DPP

DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutio

Subject : PHYSICS
DPP No. :3

Topic :- Electric charges and fields

1 **(a)**

Since, the proton is moving against the direction of electric field, so work is done by the proton against electric field. It implies that electric field does negative work on the proton. Again, proton is moving in electric field from low potential region to high potential region hence, its potential energy increases

2 **(b)**

Potential energy of the system will be given by

$$= \frac{(-e)(-e)}{4\pi\varepsilon_0 r} = \frac{e^2}{4\pi\varepsilon_0 r}$$

As r decreases, potential energy increases

3 **(d)**

$$V = \frac{2q}{4\pi\varepsilon_0 L} - \frac{2q}{4\pi\varepsilon_0 L\sqrt{5}} = \frac{2q}{4\pi\varepsilon_0 L}\left[1 - \frac{1}{\sqrt{5}}\right] volt$$

4 **(a)**

$$\frac{1}{2}mv^2 = \frac{kQq}{r_1}$$

$$\frac{1}{2}m(4v^2) = \frac{kQq}{r_2}$$

From Eqs.(i) and (ii), we get

$$\frac{r_1}{r_2} = 4$$

$$r_2 = \frac{r}{4}$$

5 **(d)**

$F \propto \frac{1}{r^2}$; so when r is halved the force becomes four times

6 **(c)**

Electric field between the plates is

$$= \frac{\sigma}{2\varepsilon_0} - \frac{(-\sigma)}{2\varepsilon_0}$$

$= \frac{\sigma}{\varepsilon_0} volt/meter$

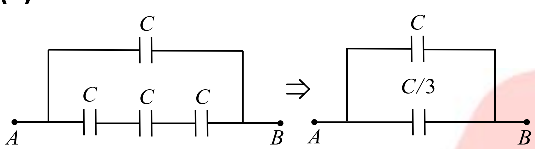
8 **(c)**

According to Gauss law $\oint E.ds = \frac{ql}{\varepsilon_0}$

$\oint E.ds = 2\pi rl$; [E is constant]

$\therefore E.2\pi rl = \frac{ql}{\varepsilon_0} \Rightarrow E = \frac{q}{2\pi\varepsilon_0 r}$ $i.e. E \propto \frac{1}{r}$

9 **(d)**



$\Rightarrow C_{eq} = \frac{C}{3} + C = \frac{4C}{3}$

10 **(b)**

$F \propto \frac{1}{r^2} \Rightarrow \frac{F_1}{F_2} = \left(\frac{r_2}{r_1}\right)^2 \Rightarrow \frac{5}{F_2} = \left(\frac{0.04}{0.06}\right)^2 = F_2 = 11.25N$

11 **(b)**

The charged particle could be positive or negative. The positive charge will move in the direction of the field. But negative charge will move opposite to the field

12 **(b)**

All the three plates will produce electric field at P along negative z-axis. Hence,

$\boldsymbol{E}_p = \left[\frac{\sigma}{2\varepsilon_0} + \frac{2\sigma}{2\varepsilon_0} + \frac{\sigma}{2\varepsilon_0}\right](-\hat{\boldsymbol{k}})$

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

13 **(b)**

Charge enclosed by cylindrical surface (length 100 cm) is $Q_{enc} = 100Q$. By applying Gauss's law $\phi = \frac{1}{\varepsilon_0}(Q_{enc.}) = \frac{1}{\varepsilon_0}(100Q)$

14 **(a)**

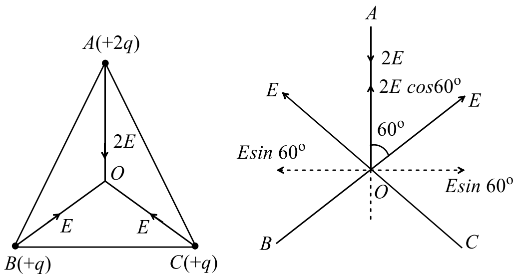
$KE = qV$

15 **(d)**

In the pressure of medium force becomes $\frac{1}{K}$ times

16 **(a)**

Resolve E along CO and BO into two perpendicular components



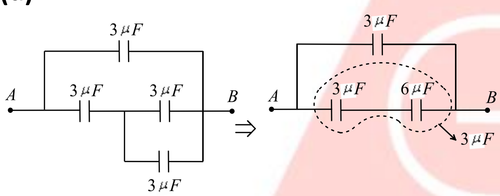
The sine components cancel each other
The cosine components add up along OA to give $2E\cos 60^{\circ}$
$\therefore$ Resultant field along $AO = 2E - 2E\cos 60°$
$= 2E - E = E$
$\therefore$ Resultant field is E along AO

17 **(d)**

Potential due to dipole in general position is given by

$$V = \frac{k.p\cos\theta}{r^2} \Rightarrow V = \frac{k.p\cos\theta\, r}{r^3} = \frac{k.(\vec{p}.\vec{r})}{r^3}$$

18 **(d)**



$\Rightarrow C_{AB} = 5\mu F$

19 **(d)**

The given figure is equivalent to a balanced Wheatstone's bridge, hence $C_{eq} = 6\ \mu F$

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