

Simple Mechanics

Unit 3
Session 3

Introduction

- Work
- Energy
- Power
- Force Frequency and Torque



Lesson Aims:

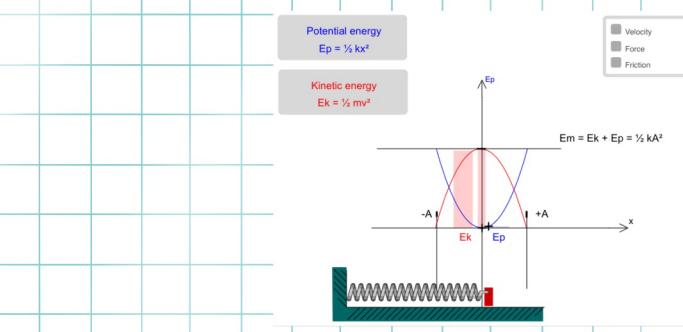
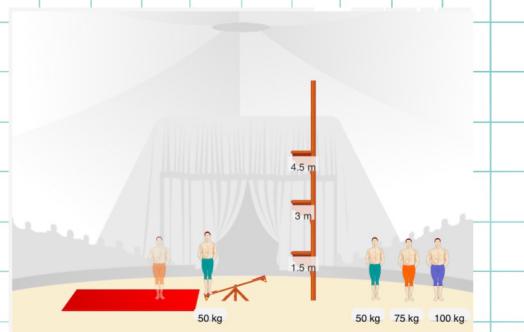
- 1) Exploration of WEP concepts.
- 2) Realization of force and torque.
- 3) Analysis of tools applications and performance assessment of the quality of energy.

- 1) What is work?
- 2) What is the flow of work, energy, or power?
- 3) How to utilize the energy to get the required work/power?



WARMUP WITH WORK, ENERGY AND POWER

Refer to reference 1 by scanning the QR code given in the end for detailed description. Few Examples are -



Answer

DISCUSSION ON WEP

Overview of Work, Energy and Power

What is Work, Energy and Power?

Work

Definition	The work done by a force is defined to be the product of component of the force in the direction of the displacement and the magnitude of this displacement.
Formula	Work can be calculated by multiplying Force and Distance in the direction of force as follows $W = F \times d$
Unit	The SI unit of work is the Joule (J)

Energy

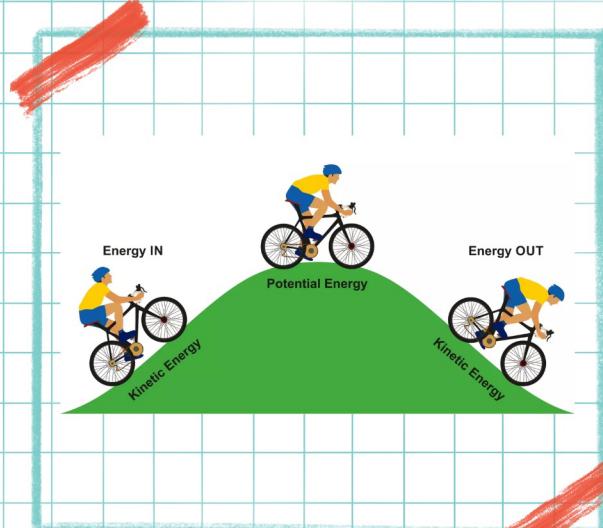
Definition	Energy is defined as the capacity to do work.
Formula	The energy stored in an object due to its position and height is known as potential energy and is given by the formula: $P.E. = mgh$
Unit	The SI unit of energy is Joules (J).

Power

Definition	Power is defined as the rate at which work is done.
Formula	The formula for power is $P = W/t$
Unit	The SI unit of power is Watt (W).

