KECUDO

PREMIUM EDITION II

PHYSICS ESSENTIALS

Class 2

Energy, Work & Power

Where motion gets its energy — work, kinetic and potential energy, springs, power, efficiency and the electricity grid, with worked examples and real data.



2026 EDITION · SCIENCE SERIES

13 chapters · 79 scored questions · 26 practice problems

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Every chapter ends with a Quick Check page.

●○○ FOUNDATION PART I · FOUNDATIONS

Chapter 1

What Is Energy?

Energy is the ability to make things happen — to move, lift, heat or light something. It comes in many **forms**, and it can change from one form to another, but it is never created or destroyed.

FORM	STORED IN…	EXAMPLE
Kinetic	motion	the Kecudo sled at 40 m/s
Gravitational potential	height	a roller-coaster car at the top
Elastic potential	stretch or squeeze	a compressed spring
Chemical	bonds in fuel and food	a snack, a tank of fuel
Thermal	random motion of particles	warm brakes
Electrical	moving charges	a phone charger

UNIT

1 joule (J) = 1 newton × 1 metre = 1 $kg \cdot m^2/s^2$

IN THIS CHAPTER

- Six common forms of energy
- The joule and how big it is
- Using a log scale for huge ranges

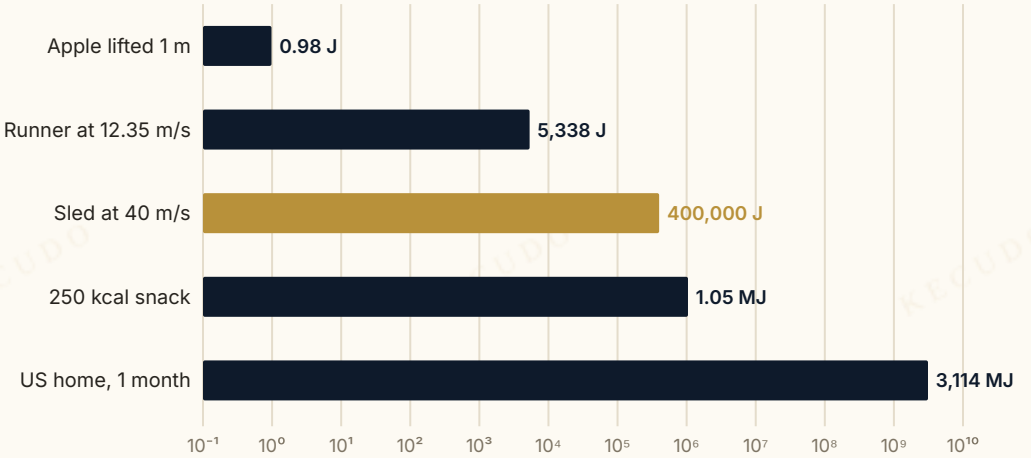
COMMON PITFALL

Treating “energy” and “power” as the same thing.

How big is a joule?

A joule is small: lifting a 100 g apple by 1 m takes about 1 J. Everyday energies span billions of joules, so the chart uses a **log scale** — each grid line is ten times the last.

FIG 1.1 The energy ladder, joules (log scale)



EXAMPLE	CALCULATION	ENERGY
Apple lifted 1 m	0.1 × 9.8 × 1	0.98 J
70 kg runner at 12.35 m/s	½ × 70 × 12.35²	5,338 J
Kecudo sled at 40 m/s	½ × 500 × 40²	400,000 J
250 kcal snack	250 × 4,184	1,046,000 J

12.35 m/s is Usain Bolt's top segment speed from Class 1. Food "Calories" are kilocalories: 1 kcal = 4,184 J.

FOUNDATION PART I · FOUNDATIONS

Chapter 2

Work

In physics, **work** is done when a force moves something. No movement, no work — holding a heavy box still is tiring, but does zero work on the box.

