Physicsaholics

DPP – 1 (Electrostatics)

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/51

Video Solution on YouTube:- https://youtu.be/pHxYqEbyIfw

Written Solution on Website:- https://physicsaholics.com/note/notesDetalis/40

Q 1. The minimum electrostatic force between two charged particles placed at a distance of 1 m is:

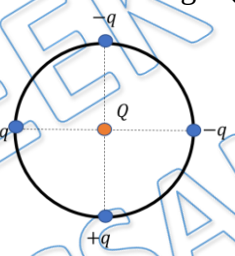
a) 2.3×10^{-28} N b) 6.2×10^{-34} N

c) 1.02×10^{-26}N d) 4.2×10^{-27}N

Q 2. If the distance between two point charges is increased by 3%, then calculate percentage decrease in force between them.

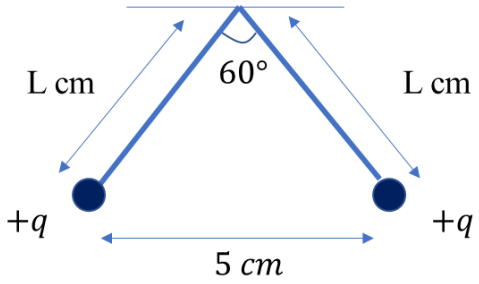
a) 3 % b) 5.7 % c) 9 % d) 1.5 %

Q 3. In the given figure calculate the force on charge Q placed at centre of circle of radius r.



(a) $\frac{1}{\sqrt{2}\pi\varepsilon_0}\frac{qQ}{r^2}$ (b) $\frac{1}{2\sqrt{2}\pi\varepsilon_0}\frac{qQ}{r^2}$ (c) $\frac{1}{\sqrt{2}\pi\varepsilon_0}\frac{qQ}{r}$ (d) $\frac{1}{8\pi\varepsilon_0}\frac{qQ}{r^2}$

Q 4. Two identically charged point spheres of mass 10 gm are suspended by thread of length L cm as shown in the figure. Calculate the charge on each sphere, If the distance between balls at equilibrium is 5 cm. [given: $(3)^{\frac{5}{4}} \approx 4$]



a) $12.5 \times 10^{-9}\ C$ b) $12.5 \times 10^{-8}\ C$ c) $12.5 \times 10^{-7}\ C$ d) $12.5 \times 10^{-6}\ C$

Q 5. The force between two charges when separated by a distance of 50 cm in air is 40 newtons. What will be the force between them if the distance becomes 25 cm?

a) 160 N b) 80 N c) 20 N d) 120 N

Q 6. A charge q is placed at the centre of the line joining two charges Q. The system of three charges will be in equilibrium if q is equal to

a) $-\frac{Q}{2}$ b) $-\frac{Q}{4}$

c) $+\frac{Q}{2}$ d) $+\frac{Q}{4}$

Q 7. A force F is acting between charges placed in vacuum. If the glass plate of dielectric constant K = 6 is now placed between them, the net force on charges now will be:

a) $6F$ b) $\frac{F}{6}$ c) $Zero$ d) $\frac{F}{36}$

Q 8. Three charges each of 5×10^{-6} coloumbs are placed at vertex of an equilateral triangle of side 10 cm. The force exerted on the charge of 1 μC placed at centre of triangle in Newton will be:

a) 13.5 b) zero c) 4.5 d) 6.75

Q 9. Three charges of equal magnitude are placed at three corners of square. If the force acting between q_1 and q_2 (placed along a side) is F_{12} and that between q_1 and q_3 (placed along a diagonal) is F_{13} then the ratio of $\frac{F_{12}}{F_{13}}$ will be:

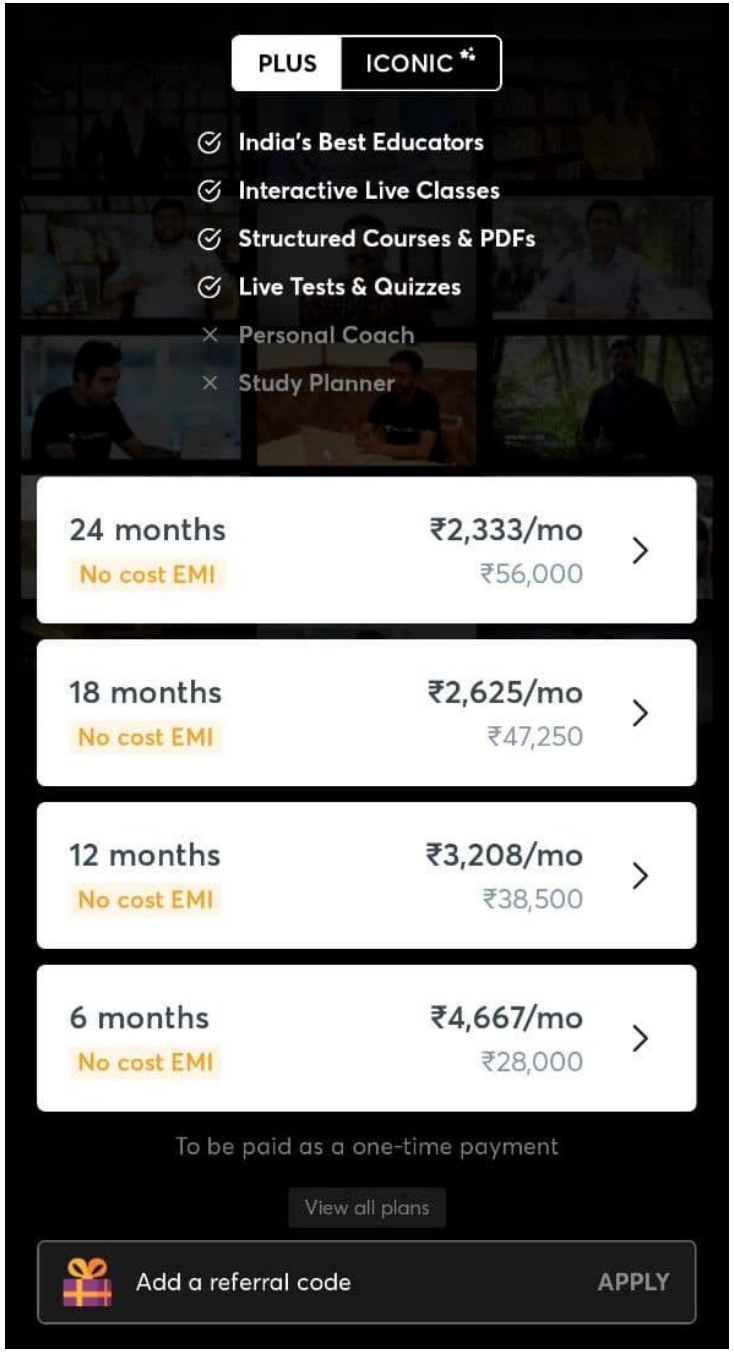
a) $\frac{1}{2}$ b) $\frac{1}{\sqrt{2}}$ c) 2 d) $\sqrt{2}$

Q 10. At all the four corners of a square a charge + q is placed. What should be the value of charge which is to be placed at the centre of square such that the entire system will be in equilibrium:

