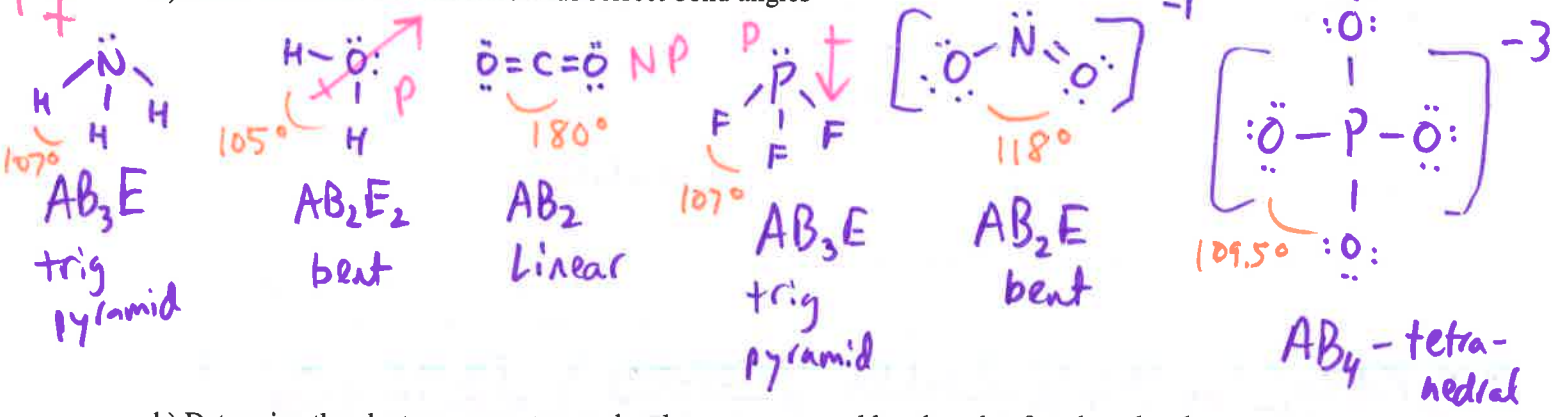
c. Which pair(s) of elements could bond covalently together?

Cl – F

d. Give an example of a compound in which chlorine is sharing electrons. OCl_2 & SCl_2

18. For each compound or ion: NH_3 , H_2O , CO_2 , PF_3 , NO_2^{-1}, PO_4^{-3}

a) Draw the Lewis dot structure with correct bond angles



b) Determine the electron geometry, molecular geometry, and bond angle of each molecule

c) Classify the first four molecules as polar or nonpolar. If polar, draw the net polarity arrow.

19. Out of the compounds KCl, $CaSO_4$, H_2CO_3, and MgF_2

a. Which one(s) contain only covalent bonds? H_2CO_3

b. Which one(s) contain only ionic bonds? KCl, MgF_2

c. Which one(s) contain both ionic and covalent bonds? $CaSO_4$

20. A solution was made by dissolving 48.0 grams of sodium chloride into 152 grams of water. The total solution volume after mixing came to 169 mL.

a. What is the density of this solution? $D = \frac{m}{V} = \frac{48.0\text{g NaCl} + 152\text{g } H_2O}{169\text{ mL}} = 1.18\text{ g/mL}$

b. What is the molarity of this solution? $M = \frac{\text{mol}}{L} = 48.0\text{g NaCl}\left(\frac{1\text{mol}}{58.44\text{g}}\right) = \frac{0.821\text{ mol NaCl}}{0.169\text{ L}} = 4.86\text{ M}$

21.a. How many grams of $CuSO_4$ are needed to make 500.0 mL of 0.800 Molar $CuSO_4$ solution?

$\text{Mol} = M \cdot L \qquad \text{mol} = 0.800\frac{\text{mol}}{L} \cdot 0.5000\text{ L} = 0.400\text{ mol } CuSO_4\left(\frac{159.61\text{g}}{1\text{ mol}}\right) =$

$63.8\text{ g } CuSO_4$

b. If you take 40.0 mL (V_1) of the above solution and then add water until the total volume is 2.00 liters (V_2), what will be the new molarity of the solution? $M_1 = 0.800\text{ M}$

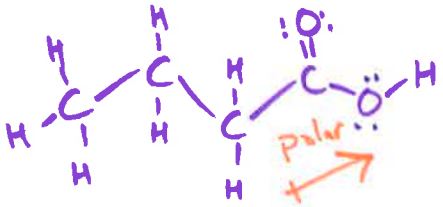
$M_1V_1 = M_2V_2$

$(0.800\text{ M})(0.0400\text{ L}) = M_2(2.00\text{ L})$

$0.0160 = M_2$

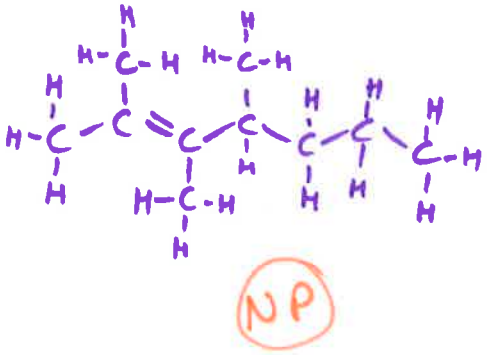
22. Draw the structure of the following compounds. Show polarity arrows on polar bonds of polar substances.

butanoic acid

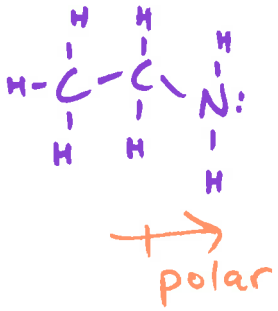


1,4 dichlorobenzene

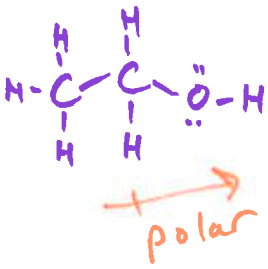
3,4,5 trimethyl 2-heptene



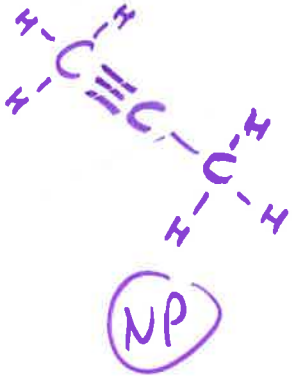
ethylamine



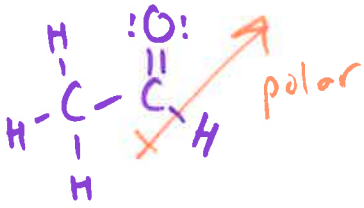
ethanol



propyne



ethanaldehyde (C_2H_4O)



2-heptanol