

Problem-3

Boron has two stable isotopes, ${}_5\text{B}^{10}$ and ${}_5\text{B}^{11}$. Their respective masses are 10.01294 u and 11.00931 u, and the atomic mass of boron is 10.811 u. Find the abundances of ${}_5\text{B}^{10}$ and ${}_5\text{B}^{11}$.

Solution:-

$$\text{Mass of } {}_5\text{B}^{10}, m_1 = 10.01294 \text{ u}$$

$$\text{Mass of } {}_5\text{B}^{11}, m_2 = 11.00931 \text{ u.}$$

$$\text{Atomic mass of boron } m = 10.811 \text{ u}$$

Let the abundance percentage of ${}_5\text{B}^{10}$ be $x\%$.

Let the abundance percentage of ${}_5\text{B}^{11}$ be $y\%$.
 $\therefore y\% = (100 - x\%)$

$$\text{Now } m = \frac{m_1 x + m_2 y}{m_1 + m_2}$$

$$\therefore 10.811 = \frac{10.01294 x + 11.0093(100 - x)}{10.01294 + 11.0093}$$

Solve:

$$x = 19.89\% \quad \& \quad 100 - x = 80.11\%$$

\therefore abundance of ${}_5^{10}\text{B}$ is 19.89%, and

\therefore abundance of ${}^1_5\text{B}$ is 19.89%, and

abundance of ${}^{11}_5\text{B}$ is 80.11%.

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