KIRUBHA ACADEMICS

CLASS XII	PHYSICS	Worksheet 1
Name: _____	Date: _____	Section: _____

Chapters: 1. Electric Charges and Fields | 2. Electrostatic Potential and Capacitance

General Instructions: Attempt all questions.

Use $g = 9.8\ m/s^2$, $\varepsilon_0 = 8.85 \times 10^{-12}\ C^2N^{-1}m^{-2}$, and $1/4\pi\varepsilon_0 = 9 \times 10^9\ Nm^2C^{-2}$ wherever required.

Section A — Multiple Choice Questions

1 mark each

1. Two point charges +q and -q are separated by distance 2a. The electric field at a point on the equatorial line at distance r from the centre is proportional to:

   (a) $1/r^2$ (b) $1/r^3$ (c) r (d) r^2 *[1]*

2. SI unit of electric dipole moment is:

   (a) C/m (b) C·m (c) N/C (d) C^2/N *[1]*

3. The electric field lines due to a point charge are:

   (a) circular (b) parallel straight lines (c) radially outward/inward straight lines (d) elliptical *[1]*

4. Electrostatic potential energy of two charges depends on:

   (a) only the magnitude of charges (b) only the distance between them (c) both the magnitudes of charges and distance between them (d) neither *[1]*

5. If a dielectric slab is inserted between the plates of a charged isolated parallel plate capacitor, its capacitance:

   (a) decreases (b) increases (c) remains the same (d) becomes zero *[1]*

Section B — Assertion–Reason Questions

1 mark each

For questions below, choose the correct option:

(A) Both Assertion (A) and Reason (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.

6. Assertion (A): Electric field inside a uniformly charged conducting sphere is zero.Reason (R): Charge resides only on the outer surface of a conductor in electrostatic equilibrium. *[1]*

7. Assertion (A): The work done in moving a charge between two points on an equipotential surface is zero.Reason (R): The electric field is always perpendicular to an equipotential surface. *[1]*

Section C — Very Short Answer Questions

2 marks each

8. State Gauss's law in electrostatics and write its mathematical expression. *[2]*

9. Why does the electric field inside a conductor become zero under electrostatic conditions? *[2]*

10. Define electric flux. Write its SI unit. *[2]*

11. Two capacitors of capacitance 4 μF and 6 μF are connected in series, and then in parallel. Find the equivalent capacitance in both cases. *[2]*

12. Why is the potential inside a charged conductor the same as on its surface? *[2]*

Section D — Short Answer Questions

3 marks each

13. Derive an expression for the electric field due to an electric dipole at a point on its axial line. *[3]*

14. A parallel plate capacitor with air between the plates has a capacitance of 8 pF. Find the new capacitance if the distance between the plates is reduced by half and the space is filled with a dielectric of dielectric constant 6. *[3]*

15. Derive the expression for capacitance of a parallel plate capacitor with air as the dielectric between the plates. *[3]*

16. Using Gauss's law, derive the expression for the electric field due to an infinitely long straight charged wire. *[3]*

Section E — Long Answer / Numerical Questions

5 marks each

17. (a) Derive an expression for the potential energy of a system of two point charges in the absence of an external electric field.

    (b) Two point charges of +5 μC and -3 μC are placed 20 cm apart in vacuum. Calculate the electrostatic potential energy of the system. *[5]*

18. (a) Define electric potential due to a point charge and derive its expression at a distance r from the charge.

    (b) Three capacitors of capacitance 2 μF, 3 μF, and 6 μF are connected first in series and then in parallel across a 12 V battery. Calculate the energy stored in each configuration. *[5]*

Section F — Case-Based / Application Question

4 marks

19. A spherical conductor of radius R carries a charge Q distributed uniformly over its surface. Based on this, answer the following: *[4]*

    (i) What is the electric field inside the conductor (r < R)? Justify your answer.

    (ii) What is the electric field at the surface (r = R)?

    (iii) How does the electric field vary for points outside the conductor (r > R)? Write the expression.

    (iv) Sketch a rough graph of electric field (E) versus distance (r) from the centre, for r = 0 to r > R.