

## CONCENTRATION OF SOLUTIONS



Answer all the questions below and then check your answers.

1. Convert the following volumes into  $\text{dm}^3$ .

- a. 500ml                      b.  $250 \text{ cm}^3$                       c. 100ml                      d.  $70 \text{ cm}^3$

2. Calculate the concentration of the following solutions. Express the concentrations in units of  $\text{g}/\text{dm}^3$

- a. 20g of sodium chloride in  $1 \text{ dm}^3$  of solution.  
b. 15g of magnesium chloride in 250 ml of solution.  
c. 25g of potassium chloride in  $800 \text{ cm}^3$  of solution.  
d. 10g of potassium oxide in 2500ml of solution.

Use the following formula to solve all the problems on this page

$c$  = concentration

$v$  = volume

$n$  = number of moles

$c = n/v$

$v = n/c$

3. Calculate the mass required to make up the following solutions:

- a.  $0.25 \text{ dm}^3$  of  $0.5 \text{ mol}/\text{dm}^3$  of potassium chloride (KCl) solution.  
b.  $0.1 \text{ dm}^3$  of  $0.75 \text{ mol}/\text{dm}^3$  of sodium nitrate ( $\text{NaNO}_3$ ) solution.  
c. 500ml of  $0.5 \text{ mol}/\text{dm}^3$  of sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) solution.  
d.  $0.1 \text{ cm}^3$  of  $0.35 \text{ mol}/\text{dm}^3$  of silver nitrate ( $\text{AgNO}_3$ ) solution.

4. Calculate the concentration in mol/dm<sup>3</sup> of each of the following hydrochloric acid solution:

a. 2 mol of HCl to make a solution of volume 0.5 dm<sup>3</sup>.

b. 1 mol of HCl to make a solution of volume 0.75 dm<sup>3</sup>.

c. 0.5 mol of HCl to make a solution of volume 500ml.

d. 0.9 mol of HCl to make a solution of volume 350cm<sup>3</sup>.

5. What mass of solute is required to make up the following solutions.

a. 0.5dm<sup>3</sup> of a 2g/dm<sup>3</sup> solution of sodium hydroxide (NaOH)

b. 0.25dm<sup>3</sup> of a 1.5g/dm<sup>3</sup> solution of sodium chloride (NaCl)

c. 500ml of a 3g/dm<sup>3</sup> solution of glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>)

6. Calculate the concentration in mol/dm<sup>3</sup> of each of the following solutions.

a. 12g of sodium chloride (NaCl) dissolved to make a solution of volume 250ml

b. 10g of potassium nitrate (KNO<sub>3</sub>) dissolved to make a solution of volume 250ml

c. 25g of sodium carbonate (Na<sub>2</sub>CO<sub>3</sub>) dissolved to make a solution of volume 125cm<sup>3</sup>

d. 30g of ammonium nitrate (NH<sub>4</sub>NO<sub>3</sub>) dissolved to make a solution of volume 350ml

# Answers

a. 500ml  $0.5\text{dm}^3$  b. 250  $\text{cm}^3$   $0.25\text{dm}^3$  c. 100ml  $0.1\text{dm}^3$

d.  $70\text{cm}^3$   $0.07\text{dm}^3$  Hint : simply divide by 1000 to convert ml or  $\text{cm}^3$  into  $\text{dm}^3$

2. Calculate the concentration of the following solutions. Express the concentrations in units of  $\text{g}/\text{dm}^3$

a. 20g of sodium chloride in  $1\text{dm}^3$  of solution.

$$20\text{g}/1\text{dm}^3 = 20\text{g}/\text{dm}^3$$

b. 15g of magnesium chloride in 250 ml of solution.

$$15\text{g}/0.25\text{dm}^3 = 60\text{g}/\text{dm}^3$$

c. 25g of potassium chloride in  $800\text{cm}^3$  of solution.

