



BOARD QUESTION PAPER : FEBRUARY 2024

PHYSICS

Time: 3 Hrs.

Max. Marks: 70

General Instructions:

The question paper is divided into **four** sections:

- (1) **Section A:** Q. No. 1 contains **Ten multiple choice type** of questions carrying **One mark** each.
Q. No. 2 contains **Eight very short answer type** of questions carrying **One mark** each.
- (2) **Section B:** Q. No. 3 to Q. No. 14 contain **Twelve short answer type** of questions carrying **Two marks** each.
(Attempt **any Eight**).
- (3) **Section C:** Q. No. 15 to Q. No. 26 contain **Twelve short answer type** of questions carrying **Three marks** each. (Attempt **any Eight**).
- (4) **Section D:** Q. No. 27 to Q. No. 31 contain **Five long answer type** of questions carrying **Four marks** each.
(Attempt **any Three**).
- (5) Use of the log table is allowed. Use of calculator is **not** allowed.
- (6) Figures to the right indicate full marks.
- (7) For multiple choice type questions, only the first attempt will be consider for evaluation.
- (8) **Physical Constants:**
 - (i) Mass of electron = 9.1×10^{-31} kg
 - (ii) $\epsilon_0 = 8.85 \times 10^{-12}$ C² / Nm²
 - (iii) $\pi = 3.142$
 - (iv) Charge on electron e = 1.6×10^{-19} C
 - (v) $\mu_0 = 4\pi \times 10^{-7}$ Wb / Am
 - (vi) Planck's constant h = 6.63×10^{-34} J.s.
 - (vii) Speed of light c = 3×10^8 m/s
 - (viii) g = 9.8 m/s²
 - (ix) Rydberg's constant R_H = 1.097×10^7 m⁻¹
 - (x) Stefan's constant $\sigma = 5.67 \times 10^{-8}$ J m⁻² s⁻¹ K⁻⁴

SECTION – A

Q.1. Select and write the correct answers for the following multiple choice type of questions: [10]

- i. The moment of inertia (MI) of a disc of radius R and mass M about its central axis is _____.
(A) $\frac{MR^2}{4}$ (B) $\frac{MR^2}{2}$ (C) MR^2 (D) $\frac{3MR^2}{2}$
- ii. The dimensional formula of surface tension is _____.
(A) $[L^{-1}M^1T^{-2}]$ (B) $[L^2M^1T^{-2}]$ (C) $[L^1M^1T^{-1}]$ (D) $[L^0M^1T^{-2}]$
- iii. Phase difference between a node and an adjacent antinode in a stationary wave is _____.
(A) $\frac{\pi}{4}$ rad (B) $\frac{\pi}{2}$ rad (C) $\frac{3\pi}{4}$ rad (D) π rad
- iv. The work done in bringing a unit positive charge from infinity to a given point against the direction of electric field is known as _____.
(A) electric flux (B) magnetic potential
(C) electric potential (D) gravitational potential
- v. To convert a moving coil galvanometer into an ammeter we need to connect a _____.
(A) small resistance in parallel with it (B) large resistance in series with it
(C) small resistance in series with it (D) large resistance in parallel with it



- vi. If the frequency of incident light falling on a photosensitive material is doubled, then kinetic energy of the emitted photoelectron will be _____.
- (A) the same as its initial value (B) two times its initial value
(C) more than two times its initial value (D) less than two times its initial value
- vii. In a cyclic process, if ΔU = internal energy, W = work done, Q = Heat supplied then
(A) $\Delta U = Q$ (B) $Q = 0$ (C) $W = 0$ (D) $W = Q$
- viii. The current in a coil changes from 50A to 10A in 0.1 second. The self inductance of the coil is 20H. The induced e.m.f. in the coil is _____.
- (A) 800V (B) 6000V (C) 7000V (D) 8000V
- ix. The velocity of bob of a second's pendulum when it is 6 cm from its mean position and amplitude of 10 cm, is _____.
- (A) 8π cm/s (B) 6π cm/s (C) 4π cm/s (D) 2π cm/s
- x. In biprism experiment, the distance of 20th bright band from the central bright band is 1.2 cm. Without changing the experimental set-up, the distance of 30th bright band from the central bright band will be _____.
- (A) 0.6 cm (B) 0.8 cm (C) 1.2 cm (D) 1.8 cm

Q.2. Answer the following questions:

[8]

- i. Define centripetal force.
- ii. Why a detergent powder is mixed with water to wash clothes?
- iii. What is the resistance of an ideal voltmeter?
- iv. Write the formula for torque acting on rotating current carrying coil in terms of magnetic dipole moment, in vector form.
- v. What is binding energy of a hydrogen atom?
- vi. What is surroundings in thermodynamics?
- vii. In a photoelectric experiment, the stopping potential is 1.5V. What is the maximum kinetic energy of a photoelectron?
- viii. Two capacitors of capacities 5 μ F and 10 μ F respectively are connected in series. Calculate the resultant capacity of the combination.

