DELHI PUBLIC SCHOOL JAMMU

SESSION - 2024 - 2025

PRACTICE TEST

CLASS - XII **Sub: Physics**

Time Allowed : 3 Hrs **M. Marks: 70**

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.

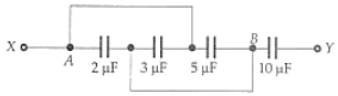
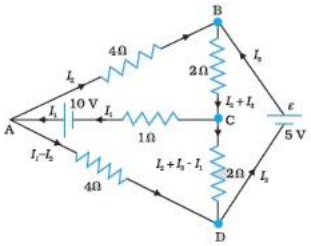
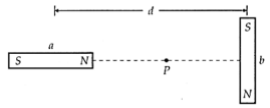
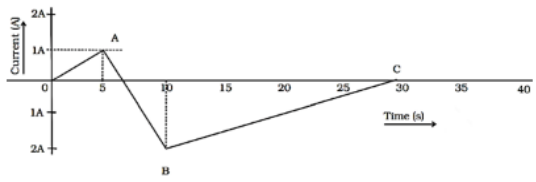
	Section A	
1	Match Column I with Column II with appropriate matching. **Column I** / **Column II** a. $\vec{E}$ / i.electric field lines b. $\vec{p}$ / ii. $\frac{q}{4\pi\varepsilon_0 r^3}\vec{r}$ c.Two lines of force do not intersect each other / iii.dipole field d.Field produced by a dipole / iv. q $\times$ 2a $\hat{p}$ a) (a) - (iv), (b) - (i), (c) - (ii), (d) - (iii) b) (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii) c) (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii) d) (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)	**[1]**

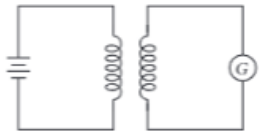
2	If there were only one type of charge in the universe, then: a) $\oint EdS = 0$ if the charge is outside the surface. b) $\oint E.dS = \frac{q}{\varepsilon_0}$ if charges of magnitude q is inside the surface. c) $\oint E.dS \neq 0$ on any surface. d) Both$\oint E.dS = 0$ if the charge is outside the surfaceand $\oint E.dS = \frac{q}{\varepsilon_0}$ if charges of magnitude q is inside the surface	**[1]**
3	Electric potential V at any point x, y, z in space is given by $V = 6z^2$. The value of the electric field at the point (2, - 1, 3) is a) - 36 b) 24 c) - 12 d) 12	**[1]**
4	n identical capacitors joined in parallel are changed to a common potential V. The battery is disconnected. Now, the capacitors are separated and joined in series. For the new combination: a) energy and potential difference both will remain unchanged b) energy will become n times, potential difference will remain V. c) energy will remain same, potential difference will become nV d) energy and potential both will become n times	**[1]**
5	What length of the wire (specific resistance $48\times 10^{-8}\ \Omega$ m) is needed to make the resistance of 4.2 Ω ? (Diameter = 0.4 mm) a) 1.1 m b) 2.1 m c) 3.1 m d) 4.1 m	**[1]**
6	Cu and Alwire each of length l = 20 cm and area of cross - section A = 50 cm^2 . Their resistivity $\rho_{Cu} = 1.69 \times 10^{-8}\ \Omega$ m and $\rho_{Al} = 2.75 \times 10^{-8}\ \Omega$ m. If they are joined end to end, then the total resistance of the combination is: a) 1×10^{-2}	**[1]**

