

**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 <sub>2</sub> O		ClO <sup>-</sup>	
acetate		H <sub>2</sub> PO <sub>4</sub> <sup>-</sup>	
NH <sub>3</sub>		HSO <sub>4</sub> <sup>-</sup>	
hydroxide		Br <sup>-</sup>	
CO <sub>3</sub> <sup>2-</sup>		Methylamine (CH <sub>3</sub> NH <sub>2</sub> )	

*Give the acid of the following conjugate bases:*

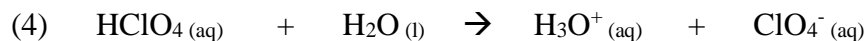
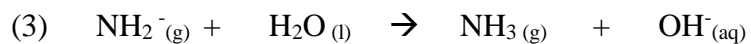
ACID →	CONJUGATE BASE	ACID →	CONJUGATE BASE
	water		OH <sup>-</sup>
	ammonia		bromide ion
	SO <sub>4</sub> <sup>2-</sup>		O <sup>2-</sup>
	HCO <sub>3</sub> <sup>-</sup>		CH <sub>3</sub> NH <sub>2</sub>
	cyanide ion		C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> <sup>-</sup>

*Give the base of the following conjugate acids:*

BASE →	CONJUGATE ACID	BASE →	CONJUGATE ACID
	HCN		hydronium
	HCO <sub>3</sub> <sup>-</sup>		CH <sub>3</sub> NH <sub>3</sub> <sup>+</sup>
	ammonium		H <sub>2</sub> O
	HF		HSO <sub>3</sub> <sup>-</sup>
	HC <sub>2</sub> H <sub>3</sub> O <sub>2</sub>		HCl

**WKS 13.1 – Conjugates Using Brønsted-Lowry's Definition (continued)***Give the conjugate base of the following acids:*

ACID →	CONJUGATE BASE	ACID →	CONJUGATE BASE
HC <sub>2</sub> H <sub>3</sub> O <sub>2</sub>		H <sub>2</sub> SO <sub>4</sub>	
HBr		nitric acid	
hydrochloric acid		H <sub>3</sub> PO <sub>4</sub>	
NH <sub>4</sub> <sup>+</sup>		H <sub>2</sub> CO <sub>3</sub>	
HCN		hydrosulfuric acid	

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

**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 <sub>2</sub> Te		H <sub>2</sub> S	
H <sub>2</sub> SO <sub>2</sub>		HNO <sub>2</sub>	
HBrO <sub>3</sub>		HIO	
HNO <sub>3</sub>		H <sub>3</sub> PO <sub>3</sub>	
HCl		HF	
H <sub>3</sub> P		HBrO <sub>2</sub>	
HIO <sub>2</sub>		H <sub>2</sub> SO <sub>3</sub>	
HClO <sub>3</sub>		H <sub>2</sub> Se	
H <sub>2</sub> SO <sub>4</sub>		HI	
HBr		HClO <sub>4</sub>	

*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  $1.30 \times 10^{-4}$  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? [ **$7.69 \times 10^{-11}$** ]
  
2.
  - (a) If the hydroxide ion concentration of a solution is  $2.8 \times 10^{-6}$  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? [ **$3.61 \times 10^{-9}$** ]
  - (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? [ **$4.68 \times 10^{-10}$** ]
  - (b) What is the pOH of this solution? (**pOH = 9.33**)
  - (c) What is the hydrogen ion concentration? [ **$2.14 \times 10^{-5}$** ]
  - (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? [ **$3.98 \times 10^{-11}$** ]
  - (c) What is the hydroxide ion concentration of this solution? [ **$2.51 \times 10^{-4}$** ]
  - (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  $3.4 \times 10^{-8}$  M or a solution whose hydroxide ion concentration is  $2.6 \times 10^{-5}$  M? ( **$2.6 \times 10^{-5}$  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 <sup>+</sup> ]	pH	[OH <sup>-</sup> ]	pOH	Acidic, Basic, or Neutral
1	$2.30 \times 10^{-4}$	3.63	$4.35 \times 10^{-11}$	10.4	Acidic
2		7.9			
3			$1.05 \times 10^{-3}$		
4	$3.66 \times 10^{-3}$				
5				11.5	
6		12			
7			$5.5 \times 10^{-7}$		
8	$7.77 \times 10^{-11}$				
9				13.0	
10		7.0			
11	$9.33 \times 10^{-6}$				
12			$1.11 \times 10^{-2}$		
13				2.55	
14		0.55			
15	$9.05 \times 10^{-14}$				



**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)<sub>2</sub>)**
10. Which would have the more acidic pH—a 0.0025 M strontium hydroxide solution or a solution whose hydrogen ion concentration is  $1.44 \times 10^{-13}$ ? **(.0025 M Sr(OH)<sub>2</sub>)**
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? ( **$4.5 \times 10^{-4}$  M Ba(OH)<sub>2</sub>**)
  
  
  
  
  
  
  
  
  
  
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:*

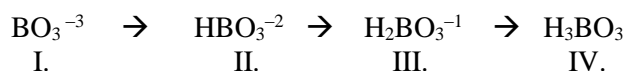
4. Cesium Hydroxide and Sulfuric Acid
  
  
  
  
  
  
  
  
  
  
5. Calcium Hydroxide and Hydrobromic Acid
  
  
  
  
  
  
  
  
  
  
6. Sodium Hydroxide and Perchloric Acid
  
  
  
  
  
  
  
  
  
  
7. Lithium Hydroxide and Hydroselenic Acid



**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<sub>2</sub>Se  
c. H<sub>3</sub>PO<sub>4</sub>  
d. Both B and C
- JUSTIFICATION:**
3. You have a solution that should 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:



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? **( $5.62 \times 10^{-5} \text{ M}$ )**
  
11. What is the  $[\text{OH}^-]$  of a sulfuric acid solution with a pH of 1.34? What is the original concentration of the acid? **( $2.19 \times 10^{-13} \text{ M}$ ,  $2.29 \times 10^{-2} \text{ M}$ )**
  
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,  $0.0132 \text{ M}$ ,  $6.59 \times 10^{-3} \text{ M}$ )**
  
13. What is the molarity of a solution of  $\text{Ba}(\text{OH})_2$  if 50.0 mL are titrated to an endpoint by 15.0 mL of a solution of  $\text{H}_2\text{SO}_4$  that is 0.300 M? **(0.0900 M)**
  
14. What is the purpose of a buffer?