Metric Units

James H Dann, Ph.D.

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AUTHOR James H Dann, Ph.D.

CONTRIBUTORS Chris Addiego

Antonio De Jesus López



Metric Units

Students will learn about the metric system and how to convert between metric units. Students will learn about the metric system and how to convert between metric units.

Frequently Used Measurements, Greek Letters, and Prefixes

Measurements

Type of measurement	Commonly used symbols	Fundamental units	
length or position	d, x, L	meters (m)	
time	t	seconds (s)	
velocity or speed	v, u	meters per second (m/s)	
mass	m	kilograms (kg)	
force	F	Newtons (N)	
energy	E, K, U, Q	Joules (J)	
power	Р	Watts (W)	
electric charge	q, e	Coulombs (C)	
temperature	Т	Kelvin (K)	
electric current	Ι	Amperes (A)	
electric field	Ε	Newtons per Coulomb (N/C)	
magnetic field	В	Tesla (T)	

TABLE 1.1: Types of Measurements

Prefixes

TABLE 1.2: Prefix Table

SI prefix	In Words	Factor
nano (n)	billionth	$1 * 10^{-9}$
micro (μ)	millionth	$1 * 10^{-6}$
milli (m)	thousandth	$1 * 10^{-3}$
centi (c)	hundreth	$1 * 10^{-2}$
deci (d)	tenth	$1 * 10^{-1}$
deca (da)	ten	$1 * 10^{1}$
hecto (h)	hundred	$1 * 10^2$
kilo (k)	thousand	$1 * 10^3$
mega (M)	million	$1 * 10^{6}$
giga (G)	billion	1 * 10 ⁹

Greek Letters

TABLE 1.3: Frequently used Greek letters.

μ "mu"	τ "tau"	Φ "Phi"*	ω "omega"	ρ "rho"
θ "theta"	π "pi "	Ω "Omega"*	λ "lambda"	Σ "Sigma"*
α "alpha"	β "beta"	γ"gamma"	Δ "Delta"*	ε "epsilon"

Two very common Greek letters are Δ and Σ . Δ is used to indicate that we should use the change or difference between the final and initial values of that specific variable. Σ denotes the sum or net value of a variable.

Guidance

- Every answer to a physics problem must include units. Even if a problem explicitly asks for a speed in meters per second (m/s), the answer is 5 m/s, not 5.
- If a unit is named after a person, it is capitalized. So you write "10 Newtons," or "10 N," but "10 meters," or "10 m."
- Metric units use a base numbering system of 10. Thus a centimeter is ten times larger than a millimeter. A decimeter is 10 times larger than a centimeter and a meter is 10 times larger than a decimeter. Thus a meter is 100 times larger than a centimeter and 1000 times larger than a millimeter. Going the other way, one can say that there are 100 cm contained in a meter.

Example 1

Question: Convert 2500 m/s into km/s

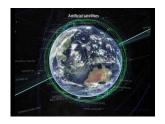
Solution: A km (kilometer) is 1000 times bigger than a meter. Thus, one simply divides by 1000 and arrives at 2.5 km/s

Example 2

Question: The lengths of the sides of a cube are doubling each second. At what rate is the volume increasing?

Solution: The cube side length, *x*, is doubling every second. Therefore after 1 second it becomes 2x. The volume of the first cube of side *x* is $x \times x \times x = x^3$. The volume of the second cube of side 2x is $2x \times 2x \times 2x = 8x^3$. The ratio of the second volume to the first volume is $8x^3/x^3 = 8$. Thus the volume is increasing by a factor of 8 every second.

Watch this Explanation



MEDIA Click image to the left for more content.

Time for Practice

1. A tortoise travels 15 meters (m) west, then another 13 centimeters (cm) west. How many meters total has she walked?



- 2. A tortoise, Bernard, starting at point A travels 12 m west and then 150 millimeters (mm) east. How far west of point *A* is Bernard after completing these two motions?
- 3. 80 m + 145 cm + 7850 mm = X mm. What is X?
- 4. A square has sides of length 45 mm. What is the area of the square in mm^2 ?
- 5. A square with area 49 cm² is stretched so that each side is now twice as long. What is the area of the square now? Include a sketch.
- 6. A rectangular solid has a square face with sides 5 cm in length, and a length of 10 cm. What is the volume of the solid in cm³? Sketch the object, including the dimensions in your sketch.
- 7. As you know, a cube with each side 4 m in length has a volume of 64 m³. Each side of the cube is now doubled in length. What is the *ratio* of the new volume to the old volume? Why is this ratio **not** simply 2? Include a sketch with dimensions.
- 8. What is the ratio of the mass of the Earth to the mass of a single proton? (See equation sheet.)
- 9. A spacecraft can travel 20 km/s. How many km can this spacecraft travel in 1 hour (h)?

Answers

- 1. 15.13 m
- 2. 11.85 m
- 3. 89,300 mm
- 4. 2025 mm^2
- 5. 196 cm^2
- 6. 250 cm^3
- 7. 8:1, each side goes up by 2 cm, so it will change by 2^3
- 8. 3.5×10^{51} : 1
- 9. 72,000 km/h