Indian School Al Wadi Al Kabir

Unit Test (2026-2027)

Sub: Physics (042)

Class: XII Max. Marks: 30

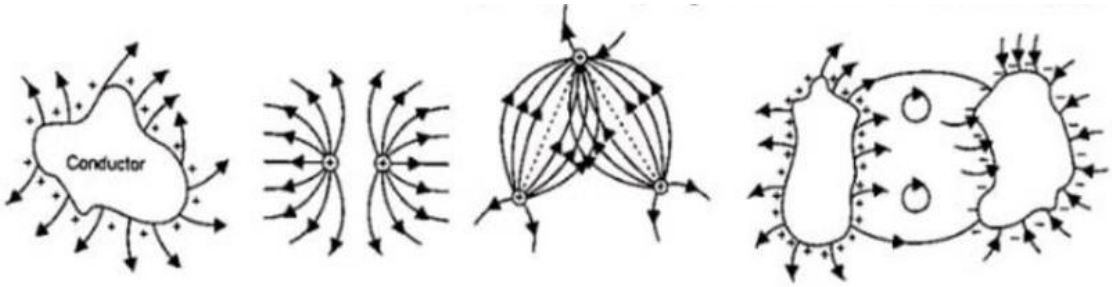
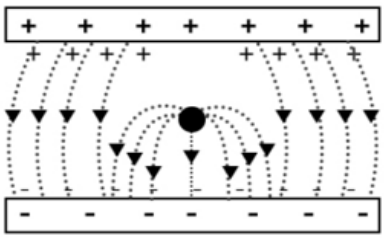
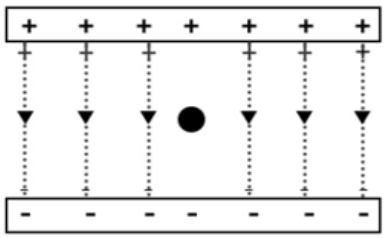
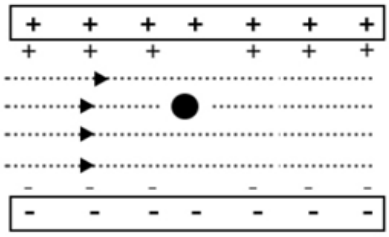
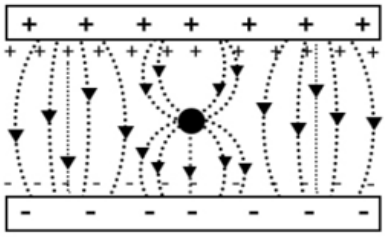
Date: 21/05/2026 Set II Time: 1 Hour

