

Work, energy and power · supported focus

International Baccalaureate · IB Diploma · Physics · HL

Scope and prerequisites

Supported HL focus. First assessment 2025; full Physics guide acquired (84 PDF pages). Remaining guide, assessment and practical requirements retain their recorded holds.

Prerequisites: read the stated quantities and units, use arithmetic and the model conditions below. Each lesson develops its own method before independent transfer.

These are original or explicitly fictional teaching examples, not actual measurements or completed assessed learner investigations.

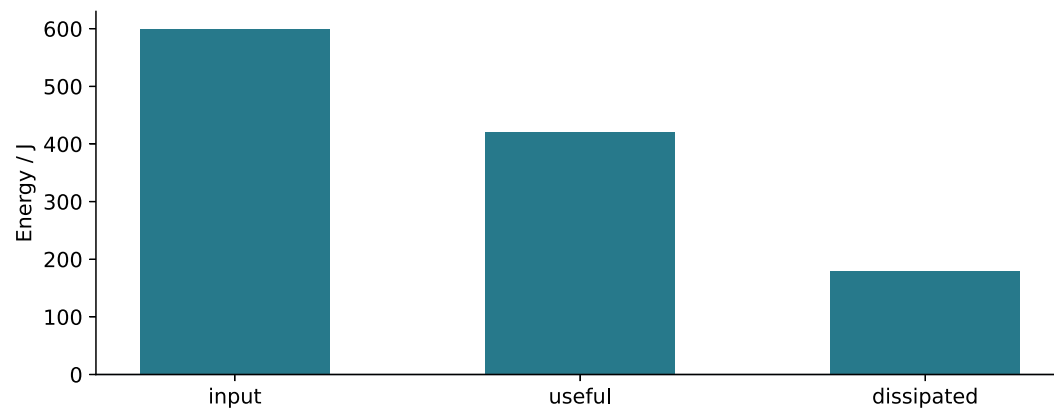
Energy stores, work and efficiency

■ What would explain this observation?

- A motor can transfer some input energy to lifting and the rest to heating. Useful output is part of the total energy transfer.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- Work done by a constant force parallel to displacement is force multiplied by distance. Kinetic energy depends on speed squared. Energy is conserved when all transfers and stores are included.
- **power** : Energy transferred per unit time; **efficiency**: Useful output divided by total input.



■ Choose evidence that can test it

- Define the system and useful output before calculating efficiency. Doubling speed quadruples kinetic energy at constant mass. Power describes transfer per time, not total energy.
- Measure a lifting height and load, time the lift, and record electrical input with suitable instruments. Repeat trials and account for heating or friction as transfers, not missing energy.

■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: a device receives 600 J and transfers 420 J usefully. Efficiency = useful output / total input. Efficiency = $420/600 = 0.70 = 70\%$. Over 3 s, useful power = useful energy/time = $420/3 = 140$ W.

Example:

A device receives 250 J and gives 150 J useful output. Find efficiency as a percentage. Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

■ Check the conclusion and its limits

- Efficiency cannot exceed 100% for a properly defined energy balance. Energy dissipated by heating is still conserved.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

Dissipated energy is destroyed. This claim is false: Efficiency cannot exceed 100% for a properly defined energy balance. Energy dissipated by heating is still conserved.

Key:

Energy stores, work and efficiency: Define the system and useful output before calculating efficiency. Doubling speed quadruples kinetic energy at constant mass. Power describes transfer per time, not total energy.