Edgenuity

Warm-Up | Potential and Kinetic Energy

Lesson Question

What is the relationship between potential and kinetic energy?

Lesson Goals

Explore the differences between potential energy and kinetic energy.

Calculate the potential energy in a system.

Calculate the kinetic energy in a system.

Explain how energy is transferred in a moving system.

Words to Know

Write the letter of the definition next to the matching word as you work through the lesson. You may use the glossary to help you.

B system

D transformation

A kinetic energy

C potential energy

A. the energy an object has due to its motion

B. a group of related objects that interact and form a complex whole

C. the stored energy an object has due to its position

D. a change in form, appearance, nature, or characteristic

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Energy

- Energy is the ability to do work.
- Work involves the transfer of energy from one object to another.
- Energy exists in several forms.
  - Chemical
  - Electrical
  - Mechanical
  - Thermal
  - Potential
  - Kinetic

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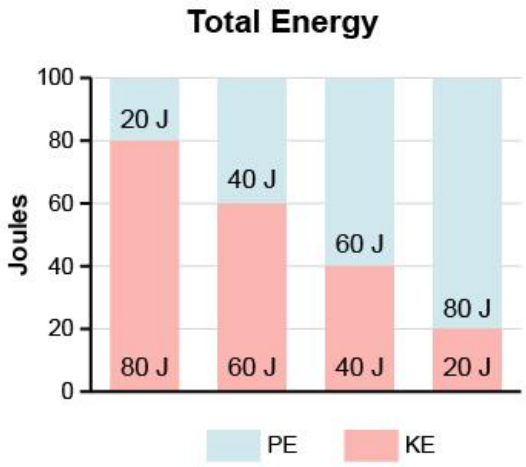
Potential Energy and Kinetic Energy

- Objects can have more than one form of [energy] at the same time.
  - [Potential energy] is the energy an object has due its position.
  - [Kinetic energy] is the energy an object has due to its motion.
- The amount of each form of energy depends on the [motion] and position of an object.

Total Energy



A [system] is the group of objects that interact with each other.

- The [total energy] in a system stays the same.
  - If potential energy increases, then kinetic energy [decreases].
  - If potential energy decreases, then kinetic energy [increases].

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Gravitational Potential Energy

- Potential energy is [stored] energy.
- Potential energy related to the [height] of an object is known as gravitational potential energy.
  - Gravitational potential energy comes from the presence of [gravity].
  - The greater the height of an object, the [greater] its gravitational potential energy.

The Potential Energy Equation

- Gravitational potential energy is directly related to:
  - an object's [mass], *m*.
  - the acceleration due to [gravity], *g*.
  - an object's [height], *h*.

$$PE = mgh$$

An Application of the Potential Energy Equation

What is the potential energy of a 150 kg rock resting on top of a hill that is 25 m high?

Gravity on Earth is a constant of [9.8] m/s/s.

$\text{PE} = (150\ \text{kg})(9.8\ \text{m/s}^2)(25\ \text{m}) =$ [36,750 J]

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The Potential Energy Equation

When potential energy is known, mass or height can be found.

$$PE = mgh$$

To find mass, rearrange equation: $m = PE/gh$

To find height, rearrange equation: $h = PE/gm$

Example: Jeremiah, who has a mass of 60 kg, starts skating down a hill with a potential energy of 1,200 J. What is the height of the hill? Round your answer to the nearest whole number.

Step 1: Identify what is known.

- $m =$ 60 kg
- $g = 9.8\ \text{m/s/s}$
- $PE =$ 1,200 J

Step 2: Multiply mass x gravity.

$60\ \text{kg} \times 9.8\ \text{m/s/s} =$ 588 kg m/s/s

Step 3: Solve the equation.

$h = (1{,}200\ \text{J})/588\ \text{kg m/s/s} =$ 2.04 m

Step 4: Round the answer to the nearest whole number.

