

Warm-Up

Energy Transformations

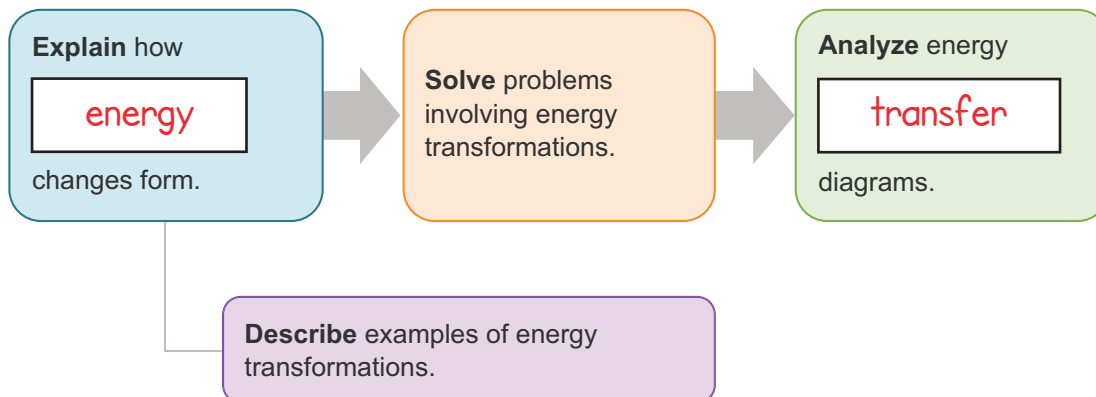


Lesson Question

How does energy change from one form to another?



Lesson Goals



Words to Know

Fill in this table as you work through the lesson. You may also use the glossary to help you.

convert	to change into a different form
energy transformation	the process of changing one form of energy to another
gravitational potential energy	the energy of an object due to its position
thermal energy	the part of total internal energy that can be transferred from one substance to another substance



Potential and Kinetic Energy

- Potential energy is the energy an object has because of its **position**.
- Kinetic energy is the energy an object has because of its **motion**.

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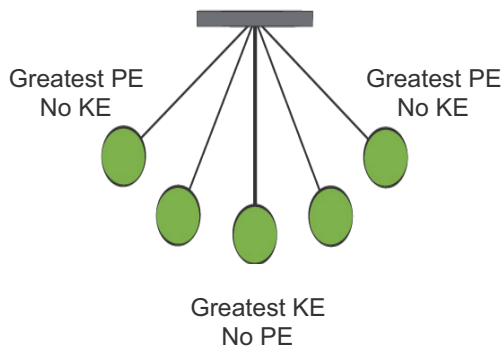
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Energy Transformations

- Most forms of energy can be transformed, or **converted**, into other forms of energy.
- The process of changing one form of energy to another is called **energy transformation**.
 - Single transformations
 - **Multiple** transformations

Common Energy Transformations

- At its highest point, the pendulum only has gravitational potential energy.
- As it swings down, potential energy is transformed into kinetic energy.
- At the bottom of the swing, all of its energy is **kinetic**.
- As it swings up, kinetic energy is transformed into potential energy.
- At the **top** of the swing, the pendulum only has gravitational potential energy.



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Multiple Transformations: Engines

- **Electrical** energy produces sparks.
- Sparks produce **thermal** energy.
- **Chemical** energy in fuel is released and transformed into thermal energy.
- Thermal energy is transformed into mechanical and electrical energy.
 - Moves car
 - Produces more sparks

Energy Transformations of Falling Objects

- Before jumping from the plane, the skydiver has **potential** energy.
- When he jumps, potential energy is transformed into kinetic energy.
- Kinetic energy increases until the skydiver reaches **terminal** velocity.
- Potential energy is **transformed** into thermal energy.

