MISCELLANEOUS I - Simple solution calculations using n=CV

1. Calculate the mass of $NaNO_3$ required to prepare a 400ml solution of 0.150mol/L $NaNO_3$ solution.

2. A solution is prepared by dissolving 45g of K_2SO_4 into 2.5L of distilled water. Calculate;
a) The concentration of K+ ions?
b) The concentration of sulfate ions?

3. How many moles of $AgNO_3$ are present in a 125ml sample of 0.215mol/L $AgNO_3$ solution?

4. What volume of water needs to be added to 12g of pure sodium fluoride to produce a solution with a concentration of 2.50mol/L?

5. What is the concentration of a solution prepared by dissolving 38g of Aluminium nitrate in 120ml of water?

6. What mass of solid oxalic acid crystals (formula $H_2C_2O_4.2H_2O$) needs to be used to make a 1.05L sample of 0.420mol/L $H_2C_2O_4$ solution?

7. What mass of $CuSO_4.5H_20$ crystals would remain in a beaker if a 200ml of 0.525mol/L $CuSO_4$ solution is left to evaporate to dryness?

8. Consider a sample of 55ml of 0.425mol/L Iron(III) nitrate solution. Calculate the following
a) The concentration of Fe^{3+} ions
b) The concentration of NO_3^{1-} ions
c) The moles of Fe^{3+} ions
d) The moles of Nitrate ions
e) The mass of Fe present in the sample

9. What is the concentration (in mol/L) of Chloride ions when 5.09g of Aluminium Chloride is dissolved in 250ml of water?

10. A 100ml sample of a solution of sulfuric acid is known to have a H^+ ion concentration of 0.2mol/L. What is the concentration of H_2SO_4?

1 $n(NaNO_3) = cV$

$= 0.15 \times 1.4$

$= 0.06$ mols

$n(NaNO_3) = \frac{m}{Mr}$ $\quad Mr\ NaNO_3 = 85$

$0.06 = \frac{m}{85} = 5.1$ g

2 a) $n(k_2SO_4) = \frac{m}{Mr}$

$Mr\ k_2SO_4 = 174.2$ $\quad = \frac{45}{174.2}$

$= 0.2583$ mols

$n(k_2SO_4) \times 2 = n(k^+)$

$= 0.5166$ mols.

$n(k^+) = cV$

$0.5166 = c \times 2.5$

$c = 0.2066$ mol L^{-1} or 0.21 mol L^{-1}

b) $n(k_2SO_4) = n(SO_4^{2-})$

$= 0.2583$ mols

$n(SO_4^{2-}) = cV$

$0.2583 = c \times 2.5$

$c = 0.1033$ mol L^{-1} or 0.10 mol L^{-1}

3 $n(AgNO_3) = cV = 0.215 \times 125 = 0.026875$ mols.

or 2.69×10^{-2} mols.

4 $n(NaF) = \frac{m}{Mr}$

$Mr\ NaF = 42$ $\quad = \frac{12}{42}$

0.2857 mols

$n(NaF) = cV$

$0.2857 = 2.5 \times V$

$V = 0.1142$ L or 114 mL.

5 $n(Al(NO_3)_3 = \frac{m}{Mr}$

$Mr\ Al(NO_3)_3$ $\quad = \frac{38}{218} = 0.1784$ mols

$= 213$

$n(Al(NO_3)_3 = cV$

$0.1784 = c \times 0.112$

$c = 1.49$ mol L^{-1}

6 $n(H_2C_2O_4.2H_2O) = cV$

0.441 mols $= 0.42 \times 1.05$

$Mr\ H_2C_2O_4.2H_2O = 126$

$n(H_2C_2O_4.2H_2O) = \frac{m}{Mr}$

$0.441 = \frac{m}{126}$

$= 55.6$ g.

7 $n(CuSO_4.5H_2O) = CV$

$= 0.525 \times 0.2$

$= 0.1105$ mols

$n = \frac{m}{Mr}$

$0.1105 = \frac{m}{249.55}$

$= 26.2\,g$

Mr $CuSO_4.5H_2O$

$249.55 = 159.55 + 90$

8 a) $Fe(NO_3)_3 \xrightarrow{H_2O} Fe^{3+}_{(aq)} + 3NO_3^-_{(aq)}$

0.425 mol $L^{-1} = Fe^{3+}$

b) $n(Fe(NO_3)_3) \times 3 = n(NO_{3(aq)})$

$0.425\,M\,L^{-1} \times 3 = 1.275\,M\,L^{-1}$

c) $n(Fe(NO_3)_3) = CV$ $\quad n(Fe(NO_3)_3) = n(Fe)$

$= 0.425 \times 0.055$ $\quad = 0.02337$ mols

d) $0.02337 \times 3 = 0.070$ mols

e) $n(Fe) = \frac{m}{Mr}$ $\quad 0.02337 = \frac{m}{55.85} = 1.305\,g$

9 $n(AlCl_3) = \frac{5}{133.35} = 0.0375$ mols $\quad n = CV$

Mr $AlCl_3 = 133.35$

$0.1125 = C \times 0.25$

$n(AlCl_3) \times 3 = n(Cl^-) = 0.1125$ M $\quad C = 0.45$ mol L^{-1}

10 $n(H+) = CV$

$= 0.2 \times 0.1$

$= 0.02$ mols

$n(H+) \times \frac{1}{2} = n(H_2SO_4)$

$= 0.01$ mols

$n = CV$

$0.01 = C \times 0.1$

$= 0.1$ mol L^{-1}