Electric Charges And Fields

Q.No.1: A parallel-plate capacitor is made of two circular plates separated by a distance of 5 mm and with a dielectric of dielectric constant 2.2 between them. When the electric field in the dielectric is 3×10^4 V/m, the charge density of the positive plate will be close to:

A. 3×10^4 C/m^2

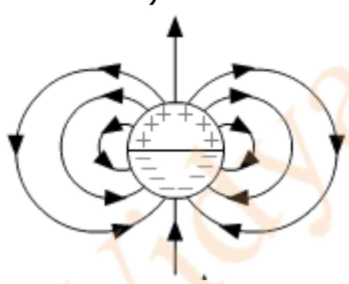
B. 6×10^4 C/m^2

C. 6×10^{-7} C/m^2

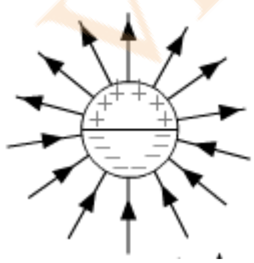
D. 3×10^{-7} C/m^2

Q.No.2: A long cylindrical shell carries positive surface charge σ in the upper half and negative surface charge $-\sigma$ in the lower half. The electric field lines around the cylinder will look like figure given in : (figure are schematic and not drawn to scale) **JEE 2015**

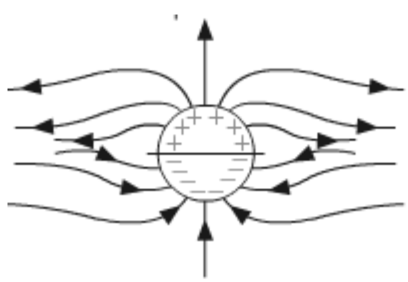
A.



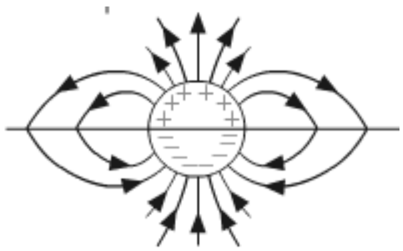
B.



C.

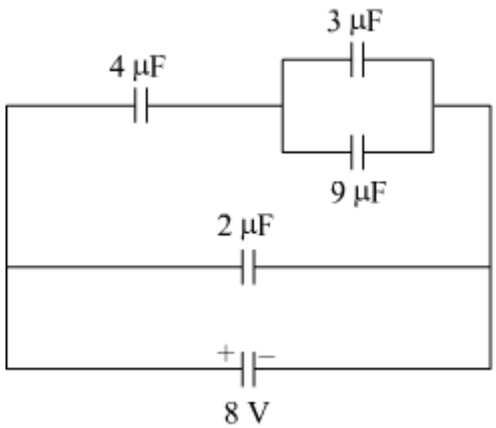


D.



Q.No.3: A combination of capacitor is set up as shown in the figure. The magnitude of the electric field, due to a point charge *Q* (having a charge equal to the sum of the sum of the charges on the 4 μF and 9 μF capacitors), at a point distant 30 m from it, would equal :

JEE 2016



A. 360 N/C
B. 420 N/C
C. 480 N/C
D. 240 N/C

Q.No.4: An electric dipole has a fixed dipole moment $\vec{p}$, which makes angle θ with respect to x-axis. When subjected to an electric field $\vec{E}_1 = E\hat{i}$, it experiences a torque $\vec{T}_1 = \tau\hat{k}$. When subjected to another electric field $\vec{E}_2 = \sqrt{3}E_1\hat{j}$ it experiences a t orque $\vec{T}_2 = -\vec{T}_1$. The angle θ is:

JEE 2017

A. 90°
B. 30°
C. 45°
D. 60°

Q.No.5: For a uniformly charged ring of radius *R*, the electric field on its axis has the largest magnitude at a distance *h* from its centre. Then value of *h* is:

JEE 2019

A. $\frac{R}{\sqrt{5}}$

B. $\frac{R}{\sqrt{2}}$

C. R

D. $R\sqrt{2}$

Q.No.6: Three charges +Q, *q*, +Q are placed respectively, at distance, 0, *d*/2 and *d* from the origin, on the *x*-axis. If the net force experienced by +Q, placed at *x* = 0, is zero, then the value of *q* is: **JEE 2019**

A. –Q/4

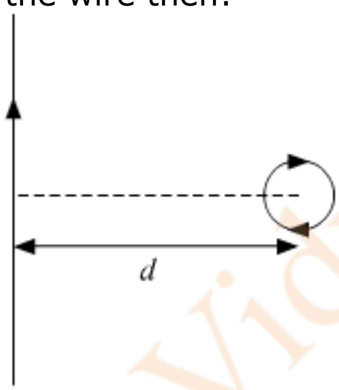
B. +Q/2

C. +Q/4

D. –Q/2

Q.No.7: An infinitely long current carrying wire and a small current carrying loop are in the plane of the paper as shown. The radius of the loop is a and distance of its centre from the wire is *d* (*d*≫*a*). If the loop applies a force F on the wire then:

JEE 2019



A. $F = 0$

B. $F \propto \left(\frac{a}{d}\right)$

C. $F \propto \left(\frac{a^2}{d^3}\right)$

D. $F \propto \left(\frac{a}{d}\right)^2$

Q.No.8: Two point charges $q_1 \left(\sqrt{10}\ \mu\text{C}\right)$ and $q_2\ (-25\ \mu\text{C})$ are placed on the *x*-axis at *x* = 1 m and *x* = 4 m respectively. The electric field (in V/m) at a point *y* = 3 m on *y*-axis is,

$\left[\text{take } \frac{1}{4\pi\varepsilon_\circ} = 9\times10^9\ \text{Nm}^2\,\text{C}^{-2}\right]$ **JEE 2019**

A. $\left(63\hat{i} - 27\hat{j}\right)\times 10^2$

B. $\left(-63\hat{i} + 27\hat{j}\right)\times 10^2$

C. $\left(81\hat{i} - 81\hat{j}\right)\times 10^2$

D. $\left(-81\hat{i} + 81\hat{j}\right)\times 10^2$

Q.No.9: The charge is distributed within a sphere of radius R with a volume charge density $\rho\left(r\right) = \frac{\text{A}}{r^2}e^{-2r/a}$, where A and *a* are constants. If Q is the total charge of this charge distribution, the radius R is: **JEE 2019**

A. $a\ \log\left(1 - \frac{\text{Q}}{2\pi a\text{A}}\right)$

B. $\frac{a}{2}\ \log\left(\frac{1}{1-\frac{\text{Q}}{2\pi a\text{A}}}\right)$

C. $a\ \log\left(\frac{1}{1-\frac{\text{Q}}{2\pi a\text{A}}}\right)$

D. $\frac{a}{2}\ \log\left(1 - \frac{\text{Q}}{2\pi a\text{A}}\right)$

Q.No.10: A charge Q is distributed over three concentric spherical shells or radii *a*, *b*, *c* (*a* < *b* < *c*) such that their surface charge densities are equal to one another.

The total potential at a point at distance *r* from their common centre,where *r* < *a*, would be: **JEE 2019**

A. $\frac{Q}{12\pi\varepsilon_0}\ \frac{ab+bc+ca}{abc}$

B. $\frac{Q\ (a^2+b^2+c^2)}{4\pi\varepsilon_0\ (a^3+b^3+c^3)}$

C. $\frac{Q}{4\pi\varepsilon_0\ (a+b+c)}$

D. $\frac{Q\ (a+b+c)}{4\pi\varepsilon_0\ (a^2+b^2+c^2)}$