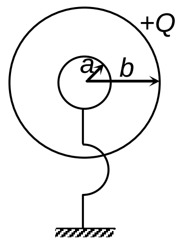
361. Three charges +4*q*, *Q* and *q* are placed in a straight line of length *l* at coordinates (0, 0), (*l*/2, 0) and (*l*, 0) respectively. What should be *Q* in order to make the net force on *q* to be zero?

(a) -*q* (b) –2*q* (c) –*q*/2 (d) 4*q*

362. What is the equivalent capacitance of the capacitor shown in the figure.



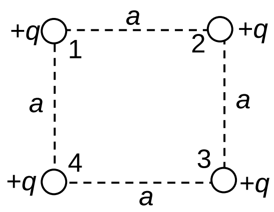
(a) $\frac{4\pi\varepsilon_0 b^2}{(b-a)}$ (b) $\frac{4\pi\varepsilon_0 a^2}{(b-a)}$

(c) $\frac{4\pi\varepsilon_0 (b-a)}{b^2}$ (d) $\frac{4\pi\varepsilon_0 (b-a)}{a^2}$

363. Five identical capacitors each of value 2 F are connected between the pair of nodes (a,c), (c,d), (a,d)(b,d) and (c,b). If all the capacitors are initially uncharged, the equivalent capacitance between the nodes a and b will be

(a) 3 F (b) 5 F (c) 1 F (d) 2 F

364. The figure shown a system of 4 charges in the vertices of a square of side *a*. Each charge of magnitude *q* is bringing from infinite to that system work required to assemble the system is $\left(\text{with } k = \frac{1}{4\pi\varepsilon_0}\right)$



(a) $\frac{(4-\sqrt{2})q^2}{4\pi\varepsilon_0 a}$ (b) $\frac{(4+\sqrt{2})q^2}{4\pi\varepsilon_0 a}$

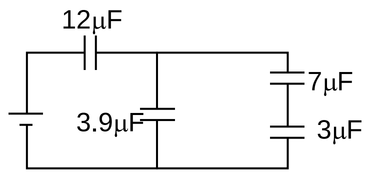
(c) $\frac{(2+\sqrt{2})q^2}{4\pi\varepsilon_0 a}$ (d) $\frac{(\sqrt{2}-2)q^2}{4\pi\varepsilon_0 a}$

365. The electric field in a region is given by $\vec{E} = \left(\frac{A}{x^3}\right)\hat{i}$. The potential in this region is ………..

(assume the potential at infinity to be zero)

(a) $2Ax^2$ (b) $\frac{2A}{x^2}$ (c) $\frac{2x^2}{A}$ (d) $\frac{A}{2x^2}$

366. Four capacitors and a battery are connected as shown in the figure. If the potential difference across the 7μF capacitor is 6V then



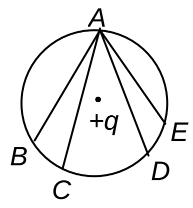
(a) the emf of the battery is 30 V

(b) the charge on the 3 μF capacitor is 78 μC

(c) the potential difference across the 12 μF capacitor is 14.4 V

(d) the potential difference across 3μF capacitor is 10 V

367. In the electric field of a point charge $+q$ a certain charge is carried from point A to B, A to C, A to D and A to E all the points are at same distance from $+q$ charge. Then the work done is



(a) least along the path AB

(b) least along the path AE

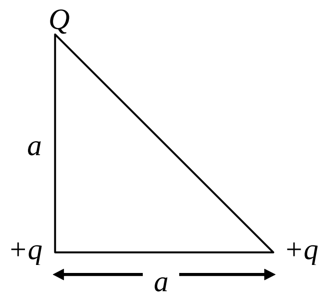
(c) zero along any of the paths, AB, AC, AD and AE

(d) least along the path AC

368. A parallel plate air capacitor having capacitance $C = 2\mu F$. A slab is introduced between its plates having dielectric constant $k = 4$ and then connected across a cell having emf $E = 100V$ with the cell remains connected find work done to slowly take the slab out of the capacitor.

