WEEK 6

Physics of Engineer

Chapter 6: Work and Energy

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Outline

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- ❑ Quantifying Work: The Equation
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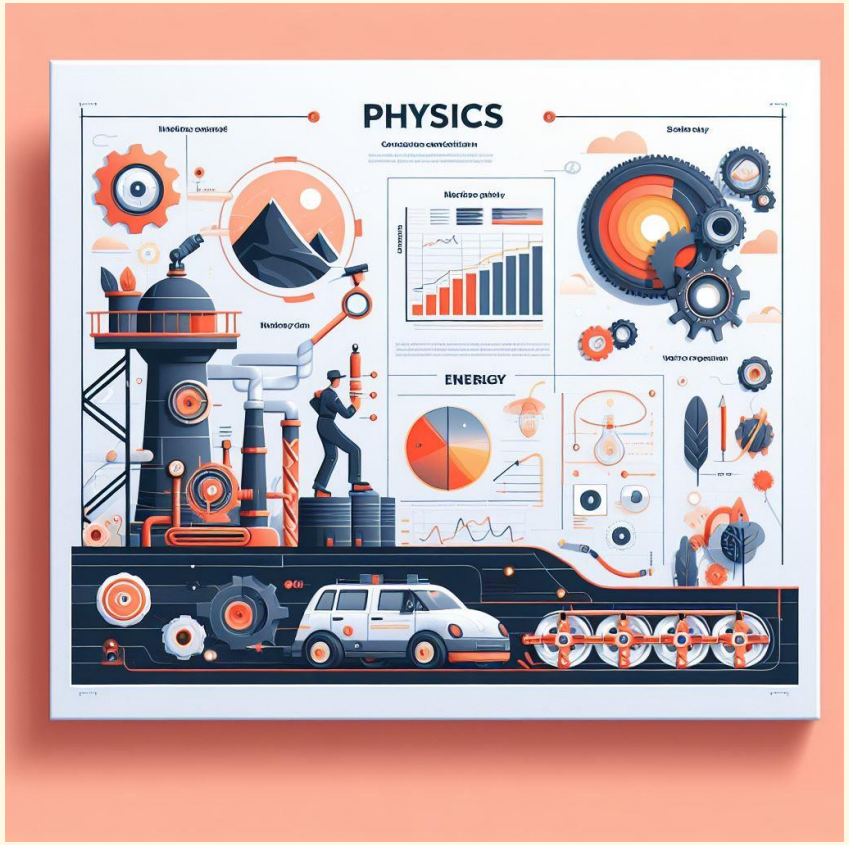


Introduction to Work

What is Work (Physics Definition)?

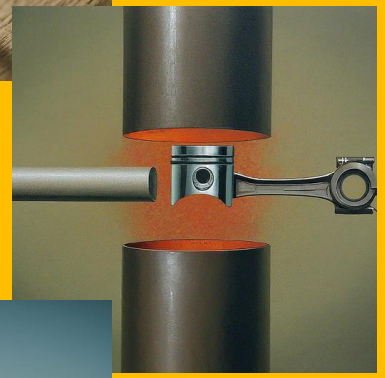
- Work is not just about effort or employment.
- In physics, work is a scientific concept related to force and displacement.
- It refers to the transfer of energy from one object to another.

Quantifying Work: The Equation

The Formula for Work (W = Fd)

- Work (W) is measured in Joules (J).
- It equals the force (F) applied to an object multiplied by the distance (d) the object moves in the direction of the force.
- Negative work indicates work done against the force.




Understanding Force and Displacement

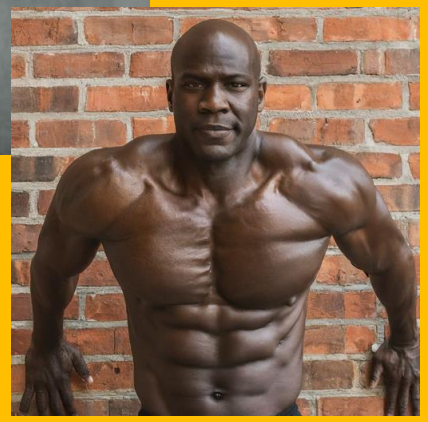
Key Parameters: Force and Displacement

- Force has magnitude and direction.
- Displacement is the straight-line distance moved in the direction of the force.
- Only the component of force in the direction of motion contributes to work.

Types of Work

Exploring Different Types of Work

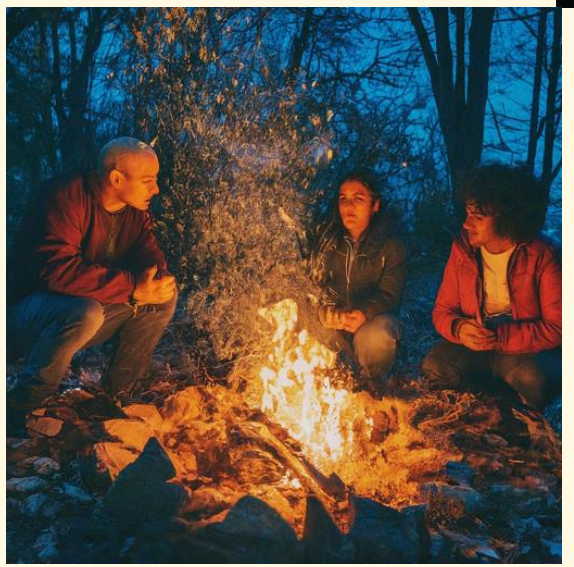
- Positive work increases the object's kinetic energy (movement).
- Negative work decreases the object's kinetic energy (opposing force).
- Work can also be done against other forces like friction or gravity.



