jeeinfo
Your JEE Guide

CBSE Class XII · Physics (042)

Sample Question Paper 4 · Session 2026-27

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

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission.
This is an original practice paper written to the official CBSE 2026-27 design; it is not issued by CBSE.

General instructions:

1. There are 33 questions in all. All questions are compulsory.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3. Section A contains sixteen questions: twelve MCQs and four Assertion–Reasoning questions of 1 mark each. Section B contains five questions of two marks each, Section C seven questions of three marks each, Section D two case study based questions of four marks each and Section E three long answer questions of five marks each.
4. There is no overall choice. However, an internal choice has been provided in two questions in Section B, one question in Section C, and all three questions in Section E.
5. Use of calculators is not allowed.
6. You may use: $c = 3 \times 10^{8}$ m/s, $m_e = 9.1 \times 10^{-31}$ kg, $e = 1.6 \times 10^{-19}$ C, $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}, $h = 6.63 \times 10^{-34}$ J s, $\varepsilon_0 = 8.854 \times 10^{-12}$ C^2 N^{-1} m^{-2}.

Section A

1.	The electric field inside a charged hollow conducting sphere is: (A) directed outwards (B) zero (C) maximum at the centre (D) uniform and non-zero	1
2.	The electrostatic potential energy of two point charges q_1 and q_2 separated by r is: (A) $\frac{q_1 q_2}{4\pi\varepsilon_0 r^2}$ (B) zero (C) $\frac{q_1 q_2}{4\pi\varepsilon_0 r}$ (D) $\frac{q_1+q_2}{4\pi\varepsilon_0 r}$	1
3.	A dielectric slab is inserted into an isolated charged capacitor (charge constant). The energy stored: (A) decreases (B) becomes zero (C) stays the same (D) increases	1
4.	The terminal potential difference of a cell is greater than its emf when the cell is: (A) on open circuit (B) short-circuited (C) supplying current (D) being charged	1

5.	The SI unit of magnetic field is the: (A) weber (B) tesla (C) henry (D) gauss	1
6.	According to Ampere's circuital law, $\oint \vec{B} \cdot d\vec{l}$ equals: (A) $\mu_0 \varepsilon_0 I$ (B) zero always (C) $\mu_0 I_{enclosed}$ (D) $\frac{I}{\mu_0}$	1
7.	By Faraday's law, the induced emf in a circuit is equal to: (A) the product of flux and time (B) the rate of change of current (C) the magnetic flux (D) the negative of the rate of change of magnetic flux	1
8.	In an AC circuit containing only a resistor, the current and voltage are: (A) in phase (B) out of phase by π/2 (C) out of phase by π (D) out of phase by π/4	1
9.	The speed of electromagnetic waves in vacuum is given by: (A) $\frac{1}{\sqrt{\mu_0 \varepsilon_0}}$ (B) $\sqrt{\mu_0 \varepsilon_0}$ (C) $\frac{\mu_0}{\varepsilon_0}$ (D) $\mu_0 \varepsilon_0$	1
10.	A ray of light passing through the centre of curvature of a concave mirror, after reflection: (A) passes through the focus (B) is absorbed (C) becomes parallel to the axis (D) retraces its path	1
11.	Which of the following pairs of sources is coherent? (A) two separate sodium lamps (B) two slits lit by the same monochromatic source (C) two torch bulbs (D) two candles	1
12.	In the Bohr model, the angular momentum of an electron in the nth orbit is: (A) $\frac{2\pi n}{h}$ (B) nh (C) $\frac{nh}{2\pi}$ (D) $\frac{h}{2\pi n}$	1
13.	**Assertion (A):** Gold foil was used in Rutherford's scattering experiment. **Reason (R):** Gold nuclei are heavy. (A) Both Assertion (A) and Reason (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.	1

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

14.	**Assertion (A):** The emf of a cell does not depend on the external resistance. **Reason (R):** Emf is the potential difference across the cell when no current is drawn from it. (A) Both Assertion (A) and Reason (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.	1
15.	**Assertion (A):** Energy is released when light nuclei fuse. **Reason (R):** The binding energy per nucleon increases when light nuclei fuse. (A) Both Assertion (A) and Reason (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.	1
16.	**Assertion (A):** Copper is a good conductor because it has a small band gap. **Reason (R):** Copper has no free electrons. (A) Both Assertion (A) and Reason (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.	1

