

Fluid mechanics

Dimensions and units :

There are two system of dimensions :

SI & U.S.

Quantity	SI	U.S.
Mass	Kg	Slug
Length	m	Ft
Time	s	S
Force	N	lb

Conversions :

1 ft	0.3048 m
Pound mass	0.4536 Kg
slug	14.59 kg
lb	4.448 N

Example :

50 lbm	$50 * 0.4536$	22.68 Kg
122 ft	$122 * 0.3048$	37.1856 m
719 slug	$719 * 14.59$	10490.21 Kg
59 lb	$59 * 4.448$	262.432 N
3.5 m	$3.5 * \left(\frac{1}{0.3045}\right)$	11.4829 ft
10 kg	$10 * \left(\frac{1}{0.4536}\right)$	22.0459 lbm

Properties of fluid s :-

Properties	Low	unit	
		SI	U.S.
Density	$\rho = \frac{M}{V}$	$\frac{Kg}{m^3}$	$\frac{slug}{ft^3}$
Specific weight	$\gamma = \frac{W}{V}$	$\frac{N}{m^3}$	$\frac{lb}{ft^3}$
Specific volume	$V_s = \frac{1}{\rho}$	$\frac{m^3}{Kg}$	$\frac{ft^3}{slug}$
Specific gravity	$S = \frac{\rho}{\rho}$	Dimensions	Dimensions

Fluid mechanics

Example

- 1- Mass = 1200 kg , volume = 0.925 m³ find weight W , Density ρ , specific weight γ , specific gravity S

$$w = m * g = 1200 * 9.81 = 11770 \text{ N}$$

$$\rho = \frac{m}{v} = \frac{1200}{0.952} = 1261 \frac{\text{Kg}}{\text{m}^3}$$

$$\gamma = \frac{w}{v} = \frac{11.77}{0.952} = 12.36 \frac{\text{Kn}}{\text{m}^3}$$

$$S = \frac{\rho}{\rho} = \frac{12.36}{9.81} = 1.26$$

- 2- Force = 100 N , accelerate = 0,2 $\frac{\text{m}}{\text{s}^2}$,find mass in kg and slug

$$f = m * a$$

$$100 = m * 0.2$$

$$m = 500 \text{ kg}$$

$$\frac{500}{14.59} = 34.3 \text{ slug}$$

- 3- Weight = 100 ib , find weight in N , mass in Kg and accelerate in (m/s^2) , if net force 50 ib

$$w = m * g = 100 * 4.448 = 444.8 \text{ N}$$

$$f = w = m * a \quad 444.8 = m * 9.81$$

$$m = 45.34 \text{ kg} = \frac{45.34}{14.59} = 3.108 \text{ slug}$$

$$f = m * a \quad 50 = 3.108 * a$$

$$a = 16.09 \frac{\text{ft}}{\text{s}^2} = 16 * 09 * (0.3048) = 4.904 \frac{\text{m}}{\text{s}^2}$$

- 4- Volume = 200 ft³ , weight = 10520 ib find Density ρ , specific weight γ , specific gravity S

$$\gamma = \frac{w}{v} = \frac{10520}{200} = 52.6 \frac{\text{ib}}{\text{ft}^3}$$

$$\rho = \frac{\gamma}{g} = \frac{52.6}{32.2} = 1.63 \frac{\text{slug}}{\text{ft}^3}$$

$$S = \frac{\rho}{\rho} = \frac{52.6}{62.4} = 0.843$$