Roll No. | | | | | | | |

Candidates must write the Code on the title page of the answer book.

- Please check that this question paper contains 16 printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains 33 questions.
- Please write down the Serial Number of the question before attempting it.
- 15 minute time has been allotted to read this question paper. Students will read the question paper only and will not write any answer on the answer-book during this period.

I-PRE BOARD EXAMINATION : 2025-26
CLASS – XII (CBSE)
PHYSICS (THEORY)

Time Allowed : 3 hours. *Max. Marks : 70*

General Instructions :

(i) *There are 33 questions in all. All questions are compulsory.*

(ii) *This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.*

(iii) *Section A contains sixteen questions, twelve MCQ and four Assertion Reason 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.*

(iv) *There is no overall choice. However, an internal choice has been provided in two questions in section B, one question in section C, one question in each CBQ in section D and in all three questions in section E. You have to attempt only one of the choice in such questions.*

(v) *Use of calculators is not allowed.*

(vi) *You may use the following values of physical constants where ever necessary -*

$C = 3 \times 10^8$ m/s, $m_e = 9.1 \times 10^{-31}$ kg, $e = 1.6 \times 10^{-19}$ Coulomb, $\epsilon_0 = 8.85 \times 10^{-12}$ $C^2 N^{-1} m^{-2}$, $\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1}, $h = 6.63 \times 10^{-34}$ Js

Avogadro's number = 6.23×10^{23} per gram mole

SECTION - A

1. What is the value of minimum force acting between two charges placed at 1 m apart from each other : [1]

(a) 23.04×10^{-29} N (b) 23.04×10^{29} N

(c) 9.00×10^{9} N (d) 9.00×10^{-9} N

2. Two conducting spheres A and B of radii a and b respectively are at the same potential. The ratio of surface charge densities of A and B is : [1]

(a) a/b (b) b/a

(c) a^2/b^2 (d) b^2/a^2

3. An electron with angular momentum 'L' moving around a nucleus , has a magnetic moment which is given by : [1]

(a) $\frac{eL}{2m}$ (b) $\frac{e^2L}{2m}$

(c) $\frac{eL}{2m^2}$ (d) $\frac{e^2L^2}{2m}$

4. A long straight wire of circular cross-section of radius 'a' carries a steady current. The current is uniformly distributed across its cross-section. The ratio of magnitudes of the magnetic field at a point $a/2$ above the surface of wire to that of a point $a/2$ below its surface is : [1]

(a) 4 : 1 (b) 1 : 1

(c) 4 : 3 (d) 3 : 4

5. The ratio of voltage sensitivity (Vs) and current sensitivity (Is) of a moving coil galvanometer of resistance G is : [1]

(a) 1/G (b) $1/G^2$

(c) G (d) G^2

6. The domain formation is a necessary feature of : [1]

(a) Diamagnetism (b) Paramagnetism

(c) Ferromagnetism (d) All of these

7. The emf generated by an AC generator is given by $V = V_0 \sin \omega t$ where ω is angular frequency of the armature of generator. What will be the equation of the emf if the angular frequency is doubled? [1]

(a) $V = V_0 \sin 2\omega t$ (b) $V = 2V_0 \sin \omega t$

(c) $V = 2V_0 \sin 2\omega t$ (d) $V = V_0 \sin \omega t$

8. Which of the following transport by EM waves: [1]

(a) Charges and momentum

(b) Frequency and wavelength

(c) Energy and momentum

(d) Wavelength and energy

9. A ray of light travelling in a direction $\frac{1}{2}\left(\hat{i} + \sqrt{3}\hat{j}\right)$ is incident on a reflecting surface. After reflection it travels along the direction $\frac{1}{2}\left(\hat{i} - \sqrt{3}\hat{j}\right)$. The angle of incidence is : [1]

(a) 30° (b) 45°

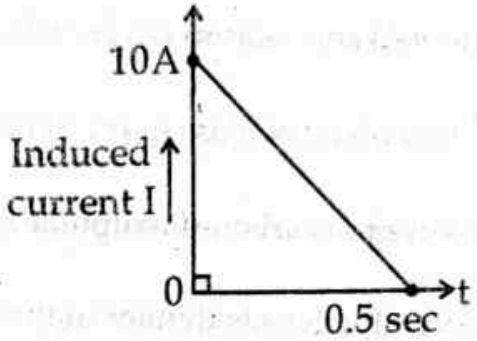
(c) 60° (d) 75°

10. In YDSE at a point the intensity is I where the path difference is $\lambda/6$, where λ is wavelength of light used. If I_0 denotes the maximum intensity, then I/I_0 is equal to - [1]

