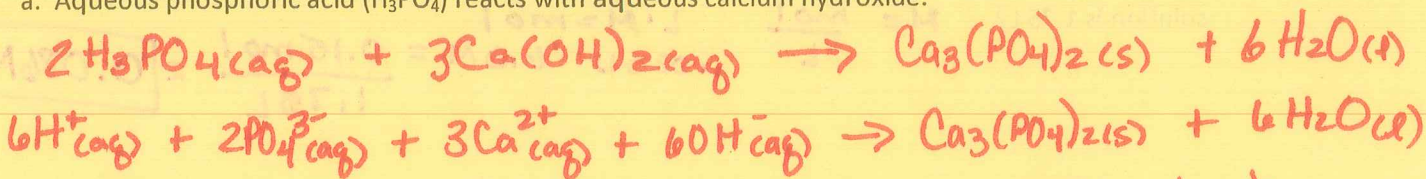


Name Beth "Key" Period _____

Review Worksheet

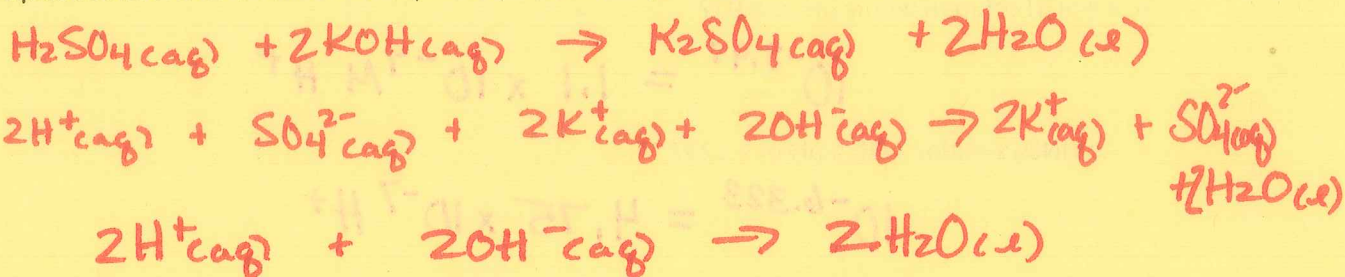
Acids/Bases

1. Write molecular, complete ionic and net ionic equations for the following neutralization reactions.
 a. Aqueous phosphoric acid (H_3PO_4) reacts with aqueous calcium hydroxide.



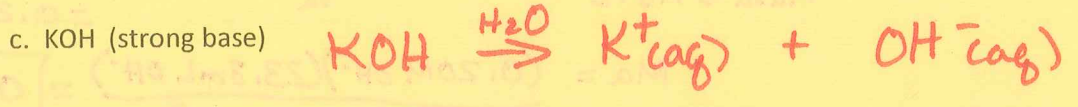
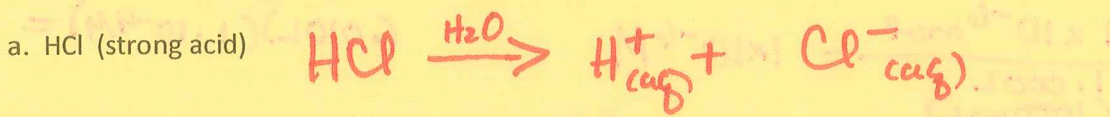
Net will be the same as complete ionic since the salt is insoluble and will precipitate out.
 What is the final pH for this reaction? 7

- b. Aqueous sulfuric acid reacts with aqueous potassium hydroxide.



