REVIEW WORKSHEET

(Note: Gas constant R=62.36 L*Torr*mol^{-1} K^{-1} when using Torr instead of atm)

1. Write the full and net ionic equation for each of the processes below.

a. Silver nitrate + sodium oxalate

b. Hydrobromic acid + ammonia

c. Iron (II) nitrate + sodium hydroxide

d. Acetic acid + barium hydroxide

2a. Predict the electron configurations of S, K ,Ti, Sn.

2b. Write the shorthand electron configuration for:

Ni

Ge

Cs

Br

3. An electron in a hydrogen atom is excited from the ground state to the n = 4 state. Comment on the correctness of the following statements (True or False).
a. n = 4 is the first excited state.

b. It takes more energy to ionize (remove) the electron from n = 4 than from the ground state.

c. The wavelength of light emitted when the electron drops from n = 4 to n = 1 is longer than that from n = 4 to n = 2.

d. The wavelength the atom absorbs in going from n = 1 to n = 4 is the same as that emitted as it goes from n = 4 to n = 1.

4. Below is a list of successive ionization energies in kJ/mol for a period 3 element. Identify the element and explain how you came to that conclusion.

IE1 = 1012; IE2 = 1900; IE3 = 2910; IE4 = 4960; IE5 = 6270; IE6 = 22,200

5. Which type of intermolecular force accounts for each of these differences?
a. CH_3OH boils at 65 ˚C; CH_3SH boils at 6 ˚C.

b. Xe is a liquid at atmospheric pressure and 120 K, whereas Ar is a gas under the same conditions.

c. Kr, atomic weight 84 g/mol, boils at 120.9 K, whereas Cl_2, molecular weight 71 g/mol, boils at 238 K.

d. Acetone boils at 56 ˚C, whereas 2-methylpropane boils at -12 ˚C.

Acetone 2-Methylpropane

6. Arrange these compounds in order of increasing boiling point. Explain your reasoning
a. CH_4 b. CH_3CH_3 c. CH_3CH_2Cl d. CH_3CH_2OH

7. Determine if the following reactions is a redox reaction. If it is a redox reaction, identify which element is oxidized and which is reduced; provide before and after oxidation state numbers.

a. $Sn\ (s) + 4HNO_3\ (aq) \rightarrow SnO_2\ (s) + 4NO_2\ (g) + 2H_2O$

b. $Hg_2(NO_3)_2\ (aq) + 2\ KBr\ (aq) \rightarrow H_2Br_2\ (s) + KNO_3\ (aq)$

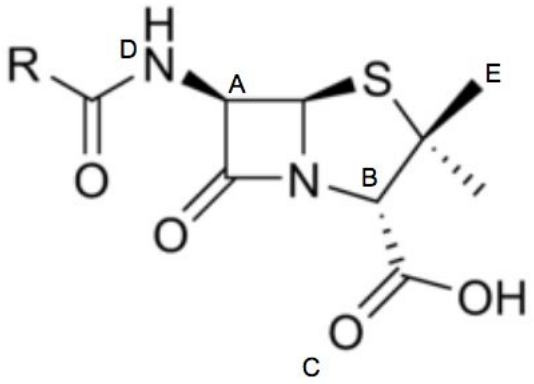
c. $4\ Al\ (s) + 3O_2\ (g) \rightarrow 2\ Al_2O_3\ (s)$

8. Compute the ΔH for the following reactions using both bond enthalpies:

a. ___H_2 (g) + ___Br_2 (g) → ___HBr (g)

b. ___H_2O_2 (g) → ___H_2O(g) + ___O_2 (g)

9. Below is the structure of penicillin:



a. Fill in all lone pairs in the above molecule.

b. What is the hybridization of atoms labeled A-E?

A: B: C: D: E:

c. What is the electron geometry at the atoms labeled B-E?

B: C: D: E:

d. Discuss one way penicillin can interact with the aqueous environment of the body using IMFs

10. What mass of sodium acetate can be obtained from mixing 15.0 g of $NaHCO_3$ with 150. mL of 0.100 M acetic acid?

11. Formic acid, HCO_2H, is a monoprotic weak acid.
a. Write a full and net ionic equations for the reaction of aqueous formic acid and aqueous potassium hydroxide:

b. If you combine 60 g formic acid and 60 g potassium hydroxide how much water (in grams) will you produce? Which is the limiting reactant?

