Exercise-1

Marked Questions can be used as Revision Questions.

OBJECTIVE QUESTIONS

Section (A) : Definition of Capacitance

A-1. The radii of two metallic spheres are 5 cm and 10 cm and both carry equal charge of 75μC. If the two spheres are shorted then charge will be transferred–
(1) 25 μC from smaller to bigger (2) 25 μC from bigger to smaller
(3) 50 μC from smaller to bigger (4) 50 μC from bigger to smaller

A-2. A parallel plate capacitor is charged and then isolated. On increasing the plate separation–

	Charge	Potential	Capacitance
(1)	remains constant	remains constant	decreases
(2)	remains constant	increases	decreases
(3)	remains constant	decreases	increases
(4)	increases	increases	decreases

A-3. The capacitance of a spherical conductor is proportional to
(1) $C \propto R^2$ (2) $C \propto R^{-2}$ (3) $C \propto R$ (4) $C \propto R^{-1}$

A-4. Stored energy in a charged conductor is
(1) $\frac{1}{2}CV^2$ (2) $\frac{1}{2}Q^2V^2$ (3) $\frac{1}{2}\frac{Q^2}{C^2}$ (4) $\frac{1}{2}\frac{Q}{C^2}$

A-5. Unit of capacitance is
(1) coulomb (2) volt (3) henry (4) farad

A-6. The capacitance of a capacitor is
(1) directly proportional to the dielectric constant of the medium between the plates
(2) inversely proportional to the dielectric constant of the medium between the plates
(3) proportional to the square of the dielectric constant of the medium between the plates
(4) independent of the dielectric constant of the medium between the plates

A-7. If the energy of a capacitor of capacitance 2μF is 0.16 joule, then its potential difference will be
(1) 800 V (2) 400 V (3) 16×10^4 V (4) 16×10^{-4} V

A-8. A capacitor of 6μF is charged to such an extent that the potential difference between the plates becomes 50 V. The work done in this process will be
(1) 7.5×10^{-2} J (2) 7.5×10^{-3} J (3) 3×10^{-6} J (4) 3×10^{-3} J

A-9. The potential of earth is zero because it is
(1) uncharged
(2) an object of zero capacitance
(3) net charge is very small but radius is very large
(4) having infinite charge

Section (B) : Circuits with capacitor and use of KCl and KVL

B-1. The work done against electric forces in increasing the potential difference of a condenser from 20V to 40V is W. The work done in increasing its potential difference from 40V to 50V will be
(1) 4W (2) $\frac{3W}{4}$ (3) 2W (4) $\frac{W}{2}$

B-2. The plate separation in a parallel plate condenser is d and plate area is A. If it is charged to V volt & battery is disconnected then the work done in increasing the plate separation to 2d will be–

(1) $\frac{3}{2}\frac{\varepsilon_0 AV^2}{d}$ (2) $\frac{\varepsilon_0 AV^2}{d}$ (3) $\frac{2\varepsilon_0 AV^2}{d}$ (4) $\frac{\varepsilon_0 AV^2}{2\ d}$

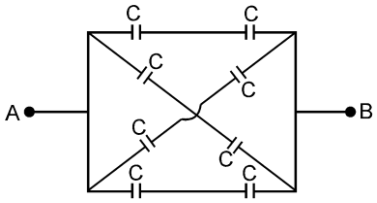
B-3. A capacitor of capacitance 10μF is charged to a potential of 100 V. Now connecting it in parallel with an uncharged capacitor, the resultant potential difference becomes 40 volt. The capacitance of this capacitor is
(1) 2.5μF (2) 5μF (3) 10μF (4) 15μF

B-4. The capacitance of a parallel plate capacitor is 12μF. If the distance between its plates is reduced to half and the area of plates is doubled, then the capacitance of the capacitor will become
(1) 24μF (2) 12μF (3) 16μF (4) 48μF

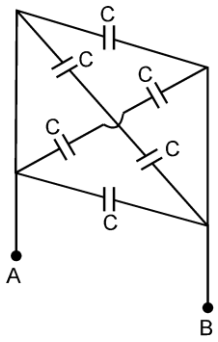
B-5. Two conducting spheres of capacitances 3μF and 5μF are charged to 300 V and 500 V respectively and are connected together. The common potential in steady state will be
(1) 400 V (2) 425 V (3) 350 V (4) 375 V

Section (C) : Combination of capacitors

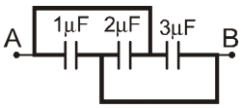
C-1. In the adjoining circuit, the capacity between the points A and B will be -
(1) C
(2) 2C
(3) 3C
(4) 4C



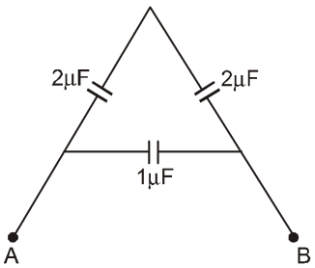
C-2. The resultant capacity between the points A and B in the adjoining circuit will be -
(1) C
(2) 2C
(3) 3C
(4) 4C



