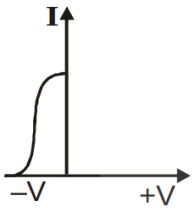
Class XII | Session 2026-27
Subject - Physics
Sample Question Paper - Set 7

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. All the sections are compulsory.
4. **Section A** contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, **Section B** contains five questions of two marks each, **Section C** contains seven questions of three marks each, **Section D** contains two case study based questions of four marks each and **Section E** contains three long answer questions of five marks each.
5. There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
6. Use of calculators is not allowed.

Section A

1. Different voltages are applied across a PN junction and the currents are measured for each value. Which of the following graphs is obtained between voltage and current? **[1]**

a)


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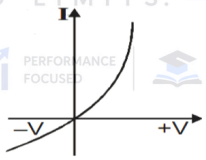

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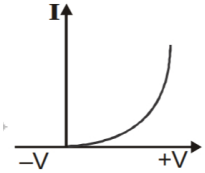

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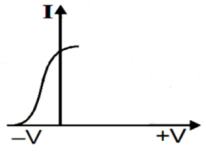


2. The instrument among the following which measures the emf of a cell most accurately is: **[1]**

a) an ammeter
b) a voltmeter
c) potentiometer
d) post office box

3. Which of the following is not due to total internal reflection? **[1]**

a) Difference between apparent and real depth of a pond
b) Working of optical fibre

c) Mirage on hot summer days

d) Brilliance of diamond

4. Consider the two idealised systems: (i) a parallel plate capacitor with large plates and small separation and (ii) a long solenoid of length L > > R, radius of cross-section. In (i), E is ideally treated as a constant between plates and zero outside. In (ii), magnetic field is constant inside the solenoid and zero outside. These idealised assumptions, however, contradict fundamental laws as below: **[1]**

a) case (ii) contradicts en $\oint H.d1 = I_{en}$

b) case (ii) contradicts Gauss's law for magnetic fields.

c) case (i) agrees with $\oint E.d1 = 0$

d) case (i) contradicts Gauss's law for electrostatic fields.

5. The earth has volume V and surface area A, then capacitance would be: **[1]**

a) $4\pi\varepsilon_0 \frac{V}{A}$

b) $12\pi\varepsilon_0 \frac{V}{A}$

c) $4\pi\varepsilon_0 \frac{A}{V}$

d) $12\pi\varepsilon_0 \frac{A}{V}$

6. A proton and an α-particle enters a uniform magnetic field perpendicular to y-axis with the same speed. If proton takes 25μ sec to make 5 revolutions, then time period for the α-particle would be **[1]**

a) 50 μsec

b) 10 μsec

c) 5 μsec

d) 25 μsec

7. The dimensional formula for emf ε in MKS system will be **[1]**

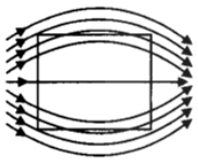
a) $[MLT^{-2}Q^{-2}]$

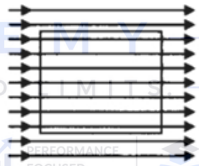
b) $[ML^{-2}Q^{-1}]$

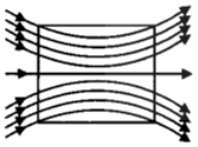
c) $[ML^{2}T^{-2}Q^{-1}]$

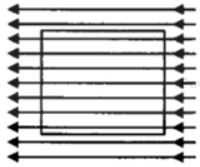
d) $[ML^{2}T^{-1}]$

8. A uniform magnetic field exists in space in the plane of paper and is initially directed from left to right. When a bar of soft iron is placed in the field parallel to it, the lines of force passing through it will be represented by **[1]**

a) 

b) 

c) 

d) 

9. A double-slit experiment is performed with light of wavelength 500 nm. A thin film of thickness 2 μm and refractive index 1.5 is introduced in the path of the upper beam. The location of the central maximum will: **[1]**

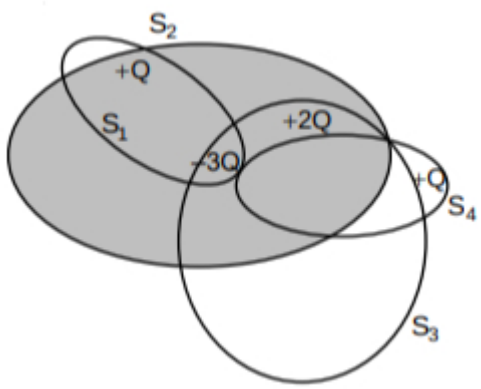
a) shift downward by nearly two fringes

b) shift upward by nearly two fringes

c) remain unshifted

d) shift downward by ten fringes

10. Following figure shows for Gaussian surfaces S_1, S_2, S_3 and S_4. **[1]**



Now, match the following columns and mark the correct code given below:

