Quiz (Basic Chemical Calculation II)

Section A: Multiple Choice

1. Which of the following apparatus are needed to dilute 25.0 cm3 of a standard solution to 250.0 cm^3?
   (1) 25.0 cm^3 pipette
   (2) 250.0 cm^3 volumetric flask
   (3) 250.0 cm^3 conical flask
   A. (1) and (2) only
   B. (1) and (3) only
   C. (2) and (3) only
   D. (1), (2) and (3)

2. What is the concentration of the resultant sodium carbonate solution when 10.0 cm^3 of 0.80 M sodium carbonate solution is diluted to 250.0 cm^3?
   A. 0.016 M
   B. 0.032 M
   C. 0.040 M
   D. 0.064 M

3. What is the mass of anhydrous sodium carbonate needed to prepare 250.0 cm^3 of 0.150 M sodium carbonate solution?
   (Relative atomic masses: C = 12.0, O = 16.0, Na = 23.0)
   A. 1.50 g
   B. 1.91 g
   C. 3.11 g
   D. 3.98 g

4. Which of the following apparatus is the most suitable for transferring 25.00 cm^3 of solution?
   A. Measuring cylinder
   B. Pipette
   C. Burette
   D. Conical flask

Section B: Structural Question

1. 14.30 g of hydrated sodium carbonate $Na_2CO_3 \bullet 10H_2O(s)$ is dissolved in water and made up to 250.0 cm^3 of solution. Calculate the molarity of the sodium carbonate solution.
   (Relative atomic masses: H = 1.0, C = 12.0, O = 16.0, Na = 23.0)

2. Calculate the volume of 2.0 M hydrochloric acid required to prepare 250.0 cm^3 of 0.15 M hydrochloric acid.

Suggested Answer

Section A

1.	A	3.	D
2.	B	4.	B

Section B

1. Number of moles of $Na_2CO_3 \bullet 10H_2O$ used
   = 14.30 / [(23.0 × 2 + 12.0 + 16.0 × 3) + 10 × (1.0 × 2 + 16.0)]
   = 0.05

   1 mole of $Na_2CO_3 \bullet 10H_2O$ contains 1 mole of Na_2CO_3.

   ∴ number of moles of Na_2CO_3 in 250.0 cm^3 solution = 0.05 mol

   Molarity of the Na_2CO_3 solution
   = 0.05 / (250.0 / 1000)
   = 0.2 mol dm^{-3}

2. Number of moles of HCl (before dilution) = Number of moles of HCl (after dilution)

   $M_1V_1 = M_2V_2$

   $2.0 \times V_1 = 0.15 \times (250.0 / 1000)$

   $V_1 = 0.0188\ dm^3$ or $18.8\ cm^3$

   ∴ volume of 2.0 M HCl(aq) required is 18.8 cm^3.