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LUCKNOW REGION

SECOND PRE-BOARD

SUBJECT- PHYSICS(THEORY)

CLASS-XII

SESSION 2023-24

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.

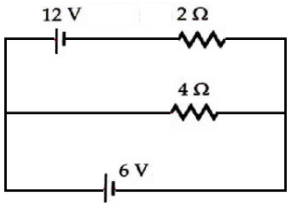
(6) Use of calculators is not allowed. (7) You may use the following values of physical constants where ever necessary i. c = 3 x 10^8 m/s ii. me = 9.1 x10^{-31} kg iii. e = 1.6 x 10^{-19} C iv. μ_0 = 4π x 10^{-7} TmA^{-1} v. h = 6.63 x10^{-34} Js vi. ε_0 = 8.854 x10^{-12} $C^2N^{-1}m^{-2}$ vii. Avogadro's number = 6.023 X 10^{23} per gram mole

SECTION A

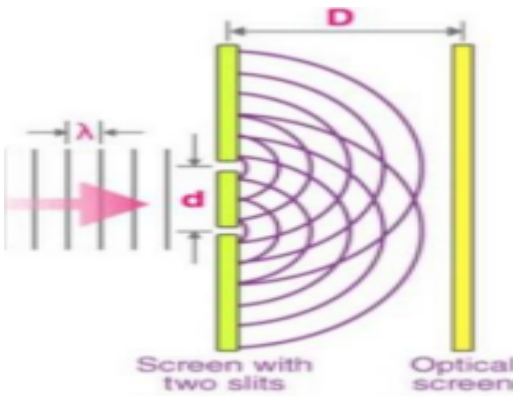
Q1	Torque acting along on electric dipole of dipole moment P placed in uniform electric field E is: (a) P x E (b) P E (c) P x(E x P) (d) E x P	1
Q2	.The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and area A, is (a) proportional to the square root of the distance between the plates. (b) linearly proportional to the distance between the plates. (c) independent of the distance between the plates. (d) inversely proportional to the distance between the plates	1
Q3.	In a Whetstone's bridge, all the four arms have equal resistance R. If resistance of the galvanometer arm is also R, then equivalent resistance of the combination is- (A) R (B)2R (C)R/2 (D)R/4	1
Q4	The force experienced by a charged particle moving in a magnetic field is maximum when the angle between the velocity of the particle and the magnetic field is: a) 0° b) 45° c) 90° d) 180°	1
Q5	The magnetic susceptibility of a diamagnetic substance is (a) ∞ (b) zero (c) small but negative (d) small but positive	1
Q6	Lenz's law of electromagnetic induction is as per law of conservation of a) energy.	1

	b) angular momentum. c) charge. d) electromotive force.	
Q7	When current in a coil changes from 5 A to 2 A in 0.1 s, average voltage of 50V is produced. The self-inductance of the coil is V is produced. The self-inductance of the coil will be. (a) 1.67 H (b) 6 H (c) 3 H (d) 0.67 H	1
Q8	An ac circuit has a resistance of 12 ohms and an impedance of 15 ohms. The power factor of the circuit will be (a) 0.8 (b) 0.4 (c) 0.125 (d) 1.25	1
Q9	What happens to the inductive reactance when the frequency of the AC supply is increased? (a) Increases (b) Decreases (c)Remains the same (d) Decreases inversely	1
Q10	The electromagnetic radiation used for water purification and eye surgery is (a)infrared (b)microwave (c) X-rays (d) ultraviolet wave	1
Q11	The emission of electron from a surface is possible due to (a) Photoelectric effect (b) Thermionic effect (c) Both (a) and (b)	1

