Exam 1: Chapters 1-3, 5, 6
Thursday, July 2nd 2009
Chem 170
Khuong

Name_____
ID _____
Sec _____
200 pts total

Directions: Circle your final answer. Express all numerical answers with correct significant figures. You must show all work and all units to receive credit.

I. Perform the following calculations. Show significant figures at each step. Write your answers in scientific notation

1) (5 pts) -110.11 - 470 + 589.9 =

2) (5 pts) $7.27 \times 10^{-2} + 40.39\ (1.3100)^{-1}$ =

3) (5 pts) $(4.1202 - 1.0 \times 10^{-3})\ (1.840 \times 10^{3})$

II. Answer the following in less than 20 words. Complete sentences are NOT required.

1) Pure butter contains milk fat and water. Briefly describe this substance in chemical terms. (15 pts)

2) Consider the process of cooking an egg. Briefly explain whether or not this is a physical or chemical process. (10 pts)

3) On Monday, forty of the forty-six students enrolled are present in class. Use the scientific method to plan one possible analysis of this observation. (25 pts)

III. Perform the following exercises in the space provided.

1) Draw a ruler measuring an object that is 182.0 mm long. (15 pts)

2) Calculate the density of benzene, a liquid used in chemistry laboratories, if 166.0 g of benzene fills a graduated cylinder to the 188-mL mark. Briefly explain the number of significant figures in your answer. (15 pts)

3) Calculate the molar mass of potassium given that the two major isotopes have the following masses and natural abundances: Isotope 1: mass = 38.9637 amu found in a 93.258% abundance and isotope 2: mass = 40.9618 amu found in 6.730% abundance. Write the chemical symbols for these isotopes. How many protons, electrons and neutrons are found in neutral atoms of each of them? (40 pts)

IV. Perform the following conversions.

1) (15 pts) Convert 9.82 meters per second to kilometers per hour.

2) (15 pts) Convert -10.0 ˚F to Kelvins.

V. Fill-in the blanks with names on the middle and right columns and formulae in the left column. (40 pts)

P_4O_{10}	_____	
_____	Tin (IV) perbromate	
K_2SeO_3	_____	
_____	dinitrogen monoxide	
$CuCl_2$	_____	_____
_____	Lithium dihydrogen phosphate	
$MgSO_4 * 9\ H_2O$	_____	
_____	Hydrofluoric acid	

Exam 2: Chapters 4,7-10,14,19.2-5
Thursday, July 16th 2009
Chem 170
Khuong

Name_____
ID _____
Sec _____
200 pts total

Directions: Circle your final answer. Express all numerical answers with correct significant figures. You must show all work and all units to receive credit.

I. Write balanced equations for each of the following. If the reaction involves ions, write a balanced net ionic equation. If there is no reaction, write the formulas of the reactants and then NR. For redox reactions, identify the atoms that are oxidized and reduced. 10 pts each

1. Aqueous solutions of iron (III) chloride react and cesium phosphate react.

2. Sodium carbonate is combined with acetic acid ($HC_2H_3O_2$) in water.

3. Aqueous solutions of magnesium chloride and nitric acid are combined.

4. Sodium hydroxide reacts with ammonium sulfate in water.

5. Aqueous nickel nitrate reacts with magnesium metal.

II. Perform the following exercises. 20 pts each

1. Find the number of particles or ions in 100.0 g of garnet ($Fe_3Al_2(SiO_4)_3$).

2. Calculate the mass of oxygen gas required to raise the pressure of an otherwise empty 100.0 L container to 7000 torr at 100.0^{o}C.

3. Calculate the mass of oxygen gas required to carry out the combustion of a 100.0 g sample of magnesium metal.

4. Balloon containing helium has a volume of 1.00 L at STP. Calculate the number of moles of argon that must be added to increase the volume to 2.00 L at STP.

5. Tungsten is recovered from tungsten (VI) oxide by reaction with hydrogen gas producing water as a byproduct. Calculate the percent yield of tungsten if 23.6 grams of tungsten is produced from the reaction of 48.2 grams of tungsten oxide and 1.000 g of hydrogen gas.

