#shareyourknowledge

#questioningisthekeyofknowledge

CHAPTER 2 Introduction to Engineering Calculations 5

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$\rho = \frac{m}{V}$ → mass, → volume

ρ density

$\frac{kg}{m^3}$ ⇒ (kilogram over meter^3)

$m \times m = m^2$ = meter square

$\frac{6g}{2g} = 3$ (dimensionless value) = numerical value

$\frac{1\ cm}{10\ mm}$ (1 centimeter per 10 milimeters)

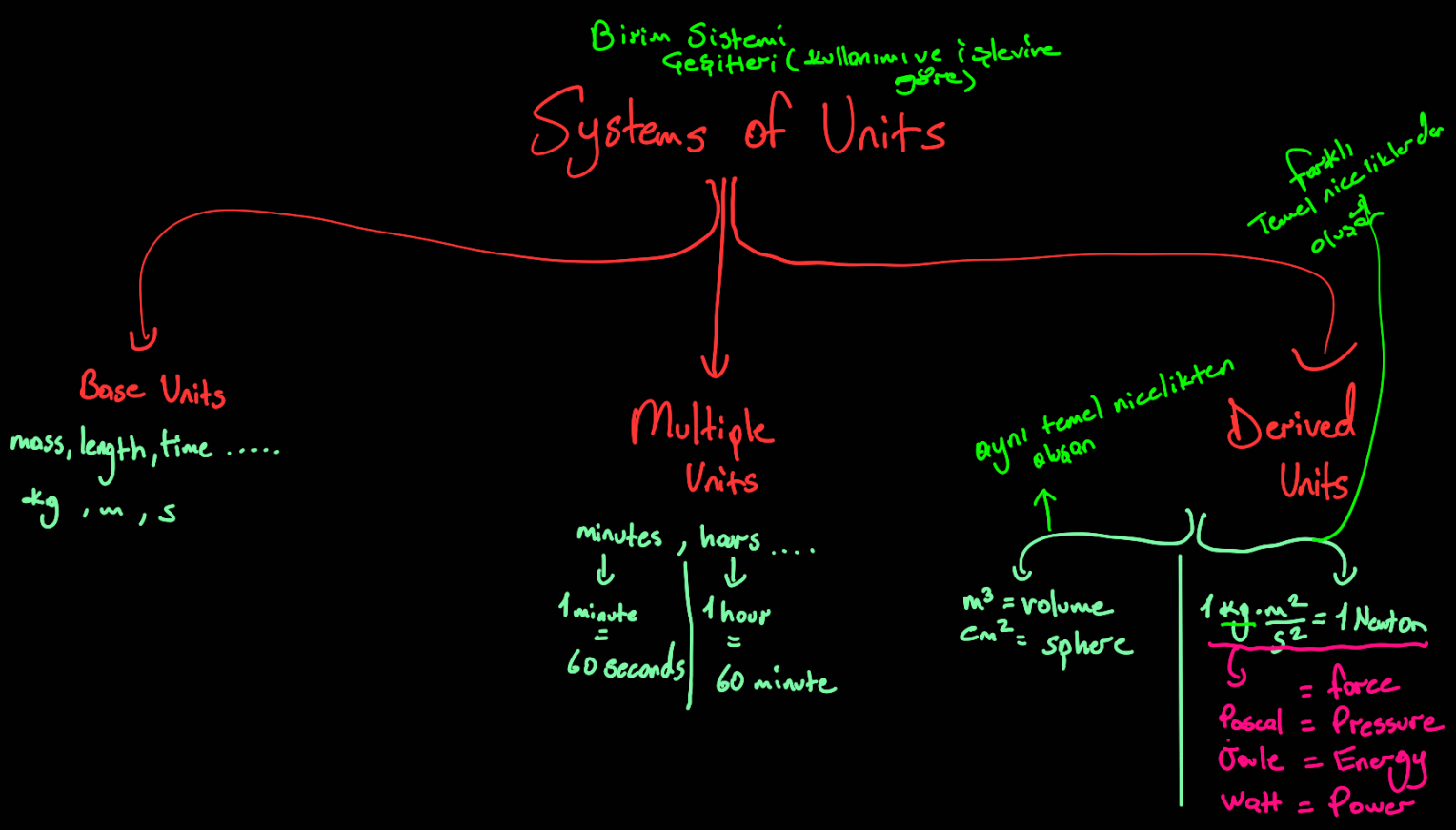
$\left(\frac{10\ mm}{1\ cm}\right)^2 = \frac{10^2 mm^2}{1\ cm^2} = \frac{100 mm^2}{1\ cm^2}$

