KECUDO

PREMIUM EDITION I

PHYSICS ESSENTIALS

Class 1

Motion & Forces

From units and vectors to Newton’s laws, projectiles, orbits and collisions — explained 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 Physics Measures

Physics describes the world with numbers — but a number on its own means nothing. “40” could be a speed, a mass or a time. Every measurement in this book is a **number plus a unit**, and the units come from the International System (SI).

Mechanics, the physics of motion, needs only three base units. Every other unit you will meet in this class is built from them.

QUANTITY	SI UNIT	SYMBOL	BUILT FROM
Length	metre	m	base
Mass	kilogram	kg	base
Time	second	s	base
Velocity	**metre per second**	**m/s**	**m ÷ s**
Acceleration	metre per second²	m/s²	m ÷ s ÷ s
Force	newton	N	kg·m/s²
Momentum	—	kg·m/s	kg × m/s

KEY IDEA

A number without a unit is not an answer.

IN THIS CHAPTER

- The three SI base units of mechanics
- How derived units such as the newton are built
- Scientific notation and the km/h ↔ m/s conversion

COMMON PITFALL

Mixing units — e.g. km/h with metres — is the No. 1 source of wrong answers. Convert to SI first.

Scientific notation & prefixes

Physics spans tiny and huge scales, so we write numbers as $a \times 10^n$. Earth's radius is 6,371,000 m = 6.371×10^6 m.

PREFIX	SYMBOL	FACTOR	EXAMPLE
kilo	k	10^3	1 km = 1,000 m
mega	M	10^6	1 Mm = 1,000,000 m
centi	c	10^{-2}	1 cm = 0.01 m
milli	m	10^{-3}	1 ms = 0.001 s

The conversion you will use most

1 km/h = 1,000 m ÷ 3,600 s, so **divide km/h by 3.6** to get m/s. 72 km/h ÷ 3.6 = **20 m/s**; 144 km/h = 40 m/s.

Running example · Kecudo Rocket Co.

Kecudo Rocket Co. (fictional) tests a **500 kg** rocket sled on a straight 1 km track. We follow the same sled through the whole book — its numbers tie from chapter to chapter.

> Convention: this book uses **g = 9.8 m/s²** for Earth (standard gravity is 9.806 65 m/s²). Answers are rounded sensibly.

● ○ ○ FOUNDATION PART I · FOUNDATIONS

Chapter 2

Position, Distance & Displacement

To describe motion we first need to say *where* something is. We pick an origin (zero) and a positive direction, then give each point a **position** *x*.

Distance is the total length of the path travelled. It is a *scalar*: size only, never negative.

Displacement is the straight-line change in position from start to finish. It is a *vector*: it has a size and a direction (shown by its sign on a line).

DISPLACEMENT

$$\Delta x = x_{final} - x_{initial}$$

The Greek letter Δ (“delta”) means “change in”. If you finish where you started, your displacement is zero — no matter how far you walked.

> Choosing which way is positive is up to you. Pick once, then stick with it for the whole problem.

IN THIS CHAPTER

- How to set an origin and a positive direction
- The difference between distance and displacement
- How to use Δ for “change in”

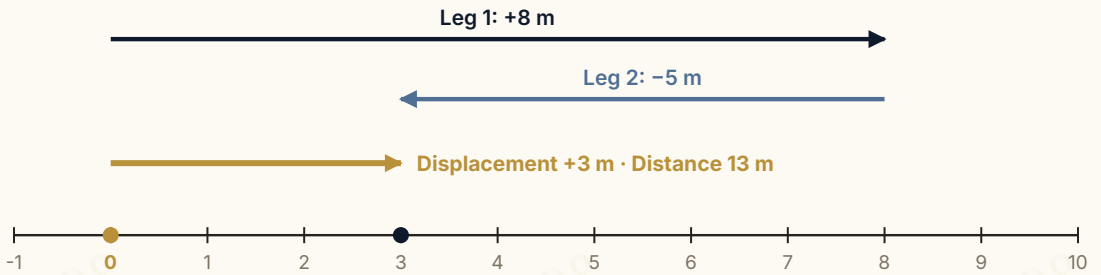
COMMON PITFALL

Forgetting the sign: a displacement of −5 m is not the same as +5 m.

Worked example · Kecudo Delivery Co.

A courier walks from the depot (x = 0) to x = +8 m, then turns back and stops at x = +3 m.

FIG 2.1 Distance vs displacement on a number line (metres)



LEG	DISTANCE	DISPLACEMENT
Depot → +8 m	8 m	+8 m
+8 m → +3 m	5 m	−5 m
Whole trip	**13 m**	**+3 m**

Distance adds every metre walked (8 + 5 = 13 m). Displacement keeps the signs (+8 − 5 = +3 m): the courier ends up only 3 m from the depot.

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 What is the SI unit of force?

- **A** Joule
- **B** Newton
- **C** Watt
- **D** Pascal

A2 Which of these is a vector quantity?

- **A** Speed
- **B** Mass
- **C** Displacement
- **D** Time

A3 An object moves in a straight line at constant velocity. The net force on it is...

- **A** zero
- **B** equal to its weight
- **C** in the direction of motion
- **D** increasing

A4 Acceleration is best defined as...

- **A** how fast something moves
- **B** distance ÷ time
- **C** a forward push
- **D** the rate of change of velocity

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Thank you for learning with Kecudo.

NEXT IN THE SERIES

Physics Essentials · Class 2

Energy, Work & Power

Kinetic and potential energy, conservation of energy, power and efficiency — with the Kecudo Rocket Co. sled back on the track.

More classes: kecudo.com