CLASS XII – PHYSICS (042)
PRACTICE PAPER – CHAPTER 2: ELECTROSTATIC POTENTIAL AND CAPACITANCE

Academic Session 2026–27

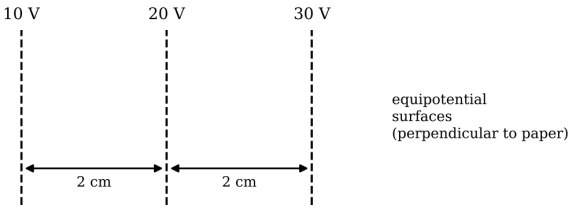
Maximum Marks : 35 **Time Allowed : 1 hour 15 minutes**

General Instructions

(1) There are 18 questions in all. All questions are compulsory.
(2) The question paper has five sections: Section A, B, C, D and E.
(3) Section A (Q.1–9) has seven MCQs and two Assertion–Reasoning questions of 1 mark each. Section B (Q.10–13) has four questions of 2 marks each. Section C (Q.14–16) has three questions of 3 marks each. Section D (Q.17) is one case study based question of 4 marks. Section E (Q.18) is one long answer question of 5 marks.
(4) There is no overall choice. An internal choice is provided in Q.12 (Section B), Q.15 (Section C), Q.17 part (iv) (Section D) and Q.18 (Section E). Attempt only one of the choices in such questions.
(5) Use of calculators is not allowed.
(6) You may use the following values of physical constants wherever necessary: $e = 1.6 \times 10^{-19}$ C, $m_e = 9.1 \times 10^{-31}$ kg, $\varepsilon_0 = 8.85 \times 10^{-12}$ C^2 N^{-1} m^{-2}, $1/(4\pi\varepsilon_0) = 9 \times 10^9$ N m^2 C^{-2}

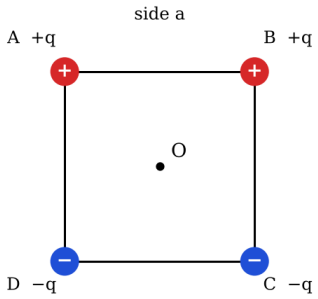
SECTION A (9 × 1 = 9)

1. The figure shows three equipotential surfaces (seen edge-on) with their potentials, 2 cm apart. The electric field in this region is **1**



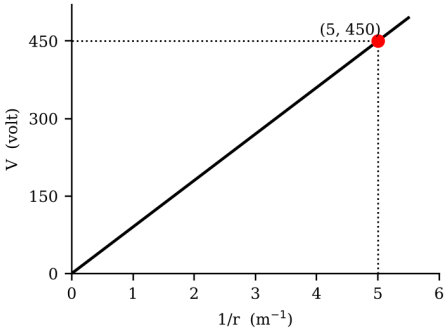
(a) 500 V m^{-1}, along +x
(b) 500 V m^{-1}, along −x
(c) 1000 V m^{-1}, along −x
(d) 50 V m^{-1}, along +x

2. Charges +q, +q, −q and −q are fixed at the corners A, B, C and D of a square of side a, as shown. At the centre O of the square, **1**



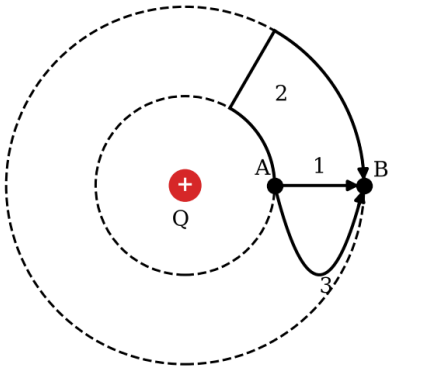
(a) V = 0 and E = 0
(b) V = 0 and E ≠ 0
(c) V ≠ 0 and E = 0
(d) V ≠ 0 and E ≠ 0

3. The graph shows the potential V at a distance r from a small isolated charged sphere (in vacuum), plotted against 1/r. The charge on the sphere is **1**



