

The background features a complex network of thin, light gray lines and dots, primarily concentrated on the left side, forming a web-like structure. Scattered across the entire background are numerous triangles of various sizes and orientations, some outlined in a slightly darker gray than the background. The overall aesthetic is minimalist and geometric.

Work and Power

By Srujana

**to understand work
and power**

Learning Objectives

**to be able to calculate
work and power**

WORK

The more work that a force does, the more energy it transfers. The amount of work done is the amount of energy transferred.

The amount of energy transferred depends on two things:

- The size of the force
 - The distance moved in the direction of the force
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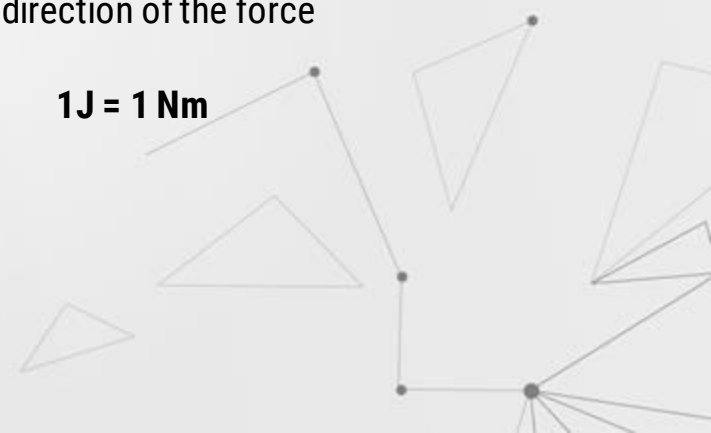




Calculating work done

Work done by a force = force x distance
 $W = f \times d$

One joule is the energy transferred by a force of one newton when it moves through a distance of one metre in the direction of the force

$$1\text{J} = 1\text{Nm}$$




Forces doing no work

If you sit on a chair, there are two forces acting on you. These are your weight (acting downwards), and the upward force of the chair. Neither of these forces is moving, which means there is no work done to you. When you sit still on a chair, your energy does not increase or decrease as a result of the forces acting on you.

There must always be movement in the direction of the force if the force is to do work.



Work done and energy transferred

When a force does work, it transfer energy to the object it is acting on. The amount of energy transferred is equal to the amount of work done.

We can write this as a simple equation:

$$W = \Delta E$$

amount of work done = change in energy

Power

Power is the rate at which you do work. The more work you do, and the shorter the time in which you do it, the greater your power.

When you lift an object, you can increase your power by:

- Increasing the weight of the object
- Lifting the object more quickly



Calculating Power

Power is measured in **watts (W)**. One watt is the power when one Joule of work is done in one second.

One watt is one joule per second.

$$1 \text{ W} = 1 \text{ J/s}$$

$$1000 \text{ W} = 1 \text{ kW}$$

$$1000000 \text{ W} = 1 \text{ MW}$$



Solved questions

A crane lifts a crate upwards through a height of 20 m. the lifting force provided by the crane is 5 kN. How much work is done by the force? How much energy is transferred to the crate?

$$F = 5 \text{ kN} = 5000 \text{ N}$$

$$d = 20 \text{ m}$$

$$\begin{aligned} W &= F \times d \\ &= 5000 \text{ N} \times 20 \text{ m} \\ &= 100000 \text{ J} \end{aligned}$$



A car of mass 800 kg accelerates from rest to a speed of 25 m/s in 10s. What is its power?

$$\text{k.e.} = \frac{1}{2} mv^2$$

$$= \frac{1}{2} \times 800 \text{ kg} \times (25 \text{ m/s})^2$$

$$= 250000 \text{ J}$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

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

$$= \frac{250000 \text{ J}}{10 \text{ s}}$$

$$10 \text{ s}$$

$$= 25000 \text{ W} = 25 \text{ kW}$$



**CALCULATING
WORK DONE**
 $W = f \times d$

**WORK AND
POWER**

**Calculating
power**

**Forces doing
no work**



