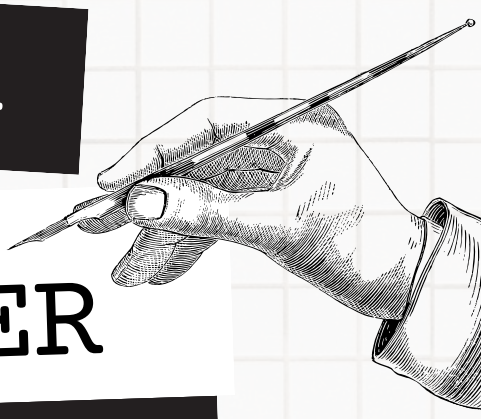
2024

Pre-Board



SAMPLE PAPER

CBSE BOARD / STATE BOARDS

NCERT Based Syllabus



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PRE-BOARD PRACTICE PAPER PHYSICS XII (042) 2023-24

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

General Instructions:

(1) There are 33 questions in all. All questions are compulsory.

(2) This question paper has **5 sections**: Section A, Section B, Section C, Section D Section E

(3) All the sections are compulsory.

(4) **Section A** contains 16 questions, **12 MCQ,** and **04 Assertion Reasoning based on 1** mark each,

(5) **Section B** contains 5 questions of two marks each,

(6) **Section C** contains 7 questions of three marks each,

(7) **Section D** contains 2 case study-based questions of four marks each and

(8) **Section E** contains 3 long answer questions of five marks each.

(9) 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.

(10) Use of calculators is not allowed.

(11) You may use the following values of physical constants where ever necessary

i. $c = 3 \times 10^8$ m/s

ii. $m_e = 9.1 \times 10^{-31}$ kg

iii. $h = 6.63 \times 10^{-34}$ Js

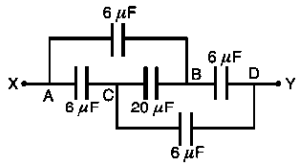
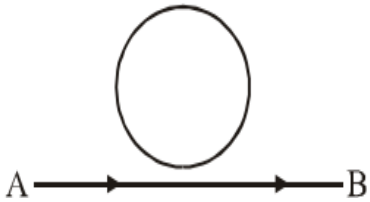
iv. $\epsilon_o = 8.854 \times 10^{-12}\ C^2N^{-1}m^{-2}$

V. Avogadro's number = 6.023×10^{23} per gram mole

Vi. $\mu_o = 4\pi \times 10^{-7}$ TmA^{-1}

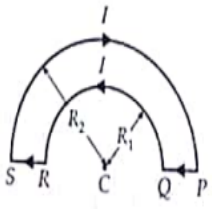
vii. $e = 1.6 \times 10^{-19}$ C

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S. N	SECTION A	MARKS
1	Some charge is being given to a conductor. Then, it's potential (a)is maximum at the surface. (b)is maximum at the centre. (c)remains the same throughout the conductor. (d)is maximum somewhere between the surface the and centre.	1
2	What is the effective capacitance between X and Y? (a)24 μC (b)18 μC (c)12 μC (d) 6 μC 	1
3	As the intensity of incident light increases: (a)photoelectric current increases. (b)photoelectric current decreases. (c)the kinetic energy of emitted photoelectrons increases. (d)the kinetic energy of emitted photoelectrons decreases.	1
4	The Bohr model of atoms (a)assumes that the angular momentum of electrons is quantized. (b)predicts continuous emission spectra for atoms. (c)predicts the same emission spectra for all types of atoms. (d)uses Einstein's photoelectric equation.	1
5	An electron moves along the line AB, which lies in the same plane as a circular loop of conducting wires as shown in diagram. What will be the direction of current induced if any, in the loop: 	1