(a) 1 nC
(b) 5 nC
(c) 10 nC
(d) 90 nC

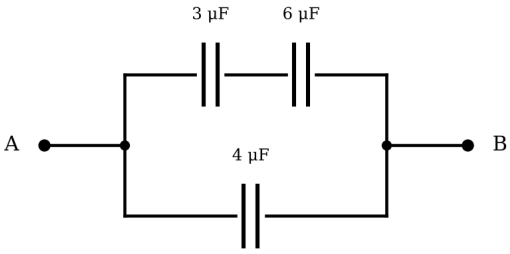
4. A small positive charge is taken from A (on the inner dashed sphere) to B (on the outer one) in the field of a fixed charge Q along the three paths 1, 2 and 3 shown. If W_1, W_2 and W_3 are the work done by the external agent, then **1**



dashed circles: equipotential surfaces

(a) $W_1 < W_2 < W_3$
(b) $W_1 > W_2 > W_3$
(c) $W_1 = W_2 = W_3$
(d) $W_2 = 0$

5. The equivalent capacitance of the network between the terminals A and B is **1**



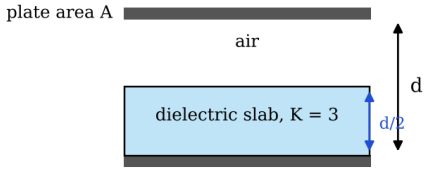
(a) 13 μF
(b) 6 μF
(c) 2 μF
(d) 7/3 μF

6. The table gives the charge and the potential difference of four capacitors. The capacitor that stores the maximum electrostatic energy is **1**

Capacitor	P	Q	R	S
Charge (μC)	12	20	18	40
Potential difference (V)	4	10	3	20

(a) P
(b) Q
(c) R
(d) S

7. An air-filled parallel plate capacitor has capacitance C_0. A dielectric slab of K = 3 and thickness d/2 is placed in contact with one plate, as shown. The new capacitance is **1**



(a) $3C_0$
(b) $2C_0$
(c) $4C_0/3$
(d) $3C_0/2$

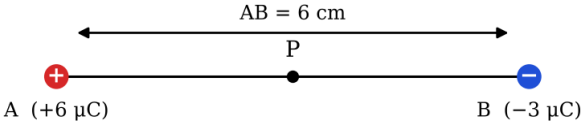
For Questions 8 and 9, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct answer from the options below.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

8. **Assertion (A):** The electrostatic field just outside the surface of a charged conductor is always perpendicular to the surface. **1**
Reason (R): If the field had a tangential component, free charges on the surface would move, and the conductor would not be in electrostatic equilibrium.

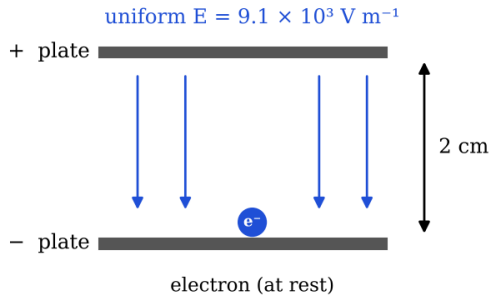
9. **Assertion (A):** The electric potential at the centre of an electric dipole is zero. **1**
Reason (R): The electric potential is zero at every point on the axis of a dipole.

SECTION B (4 × 2 = 8)

10. Two point charges +6 μC and −3 μC are placed 6 cm apart, as shown. P is the midpoint of AB. Find the electric potential at P and the work done by an external agent in bringing a 2 nC charge from infinity to P. **2**



11. An electron is released from rest at the negative plate of a parallel plate arrangement, as shown. Find the kinetic energy (in eV and in joule) with which it reaches the other plate, and its speed there. **2**

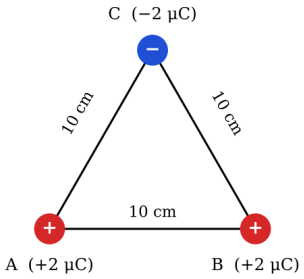


12. **(A)** A 12 μF capacitor is charged to 50 V, disconnected from the battery and then connected across an uncharged 4 μF capacitor. Find the common potential difference and the energy lost in the process. **2**

OR

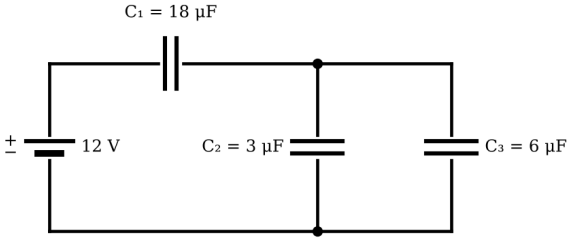
(B) An electric dipole of dipole moment 4×10^{-9} C m is placed at the origin. Find the potential at a point 20 cm away on a line making 60° with the dipole moment. What is the potential at a point on its equatorial plane? Give a reason.

