IB MOLES PRACTICE TEST

1 Balance the following equation [1]

$Fe_2O_3 + 3H_2S \rightarrow Fe_2S_3 + 3H_2O$

2 In the decomposition of a certain mass of $KClO_3$, 1.60 g of oxygen gas was produced:

$2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$

Calculate the mass of $KClO_3$ that decomposed? [3]

Amount in mol of oxygen gas = 1.60/32.00 = 0.0500 mol

Amount in mol of $KClO_3$ = 0.0500 x 2/3 = 0.0333 mol

Mass of $KClO_3$ = 0.0333 x 122.55 = 4.085 g

3 Red hot iron reacts with steam to produce hydrogen gas:

$3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$

Calculate the volume of hydrogen gas (measured at STP) produced when 2.80 g iron reacts with excess steam. [3]

Amount in mol of iron = 2.80/55.85 = 0.0501 mol

Amount in mol of H_2 = 0.0501 x 4/3 = 0.0668 mol

Volume of H_2 = 0.0668 x 22.7 = 1.52 dm^3

4 Manganate(VII) ions [$MnO_4^-(aq)$] react with iron(II) ions in the presence of acid (H^+):

$MnO_4^-(aq) + 5Fe^{2+}(aq) + 8H^+(aq) \rightarrow Mn^{2+}(aq) + 5Fe^{3+}(aq) + 4H_2O(l)$

Calculate the volume of 0.100 mol dm^{-3} iron(II) solution required to react exactly with 25.00 cm^3 of 0.0200 mol dm^{-3} $MnO_4^-(aq)$ in the presence of excess acid. [3]

Amount in mol of $MnO_4^-(aq)$ = 25.00/1000 x 0.0200 = 5.00×10^{-4} mol

Amount in mol of $Fe^{2+}(aq)$ = 5.00×10^{-4} x 5 = 2.50×10^{-3} mol

Volume of $Fe^{2+}(aq)$ = 2.50×10^{-3}/0.100 x 1000 = 25.0 cm^3

5 Copper(II) sulfate reacts with potassium iodide to form a precipitate of copper(I) iodide:

$2CuSO_4(aq) + 4KI(aq) \rightarrow 2CuI(s) + I_2(aq)$

Calculate the mass of copper(I) iodide produced when 25.00 cm^3 0.100 mol dm^{-3} $CuSO_4$ reacts with 30.00 cm^3 0.120 mol dm^{-3} KI. [3]

Since enough information is given to work out the amount in mol of more than one substance, one of these is likely to be a limiting reactant.

Amount in mol of $CuO_4(aq)$ = 25.00/1000 x 0.100 = 2.50×10^{-3} mol

Amount in mol of KI(aq) = 30.00/1000 x 0.120 = 3.60×10^{-3} mol

2.50×10^{-3} x 2 > 3.60×10^{-3} therefore KI is the limiting reactant

Amount in mol of CuI = 3.60×10^{-3}/2 = 1.80×10^{-3} mol

Mass of CuI = 1.80×10^{-3} x 190.45 = 0.343 g