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Mechanical Energy

- Mechanical energy is associated with the position and motion of an object.
- An object that has only potential energy still has **mechanical** energy.
- An object that has only **kinetic** energy still has mechanical energy.

$$ME = KE + PE$$

Instruction

Energy Transformations

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EXAMPLE

$$PE = 23 \text{ J}$$

$$KE = 41 \text{ J}$$

$$23 \text{ J} + 41 \text{ J} = \boxed{64 \text{ J}} \text{ of mechanical energy}$$

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Mechanical Energy

- $ME = KE + PE$

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

- $PE_g = mgh$

- Therefore,

$$ME = \frac{1}{2}mv^2 + \boxed{mgh}$$

- m = an object's mass
- v = an object's velocity
- g = acceleration due to gravity, 9.8 m/s^2
- h = an object's height

Charlotte passes a basketball across the court with a velocity of 11.4 m/s . The mass of the basketball is 0.62 kg .

What is the total mechanical energy of the basketball at a height of 2.5 m above the gym floor?

$$v = 11.4 \text{ m/s}$$

$$m = \boxed{0.62 \text{ kg}}$$

$$h = 2.5 \text{ m}$$

Then,

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

$$ME = \frac{1}{2}(0.62 \text{ kg})(11.4 \text{ m/s})^2 + (0.62 \text{ kg})(9.8 \text{ m/s}^2)(2.5 \text{ m})$$

$$ME = \boxed{55.5 \text{ J}}$$

Instruction

Energy Transformations

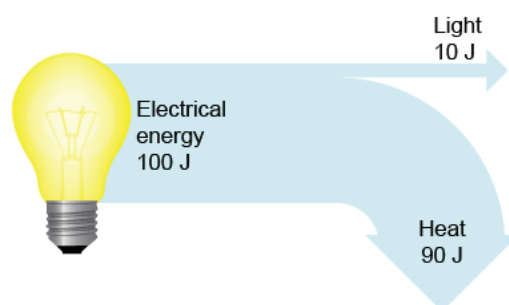
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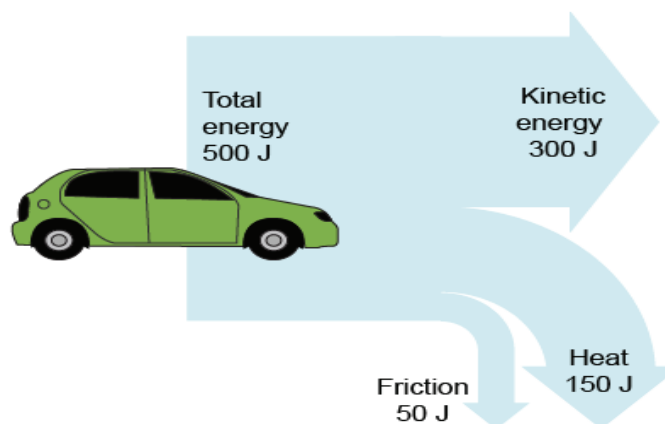
Energy Transfer Diagrams

- Energy cannot be created or **destroyed**. It can, however, change form.
- The total amount of energy before and after any **transformations** is the same.

$$100 \text{ J} = 90 \text{ J} + 10 \text{ J}$$



EXAMPLE



$$\text{Total energy} = 500 \text{ J} = 300 \text{ J} + 50 \text{ J} + 150 \text{ J}$$

Summary

Energy Transformations

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Lesson Question

How does energy change from one form to another?

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Answer

(Sample answer) Energy transformations occur from the input of additional energy into a system, either naturally or through human influence. Energy can change from potential to kinetic. It also changes into light energy, heat energy, or sound energy. Some energy can also be lost to friction.

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Review: Key Concepts

- Most forms of energy can be transformed into others. This process is called **energy** transformation.
- **Mechanical** energy is associated with the position and motion of an object. It can be expressed using the formula $ME = KE + PE$
- Energy cannot be created or destroyed. It can, however, change form.
 - The total amount of energy before and after any transformations is the **same**.



Summary

Energy Transformations

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