


# Fundamental Concepts: Units

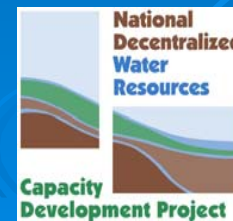
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The background of the slide is a solid blue color. In the lower right quadrant, there are several sets of concentric circles, resembling ripples in water, rendered in a lighter shade of blue. These circles are centered around the bottom right corner and extend towards the center of the slide.

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# Systems of Units

- International System of Units (SI)
  - Metric System
- U.S. Customary System of Units (USCS)
  - “English” Units

# SI Units

## ➤ Base Units

Dimension	Unit	Abbreviation
Length	meter	m
Mass	kilogram	kg
Temperature	Kelvin	K
Time	second	s

# SI Units

## ➤ Derived Units

Dimension	Unit	Abbrev.
Area	length squared	m <sup>2</sup>
Volume	length cubed, Liters	m <sup>3</sup> , L
Speed	length per time	m/s
Acceleration	length per time squared	m/s <sup>2</sup>
Density	mass per volume	kg/m <sup>3</sup>

# SI Units

## ➤ More derived units

<b>Dimension</b>	<b>Derived Units</b>	<b>Special Unit</b>	<b>Abbreviation</b>
<b>Force</b>	$\text{m}\cdot\text{kg}/\text{s}^2$	<b>Newton</b>	<b>N</b>
<b>Pressure</b>	$\text{N}/\text{m}^2$	<b>Pascal</b>	<b>Pa</b>
<b>Energy</b>	$\text{N}\cdot\text{m}$	<b>Joule</b>	<b>J</b>
<b>Power</b>	$\text{J}/\text{s}$	<b>Watt</b>	<b>W</b>

# SI Unit Multipliers

Prefix	Multiplier
kilo (k)	$10^3$
hecto (h)	$10^2$
deka (da)	$10^1$
deci (d)	$10^{-1}$
centi (c)	$10^{-2}$
milli (m)	$10^{-3}$

# USCS Units

## ➤ Base Units

<b>Dimension</b>	<b>Unit</b>	<b>Abbreviation</b>
<b>Length</b>	<b>foot or inch</b>	<b>ft or in</b>
<b>Mass</b>	<b>slug</b>	<b>slug</b>
<b>Temperature</b>	<b>Rankin</b>	<b>R</b>
<b>Time</b>	<b>second</b>	<b>s</b>

# USCS Units

## Derived Units

Dimension	Units	Abbreviation
Area	length squared	ft <sup>2</sup>
Volume	length cubed, gallons	ft <sup>3</sup> , gal
Speed	Length per time	ft/s
Acceleration	length per time squared	ft/s <sup>2</sup>
Density	mass per volume	slug/ft <sup>3</sup>
Energy	force times distance	ft-lb
Pressure	Force per area	lb/ft <sup>2</sup> or psf
Force	slug·ft/s <sup>2</sup> or pound	lb

# Converting Units

➤ Example:

➤ How many feet are in one meter if 1 meter = 3.28 feet?

$$1m * 3.28 ft / m = 3.28 ft$$

# Dimensional Homogeneity

- equations and all input variables should have consistent units
- same units on both sides of the equation