

Name: _____

Chapter 14 Review Problems

I) Write the dissociation reaction for each of the following acids in water, and identify the conj. acid/base pairs.

a.) Formic acid (HCOOH)

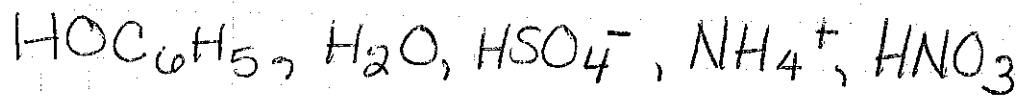
b.) perchloric acid (HClO_4)

II) Write an equilibrium expression for a & b above.

a.)

b.)

III) Arrange the following acids in order of increasing strength. (Table 14.2)



Strong \leftarrow \rightarrow Weak (1)



IV) at 10°C , $K_w = 2.9 \times 10^{-15}$, find $[\text{H}^+]$ or $[\text{OH}^-]$ for the following.

a) $[\text{OH}^-] = 9.3 \times 10^{-4} \text{ M}$, is solution acid or base?

b) find $[\text{H}^+]$ & $[\text{OH}^-]$ for neutral solution.

c) Find $[\text{OH}^-]$ if $[\text{H}^+] = 6.7 \times 10^{-11} \text{ M}$, is the solution an acid or a base?

V) Calculate $[\text{Cl}^-]$ if $\text{pHCl} = 7.32$

b) Calculate the missing data to complete the table.

	<u>pH</u>	<u>pOH</u>	<u>$[\text{H}^+]$</u>	<u>$[\text{OH}^-]$</u>
<u>A</u>	<u>6.88</u>	<u> </u>	<u> </u>	<u> </u>
<u>B</u>	<u> </u>	<u> </u>	<u> </u>	<u>8.4×10^{-14}</u>
<u>C</u>	<u> </u>	<u>3.11</u>	<u> </u>	<u> </u>
<u>D</u>	<u> </u>	<u> </u>	<u>1.0×10^{-7}</u>	<u> </u>



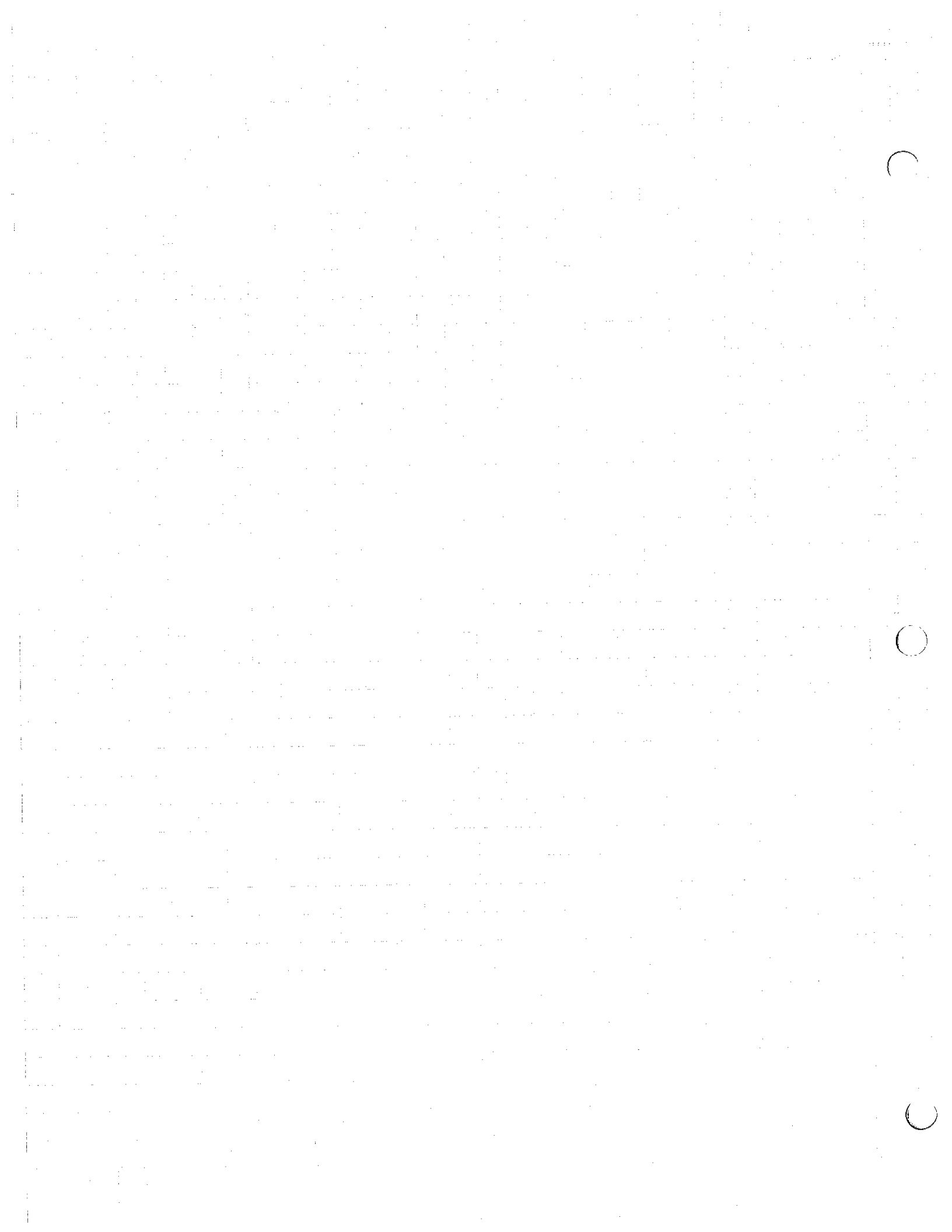
VI)

