BISHOP GEORGE SCHOOL & COLLEGE

CLASS: XI

SUBJECT: PHYSICS
WORKSHEET NO: 5

Dimensional Analysis

The dimensions of a physical quantity are the powers to which the fundamental units are raised in order to obtain the derived unit of that quantity

for example: velocity can be expressed in metre/second, km/hour or km/minute, but in every case we divide the unit of length by the unit of time, that is

$$\text{unit of velocity} = \frac{\text{unit of length}}{\text{unit of time}}$$

$$= (\text{unit of length})^{1} \times (\text{unit of time})^{-1}$$

In order to get the unit of velocity, we raise the unit of length to the power 1 and the unit of time to the power -1. These powers are called the 'dimensions of velocity'.

The dimensions of length, mass and time are denoted by [L], [M] and [T]

If the dimensions of a physical quantity are a in length, b in mass and c in time, then the dimensions of that physical quantity shall be written in the following manner. $[L^a M^b T^c]$

This is called the 'dimensional formula' of the quantity

Dimensional formulae of some physical quantities:

S.No.	Physical Quantity	Relation with other physical Quantities	Dimensional formula	SI Unit
1.	Area	length × breadth	$[M^0L^2T^0]$	m^2
2.	Volume	length × breadth × height	$[M^0L^3T^0]$	m^3
3.	Density	$\frac{\text{mass}}{\text{volume}}$	$[ML^{-3}T^0]$	Kgm^{-3}
4.	Velocity	$\frac{\text{displacement}}{\text{time}}$	$[M^0LT^{-1}]$	ms^{-1}
5.	Acceleration	$\frac{\text{change in velocity}}{\text{time}}$	$[M^0LT^{-2}]$	ms^{-2}
6.	Force	mass × acceleration	$[MLT^{-2}]$	Newton
7.	Work	force × displacement	$[ML^2T^{-2}]$	Joule
8.	Acceleration due to gravity	$\frac{\text{weight (force)}}{\text{mass}}$	$[M^0LT^{-2}]$	ms^{-2}
9.	Power	$\frac{\text{Work}}{\text{Time}}$	$[ML^2T^{-3}]$	Watt
10.	Linear momentum	mass × velocity	$[MLT^{-1}]$	$kg\,ms^{-1}$