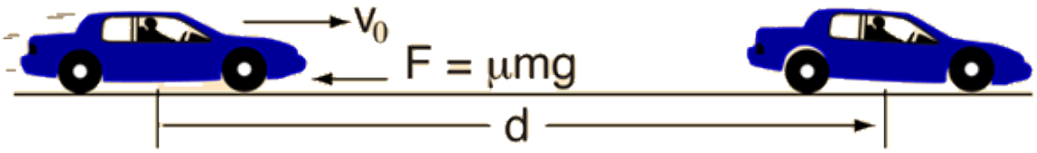
Answer on Question #64509, Physics / Other

A car driver sees a fallen tree lying across the road ahead and makes an emergency stop.
The braking distance of the car depends on the speed of the car.
for the same braking force, explain what happens to the braking if the speed doubles.
You should refer to kinetic energy in your answer.

Solution:

The amount of 'kinetic energy' that all moving objects have depends on their speed and mass.
When a car brakes, its kinetic energy is changed into heat energy.

Work done by brakes = loss in kinetic energy.



To reduce the kinetic energy to zero:

$$Work_{friction} = -\mu mgd = -\frac{1}{2}mv_0^2$$

so the stopping distance is

$$d = \frac{KE}{\mu mg} = \frac{v_0^2}{2\mu g}$$

If the speed of the car doubles, the kinetic energy and braking distance quadruple.

$$KE_2 = \frac{1}{2}m(2v_0)^2 = 4\frac{mv_0^2}{2} = 4KE_1$$

$$d_2 = \frac{(2v_0)^2}{2\mu g} = \frac{4v_0^2}{2\mu g} = 4d_1$$

Answer: braking distance quadruple.