WKS 13.1 – Conjugates Using Brönsted-Lowry's Definition (2 pages)

Give the conjugate acid of the following bases:

BASE →	CONJUGATE ACID		BASE →	CONJUGATE ACID
H_2O			ClO^-	
acetate			$H_2PO_4^-$	
NH_3			HSO_4^-	
hydroxide			Br^-	
CO_3^{2-}			Methylamine (CH_3NH_2)	

Give the acid of the following conjugate bases:

ACID →	CONJUGATE BASE		ACID →	CONJUGATE BASE
	water			OH^-
	ammonia			bromide ion
	SO_4^{2-}			O^{2-}
	HCO_3^-			CH_3NH_2
	cyanide ion			$C_2H_3O_2^-$

Give the base of the following conjugate acids:

BASE →	CONJUGATE ACID		BASE →	CONJUGATE ACID
	HCN			hydronium
	HCO_3^-			$CH_3NH_3^+$
	ammonium			H_2O
	HF			HSO_3^-
	$HC_2H_3O_2$			HCl

WKS 13.1 – Conjugates Using Brönsted-Lowry's Definition (continued)

Give the conjugate base of the following acids:

ACID →	CONJUGATE BASE		ACID →	CONJUGATE BASE
$HC_2H_3O_2$			H_2SO_4	
HBr			nitric acid	
hydrochloric acid			H_3PO_4	
NH_4^+			H_2CO_3	
HCN			hydrosulfuric acid	

Identify the acid (A), base (B), conjugate acid (CA), and conjugate base (CB) in the following reactions:

(1) $NH_{3\,(g)} + H_3O^+_{(aq)} \rightarrow NH_4^+_{(aq)} + H_2O_{(l)}$

(2) $CH_3COOH_{(l)} + NH_2^- \rightarrow CH_3COO^-_{(aq)} + NH_{3\,(g)}$

(3) $NH_2^-_{(g)} + H_2O_{(l)} \rightarrow NH_{3\,(g)} + OH^-_{(aq)}$

(4) $HClO_{4\,(aq)} + H_2O_{(l)} \rightarrow H_3O^+_{(aq)} + ClO_4^-_{(aq)}$

WKS 13.2 – Naming Acids (1 page)

Name the following acids. (They may not all exist, but use your rules to propose a name!)

Formula	Acid Name	Formula	Acid Name
H_2Te		H_2S	
H_2SO_2		HNO_2	
$HBrO_3$		HIO	
HNO_3		H_3PO_3	
HCl		HF	
H_3P		$HBrO_2$	
HIO_2		H_2SO_3	
$HClO_3$		H_2Se	
H_2SO_4		HI	
HBr		$HClO_4$	

Write the formula for the following acids.

Name	Formula	Name	Formula
Nitrous acid		Acetic acid	
Hydrobromic acid		Hypochlorous acid	
Chloric acid		Permanganic acid	
Hydrofluoric acid		Hydrochloric acid	
Hydrotelluric acid		Hyposulfurous acid	
Hypoiodous acid		Iodic acid	
Carbonic acid		Bromous acid	
Phosphorous acid		Perchloric acid	
Hydrosulfuric acid		Hydroselenic acid	

WKS 13.3 – pH / pOH Calculations, Part 1 (1 page)

Show all work and circle your answers! NO WORK / FORMULA SETUP = NO CREDIT.

1. (a) If the hydrogen ion concentration of a solution is 1.30×10^{-4} M, what is the pH of the solution? **(pH = 3.89)**

   (b) What is the pOH of this same solution? **(pOH = 10.11)**

   (c) What is the hydroxide concentration of the solution? **[7.69×10^{-11}]**

2. (a) If the hydroxide ion concentration of a solution is 2.8×10^{-6} M, is it an acidic or a basic solution? **(pH = 8.45, basic)**

   (b) What is the pH of this solution? **(pH = 8.45)**

   (c) What is the hydrogen ion concentration of this solution? **[3.61×10^{-9}]**

   (d) What is the pOH of this solution? **(pOH = 5.65)**

3. (a) If the pH of a solution is 4.67, what is the hydroxide ion concentration? **[4.68×10^{-10}]**