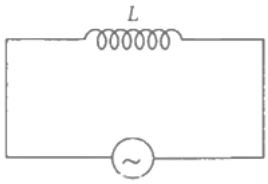
	b) 4.44 c) 0.888 d) 0.01×10^{-2}	
7	When a charged particle enters in a uniform magnetic field, its kinetic energy. a) decreases b) becomes zero c) remains constant d) increases	**[1]**
8	A beam of electrons at rest is accelerated by a potential V. This beam experiences a force F in a uniform magnetic field. The accelerating potential is changed to V' and the force experienced by the electrons in the same magnetic field is 2F. The ratio $\frac{V}{V'}$ is a) 2 b) 1 c) $\frac{1}{2}$ d) $\frac{1}{4}$	**[1]**
9	The magnetic moment has dimensions of a) [L^2 A] b) [L^2 T^{-1} A] c) [LT^{-1} A] d) [LA]	**[1]**
10	A paramagnetic sample shows a net magnetisation of 8 Am^{-1} when placed in an external magnetic field of 0.6T at a temperature of 4K. When the same sample is placed in an external magnetic field of 0.2 T at a temperature of 16K, the magnetisation will be a) 6 Am^{-1} b) $\frac{2}{3}Am^{-1}$ c) 2.4 Am^{-1}	**[1]**

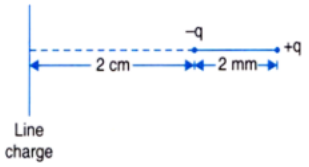
	d) $\frac{32}{3}\text{Am}^{-1}$	
11	The induction coil works on the principle of a) Fleming's right - hand rule b) self - induction c) mutual induction d) Ampere's rule	**[1]**
12	An inductor with L = 9.50 mH is connected across an ac source that has voltage amplitude 45.0 V. Frequency of the source that results in a current amplitude of 3.90 A is a) 180 Hz b) 129 Hz c) 193 Hz d) 150 Hz	**[1]**
13	**Assertion (A):** Magnetic field interacts with a moving charge and not with a stationary charge. **Reason (R):** A moving charge produces a magnetic field. 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.	**[1]**
14	**Assertion (A):** Iron behaves as magnet. **Reason (R):** In magnet, the molecular magnets are aligned in same direction. 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.	**[1]**

15	**Assertion (A):** When two identical loops of copper and Aluminium are rotated with the same speed in the same magnetic field, the induced e.m.f. will be the same. **Reason (R):** Resistance of the two loops are equal. 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.	**[1]**
16	**Assertion (A):** Quality factor of a series LCR circuit is Q = $\frac{1}{R}\sqrt{\frac{L}{C}}$ **Reason (R):** As bandwidth decreases, Q increases in a resonant LCR circuit. 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.	**[1]**
	Section B	
17	How does the speed of an electrically charged particle affect its mass and charge?	**[2]**
18	What is electrostatic potential energy? Where does it reside?	**[2]**
19	Obtain a relation between the current flowing in a conductor and drift velocity of electrons in it. Hence, obtain Ohm's law.	**[2]**
20	The magnetic moment of a circular coil carrying current I, having Nturns, each of radius r, is M. Find the magnetic moment of the same coil if it is unwound and rewound into a coil having 2Nturns for the same current.	**[2]**
21	A short bar magnet placed in a horizontal plane has its axis aligned along the magnetic north - south direction. Null points are found on the axis of the magnet at 14 cm from the centre of the magnet. The earth's magnetic field at the place is 0.36 G and the angle of dip is zero. What is the total magnetic field on the normal bisector of the magnet at the same distance as the null–point (i.e., 14 cm) from the centre of the magnet? (At null points, field due to a magnet is equal and opposite to the horizontal component of earth's magnetic field.)	**[2]**
	Section C	

22	Two insulated charged copper spheres A and B have their centres separated by a distance of 50 cm. What is the mutual force ofelectrostatic repulsion if the charge on each is 6.5×10^{-7} C? Suppose the spheres A and B have identical sizes. A third sphere of the same size but uncharged is brought in contact with the first, then brought in contact with the second, and finally removed from both. What is the new force of repulsion between A and B?	**[3]**
23	Four capacitors are connected as shown in the Figure. Calculate the equivalent capacitance between the points X and Y. 	**[3]**
24	Determine the current in each branch of the network shown in Fig. 	**[3]**
25	1. Why is the need for magnetic field radial in a moving coil galvanometer? Explain how it is achieved? 2. A galvanometer of resistance 'G' can be converted into a voltmeter of range (0 - V) volts by connecting a resistance 'R' in series with it. How much resistance will be required to change its range from 0 to $\frac{V}{2}$?	**[3]**
26	Two identical short magnets a and b of magnetic moments m each are placed at a distance d with their axes perpendicular to each other, as shown in figure. Find the magnetic field at a point P midway between the two dipoles. 	**[3]**
27	A (current vs time) graph of the current passing through a solenoid is shown in Figure. For which time is the back electromotive force (u) a maximum. If the back emf at t = 3s is e, find the back emf at t = 7 s, 15s, and 40s. OA, AB, and BC are straight line segments. 	**[3]**