a) 5q b) -5q c) -0.96q d) q

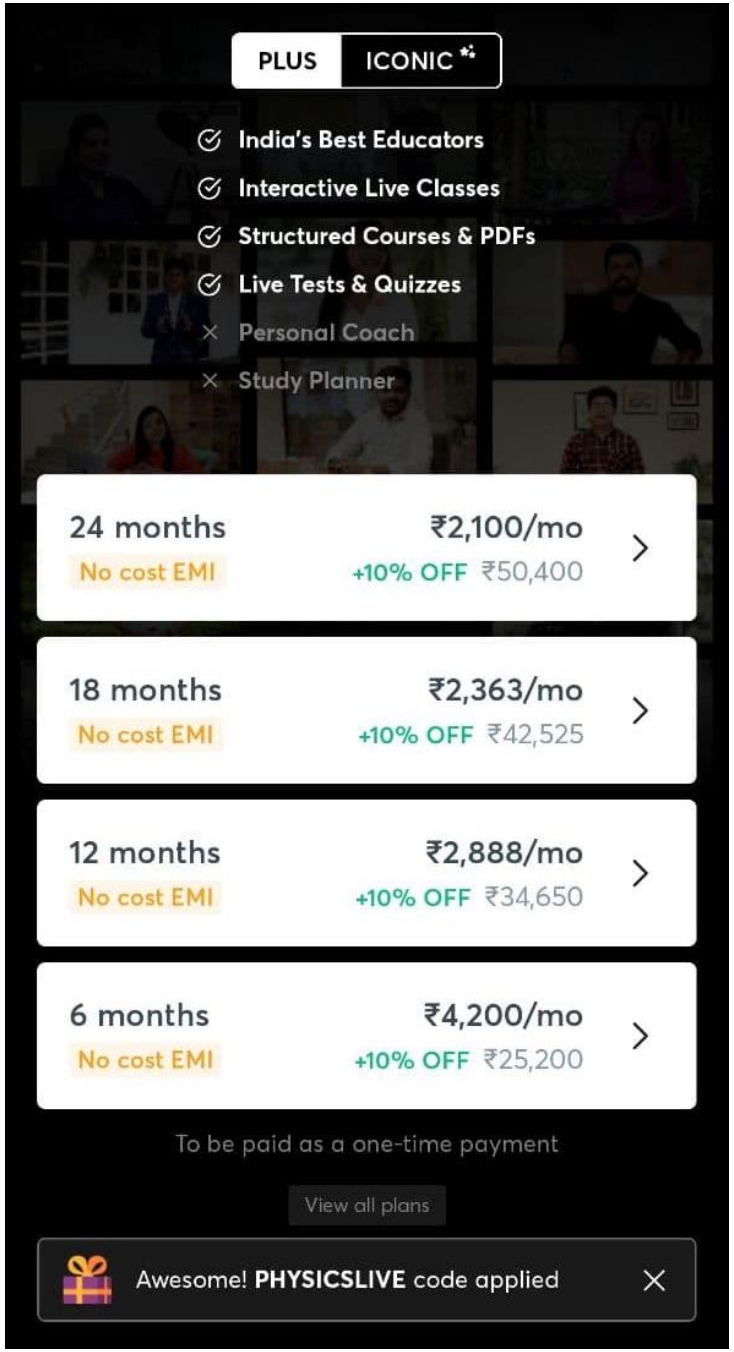
Answer Key

Q.1 a	**Q.2 b**	**Q.3 a**	**Q.4 b**	**Q.5 a**
Q.6 b	**Q.7 b**	**Q.8 b**	**Q.9 c**	**Q.10 c**



PHYSICSLIVE

Use code PHYSICSLIVE to get 10% OFF on Unacademy PLUS.



Written Solution

DPP-1 Coulomb's law

By Physicsaholics Team

Solution: 1

$$F = \frac{k e^2}{(1m)^2} = \frac{9 \times 10^9 \times 1.6 \times 10^{-19} \times 1.6 \times 10^{-19}}{1^2}$$