   (b) What is the pOH of this solution? **(pOH = 9.33)**

   (c) What is the hydrogen ion concentration? **[2.14×10^{-5}]**

   (d) Is this an acidic or basic solution? **(acidic)**

4. (a) If the pOH of a solution is 3.6, what is the pH? **(pH = 10.40)**

   (b) What is the hydrogen ion concentration of this solution? **[3.98×10^{-11}]**

   (c) What is the hydroxide ion concentration of this solution? **[2.51×10^{-4}]**

   (d) Does this solution have a higher hydrogen ion or hydroxide ion concentration? **(hydroxide)**

5. Which would have a more basic pH—a solution whose hydrogen ion concentration is 3.4×10^{-8} M or a solution whose hydroxide ion concentration is 2.6×10^{-5} M? **(2.6×10^{-5} M)**

WKS 13.4 – pH / pOH Calculations, Part 2 (1 page)

Calculate all of the unknown variables in the table. NO WORK / FORMULA SETUP = NO CREDIT.

	$[H^+]$	pH	$[OH^-]$	pOH	Acidic,Basic, or Neutral
1	2.30×10^{-4}	3.63	4.35×10^{-11}	10.4	Acidic
2		7.9			
3			1.05×10^{-3}		
4	3.66×10^{-3}				
5				11.5	
6		12			
7			5.5×10^{-7}		
8	7.77×10^{-11}				
9				13.0	
10		7.0			
11	9.33×10^{-6}				
12			1.11×10^{-2}		
13				2.55	
14		0.55			
15	9.05×10^{-14}				

WKS 13.5 – Strong Acid & Base Calculations (2 pages)

Show all work and circle your answers! NO WORK / FORMULA SETUP = NO CREDIT.

1. What is the pH of 0.80 M hydrobromic acid? **(pH = 0.097)**

2. If the pH of a sulfuric acid solution is known to be 3.25, what is the molar concentration of the acid solution? **(2.8×10^{-4} M)**

3. (a) If the pH of a barium hydroxide solution is known to be 12.50, what is the hydroxide ion concentration? **(3.16×10^{-2} M)**

   (b) What is the barium ion concentration? **(1.58×10^{-2} M)**

   (c) What is the molar concentration of the base solution? **(1.58×10^{-2} M)**

4. (a) What is the hydroxide ion concentration of a 0.166 M calcium hydroxide solution? **(0.33 M)**

   (b) What is the hydrogen ion concentration of the solution? (**3.03×10^{-14}**)

   (c) What is the pH of the solution? **(pH = 13.52)**

   (d) What is the Ca^{+2} ion concentration in this solution? **(0.166 M)**

5. If the pH of a cesium hydroxide solution is known to be 9.75, what is the molar concentration of the base solution? **(5.62×10^{-5} M)**

6. If the pH of a hydroiodic acid solution is known to be 3.21, what is the molar concentration of the acid solution? **(6.17×10^{-4})**

WKS 13.5 – Strong Acid & Base Calculations (continued)

***Show all work* and circle your answers! NO WORK / FORMULA SETUP = NO CREDIT.**

7. (a) A solution was prepared using 28.3 g of potassium hydroxide and then diluting to a final volume of 2.0000L. What is the molarity of the base solution? **(0.252 M)**

   (b) What is the pH of the solution? **(13.40)**

8. (a) A strong monoprotic acid was prepared by diluting 1.35 mL of a concentrated, 12.0 M solution to a final volume of 0.250 L. Calculate the final molarity of the solution. HINT: Think about dilution from last unit! **(0.0648 M)**

   (b) What is the molar concentration of the hydrogen ion? **(0.0648 M)**

   (c) What is the pH of the solution? **(1.19)**

   (d) What color would phenolphthalein be in this solution?

9. Which would have a higher pH—a 0.035 M potassium hydroxide solution or a 0.018 M calcium hydroxide solution? Explain. **($Ca(OH)_2$)**

10. Which would have the more acidic pH-a 0.0025 M strontium hydroxide solution or a solution whose hydrogen ion concentration is 1.44×10^{-13}? **(.0025 M $Sr(OH)_2$)**

11. If the barium ion concentration of a barium hydroxide solution is known to be 0.25 M , what is the pH of the solution? **(pH = 13.70)**

WKS 13.6 – Titration Calculations & Neutralization Reactions (1 page)

Solve the following titration problems. NO WORK / FORMULA SETUP = NO CREDIT.