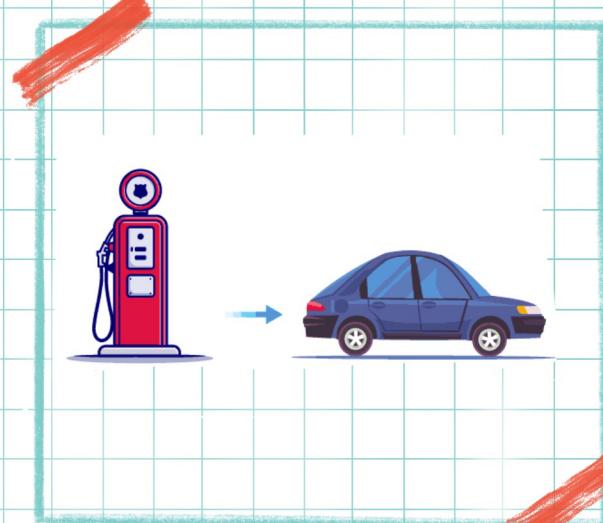
KINEMATIC ENERGY AND POTENTIAL ENERGY

Potential energy is the stored energy in any object or system by its position or arrangement of parts. However, it isn't affected by the environment outside of the object or system, such as air or height. On the other hand, kinetic energy is the energy of an object or a system's particles in motion.



LAW OF CONSERVATION OF ENERGY

Energy is required for the evolution of life forms on earth. In physics, it is defined as the capacity to do work. We know that energy exists in different forms in nature. You have learned about various forms of energy – heat, electrical, chemical, nuclear, etc. In this article, we will learn about the laws and principles that govern energy. This law is known as the law of conservation of energy.



INTRODUCTION TO HYDRAULICS

Hydraulic is a word formed via the combination of two words hydro + aulos . Hydro means water and aulos means pipe. Use reference [2] and reference [3] (scan from QR Code given at the end) for more information.



ACTIVITY

- 1) Using two syringes, water, and a piece of plastic tubing, demonstrate to students how a hydraulic system works.
- 2) Divide the class into groups of 3 or 4 students each. Let the students know that they will be compiling a "portfolio" of sketches, design ideas, notes, and a summary for presentation at the end of the project.
- 3) Have each group brainstorm the necessary components of the mechanical arm and make at least 3 sketches of possible design ideas. If they are struggling to come up with ideas, you can show them photos of similar mechanical arms or they can research photos. Here is a link to a great video showing a very simple hydraulic arm: <http://www.youtube.com/watch?v=GSNXQGEu2ew#t=58>. For an example that is a bit more complex, this video is excellent: <http://www.youtube.com/watch?v=Qeg0y5AAmtI>.
- 4) Once the students have made their sketches, they should construct and test their mechanical arms. In their tests, they should note changes, modifications, failures, and successes in their sketches.
- 5) Encourage students to think about designs that would fail, and how they can prevent failures. What do they need to do to create a stable, efficient arm that can complete the challenge?
- 6) Allow students to redesign, reconstruct, and retest their designs. Once they have finalized their design, have them compile a brief summary of their design and construction process, including documenting their failures and thoughts about how to improve their design.
- 7) Give the students time to compile the pieces of their portfolio. They will then present their finished hydraulic arm to the other groups and discuss their design and building process. Refer [4] In the QR code.

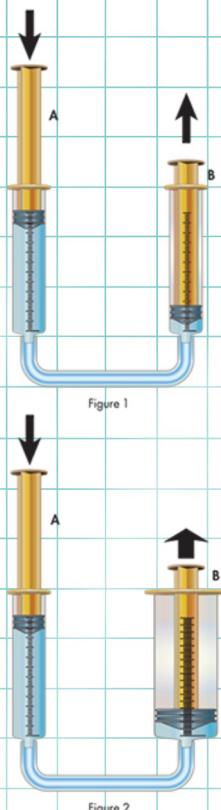


Figure 1

Figure 2

REFLECTION

FOR MORE INFORMATION -

- 1) How does work affect an object's energy?**
- 2) How are work, energy, and power related to each other?**
- 3) How are force, energy, and work related?**
- 4) What is the formula of work, energy, and power?**
- 5) How do you calculate energy from power?(Let them play with units to answer the question)**
- 6) Can force be converted into energy?**

