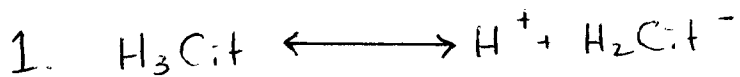


Acid #6

Answer key.



$$K_a = \frac{[\text{H}^+][\text{H}_2\text{Cit}^-]}{[\text{H}_3\text{Cit}]} = 8.4 \times 10^{-4}$$

$$[\text{H}^+] = \text{antilog}(-2.10) = 7.94 \times 10^{-3} \text{ M}$$

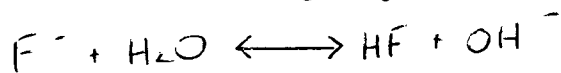
$$[\text{H}_2\text{Cit}^-] = [\text{H}^+] = 7.94 \times 10^{-3} \text{ M}$$

$$[\text{H}_3\text{Cit}] = [\text{H}_3\text{Cit}]_{\text{initial}} - [\text{H}^+]$$

$$K_a = \frac{(7.94 \times 10^{-3})^2}{[\text{H}_3\text{Cit}]_{\text{initial}} - 7.94 \times 10^{-3}} = 8.4 \times 10^{-4}$$

$$[\text{H}_3\text{Cit}]_{\text{initial}} = \underline{\underline{8.3 \times 10^{-2} \text{ M}}}$$

2. NaF: Na^+ does not hydrolyze



$$K_b = \frac{[\text{HF}][\text{OH}^-]}{[\text{F}^-]} = \frac{K_w}{K_a(\text{HF})} = \frac{1.0 \times 10^{-14}}{3.5 \times 10^{-4}} = 2.86 \times 10^{-11}$$

let $x = [\text{OH}^-]$

then $[\text{HF}] = x$

and $[\text{F}^-] = 1.0 \text{ M} - x$

$\approx 1.0 \text{ M}$ if x is small

$$2.86 \times 10^{-11} = \frac{x^2}{1.0}$$

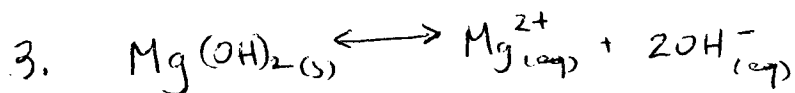
$$[\text{OH}^-] = x = 5.35 \times 10^{-6} \text{ M}$$

$$\text{pOH} = 5.272$$

$$\underline{\underline{\text{pH} = 8.73}}$$

Acid 6 cont^d.

Answer key:



$$K_{sp} = [\text{Mg}^{2+}][\text{OH}^{-}]^2 = 1.8 \times 10^{-11}$$

$$\text{let } [\text{Mg}^{2+}] = x$$

$$\text{then } [\text{OH}^{-}] = 2x$$

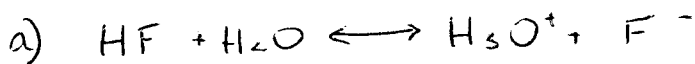
$$K_{sp} = 4x^3 = 1.8 \times 10^{-11}$$

$$x = 1.65 \times 10^{-4} \text{ M}$$

$$[\text{OH}^{-}] = 2x = 3.30 \times 10^{-4} \text{ M}$$

$$\text{pOH} = 3.481$$

$$\underline{\underline{\text{pH} = 10.52}}$$



$$K_a = \frac{[\text{H}_3\text{O}^{+}][\text{F}^{-}]}{[\text{HF}]} = 3.5 \times 10^{-4}$$

$$[\text{H}_3\text{O}^{+}] = \text{antilog}(-2.21) = 6.17 \times 10^{-3} \text{ M}$$

$$[\text{F}^{-}] = [\text{H}_3\text{O}^{+}] = 6.17 \times 10^{-3} \text{ M}$$

$$[\text{HF}] = (2.09/\text{L} \div 20 \text{ g/mol}) = 6.17 \times 10^{-3} \text{ M} = 9.38 \times 10^{-2} \text{ M}$$

