

The International System of Units

How science uses one global measurement language.



The Problem with Local Systems

In earlier times, scientists and engineers across different countries used fundamentally different measurement systems. This lack of standardization made scientific collaboration, industrial trade, and technical communication incredibly difficult and prone to dangerous errors.



⚠ Caution: Without a common measurement language, physics cannot be universal.

The Pre-SI Measurement Systems

Three fragmented systems dominated global science until recently.

CGS System

Length: Centimetre (cm)

Mass: Gram (g)

Time: Second (s)

FPS System (British)

Length: Foot (ft)

Mass: Pound (lb)

Time: Second (s)

MKS System

Length: Metre (m)

Mass: Kilogram (kg)

Time: Second (s)

Time was the only universally agreed-upon dimension.

The Solution: Système International d'Unités (SI)



Origin:

French for International System of Units

Timeline:

Established in 1971; recently revised in November 2018

SI

Authority:

Developed by BIPM (The International Bureau of Weights and Measures)

Usage:

The universally accepted standard for scientific, technical, industrial, and commercial work.



Why it works: SI is built on a decimal system. Conversions within the system simply involve shifting decimal points or using powers of 10, making calculations logical and highly convenient.



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$$E=mc^2$$



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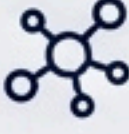
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The 7 SI Base Quantities

	Quantity	Unit	Symbol
	Length	metre	m
	Mass	kilogram	kg
	Time	second	s
	Electric Current	ampere	A
	Thermodynamic Temperature	kelvin	K
	Amount of Substance	mole	mol
	Luminous Intensity	candela	cd

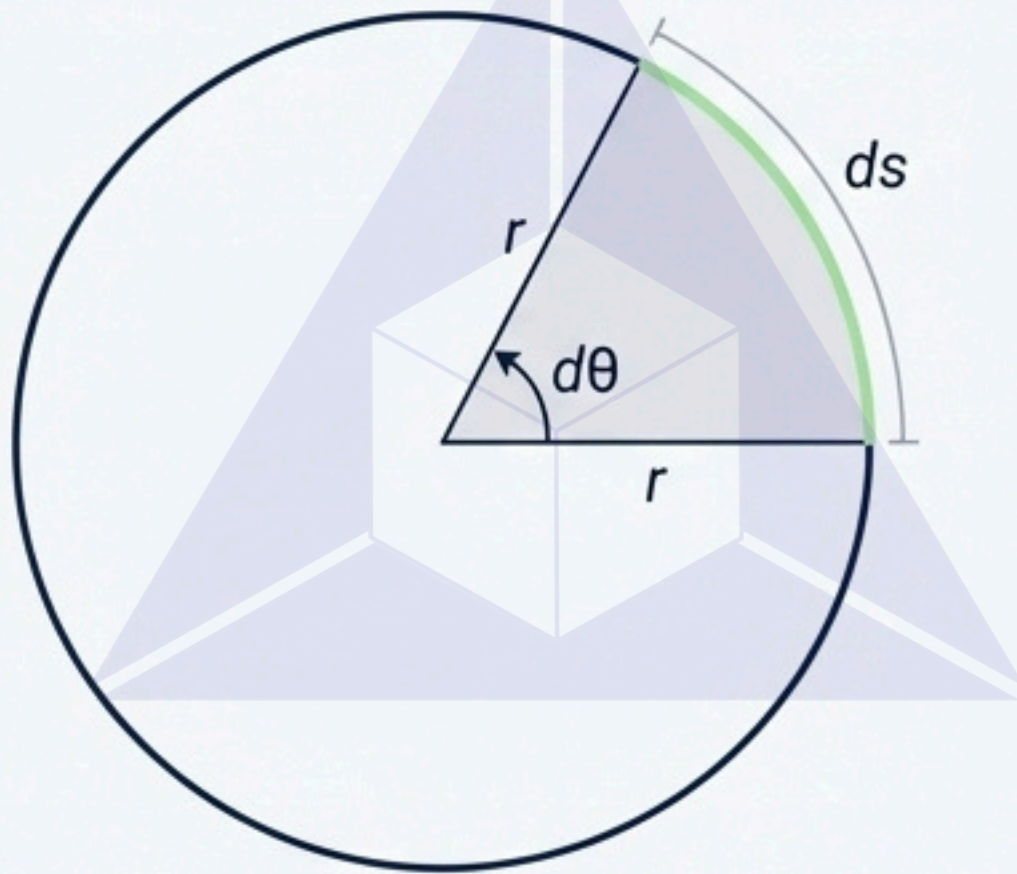
These 7 fundamental dimensions form the foundation for all other derived physical quantities in the universe.

