Answer on Question #41464 – Physics – Mechanics

A 2.0 kg stone tied to the the end of an inextensible string is whirled around in a horizontal circle of radius 1.5 m at auniform angular speed 2π rad/s Calculate the rotational kinetic energy of the stone.
220.7 J
88.8 J
47.4 J
246.7 J

Solution:
$m = 2kg -$ mass of the stone;
$\omega = 2\pi \dfrac{rad}{s} -$ angular speed;
$R = 1.5m -$ radius of the circle;
$J = mR^2 -$ moment of inertia for the stone (Point mass m at a distance R from the axis of rotation)
Formula for the rotational kinetic energy:

$$E_k = \frac{\omega^2 J}{2} = \frac{(2\pi)^2 \cdot mR^2}{2} = 2\pi^2 mR^2 = 2 \cdot \left(3.14\frac{rad}{s}\right)^2 \cdot 2kg \cdot 1.5m^2 = 59.2J$$

Answer: rotational kinetic energy of the stone is equal to 59.2J.