Class 12 Physics · Chapter 2: Electrostatic Potential and Capacitance

Worksheet · 20 marks · about 40 minutes · based on NCERT

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1. The equipotential surfaces of an isolated point charge are [1]

(a) parallel planes perpendicular to a line through the charge
(b) coaxial cylinders with the charge on their axis
(c) planes containing the charge
(d) concentric spheres centred at the charge

2. Capacitors of 6 μF and 3 μF are connected in series. The capacitance of the combination is [1]

(a) 9 μF
(b) 4.5 μF
(c) 18 μF
(d) 2 μF

3. The dimensional formula of capacitance is [1]

(a) $[M\,L^{2}\,T^{-3}\,A^{-1}]$
(b) $[M^{-1}\,L^{-2}\,T^{2}\,A]$
(c) $[M\,L^{2}\,T^{-4}\,A^{-2}]$
(d) $[M^{-1}\,L^{-2}\,T^{4}\,A^{2}]$

4. A capacitor holds a charge of 4.0 mC when the potential difference across it is 200 V. The energy stored in it is [1]

(a) 0.20 J
(b) 0.40 J
(c) 0.80 J
(d) 4.0 mJ

5. The plates of an air-filled parallel plate capacitor each have an area of $4.0 \times 10^{-2}\ m^{2}$ and are 0.885 mm apart. Take $\varepsilon_0 = 8.85 \times 10^{-12}\ C^{2}\,N^{-1}\,m^{-2}$. Its capacitance is [1]

(a) 400 pF
(b) 40 pF
(c) 4000 pF
(d) 0.40 pF

6. Distinguish between polar and non-polar molecules, giving one example of each, and state how each kind develops a dipole moment in an external electric field. [2]

7. Capacitors of capacitance C and 2C are connected in series across a battery of emf V. Find the charge on each capacitor and the potential difference across each. [2]

8. An electron and a proton, each starting from rest, are accelerated through a potential difference of 2.0 kV. (a) Find the kinetic energy each gains, in eV and in joule ($e = 1.6 \times 10^{-19}$ C). (b) Taking the proton's mass as 1836 times the electron's, find the ratio of the electron's speed to the proton's. [2]

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9. A 10 μF parallel plate capacitor is charged to 100 V and kept connected to the 100 V battery. A slab of dielectric constant 3 is slid in to fill the gap completely. Find (a) the extra charge that flows from the battery, (b) the increase in the energy stored in the capacitor, and (c) the work done by the battery in sending this charge round, and compare it with (b). [3]

10. An air-filled parallel plate capacitor has plates of area $2.0 \times 10^{-2}\ m^2$, 2.0 mm apart. Air breaks down in a field of about $3 \times 10^{6}\ V\ m^{-1}$. Take $\varepsilon_0 = 8.85 \times 10^{-12}\ C^2\ N^{-1}\ m^{-2}$. Find (a) its capacitance, (b) the largest potential difference it can safely take, and (c) the largest charge it can then hold. [3]

11. The gap d between the plates of a parallel plate capacitor (air capacitance C_0) is filled with two dielectric layers, each of thickness d/2 and parallel to the plates, of dielectric constants 2 and 4. Show that the capacitance becomes $(8/3)C_0$. [3]