(a) 10 mJ (b) 20 mJ (c) 30 mJ (d) 60 mJ

369. Three charges Q, $+q$ and $+q$ are placed at the vertices of a right angled triangle (isosceles triangle) as shown in the figure. The net electrostatic energy of the configuration is zero if Q is equal to



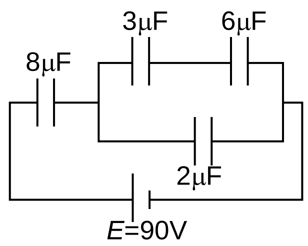
(a) $\frac{-q}{1+\sqrt{2}}$ (b) $\frac{-2q}{2+\sqrt{2}}$

(c) $-2q$ (d) $+q$

370. A charged particle of mass m and charge q is released from rest in an electric field of constant magnitude E. The kinetic energy of the particle after a time t is

(a) $\frac{E^2q^2t^2}{m}$ (b) $\frac{2E^2q^2t^2}{m}$ (c) $\frac{E^2q^2t^2}{2m}$ (d) $\frac{4E^2q^2t^2}{m}$

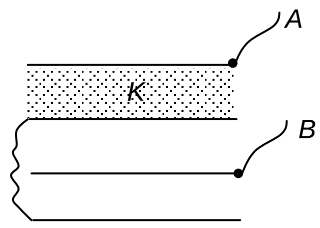
371. Under steady state energy stored in $6\mu F$ capacitor shown in the circuit is



(a) 3 mJ (b) 1.2 mJ

(c) 0.6 mJ (d) 20 mJ

372. Four plates each having area A are placed parallel to each other at separation d as shown in the figure, capacitance of the arrangement across A and B will be



(a) $\frac{2k\varepsilon_0 A}{3d}$ (b) $\frac{2k\varepsilon_0 A}{(k+2)d}$

(c) $(k+1)\frac{\varepsilon_0 A}{d}$ (d) $\frac{k\varepsilon_0 A}{(k+1)d}$

373. A 2μF capacitor is connected in series with a capacitor having capacitance XμF and a cell having emf E = 100 V is connected across the combination. Energy stored in the system under steady state is found to be 5 mJ. Then X equals to

(a) 1 (b) 2 (c) 4 (d) 6

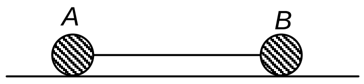
374. Two charged particles having masses m and $2m$ and charges q and $4q$ respectively are released from rest, at initial separation d. Velocity of the lighter particle when they are large distance apart is given by (neglect gravitational potential energy)

(a) $2q\left[\frac{1}{3m\pi\varepsilon_0 d}\right]^{\frac{1}{2}}$ (b) $\left[\frac{2q}{m\pi\varepsilon_0 d}\right]^{\frac{1}{2}}$ (c) $\frac{q}{d}\left[\frac{3}{\pi\varepsilon_0 d}\right]^{\frac{1}{2}}$ (d) $\left[\frac{12}{m\pi\varepsilon_0 d^2}\right]^{\frac{1}{2}}$

375. A proton is projected with kinetic energy k, against uniform constant electric field and comes to momentary rest after travelling a distance S_0. If an α particle is projected with same kinetic energy against same electric field, will come to momentary rest after travelling through

(a) S_0 (b) $\sqrt{5}S_0$ (c) $\frac{S_0}{2}$ (d) $\frac{S_0}{2\sqrt{2}}$

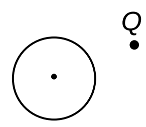
376. Two charged particles A and B are connected by insulating string having length 30 cm and the arrangement is placed on a smooth insulating surface as shown in the figure on A is 2μC and tension in the string is 0.2 N then charge on B will be



(a) 1 mC (b) 1.5 mC

(c) 1 μC (d) 3 μC

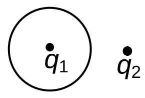
377. A point charge Q = +20 μC is placed at a distance of 2 m from the surface of solid conducting uncharged sphere of radius 0.5 m. Electrostatic potential on the surface of the sphere will be