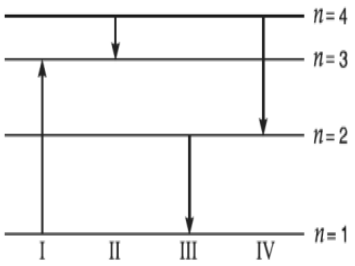
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	(a)No current will be induced (b)The current will be clockwise (c)The current will be anticlockwise (d)The current will change direct ion as the electron crosses the loop	
6	If number of turns, area and current through a coil are given by n, A and I respectively, then its magnetic moment is given by (a) nIA (b) n^2IA (c) nIA^2 (d) $\frac{nI}{\sqrt{A}}$	**1**
7	The wire loop PQRSP formed by joining two Semi-circular wires of radii R_1 and R_2, carries a current I as shown. The magnitude of the magnetic induction at the centre C is  (a)$\frac{\mu_O I}{2}$ ($\frac{1}{R_1}+\frac{1}{R_2}$) (b) $\frac{\mu_O I}{4}$ ($\frac{1}{R_1}+\frac{1}{R_2}$) (b) $\frac{\mu_O I}{2}$ ($\frac{1}{R_1}-\frac{1}{R_2}$) (d) $\frac{\mu_O I}{2}$ ($\frac{1}{R_1}-\frac{1}{R_2}$)	**1**
8	The phase difference between the alternating current and e.m.f. is π/2. Which of the following cannot be the constituent of the circuit? (a) C alone (b) L alone (c) L,C (d) R,L	**1**
9	Whenever a magnet is moved either towards or away from a conducting coil, an e.m.f. is induced, the magnitude of which is independent of (a)the strength of the magnetic field. (b)the speed with which, the magnet is moved. (c)the number of turns in the coil. (d)the resistance of the coil.	**1**
10	Which of the following is not the property of light? (a)It requires a material medium for propagation. (b)It can travel through vacuum. (c)It involves transportation of energy.	**1**

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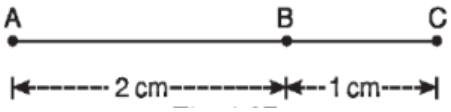
	(d)It has finite speed.	
11	The magnetic flux linked with a coil (in Wb) is given by the equation: $\Phi = 5\ t^2 + 5t + 16$. The induced e.m.f. in the coil in the fourth second will be (a) 10V (b) 108 V (c) 45 V (d) 210V	**1**
12	The diagram shows the energy levels for an electron in a certain atom. Which transition shown represents the emission of a photon with the most energy? (a) III (b) IV (c) I (d) II 	**1**
13	**Answer:(a) Both are correct and reason is correct explanation of assertion.** **Answer: (b) Both are correct but reason is not the correct explanation of assertion.** **Answer:(c) Reason is wrong.** **Answer:(d) Both are wrong.** Assertion: The kinetic energy of photoelectrons emitted from metal surface does not depend on the intensity of incident photon. Reason: The ejection of electrons from metallic surface is not possible with frequency of incident photons below the threshold frequency.	**1**
14	**Answer:(a) Both are correct and reason is correct explanation of assertion.** **Answer: (b) Both are correct but reason is not the correct explanation of assertion.** **Answer:(c) Reason is wrong.**	**1**

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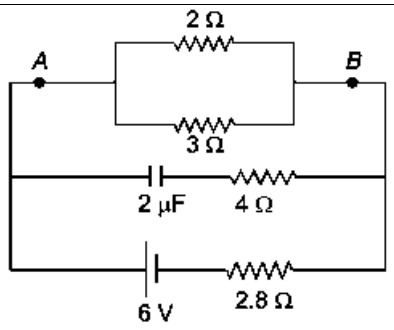
	Answer:(d) Both are wrong. Assertion: Bohr had to postulate that the electrons in stationary orbits around the nucleus do not radiate. Reason: According to classical physics all moving electrons radiate.	
15	**Answer:(a) Both are correct and reason is correct explanation of assertion.** **Answer: (b) Both are correct but reason is not the correct explanation of assertion.** **Answer:(c) Reason is wrong.** **Answer:(d) Both are wrong.** Assertion: A pure semiconductor has negative temperature coefficient of resistance. Reason: In a semiconductor on raising the temperature, more charge carriers are released, conductance increases and resistance decreases.	**1**
16	**Answer:(a) Both are correct and reason is correct explanation of assertion.** **Answer: (b) Both are correct but reason is not the correct explanation of assertion.** **Answer:(c) Reason is wrong.** **Answer:(d) Both are wrong.** Assertion: A lens, whose radii of curvature are different, is forming the image of an object placed on its axis. If the lens is reversed, the position of the image will not change. Reason: The focal length of a lens is given by $\frac{1}{f} = (\mu - 1)(\frac{1}{R_1} - \frac{1}{R_2})$, and so focal length in both the cases is same.	**1**
	SECTION B	
17	Distinguish between a metal and an insulator on the basis of energy band diagrams.	**2**
18	A proton and an electron have the same velocity. Which	**2**

