

परिभाषा

* Dimension and Dimensional Analysis

* Dimension

The dimensions of a physical quantity are the power to which the fundamental units must be raised in order to obtain the unit of a given Physical quantity.

सिमेतीय

* Dimensional formula

When any derived quantity is represented with appropriate power of symbols of the fundamental formula.

It is expressed by square bracket with no comma in between the symbols.

* Examples of dimensional formula:-

$$\textcircled{1} \quad \text{Speed} = \frac{\text{Distance}}{\text{time}} = \frac{[L^1 M^0 T^0]}{[L^0 M^0 T^1]}$$

$$\text{Dimension of speed} = [L^1 M^0 T^{-1}]$$

$$\textcircled{2} \quad \text{Force} = \text{Mass} \times \text{acceleration} \\ = \text{Mass} \times \frac{\text{Distance}}{(\text{time})^2}$$

$$\text{Dimension of force} = [L^1 M^1 T^0] \times \frac{[L^1 M^0 T^0]}{[L^0 M^0 T^2]} = [L^2 M^1 T^{-2}]$$

$$\textcircled{3} \quad \text{Acceleration} = \frac{\text{change in velocity}}{\text{Time}}$$

$$= \frac{[L^1 M^0 T^{-1}]}{[L^0 M^0 T^1]} \\ = [L^1 M^0 T^{-1} T^{-1}] \\ = [L^1 M^0 T^{-2}]$$

$$\textcircled{4} \quad \text{Pressure} = \frac{\text{Force}}{\text{area}}$$

$$= \frac{[L^2 M^1 T^{-2}]}{[L^2 M^0 T^0]} \\ = [L^0 M^1 T^{-2}] \\ = [L^{-1} M^1 T^{-2}]$$

$$\begin{aligned}
 \textcircled{5} \quad \text{Density} &= \frac{\text{Mass}}{\text{Volume}} \\
 &= \frac{[L^0 M^1 T^0]}{[L^3 M^0 T^0]} \\
 &= [L^0 L^{-3} M^1 T^0] \\
 &= [L^{-3} M^1 T^0]
 \end{aligned}$$

$$\begin{aligned}
 \textcircled{6} \quad \text{Work} &= \text{Force} \times \text{displacement} \\
 &= [L^1 M^1 T^{-2}] [L^1 M^0 T^0] \\
 &= [L^2 M^1 T^{-2}]
 \end{aligned}$$

$$\begin{aligned}
 \textcircled{7} \quad \text{Energy} &= \text{Force} \times \text{Distance} \\
 &= [L^1 M^1 T^{-2}] [L^1 M^0 T^0] \\
 &= [L^2 M^1 T^{-2}]
 \end{aligned}$$

$$\begin{aligned}
 \textcircled{8} \quad \text{Power} &= \frac{\text{Work}}{\text{Time}} \\
 &= \frac{[L^2 M^1 T^{-2}]}{[L^0 M^0 T^1]} \\
 &= [L^2 M^1 T^{-2} T^{-1}] \\
 &= [L^2 M^1 T^{-3}]
 \end{aligned}$$

$$\begin{aligned}
 \textcircled{9} \quad \text{Momentum} &= \text{Mass} \times \text{velocity} \\
 &= [L^0 M^1 T^0] \times [L^1 M^0 T^{-1}] \\
 &= [L^1 M^1 T^{-1}]
 \end{aligned}$$

$$\begin{aligned}
 \textcircled{10} \quad \text{Impulse} &= \text{Force} \times \text{Time} \\
 &= [L^1 M^1 T^{-2}] \times [L^0 M^0 T^1] \\
 &= [L^1 M^1 T^{-1}]
 \end{aligned}$$

$$\textcircled{11} \quad \text{Temperature} = [L^0 M^0 T^0 K^1]$$

$$\textcircled{12} \quad \text{Charge} = \text{Current} \times \text{Time} \\ = [L^0 M^0 T^1 A^1]$$

$$\textcircled{13} \quad \text{Frequency} = \frac{1}{\text{Time}}$$

$$= \frac{1}{[L^0 M^0 T^1]} \\ = [L^0 M^0 T^{-1}]$$

$$\textcircled{14} \quad \text{Electric Potential, } V = \frac{W}{q}$$

$$= \frac{[L^2 M^1 T^{-2}]}{[L^0 M^0 T^1 A^1]} \\ = [L^2 M^1 T^{-2} T^{-1} A^{-1}] \\ = [L^2 M^1 T^{-3} A^{-1}]$$