Roll No. ☐☐☐☐☐☐☐☐

**Q.P. Code 55/1/1**

# PHYSICS (THEORY)

CBSE Class XII Board Examination 2026

**Time allowed: 3 hours** **Maximum Marks: 70**

## General Instructions:

1. The paper has 33 questions in five sections (A to E); all questions are compulsory.
2. Section A: Q1–16, multiple choice / Assertion-Reason, 1 mark each. Section B: Q17–21, very short answer, 2 marks each.
3. Section C: Q22–28, short answer, 3 marks each. Section D: Q29–30, case-study based, 4 marks each. Section E: Q31–33, long answer, 5 marks each.
4. There is no overall choice, but some questions in Sections B to E have an internal choice.
5. Calculators are not allowed.
6. Constants: $c = 3 \times 10^8$ m/s, $h = 6.63 \times 10^{-34}$ J s, $e = 1.6 \times 10^{-19}$ C, $\mu_0 = 4\pi \times 10^{-7}$ T m $A^{-1}$, $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2$ $N^{-1}$ $m^{-2}$, $1/(4\pi\varepsilon_0) = 9 \times 10^9$ N $m^2$ $C^{-2}$, $m_e = 9.1 \times 10^{-31}$ kg, mass of neutron = $1.675 \times 10^{-27}$ kg, mass of proton = $1.673 \times 10^{-27}$ kg, Avogadro's number = $6.023 \times 10^{23}$ per gram mole, Boltzmann's constant = $1.38 \times 10^{-23}$ J $K^{-1}$.

## SECTION A

*Q1–16 carry 1 mark each (MCQ / Assertion-Reason).*

**1.** The electric potential in a region is given by V = 10 − 50x (V in volt, x in metre). What is the electric field in this region? **1**

**(A)** 10 N/C along +x
**(B)** 10 N/C along −x
**(C)** 50 N/C along +x
**(D)** 50 N/C along −x

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**2.** Two charged metal spheres A and B, of radii $r_1$ and $r_2$, are far apart and joined by a conducting wire. Find the ratio $E_A/E_B$ of the electric fields at their surfaces. **1**

**(A)** $\frac{r_1}{r_2}$
**(B)** $\frac{r_2}{r_1}$
**(C)** $\frac{r_1^2}{r_2^2}$
**(D)** $\frac{r_2^2}{r_1^2}$

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**3.** A long straight wire of circular cross-section of radius a carries a steady current I spread uniformly over its cross-section. What is the magnitude of the magnetic field at a distance a/2 from the axis? **1**

**(A)** Zero
**(B)** $\frac{\mu_0 I}{2\pi a}$
**(C)** $\frac{\mu_0 I}{4\pi a}$
**(D)** $\frac{\mu_0 I}{6\pi a}$

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**4.** In Young's double-slit experiment the screen is very far from the slits compared with the slit separation. The interference fringes then have nearly which shape? **1**

**(A)** straight
**(B)** parabolic
**(C)** circular
**(D)** hyperbolic

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**5.** An electromagnetic wave goes from vacuum into a medium having relative permittivity 3/2 and relative permeability 8/3. What happens to the wave? **1**

**(A)** wavelength is doubled and frequency remains unchanged
**(B)** wavelength is doubled and frequency is halved
**(C)** wavelength is halved and frequency remains unchanged
**(D)** wavelength and frequency both remain unchanged

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**6.** In a series LCR circuit the voltages across R, C and L are each 10 V. If the capacitor is now short-circuited, what will be the voltage across the inductor? **1**

**(A)** 10 V
**(B)** $5\sqrt{2}$ V
**(C)** $5/\sqrt{2}$ V
**(D)** $10\sqrt{2}$ V

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**7.** Electromagnetic waves used as a diagnostic tool in medicine lie in which wavelength range? **1**

**(A)** 1 nm to $10^{-3}$ nm **(B)** 400 nm to 1 nm

**(C)** 1 mm to 700 nm **(D)** 0.1 m to 1 mm

**8.** An alpha particle moving head-on towards a nucleus with speed v has distance of closest approach d. If its speed is made v/2, what is the new distance of closest approach? **1**

**(A)** d/2 **(B)** 2d

**(C)** d/4 **(D)** 4d

**9.** A concave lens of focal length 10 cm is cut into two identical plano-concave lenses. What is the focal length of each piece? **1**

