DPP

DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. :4

Topic :- Electric charges and fields

1 **(a)**

Electric field inside a conductor is zero

2 **(c)**

As the capacitors $4\mu F$ and $2\mu F$ connected in parallel, are in series with $6\mu F$ capacitor, their equivalent capacitance is $\frac{(2+4)\times 6}{2+4+6} = 3\mu F$

Charge in the circuit, $Q = 3\mu F \times 12V = 36\mu C$

Since the capacitors $4\mu F$ and $2\mu F$ are connected in parallel, therefore potential difference across them is same

$$\Rightarrow \frac{Q_1}{Q_2} = \frac{C_1}{C_2} = \frac{4}{2} \Rightarrow Q_1 = 2Q_2$$

Also, $Q = Q_1 + Q_2$

$$\therefore 36\mu C = 2Q_2 + Q_2 \Rightarrow Q_2 = \frac{36\mu C}{3} = 12\mu C$$

$$Q_1 = Q - Q_2 = 36\mu C - 12\mu C = 24\mu C = 24 \times 10^{-6} C$$

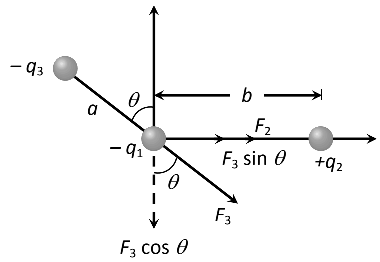
3 **(b)**

According to the question, $eE = mg \Rightarrow E = \frac{mg}{e}$

4 **(b)**

By inserting the dielectric slab. Capacitance (*i.e.* ability to hold the charge) increases. In the presence of battery more charge is supplied from battery

5 **(c)**



$F_2 =$ Force applied by q_2 on $-q_1$
$F_3 =$ Force applied by $(-q_3)$ on $-q_1$
x-component of Net force on $-q_1$ is

$$F_x = F_2 + F_3 \sin\theta = k\frac{q_1 q_2}{b^2} + k.\frac{q_1 q_3}{a^2}\sin\theta$$

$$\Rightarrow F_x = k.q_1\left[\frac{q_2}{b^2} + \frac{q_3}{a^2}\sin\theta\right] \Rightarrow F_x \propto \left[\frac{q_2}{b^2} + \frac{q_3}{a^2}\sin\theta\right]$$

6 **(c)**

Charge on $C_1 =$ charge on C_2

$\Rightarrow C_1(V_A - V_D) = C_2(V_D - V_B)$

$$\Rightarrow C_1(V_1 - V_D) = C_2(V_D - V_2) \Rightarrow V_D = \frac{C_1 V_1 + C_2 V_2}{C_1 + C_2}$$

7 **(c)**

Capacitance will increase but not 5 times [Because dielectric is not filled completely].
Hence new capacitance may be 200 $\mu\mu F$

9 **(a)**

Potential gradient along equipotential surface is zero.

i.e., $E\cos\theta = -\frac{dV}{dr} = 0$

$\therefore \quad \theta = 90°$

10 **(c)**

$$U_{system} = \frac{1}{4\pi\varepsilon_0}\frac{(q)(-2q)}{a} + \frac{1}{4\pi\varepsilon_0}\frac{(-2q)(q)}{a} + \frac{1}{4\pi\varepsilon_0}\frac{(q)(q)}{2a}$$

$$U_{system} = -\frac{7\,q^2}{8\pi\varepsilon_0 a}$$

11 **(c)**

In electric dipole, the flux coming out from positive charge is equal to the flux coming in at negative charge *i.e.* total charge on sphere $= 0$. From Gauss law, total flux passing through the sphere = 0

12 **(c)**

$$U = \frac{1}{4\pi\varepsilon_0}\left[\frac{Q_1Q_2}{r_1} + \frac{Q_2Q_3}{r_2} + \frac{Q_1Q_3}{r_3}\right]$$

$$U_{net} = 3 \times \frac{1}{4\pi\varepsilon_0} . \frac{q^2}{l}$$

14 **(a)**

There will be an electric field between two cylinders (using Gauss theorem). This electric field will produce a potential difference.

15 **(c)**

There will be a electrostatic repulsion between two charged bobs, but it does not affect the motion of pendulum. Thus, time period of pendulum remains same $ie, T = 2\pi\sqrt{\frac{l}{g}}$.

16 **(b)**

Inside the cavity, field at any point is uniform and non-zero.

17 **(a)**

The sphere will retain the charge for longer time, because in case of spherical metal conductor, the charge quickly spreads uniformly over the entire surface.

18 **(d)**

Coulomb force is given by

$$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}$$

$$\therefore (10 \times 10^{-3}) \times 10 = \frac{(9 \times 10^9) \times q^2}{(0.6)^2}$$

$$(\because q_1 = q_2 = q)$$

or $q^2 = \frac{10^{-1} \times 0.36}{9 \times 10^9}$

$= 4 \times 10^{-12}$

$q = 2 \times 10^{-6}\text{C} = 2\mu\text{C}$

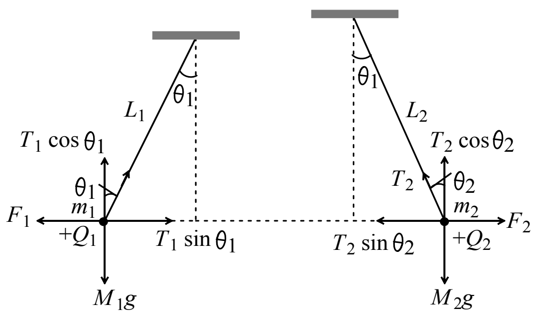
19 **(b)**

The three forces acting on each sphere are :

(i) Tension

(ii) Weight

(iii) Electrostatic force of repulsion



For sphere 1

In equilibrium, from figure

$T_1 \cos\theta_1 = M_1 g; T_1 \sin\theta_1 = F_1$

$\therefore \tan\theta_1 = \dfrac{F_1}{M_1 g}$

For sphere 2

In equilibrium, from figure

$T_2 \cos\theta_2 = M_2 g; T_2 \sin\theta_2 = F_2$

$\therefore \tan\theta_2 = \dfrac{F_2}{M_2 g}$

Force of repulsion between two charges are same.

$\therefore F_1 = F_2$

$\theta_1 = \theta_2$ only if $\frac{F_1}{M_1 g} = \frac{F_2}{M_2 g}$

But $F_1 = F_2$, then $M_1 = M_2$

20 **(c)**

Electric field is zero everywhere inside a metal (conductor) *i.e.*, field lines do not enter a 3 metal plus these are perpendicular to a metal surface (equipotential surface).

ANSWER-KEY										
Q.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A.	**A**	**C**	**B**	**B**	**C**	**C**	**C**	**C**	**A**	**C**
Q.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
A.	**C**	**C**	**C**	**A**	**C**	**B**	**A**	**D**	**B**	**C**