$$K_a = \frac{(6.17 \times 10^{-3})^2}{9.38 \times 10^{-2}} = \underline{\underline{4.1 \times 10^{-4}}}$$

$$b) \quad \% \text{ dissociation} = \frac{6.17 \times 10^{-3}}{(2.09/\text{L} \div 20 \text{ g/mol})} \times 100 = \underline{\underline{6.27\%}}$$

$$5. \quad \text{pH range } 8.2 - 10.0$$

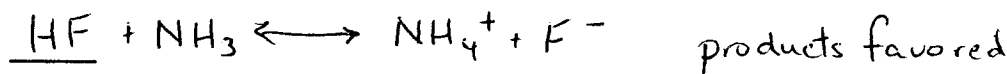
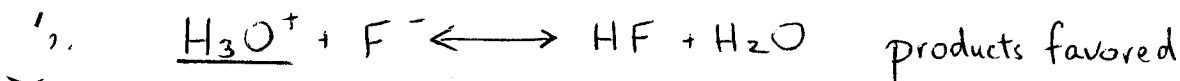
$$\text{pOH range } 5.8 - 4.0$$

$$[\text{OH}^{-}] \text{ range } 1.5 \times 10^{-6} \text{ M to } 1.0 \times 10^{-4} \text{ M a difference of } 9.35 \times 10^5 \text{ M}$$

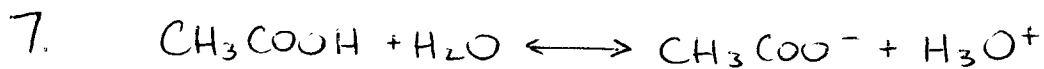
$$\underline{\underline{\text{or } 1 \times 10^4 \text{ M}}}$$

Acid # 6 cont'd

Answer key



Stronger acid underlined



$$K_a = \frac{[\text{CH}_3\text{COO}^-][\text{H}_3\text{O}^+]}{[\text{CH}_3\text{COOH}]} = 1.8 \times 10^{-5}$$

$$[\text{H}_3\text{O}^+] = \text{anti. log}(-3.2) = 6.3 \times 10^{-4} \text{ M}$$

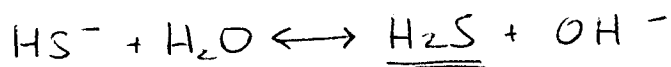
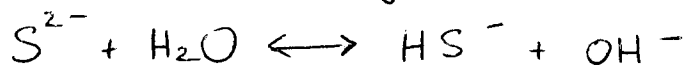
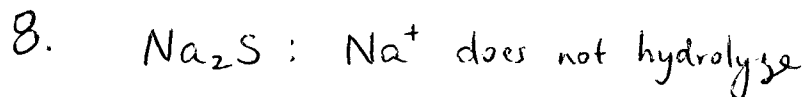
$$[\text{CH}_3\text{COO}^-] = [\text{H}_3\text{O}^+] = 6.3 \times 10^{-4} \text{ M}$$

$$[\text{CH}_3\text{COOH}] = [\text{CH}_3\text{COOH}]_{\text{initial}} - 6.3 \times 10^{-4} \text{ M}$$

$$1.8 \times 10^{-5} = \frac{(6.3 \times 10^{-4})^2}{[\text{CH}_3\text{COOH}]_{\text{ini}} - 6.3 \times 10^{-4}}$$

$$[\text{CH}_3\text{COOH}]_{\text{initial}} = 2.3 \times 10^{-2} \text{ M}$$

$$\text{mass} = 2.3 \times 10^{-2} \text{ mol/L} \times 60.0 \text{ g/mol} = \underline{\underline{1.4 \text{ g per litre}}} = \underline{\underline{1 \text{ g/L}}}$$



as H_2S gas escapes the reactions proceed in the forward direction to produce more OH^- (strongly basic) and H_2S gas (odour.)