(a) $3/4$ (b) $1/\sqrt{2}$

(c) $\sqrt{3}/2$ (d) $1/2$

11. In a coil of resistance 100 Ω, a current is induced by changing the magnetic flux through it. The variation of the current with time is shown in the figure. The magnitude of change in the flux through coil is : [1]



(a) 200 wb

(b) 275 wb

(c) 250 wb

(d) 225 wb

12. The potential energy of an electron in an excited state of hydrogen atom is about - 3.0 eV, how many emission spectral lines are possible for this excited electron? [1]

(a) 1

(b) 2

(c) 3

(d) 6

Note :For question number 13 to 16, two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Select the correct answers to these questions from the codes (a), (b), (c) and (d) as given below :

(a) If both Assertion (A) and Reason (R) are true and Reason(R) is the correct explanation of Assertion (A).

(b) If both Assertion(A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion(A).

(c) If Assertion (A) is true and Reason(R) is false.

(d) If both Assertion(A) and Reason (R) are false.

13. **Assertion (A):** A convex lens of glass ($\mu = 1.5$) behaves as a diverging lens when immersed in carbon-di-sulphide of refractive index ($\mu = 1.65$) [1]

Reason (R) : A diverging lens is thinner in the middle and thicker at the edges.

14. **Assertion (A):** If frequency of incident light is greater than the threshold frequency, then stopping potental is increased on increasing the frequency of incident light. [1]

Reason (R) : Wave theory can not explain this effect.

15. **Assertion (A):** The critical angle for light passing from glass to air is minimum for violet light. [1]

Reason (R) : The wavelength of blue light is greater than that of other colours.

16. **Assertion (A):** When a charged particle moves in a circular path, it produces electromagnetic wave. [1]

Reason (R) : A charged particle moving along circular path does not have an acceleration.

SECTION - B

17. Give one example each to illustrate the situation where there is (i) displacement current but no conduction current and (ii) only conduction current but no displacement current. [2]

OR

Suppose that the electric field part of an electromagnetic wave in vacuum is

$E = 3.1\ NC^{-1} \cos[1.8\ radm^{-1})\ y + (5.4 \times 10^{8}\ rads^{-1})t]\ \hat{i}$

i) What is the frequency.

ii) Write an expression for the magnetic field part of the wave.

18. A charged particle is accelerated by a potential difference 'V' . If λ is the de-Broglie's wevelength associated with the particle, plot a graph λ versus $\frac{1}{\sqrt{V}}$ and using the graph find the magnitude of the charge of the particle. [2]

19. Draw graphs showing variation of resistivity with temperature for (i) Good conductors (ii) Semiconductors [2]

OR

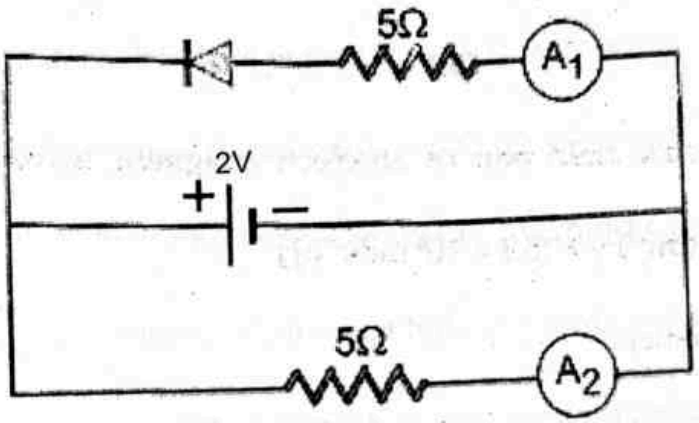
Define :

(i) Drift velocity

(ii) Mobility of charge carriers.