SECTION – B

Attempt any EIGHT questions of the following:

[16]

- Q.3.** Explain the change in internal energy of a thermodynamic system (the gas) by heating it.
- Q.4.** Explain the construction of a spherical wavefront by using Huygens' principle.
- Q.5.** Define magnetization. State its SI unit and dimensions.
- Q.6.** Obtain the differential equation of linear simple harmonic motion.
- Q.7.** A galvanometer has a resistance of 30 Ω and its full scale deflection current is 20 microampere (μ A). What resistance should be added to it to have a range 0-10 volt?
- Q.8.** Explain Biot-Savart law.
- Q.9.** What is a Light Emitting Diode? Draw its circuit symbol.
- Q.10.** An aircraft of wing span of 60 m flies horizontally in earth's magnetic field of 6×10^{-5} T at a speed of 500 m/s. Calculate the e.m.f. induced between the tips of wings of aircraft.
- Q.11.** Derive an expression for maximum speed of a vehicle moving along a horizontal circular track.



- Q.12.** A horizontal force of 0.5N is required to move a metal plate of area 10^{-2}m^2 with a velocity of $3 \times 10^{-2}\text{m/s}$, when it rests on $0.5 \times 10^{-3}\text{m}$ thick layer of glycerin. Find the coefficient of viscosity of glycerin.
- Q.13.** Two tuning forks having frequencies 320 Hz and 340 Hz are sounded together to produce sound waves. The velocity of sound in air is 340 m/s. Find the difference in wavelength of these waves.
- Q.14.** Calculate the change in angular momentum of electron when it jumps from third orbit to first orbit in hydrogen atom.

SECTION – C

Attempt any EIGHT questions of the following:

[24]

- Q.15.** A circular coil of wire is made up of 200 turns, each of radius 10 cm. If a current of 0.5A passes through it, what will be the magnetic field at the centre of the coil?
- Q.16.** Define photoelectric effect and explain the experimental set-up of photoelectric effect.
- Q.17.** Define the current gain α_{DC} and β_{DC} for a transistor. Obtain the relation between them.
- Q.18.** Define surface energy of the liquid. Obtain the relation between the surface energy and surface tension.
- Q.19.** What is an isothermal process? Obtain an expression for work done by a gas in an isothermal process.
- Q.20.** Derive an expression for equation of stationary wave on a stretched string. Show that the distance between two successive nodes or antinodes is $\lambda/2$.
- Q.21.** Derive an expression for the impedance of an LCR circuit connected to an AC power supply. Draw phasor diagram.
- Q.22.** Calculate the wavelength of the first two lines in Balmer series of hydrogen atom.
- Q.23.** A current carrying toroid winding is internally filled with lithium having susceptibility $\chi = 2.1 \times 10^{-5}$. What is the percentage increase in the magnetic field in the presence of lithium over that without it?
- Q.24.** The radius of a circular track is 200 m. Find the angle of banking of the track, if the maximum speed at which a car can be driven safely along it is 25 m/sec.
- Q.25.** Prove the Mayer's relation: $C_p - C_v = \frac{R}{J}$
- Q.26.** An alternating voltage is given by $e = 8 \sin 628.4t$. Find
- peak value of e.m.f.
 - frequency of e.m.f.
 - instantaneous value of e.m.f. at time $t = 10$ ms.

SECTION – D

Attempt any THREE questions of the following:

[12]

- Q.27.** What is a transformer? Explain construction and working of a transformer. Derive the equation for a transformer.
- Q.28.** Using the geometry of the double slit experiment, derive the expression for fringe width of interference bands.



Q.29. Distinguish between an ammeter and a voltmeter. (Two points each).

The displacement of a particle performing simple harmonic motion is $\frac{1}{3}$ rd of its amplitude. What fraction of total energy will be its kinetic energy?

Q.30. Draw a neat labelled diagram of Ferry's perfectly black body. Compare the rms speed of hydrogen molecules at 227°C with rms speed of oxygen molecule at 127°C . Given that molecular masses of hydrogen and oxygen are 2 and 32 respectively.

Q.31. Derive an expression for energy stored in a charged capacitor. A spherical metal ball of radius 15 cm carries a charge of $2\mu\text{C}$. Calculate the electric field at a distance of 20 cm from the center of the sphere.

Target Publications