

This 1938 Jam Handy Production by Chevrolet Motors shows a “circus” in which a rat performs a variety of tricks. It also presents a simple conservation of energy problem.

Towards the end of the clip, the rat jumps from a platform, through a flaming hoop, and onto a landing pad. With some assumptions, calculate the speed of the rat when it goes through the hoop and lands on the pad.

First, the assumptions are as follows:

- The height of the platform is about 3 meters.
- The height of the hoop is about 1.5 meters.

To find the rat’s final velocity, when it lands, set the initial energy to the final energy:

$$E_i = E_f$$

$$PE_i = KE_f$$

$$mgh = \frac{1}{2}mv^2$$

The masses cancel, so to solve for v:

$$v = \sqrt{2gh} = 8 \frac{m}{s}$$

Now, to find the velocity when the rat is going through the hoop, follow a similar procedure, but the final energy is a combination of both gravitational potential and kinetic energies.

$$E_i = E_f$$

$$PE_i = PE_f + KE_f$$

$$mgh_i = mgh_f + \frac{1}{2}mv_f^2$$

$$v_f = \sqrt{2g(h_i - h_f)} = 5.4 \frac{m}{s}$$

As an additional exercise in kinematics, have the students work this problem with the equations of kinematics. Also, ask the students how would the velocities be affected if the animal was more massive, like a cat or dog.