$$F \simeq 2.3 \times 10^{-28} N$$

Ans. a

Solution: 2

$$F_1 = \frac{kq_1q_2}{r^2}$$

Now $r \rightarrow 1.03r$

~~Now force between them~~

$$F_2 = \frac{kq_1q_2}{(1.03r)^2} = \frac{F_1}{(1.03)^2}$$

$$F_2 = \frac{F_1}{1.06} \Rightarrow (F_2 < F_1)$$

$$\% \text{ change} = \frac{F_1 - F_2}{F_1} \times 100$$

$$= \frac{F_1 - \frac{F_1}{1.06}}{F_1} \times 100$$

$$= \frac{F_1\left(\frac{1.06 - 1}{1.06}\right)}{F_1} \times 100$$

$$= 0.0566 \times 100$$

$$= 5.66\%$$

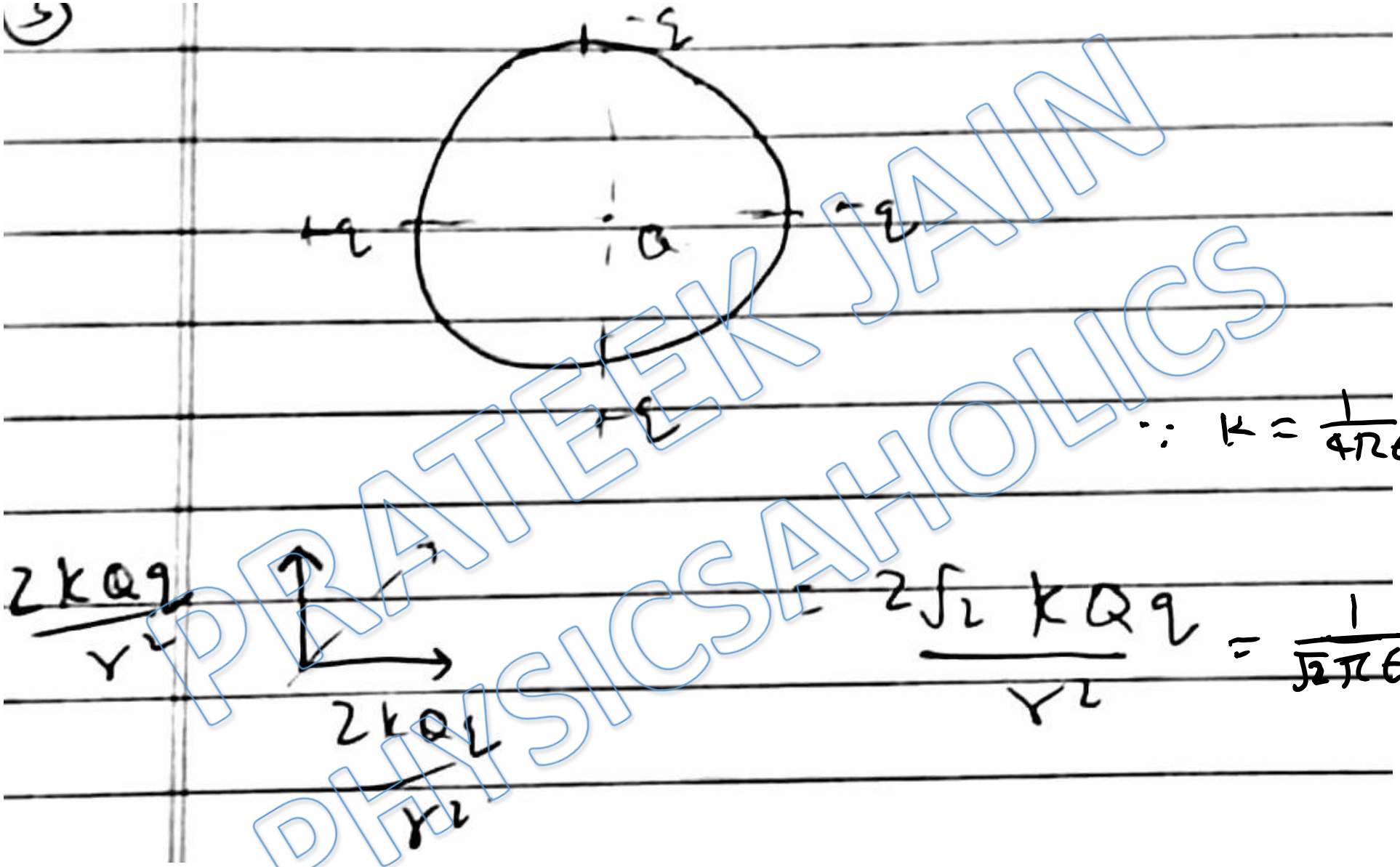
% change = 5.7 %

(decreament)

[$\because r\uparrow \Rightarrow F\downarrow$]

