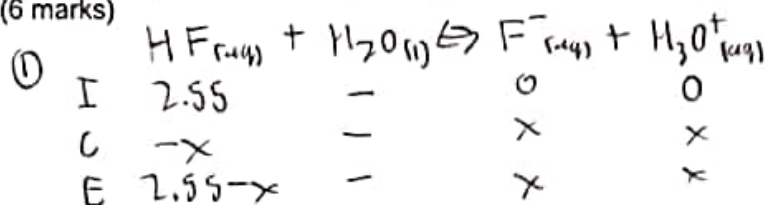


Knowledge /15	Thinking /14	Communication /8
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Chapter 8 Test - Acid-Base EquilibriumTHINKING (14 MARKS)

1. If the K_a for hydrofluoric acid, HF(aq) , is 6.6×10^{-4} , calculate the pH of a 2.55 mol/L solution of hydrofluoric acid. (6 marks)



$$\begin{aligned} \text{③ } \text{pH} &= -\log[\text{H}_3\text{O}^+] \\ &= -\log(4.10 \times 10^{-2}) \\ &= 1.387 \end{aligned}$$

$$\text{② } K_a = \frac{[\text{F}^-][\text{H}_3\text{O}^+]}{[\text{HF}]}$$

$$6.6 \times 10^{-4} = \frac{x^2}{2.55-x}$$

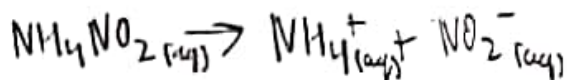
100 rule applies

$$4.10 \times 10^{-2} = x$$

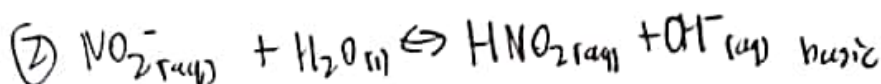
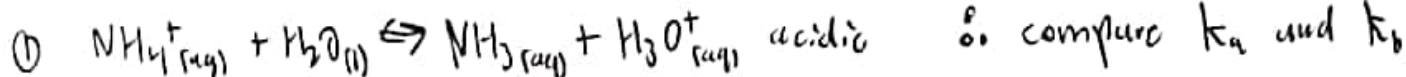
$$\therefore [\text{H}_3\text{O}^+\text{(aq)}] = 4.10 \times 10^{-2}$$

$$\therefore \text{pH of HF} = 1.387$$

2. Determine whether a solution of ammonium nitrite is acidic, basic, or neutral. Show all of your work! (4 marks)



— both are weak acid-bases



$$\text{① } K_a = 5.8 \times 10^{-10}$$

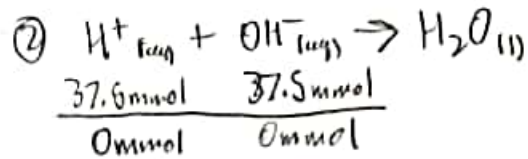
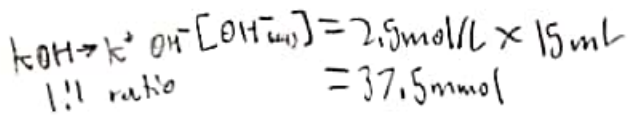
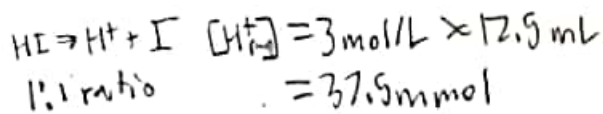
$$\text{③ } K_a > K_b \therefore \text{the solution will be acidic}$$

$$\text{② } K_b = \frac{K_w}{K_a}$$

$$= 2.2 \times 10^{-11}$$

3. What is the pH of a solution when 12.5 mL of 3.00 mol/L HI is titrated with 15 mL of 2.50 mol/L KOH? (4 marks)

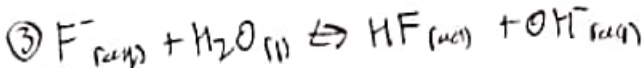
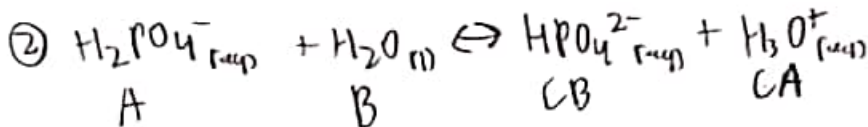
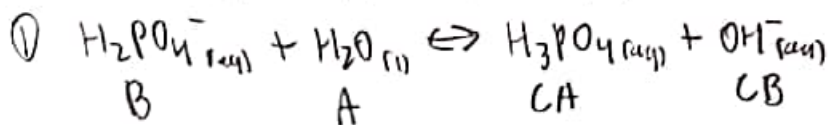
$$\textcircled{1} n = C \times V$$



\therefore as both HI and KOH are used up completely, only water is produced. therefore the solution will have a pH of 7.00 due to no H^+ and OH^- remaining

COMMUNICATION (8 MARKS)

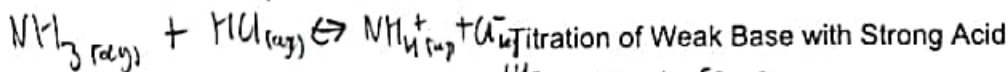
1. Show, using equations for each, how according to the Bronsted-Lowry theory, the hydrogen phosphate ion, $\text{H}_2\text{PO}_4^- (\text{aq})$ is amphiprotic, whereas the fluoride ion, F^- , is not. Label in your equations for H_2PO_4^- what are the acid (A), base (B), conjugate acid (CA), and conjugate base (CB). (4 marks)



\therefore in $\textcircled{1}$, H_2PO_4^- acts as a base as it accepts a hydrogen atom (proton)
in $\textcircled{2}$, H_2PO_4^- acts as an acid as it donates a proton
in $\textcircled{3}$, F^- can only accept protons and therefore is not amphiprotic and only acidic

2. You are given a solution of $\text{NH}_3 (\text{aq})$ that has a concentration of 0.10 M. The solution was titrated with 0.10 M $\text{HCl} (\text{aq})$. Sketch a titration curve below, showing the following: (4 marks)

- The stoichiometric (equivalence) point (approximate pH)
- The region corresponding to the buffering action of the weak base
- The endpoint of the titration.



NH_3 weak base
 HCl strong acid