**(A)** 20 cm **(B)** 30 cm

**(C)** 40 cm **(D)** 5 cm

**10.** Four independent waves are: (i) $y_1 = A_1 \sin \omega t$, (ii) $y_2 = A_2 \sin 2\omega t$, (iii) $y_3 = A_3 \cos \omega t$, (iv) $y_4 = A_4 \sin(\omega t + \pi/3)$. Between which of these can interference be obtained? **1**

**(A)** (i) and (iii) only **(B)** (iii) and (iv) only

**(C)** (i), (iii) and (iv) only **(D)** All of them

**11.** Two heaters rated ($P_1$, V) and ($P_2$, V) are joined in series and connected to a dc source of V/2 volt. What power does the combination consume? **1**

**(A)** $(P_1 + P_2)$ **(B)** $\frac{P_1 + P_2}{2}$

**(C)** $\frac{P_1 P_2}{2(P_1 + P_2)}$ **(D)** $\frac{P_1 P_2}{4(P_1 + P_2)}$

**12.** For an unbiased p-n junction in equilibrium, which statement is correct? **1**

**(A)** Diffusion current is zero but drift current exists.

**(B)** Diffusion current exists but drift current is zero.

**(C)** Diffusion and drift currents are equal and opposite.

**(D)** Both diffusion and drift currents exist but are unequal.

**13.** Assertion (A): Every atom has a net magnetic moment. **1**
Reason (R): A current loop does not always behave like a magnetic dipole.

**(A)** Both A and R are true and R is the correct explanation of A.

**(B)** Both A and R are true but R is not the correct explanation of A.

**(C)** A is true but R is false.

**(D)** Both A and R are false.

**14.** Assertion (A): A diffraction pattern is seen when accelerated electrons pass through a narrow slit. **1**

Reason (R): Electrons show both particle and wave nature.

**(A)** Both A and R are true and R is the correct explanation of A.

**(B)** Both A and R are true but R is not the correct explanation of A.

**(C)** A is true but R is false.

**(D)** Both A and R are false.

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**15.** Assertion (A): A nucleus has less mass than the total mass of its separate nucleons. **1**

Reason (R): Energy is absorbed when nucleons come together to form a nucleus.

**(A)** Both A and R are true and R is the correct explanation of A.

**(B)** Both A and R are true but R is not the correct explanation of A.

**(C)** A is true but R is false.

**(D)** Both A and R are false.

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**16.** Assertion (A): In the Bohr model of the hydrogen atom, energy levels are discrete (quantised). **1**

Reason (R): In a hydrogen atom the electrostatic attraction on the electron supplies the centripetal force for its revolution about the nucleus.

**(A)** Both A and R are true and R is the correct explanation of A.

**(B)** Both A and R are true but R is not the correct explanation of A.

**(C)** A is true but R is false.

**(D)** Both A and R are false.

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## SECTION B

*Q17–21 are very short answer questions, 2 marks each.*

**17.** Light of wavelength 200 nm falls on the emitter plate in a photoelectric experiment. The photocurrent just becomes zero when the collector potential is −0.80 V. Find the work function of the emitter in eV. **2**

**18.** A single slit of width 1 mm is lit by light containing two wavelengths, 400 nm and 600 nm. The screen is 1.5 m from the slit. Find the smallest distance from the central maximum at which dark fringes of both wavelengths fall at the same place. **2**

**OR**

In a Young's double-slit set-up the slits are 0.6 mm apart and the screen is 1.5 m away. Light having two wavelengths, 440 nm and 660 nm, is used. Find the least distance from the central maximum where bright fringes of the two wavelengths coincide.

**19.** A wire of length L is wound into (i) a square coil of N turns and (ii) a circular coil of N turns. Each coil carries the same current and can rotate about a vertical axis lying in its plane, in the same uniform horizontal magnetic field. Find the ratio of the maximum torque on the square coil to that on the circular coil. **2**

**20.** State the order of magnitude of the drift velocity of electrons in a conductor. Derive the relation between the current in a conductor and the drift velocity of its electrons. **2**

**21.** Sketch the potential energy of a pair of nucleons against their separation. State two important conclusions from this graph. **2**

## SECTION C

*Q22–28 are short answer questions, 3 marks each.*

**22.** (a) Using Gauss's law, find the electric field at a point near a uniformly charged, infinite, thin plane sheet. **3**

(b) Two large thin parallel sheets, each with surface charge density σ, are held close to each other in air. What is the net field (i) between the sheets and (ii) outside them?

