PhyzReference: Units of Measure

Systéme International d'Unitès

SI BASE UNITS

Quantity	*Quantity Symbol*	*Unit*	*Unit Symbol*
Length, Distance	*d, x, ...*	meter	m
Mass	*m, M*	kilogram	kg
Time	*t*	second	s
Temperature	*T*	kelvin	K
Electric Current	*I*	ampere	A
Luminous Intensity	*L*	candela	cd
Amount of Substance	*N*	mole	mol

Notes
1. Distance is denoted with many symbols, depending on context: "y" for vertical distance, "r" and "R" for radius, etc.
2. Notice the meter "m" is plain text while the mass "m" is italicized.
3. We won't use candelas or moles.

SI DERIVED UNITS

Quantity	*Quantity Symbol*	*Unit*	*Unit Symbol*	*Alternate*
Area	*A*	square meter	m^2	
Volume	*V*	cubic meter	m^3	
Speed	*v*	meter per second	m/s	
Acceleration	*a*	meter per second per second	m/s^2	m/s/s
Force	*F*	newton	N	$kg·m/s^2$
Momentum	*p*	kilogram-meter per second	kg·m/s	N·s
Work, Energy, Heat	*W, E, Q*	joule	J	$kg·m^2/s^2$
Power	*P*	watt	W	$kg·m^2/s^3$
Quantity of Charge	*Q*	coulomb	C	A·s
Current	*I*	ampere	A	C/s
Potential Difference,	*V*	volt	V	J/C
Electromotive Force	$\mathscr{E}$			
Electric Field Strength	*E*	newton per coulomb	N/C	V/m
Electric Resistance	*R*	ohm	Ω	V/A
Wavelength	*λ*	meter	m	
Frequency	*f, ν*	hertz	Hz	1/s
Angular Displacement	*θ*	radians	rad	"1"
Angular Velocity	ω	radians per second	rad/s	
Angular Acceleration	α	radians per second squared	rad/s^2	
Rotational Inertia	*I*	kilogram-meter squared	$kg·m^2$	
Torque	*τ*	newton-meter (never "joule")	N·m	
Angular Momentum	*L*	kilogram-meter squared per second	$kg·m^2/s$	
Density	*D, ρ*	kilogram per cubic meter	kg/m^3	
Pressure	*P*	pascal	Pa	N/m^3
Entropy	*S*	joule per kelvin	J/K	
Capacitance	*C*	farad	F	C/V
Magnetic Field Strength	*B*	tesla	T	N/A·m
Magnetic Flux	*Φ*	weber	Wb	$T·m^2$

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PhyzReference: Physical Quantities vs. Units

A common mistake of an Intro Phyz student is the confusion of *physical quantities* and *units of measure*. **Physical quantities** are any of the characteristics of objects in nature that can be measured.

A book, for example, is an object with several quantifiable characteristics. Its dimensions can be measured; these measurements involve the physical quantity of length. Other physical quantities can also be measured: Its mass can be measured, its weight can be measured, its volume can be measured, its temperature can be measured, etc.

If these physical quantities are to be measured, they must be measured in specific units of measure. **Units of measure** are the basic standards of measurement, such as miles, pounds, ounces, etc. Different physical quantities are measured in different units of measure. It is important that you distinguish between physical quantities and units of measure—they have separate meanings and functions!

Below is a table of physical quantities and some examples of the units they can be measured in.

Quantity	Symbol	Units (and Abbreviations)
Length	x	meters (m), feet (ft), yards (yd), miles (mi), light-years (ly), pipés
Weight	W	newtons (N), pounds (lb), ounces (oz), stones
Mass	m	kilograms (kg), slugs
Time	t	seconds (s), minutes (min), hours (hr), days (dy), weeks (wk), months (mo), years (yr), decades, scores, centuries, millenia, eons

So the **physical quantity** of length can be measured in many **units** (meters, yards, parsecs, etc.). Formulas in science are written in terms of **physical quantities**. Formulas are never written in terms of **units.** The formula for velocity is $v = d/t$ and is *never* expressed as v = m/s or v = mi/hr. If you can't distinguish between quantities and units, you could run into confusion when dealing with formulas. Consider the relation for density:

$$D = \frac{m}{V}$$

If you're on top of the quantity/unit distinction, then you have no problem: D is density, m is mass, V is volume. If you can't distinguish between units and quantities, you might decide that m is meters and thus density is length/volume instead of mass/volume.

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