

Grade 10 Technical Sciences



Term 1:
Mechanics

Measurement

1.1 Units and measurement

A physical quantity is a basic property of a phenomenon, body or substance, that can be quantified by measurement.

Fundamental units are used to define all other units in the relevant system.

Definition



Measurement

- 1.1.1 CGS system**
- 1.1.2 SI system**
- 1.1.3 Derived units**

Derived units are units that are derived by combining fundamental units.

Definition



Measurement

The derived units that we will require for mechanics are the following:

| Quantity | Symbol | Formula | Unit in terms of SI system | Unit in terms of CGS system | Derived SI unit | Derived CGS unit |
|--------------------|--------|---------------------------------|--|--|-----------------|---|
| Velocity; speed | v | $v = \frac{\Delta x}{\Delta t}$ | $\text{m}\cdot\text{s}^{-1}$ | $\text{cm}\cdot\text{s}^{-1}$ | | |
| Acceleration | a | $a = \frac{\Delta v}{\Delta t}$ | $\text{m}\cdot\text{s}^{-2}$ | $\text{cm}\cdot\text{s}^{-2}$ | | |
| Force; weight | f | $F_{\text{net}} = ma$ | $\text{kg}\cdot\text{m}\cdot\text{s}^{-2}$ | $\text{g}\cdot\text{cm}\cdot\text{s}^{-2}$ | newton (N) | dyne (dyn) |
| Work; energy | W; E | $W = F\Delta x \cos\theta$ | $\text{kg}\cdot\text{m}^2\cdot\text{s}^{-2}$ | $\text{g}\cdot\text{cm}^2\cdot\text{s}^{-2}$ | joule (J) | erg (erg) |
| Power | P | $P = \frac{W}{\Delta t}$ | $\text{kg}\cdot\text{m}^2\cdot\text{s}^{-3}$ | $\text{g}\cdot\text{cm}^2\cdot\text{s}^{-3}$ | watt (W) | erg per Second ($\text{erg}\cdot\text{s}^{-1}$) |

Measurement

| Quantity | Symbol | Formula | Unit in terms of SI system | Unit in terms of CGS system | Derived SI unit | Derived CGS unit |
|----------|--------|----------------------------|---|--|-----------------|------------------|
| Pressure | p | $p = \frac{F}{A}$ | $\text{kg} \cdot \text{m}^{-1} \cdot \text{s}^{-2}$ $\text{N} \cdot \text{m}^{-2}$ | $\text{g} \cdot \text{cm}^{-1} \cdot \text{s}^{-2}$ $\text{dyn} \cdot \text{cm}^{-2}$ | pascal (Pa) | barye (Ba) |
| Volume | V | $V = \ell \cdot b \cdot h$ | m^3 | cm^3 | Kilolitre (kℓ) | millilitre (mℓ) |
| Torque | τ | $\tau = F \cdot r_{\perp}$ | $\text{N} \cdot \text{m}$ | $\text{g} \cdot \text{cm}^2 \cdot \text{s}^{-2}$ | | dyne·cm (dyn·cm) |