

4.8.2 Power

Power (P) is defined as the rate that work is done or the rate that energy is transferred:

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



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(1) *The unit for power is the watt (W). From the equation, above, what is an alternative unit for power?*

For example, when talking about powerful cars, we often quote the time taken for the car to go from 0-60mph. Powerful cars can do this in a very short time. They are transferring chemical energy (in the fuel) to kinetic energy, very rapidly.

A person can measure the power of their leg muscles by running up a flight of stairs as quickly as possible. They measure the total height gained and time how long it takes to gain this height.

(2) *What is the energy transfer taking place in this case?*

(3) *How could they calculate the amount of energy that is transferred?*

(4) *How could they work out the power of their legs?*

A car has a top speed of 54ms^{-1} (120mph). At this speed, the maximum force from the engine is balanced by the frictional forces. The car cannot go any faster, because the engine cannot produce a larger force. The work done by the engine is given by:

$$W = \text{force} \times \text{distance moved}$$

(5) *Using $\text{speed} = \frac{\text{distance}}{\text{time}}$, rearrange to make distance the subject and substitute it in the equation above.*

(6) *Now use the expression at the top to write an expression for power.*

(7) *The car with a top speed of 54ms^{-1} has a maximum engine force of 5kN. What is the power output from the engine?*