

# **Chapter Eight**

## **Work, Energy And Machines:**

- When we apply a force and the force moves through a distance, then work is said to have been done.
- In science, work is only said to be done when the applied force moves.
- If we apply the force and there is no movement, then we have done no work.
- For example, if we apply a force by pushing or pulling a table and the table does not move, then we have done no work.
- Work can only be said to have been done if the table moves.
- Also a horse pulling a car does no work if the car does not move.
- To get the work done, we multiply the force by the distance moved.
- Therefore  $\text{Work} = \text{Force} \times \text{Distance}$ .

(Q1) Find the work done if a force of 10N pulls a block through a distance of 2m.

Soln:

Force = 10N and distance = 2m.

Work = Force  $\times$  Distance.

=> Work done =  $10 \times 2 = 20\text{J}$ .

N/B: Work is measured in joules.

i.e. J, which means that the unit of work is joules (J).

(Q2) A man applied a force of 12N in pulling an object. If the object moves through a distance of 5m, calculate the work done.

Soln:

Force = 12N and distance = 5m.

Work done = Force  $\times$  Distance,

=> Work =  $12 \times 5 = 60\text{J}$ .

## **Power:**

- This is defined as the rate of doing work.
- $\text{Power} = \frac{\text{Work done}}{\text{Time Taken}}$ .
- The unit of power is the watt (W).

(Q1) The work done in pulling a car by a man is 20J. If the time taken is 4 second, calculate the power.

Soln:

Work done = 2J and time = 4 seconds

$$\text{Power} = \frac{\text{Work done}}{\text{Time Taken}}.$$

$$\Rightarrow \text{Power} = \frac{20}{4} = 5W.$$

### **Energy:**

- Energy is the ability to do work, or what we must have in order to be able to do work.
- For without energy, we cannot perform activities such as walking, dancing, jumping or writing.
- Human beings and animals get the energy they need from the food they eat.
- This food contains a type of energy called chemical energy.
- The energy needed to move a car comes from the petrol we put into it.
- The petrol also contains chemical energy.

### **Forms of energy:**

- There are various forms of energy and some are:

#### **(1) Solar energy:**

- This refers to the energy we get from the sun.
- Solar energy provides us with light (sunlight) and heat.

#### **(2) Electrical energy:**

- This is the type of energy we get from generators and batteries.

#### **(3) Chemical energy:**

- This is the type of energy that we get from food and chemicals such as petrol.

#### **(4) Heat energy:**

- This is the type of energy which flows or moves from the hot to the cold part of a body.

#### **(5) Kinetic energy:**

- This is the type of energy which a moving body or object have.
- Every object which is moving therefore has kinetic energy.

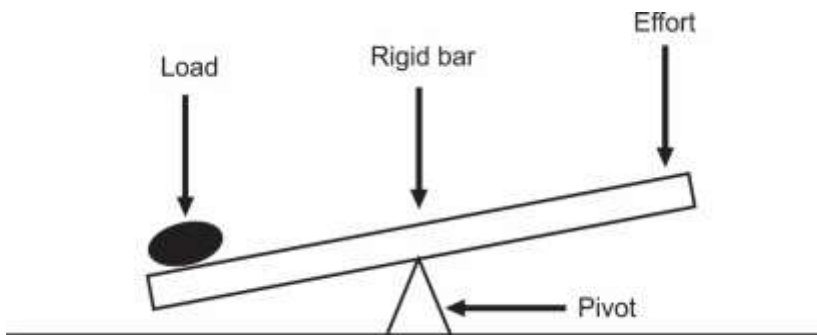
#### **(6) Potential energy:**

- This is the type of energy had by a body, which has been raised above the surface of the earth.
- Therefore an object such as a stone which has been raised above the surface of the earth , has this type of energy.

### **Machines:**

- This is any device which enables us to do work more easily.
- By means of a machine, a small force called the effort can be used to lift a heavy object called the load.

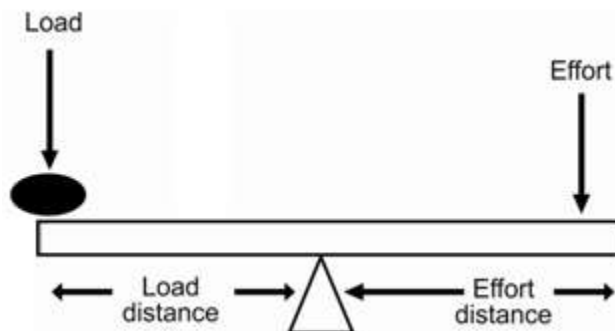
## **The lever:**



- The lever is a rigid straight bar, which lies on a pivot.
- A rigid body is a body which cannot bend and examples are iron bar, ruler and a stick.
- The lever is an example of a simple machine.
- The force which is applied to the lever is called the effort, and the work or the force it overcomes is known as the load.
- In the lever, a small force applied at one point called the effort, can be used to overcome a greater force or load at another point.
- The rigid bar rests on a pointed edge or a pointed structure.
- This pointed structure which is called a pivot, can be a plastic, wood or a metal.

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## **Load and effort distance:**



- The effort distance is the distance between the effort and the pivot.
- The load distance is the distance between the load and the pivot.
- Examples of levers are the wheelbarrow, the hammer and the crow bar.

## **Types of levers:**

- There are three types of levers and these are:
  - (i) First class levers.
  - (ii) Second class levers.
  - (iii) Third class levers