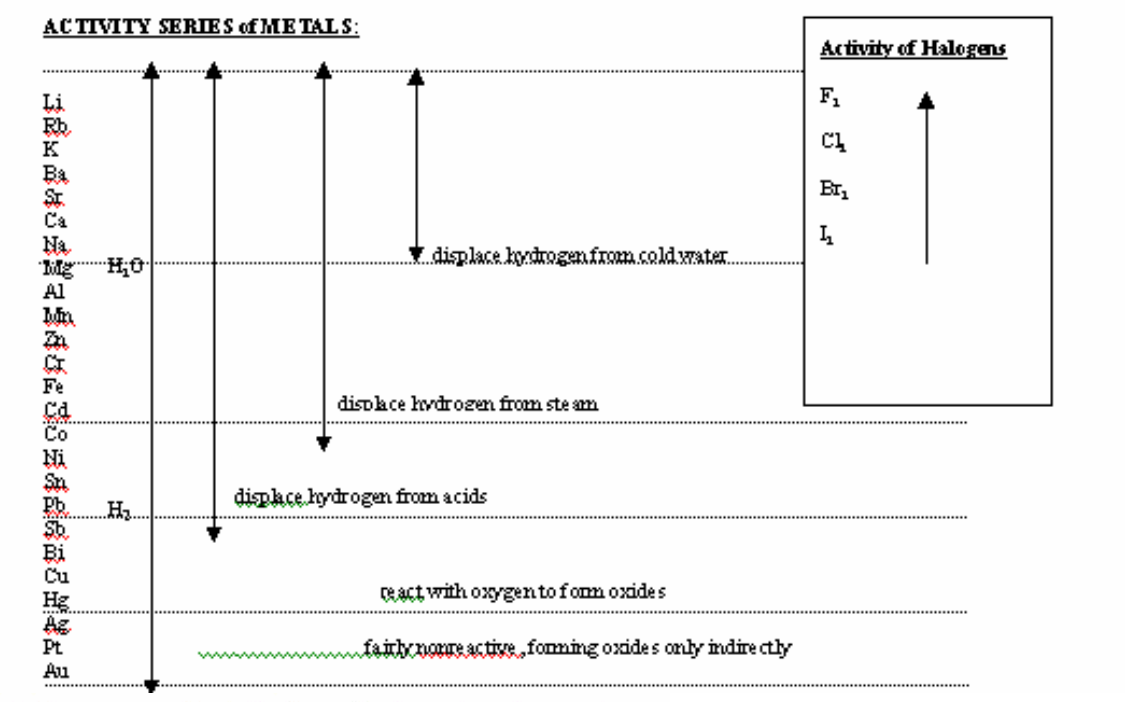
6. Determine the molecular formula for a compound of mass = 62.03678 g/mol and consisting of 38.70% carbon, 9.74% hydrogen and 51.55% oxygen by mass.

7. Consider the following unbalanced equation for a reaction that occurs in water: $K_2Cr_2O_7 + HI \rightarrow KI + CrI_3 + I_2 + H_2O$.
   a. Write the balanced equation and circle the last coefficient you set.
   b. Calculate the oxidation states of all of the atoms.
   c. Identify the oxidant and briefly explain your choice.

8. Nitroglycerine is the explosive ingredient in industrial dynamite. Much of its destructive force is derived from the sudden creation of large volumes of gaseous products. A great deal of energy is also released (1.543 MJ per mole of nitroglycerine). The unbalanced equation for the reaction is shown below.

$$C_3H_5(NO_3)_3(l) \rightarrow CO_2(g) + H_2O(g) + N_2(g) + O_2(g)$$

a. Write the balanced equation for the reaction.
b. Calculate the number of kilograms of nitroglycerine needed to generate 58.8 MJ of energy.
c. Calculate the volume of gas at STP produced by the decomposition of 1.000 g of nitroglycerine.



1. All common salts of the Group 1A elements and ammonium are soluble.
2. All common acetates and nitrates are soluble.
3. All binary compounds of Group VIIA elements (other than F) with metals are soluble except those of silver, mercury (I), and lead.
4. All sulfates are soluble except those of barium, strontium, lead, calcium, silver, and mercury(I).
5. Except for those in Rule 1, carbonates, hydroxides, oxides, and phosphates are insoluble.

Exam 3: Chapters 11-13, 15
Thursday, July 30th 2009
Chem 170
Khuong

Name_____
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200 pts total

Directions: Circle your final answer. Express all numerical answers with correct significant figures. You must show all work and all units to receive credit.