(a) zero (b) 360 KV

(c) 90 KV (d) 72 KV

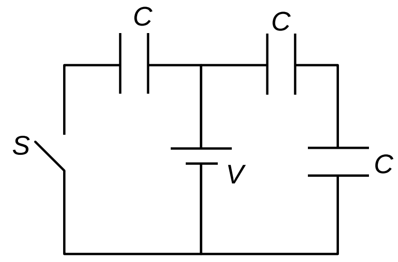
378. A point charge q_1 = +1 μC is placed at the centre of a hollow conducting neutral sphere having radius 10 cm. Another point charge q_2 = –3 μC is placed at a distance 30 cm from the centre of hollow sphere. Force exerted by the sphere on q_1 is



(a) 0.1 N towards left (b) 0.3 N towards left

(c) 0.9 N towards left (d) 0.3 N towards right

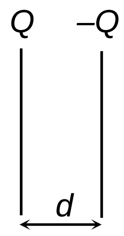
379. In the given circuit diagram, find the heat generated on closing the switch(S).



(a) $\frac{3}{2}CV^2$ (b) CV^2

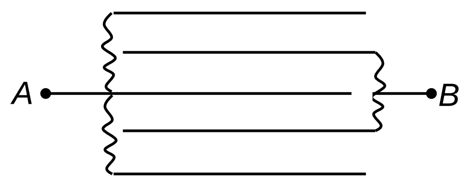
(c) $\frac{1}{2}CV^2$ (d) $2CV^2$

380. Two large parallel plates having equal and opposite charge Q are placed very close to each other and distance between the plates is d. Find the work done by external agent to increase the separation between plates by d (area of plate is A)



(a) $\frac{Q^2d}{2A\varepsilon_0}$ (b) $-\frac{Q^2d}{2A\varepsilon_0}$ (c) $-\frac{3Q^2d}{2A\varepsilon_0}$ (d) $-\frac{Q^2d}{A\varepsilon_0}$

381. Five conducting plates of area A are arranged as shown in the figure. Distance between them is d. Find the capacitance between A and B.



(a) $\frac{4\varepsilon_0 A}{d}$ (b) $\frac{\varepsilon_0 A}{4d}$

(c) $\frac{3A\varepsilon_0}{2d}$ (d) $\frac{4A\varepsilon_0}{5d}$

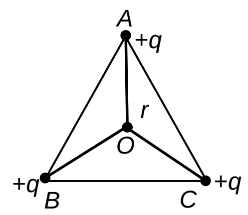
382. Four equal charges Q are placed at the four corners of a square of side a. The work done in removing a charge $-Q$ from the centre of the square to infinity is

(a) zero (b) $\frac{\sqrt{2}\,Q^2}{4\pi\varepsilon_0 a}$ (c) $\frac{\sqrt{2}\,Q^2}{\pi\varepsilon_0 a}$ (d) $\frac{Q^2}{2\pi\varepsilon_0 a}$

383. A charge $+Q$ is uniformly distributed in a spherical volume of radius R. A particle of charge $+q$ and mass m is projected with velocity v_0 from the surface of the sphere to its centre. The minimum value of v_0 such that it just reaches the center (assume that there is no resistance on the particle except electrostatic force) of the spherical volume is

(a) $\sqrt{\frac{Qq}{2\pi\varepsilon_0 mR}}$ (b) $\sqrt{\frac{Qq}{\pi\varepsilon_0 mR}}$ (c) $\sqrt{\frac{2Qq}{\pi\varepsilon_0 mR}}$ (d) $\sqrt{\frac{Qq}{4\pi\varepsilon_0 mR}}$

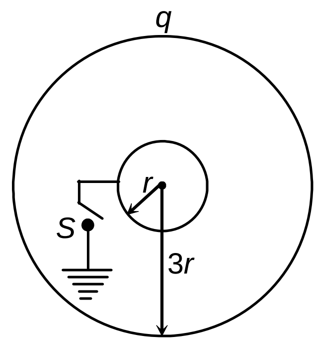
384. ABC is an equilateral triangle. Charges $+q$ are placed at each corner. The electric field intensity at centroid O will be



(a) $\frac{1}{2\pi\varepsilon_0}\times\frac{q}{r^2}$ (b) $\frac{1}{2\pi\varepsilon_0}\times\frac{3q}{r^2}$

(c) $\frac{1}{2\pi\varepsilon_0}\times\frac{\sqrt{3}q}{r^2}$ (d) zero

385. Figure shows two conducting thin concentric shells of radii r and $3r$. The outer shell carries charge q. Inner shell is neutral. Find the charge that will flow from inner shell to earth after the switch S is closed.



