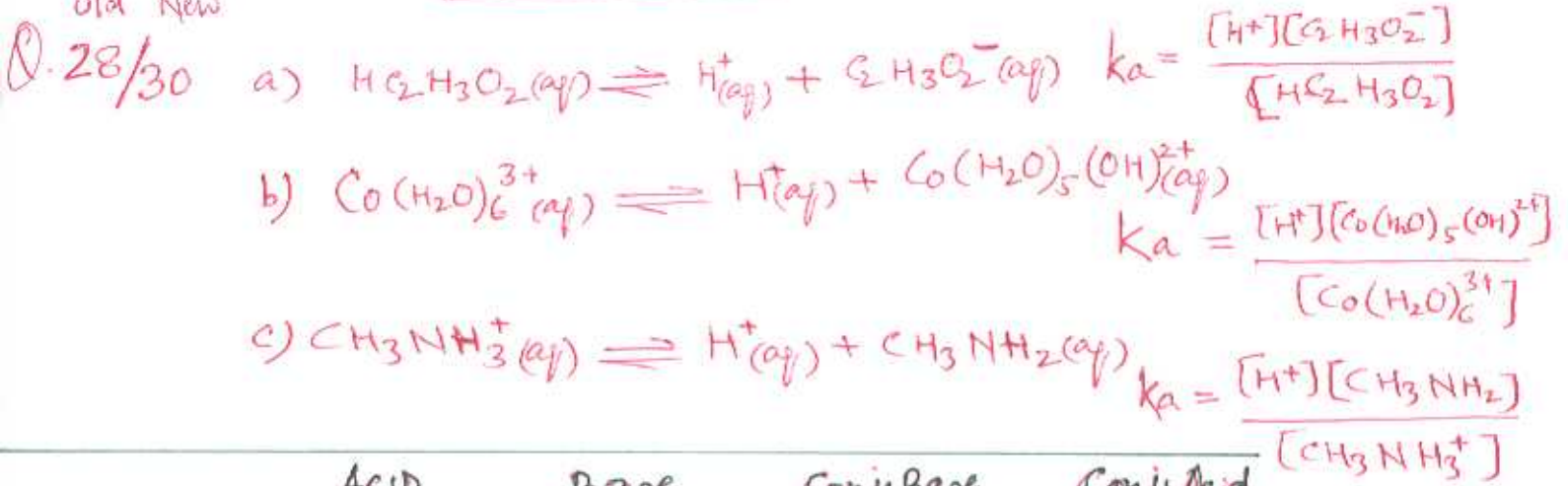


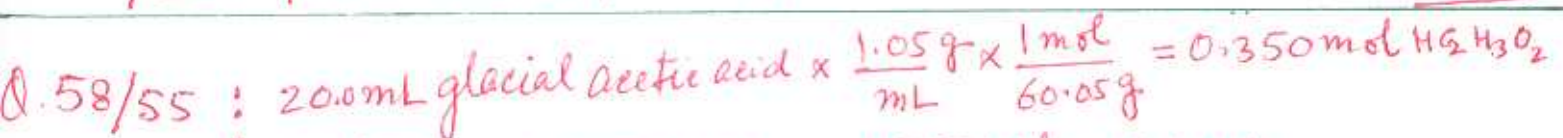
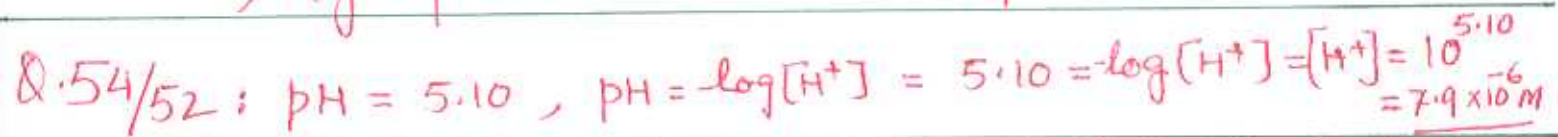
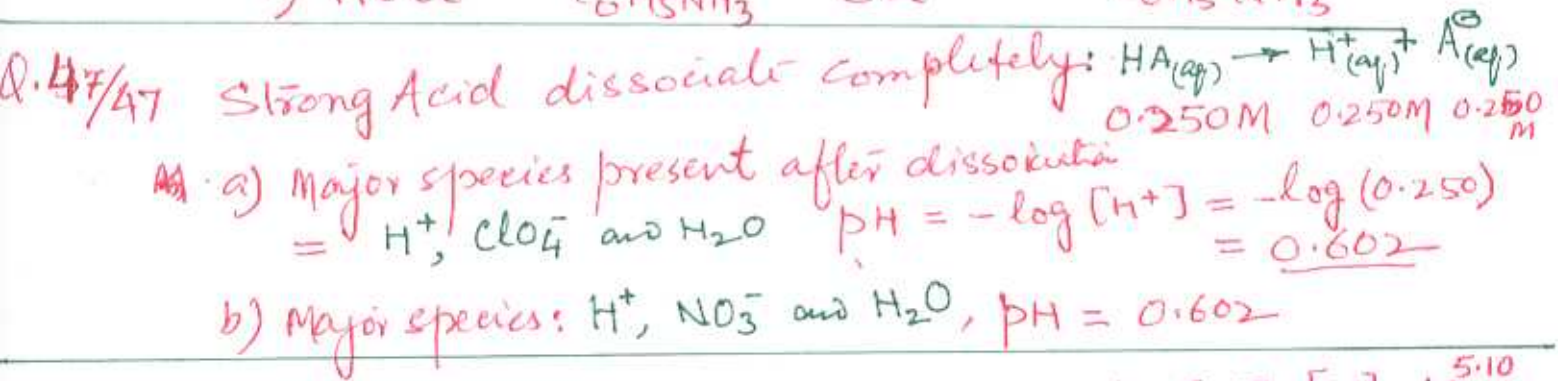
# HOME WORK SOLUTION CH# 14 ①

