Lec.5 : Work and power

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Medical Physics

ميكانيك – مرحلة اولى
محاضرة اولى

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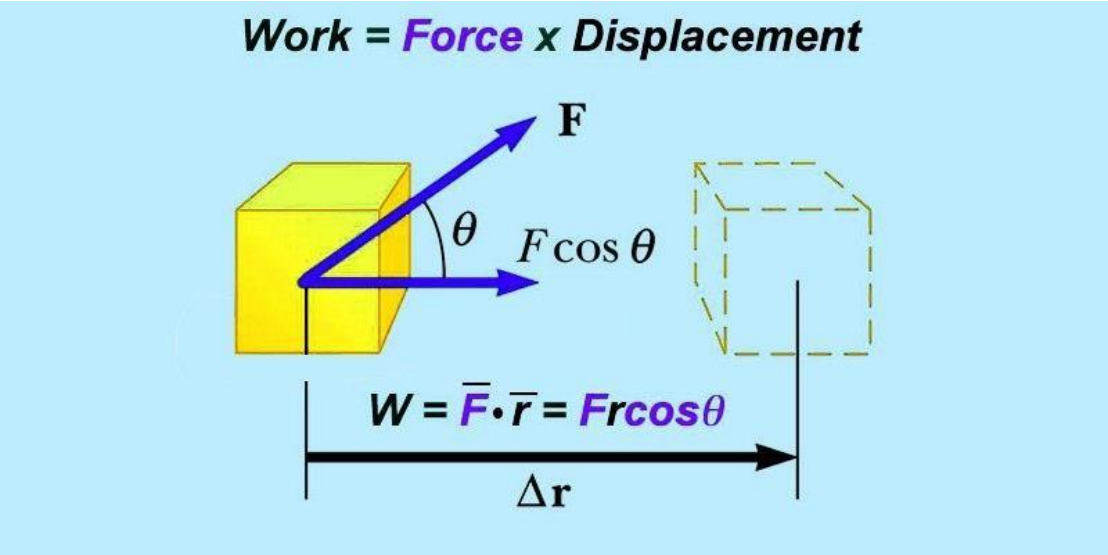
The Work

Work and energy are closely related to each other. Work can also be defined as the transfer of energy. In Physics, for two objects, the work done is defined as the transfer of energy from the first object to the second object. Also, energy is defined as the capacity to do work.

Work is believed to be done by a force when an object experiences displacement parallels to the line of action of the force. It's an activity that includes force and movement in the direction of the force. The capability for doing work is what the energy is! In this article, let's learn more about work and energy concept along with principle of work and energy.



Work is given by the equation Frcosθ, where r is the distance over which the force is applied and θ is the angle between the force and distance.

Principle of Work and Energy

The work-energy principle says states that

The change in kinetic energy of a body is equivalent to the net work done on the body.

This information is referred to as the work-energy principle and is derivable from the law conservation of energy

The law of conservation of energy states that

Energy can neither be created nor be destroyed. Although, it may be transformed from one form to another.

Work and Energy Equations

It is the resultant of the force applied (F) and the amount of displacement (r) and is articulated by the equation

$F = m \cdot g$

$W = F.r$

Power describes the rate at which work is done. It is articulated as

$P = W/t$

The energy or work is articulated in Newton-meter (Nm) or Joules or kg.m2/s2 .

$N = Kg.\ m/s^2$

$J = Nm$

$J = Kg.m/s^2\ (m)$

$J = Kg\ m^2/s^2$

What happens when the work is done against gravity?

When the work done is against gravity, the amount of work done will be equal to the product of the weight of an object and the height through which the object is lifted.

The mathematical representation of work done against the gravity is given as:

$$W = m \times g \times h$$

Where:

- **W is the work done**
- **m is the mass of an object**
- **g is the acceleration due to gravity**
- **h is the height through which the object is been lifted**

What is Power?

What is 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.

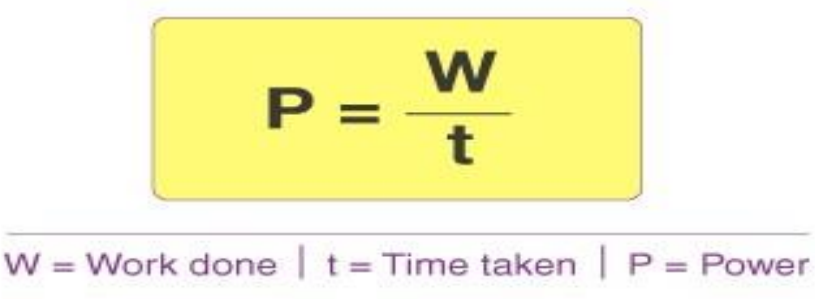
Formula of Power

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.

taken.

$$P = W/t$$

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



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 x 9.81 = 9810 N.

W = F d = 9810N x 2m = 19620 Nm = 19620 J.

The power is P = W/t = 19620J / 15s = 1308 J/s = 1308 W.

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 N, d = 8 m

Since F and d are in the same direction, θ = 0, [θ is the angle of the force to the direction of movement], therefore

W = F d Cos θ

W = 100 x 8 x Cos 0

W = 800 J [Since Cos 0 = 1]

Difference Between and Work Energy

Usually, there are two sorts of work **Positive** and **negative** work.

1- If the direction of the force is in the same direction as the motion of its spot of application, work done is said to be positive.
2- If the course of the force is in the opposite direction to the motion of its point of application, negative work is said to be done.

Work	Energy
Work is defined as transferring energy into an object so that there is some displacement	Energy is defined as the ability to do work
Work done is always the same	Energy can be of different types such as kinetic and potential energy
The mathematical representation of work is $W = F.r$ where F is the force applied r is the displacement of the object	The mathematical representation of energy for kinetic energy is $KE = 1/2\ mv^2$ and for potential energy is $PE = mgh$ where, m is the mass, v is the velocity, g is the acceleration due to gravity, h is the height.