What is the final pH for this reaction? 7

2. Write equations to show the dissociation/ionization for the following in aqueous solution.



3. Complete the following table.

Acid	Base	Conjugate Acid	Conjugate Base	Equation
HNO_2	H_2O	H_3O^+	NO_2^-	$HNO_2 + H_2O \rightarrow NO_2^- + H_3O^+$
H_2O	F^-	HF	OH^-	$H_2O + F^- \rightarrow HF + OH^-$
HCN	NH_3	NH_4^+	CN^-	$NH_3 + HCN \rightarrow NH_4^+ + CN^-$
$HClO_3$	OH^-	H_2O	ClO_3^-	$HClO_3 + OH^- \rightarrow H_2O + ClO_3^-$
HSO_4^-	PO_4^{3-}	HPO_4^{2-}	SO_4^{2-}	$HSO_4^- + PO_4^{3-} \rightarrow HPO_4^{2-} + SO_4^{2-}$
H_2O	S^{2-}	HS^-	OH^-	$S^{2-} + H_2O \rightarrow OH^- + HS^-$
HCO_2H	OH^-	H_2O	CO_2H^-	$HCO_2H + OH^- \rightarrow H_2O + CO_2H^-$

4. Calculate the pH for the following and indicate if the solution is acidic, basic or neutral.

a. 0.25M HCl

$$\text{pH} = 0.60$$

ACID

b. $1.45 \times 10^{-3} \text{M H}_2\text{SO}_4$

$$\text{pH} = 2.538$$

ACID

c. $3.6 \times 10^{-2} \text{M NaOH}$

$$\text{pOH} = 1.44$$

$$\text{pH} = 12.56$$

BASE

d. $8.334 \times 10^{-4} \text{HNO}_3$

$$\text{pH} = 3.0791$$

ACID

5. What is the pH of a solution made by diluting 25 mL of 6.0 M HCl until the final volume of the solution is 1.75 L?

$$M = \frac{\text{mol}}{\text{L}} \quad L \cdot M = \text{mol}$$

$$.025 \text{L} \cdot 6.0 \text{M} = \frac{0.15 \text{mol}}{1.75 \text{L}} = \boxed{0.086 \text{M}}$$

6. What is the $[\text{H}^+]$ for the following:

a. An HCl solution with a pH of 3.45?

$$[\text{H}^+] = 10^{-\text{pH}} \quad 10^{-3.45} = 3.5 \times 10^{-4} \text{M H}^+$$

b. A NaOH solution with a pH of 8.97?

$$10^{-8.97} = 1.1 \times 10^{-9} \text{M H}^+$$

c. An HNO_3 solution with a pH of 6.323?

$$10^{-6.323} = 4.75 \times 10^{-7} \text{H}^+$$

7. An acidic solution has a pH of 4. If I dilute 10 mL of this solution to a final volume of 1000 mL, what is the pH of the resulting solution?

$$[\text{H}^+] = 10^{-4} = 1 \times 10^{-4} \text{M}$$

$$\frac{1 \times 10^{-4} \text{mol}}{1.000 \text{L (1000 mL)}} = 1 \times 10^{-6} \text{M}$$

$$M = \frac{\text{mol}}{\text{L}}$$

$$M \cdot L = \text{mol}$$

$$(0.010 \text{L})(1 \cdot 10^{-4} \text{M}) = 1 \times 10^{-6} \text{mol}$$

8. You titrate a 35.0 mL sample of HCl with 0.10 M $\text{Mg}(\text{OH})_2$. The titration requires 23.8 mL of the base. Calculate the concentration of the HCl solution.

$$M_a V_a = M_b V_b$$

$$M_a = \frac{M_b V_b}{V_a}$$

$$0.10 \text{M Mg}(\text{OH})_2 = 0.20 \text{M OH}^-$$

$$M_a = \frac{(0.20 \text{M OH}^-)(23.8 \text{mL OH}^-)}{(35.0 \text{mL H}^+)} = \boxed{0.14 \text{M HCl}}$$

9. You titrate 25.50 mL of 0.35M H_2SO_4 with 18.60 mL of NaOH. What is the concentration of the NaOH?

$$M_b = \frac{M_a V_a}{V_b}$$

$$M_a = 0.35 \text{M H}_2\text{SO}_4 \times \frac{2 \text{H}^+}{1 \text{H}_2\text{SO}_4} = 0.70 \text{M H}^+$$

$$M_b = \frac{(0.70 \text{M H}^+)(25.50 \text{mL})}{18.60 \text{mL}} = \boxed{0.96 \text{M NaOH}}$$

10. What is meant when an acid is described as strong or weak?

Strong indicates molecules of acid will all ionize to form H^+ and an anion.

