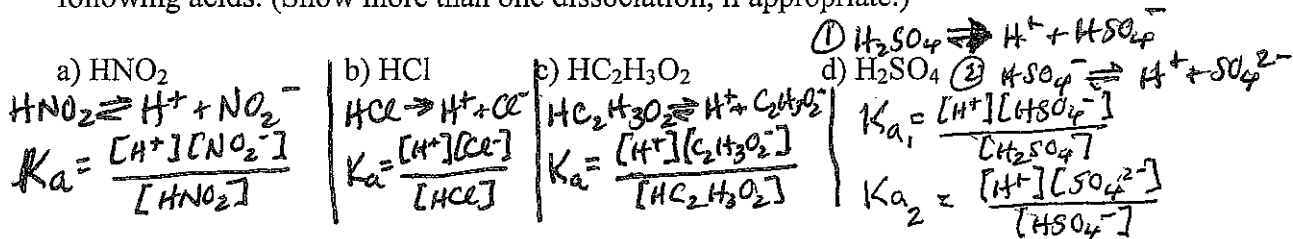


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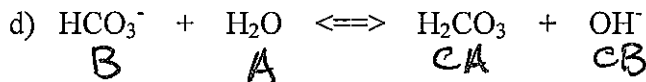
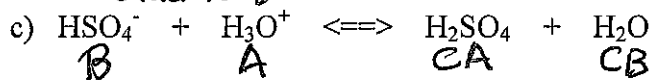
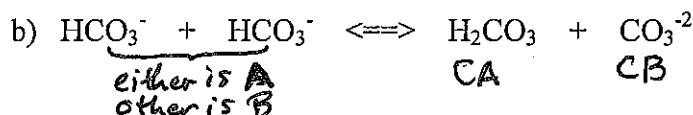
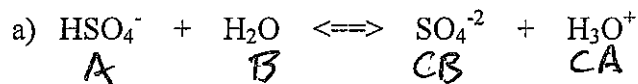
Chemistry II Practice Test – Acids & Bases

For K_a and K_b values – Zumdahl, p. 659, 678, 683, Chang, p. 680, 688, 692

1. Write the dissociation reactions and corresponding K_a expressions for each of the following acids. (Show more than one dissociation, if appropriate.)



2. Using the Brønsted-Lowry concept, identify the acid, base, conjugate acid, and conjugate base for each of the following reactions.

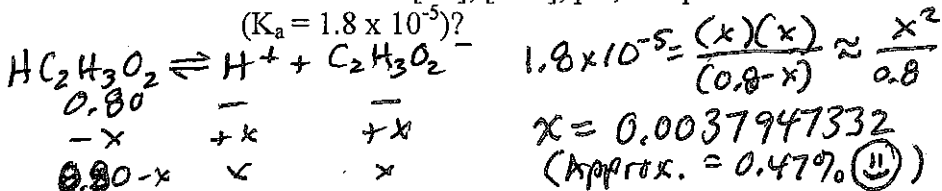


3. What are the $[H^+]$, $[OH^-]$, pH, and pOH of a 0.60 M solution of HCl?

$$[H^+] = 0,60 \text{ M} \quad pH = 0,22$$

$$pOH = 13,78 \quad [OH^-] = 1,67 \times 10^{-14}$$

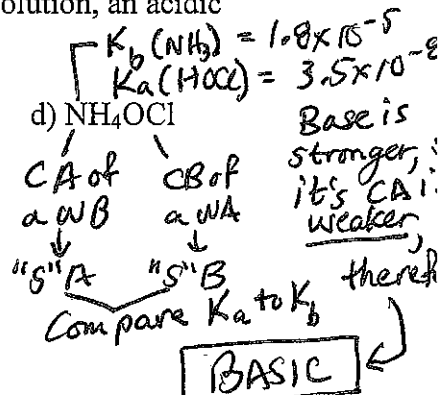
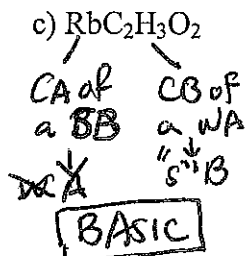
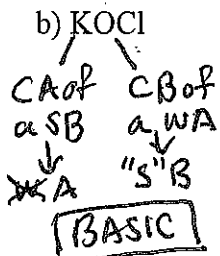
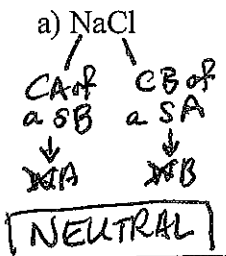
4. What are the $[H^+]$, $[OH^-]$, pH, and pOH of a 0.80 M solution of acetic acid?



