

HSC Physics Important Questions & Answers

Q: State the parallelogram law of vector addition. (2 Marks)

Ans: If two vectors are represented by two adjacent sides of a parallelogram, then their resultant vector is represented by the diagonal of the parallelogram drawn from the same point.

Q: Derive the expression for range of a projectile. (4 Marks)

Ans: For projectile motion, horizontal range is given by $R = \frac{u^2 \sin(2\theta)}{g}$, where u = initial velocity, θ = angle of projection, g = acceleration due to gravity.

Q: Derive the equation for time of flight of a projectile. (3 Marks)

Ans: $T = \frac{2u \sin\theta}{g}$

Q: A ball is projected with velocity 20 m/s at an angle of 30° . Find its range. (3 Marks)

Ans: $R = \frac{u^2 \sin(2\theta)}{g} = \frac{(20)^2 \sin(60)}{9.8} \approx 35.3 \text{ m}$

Q: State Newton's first law of motion. (2 Marks)

Ans: A body continues to be in its state of rest or uniform motion in a straight line unless compelled by an external force.

Q: State Newton's second law of motion. (2 Marks)

Ans: The rate of change of momentum of a body is directly proportional to the applied force and takes place in the direction of the force.

Q: Derive the expression for acceleration of a body sliding down an inclined plane. (4 Marks)

Ans: $a = g(\sin\theta - \mu\cos\theta)$, where μ = coefficient of friction, θ = angle of inclination.

Q: A block of mass 5 kg is acted upon by a force of 20 N. Find acceleration. (2 Marks)

Ans: $F = ma \Rightarrow a = F/m = 20/5 = 4 \text{ m/s}^2$

Q: State Newton's law of gravitation. (2 Marks)

Ans: The force of attraction between two masses is directly proportional to the product of their masses and inversely proportional to the square of distance between them.

Q: Derive expression for acceleration due to gravity on Earth's surface. (4 Marks)

Ans: $g = GM/R^2$, where G = gravitational constant, M = mass of Earth, R = radius of Earth.

Q: At what height above Earth's surface is acceleration due to gravity half its value at the surface? (3 Marks)

Ans: $h = (\sqrt{2} - 1)R$

Q: Escape velocity expression. (3 Marks)

Ans: $v_e = \sqrt{2GM/R} = \sqrt{2gR}$

Q: Define time period, frequency and amplitude. (2 Marks)

Ans: Time period: time for one oscillation; Frequency: number of oscillations per second; Amplitude: maximum displacement from mean position.

Q: Derive expression for time period of a simple pendulum. (4 Marks)

Ans: $T = 2\pi\sqrt{l/g}$

Q: A pendulum of length 1 m is taken to Moon ($g = 1.6 \text{ m/s}^2$). Find its time period. (3 Marks)

Ans: $T = 2\pi\sqrt{1/1.6} \approx 4.96 \text{ s}$

Q: State and prove work-energy theorem. (3 Marks)

Ans: Work done on a body is equal to the change in its kinetic energy.

Q: Derive expression for kinetic energy. (2 Marks)

Ans: $K.E = \frac{1}{2} mv^2$

Q: Power of an engine is 5 kW. How much work is done in 10 seconds? (2 Marks)

Ans: $W = P \times t = 5000 \times 10 = 50,000 \text{ J}$

Q: Derive expression for velocity of a wave on a stretched string. (3 Marks)

Ans: $v = \sqrt{T/\mu}$, where T = tension, μ = mass per unit length.

Q: State Laplace correction for velocity of sound. (2 Marks)

Ans: $v = \sqrt{\gamma P/\rho}$, where γ = ratio of specific heats, P = pressure, ρ = density.

Q: A tuning fork of frequency 256 Hz is sounded near a closed pipe. First resonance occurs when length is 0.33 m. Find velocity of sound. (3 Marks)

Ans: $v = 4 \times f \times l = 4 \times 256 \times 0.33 \approx 338 \text{ m/s}$

Q: State Ohm's law. (2 Marks)

Ans: At constant temperature, current through a conductor is directly proportional to potential difference across it.

Q: Derive expression for effective resistance of resistors in parallel. (3 Marks)

Ans: $1/R = 1/R_1 + 1/R_2 + 1/R_3$

Q: A wire of resistance 10Ω is stretched to double its length. Find new resistance. (3 Marks)

Ans: $R \propto l^2 \Rightarrow R_{\text{new}} = 4R = 40\Omega$

Q: State Fleming's left-hand rule. (2 Marks)

Ans: If we stretch the thumb, forefinger and middle finger of left hand mutually perpendicular, then forefinger shows field, middle finger shows current and thumb shows force.

Q: Derive expression for force on a current-carrying conductor in a magnetic field. (3 Marks)

Ans: $F = BIL \sin\theta$

Q: A straight conductor of length 0.5 m carrying 3 A current is placed perpendicular to a field of 0.2 T. Find force. (2 Marks)

Ans: $F = BIL = 0.2 \times 3 \times 0.5 = 0.3 \text{ N}$

Q: State Einstein's photoelectric equation. (2 Marks)

Ans: $h\nu = W + KE_{\text{max}}$

Q: Derive expression for de Broglie wavelength. (3 Marks)

Ans: $\lambda = h/p = h/(mv)$

Q: Calculate de Broglie wavelength of an electron moving with velocity $2 \times 10^6 \text{ m/s}$. (3 Marks)

Ans: $\lambda = h/mv \approx 3.63 \times 10^{-10} \text{ m}$