Chemistry 12 Self Test #1

1. Identify the acid-base reactions

(a)	$H_2SO_3 + HCO_3^- \text{------>} HSO_3^- + H_2CO_3$	Acid/Base
(b)	$BaCl_2 + Na_2SO_4 \text{------>} 2NaCl + BaSO_4$	Double replacement
(c)	$2HCl + Zn \text{------>} ZnCl_2 + H_2$	Single replacement
(d)	$KHSO_3 + Na_3PO_4 \text{------->} K^+ + 3Na^+ + SO_3^{2-} + HPO_4^{2-}$	Acid/Base
(e)	$Cu + 2Ag^+ \text{------>} 2Ag + Cu^{2+}$	Single replacement
(f)	$HNO_2 + NH_3 \text{------->} NO_2^- + NH_4^+$	Acid/Base
(g)	$2KI + Pb(NO_3)_2 \text{------->} 2KNO_3 + PbI_2$	Double replacement
(h)	$H_2CO_3 + K_2S \text{------->} KHCO_3 + KHS$	Acid/Base
(i)	$2C + 3H_2 \text{------>} C_2H_6$	Synthesis
(j)	$H_2O + NH_2^- \text{------>} NH_3 + OH^-$	Acid/Base
(k)	$Cl_2 + 2NaI \text{------->} 2NaCl + I_2$	Single replacement
(l)	$NaClO_4 + HI \text{------->} NaI + HClO_4$	Acid/Base

2. Write the conjugate acid of:

(a)	NO_2^-	HNO_2
(b)	HCO_3^-	H_2CO_3
(c)	HPO_4^{2-}	$H_2PO_4^-$
(d)	CH_3NH_2	$CH_3NH_3^+$

3. Write the conjugate base of:

(a)	HF	F^-
(b)	HCO_3^-	CO_3^{2-}
(c)	NH_3	NH_2^-
(d)	$N_2H_5^+$	N_2H_4
(e)	HPO_4^{2-}	PO_4^{3-}
(f)	$(CH_3)_2NH_2^+$	$(CH_3)_2NH$

4. Identify the two acids and the two bases.

(a)	$2HBr + S^{2-} \text{<----->} H_2S + Br_2$	A+B<->A+B
(b)	$CO_3^{2-} + HNO_2 \text{<----->} NO_2^- + HCO_3^-$	B+A<->B+A
(c)	$NH_3 + H_2O \text{<------>} NH_4^+ + OH^-$	B+A<->A+B

5. Write the Bronsted-Lowry acid base equilibria which occur when the following pairs of substances are mixed in solution. Identify the conjugate pairs formed.

(a) HNO_2 and NH_3 <—> NO_2^- + NH_4^+ HNO_2 / NO_2^- and NH_3 / NH_4^+

(b) CO_3^{2-} and HF <---> HCO_3^- + F^- CO_3^{2-} / HCO_3^- and HF / F^-

(c) HCO_3^- and S^{2-} <—> CO_3^{2-} + HS^- HCO_3^- / CO_3^{2-} and S^{2-} / HS^-

(d) H^- and H_2O <—> H_2 + OH^- H^- / H_2 and H_2O / OH^-

(e) H_2S and HO_2^- <—> HS^- + H_2O_2 H_2S / HS^- and HO_2^- / H_2O_2

(f) O^{2-} and H_2O <—> $2OH^-$ O^{2-} / OH^- and H_2O / OH^-

(g) H_2O and H_2SO_3 <—> H_3O^+ + HSO_3^- H_2O / H_3O^+ and H_2SO_3 / HSO_3^-

6. Classify each of the following as strong acid, weak acid, strong base, weak base, salt.

(a) NaCl salt

(b) KOH strong base

(c) H_2O weak acid and weak base

(d) CH_3COOH weak acid

(e) H_2SO_4 strong acid

(f) NH_3 weak base

(g) KI salt

(h) $CaCl_2$ salt

7. List the following acids in decreasing order of strength.
CH_3COOH, HNO_2, $HClO_4$ and HCO_3^- $HClO_4$, HNO_2, CH_3COOH, HCO_3^-

8. List the conjugate bases of the following acids in decreasing order of strength.
CH_3COOH, HNO_2, $HClO_4$ and HCO_3^- CO_3^{2-}, CH_3COO^-, NO_2^-, ClO_4^-

