

Answer on the question #56249 - Chemistry - General chemistry

Question:

Calculate how many grams of heavy water are required to produce 345.0 mg of $\text{ND}_3(\text{g})$. The mass of deuterium, D, is 2.014 g/mol.



Solution:



One can see from the reaction equation that the number of the moles of heavy water and ND_3 relate as:

$$\frac{n(\text{D}_2\text{O})}{3} = n(\text{ND}_3)$$

The number of the moles of ND_3 is the ratio of the mass and the molar mass:

$$n(\text{ND}_3) = \frac{m}{M} = \frac{345.0}{(14.007 + 2.014 \cdot 3)} = 17.21 \text{ mol}$$

The number of the moles of D_2O is:

$$n(\text{D}_2\text{O}) = 3 \cdot n(\text{ND}_3) = 3 \cdot 17.21 = 51.62 \text{ mol}$$

Then, the mass of heavy water required to produce 345.0 g of ND_3 is:

$$m(\text{D}_2\text{O}) = n(\text{D}_2\text{O}) \cdot M(\text{D}_2\text{O}) = 51.62 \cdot (2.014 \cdot 2 + 15.999) = 1033.8 \text{ g}$$

Answer: 1033.8 g