20. Use the mirror equation to deduce that an object placed between the pole and focus of a concave mirror produces a virtual and enlarged image. [2]

21. What are the reading of ammeters A_1 and A_2 as shown in the figure. Neglect the resistance of ammeters while p-n junction used is ideal one. [2]



SECTION - C

22. A slit of width 'a' is illuminated by red light of wavelength 6500 Å. For what value of 'a' will (i) the first minimum fall at an angle of diffraction of 30° and (ii) the first maximum fall at an angle of diffraction of 30°. [3]

23. (a) Plot a graph between the binding energy per nucleon versus mass number A for nuclei in the range $0 \leq A \leq 240$ [2]

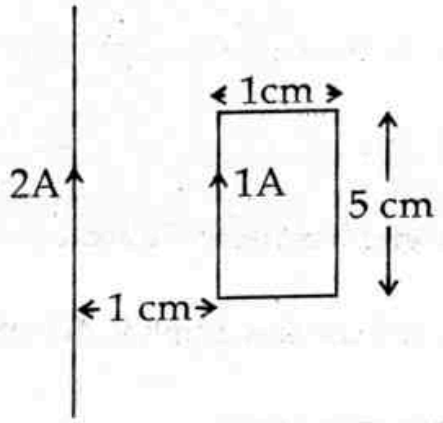
(b) A nucleus with binding energy per nucleon equal to 7.6 Mev and mass number 240 breaks into two equal parts of mass numbers 120 each and binging energy per nucleon 8.5 Mev. Find the energy released in this process. [1]

24. A rectangular loop carries a current of 1 Ampere. A straight long wire carrying current of 2 Ampere is kept near the loop in same plane as shown in figure.

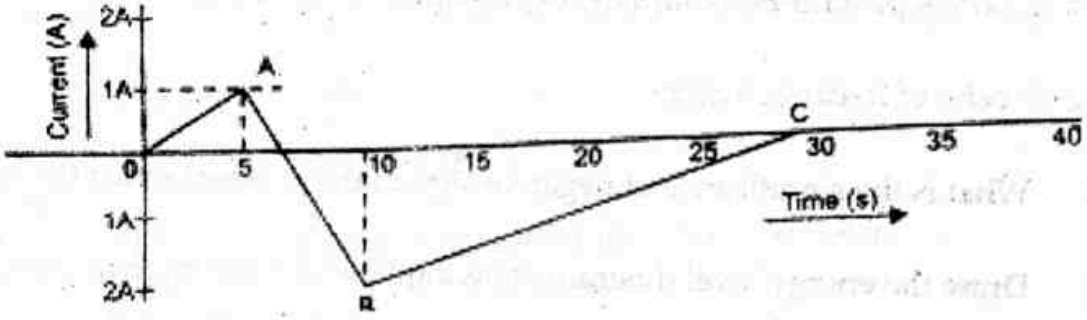
Find : [3]

(i) Torque acting on the loop.

(ii) The amplitude and direction of net force on the loop.



25. A (current vs time) graph of current passing through a solenoid is shown in the figure. [3]



For which time the back emf is maximum ? If back emf at t = 3 s is -2 volt, find the back emf at t = 8 s, 15 s and 40 s. OA, AB and BC are straight line segments.

26. An ac voltage $V = V_0 \sin \omega t$ is applied across a capacitor of capacitance 'C'. [3]

a) Show that current leads the voltage by 90°.

b) Show the graphical variation of capacitive reactance versus frequency.

OR

An ac voltage $V = V_0 \sin \omega t$ is applied across an inductor of inductance 'L'

a) Show that current lags behind the voltage by 90°.

b) Show the graphical variation of inductive reactance versus frequency.

27. Light of wavelength λ is incident on a metallic surface of threshold frequency λ_0 ($\lambda < \lambda_0$) and photoelectrons are emitted. [3]

(a) Write the expression for stopping potential (V_s) for the emitted electrons in terms of λ and λ_0.

(b) Draw the graph between Vs and $1/\lambda$.

(c) How can one use this graph to determine the value of Planck's constant and work function of metal.

28. Using Bohr's postulates, obtain the expression for total energy of the electron in the n^{th} orbit of hydrogen atom. [3]

a) What is the significance of negative sign in the expression for the energy?