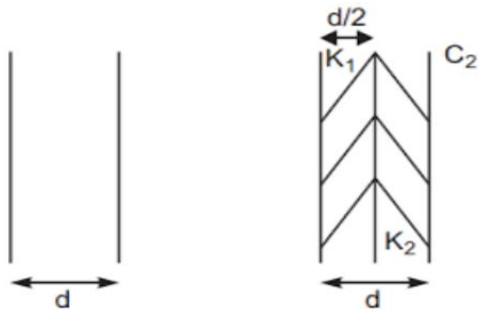
General Instructions

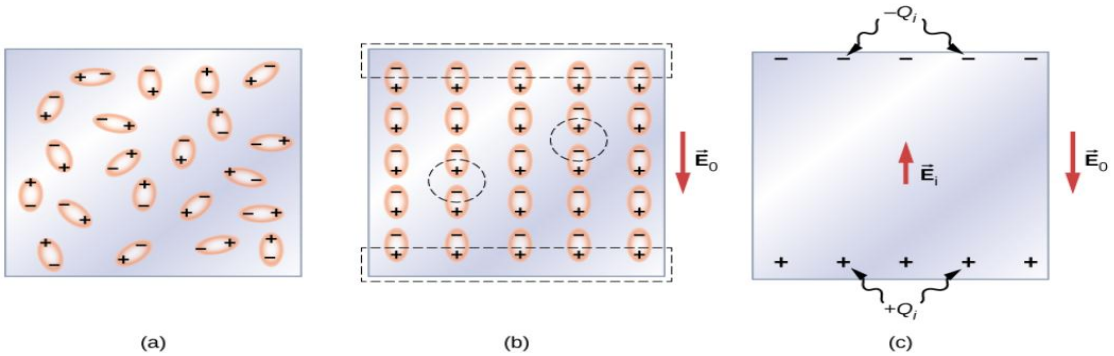
- There are 15 questions in all. All questions are compulsory.
- This question paper has five sections: Section A, B, C, D & E.
- **Section A** contains eight questions, six MCQ's and two Assertion Reasoning of 1 mark each.
- **Section B** contains two questions of two marks each, **Section C** contains three questions of three marks each, **Section D** contains one case study-based question of 4 marks, and **Section E** contains one long answer question of five marks.
- There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks, one question for case study and for long answer question. You have to attempt only one of the choices in such questions.
- You may use log tables if necessary, but the use of a calculator is not allowed.
- You may use the following values of physical constants wherever necessary:

$c = 3 \times 10^{8}\ ms^{-1}$, $h = 6.626 \times 10^{-34} Js$, $e = 1.602 \times 10^{-19}\ C$,
$\epsilon_o = 8.854 \times 10^{-12}\ C^2N^{-1}m^{-2}$, $k = 9 \times 10^{9}\ C^{-2}Nm^2$.
$m_e = 9.1 \times 10^{-31} kg$,
$m_n = 1.675 \times 10^{-27} kg$, $m_p = 1.673 \times 10^{-27}\ kg$,
Avogadro's number $N_A = 6.023 \times 10^{23}$ per gram mole,
Boltzmann Constant $= 1.38 \times 10^{-23}$ J/K

Q. No.	Questions	Marks
	SECTION A	
1	An isolated point charge particle produces an electric field E at a point 3m away from it. The distance of the point at which the electric field is E/4 is (A) 2 m (B) 3m (C) 4m (D) 6m	1
2	The electrostatic potential on the surface of a charged conducting sphere is 100V. Two statements are made in this regard: S_1: At any point inside the sphere, electric intensity is zero. S_2: At any point inside the sphere, the electrostatic potential is 100V. Which of the following is a correct statement? (A) S_1 is true, but S_2 is false. (B) Both S_1 & S_2 are false. (C) S_1 is true, S_2 is also true, and S_1 is the cause of S_2. (D) S_1 is true, S_2 is also true, but the statements are independent.	1

3	Which among the curves shown in the figure can possibly represent electrostatic field lines?  (A) (B) (C) (D)	1
4	A point P lies at a distance X from the midpoint of an electric dipole on its axis. The electric potential at point P is proportional to (A) $\frac{1}{X^2}$ (B) $\frac{1}{X^3}$ (C) $\frac{1}{X^4}$ (D) X	1
5	Which of the diagrams correctly represents the electric field between two charged plates if a neutral conductor is placed in between the plates? [A]  [B]  [C]  [D] 	1
6	The electric potential V at any point (x, y, z) is given by $V = 3x^2$ where x is in metres and V in volts. The electric field at the point (1 m, 0, 2 m) is - (A) 6 V/m along -x-axis. (B) 6 V/m along +x-axis (C) 1.5 V/m along –x-axis (D) 1.5 V/m along +x-axis	1
	For Questions 7 & 8, two statements are given –one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the options given below. **a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.** **b) If both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.**	