$$[H^+] = 0.00379 \quad pH = 2.42$$

$$[OH^-] = 2.64 \times 10^{-12} \quad pOH = 11.58$$

5. Indicate whether each of the following would produce a neutral solution, an acidic solution, or a basic solution. Explain your answers.



6. Calculate the pH of a 0.075 M solution of sulfuric acid. Also, calculate the equilibrium concentration of the sulfate ion.
(BONUS: What mass of solid barium hydroxide would be needed to completely neutralize 20.0 mL of this acid? What mass of precipitate would be formed during the neutralization?)

From 1st dissociation

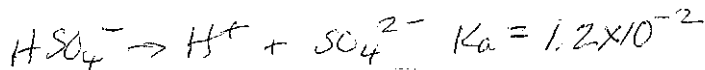
$$[H^+] = 0.075 M$$

$$[HSO_4^-] = 0.075 M$$

From 2nd dissociation

$$[H^+] = 0.0093 M$$

$$[SO_4^{2-}] = 0.0093 M$$



I	0.075	0.075	—
C	-x	+x	+x
E	0.075-x	0.075+x	x

$$1.2 \times 10^{-2} = \frac{(0.075+x)(x)}{(0.075-x)}$$

TOTAL

$$[H^+] = 0.075 M + 0.0093 M$$

$$= 0.0843 M$$

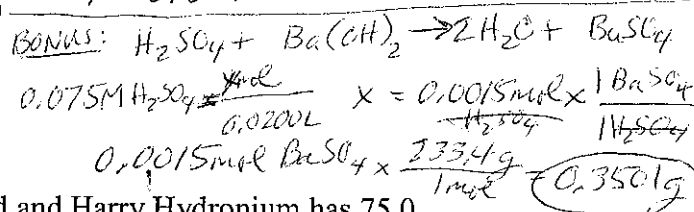
$$pH = -\log(0.0843)$$

$$pH = 1.07$$

$$9 \times 10^{-4} - 0.012x = 0.075x + x^2$$

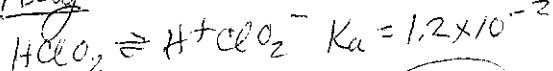
$$x^2 + 0.087x - 9 \times 10^{-4} = 0$$

$$x = 0.00934174$$



7. Ally Acid has 50.0 mL of 0.25 M chlorous acid and Harry Hydronium has 75.0 mL of 0.15 M hypochlorous acid. What are the pH values of the two solutions separately? What will be the pH if they mix their solutions together?