	Column - I		**Column - II**
(i)	ϕ_{s_1}	(p)	$+\frac{Q}{\varepsilon_0}$
(ii)	ϕ_{s_2}	(q)	0
(iii)	ϕ_{s_3}	(r)	$-\frac{Q}{\varepsilon_0}$
(iv)	ϕ_{s_4}	(s)	$-\frac{2Q}{\varepsilon_0}$

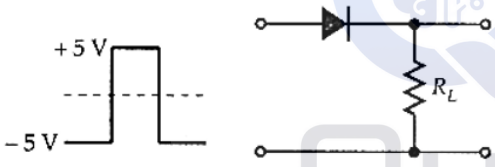
a) (i) q; (ii) s; (iii) r; (iv) p

b) (i) s; (ii) q; (iii) r; (iv) p

c) (i) r; (ii) s; (iii) p; (iv) q

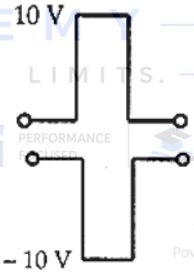
d) (i) q; (ii) r; (iii) s; (iv) p

11. If in a p-n junction, a square input signal of 10 V is applied as shown, **[1]**



then the output across R_L will be

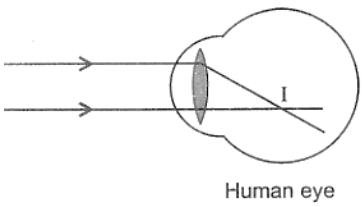
a) 

b) 

c) 

d)

12. In the figure, the image is formed of retina. The eye has: **[1]**



Human eye

a) colour blindness

b) hypermetropia

c) myopia

d) astigmatism

13. **Assertion (A):** The energy of X-ray photon is greater than that of light (visible) photon. **[1]**

Reason (R): X-ray photon in vacuum travels faster than light photon.

a) Both A and R are true and R is the correct

b) Both A and R are true but R is not the

explanation of A.

correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

14. **Assertion (A):** When a charged capacitor is filled completely with a metallic slab, its capacitance is increased by a large amount. **[1]**

Reason (R): The dielectric constant for metal is infinite.

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) A is false but R is true.

15. **Assertion (A):** Newton's rings are formed in the reflected system. When the space between the lens and the glass plate is filled with a liquid of refractive index greater than that of glass, the central spot of the pattern is dark. **[1]**

Reason (R): The reflections in Newton's ring cases will be from a denser to a rarer medium and the two interfering rays are reflected under similar conditions.

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) A is false but R is true.

16. **Assertion (A):** A bulb connected in series with a solenoid is connected to ac source. If a soft iron core is introduced in the solenoid, the bulb will glow brighter. **[1]**

Reason (R): On introducing soft iron core in the solenoid, the inductance increases.

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) A is false but R is true.

Section B

17. The magnetic field in a plane electromagnetic wave is given by $B_y = (2 \times 10^{-7})$ T sin $(0.5 \times 10^3 x + 1.5 \times 10^{11}$ t). **[2]**

a. What is the wavelength and frequency of the wave?

b. Write an expression for the electric field.

18. A sample of paramagnetic salt contains 2.0×10^{24} atomic dipoles each of dipole moment 1.5×10^{-23} JT^{-1}. The sample is placed under homogeneous magnetic field of 0.84 T and cooled to the temperature of 4.2 K. The degree of magnetic saturation achieved is equal to 15%. What is the total dipole moment of the sample for a magnetic field of 0.98 T and a temperature of 2.8 K (assume Curie's law)? **[2]**

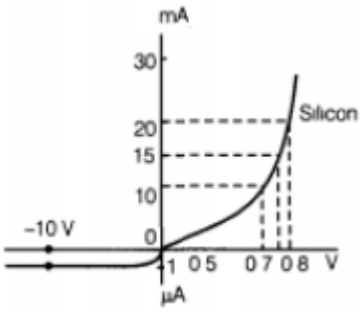
OR

A neutral point is found on the axis of a bar magnet at a distance of 10 cm from its one end. If the length of the magnet be 10 cm and B_H = 0.3 G, find the magnetic moment of the magnet.