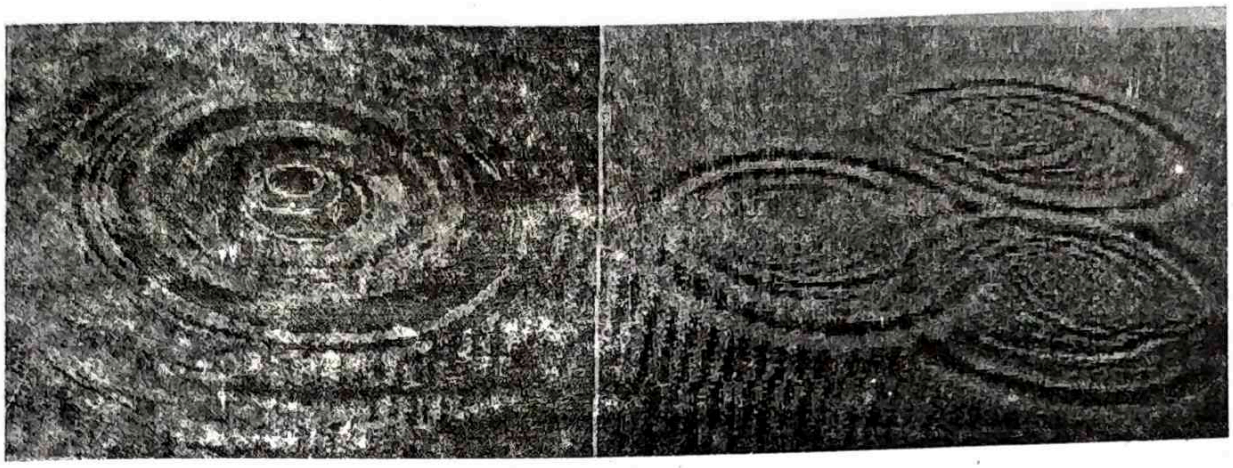
b) Draw the energy level diagram showing how the line spectra corresponding to paschen series occur due to transition between energy levels.

SECTION - D

CASE STUDY BASED QUESTIONS

29. **Read the paragraph and answer the following questions.** **[4]**

Jimmy and johny both were creating a series of circular waves while fishing in the water. The waves form a pattern similar to the diagram as shown. Their friends, Anita, advised jimmy and johny not to play with water for a long time. She then observed beautiful pattern of ripples which become very colourful, when her friend Lata poured an oil drop on it. Lata, a 12th standard girl, had explained the cause for colourful ripples pattern to Anita earlier.



(i) Huygens concept of secondary wave.

(a) allows us to find focal length of thick lens

(b) is a geometrical method to find a wavefront

(c) is used to determine the velocity of light

(d) is used to explain polarization

OR

A plane wavefront passes through convex lens. The geometrical shape of the wavefront that emerges is :

(a) plane

(b) diverging spherical

(c) converging spherical

(d) none of these

(ii) Name the phenomenon involve in the activity :

(a) reflection

(b) refraction

(c) interference

(d) polarization

(iii) A surface over which an optical wave has a same phase is called :

(a) wave (b) wavefront

(c) elasticity (d) None of these

(iv) Which of the following is correct for light diverging from a point source?

(a) the intensity decreases in proportion for the distance squared

(b) the wavefront is parabolic

(c) the intensity at the wavelength does not depend on the distance

(d) none of the above

30. Read the **paragraph and answer the following questions.** **[4]**

Mirage in Deserts :

To a distant observer, the light appears to be coming from somewhere below the ground. The observer naturally assumes that light is being reflected from the ground, say a pool of water near the tall object.

Such inverted images of distant tall objects cause an optical illusion to the observer. This phenomenon is called mirage. This type of mirage is especially in hot deserts.

(i) Which phenomenon is involved in formation of mirage?

(a) Refraction, total internal reflection

(b) Dispersion, refraction

(c) Dispersion, scattering of light

(d) Total internal reflection and diffraction

(ii) A diver at a depth 12 m inside water $\mu = 4/3$ sees the sky in a cone of semi-vertical angle :

(a) $\sin^{-1} \frac{4}{3}$

(b) $\tan^{-1} \frac{4}{3}$

(c) $\sin^{-1} \frac{3}{4}$

(d) 90°

(iii) In an optical fibre, if n_1 and n_2 are the refractive indices of the core and cladding, which of the following is correct ?

(a) $n_1 < n_2$ (b) $n_1 = n_2$

(c) $n_1 << n_2$ (d) $n_1 > n_2$

(iv) The critical angle is maximum when light travels from :

(a) Water to air (b) Glass to air

(c) Glass to water (d) Air to water

OR

Sparking of diamond is due to :

(a) Refraction (b) Total internal reflection

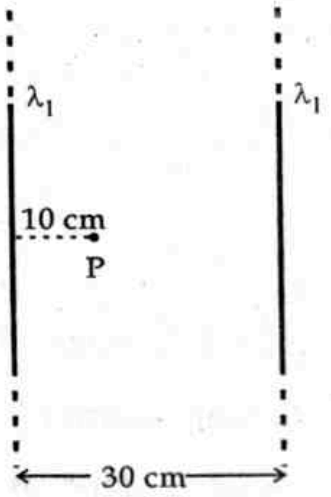
(c) Reflection and scattering (d) Dispersion

