

# The Law of Conservation of Energy

- The Law of Conservation of Energy
- Total Mechanical Energy
- Other forms of energy
- Application



# Preview File

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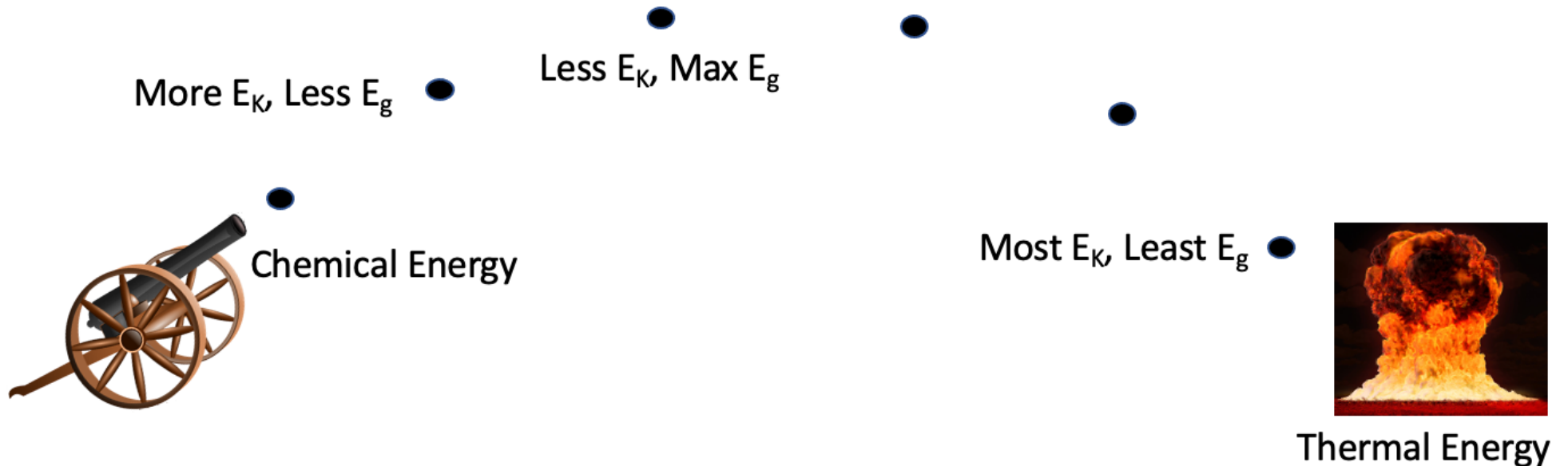
- Some slides appear blank because they have been removed
- Student versions have portions of the text removed which is given in the teacher version and appear as \_\_\_\_\_ which the students are to fill in
- Other slides may have ..... on them, this represents writing that has been removed on this sample

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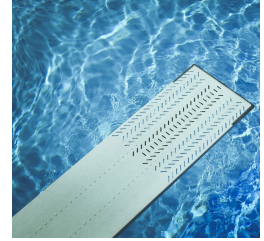