Supplementary Units: Angles

Two additional dimensionless units complete the base system.



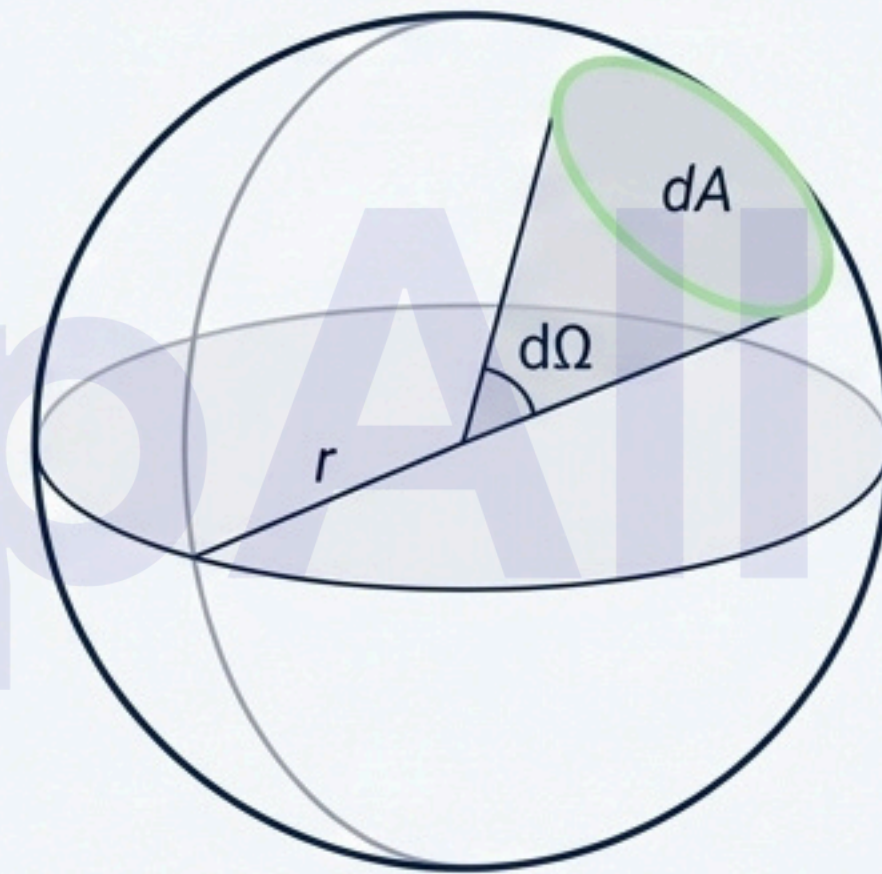
Plane Angle ($d\theta$)



Ratio of arc length to radius ($d\theta = \frac{ds}{r}$)

Unit: radian (rad)

Solid Angle ($d\Omega$)



Ratio of intercepted area to the square of the radius ($d\Omega = \frac{dA}{r^2}$)

Unit: steradian (sr)

Why SI is Critical for Physics



Universal Consistency

Guarantees that an equation solved in India yields the exact same numerical result as one solved in Japan.

$\times 10^x$

Decimal Simplicity

Because it is base-10, scaling from micro-units to mega-units simply requires moving a decimal point, drastically reducing calculation errors.



Dimensional Analysis

Using SI base units allows us to check the absolute validity and homogeneity of complex derived physics equations.

Exam Rule: Always convert all given values in a numerical problem to SI units before starting your calculation to avoid immediate errors!

Quick Recap & Knowledge Check

- ✓ SI replaced fractured local systems like CGS, FPS, and MKS.
- ✓ Built on a simple decimal framework.
- ✓ Consists of 7 base units (m, kg, s, A, K, mol, cd).
- ✓ Includes 2 dimensionless supplementary units (rad, sr).

Q1: Which base quantity is measured in candela (cd)?

Answer: Luminous Intensity

Q2: What does the MKS system stand for?

Answer: Metre, Kilogram, Second

Q3: Are radian and steradian dimensional or dimensionless?

Answer: Dimensionless

Next Chapter Section: 1.3 Significant Figures →



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