What is Energy?

Unveiling the Concept of Energy

- Energy is the ability to do work.
- It exists in various forms, like kinetic, potential, thermal, etc.
- Energy can be transformed from one form to another, but the total amount remains constant (Law of Conservation of Energy).



Kinetic Energy

The Energy of Motion: Kinetic Energy

- Kinetic energy (KE) depends on the object's mass (m) and velocity (v).

$$KE = 1/2\ mv^2$$

- Higher mass or velocity leads to higher kinetic energy.

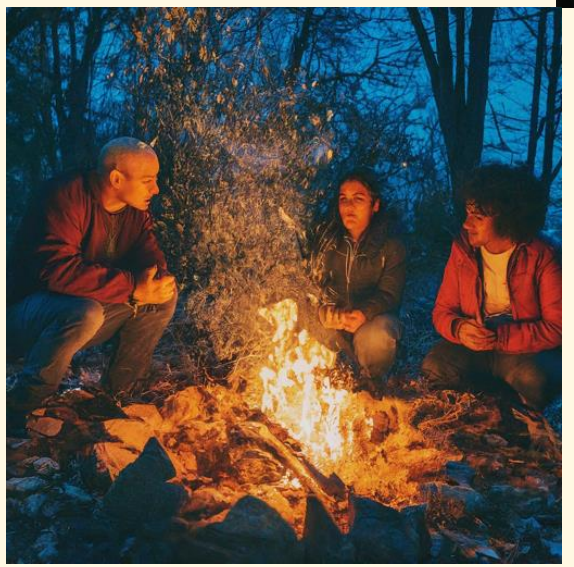
Potential Energy

Stored Energy: Potential Energy

- Potential energy (PE) depends on an object's position or configuration.
- Gravitational potential energy (GPE) depends on mass (m), gravity (g), and height (h):

$$PE = mgh.$$

- Elastic potential energy (EPE) depends on how



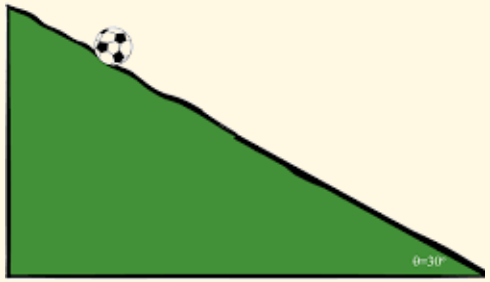
Work-Energy Theorem

- The work-energy theorem states that the net work done on an object equals the change in its kinetic energy.
- Mathematically

$$W = \Delta KE$$

where ΔKE is the change in kinetic energy.

- This theorem helps us understand how work can change the motion of objects.



Applications in Daily Life

Work and energy concepts are applied in various aspects of daily life:

- Riding a bicycle (using muscular work to convert chemical energy into kinetic energy)
- Lifting weights (against gravity's work to increase potential energy)
- Cooking (thermal energy from heat source transforms food's chemical energy)
- Electricity generation (converting various energy sources into electrical energy)

Conclusion

- **Recap**: Briefly summarize the key concepts covered in the presentation, including the definition of work, the formula for work, different types of energy, and the work-energy theorem.
- **Emphasize the importance**: Highlight the significance of understanding work and energy in various fields, such as physics, engineering, and daily life.
- **Connect to real-world applications**: Provide specific examples of how work and energy concepts are used in everyday situations, such as sports, transportation, and energy consumption.
- **Challenge and encourage**: Motivate students to apply their understanding of work and energy to solve problems, analyze real-world scenarios, and further explore related topics.
- **Call to action**: Encourage students to ask questions, seek further information, and continue their learning journey in physics and beyond.

Resources and References

Online Resources:

- Interactive simulations and animations:
  - PhET Interactive Simulations: https://www.colorado.edu/csl/programs/phet-interactive-simulations
  - The Physics Classroom: https://www.physicsclassroom.com/
  - Khan Academy: https://www.khanacademy.org/science/physics
- Educational websites and articles:
  - HyperPhysics: http://hyperphysics.phy-astr.gsu.edu/
  - MIT OpenCourseware: https://ocw.mit.edu/courses/8-01sc-classical-mechanics-fall-2016/
  - National Geographic: https://www.nationalgeographic.com/environment/article/powering-the-future

Resources and References

Online Resources:

- **Books and Textbooks:**
  - Specify relevant textbooks used in your class or suggest introductory physics books like:
    - "Physics for Scientists and Engineers" by Tipler and Mosca
    - "University Physics" by Young and Freedman
    - "Conceptual Physics" by Hewitt
- **Documentaries and Videos:**
  - PBS Space Time: https://www.youtube.com/@pbsspacetime
  - Kurzgesagt – In a Nutshell: https://www.youtube.com/channel/UCsXVk37bltHxD1rDPwtNM8Q
  - National Geographic documentaries on energy and physics

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