Old New

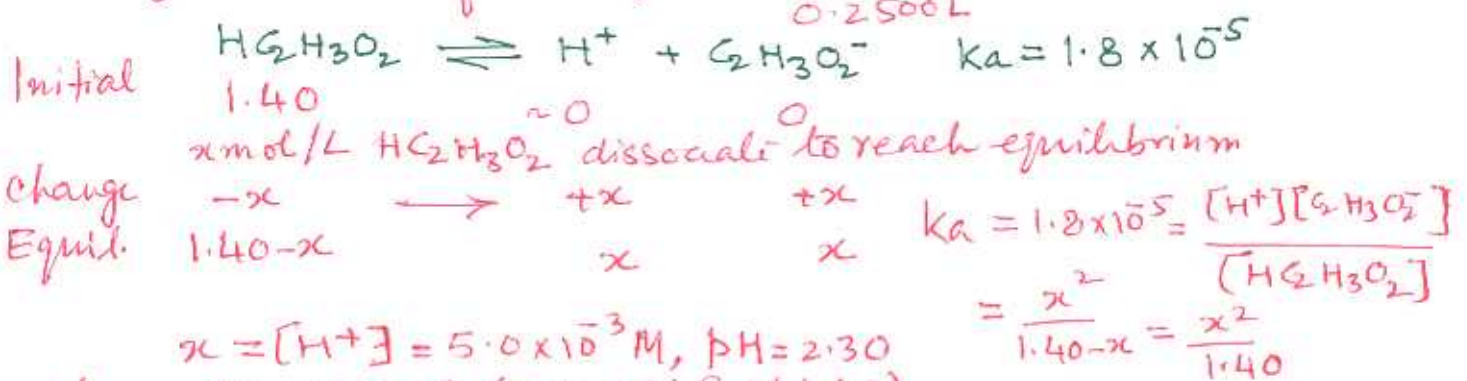


Q. 30/32

|    | <u>ACID</u>                            | <u>Base</u>                       | <u>Conj. Base</u>                                 | <u>Conj. Acid.</u>                  |
|----|--|-----------------------------------|---|-------------------------------------|
| a) | $\text{Al}(\text{H}_2\text{O})_6^{3+}$ | $\text{H}_2\text{O}$              | $\text{Al}(\text{H}_2\text{O})_5(\text{OH})^{2+}$ | $\text{H}_3\text{O}^+$              |
| b) | $\text{HONH}_3^+$                      | $\text{H}_2\text{O}$              | $\text{HONH}_2$                                   | $\text{H}_3\text{O}^+$              |
| c) | $\text{HOCl}$                          | $\text{C}_6\text{H}_5\text{NH}_2$ | $\text{OCl}^-$                                    | $\text{C}_6\text{H}_5\text{NH}_3^+$ |