Section B

17.	Four equal charges of 2 μC are placed at the corners of a square of side 20 cm. Find the electric potential at the centre of the square. **OR** For the arrangement of four equal charges at the corners of a square, what is the electric field at the centre? Explain.	2
18.	A 2 kW heater is used for 3 hours. Find the energy used in kWh, its cost at ₹8 per kWh, and the current it draws from 230 V.	2
19.	An electron moves at 2×10^6 m/s perpendicular to a magnetic field of 0.5 T. Find the force on it. Does this force change its speed?	2
20.	A square loop of side 10 cm lies in a field of 0.5 T whose direction makes 60° with the normal to the loop. Find the flux through it. If the field falls to zero uniformly in 0.1 s, find the average induced emf. **OR** State Lenz's law. Explain how it is consistent with the conservation of energy, using a magnet pushed towards a coil.	2
21.	Find the energy equivalent of 1 g of matter.	2

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

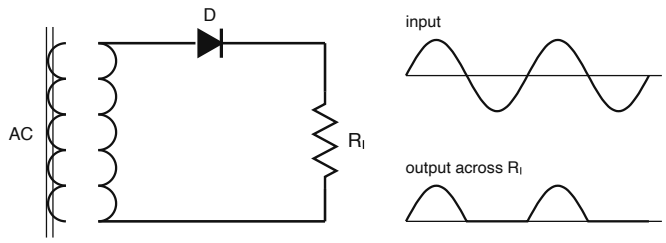
Section C

22.	A parallel plate capacitor has capacitance 8 pF. If the separation between the plates is halved and the space is filled with a dielectric of constant 6, find the new capacitance. **OR** A capacitor C charged to V is connected to an identical uncharged capacitor. Find the common potential and the fraction of energy lost.	3
23.	n identical cells, each of emf E and internal resistance r, are connected to an external resistance R. Find the current when they are connected (i) in series, (ii) in parallel. When is each arrangement better?	3
24.	A solenoid 0.5 m long has 500 turns and carries 5 A. Find the magnetic field inside it. Why is the field outside a long solenoid nearly zero?	3
25.	A 44 mH inductor is connected to a 220 V, 50 Hz supply. Find its reactance and the rms current. Write the phase relation between the voltage and the current.	3
26.	An object is placed 20 cm from a convex lens of focal length 15 cm. Find the position and magnification of the image and draw the ray diagram.	3
27.	Draw graphs showing the variation of photoelectric current with anode potential for (i) different intensities of light of the same frequency, (ii) different frequencies of light of the same intensity. What do they show?	3
28.	Calculate the energy released in the fusion reaction $^{2}H + {}^{2}H \rightarrow {}^{3}He + n$. (Masses: ^{2}H 2.014102 u, ^{3}He 3.016029 u, n 1.008665 u; 1 u = 931.5 MeV/c^2.)	3

Section D

29.	**Case study.** Electricity generated at a power station is sent over long distances through transmission lines. The voltage is stepped up to a very high value for transmission and stepped down before it reaches homes. A transformer works on the principle of mutual induction. (i) Why is power transmitted at high voltage? (A) to reduce the current and hence the I^2R loss (B) to increase the current (C) to increase the frequency (D) to make it DC *[1]* (ii) 1 MW of power is sent at 10 kV and then at 100 kV. Find the line currents. *[1]* (iii) By what factor is the line loss reduced in the second case? *[1]* (iv) Can a transformer step up a DC voltage? Why? *[1]*	4

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

30.	**Case study.** A p-n junction diode conducts when forward biased and hardly conducts when reverse biased. This property is used to convert AC into DC. In a half-wave rectifier, a single diode is connected in series with the load.  (i) During which half-cycle of the input does the diode conduct? *[1]* (ii) If the input frequency is 50 Hz, the output ripple frequency of a half-wave rectifier is: (A) 25 Hz (B) 50 Hz (C) 100 Hz (D) 0 Hz *[1]* (iii) What is the ripple frequency of a full-wave rectifier for the same input? *[1]* (iv) Why is the output of a rectifier not steady DC, and how can it be smoothed? *[1]*	4

