MECHANICAL ENERGY

Mechanical Energy, Work and Power

ENERGY

Energy is the ability to do work or produce change. It is a property of objects and systems and comes in various forms, such as thermal, chemical, electrical, and kinetic energy.





KINETIC ENERGY

Kinetic energy is the energy an object possesses due to its motion. It depends on both the mass of the object and its velocity. It is a scalar quantity and so does **not** depend on direction of motion.



GRAVITATIONAL POTENTIAL ENERGY

Gravitational potential energy is the energy an object has due to its position in a gravitational field, typically related to its height above a reference point (often the ground).



MECHANICAL ENERGY

Mechanical energy is the sum of an object's kinetic energy and gravitational potential energy. It represents the energy associated with the motion and position of an object in a gravitational field.

EXAMPLE PROBLEM

A 750 g throwing axe is thrown with a velocity of 6.30 m s⁻¹ from 1.30 m above the ground. Determine the mechanical energy of the axe the moment it was thrown, using the ground as the reference height.



WORK

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WORK

Work is the transfer of energy that occurs when a force is applied to an object, causing it to move in the direction of the force. The amount of work done depends on the magnitude of the force and the displacement of the object along the direction of that force.



COMPONENT OF FORCE PARALLEL WITH DISPLACEMENT

For work to be done, the force and the displacement of the object must be parallel. If the force and displacement are not aligned, we can take the component of the force that acts parallel with the displacement.



NEGATIVE WORK

When a force acts over a displacement to speed up an object, that object increases in kinetic energy and is an example of positive work.

Negative work occurs when a force acts against the motion of an object, causing it to lose kinetic energy.



| EXAMPLE | A 15.0 kg box starting from rest slides down the frictionless ramp shown in the diagram below. Once at the bottom, it slides along a rough surface, coming to rest after 2.00 m. |
|---------|--|
| PROBLEM | a) Determine the work done by gravity on the box b) Determine the frictional force that acts on the box. |



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POWER

Power is the rate at which energy is transferred, or at which work is done.



POWER AND MECHANICAL ENERGY

Using equations of motion and the relationship between power, work and time, we can derive an equation for the power in terms of velocity.



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