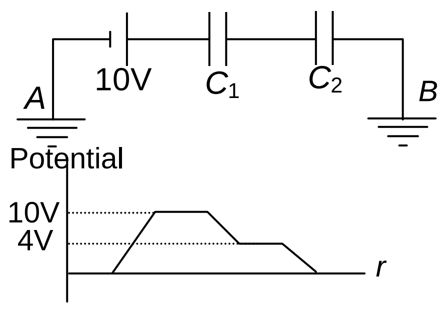
(a) $+\frac{q}{3}$ (b) $-\frac{q}{3}$

(c) $+3q$ (d) $-3q$

386. Two sources of current of equal emf are connected in series having different internal resistances r_1 and r_2 ($r_2 > r_1$). What should be the value of external resistance R at which the potential difference across the terminals of one of the source became zero

(a) $r_1 + r_2$ (b) $\frac{r_1 r_2}{r_1 + r_2}$ (c) $r_2 - r_1$ (d) $\frac{r_2}{r_1}$

387. Figures shows two capacitors C_1 and C_2 connected with 10 V battery and terminal A and B are earthed. The graph shows the variation of potential as one moves from left to right. Then the ratio of C_1/C_2 is



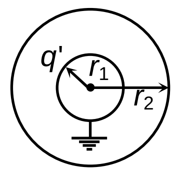
(a) 5/2 (b) 2/3

(c) 2/5 (d) 4/3

388. Two concentric thin metallic hollow spheres of radii R_1 and R_2 ($R_1 > R_2$) bear charges Q_1 and Q_2 respectively. Then the potential at radius r from the common centre will be ($k = 1/(4\pi\varepsilon_0$, $R_2 < r < R_1$)

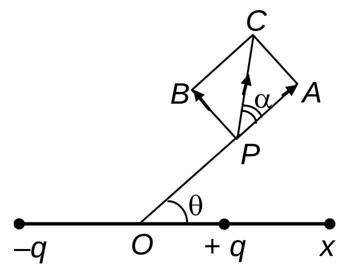
(a) $\frac{k(Q_1+Q_2)}{r}$ (b) $\frac{kQ_1}{R_1}+\frac{kQ_2}{r}$ (c) $\frac{kQ_1}{R_1}+\frac{kQ_2}{R_2}$ (d) $\frac{kQ_1}{R_2}+\frac{kQ_2}{R_1}$

389. The concentric hollow spheres are of radii r_1 and r_2. The outer sphere is given a charge q as shown in the figure. The charge q' on the inner sphere will be (inner sphere is grounded)



(a) q (b) $-q$ (c) $-q\frac{r_1}{r_2}$ (d) zero

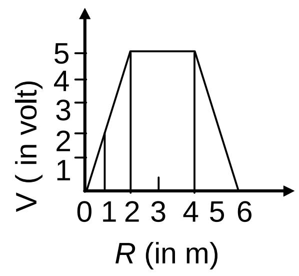
390. An electric dipole of moment $\vec{p}$ is placed at the origin along the *x*-axis. The electric field at a point *P*, whose position vector makes an angle θ with the x-axis, will make an angle with the *x*-axis.



(a) α (b) θ
(c) $\theta + \alpha$ (d) $2\theta + \alpha$

with the x-axis, where $\tan\alpha = \dfrac{\tan\theta}{2}$

391. The variation of potential with distance *R* from a fixed point is as shown in the figure. The electric field at *R* = 5 m is



(a) 2.5 V/m (b) – 2.5 V/m
(c) (2/5) V/m (d) – (2/5) V/m

392. The electric field at the origin is along the positive *X*-axis. A small circle is drawn with the centre at the origin cutting the axes at points *A*, *B*, *C* and *D* having coordinates (*a*, 0) (0, *a*), (–*a*, 0), 0, –*a*) respectively. Out of the points on the periphery of the circle, the potential is minimum at

