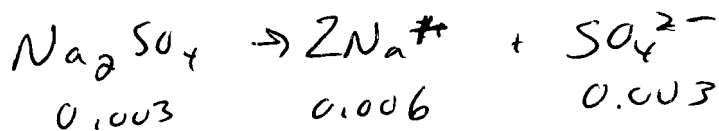
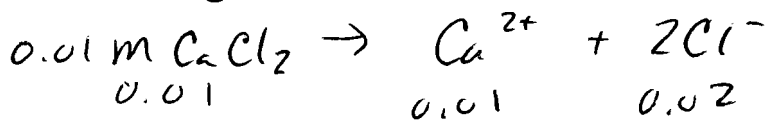


What is  $\mu$  for a mix of  
 $0.01 \text{ M CaCl}_2 + 0.003 \text{ M Na}_2\text{SO}_4$



$$\mu = \frac{1}{2} \left[ \sum c_i z_i^2 \right]$$

$$= \frac{1}{2} \left[ (0.01)(2^2) + (0.02)(-1)^2 + (0.006)(+1)^2 + (0.003)(-2)^2 \right]$$

$$\boxed{\mu = 0.039}$$

pH 1, 3, 36 mL of 0.08 M HCl  
 with 35 mL 0.07 M NaOH

$$35 \text{ mL } 0.07 \text{ M NaOH} = 2.45 \text{ mmol Base}$$

$$1 \text{ mL } 0.08 \text{ M HCl} = \underline{0.08 \text{ mmol Acid}}$$

$$\underline{36 \text{ mL total}} \quad 2.37 \text{ mmol Base}$$

$$\frac{2.37 \text{ mmol Base}}{36 \text{ mL total}} = 0.065 \text{ M Base}$$

$$\text{pOH} = 1.18$$

$$\boxed{\text{pH} = 12.82}$$

$$3 \text{ mL } 0.08 \text{ Acid} = 0.24 \text{ mmol Acid}$$

$$35 \text{ mL } 0.07 \text{ Base} = \underline{2.45 \text{ mmol Base}}$$

$$\frac{2.21 \text{ mmol Base}}{38 \text{ mL Soln}} = 0.0582 \text{ M Base}$$

$$\text{pOH} = 1.24$$

$$\boxed{\text{pH} = 12.76}$$

$$36 \text{ mL } 0.08 \text{ M Acid} = 2.88 \text{ mmol Acid}$$

$$\underline{35 \text{ mL } 0.07 \text{ M Base}} = \underline{2.45 \text{ mmol Base}}$$

$$71 \text{ mL}$$

$$\frac{0.43 \text{ mmol Acid}}{71 \text{ mL}} = \leftarrow 0.0061 \text{ M Acid}$$

$$\boxed{\text{pH} = 2.22}$$

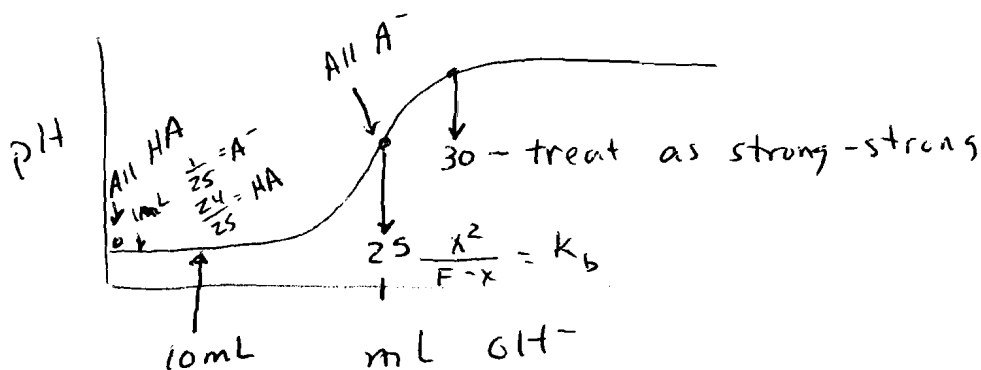
3) 1, 10, 25, 30 mL of 0.1 M NaOH  
 to 25 mL of 0.1 M weak acid  
 with a  $K_a$  of  $4 \times 10^{-6}$  ( $pK_a = 5.4$ )

$$pH = pK_a + \log \frac{[A^-]}{[HA]}$$

$$V_e = (x \text{ mL})(0.1 \text{ M Base}) = (25 \text{ mL})(0.1 \text{ M Acid})$$

$$V_e = 25 \text{ mL Base added}$$

So at  $V_e$  All HA is  $A^-$



$$\frac{10}{25} = A^-$$

$$\frac{15}{25} = HA$$

---

1 mL  $pH = 5.4 + \log \frac{\frac{1}{25}}{\frac{24}{25}}$  ( $\frac{x}{x}$  log term = -1.38)

$$pH = 5.4 - 1.38 = \boxed{4.02}$$

---

10 mL  $pH = 5.4 + \log \frac{10}{25}$

$$pH = 5.4 + \left(-\frac{15}{25}\right) = \boxed{5.22}$$

---

25 mL All  $A^-$   $(50 \text{ mL})(x \text{ M}) = (25 \text{ mL})(0.1 \text{ M})$