**OR**

(a) Derive the balance condition of a Wheatstone bridge.

(b) Find the equivalent resistance between A and B of this network: A to M is 2R. From M, one resistor R goes to point O and another R goes (over the top) to point P. Between O and P there is R. From O, a resistor R goes (along the bottom) to point N, and between P and N there is R. Finally N to B is 3R.

**23.** A parallel-plate capacitor of capacitance C has a dielectric slab between its plates. It is charged to potential difference V by a battery, and then the battery is removed. Now the slab is pulled out. How do (a) the capacitance, (b) the stored energy and (c) the potential difference between the plates change? Justify each. **3**

**24.** A narrow electron beam with speed $3 \times 10^7$ m/s enters midway between two horizontal parallel plates $P_1P_1'$ (upper) and $P_2P_2'$ (lower) that are 2 cm apart. Each plate is 3 cm long. Find the potential difference V between the plates needed so that the beam just hits the far end $P_2'$ of the lower plate. **3**

**25.** An ac voltage $V_i = 12 \sin(100\pi t)$ V is applied between points A (top) and B (bottom) of a diamond-shaped network. Ideal diode $D_1$ joins A to P (cathode at A, anode at P) and ideal diode $D_2$ joins A to R (anode at A, cathode at R). A 1 kΩ resistor joins P and R, 2 kΩ joins P and B, and 3 kΩ joins R and B. Consider the positive half-cycle (A positive). **3**

(a) Which diode conducts, and why?

(b) Draw the equivalent circuit showing the current path.

(c) Find the voltage drops across the three resistors when $V_i$ is at its peak.

**26.** Briefly describe the two important processes that take place while a p-n junction is being formed. **3**

**27.** (a) Draw a ray diagram for image formation by a refracting telescope and write its angular magnification in normal adjustment. **3**

(b) Give two reasons why a reflecting telescope is preferred to a refracting one.

**28.** (a) Write the two conditions needed for total internal reflection. **3**

(b) A transparent container holds three immiscible liquid layers: A at the bottom (refractive index n), B in the middle (3n/4) and C on top (2n/3). A laser beam inside A strikes the A–B interface at angle θ. Show that the beam does not enter C at all if $\sin\theta \geq 2/3$.

## SECTION D

*Q29–30 are case-study based questions, 4 marks each.*

**29.** *A moving-coil galvanometer detects and measures small currents: the current-carrying coil feels a deflecting torque in a magnetic field, a hair spring supplies the restoring torque, and with suitable resistances the galvanometer can be turned into an ammeter or a voltmeter of any desired range.* **4**

(a) (I) The torque on the coil stays the same whatever the coil's orientation during rotation. This is because of:

**(A)** the soft iron core, which increases the magnetic field

**(B)** the radial magnetic field

**(C)** the hair spring, which provides the counter torque

**(D)** eddy currents in the iron core, which cause damping

(b) (II) The best way to increase the current sensitivity of a galvanometer is by:

**(A)** increasing the number of turns of the coil

**(B)** increasing the area of the coil and the magnetic field strength

**(C)** decreasing the area of the coil and the magnetic field strength

**(D)** increasing the torsional constant of the hair spring

(c) (III) A galvanometer coil of cross-sectional area $4.0 \times 10^{-3}$ m² and 50 turns is in a magnetic field of 0.25 T. What torque acts on it when a current of 5 A flows?

**(A)** 1.0 N m **(B)** 2.0 N m

**(C)** 0.50 N m **(D)** 0.25 N m

**OR**

(c) (III) A galvanometer of coil resistance 15 Ω gives full-scale deflection at 3 mA. What resistance is needed to make it a voltmeter of range 0–12 V?

