ACID BASE CALCULATION - PRACTICE QUESTIONS 1

1. A chemist added 50.0 mL of 0.010 mol L^{-1} hydrochloric acid to 100.0 mL of 0.100 mol L^{-1} sodium chloride solution. Which one of the following is the correct pH of the resulting solution?

   (a) 2.5

   (b) 3.0

   (c) 3.8

   (d) 5.2

2. For the titration between dilute ethanoic acid (in a burette) and standardised sodium hydroxide in a conical flask, which of the following procedures is incorrect?

   (a) Prior to filling the burette with acid, rinse the burette with distilled water.

   (b) Pipette out 20.00 mL aliquots of the sodium hydroxide solution into three separate conical flasks which have each been rinsed with distilled water.

   (c) Rinse the pipette with the standardised sodium hydroxide solution before transferring the first aliquot to the conical flask.

   (d) Add a few drops of phenolphthalein to each of the conical flasks containing the sodium hydroxide aliquots.

3. Which of the following solutions has a pH less than 7?

   (a) $Mg(OH)_2(aq)$

   (b) $CH_3COOH(aq)$

   (c) distilled water

   (d) $Na_2CO_3(aq)$

4. Phenolphthalein indicator is added to a dilute potassium hydroxide solution in a conical flask which is then titrated against a dilute sulfuric acid solution from a burette. Which of the following statements about this titration is true?

   (a) The end point will be reached before the equivalence point.

   (b) The end point and equivalence point will be reached simultaneously.

   (c) The phenolphthalein will remain orange/red until the end point is reached.

   (d) The equivalence point will be reached before the end point.

5. For the titration between dilute ethanoic acid (in a burette) and standardised sodium hydroxide (in a conical flask), which of the following experimental procedures would be inappropriate?

(a) Add a few drops of phenolphthalein indicator to the sodium hydroxide.

(b) Add sulfuric acid catalyst to the conical flask and warm the contents to about $80^{o}C$ before commencing the titration.

(c) Prior to adding the acid to the burette, rinse the burette with distilled water and then a small portion of the acid solution.

(d) Pipette out 20.00 mL aliquots of the sodium hydroxide solution into three separate conical flasks which have each been rinsed with distilled water.

1. In an acid-base titration, 1.0 mol L^{-1} HCl(aq) (from a burette) is added slowly to 20.0 mL of 1.0 mol L^{-1} NaOH(aq) in a conical flask.

   (a) Calculate the pH of the solution in the conical flask after 19.90 mL of the HCl(aq) has been added. Assume the total volume of solution is now 39.90 mL.

   (b) Calculate the pH of the solution in the flask after 20.10 mL of the HCl(aq) has been added. Assume the total volume of solution is now 40.10 mL.

   (c) On the basis of the above pH changes, explain why both methyl orange and phenolphthalein are suitable indicators for this titration.

(6 marks)

2. A solution was prepared by mixing dilute sulphuric acid and dilute tartaric acid. Tartaric acid has the formula HOOCCHOHCHOHCOOH and in acid-base reactions, releases two protons and forms the tartrate ion: $OOCCHOHCHOHCOO^{2-}(aq)$. The mixture of the two acids was analysed as follows:

   (i) 25·00 mL of the mixture was taken, and it required 29·8 mL of 0·504 mol L^{-1} NaOH to neutralize both acids.

   (ii) A second 25·00 mL of the mixture was treated with excess barium nitrate solution, and resulted in the precipitation of 0.712 g of barium sulphate.

   Calculate the concentration of sulphuric acid and tartaric acid in moles per litre in the mixture.

   (10 marks)