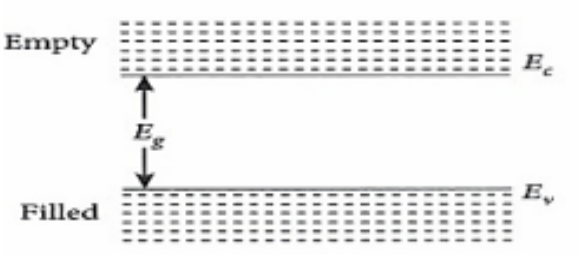
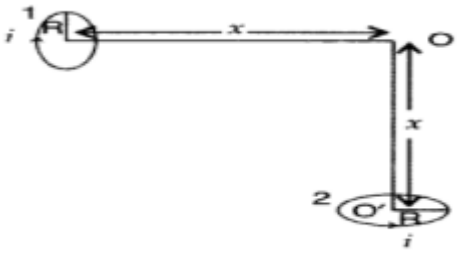
	(d) None of the above	
Q12	For a nuclear fusion process, suitable nuclei are (a.) Any nuclei (b)Heavy nuclei (c) Light nuclei (d).Nuclei lying in middle of periodic table	1
	ASSERTION –REASON QUESTION DIRECTIONS: Read the following questions and choose any one of the following four responses. EACH QUESTION OF 1 MARK **A. If both assertion and reason are true and reason is the correct explanation of the assertion.** **B. if both assertion and reason are true but reason is not a correct explanation of assertion.** **C. If assertion is true but reason is false.** **D. If both assertion and reason is false.**	
Q13	Assertion: Diffraction takes place for all types of waves mechanical or non-mechanical, transverse or longitudinal. Reason :Diffraction's effect are perceptible only if wavelength of wave is comparable to dimensions of diffracting device.	1
Q14	. Assertion (A): A very intense beam of light having frequency less than the threshold frequency does not cause photoelectric emission Reason (R) : Photoelectric emission is only possible if the frequency of incident radiation is greater than the threshold frequency.	1
Q15	**Assertion:** The depletion layer in p-n junction under forward bias decreases. **Reason:** The electric field due to external voltage supports the electric field due to potential barrier..	1
Q16	Assertion: Density of nuclear matter is same for all nuclei. Reason: Density has nothing to do with mass and size of the nucleus	1
	SECTION B	
Q17	Two point charges of 3 x10 $^{-8}$C and -2 x10 $^{-8}$ Care placed 15 cm apart in air. At what point on the line joining the two charge is the electric potential zero? Take the potential at infinity to be zero	2
Q18	Name the part of electromagnetic spectrum whose wavelength lies	2

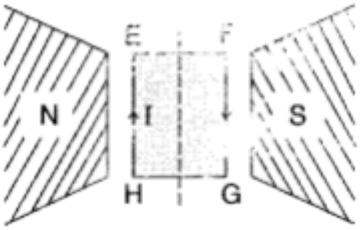
	in the range 10^{-10}m. Give its one use.	
Q19	Under what conditions does the phenomenon of total internal reflection take place? Draw a ray diagram showing how a ray of light deviates by 90° after passing through a right-angled isosceles prism.	2
Q20	Assume that the frequency of the radiation incident on a metal plate is greater than its threshold frequency. How will the following change, if the frequency of incident radiation is doubled? (1) Kinetic energy of electrons (2) Photoelectric current Or A proton and an electron have same kinetic energy. Which one has greater de- Broglie wavelength.	2
Q21	Define the terms (i) depletion region and (ii) potential barrier.	2
	SECTION C	
Q22	State Gauss's law in electrostatics. Using this law derive an expression for the electric field due to a uniformly charged infinite plane sheet.	3
Q23	State Kirchhoff's laws. In the electric network shown in the figure, use Kirchhoff's rules to calculate the power consumed by the resistance R=4Ω 	3
Q24	3. A solenoid has a core of a material with relative permeability 400. The winding of solenoid is insulated from the core and carry a current of 2A. If the number of turn is 1000 per metre, calculate 1.H 2. M and 3. B	3
Q25	In a series L-C-R circuit, obtain the conditions under which (i) the impedance of circuit is minimum and (ii) wattles current flows in the circuit. OR 4. An AC source of voltage $V = V_m$ sin wt is applied across a series L-C-R Draw the phasor diagram for this circuit when the (a)capacitive impedance exceeds the inductive impedance. (b) inductive impedance exceeds the capacitive impedance.	3