12. Sweat cools the body because evaporation is an endothermic process:

$$H_2O_{(l)} \rightarrow H_2O_{(g)} \quad \Delta H^o_{rxn} = +44.01 \text{ kJ}$$

Estimate the mass of water that must evaporate from the skin to cool the body by 0.50°C. Assume a body mass of 95 kg and that the specific heat capacity of the body is 4.0 J/g*K.

13. Lakes that have been acidified by acid rain (HNO_3 and H_2SO_4) can be neutralized by a process called liming, in which limestone ($CaCo_3$) is added to the acidified water. What mass of limestone (in kg) would be required to completely neutralize a 15.2 billion-liter lake that is 1.8 x 10^{-5} M in H_2SO_4 and 8.7 x 10^{-6} M in HNO_3?

14. Find the mass of barium metal (in grams) that must react with oxygen gas to produce enough barium oxide to prepare 1.0 L of a 0.10 M solution of OH^-

15. CaO (s) reacts with water to form $Ca(OH)_2$ (aq). If 6.50 g CaO is combined with 99.70g H_2O in a coffee cup calorimeter, the temperature of the resulting solution increases from 21.7 ºC to 43.1 ºC. Calculate the enthalpy change for the reaction per mole of CaO. Assume that the specific heat capacity of the solution is 4.18 J/g•K.

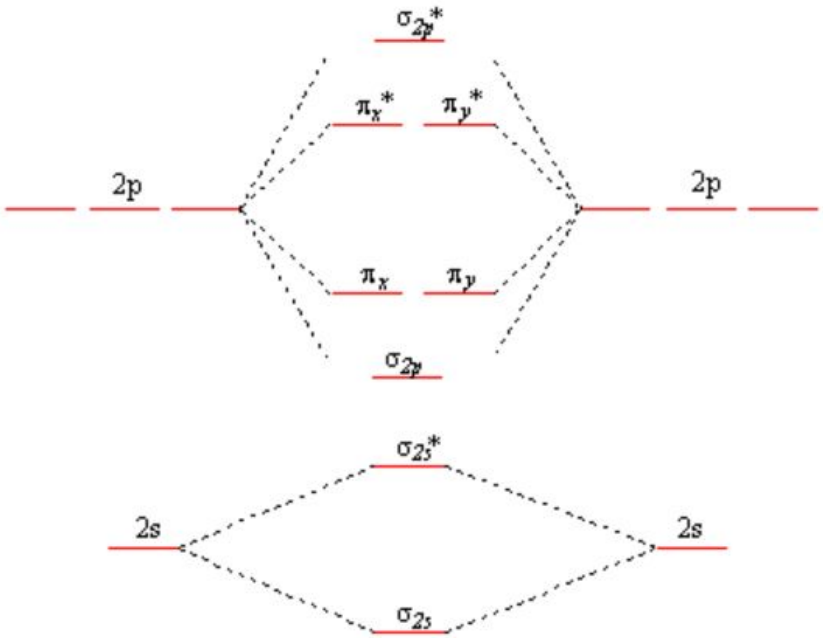
16. If you put 120 volts of electricity through a pickle, the pickle will smoke and start glowing orange-yellow. The light is emitted because sodium ions in the pickle become excited; their return to the ground state results in light emission.

a. The wavelength that is emitted is 589 nm. Calculate its frequency.

b. What is the energy of 0.10 mol of these photons?

c. Calculate the energy gap between the excited and ground states for the sodium ion.

17. Fill in the molecular orbital diagram for F_2, give the bond order, and identify whether it is diamagnetic or paramagnetic.



18. A gaseous hydrogen and carbon containing compound is decomposed and found to contain 82.66% carbon and 17.34% hydrogen by mass. The mass of 158 mL of the gas, measured at 556 torr and 25 ˚C, was 0.275 g. What is the molecular formula of the compound?

GOOD LUCK!