Chapter 1

Introduction, Measurement, Estimating

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1-5 Units, Standards, and the SI System

Quantity	Unit	Standard
Length	Meter	Length of the path traveled by light in 1/299,792,458 second.
Time	Second	Time required for 9,192,631,770 periods of radiation emitted by cesium atoms
Mass	Kilogram	Platinum cylinder in International Bureau of Weights and Measures, Paris

1-5 Units, Standards, and the SI System

These are the standard SI prefixes for indicating powers of 10. Many are familiar; Y, Z, E, h, da, a, z, and y are rarely used.

TABLE 1–4 Metric (SI) Prefixes

Prefix	Abbreviation	Value
yotta	Y	10^{24}
zetta	Z	10^{21}
exa	E	10^{18}
peta	P	10^{15}
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}
hecto	h	10^{2}
deka	da	10^{1}
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro[†]	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}
atto	a	10^{-18}
zepto	z	10^{-21}
yocto	y	10^{-24}

[†] μ is the Greek letter "mu."

1-5 Units, Standards, and the SI System

We will be working in the SI system, where the basic units are kilograms, meters, and seconds.

TABLE 1–5 SI Base Quantities and Units

Quantity	Unit	Unit Abbreviation
Length	meter	m
Time	second	s
Mass	kilogram	kg
Electric current	ampere	A
Temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd

Other systems: cgs; units are grams, centimeters, and seconds.

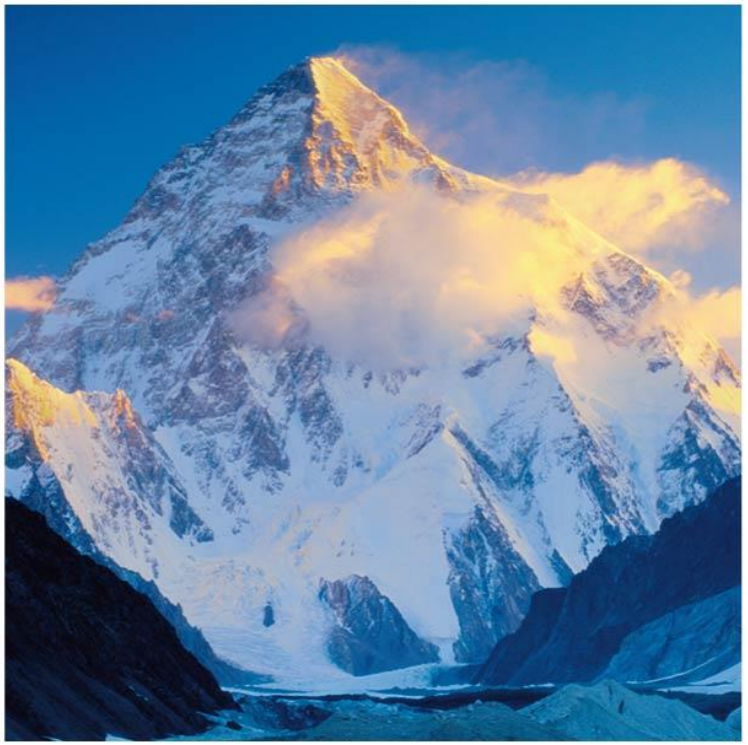
British engineering system has force instead of mass as one of its basic quantities, which are feet, pounds, and seconds.

1-6 Converting Units

Converting between metric units, for example from kg to g, is easy, as all it involves is powers of 10.

Converting to and from British units is considerably more work.

For example, given that 1 m = 3.28084 ft, this 8611-m mountain is 28251 feet high.



1-8 Dimensions and Dimensional Analysis

Dimensions of a quantity are the base units that make it up; they are generally written using square brackets.

Example: Speed = distance / time

Dimensions of speed: [L/T]

Quantities that are being added or subtracted must have the same dimensions. In addition, a quantity calculated as the solution to a problem should have the correct dimensions.

Summary of Chapter 1

Dimensional analysis is useful for checking calculations.