a.) Find pH and $[\text{OH}^-]$ of $5.0 \times 10^{-3} \text{ M}$ HClO_4

* b.) A solution is prepared by adding 15.8 g HCl to 400 ml of H_2O . What is the pH of the solution? How much H^+ ion is contributed by the autoionization of water?

II) The value of K_a for Citric acid ($\text{C}_6\text{H}_8\text{O}_7$) is 7.5×10^{-4} . Calculate pH for 0.200 M of Citric acid.

b.) Calculate pH of a 0.35 M solution of CH_3NH_2
 $K_b = 4.38 \times 10^{-4}$



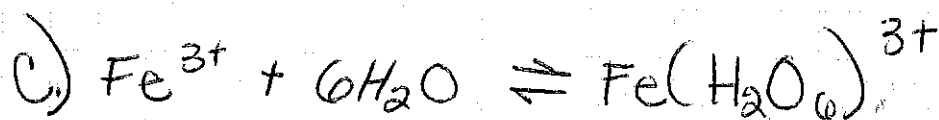
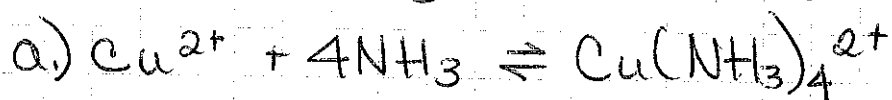
Define : Lewis acid :

