

Concept 4: Physical quantities contribute to different forms of energy.

- Physical quantities (e.g., height, mass, speed (velocity), etc.) can affect different forms of energy.
- For example, the higher the object is above the ground, the more gravitational potential energy it has.

Energy Equations

- Equation for mechanical kinetic energy (KE):

$$E_k = \frac{1}{2} m v^2$$

E_k mechanical kinetic energy (J)

m mass (kg)

v velocity (m/s)

Raynbow's Fall

- Raynbow weighs 12 kg and fell to the ground at a velocity of 5 m/s. How much kinetic energy did she hit the ground with?
 - $E_k = \frac{1}{2} mv^2$
 - $E_k = \frac{1}{2} (12)(5)^2$
 - $E_k = \frac{1}{2} (12)(25)$
 - $E_k = 150 \text{ J}$

Energy Equations (continued)

Equation for gravitational potential energy (GPE):

$$E_g = mg\Delta h$$

E_g gravitational potential energy (J)

m mass (kg)

g acceleration due to gravity (9.8 m/s^2)

h height (m)

Raynbow's Fall

- Raynbow weighs 12 kg and is sitting 1.25 meters above the ground. How much potential energy does she have? Gravity is 9.8 m/s^2 .

Raynbow's Fall

- Raynbow weighs 12 kg and is sitting 1.275 meters above the ground. How much potential energy does she have? Gravity is 9.8 m/s^2 .
 - $E_g = mg\Delta h$
 - $E_g = (12)(9.8)(1.275)$
 - $E_g = 150 \text{ J}$

Discussion Questions

1. What physical quantities affect
 - a) mechanical kinetic energy and
mass and speed (velocity)
 - b) gravitational potential energy?
mass and height

Examples

A ball falls at 20 m/s and weighs 9 kg. How much energy does it hit the ground with?

- $E_k = \frac{1}{2} mv^2$
- $E_k = \frac{1}{2} (9)(20)(20)$
- $E_k = 1800 \text{ J}$

If the ball falls with 1000 J of energy how fast was the ball moving (hint find the ball's velocity)?

- $E_k = \frac{1}{2} mv^2$
- $1000 \times 2 = (\frac{1}{2} (9)v^2) \times 2$
- $2000/9 = 9v^2/9$
- $\sqrt[2]{222.2} = \sqrt[2]{v^2}$
- $v = 14.9 \text{ m/s}$

A boulder falls at 0.25 m/s and hits the ground with 1200 J. What is the mass of the boulder?

- $E_k = \frac{1}{2} m v^2$
- $1200 = \frac{1}{2} m (0.25)(0.25)$
- $1200/0.03125 = 0.03125m/0.03125$
- 38400 kg