

Raised objects have gravitational potential energy. Moving objects have kinetic energy. How are these two quantities related in a system that involves a ball rolling down a ramp?

Purpose:

To find a ball's potential energy at the top of a ramp and its kinetic energy at the bottom of a ramp and to look at the relationship between the two.

Equipment

| | | | |
|-----------|--------------|-----------|-------|
| Board | Meter stick | Golf Ball | Books |
| Stopwatch | Masking Tape | Balance | |

Procedure

1. Measure the mass of the golf ball and record it in the data table.
2. Place a strip of masking tape across the board close to one end and measure the distance from the tape to the other end of the board. Record this distance as the length of the ramp
3. Make a stack of books approximately 10 cm high. Build a ramp by setting the taped end of the board on top of the books. Measure the vertical height of the board at the tape and record this as the height of the ramp.
4. Place the ball on the ramp on the tape. Release the ball and measure how long it takes the ball to travel to the end of the board. Record the time in your data table.
5. Repeat step 4 two more times and record the results in your data table. After three trials calculate the average time and record it in your data table.
6. Repeat steps 3 -5 with the books approximately 20 and 40 cm high.

Data Table

| | Height 1 | Height 2 | Height 3 |
|-------------------------|----------|----------|----------|
| Mass of ball(g) | | | |
| Length of ramp (cm) | | | |
| Height of ramp (cm) | | | |
| Time of travel, trial 1 | | | |
| Time of travel, trial 2 | | | |
| Time of travel, trial 3 | | | |
| Average Time of travel | | | |

Calculations: Show your work and include the units

1. We measured the length of the ramp in centimeters. Find the length of the ramp in meters. There are 100 cm in one meter.

2. Calculate the average speed of the ball in each using the following equation

$$\text{averagespeed} = \frac{\text{length of ramp (m)}}{\text{average time ball travelled}}$$

3. Multiply the final the average speed by 2 to find the final speed.

4. We measured the mass of the ball in grams. Find the mass of the ball in kilograms. There are 1000 g in one kilogram.

5. Calculate the kinetic energy of the ball for each trial using this equation

$$\text{KE} = \frac{1}{2}mv^2$$

6. We measured the height of the ramp in centimeters. Find the height of the ramp in meters for each trial. There are 100 cm in one meter.

7. Calculate the potential energy for each trial using the following equation

$$\text{PE} = mgh$$

8. For each of the three heights compare the ball's potential energy to its kinetic energy.

9. Why should the value for kinetic energy be less than the value for potential energy.