

A particle is moving in a circular path of radius a under the action of an attractive potential $U = -\frac{k}{2r^2}$. Its total energy is:

(1) $-\frac{k}{4a^2}$

(2) $\frac{k}{2a^2}$

(3) Zero

(4) $-\frac{3k}{2a^2}$

Based on JEE Main 2018 - [123IITJEE](#)

Let the mass of the particle be m ,

$$P.E. = mU = -\frac{1}{2} \frac{mk}{r^2}$$

$$T.M.E. = \frac{1}{2}mv^2 + \left(-\frac{1}{2} \frac{mk}{r^2}\right)$$

Where v is the speed of the particle.

$$T.M.E. = \frac{1}{2}m\left(v^2 - \frac{k}{r^2}\right)$$

$$F = -\frac{d}{dr}\left(-\frac{1}{2} \frac{mk}{r^2}\right) = -\frac{1}{2} \frac{2mk}{r^3} = -\frac{mk}{r^3}$$

Since F provides centripetal force,

$$\left|-\frac{mk}{r^3}\right| = \frac{mv^2}{r}, \quad \therefore \frac{k}{r^2} = v^2$$

Hence, T.M.E. = 0

Hence, Option (3).