

Answer on Question #44270 – Physics – Mechanics | Kinematics | Dynamics

after rolling halfway down an incline, a marble's kinetic energy is?

Solution

After rolling halfway down an incline a marble's kinetic energy is the same as its potential energy

Energy can't be created or destroyed, it can only be converted from one form to another; it's one of the fundamental laws of thermodynamics. So it will have lost half its gravitational potential energy but gained an identical amount of kinetic energy (ignoring friction).

Assuming it was stationary at the top of the incline, when it is half way down half of its potential energy will have been converted to kinetic energy.

However, we cannot solve for the speed by equating $\frac{mv^2}{2}$ to half the initial potential energy. This is because the marble also acquires rotational kinetic energy given by $E_R = \frac{J\omega^2}{2}$ where J is the moment of inertia and ω is its angular rate.

Thus, relation between potential energy, kinetic and rotational kinetic energies when a marble rolling halfway down:

$$\frac{mv^2}{2} + \frac{J\omega^2}{2} = \frac{P}{2}$$

ω is related to v and the marble radius and you can determine J from the properties, so if need be, we can solve for the speed.