General Chemistry I

1. If 65 J of heat are added to a system and the system performs 34 J of work on the surroundings. What is the total change in internal energy?

2. A system releases 78 J of energy to the surroundings and the surroundings perform 50 J of energy on the system. What is the final internal energy if the initial was 50 J.

3. An exothermic gaseous reaction releases 150 J of energy to the surroundings while expanding from an initial volume of 50 ml to 100 ml against an external pressure of 4 atm. What is the total change in internal energy? (L*atm = 101.325 J).

4. A balloon contains 5 L of a gas at a pressure of 2 atm and a temperature of 298 K. What is the final volume of the gas if the balloon is submerged under water which is at a temperature of 290 K and a pressure of 4 atm?

5. Write all the gas formulas.

6. How much heat is added to 50 kg of ethanol (C_s=2.42 J/g*C) if the change in temperature is 50° C?

7a. Find the ΔH_{rxn} for the following reaction.

___$C_6H_{12}O_6$(s) + ___O_2(g)→ ___CO_2(g)+___H_2O(l)

Substance	ΔH°_{form}(Kj/mol)
$C_6H_{12}O_6$ (s)	- 1273.3
O_2 (g)	0
CO_2 (g)	- 393.5
H_2O (l)	-285.8

7b. If 5 grams of $C_6H_{12}O_6$ react with 20 grams of O_2 how much CO_2 will form?

7c. How much heat will evolve if 5 grams of $C_6H_{12}O_6$ reacts with excess O_2?

8. Use Hess Law to find the ΔH°_{rxn} following reaction:

$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$

Using these reactions:

$C(graphite) + 2H_2(g) \rightarrow CH_4(g)$ $\Delta H°_{rxn} = -74$ kj/mol

$2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$ $\Delta H°_{rxn} = 571.6$ kj/mol

$C(graphite) + O_2(g) \rightarrow CO_2(g)$ $\Delta H°_{rxn} = -393.5$ kj/mol

9. Using the $\Delta H°_{form}$ find the $\Delta H°_{rxn}$ for the following reaction:

$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$

Substance	$\Delta H°_{form}$(Kj/mol)
CH_4 (g)	-74.6
O_2 (g)	0
CO_2 (g)	-393.5
H_2O (l)	-285.8

10. Using the bond dissociation energies find the $\Delta H°_{rxn}$ for the following reaction:

$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$

Bond	Bond Energy (kj/mol)
C—H	414
O==O	498
C==O	736
O—H	464

11. Give the root mean square velocity for gaseous NO_2 at a temperature of 450 K.

12. What is the molar mass of a gas that effuses 1.69 times faster than SO_2?

General Chemistry

1. A certain liquid compound contains C, H, O and Cl, and when it fully combusts it releases 7.806 g of CO_2, 3.194 g of H_2O and 2.070 g of Cl_2 according to the following equation. What is the empirical and molecular formula for the compound if the molar mass is 186 g/mol?

$$C_xH_yCl_zO_k\ (l) + O_2\ (g) \rightarrow CO_2\ (g) + H_2O\ (g) + Cl_2\ (g)$$

2. Complete the following reaction:

$\_\_\_C_6H_6\ (l) + \_\_\_O_2\ (g) \rightarrow \_\_\_CO_2\ (g) + \_\_\_H_2O\ (g)$

2a. If 5 liters of benzene (C_6H_6) (density = 0.8737 g/ml) reacts with 2 kg of oxygen what is the theoretical yield of CO_2 in grams?

2b. If 2 liters of benzene react with excess O_2 what is the theoretical yield of CO_2 in ml if the reaction proceeds under STP conditions?

2c. If 2 liters of benzene react with excess O_2 what is the theoretical yield of CO_2 in ml if the reaction proceeds under a temperature of 600 K and 3 atm.

3. Give the oxidation and reduction half reactions for the following equation. (In acid and base)

$$Cr_2O_7^{2-}(aq) + Fe\ (s) \rightarrow Fe_2O_3\ (s) + CrO_4^{2-}\ (aq)$$

4. Determine whether the following reactions would occur.

$Ag^+\ (aq) + Zn(s) \rightarrow Zn^{2+}(aq) + Ag\ (s)$ $\quad$ $Cu^{2+}(aq) + Na\ (aq) \rightarrow Na^+(aq) + Cu(s)$ $\quad$ $K(s) + Ni^{2+}(aq) \rightarrow Ni\ (s) + K^+\ (aq)$

5. If 10 ml of 1.5 M $Ba(NO_3)_2$ is mixed with 30 ml of 2.3 M $(NH_4)_3PO_4$ how many grams of the solid product will form?

$$Ba(NO_3)_2\ (aq) + (NH_4)_3PO_4\ (aq) \rightarrow ?$$

5b. If you observed that the following reaction raised the temperature of the solution by 5° C. Is the reaction exothermic or endothermic? Does the reaction have a (-) or (+) ΔH?

6. If you found that a reaction should have theoretically produced 50 grams of your product but you actually produced 31 grams. What is your percent yield?

General Chemistry

7. Give the pH and pOH for the following solutions:

Solution	pH	pOH
0.98 M HCl		
1.34 M NaOH		
1.35 M $Ba(OH)_2$		
3.5 M H_2SO_4		
2.67 M $Al(OH)_3$		

8. Complete the following neutralization reaction:

$$\_\_\_H_2SO_4\ (aq) + \_\_\_Al(OH)_3\ (s) \rightarrow$$

8b. What volume of $Al(OH)_3$ is needed to needed to neutralize 50 ml of 2.0 M H_2SO_4?

9. Give the Lewis structure, molecular shape, hybridization of the central atom for the following compounds:

9a. $AlCl_3$ 9b. SO_4^{2-} 9c. XeF_4 9d. I_3^- 9e. SO_2 9f. CO_3^{2-}

10. Give the name for the following compounds:

10a. $As_2(CO_3)_5$ 10b. $AsBO_3$ 10c. $Cr_2(CO_3)_3$ 10d. ZnS 10e. $Bi(IO_3)_3$ 10f. $NiHPO_4$ 10g. $NaHCO_3$

11. Give the formula for the following names:

Zinc Phophate Manganese (II) Carbonate Magnesium Iodate Copper (I) Nitride

12. What is the wavelength emission of an electron that falls from n=4 to n=2?

13. What is the energy associated with a frequency of $1.2*10^{15}$ Hz?

14. What is the wavelength associated with a frequency of $1.5*10^{16}$ Hz?

15. What is the energy associated with a wavelength of 236 nm?

16. What is the wavelength associated with a ping pong ball that has a mass of 2 grams and is traveling at a speed of 15 mph?

17. Give the quantum numbers for the following elements last electron:

Cu Sc P S Ba I Xe Tc U Au Pb C F^- Ca^{2+}