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	one has a greater de Broglie wavelength and why?	
19	A ray of light passing from the air through an equilateral glass prism undergoes minimum deviation when the angle of incidence is $\frac{3}{4}$th of the angle of the prism. Calculate the speed of light in the prism.	**2**
20	When 5 V potential difference is applied across a wire of length 0.1 m, the drift speed of electrons is 2.5×10^{-4} m/s. If the electron density in the wire is 8×10^{28} m^{-3}, calculate the resistivity of the material of wire.	**2**
21	Why is that sun-glasses (goggles), which have curved surfaces, do not have any power? **OR** Can a convergent lens in one medium behave as a divergent lens in some other medium?	**2**
	SECTION C	
22	The radius of innermost orbit of a hydrogen atom is 5.3×10^{-11} m. What are the radii of n=2 and n=3 orbits?	**3**
23	Three equally charged objects are located as shown in Fig. The electric force exerted by the object A on B is 3:0 x 10^{-6} N. (a) What electric force C exert upon B? (b) What is the net electric force on B? 	**3**
24	How long an electric lamp of 100 W can be kept glowing by fusion of 2.0 kg of deuterium? The fusion reaction can be taken as: $_1H^2 + {}_1H^2 \longrightarrow {}_2He^3 + n + 3.2$ MeV	**3**

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25	Calculate the steady current through the 2 Ω resistor in the circuit shown below. 	**3**
26	Write any two important points of similarities and differences each between Coulomb's law for the electrostatic field and Biot-Savart's law for the magnetic field.	**3**
27	How are electromagnetic waves produced? What is the source of energy of these waves? Write mathematical expressions for electric and magnetic fields of an electromagnetic wave propagating along the z-axis. Write any two important properties of electromagnetic waves.	**3**
28	Define self-inductance of a coil. Show that magnetic energy required to build up the current I in a coil of self-inductance L is given by $\frac{1}{2}$ LI^2. **OR** Show that Lenz's law is in accordance with the law of conservation of energy.	**3**
	SECTION D	
29	Read the following paragraph and answer the questions that follow. **Band theory of solid:** Consider that the Si or Ge crystal contains N atoms. Electrons of each atom will have discrete energies in different orbits. The electron energy will be same if all the atoms are isolated, i.e., separated from each other by a large distance. However, in a crystal, the atoms are close to each other (2 Å to 3 Å) and therefore the electrons interact with each other and also with the neighbouring atomic cores. The overlap (or interaction) will be more felt	**4**

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by the electrons in the outermost orbit while the inner orbit or core electron energies may remain unaffected. Therefore, for understanding electron energies in Si or Ge crystal, we need to consider the changes in the energies of the electrons in the outermost orbit only. For Si, the outermost orbit is the third orbit (n = 3), while for Ge it is the fourth orbit (n = 4). The number of electrons in the outermost orbit is 4 (2s and 2p electrons). Hence, the total number of outer electrons in the crystal is 4N. The maximum possible number of outer electrons in the orbit is 8 (2s + 6p electrons). So, out of the 4N electrons, 2N electrons are in the 2N s-states (orbital quantum number l = 0) and 2N electrons are in the available 6N p-states. Obviously, some p-electron states are empty. This is the case of well separated or isolated atoms.

(i)The energy of electrons of atoms of a substance will be same if:

(a) atoms are isolated. (b) atoms are closely spaced.

(c) atoms are excited. (d) atoms are charged.

(ii) The overlap (or interaction) will be more felt by the electrons when they are:

(a) in the outermost orbit. (b) in the innermost orbit.

(c) free. (d) in any orbit.

