Quiz (Dilution)

1. 10.0 cm^3 of 2.50 M sodium carbonate solution is diluted to 250.0 cm^3 using distilled water. What is the molarity of the diluted sodium carbonate solution?

2. Describe briefly how to prepare 100.0 cm^3 of 0.50 M sodium carbonate solution from 5.30 g of anhydrous sodium carbonate.

3. A student prepared 500.0 cm^3 of 0.1 M standard ethanedioic acid solution by dissolving hydrated ethanedioic acid crystals ($(COOH)_2 \bullet 2H_2O$) in water.
   (a) Calculate the mass of hydrated ethanedioic acid crystals needed.

   (b) If the student weighed out 6.45 g of the crystals, calculate the molarity of the solution prepared.

   (c) Is the solution prepared in (b) a standard solution? Explain your answer.

   (d) To prepare 250.0 cm^3 of 0.0150 M ethanedioic acid solution, what is the volume of the solution (as prepared in (b)) required for dilution?

Suggested Answer

1. (number of moles of Na_2CO_3)$_{before\ dilution}$ = (number of moles of Na_2CO_3)$_{after\ dilution}$,

   $M_1V_1 = M_2V_2$

   $2.50 \times 10.0 / 1000 = M_2 \times 250.0 / 1000$

   $M_2 = 0.1$

   ∴ the concentration of the diluted sodium carbonate solution is 0.1 M.

2. First, **dissolve** 5.30 g of anhydrous sodium carbonate in some **distilled water** in a beaker.

   Then, transfer the solution to a **100.0 cm^3 volumetric flask**.

   Wash the beaker and the glass rod with distilled water several times and **pour all the washing to the volumetric flask.**

   Add distilled water up to the **graduation mark** of the volumetric flask.

   Finally, stopper and invert the volumetric flask several times **to mix the contents well**.

3. (a) Number of moles of $(COOH)_2•2H_2O$ needed
   = 0.1 × 500.0 / 1000
   = 0.05

   Mass of $(COOH)_2•2H_2O$ needed
   = 0.05 × [2 × (12.0 + 16.0 × 2 + 1.0) + 2 × (1.0 × 2 + 16.0)]
   = 6.3 g

   (b) Number of moles of $(COOH)_2•2H_2O$ used
   = 6.45 / 126.0
   = 0.0512

   Molarity of the solution prepared
   = 0.0512 / (500.0 / 1000)
   = 0.102 mol dm^{-3}

   (c) Yes. This is because the accurate molar concentration of the solution is known.

(d) Number of moles of ethanedioic acid (before dilution)
= Number of moles of ethanedioic acid (after dilution)

$M_1V_1 = M_2V_2$

$0.102 \times V_1 = 0.0150 \times (250.0 / 1000)$

$V_1 = 0.0368$

$\therefore$ the volume of the 0.102 mol dm^{-3} solution needed is 36.8 cm^3.