$$\frac{x^2}{0.05 - x} = 2.5 \times 10^{-9}$$

$K_b K_a = K_w$   
 $K_b = \frac{1 \times 10^{-14}}{4 \times 10^{-6}} = 2.5 \times 10^{-9}$

$$x^2 = (2.5 \times 10^{-9})(0.05 - x)$$

ignore

$$x^2 = 1.25 \times 10^{-10}$$

$$x = 1.118 \times 10^{-5}$$

$$pOH = 4.95$$

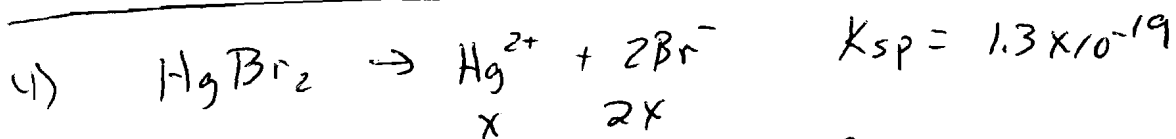
$$pH = \boxed{9.05}$$

3) 
$$\begin{array}{r} 30 \text{ mL} \\ 25 \text{ mL} \\ \hline 55 \text{ mL} \end{array}$$

$0.1 \text{ M NaOH} = 3 \text{ mmol Base}$   
 $0.1 \text{ M Acid} = 2.5 \text{ mmol Acid}$   
 $\hline 0.5 \text{ mmol Base}$

$\frac{0.5 \text{ mmol Base}}{55 \text{ mL}} = 9.09 \times 10^{-3} \text{ pH} = 2.04$

$\text{pH} = 11.95$

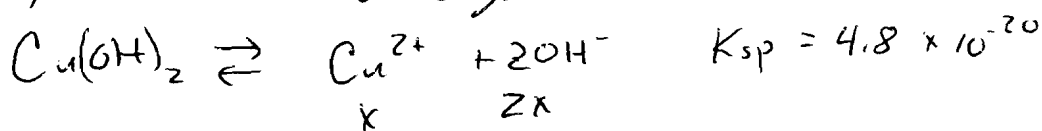


$(x)(2x)^2 = 1.3 \times 10^{-19}$

$4x^3 = 1.3 \times 10^{-19}$

$x = 3.019 \times 10^{-7} = [\text{Hg}^{2+}]$

5) Using activities where  $\mu = 0.05$



$(x)(2x)^2 \gamma_{\text{Cu}^{2+}} \gamma_{\text{OH}^-}^2 = 4.8 \times 10^{-20}$

$4x^3 (0.485)(0.81)^2 = 4.8 \times 10^{-20}$

$x = 3.35 \times 10^{-7} = [\text{Cu}^{2+}]$

6) pH of 0.1 M HCl = 0.98  $\gamma_{\text{H}^+} = ?$

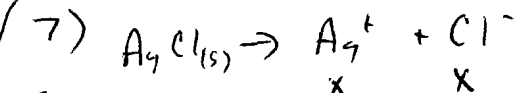
$\text{pH} = -\log [\text{H}^+] (\gamma_{\text{H}^+})$

$0.98 = -\log \text{H}^+ \gamma_{\text{H}^+}$

$-0.98 = \log [\text{H}^+] \gamma_{\text{H}^+}$

$10^{-0.98} = 0.1 (\gamma_{\text{H}^+})$

$1.047 = \gamma_{\text{H}^+}$



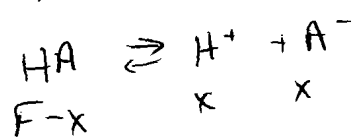
I	$x$	$x$
C		+ 0.01
E	$x$	$(x + 0.01)$

$(x) \gamma_{\text{Ag}^+} (\cancel{x} + 0.01) \gamma_{\text{Cl}^-} = 1.8 \times 10^{-10}$

$(x)(0.898)(0.01)(0.899) = 1.8 \times 10^{-10}$

$x = 2.23 \times 10^{-8}$

8) pH of 0.08 M Acid  $K_a = 1.8 \times 10^{-5}$



F-x

x

x

$$\frac{x^2}{F-x} = K_a$$

$$\frac{x^2}{0.08 - x} = K_a$$

$$x^2 = (0.08)(1.8 \times 10^{-5})$$

$$x = 2.2 \times 10^{-3} = 0.0022$$

$$\text{pH} = 2.92$$

a) pH of 0.08 M Base  $K_a = 5.7 \times 10^{-10}$

$$\frac{1 \times 10^{-14}}{5.7 \times 10^{-10}} = K_b$$

$$K_b = 1.75 \times 10^{-5}$$

$$K_a K_b = K_w$$

~~$$\frac{x^2}{0.08 - x} = K_b$$~~



I 0.08

+x

+x

C -x

x

x

E 0.08-x

$$\frac{x^2}{0.08 - x} = 1.75 \times 10^{-5}$$

$$x^2 = (1.75 \times 10^{-5})(0.08)$$

$$x^2 = 1.4 \times 10^{-6}$$

$$x = 1.18 \times 10^{-3}$$

$$\text{pOH} = 2.92$$

$$\text{pH} = 11.07$$