ENERGY

CHAPTER NO.4

SUB: PHYSICS

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LEARNING OUTCOMES

Students will be able to:

- Define kinetic energy.
- Express kinetic energy in proper units.
- Solve simple problems based on kinetic energy.
- Define potential energy.
- Define gravitational potential energy.
- Solve problems based on gravitational potential energy.
- Describe energy transformation in daily life situation .
- Distinguish between energy and power.

Website: www.odmegroup.org
Email: info@odmps.org
Toll Free: **1800 120 2316**
Sishu Vihar, Infocity Road, Patia, Bhubaneswar- 751024

POINTS TO BE COVERED

- Conversion of potential energy into kinetic energy
- Different forms of energy.

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INTRODUCTION

https://youtu.be/IqV5L66EP2E

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CONVERSION OF KINETIC ENERGY INTO POTENTIAL ENERGY

- The potential energy changes into kinetic energy when it is put to use.
- Sum of potential energy and kinetic energy remains constant at each instant.
- This is called the law of conservation of mechanical energy.

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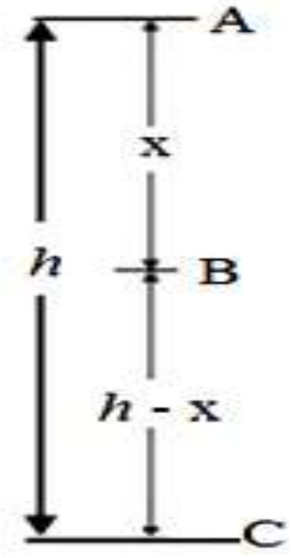
LAW OF CONSERVATION OF ENERGY

- **Law of Conservation of Energy**
- It states that energy can neither be created nor destroyed, but it can be transformed from one form to another.
- The total energy before and after the transformation remains the same.

- **Proof of Law of Conservation of Energy**
- Let a body of mass *m* falls from a point A, which is at a height *h* from the ground as shown in the following figure:



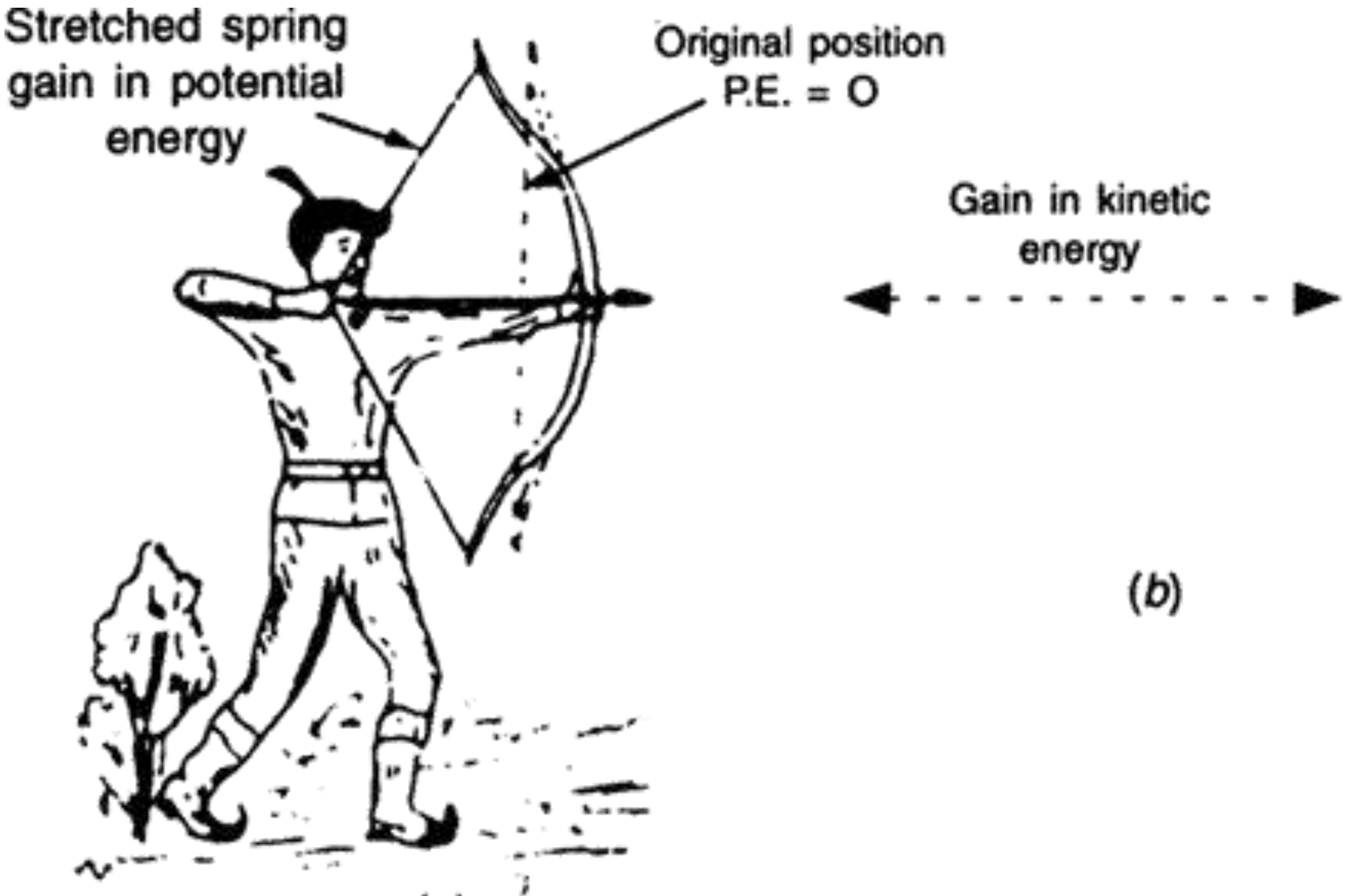
- **At point A,**
- Kinetic energy $E_k = 0$
- Potential energy $E_p = mgh$
- Total energy, $E_A = E_p + E_k$
- $\Longrightarrow \quad E_A = mgh + 0$
- $\Longrightarrow \quad E_A = mgh$
- During the fall, after moving a distance x from A, the body has reached at B.
- **At point B,**
- Let the velocity at this point be v.
- We know, $v^2 = u^2 + 2as$
- $\Longrightarrow \quad v^2 = 0 + 2a\text{x} = 2a\text{x}$ [As, velocity at A, $u = 0$]
- Also, Kinetic energy, $E_k = 1/2\ mv^2$
- $\Longrightarrow \quad E_k = 1/2\ m \times 2g\text{x}$
- $\Longrightarrow \quad E_k = mg\text{x}$

- Potential energy, $E_p = mg(h - \text{x})$
- So, total energy, $E_\text{B} = E_p + E_k$
- $\Longrightarrow \quad E_\text{B} = mg\ (h - x) + mgx$
- $\Longrightarrow \quad E_\text{B} = mgh - mgx + mgx$
- $\Longrightarrow \quad E_B = mgh$
- At the end the body reaches the position C on ground.
- **At point C,**
- Potential energy, $E_p = 0$
- Velocity of the body is zero here.
- So, $\quad v^2 = u^2 + 2as$
- $\Longrightarrow \quad v^2 = 0 + 2gh = 2gh$
- Kinetic energy, $E_k = 1/2\ mv^2$
- $\Longrightarrow \quad E_k = 1/2 \text{ x } m \text{ x } 2gh = mgh$
- Total energy at C

- $E_C = E_p + E_k$
- $E_C = 0 + mgh$
- $E_C = mgh$
- Hence, energy at all points remains same.

EXAMPLES

- 1.Stone falling from a height.
- A stretched bow has potential energy because of its stretched position. When it is released, the potential energy is converted into kinetic energy.


Stretched spring
gain in potential
energy
Original position
P.E. = O
Gain in kinetic
energy

(a) (b)

- A compressed spring has the potential energy in it due to its compressed state. When the compressed spring is released, the potential energy changes into kinetic energy.
- https://youtu.be/IqV5L66EP2E

HOME ASSIGNMENT

- Exercise: B: 11,12,13,14

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