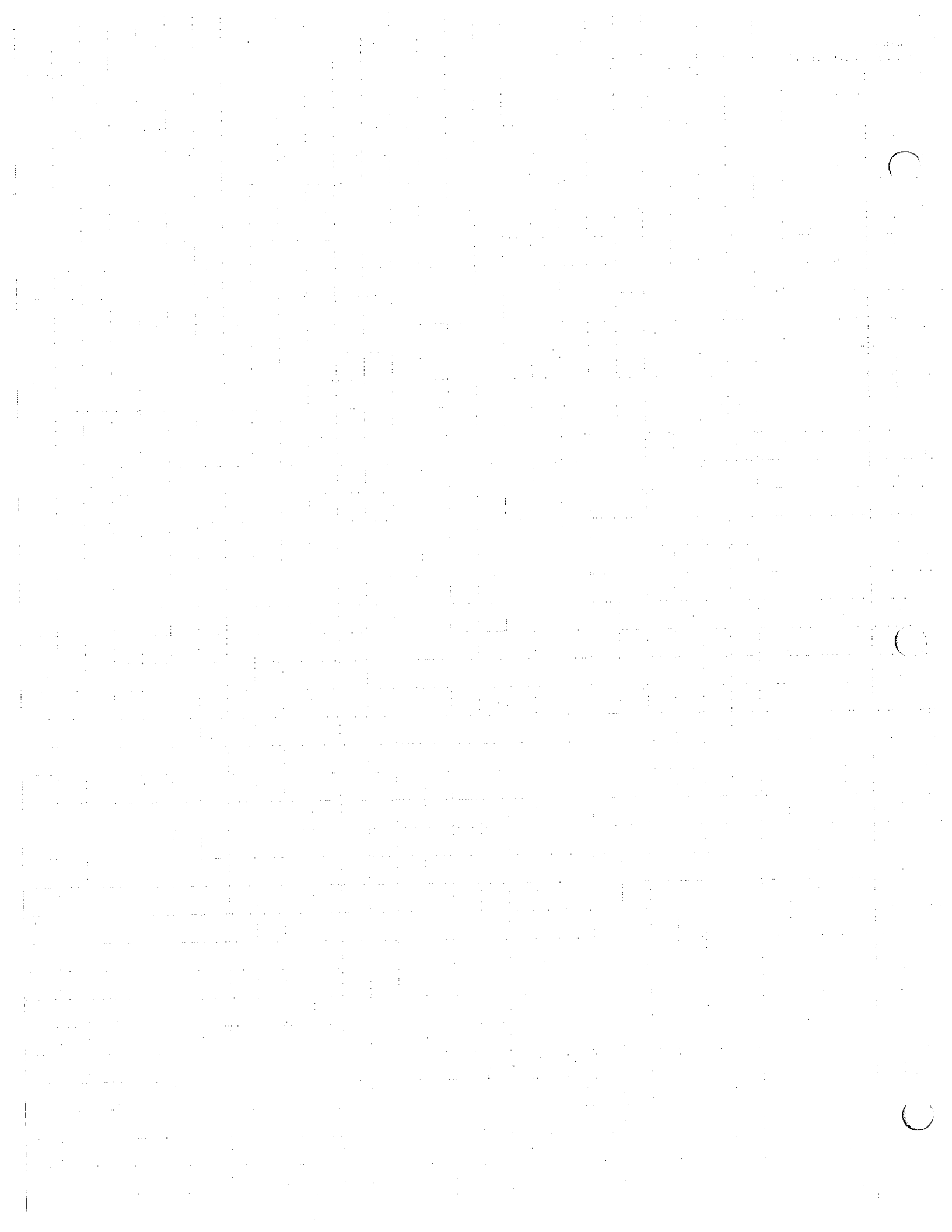
Lewis Base :

Bronsted-Lowery acid :

Bronsted Lowery bases

• Identify the Lewis acid and base in each of the following reactions. (Hint: draw Lewis structure)



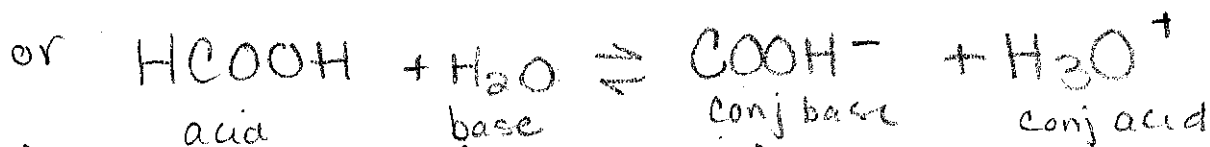
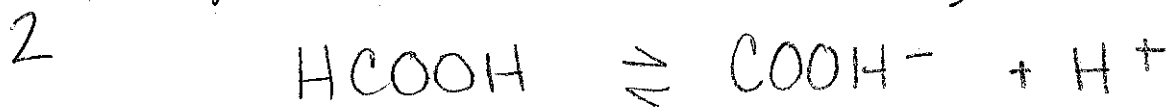


