

Q2. The deBroglie wavelength of a proton and an α -particle are equal. The ratio of their velocities is :

- (a) 4:3 (b) 4:1 (c) 4:2 (d) 1:4

Solution:

The image shows a handwritten solution on lined paper. It starts with the deBroglie wavelength formula for two particles, λ_1 and λ_2 , where $\lambda_1 = \frac{m_2 v_2}{m_1 v_1}$ and $\lambda_2 = \frac{m_\alpha v_\alpha}{m_p v_p}$. It notes that $\lambda_p = \lambda_\alpha$. This leads to the equation $m_\alpha v_\alpha = m_p v_p$. From this, the ratio of velocities is derived as $\frac{v_p}{v_\alpha} = \frac{m_\alpha}{m_p}$. The final result is boxed as $\frac{v_p}{v_\alpha} = \frac{4}{1}$.

$$\frac{\lambda_1}{\lambda_2} = \frac{m_2 v_2}{m_1 v_1} \Rightarrow \frac{\lambda_p}{\lambda_\alpha} = \frac{m_\alpha v_\alpha}{m_p v_p} \quad \text{As } (\lambda_p = \lambda_\alpha)$$
$$m_\alpha v_\alpha = m_p v_p \Rightarrow \frac{v_p}{v_\alpha} = \frac{m_\alpha}{m_p}$$
$$\Rightarrow \boxed{\frac{v_p}{v_\alpha} = \frac{4}{1}}$$