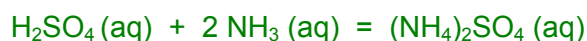


- (ii) Determine the concentration of the base. [2]
 (iii) Using HIn as an example, explain how an indicator works [3]
 (iv) Write an equilibrium expression for HIn and show how the pKa value relates to the pH value at which it changes colour. [3]
 (v) State the pKa value of an indicator that would be suitable [1]
- (b) Explain why sodium ethanoate solution is basic whereas ammonium ethanoate solution is neutral. [4]
 (c) If the pH of a swimming pool goes above 8 aluminium sulphate is added. Explain. [3]
- (d) A household cleaner contains ammonia solution. A 2.447g sample of the cleaner is diluted with water to 20.00 cm³. The solution requires 28.51 cm³ of 0.4040 mol dm⁻³ sulphuric acid to reach the equivalence point.
- (i) Write a balanced equation for the reaction forming ammonium sulphate. [1]
 (ii) Calculate the moles of acid required and the moles, mass and percentage by mass of ammonia present. [4]

Comments

- (a) (i) If strong the acid ought to have pH 2 as its concentration is 10⁻² molar. As it's 3 it must be weak. The base must therefore be strong as the graph has a vertical section.
 (ii) The answer is 0.113 mol dm⁻³. Don't forget units!
 (iii) and (iv) see the notes above!
 (v) The middle point of the vertical section (sometimes called the equivalence point) is between pH 8 and 9 so as $pK_a = pH$ any figure around here would do. (No units here!)

- (b) See the section on salt hydrolysis to answer this.
 (c) Salt hydrolysis again, but this time it's those Al³⁺ ions releasing hydrogen ions.
 (d) (i)



- (ii) Moles of acid = 0.404 x 0.02851 (litres!) = 0.01152
 Moles of ammonia = twice that of acid = 0.02304
 Mass of ammonia = 17 x 0.02304 = 0.392g
 % ammonia = 0.392/2.447 = 16.0%

May 1999 Paper 1 (Multiple Guess)

Q30 Which of the following is a buffer when equal volumes are mixed?

- I 0.1M HCl and 0.1M NH₄Cl
 II 0.1M HCl and 0.2M NH₃
 III 0.1M NH₃ and 0.1M NH₄Cl

Comments: Not the first as it is a strong acid plus salt. The second is a hidden buffer (beware!), the two reacting to give a salt and some weak base left over. The third is what is made by the second, so II and III.