Shiksha Classes Bhandara
CHAPTER TEST

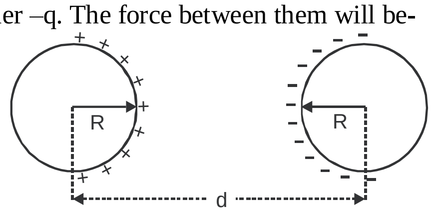
Subject : Physics **Topic : Electrostatics** **M.M. : 100**

Marking Scheme:

(i) Each question is allotted 4 (four) marks for each correct response.

(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 Two charged spheres of radius 'R' are kept at a distance 'd' (d > 2R). One has a charge +q and the other –q. The force between them will be-



(A) $\frac{1}{4\pi\varepsilon_0}\frac{q^2}{d^2}$ (B) $> \frac{1}{4\pi\varepsilon_0}\frac{q^2}{d^2}$

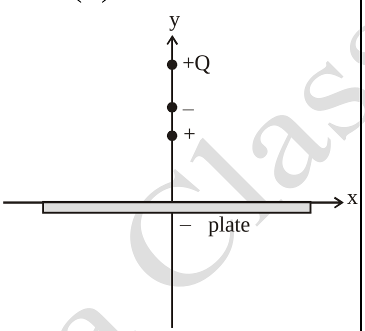
(C) $< \frac{1}{4\pi\varepsilon_0}\frac{q^2}{d^2}$ (D) None of these

Q.2 What is the smallest electric force between two charges placed at a distance of 1.0 m.

(A) 2.304×10^{-28} N (B) 1.314×10^{-28} N.

(C) 0.204×10^{-28} N (D) 4.104×10^{-28} N.

Q.3 A large uniformly charged (negative) plate is placed in xz plane and a positive point charge is fixed on the y-axis. A short dipole is positioned in between with its axis along y-axis, as shown. The dipole initially moves in –



(A) negative y-direction (B) negative x-direction

(C) positive x-direction (D) positive y-direction

Q.4 A charge is situated at a certain distance from an electric dipole in the end-on position experiences a force F. If the distance of the charge is doubled, the force acting on the charge will be :

(A) F/4 (B) F/8

(C) 2F (D) F/2

Q.5 Which of the following statements is true –

(A) The electric field due a point charge can be same at two points.

(B) The electric field increases continuously as one goes away from centre of a solid uniformly charged sphere

(C) The electric field of force of the electric field produced by the static charges form closed loops

(D) The magnetic lines of force of magnetic field produced by current carrying wire form closed loops

Q.6 A point charge Q is placed at a distance d from the centre of an uncharged conducting sphere of radius R. The potential at the centre of the sphere is (d > R)

(A) $\frac{1}{4\pi\epsilon_0}.\frac{Q}{(d-R)}$ (B) $\frac{1}{4\pi\epsilon_0}.\frac{Q}{d}$

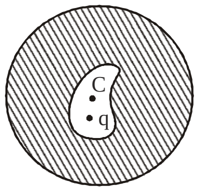
(C) $\frac{1}{4\pi\epsilon_0}.\frac{Q}{R}$ (D) zero

Q.7 The plate of a parallel plate capacitor are separated by d cm. A plate of thickness t cm. with dielectric constant k_1 is inserted and the remaining space is field with a plate of dielectric constant k_2. If Q is the charge on the capacitor and area of plates is A cm^2 each, then potential difference between the plates is –

(A) $\frac{Q}{\varepsilon_0 A}\left(\frac{t}{k_1}+\frac{d-t}{k_2}\right)$ (B) $\frac{4\pi Q}{A}\left(\frac{t}{k_1}+\frac{d-t}{k_2}\right)$

(C) $\frac{4\pi Q}{A}\left(\frac{k_1}{t}+\frac{k_2}{d-t}\right)$ (D) $\frac{Q}{\varepsilon_0 A}\left(\frac{k_1}{t}+\frac{d-t}{k_2}\right)$

Q.8 The figure shows a charge q placed insider a cavity in an uncharged conductor. Now if an external electric field is switched on –



(A) only induced charge on outer surface will redistribute

(B) only induced charge on inner surface will redistribute

(C) both induced charge on outer and inner surface will redistribute

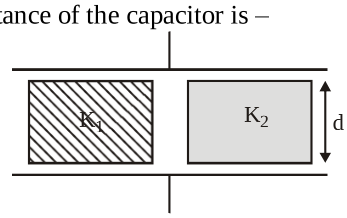
(D) force on charge q placed inside the cavity will change

Q.9 An electron enters in an electric field of magnitude 50×10^2 V/m. If $\frac{e}{m}$ of an electron is 1.76×10^{11} C/kg, then the acceleration of electron (in m/s^2) is –

(A) zero (B) 5.4×10^{12}

(C) 6.2×10^{14} (D) 8.8×10^{14}

Q.10 Two dielectrics (same dimension) of dielectric constants K_1 and K_2 are filled in the gap of parallel plate capacitor as shown in figure. The capacitor has plate each of area A and separation d. The capacitance of the capacitor is –



(A) $\frac{\varepsilon_0 A (K_1 + K_2)}{2d}$ (B) $\frac{\varepsilon_0 A}{2d}\left(\frac{K_1 + K_2}{K_1 K_2}\right)$

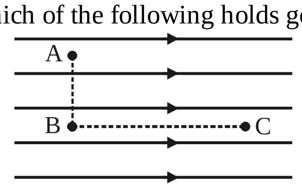
(C) $\frac{\varepsilon_0 A}{d}\left(\frac{K_1 K_2}{K_1 + K_2}\right)$ (D) $\frac{2\varepsilon_0 A}{d}\left(\frac{K_1 K_2}{K_1 + K_2}\right)$

Q.11 If n drops of potential V merge, find new potential on the big drop –

(A) $n^{2/3}V$ (B) $n^{1/3}V$

(C) nV (D) $V^{n/3}$

Q.12 Figure shows three point A, B and C in a region of uniform electric field $\vec{E}$. The line AB is perpendicular and BC is parallel to the field lines. Then, which of the following holds good ?