$h = 2.04\ \text{m} =$ 2 m

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Kinetic Energy

Kinetic energy:

- is the energy of [motion].
- depends on the mass and velocity of an object.
  - Increases when [mass] increases
  - Increases when [velocity] increases

The Kinetic Energy Equation

- Kinetic energy is directly related to [one-half] an object's mass, *m*, times an object's velocity, *v*, [squared].

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

Mass (*m*) is measured in [kg].

Velocity squared (v^2) is measured in [m^2/s^2].

Multiplied together give us [joules], J.

An Application of the Kinetic Energy Equation

Example: What is the kinetic energy of a 55 kg girl walking at a velocity of 2 m/s?

Step 1: Identify what is known.

- m = 55 kg
- v = w m/s

Step 2: Find half of 55 kg.

55 kg/2 = 27.50 kg

Step 3: Square the velocity

2 m/s × 2 m/s = 4 m^2/s^2

Step 4: Solve the equation.

KE = 27.5 kg × 4 m^2/s^2 = 110 J

Imagine that the girl's velocity increases to 4 m/s. Her kinetic energy increases to 440 J.

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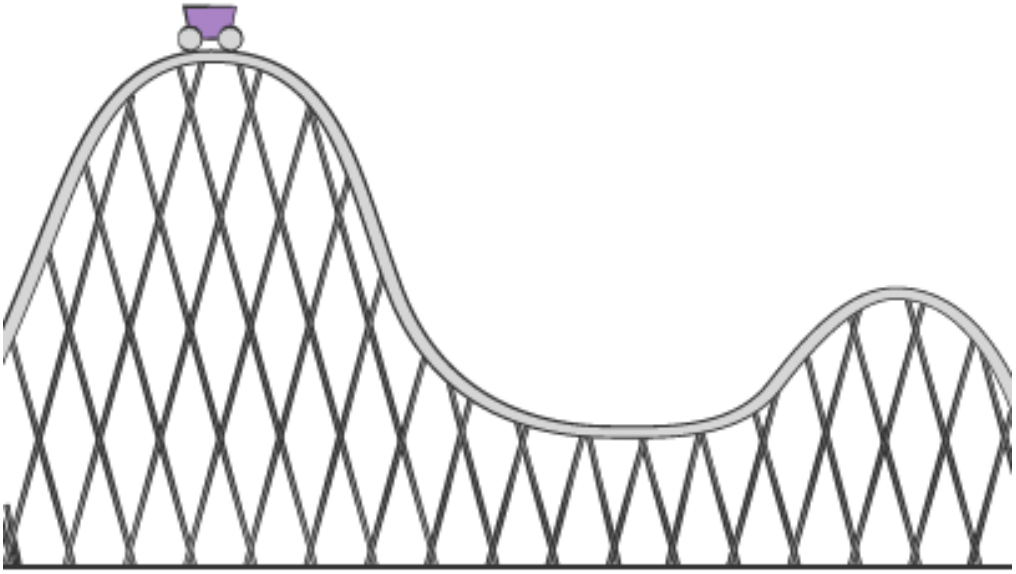
Potential and Kinetic Energy Transformations

- PE and KE goes through [transformations], or changes
  - Top of the hill = all [potential] energy
  - Downhill = potential becomes [kinetic]
  - On the ground = [all] kinetic energy
  - Uphill = kinetic becomes [potential]



Summary | Potential and Kinetic Energy

Lesson Question

What is the relationship between potential and kinetic energy?

Answer

(Sample answer) A falling object's potential energy decreases as its height decreases. At the same time, the object is speeding up, so its kinetic energy increases.

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Review: Key Concepts

- Gravitational potential energy [decreases] as an object gets closer to the ground.
- At the same time, kinetic energy increases because the object is [speeding] up.

Term	Definition	Affected by	Equation
Kinetic	Energy of [motion]	Velocity	$KE = \frac{1}{2}mv^2$
Potential	Energy due to [position]	Height	$PE =$ [mgh]

Summary | Potential and Kinetic Energy

Use this space to write any questions or thoughts about this lesson.