13. Three point charges are placed at the vertices of an equilateral triangle of side 10 cm, as shown. Calculate the electrostatic potential energy of the system. What does the sign of your answer signify? **2**



SECTION C (3 × 3 = 9)

14. A network of three capacitors is connected across a 12 V battery as shown. Find (a) the equivalent capacitance, (b) the charge on each capacitor, and (c) the total energy stored in the network. **3**

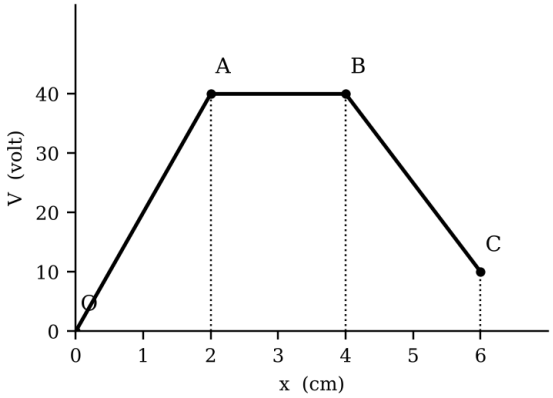


15. **(A)** Derive an expression for the electric potential at a point due to an electric dipole, at a distance r much greater than its size. Hence write the potentials at points on its axis and on its equatorial plane. **3**

OR

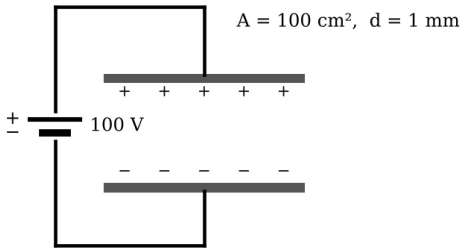
(B) Derive an expression for the energy stored in a charged capacitor. Hence show that the energy density of the electric field between its plates is $\frac{1}{2}\varepsilon_0 E^2$.

16. The potential V in a region varies with the distance x along the x-axis as shown in the graph. (a) Find the magnitude and direction of the electric field in the regions OA, AB and BC. (b) Find the work done by the electric field in moving a charge of +2 μC from O to C. **3**

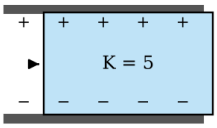


SECTION D (1 × 4 = 4)

17. **Case Study.** A parallel plate capacitor with air between its plates has plate area A = 100 cm^2 and plate separation d = 1 mm. It is charged by a 100 V battery as in (a). The battery is then disconnected and a dielectric slab of dielectric constant K = 5, which fills the entire gap, is slid in as in (b). Take $\varepsilon_0 = 8.85 \times 10^{-12}$ F m^{-1}. Answer the following: **4**



(a) charged by a 100 V battery



(b) battery removed, then slab inserted

(i) The charge on the plates in (a) is

(a) 0.885 nC (b) 8.85 nC (c) 88.5 nC (d) 885 nC

(ii) The potential difference between the plates after the slab is inserted is

(a) 500 V (b) 100 V (c) 20 V (d) 5 V

(iii) The capacitance after the slab is inserted is

(a) 17.7 pF (b) 88.5 pF (c) 177 pF (d) 442.5 pF

(iv) The energy stored in the capacitor after the slab is inserted, compared with the energy before, is

(a) 5 times (b) the same (c) 1/5 times (d) 25 times

OR

(iv) If the slab were inserted while the battery remained connected, the charge on the plates would become

(a) 8.85 nC (b) 17.7 nC (c) 44.25 nC (d) 1.77 nC

SECTION E (1 × 5 = 5)

18. **(A)** Using the field of two large oppositely charged plane sheets, derive an expression for the capacitance of a parallel plate capacitor of plate area A and separation d with air between the plates. How does the capacitance change when a dielectric of constant K fills the space between the plates? (3) **5**

A capacitor has plates of area 100 cm^2 separated by 2 mm. It is connected to a 300 V battery and a mica sheet of K = 6 is then inserted to fill the gap, the battery remaining connected. Find the capacitance, the charge on the plates and the energy stored after the mica is inserted. (2)

OR

(B) Using Gauss's law and a pillbox, show that the electric field just outside the surface of a charged conductor is σ/ε_0, normal to the surface. Also state any two properties of a conductor in electrostatic equilibrium. (3)

A conducting sphere of radius 10 cm carries a charge of 1.0 µC. Find the electric field just outside its surface and the potential at its centre. (2)

— End of Question Paper —