Initial concn. of  $\text{HC}_2\text{H}_3\text{O}_2 = \frac{0.350 \text{ mol}}{0.2500 \text{ L}} = 1.40 \text{ M}$



$x = [\text{H}^+] = 5.0 \times 10^{-3} \text{ M}$ ,  $\text{pH} = 2.30$

Assumption is good ( $x$  is 0.36% of 1.40)

old New  
Q.66/64

2

a)  $\text{HNO}_3$  is strong acid; it is assumed 100% dissociated in solution.

b) Nitrous acid:  $\text{HNO}_2 \rightleftharpoons \text{H}^+ + \text{NO}_2^-$   $K_a = 4.0 \times 10^{-4}$

|         |  |     |   |
|---------|--|-----|---|
| Initial | 0.20 M   | ~0  | 0 |
|         | $x$ mol/L $\text{HNO}_2$ dissociate to reach equilibrium |     |   |
| Change  | -x   | → x | x |
| Equil.  | 0.20-x   | x   | x |

$$K_a = \frac{[\text{H}^+][\text{NO}_2^-]}{[\text{HNO}_2]} = \frac{[x]^2}{0.20-x} = \frac{[x]^2}{0.20} = 4.0 \times 10^{-4}$$

$x = [\text{H}^+] = [\text{NO}_2^-] = 8.9 \times 10^{-3} \text{ M}$ ; Assumption good.

% Dissociation;  $\% = \frac{[\text{H}^+]}{[\text{HNO}_2]_0} \times 100 = \frac{8.9 \times 10^{-3}}{0.20} = 4.5\%$

c)  $\text{HO}_6\text{H}_5 \rightleftharpoons \text{H}^+ + \text{O}_6\text{H}_5^-$   $K_a = 1.6 \times 10^{-10}$

|         |   |      |    |
|---------|---|------|----|
| Initial | 0.20 M  | ~0   | 0  |
|         | $x$ mol/L $\text{HO}_6\text{H}_5$ dissociate to reach equilibrium |      |    |
| Change  | -x  | → +x | +x |
| Equil.  | 0.20-x  | x    | x  |

$$K_a = \frac{[\text{H}^+][\text{O}_6\text{H}_5^-]}{[\text{HO}_6\text{H}_5]}$$

$$K_a = \frac{[x^2]}{0.20-x} = 1.6 \times 10^{-10} = x = [\text{H}^+][\text{O}_6\text{H}_5^-] = 5.7 \times 10^{-6} \text{ M}$$

% Dissociation:  $\frac{5.7 \times 10^{-6}}{0.20} \times 100 = 2.9 \times 10^{-3}\%$

d) For the same initial concn, the percent dissociation increase as the strength of the acid increase (as  $K_a$  increase).

Q.84/80:

a) Major species:  $\text{Na}^+$ ,  $\text{Li}^+$ ,  $\text{OH}^-$ ,  $\text{H}_2\text{O}$  ( $\text{NaOH}$  and  $\text{LiOH}$  are both strong bases)  
 $[\text{OH}^-] = 0.050 + 0.050 = 0.100 \text{ M}$ ,  $\text{pH} = 13.00$

b) Major species:  $\text{Ba}^{2+}$ ,  $\text{Rb}^+$ ,  $\text{OH}^-$ ,  $\text{H}_2\text{O}$ ; Both  $\text{Ba}(\text{OH})_2$  and  $\text{RbOH}$  are strong bases and  $\text{Ba}(\text{OH})_2$  donate 2 mol  $\text{OH}^-$  per mol  $\text{Ba}(\text{OH})_2$   
 $[\text{OH}^-] = (2 \times 0.011) = 0.022 \text{ M}$

$\text{pOH} = -\log(0.022) = 1.66$ ;  $\text{pH} = 12.34$

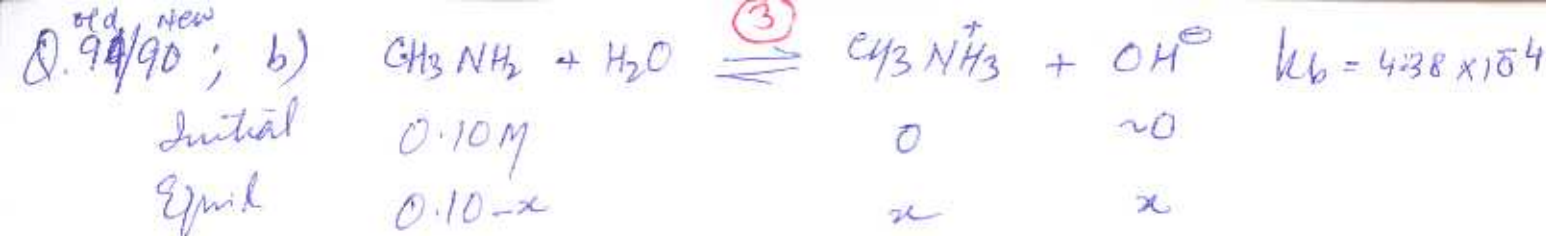
Q.94/90;