19. The V-I characteristic of a silicon diode is as shown in the figure. Calculate the resistance of the diode at **[2]**

a. I_D = 15 mA and

b. V_D = -10V



20. In a Geiger-Marsden experiment, calculate the distance of closest approach to the nucleus of Z = 80, when an a-particle of 8 MeV energy impinges on it before it comes momentarily to rest and reverses its direction. **[2]**

21. A charged particle of mass'm', charge 'q' moving at uniform velocity 'v', enters a uniform magnetic field 'B' acting normal to the plane of the paper. Deduce expression for the (t) radius of the circular path in which it travels, (ii) kinetic energy of the particle (assuming v << c). **[2]**

Section C

22. A cell of emf 'E' and internal resistance 'r' is connected across a variable load resistor R. Draw the plots of the terminal voltage V versus (i) R and (ii) the current I. **[3]**

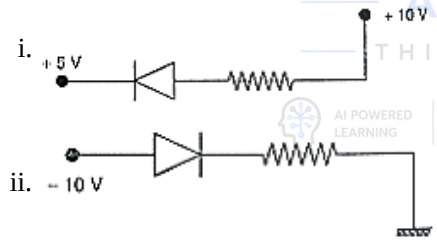
It is found that when R = 4 Ω, the current is 1 A when R is increased to 9 Ω, the current reduces to 0.5 A. Find the values of the emf E and internal resistance r.

23. Ultra-violet light of wavelength 200 nm from a source is incident on a metal surface. If the stopping potential is -2.5 V, **[3]**

a. Calculate the work function of the metal, and

b. How would the surface respond to a high intensity red light of wavelength 6328 A produced by a laser?

24. Explain, with the help of a circuit diagram, how the thickness of depletion layer in a p-n junction diode changes when it is forward biased. In the following circuits which one of the two diodes is forward biased and which is reverse biased? **[3]**



25. Draw a graph showing the variation of binding energy per nucleon with mass number of different nuclei. Write any two salient features of the curve. How does this curve explain the release of energy both in the processes of nuclear fission and fusion? **[3]**

26. Calculate the de-Broglie wavelength associated with the electron revolving in the first excited state of hydrogen atom. The ground state energy of the hydrogen atom is -13.6 eV. **[3]**

27. a. State two conditions for two light sources to be coherent. **[3]**

b. Give two points of difference between an interference pattern due to a double-slit and a diffraction pattern due to a single slit.

28. Deduce an expression for the mutual inductance of two long coaxial solenoids but having different radii and different number of turns. **[3]**

OR

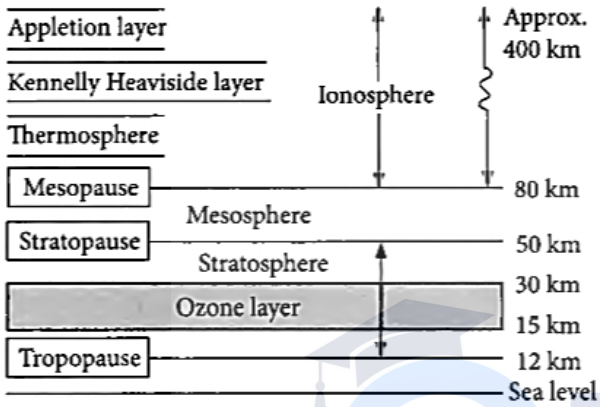
i. Define the term self-inductance and write its S.I. unit.

ii. Obtain the expression for the mutual inductance of two long co-axial solenoids S_1 and S_2 wound one over the other, each of length L and radii r_1 and r_2 and n_1 and n_2 number of turns per unit length, when a current I is set up in the outer solenoid S_2.

Section D

29. **Read the text carefully and answer the questions:** **[4]**

Radio waves are produced by the accelerated motion of charges in conducting wires. Microwaves are produced by special vacuum tubes. Infrared waves are produced by hot bodies and molecules also known as heat waves. UV rays are produced by special lamps and very hot bodies like Sun.



(a) Solar radiation is

i. transverse electromagnetic wave

ii. longitudinal electromagnetic waves

iii. both longitudinal and transverse electromagnetic waves

iv. none of these.

a) Option (iii) b) Option (ii)

c) Option (iv) d) Option (i)

(b) What is the cause of greenhouse effect?

a) X-rays b) Ultraviolet rays

c) Infrared rays d) Radiowaves

(c) Biological importance of ozone layer is

a) It layer reduces greenhouse effect b) it stops ultraviolet rays

c) it reflects radiowaves d) none of these.