28	Derive an expression for the average power consumed in a series LCR circuit connected to a.c. source in which phase difference between the voltage and the current in the circuit isϕ .	**[3]**
	Section D	
29	**Read the text carefully and answer the questions:** Mutual inductance is the phenomenon of inducing emf in a coil, due to a change of current in the neighbouring coil. The amount of mutual inductance that links one coil to another depends very much on the relative positioning of the two coils, their geometry and relative separation between them. Mutual inductance between the two coils increasesμ_r times if the coils are wound over an iron core of relative permeability μ_r .  1. A short solenoid of radius a, number of turns per unit length n_1 , and length Lis kept coaxially inside a very long solenoid of radius b, number of turns per unit length n_2 . What is the mutual inductance of the system? a) $\mu_0\pi\, b^2\, n_1\, n_2\, L^2$ b) $\mu_0\pi\, a^2\, n_1\, n_2\, L$ c) $\mu_0\pi\, a^2\, n_1\, n_2\, L^2$ d) $\mu_0\pi\, b^2\, n_1\, n_2\, L$ 2. Mutual inductance of two coils can be increased by a) decreasing the number of turns in the coils b) winding the coils on wooden cores c) winding the coils on iron cores d) increasing the number of turns in the coils 3. When a sheet of iron is placed in between the two co - axial coils, then the mutual inductance between the coils will a) remains same b) decrease c) cannot be predicted	**[4]**

	d) increase 4. The SI unit of mutual inductance is a) ohm b) hmo c) henry d) mho	
30	**Read the text carefully and answer the questions:** Let a source of alternating e.m.f. $E = E_0 \sin \omega t$ be connected to a circuit containing a pure inductance L. If I is the value of instantaneous current in the circuit, then $I = I_0 \sin\left(\omega t - \frac{\pi}{2}\right)$. The inductive reactance limits the current in a purely inductive circuit and is given by $X_L = \omega L$.  1. A 100 hertz a.c. is flowing in a 14 mH coil. The reactance is a) 7.5Ω b) 15Ω c) 10Ω d) 8.8Ω 2. In a pure inductive circuit, resistance to the flow of current is offered by a) resistor and inductor b) capacitor c) inductor d) resistor 3. In an inductive circuit, by what value of phase angle does alternating current lags behind e.m.f.? a) 90^o b) 75^o	**[4]**

	c) 45^o d) 120^o 4. How much inductance should be connected to 200 V, 50 Hz a.c. supply so that a maximum current of 0.9 A flows through it? a) 5 H b) 10 H c) 1 H d) 4.5 H	
31	1. State Gauss's law in electrostatics. Use this law to derive an expression for the electric field due to an infinitely long straight wire of linear charge density$\lambda\ Cm^{-1}$. 2. An electric dipole consists of charges of$2.0 \times 10^{-8}C$ separated by a distance of 2 mm. It is placed near a long line charge of density $4.0 \times 10^{-4}Cm^{-1}$ as shown in the figure below, such that the negative charge is at a distance of 2 cm from the line charge. Calculate the force acting on dipole. 	**[5]**
32	Show that the potential energy of a dipole making angleθ with the direction of the field is given by $U(\theta) = -\vec{P} \cdot \vec{E}$. Hence find out the amount of work done in rotating it from the position of unstable equilibrium to the stable equilibrium.	**[5]**
33	1. State the two Kirchhoff's rules used in the analysis of electric circuits and explain them. 2. Derive the equation of the balanced state in a Wheatstone bridge using Kirchhoff's laws.	**[5]**