WORK

$$W = F \cdot d \cdot \cos \theta$$

θ is the angle between the force and the motion. Push along the motion (θ = 0°) and all the force counts. Push at right angles (θ = 90°) and the work is zero — gravity does no work on a car driving on level ground.

Work can be **negative**: friction and brakes push against the motion (θ = 180°), taking energy away.

Kecudo Delivery Co.

A courier pulls a cart 20 m with a 50 N force at 30° to the ground. W = 50 × 20 × cos 30° = **866 J**.

IN THIS CHAPTER

- W = F·d·cos θ
- Positive, negative and zero work
- Work as area under a force–distance graph

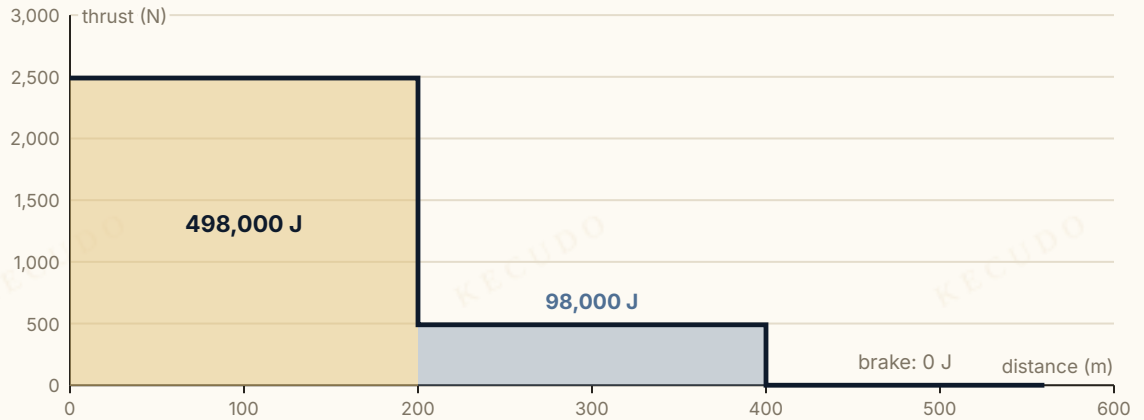
COMMON PITFALL

Counting work when nothing moves, or when the force is at 90° to the motion.

Work as area under a force–distance graph

When the force is plotted against distance, the work is the area under the line. Here is the force from the sled's rocket across its Class 1 test run.

FIG 2.1 Kecudo sled — rocket thrust (N) vs distance (m); shaded area = work



PHASE	THRUST × DISTANCE	WORK BY ROCKET
Launch (0–200 m)	2,490 N × 200 m	498,000 J
Coast (200–400 m)	490 N × 200 m	98,000 J
Brake (400–560 m)	0 N	0 J
Whole run		**596,000 J**

During the coast the rocket only balances friction, so all 98,000 J of that work turns into heat in the track.

Self-Assessment · Part A

Basics

40 questions in 5 parts. Each answer locks once chosen and shows a one-line explanation. Your score updates in the top bar; your rating is on the Results page.

A1 The SI unit of power is the...

- **A** joule
- **B** newton
- **C** watt
- **D** kilowatt-hour

A2 Which has gravitational potential energy?

- **A** Light
- **B** A rolling ball on flat ground only
- **C** A silent phone
- **D** A book on a high shelf

A3 Work is done on an object when...

- **A** a force is applied
- **B** a force moves it some distance
- **C** it is heavy
- **D** it is hot

A4 Kinetic energy depends on...

- **A** mass and height
- **B** temperature
- **C** mass and speed
- **D** force and area

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Thank you for learning with Kecudo.

NEXT IN THE SERIES

Physics Essentials · Class 3

Waves & Sound

Oscillations, waves, the speed of sound, decibels, music and the Doppler effect — with the Kecudo Rocket Co. sled's siren.

More classes: kecudo.com