1. What is the molarity of a solution of barium hydroxide if 50.0 mL are titrated to an endpoint by 15.0 mL of a solution of hydrobromic acid that is 0.00300 M? **(4.5×10^{-4} M $Ba(OH)_2$)**

2. What is the concentration of a strontium hydroxide solution if 20.0 mL of it is neutralized by 25.0 mL of a 0.0500 M hydrochloric acid solution? **(0.0313 M)**

3. If 25.0 mL of vinegar solution (acetic acid) is neutralized 15.0 mL of 0.500 M NaOH, what is the molarity of the vinegar? **(0.300 M)**

Write the balanced neutralization reactions for the following:

4. Cesium Hydroxide and Sulfuric Acid

5. Calcium Hydroxide and Hydrobromic Acid

6. Sodium Hydroxide and Perchloric Acid

7. Lithium Hydroxide and Hydroselenic Acid

WKS 13.7 – A Little Bit of Everything Review! (2 pages)

1. Put the following in order of most acidic to most basic.
   a. pH 3.6
   b. $[H^+] = 1.25 \times 10^{-7}$
   c. pOH = 13.2
   d. $[OH^-] = 5.89 \times 10^{-2}$

   JUSTIFICATION:

2. Which of the following represents a polyprotic acid?
   a. HCl
   b. H_2Se
   c. H_3PO_4
   d. Both B and C

   JUSTIFICATION:

3. You have a solution that <u>should</u> be at a pH of 11. You check the pH and find out that it is currently at a pH of 10.5. In order to change the pH to the desired value of 11, you should add:
   a. water – pH 7
   b. lye – pH 13
   c. vinegar– pH 4
   d. ammonia – pH 10

   JUSTIFICATION:

4. Examine the following equation:

   BO_3^{-3} → HBO_3^{-2} → $H_2BO_3^{-1}$ → H_3BO_3
   I. II. III. IV.

   Which of the above would be considered amphiprotic?
   a. I & IV
   b. II & III
   c. I & II
   d. III & IV

   JUSTIFICATION:

5. Fill out the following chart with regards to acids and bases:

	ACIDS	**BASES**
Usually have in the formula:		
Arrhenius' definition says:		
Bronsted-Lowry's definition says:		
Has a pH range of:		
Will turn this color with litmus paper:		
Will turn this color in phenolphthalein:		
Will do this when put with a metal: (include identity of gas, if formed)		

6. Fill out the following chart with regards to strong vs. weak acids and bases:

	Strong Acids and Bases	**Weak Acids and Bases**
To what % do they ionize?		
Are they a strong conductor or a poor conductor?		
Would their pH be closer or farther away from 7 (neutral)?		
Which arrow do we show in their ionization reaction?		

WKS 13.7 – A Little Bit of Everything Review! (continued)

7. Write a reaction using phosphoric acid and ammonia as reactants. Identify each reactant and product as being an acid, base, conjugate acid, or conjugate base. (Use Bronsted-Lowry's definition to help you!)

8. What is the difference between strength and concentration (in regards to acids and bases)?

9. What is the pH of a 0.32 M solution of calcium hydroxide? **(13.81)**

10. If the pH of a cesium hydroxide solution is known to be 9.75, what is the molar concentration of the original base solution? **(5.62×10^{-5} M)**

11. What is the $[OH^-]$ of a sulfuric acid solution with a pH of 1.34? What is the original concentration of the acid? **(2.19×10^{-13} M, 2.29×10^{-2} M)**

12. How many grams of strontium hydroxide must be dissolved to make a 8.78 L solution with a pH of 12.12? What is the hydroxide ion concentration? What is the strontium ion concentration? **(7.02 g, 0.0132 M, 6.59×10^{-3} M)**

13. What is the molarity of a solution of $Ba(OH)_2$ if 50.0 mL are titrated to an endpoint by 15.0 mL of a solution of H_2SO_4 that is 0.300 M? **(0.0900 M)**

14. What is the purpose of a buffer?