CHEM 1105
|Sample Final Exam 2   ANSWERS

1. a) i) $HClO_2$ ii) Na_2SO_4 iii) P_4O_{10} iv) $Fe_2(SO_3)_3$ v) $Ca(OH)_2.2H_2O$

   b) i) ammonium sulfide   ii) aluminum chlorate   iii) nickel(II) cyanide
   iv) hydroiodic acid   v) iron(III) carbonate
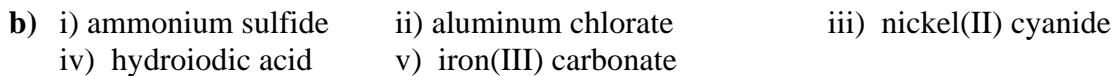
2. a)

Nuclear Symbol	Number of Protons	Number of Electrons	Number of Neutrons	Atomic Number	Mass Number
$^{27}Al^{3+}$	13	10	14	13	27
$^{31}S^{2-}$	16	18	15	16	31
^{84}Kr	36	36	48	36	84

   b) 64.94 amu

3. a) $3\ Na_2CO_3(aq)\ +\ 2\ Al(NO_3)_3(aq)$ ---> $Al_2(CO_3)_3(s)\ +\ 6\ NaNO_3(aq)$

   $2\ Al^{3+}(aq)\ +\ 3\ CO_3^{2-}(aq)$ ---> $Al_2(CO_3)_3(s)$

   b) $2C_8H_{18}(l)\ +\ 25\ O_2$ ---> $16\ CO_2(g)\ +\ 18\ H_2O(l)$

4. a) empirical formula: $C_3H_6O_2$

   b) molar mass = 74.1 g/mol;   molecular formula: $C_3H_6O_2$

5. a) density of $CO_2(g)$: 1.74 g/L

   b) P_{total} = 15.6 atm; P_{He} = 12.0 atm; P_{Ne} = 2.38 atm; P_{Ar} = 1.20 atm

6. a) limiting reagent: $Fe(NO_3)_3$
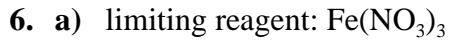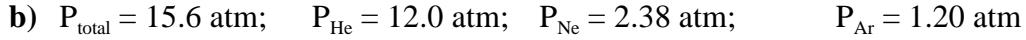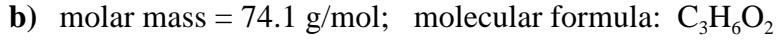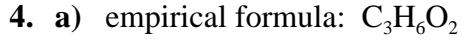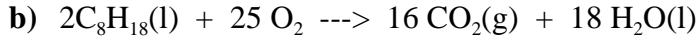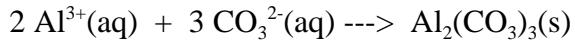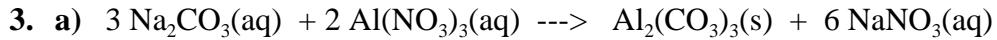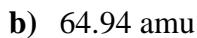
b) theoretical yield of $Fe_2S_3(s)$: 2.29g

c) percentage yield of Fe_2S_3: 94.0 %

d) concentration of HNO_3: 0.600 M

7. ΔH for the neutralization reaction: -56 kJ

8. a) $\Delta H° = +36.2$ kJ

b) $Na(s) + ½ H_2(g) + C(s) + 3/2 O_2(g)$ ---> $NaHCO_3(s)$

$\Delta H_f°$ $(NaHCO_3(s)) = -950.81$ kJ/mol

c) $\Delta H_f°$ for $NO_2(g)$: +34 kJ/mol

9. a)

$$\frac{[HCN]^2}{[NH_3]^2 \, [CH_4]^2 \, [O_2]^3}$$

b) $O_2(aq) + 4 HBr(aq)$ ---> $2 Br_2(aq) + 2 H_2O(l)$

c) $K_c = (1/4.4 \times 10^{-4})^{½} = 48$

d)

	moles of N_2	K_c
i) O_2 is removed	D	N.C.
ii) NH_3 is added	I	N.C.
iii) volume of container is increased	D	N.C.
iv) temperature is increased	D	I
v) water is added (assume volume does not change)	N.C.	N.C.

10. a) $[CH_4]$equil. $= 0.0080$ M; $[H_2]$equil. $= 0.078$ M

b) $K_c = 0.19$

11. a) weakest acid: HCO_3^-; conjugate base: CO_3^{2-}; $K_b = 2.1 \times 10^{-4}$

b)
       HI : strong acid <u>True</u> NH_3 : strong base <u>False</u>

HCN : weak acid <u>True</u> $H_2PO_4^-$: amphiprotic <u>True</u>

LiOH : strong base <u>True</u> PO_4^{3-} : amphiprotic <u>False</u>

NO_3^- : strong base <u>False</u> SO_4^{2-} : weak base <u>True</u>

12. a) $[OH^-] = 5.00 \times 10^{-4}\ M$;   pOH = 3.30; $[H_3O^+] = 2.00 \times 10^{-11}\ M$;   pH = 10.7

b) pH = 1.60

13. a) pH = 2.36; percent ionization = 4.4 %

b) pH = 8.72

c) pH = 3.72

d) pH = 3.72

14. a) $S_2O_3^{2-}$ <u>+2</u>   **b)** HSO_3^- <u>+4</u>   **c)** H_2S <u>-2</u>   **d)** SO_4^{2-} <u>+6</u>

15. a) $2\ ClO_3^-\ (aq)\ +\ 5\ SO_2(g) + 4\ H_2O(l)$ ----> $Cl_2(g) + 5\ SO_4^{2-}(aq) + 8\ H^+(aq)$
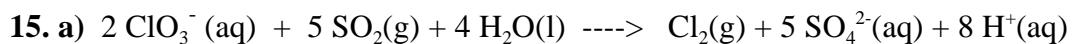
b) oxidizing agent: ClO_3^-

c) species oxidized: SO_2

16. Molar mass of Reserpine: 610 g/mol