Conversion factor $\left(\frac{new\ unit}{old\ unit}\right)$

$(36\ mg) \times \left(\frac{1\ g}{1000\ mg}\right) = 0.036\ g$

Dünyadaki Birim Sistemleri

- SI (Uluslararası) • m, kg, ...
- CGS (Bilmiyorum:)) • cm, g, ...
- FPS (Amerika ve İngiltere'deki) • ft, lb, ...



FACTORS FOR UNIT CONVERSIONS

Quantity	Equivalent Values
Mass	1 kg = 1000 g = 0.001 metric ton = 2.20462 lb_m = 35.27392 oz 1 lb_m = 16 oz = 5×10^{-4} ton = 453.593 g = 0.453593 kg
Length	1 m = 100 cm = 1000 mm = 10^6 microns (μm) = 10^{10} angstroms (Å) = 39.37 in. = 3.2808 ft = 1.0936 yd = 0.0006214 mile 1 ft = 12 in. = 1/3 yd = 0.3048 m = 30.48 cm
Volume	1 m^3 = 1000 L = 10^6 cm^3 = 10^6 mL = 35.3145 ft^3 = 220.83 imperial gallons = 264.17 gal = 1056.68 qt 1 ft^3 = 1728 $in.^3$ = 7.4805 gal = 0.028317 m^3 = 28.317 L = 28.317 cm^3
Force	1 N = 1 kg·m/s^2 = 10^5 dynes = 10^5 g·cm/s^2 = 0.22481 lb_f 1 lb_f = 32.174 lb_m·ft/s^2 = 4.4482 N = 4.4482×10^5 dynes
Pressure	1 atm = 1.01325×10^5 N/m^2 (Pa) = 101.325 kPa = 1.01325 bar = 1.01325×10^6 dynes/cm^2 = 760 mm Hg at 0°C (torr) = 10.333 m H_2O at 4°C = 14.696 $lb_f/in.^2$ (psi) = 33.9 ft H_2O at 4°C = 29.921 in. Hg at 0°C
Energy	1 J = 1 N·m = 10^7 ergs = 10^7 dyne·cm = 2.778×10^{-7} kW·h = 0.23901 cal = 0.7376 ft-lb_f = 9.486×10^{-4} Btu
Power	1 W = 1 J/s = 0.23901 cal/s = 0.7376 ft·lb_f/s = 9.486×10^{-4} Btu/s = 1.341×10^{-3} hp

AMERICAN ENGINEERING SYSTEM OF UNITS (AES)

Amerika ve İngilterede kullanılan birim sistemleri

Fundamental Dimensions	Base Units
Length [L]	foot (ft)
mass [m]	Pound (lbm)
Force [F]	Pound (lbf)
time [T]	Second (sec)
electric charge [Q]	coulomb (C)
absolute temperature [θ]	degree Rankine (°R)
Luminous intensity [I]	candela (cd)
amount of substance [n]	mole (mol)

What is the differences between Units and Dimensions :

Boyutlar ölçülebilen fiziksel niceliklerdir, oysa birimler belirli boyutları göreli hale getirmek için ilişkilendirilen gelişigüzel adlardır. (Örneğin boyut uzunluktur, oysa metre uzunluğu tanımlayan görsel bir birimdir.)