a)  ~~$\text{pH} = 10.50$~~   $\text{HONH}_2 + \text{H}_2\text{O} \rightleftharpoons \text{HONH}_3^+ + \text{OH}^-$   $K_b = 1.1 \times 10^{-8}$

|         |        |   |   |
|---------|--------|---|---|
| Initial | 0.10 M | 0 | 0 |
| Equil.  | 0.10-x | x | x |

$$1.1 \times 10^{-8} = \frac{x^2}{0.10-x} = \frac{x^2}{0.1} \quad x = [\text{OH}^-] = 3.3 \times 10^{-5} \text{ M}$$

% Ionization =  $\frac{[\text{OH}^-]}{[\text{HONH}_2]_0} \times 100 = \frac{3.3 \times 10^{-5}}{0.10} \times 100 = 0.033\%$



$$4.38 \times 10^{-4} = \frac{x^2}{0.10-x} \approx \frac{x^2}{0.10} = x = 6.6 \times 10^{-3}$$

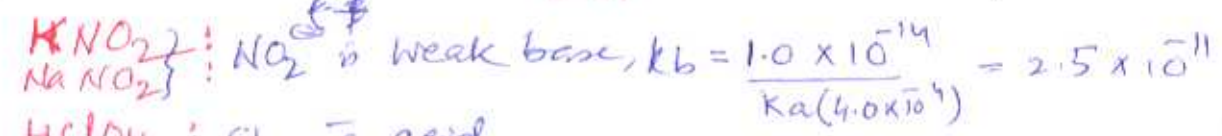
assumption fail the 5% rule (x is 6.6% of 0.10)

Using successive approximation and carrying extra significant figure.

$$\frac{x^2}{0.10-0.0066} = \frac{x^2}{0.093} = 4.38 \times 10^{-4} \quad x = 6.4 \times 10^{-3} \text{ (consistent answer)}$$

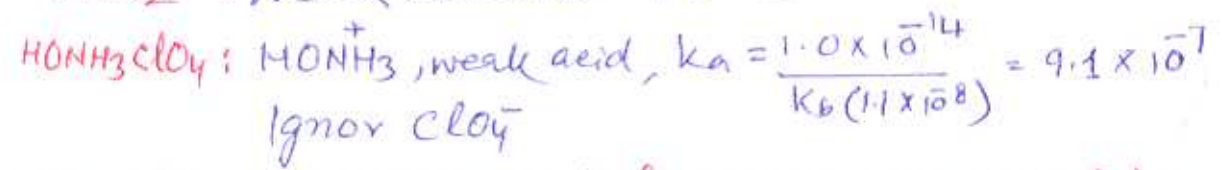
% ionization:  $\frac{6.4 \times 10^{-3}}{0.10} \times 100 = \boxed{6.4\%}$

Q. 104/100:  $(\text{CaBr}_2) \& \text{Ca}(\text{NO}_3)_2$  neutral;  $\text{Ca}^{2+}$  and  $\text{Br}^-/\text{NO}_3^-$  have no acidic/basic properties



$\text{HClO}_4$ : Strong acid

$\text{HNO}_2$ : Weak acid,  $K_a = 4.0 \times 10^{-4}$



most acidic  $\rightarrow$  most basic:  $\text{HClO}_4 > \text{HNO}_2 > \text{HONH}_3\text{ClO}_4 > \text{CaBr}_2 > \text{KNO}_2$   
 acidic  $\rightarrow$  basic

Q. 106/102: Since  $\text{NH}_3$  is a weaker base (smaller  $K_b$  value) than  $\text{CH}_3\text{NH}_2$ , the conjugate acid of  $\text{NH}_3$  will be stronger than the conjugate acid of  $\text{CH}_3\text{NH}_2$ : Thus  $\text{NH}_4^+$  is stronger acid than  $\text{CH}_3\text{NH}_3^+$ .