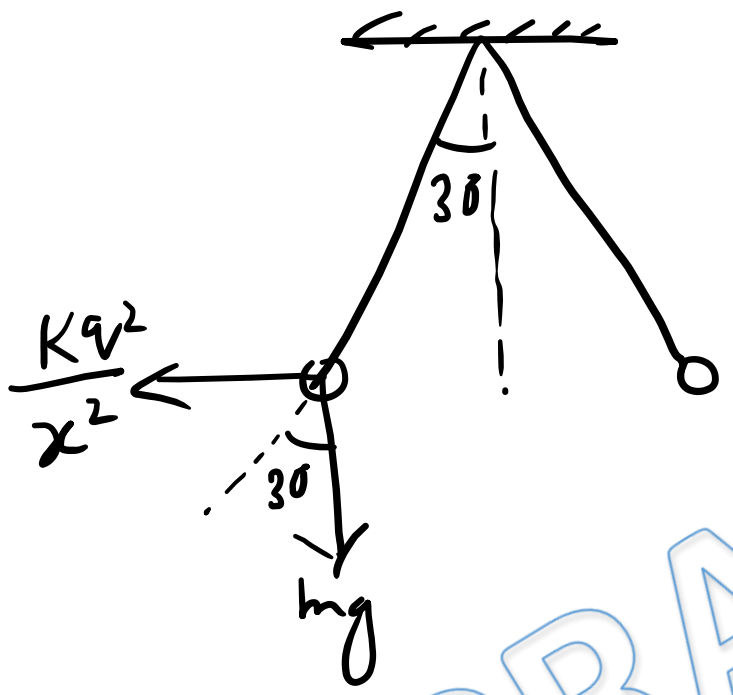
Ans. b

Solution: 3



Ans. a

Solution: 4



- $m = 10\,gram$, $x = 5\,cm$

$$\tan 30^\circ = \frac{Kq^2}{x^2 mg} = \frac{1}{\sqrt{3}}$$

$$q^2 = \frac{x^2 mg}{\sqrt{3}K} = \frac{25\times10^{-4}\times10^{-2}\times10}{\sqrt{3}\times9\times10^{9}}$$

$$q^2 = \frac{25}{9\sqrt{3}}\times10^{-14}$$

$$q = \frac{5}{(3)^{5/4}}\times10^{-7}$$

$$= \frac{5}{4}\times10^{-7}$$

$$= 12.5\times10^{-8}\,C$$

Ans. b

Solution: 5

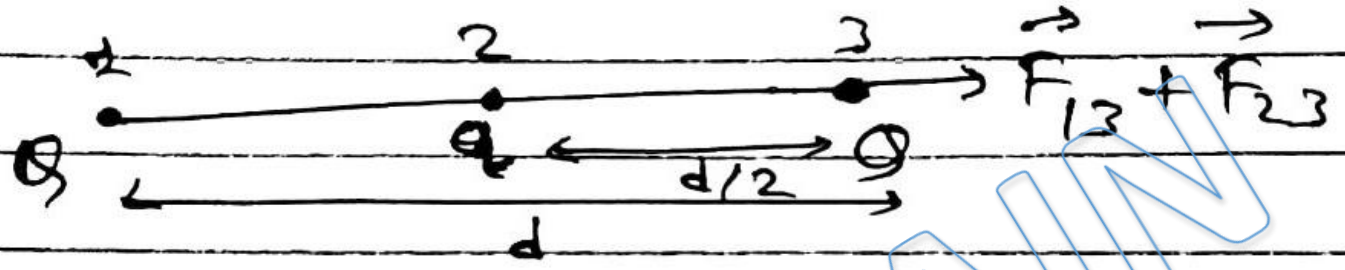
$$F = \frac{k q_1 q_2}{r^2}$$

$$40 = \frac{k q_1 q_2}{(50\,cm)^2} \Rightarrow k q_1 q_2 = 40 \times (50\,cm)^2$$

$$F = \frac{k q_1 q_2}{(25\,cm)^2} = \frac{40 \times (50\,cm)^2}{(25\,cm)^2} = 160\,N$$