Section E

31.	(a) Using Gauss's law, find the electric field of a uniformly charged thin spherical shell at a point (i) outside, (ii) inside the shell. (b) A shell of radius 10 cm carries 10 nC. Find the field at 20 cm and at 5 cm from its centre. **OR** (a) Derive an expression for the potential energy of an electric dipole in a uniform electric field. (b) A dipole of moment 2×10^{-8} C m is in a field of 10^5 N/C. Find the work done in turning it from the stable position through 180°.	5
32.	(a) Draw a ray diagram for refraction through a prism and derive $n = \frac{\sin\frac{A+\delta_m}{2}}{\sin\frac{A}{2}}$. (b) A prism of angle 60° has refractive index $\sqrt{3}$. Find its angle of minimum deviation. **OR** (a) What are coherent sources? Write the conditions for constructive and destructive interference in terms of path difference. (b) Two coherent waves of equal intensity I_0 meet with a path difference of $\lambda/4$. Find the resulting intensity as a fraction of the maximum.	5

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

33.	(a) An AC voltage $v = v_m \sin \omega t$ is applied to a pure inductor. Show that the current lags the voltage by π/2, and find the inductive reactance. (b) What is meant by wattless current? Write the expression for the average power in a series LCR circuit. **OR** (a) Explain how a depletion layer and a potential barrier form at a p-n junction. (b) Draw the I–V characteristics of a junction diode and explain the shapes of the forward and reverse parts.	5

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

Answers and Marking Scheme

Marks for each step are shown in brackets. Any correct alternative method gets full credit.

Section A

1. **(B)** zero. *Working:* There is no charge inside the Gaussian surface drawn within the cavity.

2. **(C)** $\frac{q_1 q_2}{4\pi\varepsilon_0 r}$. *Working:* Standard result.

3. **(A)** decreases. *Working:* $U = \frac{Q^2}{2C}$ and C increases.

4. **(D)** being charged. *Working:* While charging, V = E + Ir.

5. **(B)** tesla. *Working:* 1 T = 1 N A^{-1} m^{-1}.

6. **(C)** $\mu_0 I_{enclosed}$. *Working:* Line integral around a closed loop.

7. **(D)** the negative of the rate of change of magnetic flux. *Working:* $\varepsilon = -\frac{d\Phi}{dt}$.

8. **(A)** in phase. *Working:* For a resistor V = IR at every instant.

9. **(A)** $\frac{1}{\sqrt{\mu_0\varepsilon_0}}$. *Working:* Maxwell's result.

10. **(D)** retraces its path. *Working:* It strikes the mirror normally.

11. **(B)** two slits lit by the same monochromatic source. *Working:* Coherent sources have a constant phase difference, which needs a common source.

12. **(C)** $\frac{nh}{2\pi}$. *Working:* Bohr's quantisation condition.

13. **(B)** Both A and R are true but R is not the correct explanation of A. *Working:* Both are true. Gold was chosen mainly because it can be beaten into an extremely thin foil; heaviness alone does not explain the choice.

14. **(A)** Both Assertion (A) and Reason (R) are true and R is the correct explanation of A. *Working:* Emf is defined on open circuit, so the external resistance does not affect it.

15. **(A)** Both Assertion (A) and Reason (R) are true and R is the correct explanation of A. *Working:* The increase in binding energy appears as released energy.

16. **(D)** Both A and R are false. *Working:* Both are false: in copper the bands overlap (no gap) and there are many free electrons.

Section B

17. Each charge is $\frac{0.2}{\sqrt{2}}$ m from the centre (½). $V = 4 \times \frac{9\times10^9\times2\times10^{-6}}{0.1414}$ (1) $\approx 5.1 \times 10^5$ V (½).

OR Zero (1). The fields due to opposite corners are equal in magnitude and opposite in direction, so they cancel in pairs (1).

18. Energy = 2 × 3 = 6 kWh; cost ₹48 (1). I = 2000/230 ≈ 8.7 A (1).

19. F = evB = 1.6 × 10^{-19} × 2 × 10^{6} × 0.5 = 1.6 × 10^{-13} N (1). No; the force is perpendicular to the velocity and does no work (1).