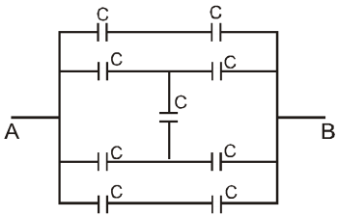
C-3. The equivalent capacitance between A and B of the combination, shown in the figure, will be
(1) 1.5μF (2) 3.0μF
(3) $\frac{6}{11}\mu F$ (4) 6μF



C-4. The effective capacitance between A and B is
(1) 1μF
(2) 2μF
(3) 1.5μF
(4) 2.5μF



C-5. In the figure given, the effective capacitance between A and B will be



(1) C
(2) C/2
(3) 2C
(4) 3C

Section (D) : Equation of charging and discharging

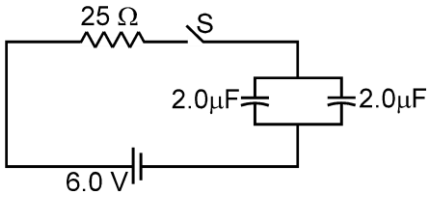
D-1. The plates of a capacitor of capacitance 10 μF, charged to 60 μC, are joined together by a wire of resistance 10 Ω at t = 0, then

(i) the charge on the capacitor in the circuit at t = 0 is :
(1) 120 μC (2) 60 μC (3) 30 μC (4) 44 μC

(ii) the charge on the capacitor in the circuit at t = 100 μs is :
(1) 120 μC (2) 60 μC (3) 22 μC (4) 18 μC

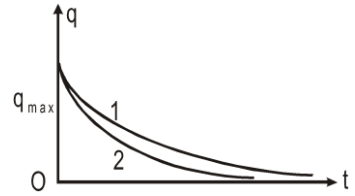
(iii) the charge on the capacitor in the circuit at t = 1.0 ms is :
(1) 0.003 μC (2) 60 μC (3) 44 μC (4) 18 μC

D-2. The charge on each of the capacitors 0.20 ms after the switch S is closed in figure is :
(1) 24 μC
(2) 16.8 μC
(3) 10.37 μC
(4) 4.5 μC



D-3. If the two plates of the charged capacitor are connected by a wire, then
(1) potential will become infinite (2) charge will become infinite
(3) capacitor will get discharged (4) charge will become double that of earlier one

D-4. The instantaneous charge on capacitor in two discharging RC circuits is plotted with respect to time in figure. Choose the correct statement(s) (where E_1 and E_2 are emfs of two DC sources in two different charging circuits and capacitor are fully charged).



(1) $R_1C_1 < R_2C_2$ (2) $\frac{R_1}{R_2} < \frac{C_2}{C_1}$
(3) $R_1 > R_2$ if $E_1 = E_2$ (4) $C_2 > C_1$ if $E_1 = E_2$

D-5. An uncharged capacitor of capacitance 4μF, a battery of emf 12 volt and a resistor of 2.5 MΩ are connected in series. The time after which $V_C = 3V_R$ is (take $\ell n2 = 0.693$)
(1) 6.93 seconds (2) 13.86 seconds
(3) 7 seconds (4) 14 seconds

Section (E) : Capacitor with dielectric

E-1. The distance between the plates of a parallel plate condenser is d. If a copper plate of same area but thickness $\frac{d}{2}$ is placed between the plates then the new capacitance will become-
(1) half (2) double (3) one fourth (4) unchanged

E-2. A parallel plate condenser is connected to a battery of e.m.f. 4 volt. If a plate of dielectric constant 8 is inserted into it, then the potential difference on the condenser will be-
(1) 1/2 V (2) 2V (3) 4V (4) 32V

E-3. In the above problem if the battery is disconnected before inserting the dielectric, then potential difference will be-
(1) 1/2 V (2) 2V (3) 4V (4) 32V

E-4. A parallel plate condenser with plate separation d is charged with the help of a battery so that U_0 energy is stored in the system. A plate of dielectric constant K and thickness d is placed between the plates of condenser while battery remains connected. The new energy of the system will be-
(1) KU_0 (2) K_2U_0 (3) $\frac{U_0}{K}$ (4) $\frac{U_0}{K^2}$

E-5. In the above problem if the battery is disconnected before placing the plate, then new energy will be–
(1) K_2U_0 (2) $\frac{U_0}{K^2}$ (3) $\frac{U_0}{K}$ (4) KU_0

E-6. If a thin metal foil of same area is placed between the two plates of a parallel plate capacitor of capacitance C, then new capacitance will be
(1) C (2) 2C (3) 3C (4) 4C

E-7. To reduce the capacitance of a parallel plate capacitor, the space between the plates is
(1) filled with dielectric material
(2) reduced and area of the plates is increased
(3) increased and area of the plates is decreased
(4) increased and area is increased relatively

E-8. After charging a capacitor the battery is removed. Now by placing a dielectric slab between the plates
(1) the potential difference between the plates and the energy stored will decrease but the charge on plates will remain same
(2) the charge on the plates will decrease and the potentaial difference between the plates will increase
(3) the potential difference between the plates will increase and energy stored will decrease but the charge on the plates will remain same
(4) the potential difference, energy stored and the charge will remain unchanged