Name: Key

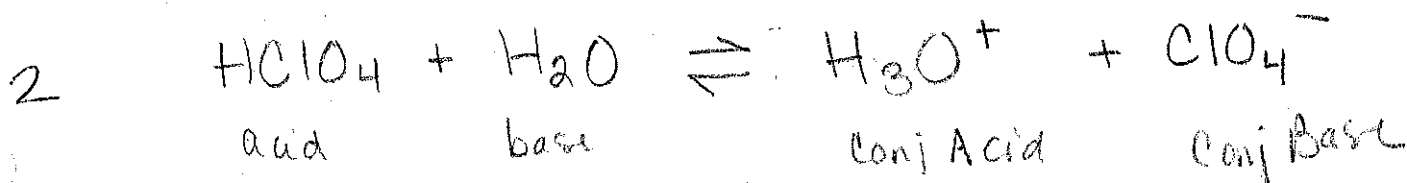
Chapter 14 Review Problems

I) Write the dissociation reaction for each of the following acids in water, and identify the conj. acid/base pairs.

a.) Formic acid (HCOOH)



b.) perchloric acid (HClO_4)

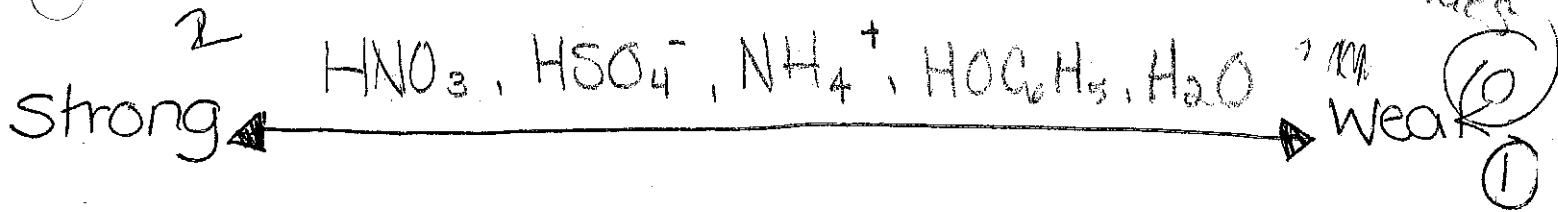


II) write an equilibrium expression for a & b above.

$$2 \quad \text{a.)} \quad \frac{[\text{COOH}^-][\text{H}_3\text{O}^+]}{[\text{HCOOH}]} = K_a$$

$$2 \quad \text{b.)} \quad \frac{[\text{ClO}_4^-][\text{H}_3\text{O}^+]}{[\text{HClO}_4]}$$

III) arrange the following acids in order of increasing strength. (Table 14.2)



IV) at 10°C , $K_w = 2.9 \times 10^{-15}$, find $[\text{H}^+]$ or $[\text{OH}^-]$ for the following.

a) $[\text{OH}^-] = 9.3 \times 10^{-4} \text{ M}$, is solution acid or base?

$$K_w = \frac{[\text{H}^+]}{[\text{OH}^-]} = \frac{2.9 \times 10^{-15}}{9.3 \times 10^{-4}} = \boxed{3.1 \times 10^{-12} \text{ M}}$$

b) find $[\text{H}^+]$ & $[\text{OH}^-]$ for neutral solution. base

Let $X = [\text{H}^+]$ $\therefore 2.9 \times 10^{-15} = X^2$

$[\text{H}^+] = [\text{OH}^-]$

$X = \boxed{5.4 \times 10^{-8}}$

c) Find $[\text{OH}^-]$ if $[\text{H}^+] = 6.7 \times 10^{-11} \text{ M}$. Is the solution an acid or a base? neutral

$$\frac{2.9 \times 10^{-15}}{6.7 \times 10^{-11}} = \boxed{4.3 \times 10^{-5} \text{ M}}$$

basic

V) Calculate $[\text{Cl}^-]$ if $\text{pHCl} = 7.32$

$\text{pH} = -\log [\text{H}^+]$

$10^{-7.32} = \text{pH} = \boxed{4.8 \times 10^{-8}}$

b) Calculate the missing data to complete the table.