(A) $V_A = V_B = V_C$ (B) $V_A = V_B > V_C$

(C) $V_A = V_B < V_C$ (D) $V_A > V_B = V_C$

Q.13 An electric field is given by $E_x = -2x^3$ kN/C. The potential of the point (1, –2), if potential of the point (2, 4) is taken as zero, is –

(A) 7.5×10^3 V (B) -7.5×10^3 V

(C) -15×10^3 V (D) 15×10^3 V

Q.14 A charge Q μC is placed at the centre of a cube, the flux coming out from any surface will be –

(A) $\frac{Q}{6\varepsilon_0} \times 10^{-6}$ (B) $\frac{Q}{6\varepsilon_0} \times 10^{-3}$

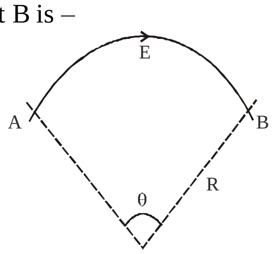
(C) $\frac{Q}{24\varepsilon_0}$ (D) $\frac{Q}{8\varepsilon_0}$

Q.15 Each corner of a cube of side ℓ has a negative charge, – q. The electrostatic potential energy of a charge q at the centre of the cube is –

(A) $-\frac{4q^2}{\sqrt{2}\pi\varepsilon_0 \ell}$ (B) $\frac{\sqrt{3}q^2}{4\pi\varepsilon_0 \ell}$

(C) $\frac{4q^2}{\sqrt{2}\pi\varepsilon_0 \ell}$ (D) $-\frac{4q^2}{\sqrt{3}\pi\varepsilon_0 \ell}$

Q.16 Figure shows an electric line of force which curves along a circular arc. The magnitude of electric field intensity is same at all points on this curve and is equal to E. If the potential at A is V, then the potential at B is –



(A) $V - ER\theta$ (B) $V - E2R\sin\frac{\theta}{2}$

(C) $V + ER\theta$ (D) $V + 2ER\sin\frac{\theta}{2}$

Q.17 Two parallel plate capacitors of capacitances C and 2C are connected in parallel and charged to a potential difference V. The battery is then disconnected and the region between the plates of the capacitor C is completely filled with a material of dielectric constant K. The potential difference across the capacitors now becomes –

(A) $\frac{3V}{K+2}$ (B) KV

(C) V/K (D) 3/KV

Q.18 A parallel plate capacitor is charged to a certain potential difference A slab of thickness 3 mm is inserted between the plates and it becomes necessary to increase the distance between the plates by 2.4 mm to maintain the same potential difference. The dielectric constant of the slab is–

(A) 3 (B) 5

(C) 2.5 (D) 2

Q.19 The electric potential V as a function of distance x (in metre) is given by : $V = (15x^2 + 10x - 9)$V. The value of electric field of x = 1m would be –

(A) 20 V/m (B) 6 V/m

(C) 11 V/m (D) –23 V/m

Q.20 An uncharged capacitor with a solid dielectric is connected to a similar air capacitor charged to a potential of V_0. If the common potential after sharing of charges becomes V, then the dielectric constant of the dielectric must be –

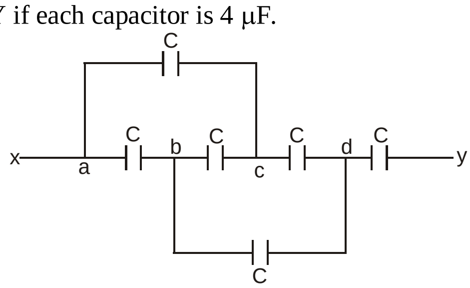
(A) $\frac{V_0}{V}$ (B) $\frac{V}{V_0}$

(C) $\frac{V_0 - V}{V}$ (D) $\frac{V_0 - V}{V_0}$

For Q.21-Q.25 :

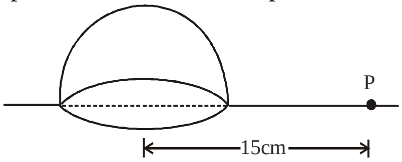
The answer to each question is a NUMERICAL VALUE.

Q.21 Find equivalent capacitance (in μF) between X and Y if each capacitor is 4 μF.



Q.22 A point charge +Q is placed at the centroid of an equilateral triangle. When a second charge +Q is placed at a vertex of the triangle, the magnitude of the electrostatic force on the central charge is 8N. The magnitude (in N) of the net force on the central charge when a third charge +Q is placed at another vertex of the triangle is –

Q.23 Figure shows a solid hemisphere with a charge of 5nC distributed uniformly through its volume. The hemisphere lies on a plane and point P is located on the plane, along a radial line from the centre of curvature at distance 15 cm. The electric potential (in V) at point P due to the hemisphere, is –



Q.24 The plates of a parallel plate capacitor are charged upto 100 volt. A 2mm thick plate is inserted between the plates , then to maintain the same potential difference, the distance between the capacitor plates is increased by 1.6 mm. The dielectric constant of the plate is :

Q.25 A capacitor of 1 μF withstands a maximum voltage of 6 kilovolt while another capacitor of 2μF withstands a maximum voltage of 4 kilovolt. If the two capacitors are connected in series, the system will withstand a maximum voltage (in kV) of –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