SECTION - E

31. (a) State Gauss's law in electrostatics [1]

(b) Apply Gauss's law to obtain electric field $\vec{E}$ at a point due to a uniformly charged straight wire of infinite length. [2]

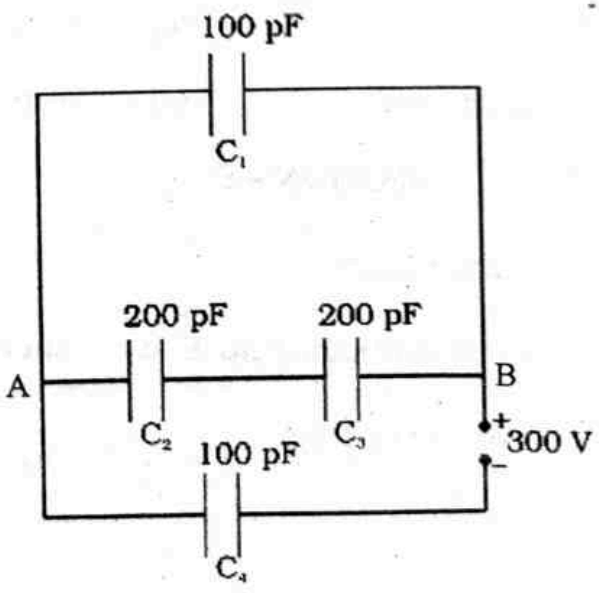
(c) Two long straight wires 1 and 2 are kept as shown in figure. The linear charge densities of two wires are $\lambda_1 = 10\mu C m^{-1}$ and $\lambda_2 = -20\mu C m^{-1}$. Find net force $\vec{F}$ experienced by an electron held at point P. [2]



OR

(a) Derive the expression for the capacitance of parallel plate capacitor, when a dielectric slab of thickness t (t < d) is inserted between the plates. [2]

(b) Obtain the equivalent capacitance of the network shown in the figure, For a 300 V supply, determine the charge and voltage across each capacitor. [3]



OR

32. (a) Derive an expression for drift velocity of electrons in a conductor, hence deduce Ohm's law. [4]

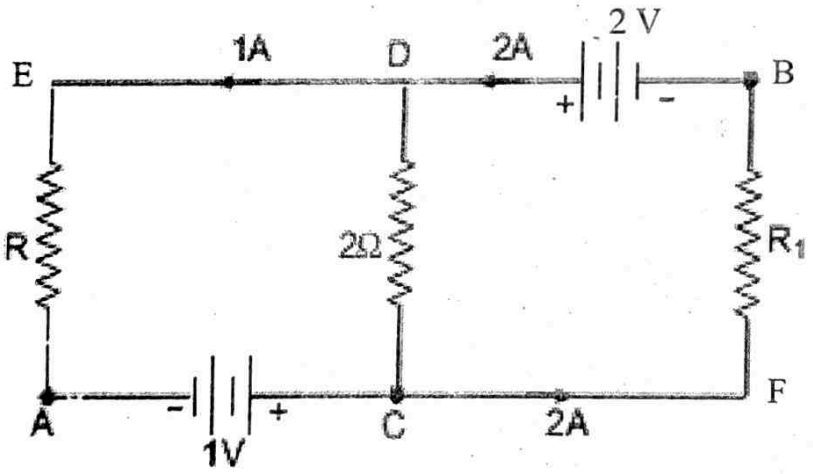
(b) A wire whose cross sectional area is increasing linearly from its one end to the other, is connected across a battery of V volts. Which of the following quantities remains constant in the wire? [1]

Drift velocity, Current density, Electric current, Electric field

OR

(a) Write the Kirchhoff's laws for electric circuit. Which physical quantities remain conserved in these laws. [2]

(b) In the given circuit, assuming point A to be at zero potential , use Kirchhoff's rules to determine the potential at point B. [3]



33. (a) State briefly the process involved in the formation of p-n junction explaining clearly how the depletion region is formed ? [2]

(b) Using necessary circuit diagrams show how the V–I. characteristics of a p-n junction are obtained in (i) forward biasing (ii) reverse biasing. [3]

OR

(a) State the principle of working of a p-n junction diode as a rectifier. [1]

(b) Explain with the help of a circuit diagram the use of p-n junction diode as a full wave rectifier. [3]

(c) Draw a sketch of input and output waveforms? [1]

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