(a) *A* (b) *B* (c) *C* (d) *D*

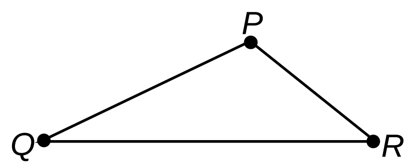
393. Charge *Q* is given a displacement $\vec{r} = a\hat{i} + b\hat{j}$ in an electric field $\vec{E} = E_1\hat{i} + E_2\hat{j}$. The work done is

(a) $Q(E_1a + E_2b)$ (b) $Q\sqrt{(E_1a)^2 + (E_2b)^2}$
(c) $Q(E_1 + E_2)\sqrt{a^2 + b^2}$ (d) $Q\sqrt{E_1^2 + E_2^2}\ \sqrt{a^2 + b^2}$

394. The electric potential *V* (in volt) varies with *x* (in metre) according to the relation $V = 5 + 4x^2$. The force experienced by a negative charge of 2×10^{-6} C located at *x* = 0.5 m is

(a) 2×10^{-6} N (b) 4×10^{-6} N (c) 6×10^{-6} N (d) 8×10^{-6} N

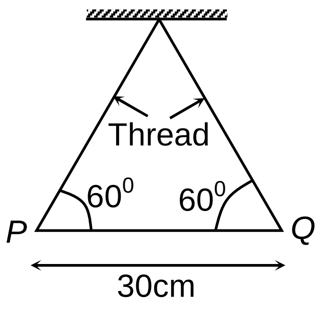
395. Two similar charges, each of magnitude $q = +2\mu C$ are placed at the vertices *Q* and *R* of the triangle as shown in the figure. The sum of the sides *PQ* and *PR* is 12 cm and their product is 32 cm^2. The potential at point *P* would be



(a) 6.00×10^5 V (b) 6.25×10^5 V (c) 6.50×10^5 V (d) 6.75×10^5 V

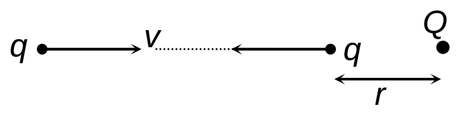
396. Two small identical balls P and Q, each of mass $\sqrt{3}/10$ gram, carry identical charges and are suspended by threads of equal lengths. At equilibrium, they position themselves as shown in the figure. What is the charge on each ball.

(Given $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ Nm^{2}C^{-2} and take g = 10 ms^{-2})



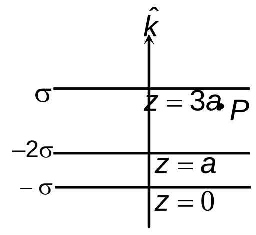
(a) 10^{-3}C (b) 10^{-5} C (c) 10^{-7} C (d) 10^{-4} C

397. A particle carrying a charge q is shot with a speed v towards a fixed particle carrying a charge Q. It approaches Q up to a certain distance r and then returns as shown in the figure. If charge q were moving with a speed $2v$, the distance of the closest approach would be



(a) r (b) $2r$ (c) $\frac{r}{2}$ (d) $\frac{r}{4}$

398. Three large conducting sheets with surface charge density σ, -2σ and $-\sigma$ are placed as shown in figure. Electric field intensity at the point P is



(a) $-\frac{4\sigma}{\varepsilon_0}\hat{k}$ (b) $\frac{4\sigma}{\varepsilon_0}\hat{k}$

(c) $-\frac{2\sigma}{\varepsilon_0}\hat{k}$ (d) $\frac{2\sigma}{\varepsilon_0}\hat{k}$

399. When a capacitors is connected to a battery

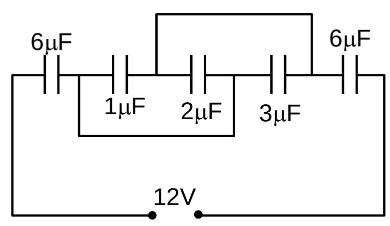
(a) no current flows in the circuit at all

(b) a current flows in the circuit for sometime and then decreases to zero

(c) the current keeps on increasing, reaching a maximum value when the capacitor is charged to the voltage of the battery

(d) an alternating current flows in the circuit

400. Five capacitors are connected across a battery of emf 12 V as shown in the figure. What is the potential drop across the 2μF?



(a) 6 V (b) 4 V

(c) 10 V (d) 12 V