I. Perform each of the following exercises. 10 pts each

1. Write the mechanism of the reaction of sodium metal and atomic chlorine.

2. Compound A is more viscous than compound B. Which compound would you expect to have A. a higher boiling point, B. a higher vapor pressure, and C. a higher surface tension?

3. Draw a diagram describing the temperature as a function of heat content for carbon dioxide which sublimes (changes directly from solid to gas and back without going through a liquid phase) at -78.5 ^{o}C.

4. Briefly describe the physical significance of the principle quantum number.

5. Draw a reasonable Lewis structure for formic acid, $HCHO_2$.

6. Write the chemical symbols for one neutral atom, two cations and one anion that all have ten total electrons. Write the term used for the relationship between these species.

II. Perform each of the following exercises. 25 pts each

1. Consider the first six energy levels of a single hydrogen atom. **Use each energy level only once in your answer.**

   a. Draw a Bohr model showing **only** the first six energy levels in this atom.
   b. Draw an arrow showing an electronic excitation between the fifth and second energy levels. Label this arrow A.
   c. Draw an arrow showing a lower energy transition that would emit photons. Label this arrow B.
   d. Draw an arrow showing a transition that would absorb farther into the blue region of the EM spectrum. Label this arrow C.
   e. Circle the letter of the transition that involves the photons with the shortest wavelength.

2. Predict the relative vapor pressures of each of the following pairs of compounds. Explain briefly. Use structural formulas in your explanation, wherever possible.

SiH_4 vs. BeH_2

CH_3-OH vs. CH_2O

3. Arrange the following species in order. No explanation is necessary.

   Greatest to poorest metallic character: Phosphorous, Chlorine, Bromine

   Highest to lowest electronegativity: Nitrogen, Bromine, Fluorine, Carbon, Oxygen, Chlorine

   Highest to lowest ionization energy: Tellerium (Te), Iodine, Xenon (Xe), Rubidium.

   Largest to smallest in size: Calcium ion-Potassium atom-Bromide ion

   Largest to smallest in size: Bromide ion-Krypton (Kr) atom, Rubidium ion

4. Draw and rank the three most significant resonance structures for each of the following species. Clearly show the formal charges, bond angles and shapes. If three such structures do not exist, draw as many as possible.

NO_2^+

SO_3Cl^-

5. Draw an energy diagram showing the location of the electrons in an iron atom. Write the quantum numbers describing the location of the last electron added to the diagram.

6. A 10.00 g piece of red-hot copper (800. ^{o}C) is dropped into a cup of 100.0 ^{o}C water. Calculate the amount of hot water that can be vaporized. Assume all of the heat from the cooling copper is transferred to the water.

Substance	$\frac{J}{g \cdot °C}$
Elements	
Aluminum	0.88
Cadmium (s)	0.232
Cadmium (ℓ)	0.267
Carbon	
Diamond	0.50
Graphite	0.71
Cobalt	0.46
Copper	0.38
Gold (s)	0.13
Gold (ℓ)	0.148
Iron (s)	0.444
Iron (ℓ)	0.452
Lead	0.16
Magnesium	1.0
Silicon	0.71
Silver (s)	0.24
Silver (ℓ)	0.32
Sulfur	0.732
Zinc (s)	0.38
Zinc (ℓ)	0.512
Compounds	
Acetone	2.1
Benzene	1.8
Carbon tetrachloride	0.84
Ethanol	2.5
Methanol	2.6
Ice [$H_2O(s)$]	2.1
Water [$H_2O(\ell)$]	4.18
Steam [$H_2O(g)$]	2.0

Substance	Melting Point (°C)	Boiling Point (°C)	Heat of Fusion		Heat of Vaporization	
			(J/g)	(cal/g)	(kJ/g)	(cal/g)
$H_2O(s)$	0		335	80		
$H_2O(\ell)$		100			2.26	540
Na	98	892	113	27	4.27	1020
NaCl	801	1413	519	124		
Cu(s)	1083		205	49		
Cu(ℓ)		2595			4.81	1150

EC. Briefly explain why the shape of a drop of water is different on a glass surface versus a dodecanethiol monolayer. 5 pts