**(A)** 4015 Ω **(B)** 3985 Ω

**(C)** 415 Ω **(D)** 385 Ω

(d) (IV) A galvanometer of coil resistance 20 Ω gives full-scale deflection at 5 mA. To convert it into an ammeter of range 0–10 A, one should connect:

**(A)** 0.05 Ω in series with it **(B)** 0.05 Ω in parallel with it

**(C)** 0.01 Ω in parallel with it **(D)** 0.01 Ω in series with it

**30.** *A researcher shines monochromatic light of different frequencies on two metals A and B and records the stopping potential Vs. The graph of Vs against frequency v gives two parallel straight lines: line A cuts the v-axis at $v_1$ and line B at $v_2$ ($v_2 > v_1$); extended backwards, they meet the Vs-axis below the origin at $-V_1$ (A) and $-V_2$ (B).* **4**

(a) (I) From the graph, the work functions of A and B are (h = Planck's constant, e = electronic charge):

**(A)** $\nu_1$ and $\nu_2$ **(B)** $V_1$ and $V_2$

**(C)** $h\nu_1$ and $h\nu_2$ **(D)** $h\nu_1/e$ and $h\nu_2/e$

(b) (II) For light of frequency $\nu > \nu_2$ falling on both A and B, the maximum kinetic energy of the emitted electrons is:

**(A)** greater for metal A because it has a smaller work function

**(B)** greater for metal B because it has a larger work function

**(C)** greater for metal B because it has a higher threshold frequency

**(D)** the same for both, as it does not depend on the work function

(c) (III) If the intensity of the light falling on A and B is doubled without changing its frequency, then:

**(A)** the slope of the parallel lines will increase

**(B)** the slope of the parallel lines will decrease

**(C)** the threshold frequencies of both A and B will decrease

**(D)** the slope will not change, but more electrons will be emitted per second

(d) (IV) A metal has threshold frequency $\nu_0$. With light of frequency $3\nu_0$ the maximum KE of the photoelectrons is $E_1$; with frequency $6\nu_0$ it is $E_2$. Find $E_1/E_2$.

**(A)** 1/3 **(B)** 1/2

**(C)** 2/5 **(D)** 3/4

**OR**

(d) (IV) If the slope of the line for metal B is m and e is the electronic charge, Planck's constant h equals:

**(A)** me **(B)** 1/(me)

**(C)** m/e **(D)** e/m

## SECTION E

*Q31–33 are long answer questions, 5 marks each.*

**31.** (a) An electric dipole is made of charges q and −q separated by 2a. Derive the electric field at a point at distance r from its centre on the equatorial plane. Write the result for a far point ($r \gg a$). **5**

(b) A dipole lies in the x-y plane with charge q at x = a and −q at x = b on the x-axis. A uniform field $\vec{E} = 2\hat{i}$ N/C exists in the region. Find the force and the torque on the dipole.

**OR**

(a) Two cells of emfs $E_1$ and $E_2$ and internal resistances $r_1$ and $r_2$ are joined in parallel (positive to positive, negative to negative). Derive the equivalent emf and equivalent internal resistance.

(b) Two such cells, of emfs E and 3E and internal resistance R each, are joined in parallel as in (a) and connected across a resistance 2R. Find the current through 2R.

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**32.** (a) Starting from the formula for refraction at a spherical surface, derive the lens maker's formula. **5**

(b) Three convex lenses $L_1$, $L_2$, $L_3$, each of focal length 40 cm, are placed coaxially. $L_1$ to $L_2$ is 120 cm and $L_2$ to $L_3$ is 20 cm. An object is 80 cm to the left of $L_1$. How far is the final image from the object?

**OR**

(a) Draw a ray diagram for a concave mirror with the object between F and C. Use it to derive the mirror formula.

(b) A concave mirror gives a virtual image twice the size of an object placed 10 cm in front of it. Find its focal length.

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**33.** (a) State Faraday's law of electromagnetic induction. **5**

(b) Derive the self-inductance of a long air-cored solenoid of length l, cross-sectional area A and N turns.

(c) A 50 cm conducting rod, pivoted at one end, rotates at 60 rpm in a uniform 4.0 mT magnetic field perpendicular to its plane of rotation. Find the emf induced in the rod.

**OR**

(a) Draw a labelled diagram of a step-up transformer. State its working principle and obtain the ratio of secondary to primary voltage in terms of the numbers of turns and the currents in the two coils.

(b) An ideal transformer has primary-to-secondary turns ratio 1 : 5. If 5 kW at 200 V is fed to the primary, find (i) the primary current and (ii) the output voltage.

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Questions restated from the CBSE Class XII Board Examination 2026 (set 55/1/1) for practice. Reading passages and map items are described, not reproduced.