20. Φ = BA cos 60° = 0.5 × 0.01 × ½ = 2.5 × 10^{-3} Wb (1). ε = ΔΦ/Δt = 0.025 V (1).

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

OR The induced current opposes the change in flux that produces it (1). When the N-pole approaches, the near face of the coil becomes an N-pole and repels the magnet; work must be done against this repulsion, and that work appears as electrical energy (1).

21. E = mc² (1) = $10^{-3} \times (3 \times 10^{8})^2 = 9 \times 10^{13}$ J (1).

Section C

22. $C = \frac{K\varepsilon_0 A}{d/2} = 2K \cdot \frac{\varepsilon_0 A}{d}$ (1½) = 2 × 6 × 8 pF = 96 pF (1½).

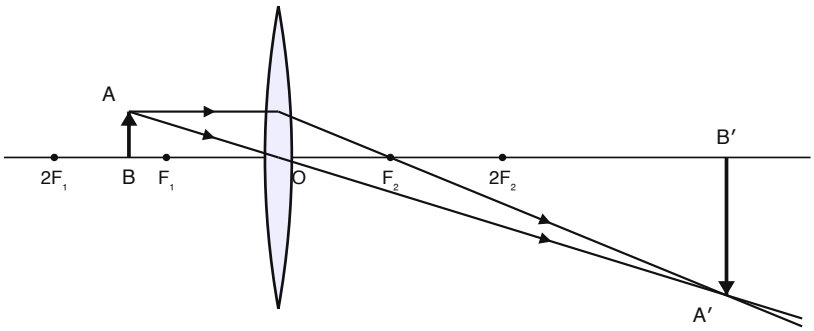
OR Charge is shared: common potential V/2 (1). Initial energy ½CV²; final $2 \times \frac{1}{2}C\left(\frac{V}{2}\right)^2 = \frac{1}{4}CV^2$ (1). Half the energy is lost, as heat and radiation (1).

23. (i) $I = \frac{nE}{R+nr}$ (1). (ii) $I = \frac{E}{R+r/n}$ (1). Series gives more current when R ≫ r; parallel when R ≪ r (1).

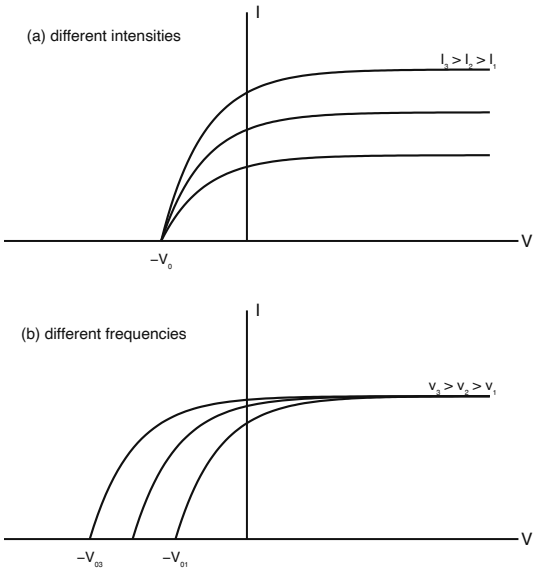
24. n = 500/0.5 = 1000 per m (½). B = $\mu_0 nI = 4\pi \times 10^{-7} \times 1000 \times 5 \approx 6.3 \times 10^{-3}$ T (1½). Outside, the fields of adjacent turns largely cancel and the lines spread over a very large area (1).

25. $X_L = 2\pi \times 50 \times 0.044 \approx 13.8\ \Omega$ (1). I = 220/13.8 ≈ 15.9 A (1). The current lags the voltage by π/2 (1).

26. $\frac{1}{v} = \frac{1}{15} - \frac{1}{20}$, v = 60 cm (1). m = v/u = –3: real, inverted, three times larger (1). Diagram (1):



27. Graphs (2):



© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

The saturation current depends on intensity, but the stopping potential depends only on frequency (1).

28. Mass of reactants 4.028204 u; products 4.024694 u (1). Δm = 0.00351 u (1). Q = 0.00351 × 931.5 ≈ 3.27 MeV (1).

Section D

29. (i) (A) A high voltage means a low current for the same power, so less I^2R loss.
(ii) 100 A and 10 A.
(iii) Loss $\propto I^2$, so it falls by a factor of 100.
(iv) No. A steady current gives no change in flux, so no emf is induced in the secondary.