Ans. a

Solution: 6



For equilibrium of system, all charges should have $F_{net} = 0$

$\therefore$ let F_{net} on charge-3

$$\vec{F}_{13} + \vec{F}_{23} = 0$$

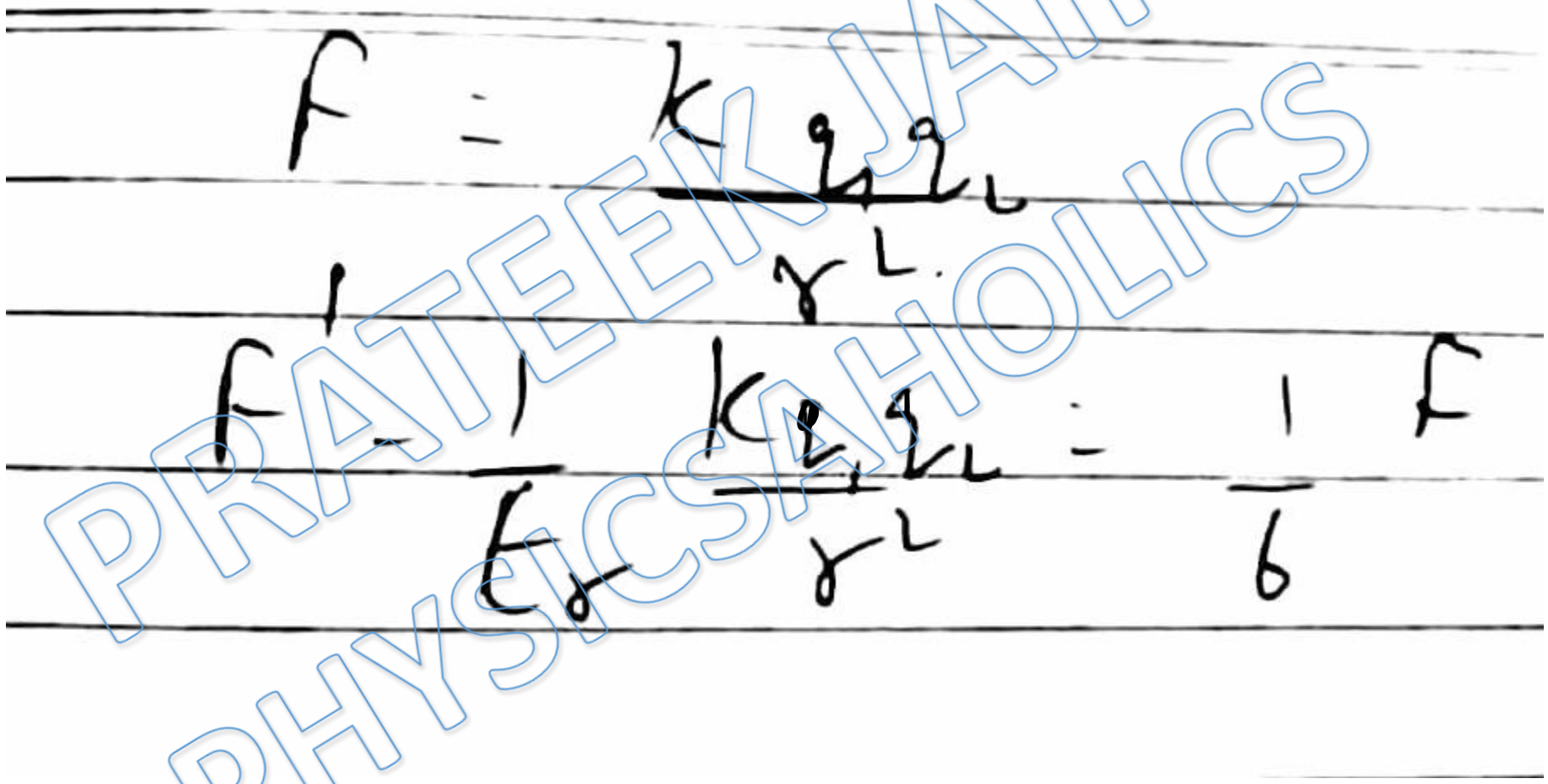
$$\frac{kQ \cdot Q}{d^2} + \frac{kqQ}{(d/2)^2} = 0$$