Weak means that only a few of the acid molecules will ionize to form H^+ and an anion.

1)

$$\text{HC}_7\text{H}_3\text{O}_2(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{C}_7\text{H}_3\text{O}_2^-(\text{aq})$$

initial	0.35 M	0 M	0 M
change	- x M	+ x M	+x M
equilibrium	(0.35 - x) M	x M	x M

Note that: $(0.35 - x) \text{ M} \approx 0.35 \text{ M}$ so

$$K_a = \frac{[\text{H}^+][\text{C}_7\text{H}_3\text{O}_2^-]}{[\text{HC}_7\text{H}_3\text{O}_2]} = \frac{(x)(x)}{(0.35 - x)} = \frac{(x)(x)}{(0.35)} = \frac{x^2}{(0.35)} = 6.3 \times 10^{-5}$$

$$x^2 = (6.3 \times 10^{-5})(0.35) = 2.205 \times 10^{-5}$$

$$x = 4.7 \times 10^{-3} \text{ M} \quad x = \text{moles/L formed}$$

$$\text{pH} = -\log(4.7 \times 10^{-3}) = 2.33$$

2)

$$\text{HClO}(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{ClO}^-(\text{aq})$$

initial	0.275 M	0 M	0 M
change	- x M	+ x M	+x M
equilibrium	(0.275 - x) M	x M	x M

Note that: $(0.275 - x) \text{ M} \approx 0.275 \text{ M}$ so

$$K_a = \frac{[\text{H}^+][\text{ClO}^-]}{[\text{HClO}]} = \frac{(x)(x)}{(0.275 - x)} = \frac{(x)(x)}{(0.275)} = \frac{x^2}{(0.275)} = 3.0 \times 10^{-8}$$

$$x^2 = (3.0 \times 10^{-8})(0.275) = 8.25 \times 10^{-9}$$

$$x = 9.08 \times 10^{-5} \text{ M}$$

$$\text{pH} = -\log(9.08 \times 10^{-5}) = 4.042$$

3)

First the amount of H^+ from each acid must be calculated.

$$\text{HNO}_2(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{NO}_2^-(\text{aq})$$

initial	0.0925 M	0 M	0 M
change	- x M	+ x M	+x M
equilibrium	(0.0925 - x) M	x M	x M

Note that: $(0.0925 - x) \text{ M} \approx 0.0925 \text{ M}$ so

$$K_a = \frac{[\text{H}^+][\text{NO}_2^-]}{[\text{HNO}_2]} = \frac{(x)(x)}{(0.0925 - x)} = \frac{(x)(x)}{(0.0925)} = \frac{x^2}{(0.0925)} = 4.5 \times 10^{-4}$$

$$x^2 = (4.5 \times 10^{-4})(0.0925) = 4.1625 \times 10^{-5}$$

$$x = 6.45 \times 10^{-3} \text{ M} \quad x = \text{moles/L formed}$$

$$\text{HC}_2\text{H}_3\text{O}_2(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{C}_2\text{H}_3\text{O}_2^-(\text{aq})$$

initial	0.139 M	0 M	0 M
change	- x M	+ x M	+x M
equilibrium	(0.139 - x) M	x M	x M

Note that: $(0.139 - x) \text{ M} \approx 0.139 \text{ M}$ so

$$K_a = \frac{[\text{H}^+][\text{C}_2\text{H}_3\text{O}_2^-]}{[\text{HC}_2\text{H}_3\text{O}_2]} = \frac{(x)(x)}{(0.139 - x)} = \frac{(x)(x)}{(0.139)} = \frac{x^2}{(0.139)} = 1.8 \times 10^{-5}$$

$$x^2 = (1.8 \times 10^{-5})(0.139) = 2.502 \times 10^{-6}$$

$$x = 1.58 \times 10^{-3} \text{ M}$$

Then add the results together and use that value to find the pH.

$$6.45 \times 10^{-3} \text{ M} + 1.58 \times 10^{-3} \text{ M} = 8.03 \times 10^{-3} \text{ M}$$

$$\text{pH} = -\log(8.03 \times 10^{-3}) = 2.095$$