OR

Earth's atmosphere is richest in

a) ultraviolet b) X-rays

c) microwaves d) infrared

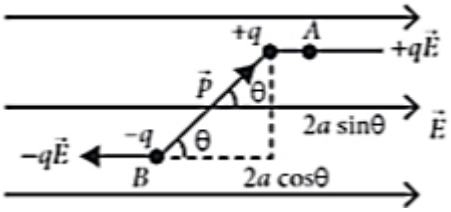
(d) Ozone is found in

a) mesosphere b) ionosphere

c) stratosphere d) troposphere

30. When electric dipole is placed in uniform electric field, its two charges experience equal and opposite forces, **[4]**

which cancel each other and hence net force on electric dipole in uniform electric field is zero. However these forces are not collinear, so they give rise to some torque on the dipole. Since net force on electric dipole in uniform electric field is zero. so no work is done in moving the electric dipole in uniform electric field. However some work is done in rotating the dipole against the torque acting on it.



i. The dipole moment of a dipole in a uniform external field $\vec{E}$ is $\vec{P}$. Then find the torque $\vec{\tau}$ acting on the dipole.

ii. An electric dipole consists of two opposite charges, each of magnitude 1.0 μC separated by a distance of 2.0 cm. The dipole is placed in an external field of 10^5 NC^{-1}. Then find the maximum torque on the dipole.

iii. Find the θ when torque on a dipole in uniform electric field is minimum.

iv. What is the net force F and torque τ on the dipole when an electric dipole is held at an angle in a uniform electric field?

v. An electric dipole of moment p is placed in an electric field of intensity E. The dipole acquires a position such that the axis of the dipole makes an angle θ with the direction of the field. Assuming that the potential energy of the dipole to be zero when $\theta = 90^o$, Find the torque and the potential energy of the dipole.

Section E

31. a. Draw a labelled ray diagram of an astronomical telescope to show the image formation of a distant object. Write the main considerations required in selecting the objective and eyepiece lenses in order to have large magnifying power and high resolution of the telescope. **[5]**

b. A compound microscope has an objective of focal length 1.25 cm and eyepiece of focal length 5 cm. A small object is kept at 2.5 cm from the objective. If the final image formed is at infinity, find the distance between the objective and the eyepiece.

OR

i. State Huygens principle. A plane wave is incident at an angle i on a reflecting surface. Construct the corresponding reflected wavefront. Using this diagram, prove that the angle of reflection is equal to the angle of incidence.

ii. What are the coherent sources of light? Can two independent sodium lamps act like coherent sources? Explain.

iii. A beam of light consisting of a known wavelength 520 nm and an unknown wavelength λ, used in Young's double slit experiment produces two interference patterns such that the fourth bright fringe of unknown wavelength coincides with the fifth bright fringe of known wavelength. Find the value of λ.

32. a. Describe briefly the process of transferring the charge between the two plates of a parallel plate capacitor when connected to a battery. Derive an expression for the energy stored in a capacitor. **[5]**

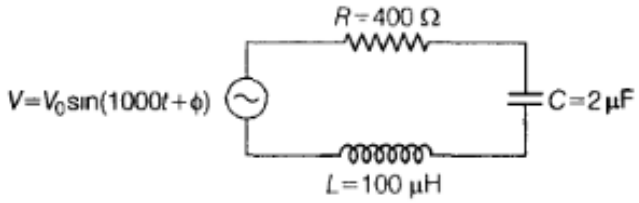
b. A parallel plate capacitor is charged by a battery to a potential difference V. It is disconnected from the battery and then connected to another uncharged capacitor of the same capacitance. Calculate the ratio of the energy stored in the combination to the initial energy on the single capacitor.

OR

i. Derive an expression for potential energy of an electric dipole $\vec{p}$ in an external uniform electric field $\vec{E}$. When is the potential energy of the dipole (1) maximum, and (2) minimum?

ii. An electric dipole consists of point charges -1.0 pC and +1.0 pC located at $(0, 0)$ and (3 mm, 4 mm) respectively in x - y plane. An electric field $\vec{E} = \left(\frac{1000V}{m}\right)\hat{i}$ is switched on in the region. Find the torque $\vec{\tau}$ acting on the dipole.

33. i. Determine the value of phase difference between the current and the voltage in the given series L-C-R circuit. **[5]**

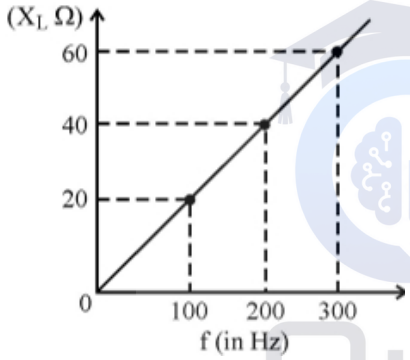


ii. Calculate the value of additional capacitor which may be joined suitably to the capacitor C that would make the power factor of the circuit unity.

OR

a. Show that an ideal inductor does not dissipate power in an ac circuit.

b. The variation of inductive reactance (X_L) of an inductor with the frequency (f) of the ac source of 100 V and variable frequency is shown in the fig.



i. Calculate the self-inductance of the inductor.

ii. When this inductor is used in series with a capacitor of unknown value and a resistor of 10Ω at 300 s^{-1}, maximum power dissipation occurs in the circuit. Calculate the capacitance of the capacitor.