$$25\text{g}/0.8\text{dm}^3 = 31.25\text{g}/\text{dm}^3$$

d. 10g of potassium oxide in 2500ml of solution.

$$10\text{g}/2.5\text{dm}^3 = 4\text{g}/\text{dm}^3$$

Use the following formula to solve all the problems on this page

$c$  = concentration

$v$  = volume

$n$  = number of moles

$$c = n/v$$

$$v = n/c$$

$$n = c \times v$$

3. Calculate the mass required to make up the following solutions:

a.  $0.25\text{dm}^3$  of  $0.5\text{ mol/ dm}^3$  of potassium chloride (KCl) solution.

$$M_r \text{ of potassium chloride} = 39 + 35.5 = 74.5$$

$$n = c \times v$$

$$= 0.25 \times 0.5$$

$$= 0.125 \text{ moles.}$$

$$1 \text{ mole} = 74.5\text{g, so mass of } 0.125\text{moles} = 74 \times 0.125 = 9.25\text{g}$$

b.  $0.1\text{ dm}^3$  of  $0.75\text{ mol/ dm}^3$  of sodium nitrate ( $\text{NaNO}_3$ ) solution.

$$M_r \text{ of sodium nitrate} = 23 + 14 + 48 = 85$$

$$n = c \times v$$

$$= 0.1 \times 0.75$$

$$= 0.075 \text{ moles.}$$

$$1 \text{ mole} = 85\text{g, so mass of } 0.075\text{moles} = 74 \times 0.125 = 5.625\text{g}$$

c.  $500\text{ml}$  of  $0.5\text{ mol/ dm}^3$  of sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) solution.

Don't forget to convert volume into  $\text{dm}^3$

$$M_r \text{ of sodium carbonate} = (23 \times 2) + 12 + 48 = 106$$

$$n = c \times v$$

$$= 0.5 \times 0.5$$

$$= 0.25 \text{ moles.}$$

$$1 \text{ mole} = 106\text{g, so mass of } 0.25\text{moles} = 83 \times 0.25 = 26.5\text{g}$$

d.  $0.1 \text{ cm}^3$  of  $0.35 \text{ mol/dm}^3$  of silver nitrate ( $\text{AgNO}_3$ ) solution.

$$M_r \text{ of silver nitrate} = 108 + 14 + 48 = 170$$

$$n = c \times v$$

$$= 0.1 \times 0.35$$

$$= 0.035 \text{ moles.}$$

$$1 \text{ mole} = 170\text{g, so mass of } 0.035\text{moles} = 170 \times 0.035 = 5.95\text{g}$$

4. Calculate the concentration in  $\text{mol/dm}^3$  of each of the following hydrochloric acid solution:

a. 2 mol of HCl to make a solution of volume  $0.5 \text{ dm}^3$ .

$$C = n/v$$

$$C = 2 \text{ mol}/0.5 \text{ dm}^3 = 4 \text{ mol dm}^{-3} \text{ or } 4 \text{ mol/dm}^3$$

b. 1 mol of HCl to make a solution of volume  $0.75 \text{ dm}^3$ .

$$C = n/v$$

$$C = 1 \text{ mol}/0.75 \text{ dm}^3 = 1.3 \text{ mol dm}^{-3} \text{ or } 1.3 \text{ mol/dm}^3$$

c. 0.5 mol of HCl to make a solution of volume 500ml.

$$C = n/v$$

$$C = 0.5 \text{ mol}/0.5 \text{ dm}^3 = 1 \text{ mol dm}^{-3} \text{ or } 1 \text{ mol/dm}^3$$

d. 0.9 mol of HCl to make a solution of volume  $350\text{cm}^3$ .

$$C = n/v$$

$$C = 0.9 \text{ mol}/0.35 \text{ dm}^3 = 2.5 \text{ mol dm}^{-3} \text{ or } 2.5 \text{ mol/dm}^3$$