

# Physics – Formulas and Definitions

## Definitions:

### 1. Mechanics

- **Speed** – the distance traveled per unit of time.
- **Acceleration** – the change in velocity per unit of time.
- **Newton's Second Law** – the force acting on an object is equal to the product of its mass and acceleration.
- **Momentum** – the quantity of motion of a moving object, calculated as the product of mass and velocity.
- **Law of Conservation of Momentum** – in a closed system, the total momentum before a collision is equal to the total momentum after the collision.

### 2. Work, Energy, and Power

- **Work** – the transfer of energy that occurs when a force is applied over a distance.
- **Kinetic Energy** – the energy an object possesses due to its motion.
- **Potential Energy** – the stored energy of an object due to its position in a gravitational field.
- **Law of Conservation of Energy** – energy cannot be created or destroyed, only transferred or transformed.
- **Power** – the rate at which work is done or energy is transferred.

### 3. Thermal Phenomena

- **Heat Quantity** – the amount of thermal energy transferred due to temperature difference.
- **First Law of Thermodynamics** – the change in the internal energy of a system is equal to the heat added to the system minus the work done by the system.
- **Efficiency** – the ratio of useful work output to total energy input, usually expressed as a percentage.

### 4. Electricity and Magnetism

- **Ohm's Law** – the principle stating that the voltage across a conductor is proportional to the current flowing through it.

- **Electrical Power** – the rate at which electrical energy is consumed or produced.
- **Resistance** – the opposition to the flow of electric current, depending on the material, length, and cross-sectional area of the conductor.
- **Joule-Lenz Law** – the law describing the heat produced in a conductor due to the flow of electric current.
- **Lorentz Force** – the force exerted on a charged particle moving through a magnetic field.

## 5. Oscillations and Waves

- **Pendulum Period** – the time it takes for a pendulum to complete one full oscillation.
- **Frequency** – the number of oscillations or waves that pass a given point per second.
- **Wave Speed** – the speed at which a wave propagates through a medium.

## Formulas

### 1. Mechanics

- **Speed:**  $v = \frac{s}{t}$   $v = \frac{s}{t}$  (distance/time)
- **Acceleration:**  $a = \frac{\Delta v}{\Delta t}$   $a = \frac{\Delta v}{\Delta t}$  (change in velocity/time)
- **Distance in uniformly accelerated motion:**  $s = v_0 t + \frac{1}{2} a t^2$   $s = v_0 t + \frac{1}{2} a t^2$
- **Newton's Second Law:**  $F = ma$   $F = ma$
- **Momentum:**  $p = mv$   $p = mv$
- **Law of Conservation of Momentum:**  $m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$   $m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$

### 2. Work, Energy, and Power

- **Work:**  $W = F s \cos \theta$   $W = F s \cos \theta$
- **Kinetic Energy:**  $E_k = \frac{1}{2} m v^2$   $E_k = \frac{1}{2} m v^2$
- **Potential Energy:**  $E_p = mgh$   $E_p = mgh$
- **Law of Conservation of Energy:**  $E_{\text{initial}} = E_{\text{final}}$   $E_{\text{initial}} = E_{\text{final}}$
- **Power:**  $P = \frac{W}{t}$   $P = \frac{W}{t}$

### 3. Thermal Phenomena

- **Heat Quantity:**  $Q = cm\Delta T$
- **First Law of Thermodynamics:**  $\Delta U = Q - A$
- **Efficiency:**  $\eta = \frac{A_{\text{useful}}}{Q_{\text{input}}} \times 100\%$

### 4. Electricity and Magnetism

- **Ohm's Law:**  $U = IR$
- **Electrical Power:**  $P = UI$
- **Resistance of a Conductor:**  $R = \rho \frac{l}{S}$
- **Joule-Lenz Law:**  $Q = I^2 R t$
- **Lorentz Force:**  $F = Bqv \sin \theta$

### 5. Oscillations and Waves

- **Pendulum Period:**  $T = 2\pi \sqrt{\frac{l}{g}}$
- **Frequency:**  $f = \frac{1}{T}$
- **Wave Speed:**  $v = \lambda f$