Q26	Draw a ray diagram for the formation of image of a point object by a thin double convex lens having radii of curvature R_1 and R_2. Hence derive lens maker's formula.	3
Q27	The work function of Caesium metal is 2.14eV. When light of frequency 6 x 10^{14} Hz is incident on the metal surface photoemission of electrons occurs. (a). What is the maximum kinetic energy of the emitted (b). stopping potential and maximum speed of the emitted photoelectrons	3
Q28	1. Draw the plot of binding energy per nucleon curve as a function of mass number. 2. write two characteristics of nuclear forces.	3
	SECTION D	
Q29	CASE BASED QUESTION -	
	Young's double-slit experiment uses two coherent sources of light placed at a small distance apart, usually, only a few orders of magnitude greater than the wavelength of light is used. Young's double-slit experiment helped in understanding the wave theory of light which is explained with the help of a diagram. A screen or photo detector is placed at a large distance 'D' away from the slits as shown. The original Young's double-slit experiment used diffracted light from a single source passed into two more slits to be used as coherent sources. Lasers are commonly used as coherent source in the modern-day experiments. i. In Young's Double Slit Experiment, if instead of monochromatic light white light is used, what would be the observation? (a) The pattern will not be visible (b) The shape of the pattern will change from hyperbolic to circular (c) Coloured fringes will be observed with a white bright fringe at the centre (d) The bright and dark fringes will change position ii. What kind of sources is required for Young's Double Slit experiment? (a) Coherent (b) Incoherent (c) Intense (d) Bright	

	iii. If the distance between the two slits is doubled, the fringe width _____ (a) Doubles (b) Halves (c) Four-times (d) Remains same iv. There is no effect on the interference pattern when the width of the slit is increased. (a) True (b) False OR What is the effect on angular width of the fringes if screen distance increases a) Doubles (b) Remains same (c) Four-times (d) Halves  	
Q30	From Bohr's atomic model, we know that the electrons have well defined energy levels in an isolated atom. But due to inter atomic interactions in a crystal, the electrons of the outer shells are forced to have energies different from those in isolated atoms. Each energy level splits into a number of energy levels forming a continuous band. The gap between top of valence band and bottom of the conduction band in which no allowed energy levels for electrons can exist is called energy gap. (i) In an insulator energy band gap is	

	(a) $E_g = 0$ (b) $E_g < 3eV$ (c) $_{Eg} > 3eV$ (d) None of the above (ii) In a semiconductor, separation between conduction and valence band is of the order of (a) 0 eV (b) 1eV (c) 10 eV (d) 50 eV (iii) Based on the band theory of conductors, insulators and semiconductors, the forbidden gap is smallest in (a) conductor (b) insulator (c) semiconductors (d) All of these. (IV)In semiconductors at a room temperature (a) the valance band is partially empty and the conduction band is partially filled. (b) the valance band is completely filled and the conduction band is partially filled. (c) the valance band is completely filled. (d) the conduction band is completely empty. OR If no external voltage is applied across p-n junction, then there would be (a) no electric field across the junction (b) an electric field pointing from n-type to p-type side across the junction (c) an electric field pointing from p-type to n-type side across the junction (d) a temporary electric field during formation of p-n junction that would subsequently disappear	

		
	SECTION E	
Q31	Using the concept of free electrons in a conductor, derive the expression for the resistivity of a wire in terms of number density and relaxation time. Hence obtain the relation between current density and the applied electric field E. Or (a) (i) Why do the 'free electrons', in a metal wire, 'flowing by themselves', not cause any Current flowing in the wire? (ii)Explain the term 'drift velocity' of electrons in a conductor. Derive the expression of drift velocity Hence obtain the expression for the current through a conductor in terms of 'drift velocity' (b) Use the above expression to show that the 'resistivity', of the material of a wire, is proportional to the Relaxation time	5
Q32	(a) Using Biot-Savart's law, derive an expression for the magnetic field at the centre of a circular coil of radius R, number of turns N, carrying current I. (b) Two small identical circular coils marked 1, 2 carry equal currents and are placed with their geometric axes perpendicular to each other as shown in the figure. Derive an expression for the resultant magnetic field at O.  Or (a)Two straight long parallel conductors carry currents I_1 and I_2 in the same direction. Deduce the expression for the force per unit	

	length between them. Depict the pattern of magnetic field lines around them. (b) A rectangular current carrying loop EFGH is kept in a uniform magnetic field as shown in the figure. (i) What is the direction of the magnetic moment of the current loop? (ii) When is the torque acting on the loop (A) maximum, (B) zero?  	
Q33	Draw a schematic labelled ray diagram of a reflecting type telescope. (ii) Writing two important advantages justifying why reflecting type telescopes are preferred over refracting telescopes. (iii) The objective of a telescope is of larger focal length and of larger aperture. Why? give reasons Or Draw a labelled ray diagram of a refracting telescope. Define its magnifying power and write the expression for it. Write two important limitations of a refracting telescope over a reflecting type telescope.	