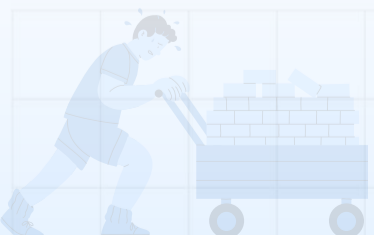
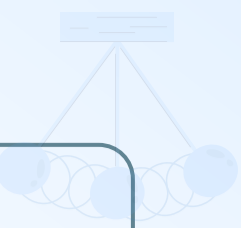


# Rest and Motion

- Rest and motion are **relative**, never absolute, and always depend on the observer.
- Motion can be described **only after fixing a frame of reference**.
- Same object can be **at rest in one frame and in motion in another frame** at the same time.
- **Distance** is total path length travelled, **scalar**, path-dependent, always positive.
- **Displacement** is shortest straight-line distance between initial and final position, **vector**, path-independent.
- Distance  $\geq$  displacement, and displacement can be **zero even when distance is not zero**.
- Motion means **change in position with time**, not just change in speed.
- Uniform motion means **equal distances in equal intervals of time**, speed remains constant.
- Uniform velocity requires **both constant speed and constant direction**.
- Speed is distance per unit time and has **magnitude only**.















- Velocity is displacement per unit time and has **magnitude and direction.**
- Zero velocity does **not always mean zero acceleration.**
- Acceleration occurs due to **change in speed or change in direction or both.**
- Circular motion has **constant speed but changing velocity** due to continuous change in direction.
- Rotational motion involves rotation about a **fixed axis**, not translation of the whole body.
- Oscillatory motion is a **to-and-fro motion about a mean position.**
- All oscillatory motion is **periodic**, but all periodic motion is **not oscillatory.**
- Zero displacement implies **average velocity is zero**, not average speed.
- An object at rest on Earth is still in **motion with Earth**, so absolute rest does not exist.
- Classical definitions of rest and motion are valid for **ordinary speeds**, not relativistic speeds.




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