Answer on Question #55805 – Chemistry – General chemistry

Question

The compound As2I4 is synthesized by reacting arsenic metal with arsenic triiodide (AsI3). If a solid cubic block of arsenic (density = 5.72 g/cm^3) that is 3.00 cm on edge is allowed to react with 1.01 x 10^24 molecules of arsenic tiiodide, how much As2I4 can be prepared?

As + AsI3 ---- As2I4
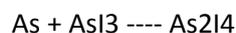
If the % yield of As2I4 was 75.6, what mass of As2I4 was actually isolated?

Solution

$2As + 4AsI_3 \rightarrow 3As_2I_4$

$1mol\ As + 2mol\ AsI_3 = 1.5mol\ As_2I_4$

$n(As) = m(As)/Mw(As) = \rho(As) \times V(As)/Mw(As) = \rho(As) \times a^3(As)/Mw(As) = 5.72\ g/cm^3 \times 3^3\ cm^3\ /\ 74.9216\ g/mol = 2.06mol$

$n\ (AsI_3) = N\ (AsI_3)/N_A = 1.01 \times 10^{23}\ /\ 6.02 \times 10^{23}\ mol^{-1} = 1.68mol$

$n(As) < n(AsI_3)$

$n(As_2I_4) = 4/3\ n(AsI_3) = 2.24mol$

$n'(As_2I_4) = n(As_2I_4) \times 0.756 = 1.69mol$

$m'(As_2I_4) = n'(As_2I_4) \times Mw(As_2I_4) = 1.69mol \times 657.46\ g/mol = 1110g$

Answer: 1110g