#logic

- Base Units
- Unit Preferences

1 Kilo metre = 10^3 metre

1 Kilo gram = 10^3 gram

Multiple Unit Preferences

tera (T) = 10^{12}	centi (c) = 10^{-2}
giga (G) = 10^{9}	milli (m) = 10^{-3}
mega (M) = 10^{6}	micro (μ) = 10^{-6}
kilo (k) = 10^{3}	nano (n) = 10^{-9}

there are some extra

Preferences of Units

1 centimetre (cm) 1×10^{-2} m

1 milimetre (mm) 1×10^{-3} m

1 mikrometre (μm) = 1×10^{-6} m

1 nanometre (nm) = 1×10^{-9} m

1 pikometre (pm) = 1×10^{-12} m

1 angstrom (Å) = 1×10^{-10} m

TABLE 2.3-1 SI and CGS Units

Base Units

Quantity	Unit	Symbol
Length	meter (SI)	m
	centimeter (CGS)	cm
Mass	kilogram (SI)	kg
	gram (CGS)	g
Moles	gram-mole	mol or g-mole
Time	second	s
Temperature	kelvin	K
Electric current	ampere	A
Light intensity	candela	cd

Multiple Unit Preferences

tera (T) = 10^{12}	centi (c) = 10^{-2}
giga (G) = 10^{9}	milli (m) = 10^{-3}
mega (M) = 10^{6}	micro (μ) = 10^{-6}
kilo (k) = 10^{3}	nano (n) = 10^{-9}

Derived Units

Quantity	Unit	Symbol	Equivalent in Terms of Base Units
Volume	liter	L	$0.001\ m^3$
			$1000\ cm^3$
Force	newton (SI)	N	$1\ kg \cdot m/s^2$
	dyne (CGS)		$1\ g \cdot cm/s^2$
Pressure	pascal (SI)	Pa	$1\ N/m^2$
Energy, work	joule (SI)	J	$1\ N \cdot m = 1\ kg \cdot m^2/s^2$
	erg (CGS)		$1\ dyne \cdot cm = 1\ g \cdot cm^2/s^2$
	gram-calorie	cal	$4.184\ J = 4.184\ kg \cdot m^2/s^2$
Power	watt	W	$1\ J/s = 1\ kg \cdot m^2/s^3$

$$1 \text{ newton (N)} \equiv 1 \text{ kg} \cdot \text{m/s}^2$$

$$1 \text{ dyne} \equiv 1 \text{ g} \cdot \text{cm/s}^2$$

$$1 \text{ lb}_\text{f} \equiv 32.174 \text{ lb}_\text{m} \cdot \text{ft/s}^2$$

$$g_c = \frac{1 \text{ kg} \cdot \text{m/s}^2}{1 \text{ N}} = \frac{32.174 \text{ lb}_\text{m} \cdot \text{ft/s}^2}{1 \text{ lb}_\text{f}}$$

$$\begin{aligned} g &= 9.8066 \text{ m/s}^2 \\ &= 980.66 \text{ cm/s}^2 \\ &= 32.174 \text{ ft/s}^2 \end{aligned}$$

FORCE and WEIGHT

$F = m \cdot a$

$F = m \cdot \frac{m/s}{s}$

mass • length / (second)^2

(SI) $F = kg \cdot m/s^2 = \text{newton}$ dyne $= g \cdot cm/s^2$ (CGS)

$1 lb_f \equiv 32.174\ lb_m \cdot ft/s^2 = (AES) = \text{pound force}$

(SI) 1 N kuvvet 1 kg yükü 1 m/s^2 ivmeyle hareketc geciren kuvvettir.

(AES) 1 lbf'luk kuvvet 32.174 lbm'lik yük 1 ft/s^2 lik ivmeyle " ".

#bytheway

1 m = 3.2808 ft

Weight

$mg = W$

at 45° Latitude :

$g = 9.8066\ m/s^2$ (SI)

" $= 980.66\ cm/s^2$ (CPG)

" $= 32.174\ ft/s^2$

WORK

$1J = 1N.m$ → force x length

SI sisteminde çoğunlukla Joule yerine kilojoule ($1kJ = 10^3 J$) kullanılır.

İngilizlerde ise bunun yerine Btu (British thermal unif) kullanılır.

1 Btu 1 lbm suyun sıcaklığını 1°F arttırmak için gereken enerji olarak tanımlanır.

metrik sistemde ise 1 g suyun sıcaklığını 1°C arttırmak için gereken enerji = 1 Calorie(cal)'dir.

#bytheway

$1 cal = 4.1868 Joule$

$1 Btu = 1.0551 kJ$

$$°F = °C \times \frac{9}{5} + 32$$