	<u>pH</u>	<u>pOH</u>	<u>$[\text{H}^+]$</u>	<u>$[\text{OH}^-]$</u>
<u>A</u>	<u>6.88</u>	<u>7.12</u>	<u>1.3×10^{-7}</u>	<u>7.6×10^{-8}</u>
<u>B</u>	<u>0.92</u>	<u>13.08</u>	<u>0.12</u>	<u>8.4×10^{-14}</u> 10
<u>C</u>	<u>10.89</u>	<u>3.11</u>	<u>1.3×10^{-11}</u>	<u>7.8×10^{-4}</u>
<u>D</u>	<u>7.00</u>	<u>7.00</u>	<u>1.0×10^{-7}</u>	<u>1.0×10^{-7}</u> 2

VI)

a) Find pH and $[OH^-]$ of $5.0 \times 10^{-3} M$ $HClO_4$

$pH = -\log [HClO_4]$

$= -\log [5.0 \times 10^{-3}]$ $pH = 2.3$

Strong acid dissociate 100%

$[OH^-] = \frac{K_w}{[H^+]} = \frac{1.0e^{-14}}{5e^{-3}} = 2.1e^{-12} M [OH^-]$

b) A solution is prepared by adding 15.8g HCl to 400ml of H_2O . What is the pH of the solution? How much H^+ ion is contributed by the autoionization of water?

$[HCl]_0 = \frac{15.8g}{0.4L} \times \frac{1mol}{36.5g} = 1.08 M HCl$

diss. 100% $pH = -\log [H^+] = -\log [1.08] = -0.033$

$K_w = [H^+][OH^-]$ only place to get OH⁻ from H₂O

$1.0 \times 10^{-14} = [1.08][OH^-]$

$[OH^-] = 9.3 \times 10^{-15} M$

autoionization $H_2O \rightarrow OH^- + H^+$

$\therefore [H^+] = 9.3 \times 10^{-15} M$

H^+ from $H_2O = 1.0 \times 10^{-7} M$

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The value of K_a for Citric acid ($C_6H_7O_8$) is 7.5×10^{-4} . Calculate pH for 0.200 M of Citric acid (HCA)



Weak

200	0	0
-x	+x	+x
200 - x	x	x
$\frac{x^2}{0.200 - x}$		

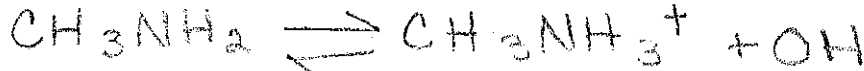
$7.5e^{-4} = \frac{x^2}{0.200}$

quad. \therefore

$x = 1.22e^{-2} M$

$[H^+] = 1.18e^{-2}$
 $pH = 1.93$

b) Calculate pH of a 0.35M solution of CH_3NH_2 $K_a = 4.38 \times 10^{-4}$



0.35	0	0
-x	+x	+x
0.35 - x	x	x

$4.38e^{-4} = \frac{x^2}{0.35}$

$x = 0.0124 M$

$pH = -\log (0.0124)$

16
3

Define = Lewis acid:

1 * electron acceptor

Lewis Base:

1 * electron donor

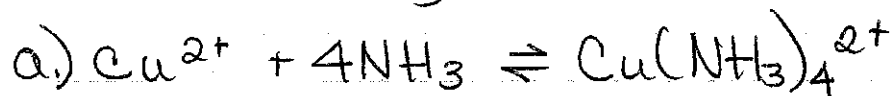
Bronsted-Lowery acid:

1 * proton ~~acceptor~~
Donate

1 Bronsted Lowery base:

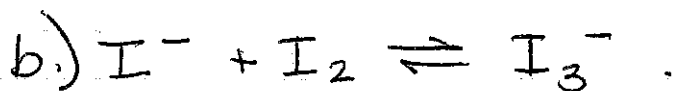
* proton ~~donor~~
accept

• Identify the Lewis acid and base in each of the following reactions. (Hint: draw Lewis structure)



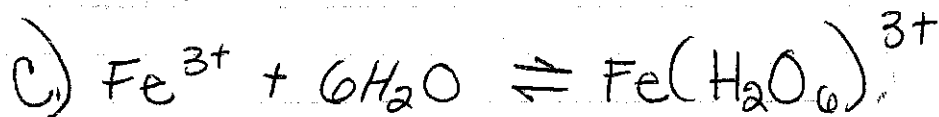
LA LB

2



LB LA

2



LA LB

2

10

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