



Lecture 3
Al-Mustaqbal University
College of Science
Department of Medical Physics

Lecturers
Dr. Anees Ali
Dr. Ahed Hameed

What is Work?

For work to be done a force must be exerted and there must be motion or displacement in the direction of the force. The work done by force acting on an object is equal to the magnitude of the force multiplied by the distance moved in the direction of the force. Work has only magnitude and no direction. Hence, work is a scalar quantity.

Formula of Work

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.

$$\mathbf{W} = (\mathbf{F} \cos \theta)\mathbf{d} = \mathbf{F} \cdot \mathbf{d}$$

We understand from the work equation that if there is no displacement, there is no work done, irrespective of how large the force is. To summarize, we can say that no work is done if:

- The displacement is zero
- The force is zero
- The force and displacement are mutually perpendicular to each other.

What is Power?

Power is a physical concept with several different meanings, depending on the context and the available information. We can define power as the rate of doing work, and it is the amount of energy consumed per unit of time.

Formula of Power

As discussed, power is the rate of doing work. Therefore, it can be calculated by dividing work done by time. The formula for power is given below.

$$P = W/t$$

Where, P is the power, W is the work done and T is the time taken.

$$P = \frac{W}{t}$$

W = Work done | t = Time taken | P = Power

Example of Power

A garage hoist lifts a truck up 2 meters above the ground in 15 seconds. Find the power delivered to the truck. [Given: 1000 kg as the mass of the truck]

First we need to calculate the work done, which requires the force necessary to lift the truck against gravity:

$$F = mg = 1000 \times 9.81 = 9810 \text{ N.}$$

$$W = Fd = 9810\text{N} \times 2\text{m} = 19620 \text{ Nm} = 19620 \text{ J.}$$

$$\text{The power is } P = W/t = 19620\text{J} / 15\text{s} = 1308 \text{ J/s} = 1308 \text{ W.}$$

.....

Q/ A garage hoist lifts a truck up 2 meters above the ground in 15 seconds. The power is -----.

- a) **1308 W**
 - b) -1308 W
 - c) $\pm 1308 \text{ W}$
 - d) Zero
-

Example of Work

An object is horizontally dragged across the surface by a 100 N force acting parallel to the surface. Find out the amount of work done by the force in moving the object through a distance of 8 m.

Solution:

Given:

$$F = 100 \text{ N, } d = 8 \text{ m}$$

Since F and d are in the same direction, $\theta = 0$, [θ is the angle of the force

to the direction of movement], therefore

$$W = Fd\cos \theta$$

$$W = 100 \times 8 \times \cos 0$$

$$W = 800 \text{ J [Since } \cos 0 = 1]$$

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 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).

.....
Q/ The formula of work is -----.

- a) **$W=F*d$**
- b) $W=F/$
- c) $W=F*d*t$
- d) $W=F*t$

.....
Q/ The formula for power is -----.

- a) $P=Wt$
 - b) $P=W^2t^2$
 - c) $P=W^2t$
 - d) **$P=W/t$**
-