	c) If Assertion is true but Reason is false. **d) If both Assertion and Reason are false.**	
7	**Assertion(A):** On bringing a positively charged rod near the uncharged conductor, the conductor gets attracted towards the rod. **Reason(R):** The electric field lines of the charged conductor are perpendicular to the surface of the conductor.	1
8	**Assertion(A):** Work done in moving a charge between any two points in an electric field is independent of the path followed by the charge between these points. **Reason(R):** Electrostatic force is a non-conservative force.	1
	SECTION-B	
9	(i) Derive the dimensional formula and SI unit of the electrostatic force constant k? **OR** (ii) Represent graphically the variation of the electric field with distance, for a (i) uniformly charged plane sheet, (ii) spherical conductor, (iii) long straight conductor.	2
10	A 2μF capacitor is charged to 200 volts, and then the battery is disconnected. When it is connected in parallel to another uncharged capacitor, the potential difference between the plates of both is 40 volts. Find the capacitance of the other capacitor.	2
	SECTION- C	
11	(i) Two-point charges 4Q, Q are separated by 1 m in air. At what point on the line joining the charges is the electric field intensity zero? Also, calculate the electrostatic potential energy of the system of charges, taking the value of charge, $Q = 2 \times 10^{-7}$C. **OR** (ii) You are given a parallel plate capacitor C1. The space between them is now filled with dielectric slabs of dielectric constant K1 and K2, as shown in C2. Find the capacitance of the capacitor C2, if the plate area is A and the distance between the plates is d. 	3
12	State Gauss's law. Using Gauss's law, obtain an expression for the electric field due to a uniformly charged, infinitely long straight conductor.	3
13	(a)What are electric field lines? (b) A metallic spherical shell has an inner radius R_1 and outer radius R_2. A charge Q is placed at the centre of the spherical cavity. What will be the surface charge density on (i) the inner surface (ii) the outer surface?	3

	SECTION D	
14	Read the passage given below and answer the questions When an insulator is placed in an external field, the dipoles become aligned. Induced surface charges on the insulator establish a polarisation field $\bar{E}_i$ in its interior. The net field $\bar{E}$ in the insulator is the vector sum of $\bar{E}$ and $\bar{E}_i$ as shown in the figure.  On the application of an external electric field, the effect of aligning the electric dipoles in the insulator is called polarisation, and the field $\bar{E}$ is known as the polarisation field. The dipole moment per unit volume of the dielectric is known as polarisation (***P***). For linear isotropic dielectrics, $\boldsymbol{P = \chi E}$, where χ = the electrical susceptibility of the dielectric medium.	
(i)	Which among the following is an example of a polar molecule? (a) O_2 (b) H (c) N_2 (d) HCI	1
(ii)	When air is replaced by a dielectric medium of constant K, the maximum force of attraction between two charges separated by a distance: (a) increases K times (b) remains unchanged (c) decreases K times (d) increases 2K times.	1
(iii)	Which of the following is a dielectric? (a) Copper (b) Glass (c) Antimony (Sb) (d) Arsenic	1
(iv)	For a polar molecule, which of the following statements is true? (a) The centre of gravity of electrons and protons coincides. (b) The centre of gravity of electrons and protons does not coincide. (c) The charge distribution is always symmetrical. (d) The dipole moment is always zero.	1
	OR	
(iv)	A comb rubbed with dry hair attracts pieces of paper. This is because the (a) the comb polarises the piece of paper.	

	(b) the comb induces a net dipole moment opposite to the direction of the field. (c) the electric field due to the comb is uniform. (d) the comb induces a net dipole moment perpendicular to the direction of the field.	
	SECTION E	
15	(i) Derive an expression for the electric potential at any arbitrary point outside the electric dipole, and thereby deduce the formula for the electric potential (a) On the axial line (b) on the equatorial line of the electric dipole **OR** (ii) (a) Derive an expression for the capacitance of a parallel plate capacitor with a dielectric slab filling the space. (b) What will happen to the following when a dielectric slab is introduced between the plates of the capacitor: (a) Capacitance, (b) Charge, (c) potential? Given i) the battery remains connected with the capacitor, ii) the battery is disconnected.	5

All the best