CAIE Physics A-level

5 - Work, Energy and Power

Flashcards

This work by PMT Education is licensed under CC BY-NC-ND 4.0

State the principle of conservation of energy.

CC BY NC ND

State the principle of conservation of energy.

Energy can neither be created nor destroyed, only transferred into alternative forms of energy.

Therefore the total energy, in a closed system, will always remain the same.

CC BY NC ND

Define work done.

CC BY NC ND

Define work done.

Work done is equal to the energy transferred usefully. It is the product of the force applied and the displacement moved in the direction of the force.

CC BY NC ND

Define kinetic energy and give its SI base unit.

CC BY NC ND

Define kinetic energy and give its SI base unit.

The energy associated with the motion of an object with mass. Its unit is J and its SI base unit is kgm^2s^{-2}.

$$E_k = \frac{1}{2} mv^2$$

CC BY NC ND

Define gravitational potential energy.

CC BY NC ND

Define gravitational potential energy.

The energy stored by an object at a point in a gravitational field.

$$GPE = mg\Delta h$$

CC BY NC ND

Define elastic potential energy.

CC BY NC ND

Define elastic potential energy.

The energy stored by an object as a result of a reversible change in an object's shape:

$$EPE = 1/2kx^2$$

where k is spring constant N/m and x is the extension in m.

CC BY NC ND

If we consider a closed system where an object is moving up and down, derive a formula for the velocity of an object in a gravitational field.

CC BY NC ND

If we consider a closed system where an object is moving up and down, derive a formula for the velocity of an object in a gravitational field.

All initial GPE is converted to KE as the object falls, and this KE is converted back to GPE as it rises.

Equating KE and GPE gives: $mgh = \frac{1}{2} mv^2$

Rearranging this in terms of v^2 gives $v^2 = 2gh$, so $v = 2gh^{1/2}$

Since mass cancels out, the velocity of the object is independent of mass.

CC BY NC ND

The rate of work done is equal to…

CC BY NC ND

The rate of work done is equal to...

...power.

CC BY NC ND

What is efficiency?

CC BY NC ND

What is efficiency?

Efficiency (%) = (The useful output energy/ total input energy) x 100

= (The useful output power/ total input power) x 100

CC BY NC ND

How can efficiency be maximised?

CC BY NC ND

How can efficiency be maximised?

By minimising energy losses into non-useful forms. Any measure that reduces friction, air resistance, noise generation, heat production etc. in a system designed to do work, will improve its efficiency.

CC BY NC ND

How can the work done by an expanding gas be calculated?

CC BY NC ND

How can the work done by an expanding gas be calculated?

$$\text{Work done} = p\Delta V$$

Where p is pressure (which must be constant) and ΔV is the change in the gas's volume.

CC BY NC ND

How can the efficiency of a system that loses energy due to friction be increased?

CC BY NC ND

How can the efficiency of a system that loses energy due to friction be increased?

Lubricate parts of the system and reduce the number of parts that touch.

CC BY NC ND

Derive power as the product of force and velocity.

CC BY NC ND

Derive power as the product of force and velocity.

Power = work done / time

(Work done = force x displacement)

Power = force x displacement / time

Power = force x velocity

CC BY NC ND