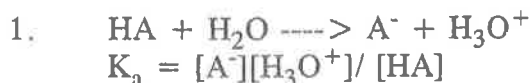


Review #4 – Acids

1. A 0.0150 M solution of a monoprotic acid has a pH of 2.78. Calculate its K_a .
2. A 1.00 g impure sample of $\text{Ca}(\text{OH})_2$ was added to a flask together with 25 mL of water. In a titration, 28.65 mL of 0.600 M HCl was required to reach the endpoint. Calculate the % purity of the sample.
3. How many moles of potassium hydrogen sulphide, KHS, must be dissolved in 300 mL of water in order to produce a pH of 10.40?
4. The oxide ion, O^{2-} , is a strong base in aqueous solution. Write the reaction equation showing the oxide ion acting as a base and calculate the pH of a 3.0×10^{-3} M solution of barium oxide, BaO.
5. What is the resulting pH when 75.0 mL of 0.400 M KOH is added to 60.0 mL of 0.240 M H_2SO_4 ?
6. Grapes grown in B.C. frequently produce wine that is too acidic. A common method of reducing acidity in wine is to add $\text{CaCO}_3(\text{s})$. Explain why this method works using appropriate equations.
7. A 2.0 M solution of an unknown monoprotic acid has a pH of 1.43. Use the K_a table to identify the acid.
8. HCl gas is bubbled through 2.00 L of an HCl solution. How many moles of HCl gas would have to dissolve to lower the pH from 3.00 to 2.00?
9. A 0.60 M base solution, $\text{NaX}_{(\text{aq})}$ is found to have a $[\text{OH}^-]$ of 0.12 M. Determine the value of K_b for the base.
10. Discuss, in terms of hydrolysis, the use of sodium acetate, NaCH_3COO , to produce the vinegar flavour on some potato chips.
11. Calculate the $[\text{H}_3\text{O}^+]$ in 0.25 M NH_4NO_3 .

Chemistry 12
Review #4



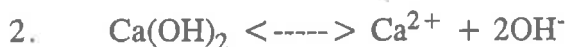
$$[\text{H}_3\text{O}^+] = \text{antilog } -2.78 = 1.66 \times 10^{-3} \text{ M}$$

$$[\text{A}^-] = 1.66 \times 10^{-3} \text{ M}$$

$$[\text{HA}] = 0.0150 \text{ M} - 1.66 \times 10^{-3} \text{ M} = 0.01334$$

$$K_a = (1.66 \times 10^{-3})^2 / (0.0133)$$

$$= 2.1 \times 10^{-4}$$



$$\text{mols of H}^+ = 0.600 \text{ M} \times 28.65 \text{ mL} = 17.19 \text{ mmols}$$

$$\text{mols of OH}^- = 17.19 \text{ mmols}$$

$$\text{mols of Ca(OH)}_2 = 17.19 \text{ mmols OH}^- \times 1 \text{ mol Ca(OH)}_2 / 2 \text{ mol OH}^-$$

$$= 8.595 \text{ mmols}$$

$$\text{Ca(OH)}_2 = 4.01 + 2(16.0 + 1.0) = 74.1 \text{ g/mol}$$

$$8.595 \times 10^{-3} \text{ mol} \times 74.1 \text{ g/mol} = 0.637 \text{ g}$$

$$\% \text{ purity} = 0.637 \text{ g} / 1.00 \text{ g} = 63.7\%$$



$$K_b = [\text{OH}^-][\text{H}_2\text{S}] / [\text{HS}^-]$$

$$= 1.00 \times 10^{-14} / 9.1 \times 10^{-8}$$

$$= 1.10 \times 10^{-7}$$

$$[\text{OH}^-] = \text{antilog } (-3.60) = 2.51 \times 10^{-4} \text{ M}$$

$$\text{Let } [\text{HS}^-] = x - 2.51 \times 10^{-4}$$

$$(2.51 \times 10^{-4})^2 / (x - 2.51 \times 10^{-4}) = 1.10 \times 10^{-7}$$

$$x - 2.51 \times 10^{-4} = 0.574$$

$$x = 0.574 \text{ M}$$

$$\text{mols of HS}^- = 0.574 \text{ M} \times 0.300 \text{ L} = 0.17 \text{ mol}$$



$$[\text{O}^{2-}] = 3.0 \times 10^{-3} \text{ M}$$

$$[\text{OH}^-] = 3.0 \times 10^{-3} \text{ M} \times 2 = 6.0 \times 10^{-3} \text{ M}$$

$$\text{pOH} = -(\log 6.0 \times 10^{-3}) = 2.22$$

$$\text{pH} = 14 - 2.22 = 11.78$$

5. $\text{mols of OH}^- = 0.400 \text{ M} \times 75.0 \text{ mL} = 30.0 \text{ mmol}$

$$\text{mols of H}^+ = 0.240 \text{ M} \times 2 \times 60.0 \text{ mL} = 28.8 \text{ mmol}$$

$$\text{OH}^- \text{ in excess} : 30.0 - 28.8 = 1.20 \text{ mmol}$$

$$[\text{OH}^-] = 1.2 \text{ mmol} / (75.0 + 60.0) = 8.9 \times 10^{-3} \text{ M}$$

$$\text{pOH} = 2.05$$

$$\text{pH} = 11.95$$