# The Law of Conservation of Energy

For an isolated system, \_\_\_\_\_



# Example 1

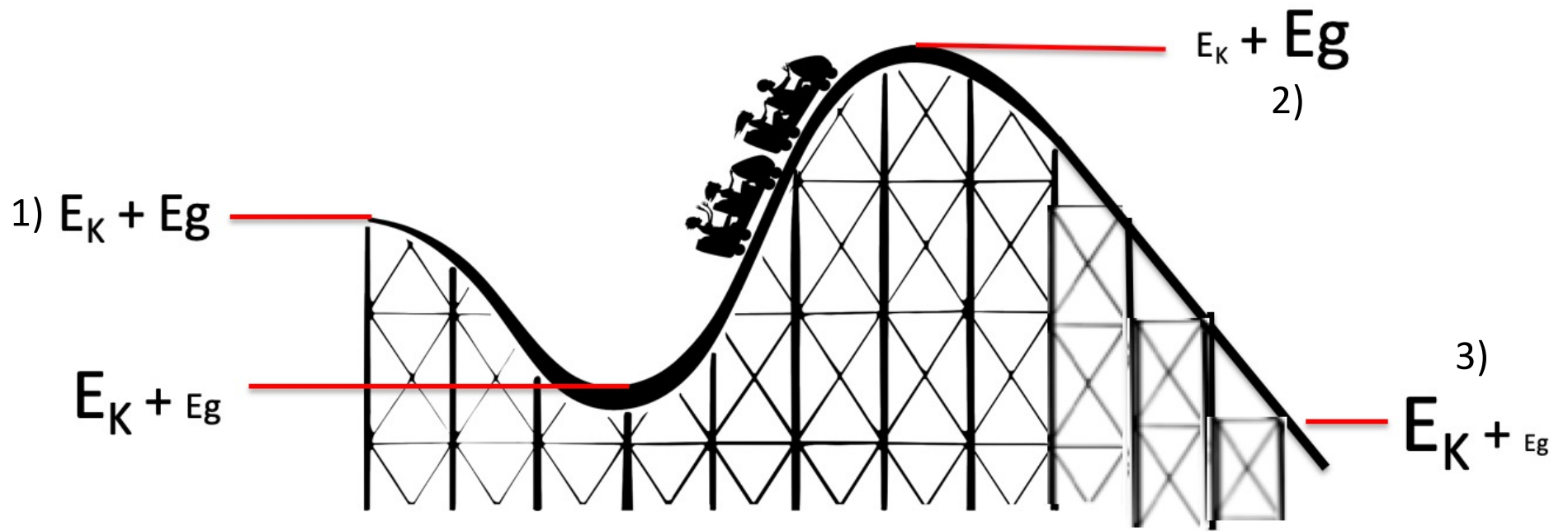


A 50.0 kg swimmer jumps (from rest) from a 3.00 m diving board under negligible air resistance. At the diving board, the swimmer has zero kinetic energy (no movement) and maximum gravitational potential energy relative to the water surface below. Together, the kinetic energy and gravitational potential energy make up the swimmer's *mechanical energy*.

| Height (m) | $E_g$ (J)          | $E_k$ (J)          | Mechanical Energy (J) |
|------------|--------------------|--------------------|-----------------------|
| 3.00       | $1.47 \times 10^3$ | 0.00               | $1.47 \times 10^3$    |
| 2.00       | $9.80 \times 10^2$ | $4.90 \times 10^2$ | $1.47 \times 10^3$    |
| 1.00       | $4.90 \times 10^2$ | $9.80 \times 10^2$ | $1.47 \times 10^3$    |
| 0.00       | 0.00               | $1.47 \times 10^3$ | $1.47 \times 10^3$    |

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# Total Mechanical Energy



# Check Your Understanding

A basketball player makes a free-throw shot at the basket. The basketball leaves the player's hand at a speed of 7.2 m/s from a height of 2.21 m above the floor. Determine the speed of the basketball as it goes through the hoop, 3.05 m above the floor.

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

# Note

The direction and therefore the sign (+ or -) of the flight and velocity are not important since the kinetic and potential energies are scalar quantities, and do not involve a direction.

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# Application

- When a hockey player pushes hard against the ice, he/she will glide until they stop (assume no additional work is done)

- \_\_\_\_\_



# Application

- \_\_\_\_\_
- In this case, the Friction transfers all the  $E_K$  into thermal energy
  - The heat produced when the surfaces slide across one another heats up both the skates and ice creating a layer of water under the skates
- The work done by friction can be written as
  - $= - F_K \Delta d$
  - $E_{th} \text{ (thermal energy)} = F_K \Delta d$



# Check Your Understanding

After leaving a player's hand, a 19.9-kg curling rock slides in a straight line for 28.8 m, experiencing friction with a coefficient of kinetic friction of 0.105. Draw the situation and determine

- a) How much thermal energy is produced during the slide
- b) The rock's speed just as it left the player's hand.
- c) How much work must have been done by the thrower on the rock?



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