Answer on Question #72147-Physics-Classical Mechanics

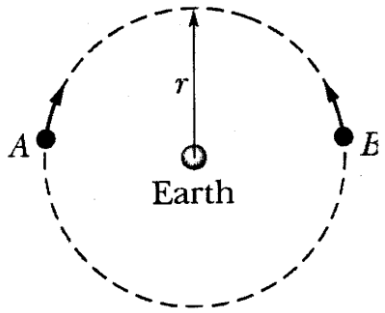
Two satellites of same mass m are revolving around earth(M) in same orbit of radius r. Rotational directions of the 2 satellites are opposite, therefore they can collide. Total mechanical energy of the system (both satellites and earth) is (m<<M) __?

1)-GMm/r

2)-2GMm/r

3)-GMm/2r

Solution



Total mechanical energy of satellite A is

$$E_A = E_{pot} + E_{kin}$$

$$E_A = -\frac{GMm}{r} + \frac{1}{2}mv^2 = -\frac{GMm}{2r}$$

Satellites are identical, so

$$E_B = E_A = -\frac{GMm}{2r}$$

Total mechanical energy of the system (both satellites and earth) is

$$E = E_B + E_A = -\frac{GMm}{2r} - \frac{GMm}{2r} = -\frac{GMm}{r}$$