2. A deuteron and an alpha particle having equal kinetic energy enter perpendicular into a magnetic field. Let r_d and r_α be their respective radii of circular path. The value of $\frac{r_d}{r_\alpha}$ is equal to : [July 20, 2021 (I)]

(a) $\frac{1}{\sqrt{2}}$ (b) $\sqrt{2}$ (c) 1 (d) 2

Ans

(b) From, $F = \frac{mv^2}{r}$ and $F = qvB$

$$\frac{mv^2}{r} = qvB \Rightarrow \frac{mv}{r} = qB \Rightarrow r = \frac{\sqrt{2mE}}{qB}$$

$$\left[\because P = mv = \sqrt{2mE}\right]$$

$$\therefore \quad r \propto \frac{\sqrt{m}}{q}$$

$m_\alpha = 2m_d$ and $q_\alpha = 2q_d$

$$\therefore \quad \frac{r_d}{r_\alpha} = \frac{\sqrt{m_d}}{q_d} \times \frac{2q_d}{\sqrt{2m_d}} = \sqrt{2}$$