(iii) For Silicon and Germanium, the outermost orbits are respectively:

(a) n = 3 and n = 5 (b) n = 4 and n = 3

(c) n = 5 and n = 4 (d) n = 3 and n = 4

(iv)In a crystal, the distance between two atoms is:

(a) 200 Å to 300 Å (b) 2 Å to 3 micron

(c) 2 Å to 3 Å (d) 2 mm to 3 mm

OR

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	The maximum possible electrons in an orbit is: (a) 8 (2s + 6p electrons) (b) 8 (6s + 2p electrons) (c) 8 (4s + 4p electrons) (d) 8 (1s + 7p electrons)	
30	Read the following paragraph and answer the questions that follow. **Lens Maker's Formula** The lens maker's formula relates the focal length of a lens to the refractive index of the lens material and the radii of curvature of its two surfaces. This formula is called so because it is used by manufacturers to design lenses of the required focal length from a glassa of given refractive index. If the object is placed at infinity, the image will be formed at a focus for both double convex lens and double concave lens. Therefore, Len's maker's formula is $\frac{1}{f} = (\frac{\mu_2}{\mu_1} - 1)(\frac{1}{R_1} - \frac{1}{R_2})$, When lens is placed in air, μ_1, = 1 and μ_2, = μ_w. The lens maker formula takes the form, $\frac{1}{f} = (\mu - 1)(\frac{1}{R_1} - \frac{1}{R_2})$ (i) The radius of curvature of each face of biconcave lens with refractive index 1.5 is 30 cm. The focal length of the lens in air is (a) 12cm (b) 10cm (c) 20cm (d) 30cm (ii) The radii of curvature of the faces of a double convex lens are 10 cm and 15 cm. If focal length is 12 cm, then refractive index of glass is (a) 1.5 (b) 1.78 (c) 2.0 (d) 2.52 (iii) An under-water swimmer cannot see very clearly even in absolutely clear water because of (a) absorption of light in water	**4**

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	(b) scattering of light in water (c) reduction of speed of light in water (d) change in the focal length of eye-lens (iv) A thin lens of glass (μ = 1.5) of focal length 10 cm is immersed in water (μ = 1.33). The new focal length is (a) 20cm (b) 40cm (c) 48cm (d) 12cm **OR** An object is immersed in a fluid. In order that the object becomes invisible, it should (a) behave as a perfect reflector (b) absorb all light falling on it (c) have refractive index one (d) have refractive index exactly matching with that of the surrounding fluid.	
	SECTION E	
31	(a) Two thin lenses are placed coaxially in contact. Obtain the expression for the focal length of this combination in terms of the focal lengths of the two lenses. (b) A converging lens of refractive index 1.5 has a power of 10 D. When it is completely immersed in a liquid, it behaves as a diverging lens of focal length 50 cm. Find the refractive index of the liquid. 3+2 **OR** (a) Draw the ray diagram showing refraction of light through a glass prism and hence obtain the relation between the refractive index m of the prism, angle of prism and angle of minimum deviation. (b) Determine the value of the angle of incidence for a ray of light travelling from a medium of refractive index μ_1 = $\sqrt{2}$into the medium of refractive index μ_2 = 1, so that it just grazes along the surface of separation. 3+2	**5**

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32	(i) Define torque acting on a dipole of dipole moment p placed in a uniform electric field E . Express it in the vector form and point out the direction along which it acts. (ii) What happens if the field is non-uniform? (iii) What would happen if the external field E is increasing (a) parallel to $\vec{p}$ and (b) antiparallel to $\vec{p}$? 2+1+2 **OR** (i)A thin conducting spherical shell of radius R has charge Q spread uniformly over its surface. Using Gauss's theorem, derive an expression for the electric field at a point outside the shell. (ii)Draw a graph of electric field E(r) with distance r from the center of the shell for $0 \leq r \leq \infty$. 3+2	**5**
33	(a) What is impedance? (b) A series LCR circuit is connected to an ac source having voltage $V = V_o \sin \omega t$. Derive expression for the impedance, instantaneous current and its phase relationship to the applied voltage. (c)Find the expression for resonant frequency. 1+2+2 **OR** (a) An ac source of voltage $V = V_o \sin \omega t$ is connected to a series combination of L, C and R. Use the phasor diagram to obtain expressions for impedance of the circuit and phase angle between voltage and current. Find the condition when current will be in phase with the voltage. What is the circuit in this condition called? (b) In a series LR circuit $X_L = R$ and power factor of the circuit is P_1. When capacitor with capacitance C such that $X_L = X_C$ is put in series, the power factor becomes P_2. Calculate $\frac{P_1}{P_2}$. 2+3	**5**

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