A particle is moving under the action of a central force associated with potential energy $U(r) = 10r^3 J$. The total mechanical energy in J such that the particle revolves in the circular orbit of radius r is:

(A) $10r^3$ (B) $15r^3$ (C) $25r^3$ (D) $5r^3$

Solution

$$F = -\frac{\partial}{\partial r}U(r) = -30r^2$$

$$\therefore \frac{mv^2}{r} = 30r^2$$

$$\therefore \frac{mv^2}{2} = KE = 15r^3$$

$$TME = PE + KE = 10r^3 + 15r^3 = 25r^3$$

Hence, (C)