DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. :5

Topic :- Electric charges and fields

1 **(a)**

All charge resides on the outer surface so that according to Gauss law, electric field inside a shell is zero

2 **(c)**

Plane conducting surfaces facing each other must have equal and opposite charge densities. Here as the plate areas are equal, $Q_2 = -Q_3$.

The charge on a capacitor means the charge on the inner surface of the positive plate [Here it is Q_2]

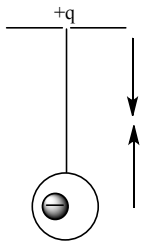
Potential difference between the plates

$$= \frac{\text{charge}}{\text{capacitance}} = \frac{Q_2}{C} = \frac{2Q_2}{2C}$$

$$= \frac{Q_2 - (-Q_2)}{2C} = \frac{Q_2 - Q_3}{2C}$$

3 **(c)**

There is no change in the restoring force as the electrostatic forces are the central forces. Negative and positive charges at the two extremeties of the string affect tension T which does not affect the restoring force



4 **(a)**

By using charge conservation $0.2 \times 600 = (0.2 + 1)V$

$$\Rightarrow V = \frac{0.2 \times 600}{1.2} = 100\ V$$

5 **(b)**

Nuclear force binds the protons and neutrons in the nucleus of an atom

6 **(d)**

Point charge produces non-uniform electric field

7 **(d)**

Due to symmetric charge distribution

8 **(b)**

$$V = \frac{C_1V_1 - C_2V_2}{C_1 + C_2} = \frac{6 \times 12 - 3 \times 12}{3 + 6} = 4\ volt$$

9 **(c)**

Because in case of metallic sphere either solid or hollow, the charge will reside on the surface of the sphere. Since both the spheres have same surface area, so they can hold equal maximum charge

10 **(b)**

Relation for electric field is given by $E = \frac{\lambda}{2\pi\varepsilon_0 r}$

[Given:$E = 7.182 \times 10^8\ N/C$]

$r = 2\ cm = 2 \times 10^{-2} m$

$$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \Rightarrow \lambda = 2\pi\varepsilon_0 rE = \frac{2 \times 2\pi\varepsilon_0 rE}{2}$$

$$= \frac{1 \times 2 \times 10^{-2} \times 7.182 \times 10^8}{2 \times 9 \times 10^9} = 7.98 \times 10^{-4} C/m$$

11 **(b)**

$$\vec{E} = -\frac{\sigma}{2\varepsilon_0}\hat{k} - \frac{2\sigma}{2\varepsilon_0}\hat{k} - \frac{\sigma}{2\varepsilon_0}\hat{k} = -\frac{2\sigma}{\varepsilon_0}\hat{k}$$

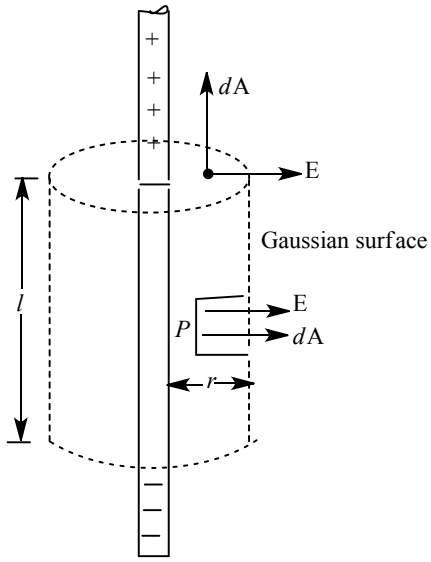
12 **(d)**

Force on charge $F = q(E_a) = q \times \frac{k.2p}{r^3} \Rightarrow F \propto \frac{1}{r^3}$

When $r \rightarrow$doubled;$F \rightarrow \frac{1}{8}$times

14 **(a)**

According to Gauss theorem for closed surface



Taking cylindrical Gaussian surface of radius r, height h curved surface$=2\pi rh$.

Electric flux through it $=E \times 2\pi rh$

Charge enclosed$=\lambda h$

$\therefore$ From Gauss theorem,

Charge $= \varepsilon_0 \times$ (Electric flux)

$\Longrightarrow \varepsilon_0 E \times 2\pi rh = \lambda h$

$$\Longrightarrow E = \frac{1}{2\pi\varepsilon_0} \cdot \frac{\lambda}{r} = \frac{\lambda}{2\pi\varepsilon_0 r}$$

15 **(a)**

In series $C' = C/n$ *i.e.* $C = nC' = 2 \times 3 = 6\ \mu F$

In parallel $C' = nC$ *i.e.* $C = \frac{C'}{n} = \frac{12}{2} = 6\ \mu F$

16 **(b)**

$$F_a = \frac{q_1 q_2}{4\pi\varepsilon_0 r^2}, F_b = \frac{q_1 q_2}{K4\pi\varepsilon_0 r^2} \Rightarrow F_a : F_b = K{:}1$$

17 **(b)**

Axis of an electric dipole is always directed from negative charge to the positive charge.

18 **(b)**

By using, $KE = QV \Rightarrow 4 \times 10^{20} \times 1.6 \times 10^{-19}$

$= 0.25 \times V \Rightarrow V = 256\ volt$

19 **(b)**

Charge of capacitor A is given by

$Q_1 = 15 \times 10^{-6} \times 100 = 15 \times 10^{-4} C$

Charge on capacitor B is given by

$Q_2 = 1 \times 10^{-6} \times 100 = 10^{-4} C$

Capacity of capacitor A after removing dielectric

$= \frac{15 \times 10^{-6}}{15} = 1\mu F$

Now when both capacitors are connected in parallel their equivalent capacitance will be

$C_{eq} = 1 + 1 = 2\mu F$

So common potential $= \frac{(15 \times 10^{-4}) + (1 \times 10^{-4})}{2 \times 10^{-6}} = 800V$

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