Ally



I	0.25	—	—
C	-x	+x	+x
E	0.25-x	x	x

$$1.2 \times 10^{-2} = \frac{(x)(x)}{(0.25-x)}$$

$$x^2 + 0.012x - 0.003 = 0$$

$$x = 0.049$$

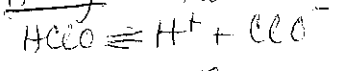
$$pH = 1.3$$

mol = M · L

$$= 0.25 M \cdot 0.050 L$$

$$= 0.0125 \text{ mol}$$

Harry



I	0.15	—	—
C	-x	+x	+x
E	0.15-x	x	x

$$3.5 \times 10^{-8} = \frac{(x)(x)}{(0.15-x)}$$

$$x^2 + 0.0012x - 0.0012 = 0$$

$$x = 0.0011$$

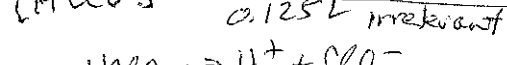
$$pH = 4.14$$

$$x \approx 7.25 \times 10^{-5}$$

MIX

$$[HClO_2] = \frac{0.0125 \text{ mol}}{0.125 L} = 0.1 M$$

$$[HClO] = \frac{0.01125 \text{ mol}}{0.125 L} = 0.09 M$$



I	0.1	—	—
C	-x	+x	+x
E	0.1-x	x	x

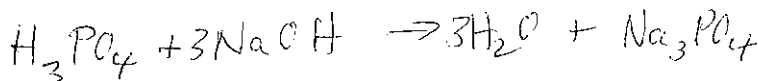
$$1.2 \times 10^{-2} = \frac{(x)(x)}{(0.1-x)}$$

$$x^2 + 0.012x - 0.0012 = 0$$

$$x = 0.0011$$

$$pH = 1.54$$

8. A 12.5 mL sample of phosphoric acid is titrated using 0.1 M NaOH. If the analyte is neutralized by 48.2 mL of titrant, what is the concentration of the original phosphoric acid?



$$0.1 M = \frac{x}{0.0482 L}$$

$$M = \frac{0.00161 \text{ mol}}{0.0125 L} = 0.13 M$$

$$x = 0.00482 \text{ mol}$$

$$0.00482 \text{ mol} \times \frac{1}{3} = 0.00161 \text{ mol } H_3PO_4$$

6. Calculate the pH of a 0.075 M solution of sulfuric acid. Also, calculate the equilibrium concentration of the sulfate ion.

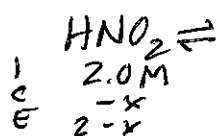
(BONUS: What mass of solid barium hydroxide would be needed to completely neutralize 20.0 mL of this acid? What mass of precipitate would be formed during the neutralization?)

1st dissociation.

7. Ally Acid has 50.0 mL of 0.25M chlorous acid and Harry Hydronium has 75.0 mL of 0.15M hypochlorous acid. What are the pH values of the two solutions separately? What will be the pH if they mix their solutions together?

8. A 12.5 mL sample of phosphoric acid is titrated using 0.1 M NaOH. If the analyte is neutralized by 48.2 mL of titrant, what is the concentration of the original phosphoric acid?

9. What is the pH of a buffer solution containing 2.0 M nitrous acid and 2.0 M potassium nitrite? What will the pH be after adding 0.1 M of perchloric acid?



$$4.5 \times 10^{-4} = \frac{(x)(2+x)}{(2-x)} \approx x$$

($x = 4.5 \times 10^{-4}$, even when solved)

$$\text{pH} = -\log(4.5 \times 10^{-4})$$

pH = 3.3

HClO_4 is a **STRONG** Acid
If all H^+ from SA is combined w/ NO_2^- then a new $[\text{HNO}_2]$ \rightarrow eq. prob is done, pH is still about **3.3**

10. Indicate whether each of the following compounds would be classified as an acidic oxide, basic oxide, or amphoteric oxide;

Oxide	A, B or Amph?	Explanation
SO_3	A	$\text{SO}_3 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{SO}_4 \rightleftharpoons \text{H}^+ + \text{HSO}_4^-$ Oxides of non-metals are acidic* unless the non-metal has LOW ox. st.
Na_2O	B	$\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH}$ Oxides of metals tend to be basic**
SrO	B	$\text{SrO} + \text{H}_2\text{O} \rightarrow \text{Sr}(\text{OH})_2$ Oxides of metals tend to be basic.**
Al_2O_3	Amp	
Br_2O_7	A	$\text{Br}_2\text{O}_7 + \text{H}_2\text{O} \rightleftharpoons 2\text{HBrO}_4 \rightleftharpoons 2\text{H}^+ + 2\text{BrO}_4^-$ Oxides of non-metals are acidic.*

such as CO_2
NO - these are "none of the above"

* Non-metals have relatively high electronegativities which make the O-H bond susceptible to dissociation.

** The low electronegativities of metals make the Met-OH bond sus. to dissociation.