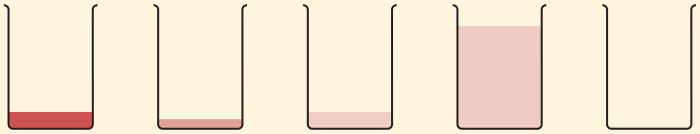
Activity 4A: Concentrations

Ans p. 16

1. When cobalt chloride is dissolved in water, it produces a deep pink-coloured solution. The following solutions of cobalt chloride were prepared:



A	B	C	D	E
0.8 mol in 100 mL	0.2 mol in 50 mL	0.2 mol in 100 mL	1 mol in 500 mL	0.01 mol in 10 mL

a. Which solution contains the most dissolved solute?

b. Which solution has the greatest volume?

c. Copy and complete the following table:

	Solutions				
	A	B	C	D	E
Concentration (mol L^{-1})					

d. Which solution has the greatest concentration?

e. Which solution is most dilute (i.e. has the smallest concentration)?

f. Which solution will appear lightest in colour?

2. Find the concentrations of the following solutions, before and after dilution:

a. 0.1 mol sodium hydroxide in 250 mL is diluted to 1 000 mL.

b. 10 mL of a solution of hydrochloric acid containing 0.04 mol of solute is diluted to 100 mL by adding 90 mL of water.

3. Calculate the mass of solid needed to prepare the following solutions:

a. 500 mL of 0.500 mol L^{-1} $K_2Cr_2O_7$ $M(K_2Cr_2O_7) = 294.2$ g mol^{-1}.

b. 200 mL of 1.00 mol L^{-1} $FeSO_4 \cdot 7H_2O$ $M(FeSO_4 \cdot 7H_2O) = 277.9$ g mol^{-1}.

4. A colorimetric analysis of a solution containing $Co^{2+}(aq)$ is to be carried out. Calculate the mass of $CoCl_2 \cdot 6H_2O$ that would be needed to prepare 250 mL of a stock solution of concentration 0.00100 mol L^{-1}.
$M(CoCl_2 \cdot 6H_2O) = 237.8$ g mol^{-1}

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1. a. D **b.** D

c.

	Solutions				
	A	B	C	D	E
Concentration (mol L^{-1})	8	4	2	2	1

d. A **e.** E **f.** E

2. a. Before dilution: $c = \frac{0.1 \text{ mol}}{0.25 \text{ L}} = 0.4 \text{ mol L}^{-1}$

After dilution: $c = \frac{0.1 \text{ mol}}{1 \text{ L}} = 0.1 \text{ mol L}^{-1}$

b. Before dilution: $c = \frac{0.04 \text{ mol}}{0.01 \text{ L}} = 4 \text{ mol L}^{-1}$

After dilution: $c = \frac{0.04 \text{ mol}}{0.1 \text{ L}} = 0.4 \text{ mol L}^{-1}$

3. a. $n = cV = 0.500 \text{ mol L}^{-1} \times 0.500 \text{ L} = 0.250 \text{ mol}$

$m = nM = 0.250 \text{ mol} \times 294.2 \text{ g mol}^{-1} = 73.6 \text{ g}$

b. $n = cV = 1.00 \text{ mol L}^{-1} \times 0.200 \text{ L} = 0.200 \text{ mol}$

$m = nM = 0.200 \text{ mol} \times 277.9 \text{ g mol}^{-1} = 55.6 \text{ g}$

4. $n = cV = 0.00100 \text{ mol L}^{-1} \times 0.250 \text{ L}$

$= 2.50 \times 10^{-4} \text{ mol}$

$m(COCl_2 \cdot 6H_2O) = nM = 2.50 \times 10^{-4} \text{ mol} \times 237.8 \text{ g mol}^{-1}$

$= 0.0595 \text{ g}$

RESOURCES

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