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PHYSICS

BOOKS - CENGAGE PHYSICS (HINGLISH)

Electrostatic Potential and Capacitance

Question Bank

1. A positively charged oil droplet remains in the electric field between two horizontal plates, separated by a distance $1 cm$. If the charge on the drop is $3:3 \times 10^{-3} C$ and the mass of the droplet is $10^{14} kg$, then what is the potential difference (in volt) between the plates? (Take $g = 9.9 ms^2$)

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2. A hexagon of side 8 cm has a charge $4\mu C$ at each of its vertices. The potential at the centre of the hexagon is

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3. Three charges $+q, \ +q$ and Q are located at the vertices of a right-angled isosceles triangle. If the total interaction energy is zero, then $Q = -\frac{q}{p\sqrt{r}}$, Find $(p+r)$.

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4. Minimum number of capacitors each of $8\mu F$ and 250 V used to make a composite capacitor of $16\mu F$ and 1000 V are

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5. An atrangement of source charges produces electric. potential $\overline{V} = 5000t^2$ along the x - axis, where V is in volt and x is in metre. If a charge particle of mass 1g and $char \geq$ 1nC is present in this field and its turning points are at $\pm 8.0cm$, then what is the particie's maximum speed (in mm/s).

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6. An electric field $\left(-30\hat{i}+20j\right)\{V\}\{m\}^{-\{t\}}$ exists in space. If the potential at the origin is zero, then find the potential (in volt) at (5m,3m).

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7. Two charges $+2q$ and $-3q$ are fixed at co-ordinates (4m, 0,0) and (9m,0,0) , respectively. The distance 'between two points on x -axis (in m) where the potential is zero is z. Then the value of $\frac{z}{2}$ is (Assume standard reference.point)

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8. There is an electric field E in x-direction. If the work done on moving a charge of $0.2C$ through a distance of 2w m along a line making a angle 60° with x-axis is 4 J, then what is the value of E?

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9. Two insulating plates, shown in the figure, are thi uniformly .charged in such a way that the potentia difference between them is $V_3 - V_1 = 20V$ (i.e., plate 2 is at a higher potential). The plates are separated by distanc d = 0.1 m and can be treated as infinitely large. Al clectron is roleased from rest on the inner surface of plate 1. Its speed when it hits plate 2 is $2.65 \times 10^n \frac{m}{s}$ Find n

$(q = 1.6 \times 10^{-19} C, m_0 = 9.11 \times 10^{-11} kg)$

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figure

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10. In the given circuit, if charge on $6\mu F$ capacitor is $10\mu C, thenthechar \geq (\in$ mu C $)on$4 mu F` capacitor will be

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11. In the circuit shown in the figure, initially switch S is opén. When the switch is closed, the charge passing through the switch is μC in the direction A to B.

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12. In the given circuit, switch S_{W_1} is closed and S_{W_2} is open. After a long time, S_{w1} is opened and S_{W_2} is closed. Calculate the ratio of charge on capacitor B to that on capacitor A.

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13. In the given network, if potential difference between p and q is $2V$ and $C_2 = 3C_1$, then find the potential difference (in volt) between a and b.

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14. In the circuit shown below, $C_1 = 6\mu F, C_2 = 3\mu F$ and battery. $E = 20V$. The switch $S_{\{1\}}$ is first closed. It is then opened and. afterwards S_2 is closed. What is the charge (in $\mu C)on$C_{2} ?`

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15. Two identical thin rings, each of radius R, are coaxially placed a distance R apart. Q_1 and Q_2 are respectively the charges uniformly spread on the two rings. The work done in moving a charge q fróm the centre of one ring to that of the other is $\frac{(\sqrt{x}-y)q(Q_2-Q_1)}{4\sqrt{2}\pi\varepsilon_0 R}$.

Find $(x-y)$

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16. An electron is released from a distanće 120cm from a stationary point charge $+2 \times 10^{-9} C$. The speed of the cloctron when it is 18 cm frotn the point charge is $5.467 \times 10^{n} \frac{m}{s}$. Find n

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17. A capacitor is filled with an insulator and a certain potential difference is applied to its pltaes. The energy stored in the capacitor is U.

Now the capacitor is disconnected from the source and the insulator is pulled out of the capacitor. The work performed against the forces of electric field in pulling out the insulator is $4U$. Then dielectric constant of the insulator is.

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18. Find the equivalent capacitance (in μF) of the circuit between points A and B. (Given:

$C = 5 \mu F$).

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19. Consider the arrangemient of three plates X, Y and Z, each of the area A and separation d. The eaergy stored when the plates are fully charged is $\frac{p\varepsilon_{\{n\}}AV^2}{4d}$. Find p.

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20. The equivalent capacitance for the network shown in the figure is $\frac{k}{7} pF$. Find k.

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21. Three dielectrics of relative primitivities $\varepsilon_{\eta} = 6$, $\varepsilon_{\frac{r}{2}} = 2$ and $\varepsilon_{\frac{r}{3}} = 3$ are introduced in a parallel plate capacitor of plate area A and separation d, as shown in the figure. If the effective capacitance between points P and Q

is $\frac{x\varepsilon_0 A}{d}$, then $\frac{5}{7}x$ will be

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22. The equivalent capacitance between points A and B shown in the figare is $\frac{n\varepsilon_0 A}{d}$. Find n.

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23. A parallel plate cepacitor is made of two dielectric blocks in series. One of the blocks has thickness d_1 and dielectric constant k, and the ather has thickness d_2, and dielectric constant k_2 as showni in the figure, This arrangement can be thought as a dielestric slab of thickness $d = (d_1 + d_2)$ and effective dielectic eonstant k. Then k is (Given: $\{k\}_1 = 2, k_2 = 3, d_1 = d_2 + 4cm\}$)

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