9. Complete the following acid-base equilibria after identifying the stronger acid.

(a) H_2O_2 and HSO_3^- H_2O_2 + HSO_3^- <-> $H_3O_2^+$ + SO_3^{2-}

(b) $H_2PO_4^-$ and HCO_3^- $H_2PO_4^-$ + HCO_3^- <—> HPO_4^{2-} + H_2CO_3

10. Complete the following acid-base equilibria after identifying the stronger base.

(a) HCO_3^- and HS^- HCO_3^- + HS^- <—> H_2S + CO_3^{2-}

(b) OH^- and NH_3 OH^- + NH_3 <—> H_2O + NH_2^-

(c) HPO_4^{2-} and HS^- HPO_4^{2-} + HS^- <—> $H_2PO_4^-$ + S^{2-}

(d) HS^- and HSO_3^- HS^- + HSO_3^- <—> H_2S + SO_3^{2-}

11. Classify the following statements as true or false.

(a) A strong electrolyte is more completely ionized than a weak electrolyte. TRUE

(b) In solutions of equal concentration, a weak electrolyte will have a lower electrical conductivity than a strong electrolyte. TRUE

(c) The stronger an acid, the stronger its conjugate base. FALSE

12. Explain why HF is a stronger acid than H_2O but a weaker acid than HCl.
Ans: The dissociation of HF lies between that of HCl (100%) and that of H_2O. Since strength is related to dissociation, then the strength of HF is between that of HCl (strong) and that of H_2O (weak).

13. For the following, state whether reactants or products are favored.

(a)	$HPO_4^{2-} + HCO_3^- <------> H_2PO_4^- + CO_3^{2-}$	Reactants
(b)	$HCl + CH_3COO^- <------> CH_3COOH + Cl^-$	Products
(c)	$NH_4^+ + F^- <------> HF + NH_3$	Reactants
(d)	$CH_3COOH + CO_3^{2+} <------> CH_3COO^- + HCO_3^-$	Products
(e)	$HCN + F^- <------> HF + CN^-$	Reactants
(f)	$HCO_3^- + OH^- <-----> CO_3^{2-} + H_2O$	Products
(g)	$HF + SO_4^{2-} <------> F^- + HSO_4^-$	Reactants
(h)	$H_2CO_3 + F^- <------> HCO_3^- + HF$	Reactants
(i)	$HSO_4^- + HCO_3^- <------> SO_4^{2-} + H_2CO_3$	Products

14. Write an equation to show the ionization of water. $2H_2O <—> H_3O^+ + OH^-$

15. Write the mathematical definition for pH $-\log [H_3O^+]$

16. Calculate the $[H_3O^+]$ and the $[OH^-]$ in a solution in which:

(a) pH = 9.00	1.0×10^{-9} M	1.0×10^{-5} M
(b) pH = 4.75	1.8×10^{-5} M	5.6×10^{-10} M
(c) pH = -1.10	13M	7.9×10^{-16} M
(d) pH = 0.00	1.0M	1.0×10^{-14} M
(e) pH = 12.35	4.5×10^{-13} M	2.2×10^{-2} M
(f) pH = 14.80	1.6×10^{-15} M	6.3M
(g) pOH = 9.00	1.0×10^{-5} M	1.0×10^{-9} M
(h) pOH = 4.75	5.6×10^{-10}M	1.8×10^{-5} M
(i) pOH = -1.10	7.9×10^{-16} M	13M
(j) pOH = 0.00	1.0×10^{-14} M	1.0M
(k) pOH = 12.35	2.2×10^{-2} M	4.5×10^{-13} M
(l) pOH = 14.80	6.3M	1.6×10^{-15} M

17. Calculate the $[H_3O^+]$, the $[OH^-]$, the pH and the pOH for

(a)	0.0010 M HCl	1.0×10^{-3} M	1.0×10^{-11}M	3.00	11.00
(b)	4.0 M NaOH	2.5×10^{-15} M	4.0M	14.60	-6.0×10^{-1}
(c)	2.5×10^{-3} M $NaNH_2$	4.0×10^{-12} M	2.5×10^{-3} M	11.40	2.60
(d)	6.0×10^{-3} M $Ca(OH)_2$	8.3×10^{-13} M	1.2×10^{-2} M	12.08	1.92
(e)	Saturated solution of $Mg(OH)_2$; $K_{sp} = 5.6 \times 10^{-12}$	4.5×10^{-11}M	2.2×10^{-4} M	10.35	3.65