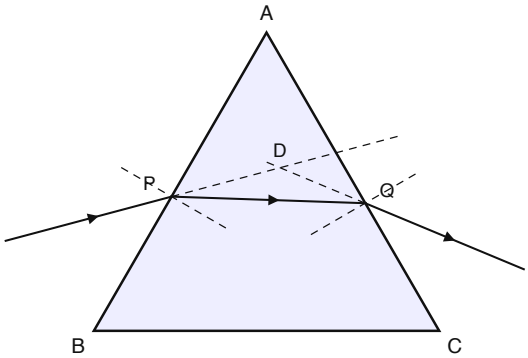
30. (i) During the half-cycle in which the diode is forward biased (here, the positive half-cycle).
(ii) (B) 50 Hz.
(iii) 100 Hz.
(iv) It is pulsating; a capacitor filter connected across the load smooths it.

Section E

31. (a) (i) A concentric Gaussian sphere of radius r > R encloses q: $E \cdot 4\pi r^2 = \frac{q}{\varepsilon_0}$, $E = \frac{q}{4\pi\varepsilon_0 r^2}$ (1½). (ii) For r < R no charge is enclosed, so E = 0 (1½). (b) At 20 cm: $E = \frac{9\times10^9\times10^{-8}}{0.04} = 2250$ N/C (1); at 5 cm: E = 0 (1).

OR (a) Work to turn it from θ_1 to θ_2: $W = \int pE\sin\theta\, d\theta = pE(\cos\theta_1 - \cos\theta_2)$ (2). Taking U = 0 at θ = 90°, $U = -pE\cos\theta = -\vec{p}\cdot\vec{E}$ (1). (b) W = pE(1 − (−1)) = 2pE = 4 × 10^{-3} J (2).

32. (a) Diagram (1):



D: angle of deviation

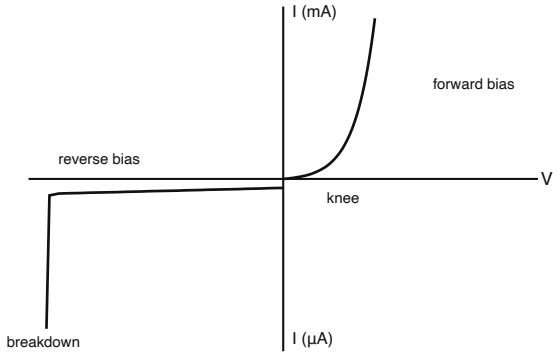
$r_1 + r_2 = A$ and $\delta = i + e - A$ (1). At minimum deviation $r_1 = r_2 = A/2$ and $i = e = (A + \delta_m)/2$, so $n = \sin i / \sin r$ gives the formula (1). (b) $\sin\frac{60^\circ+\delta_m}{2} = \sqrt{3}\sin 30^\circ = \frac{\sqrt{3}}{2}$, so $\frac{60^\circ+\delta_m}{2} = 60^\circ$ and $\delta_m = 60^\circ$ (2).

OR (a) Sources with a constant phase difference (1). Constructive: path difference nλ; destructive: (2n + 1)λ/2 (2). (b) Phase difference π/2; $I = 4I_0\cos^2\frac{\pi}{4} = 2I_0$, which is half the maximum $4I_0$ (2).

33. (a) $v_m\sin\omega t = L\frac{di}{dt}$; integrating, $i = -\frac{v_m}{\omega L}\cos\omega t = i_m\sin(\omega t - \frac{\pi}{2})$ (2), with $X_L = \omega L$ (1). (b) Current whose phase difference with voltage is π/2, so that it uses no average power (1). $P = V_{rms}I_{rms}\cos\varphi$ (1).

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

OR (a) Electrons diffuse from n to p and holes from p to n, leaving immobile ions near the junction: this is the depletion layer (1½). The ions set up an electric field that opposes further diffusion; the potential difference across the layer is the barrier potential (1½). (b) Characteristics (1):



Forward current rises sharply after the knee voltage; in reverse bias only a tiny current flows until breakdown (1).

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.