$$\frac{kQ}{d^2}\left[Q + 4q\right] = 0$$

$$\boxed{q = -\frac{Q}{4}}$$

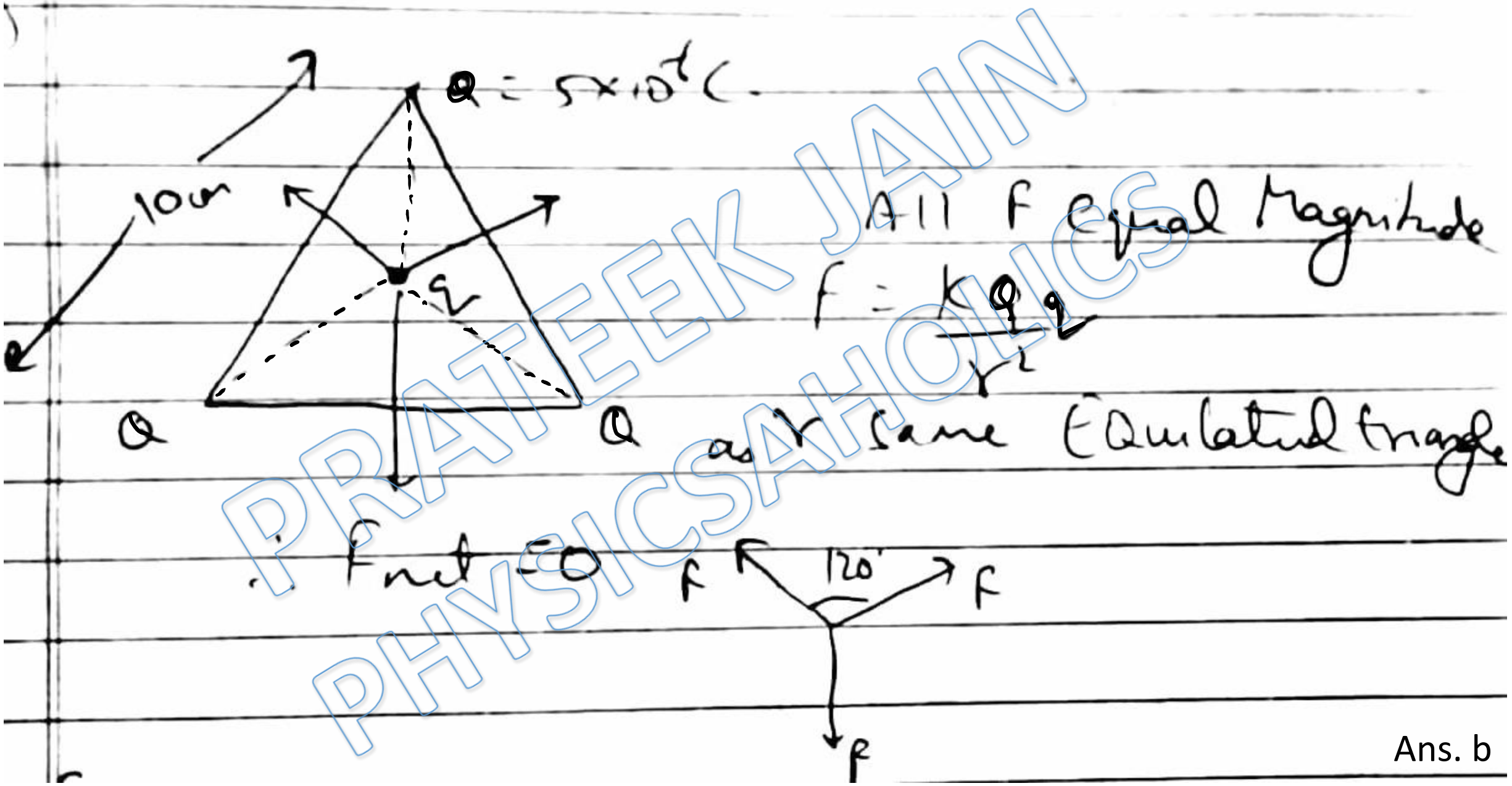
Ans. a

Solution: 7



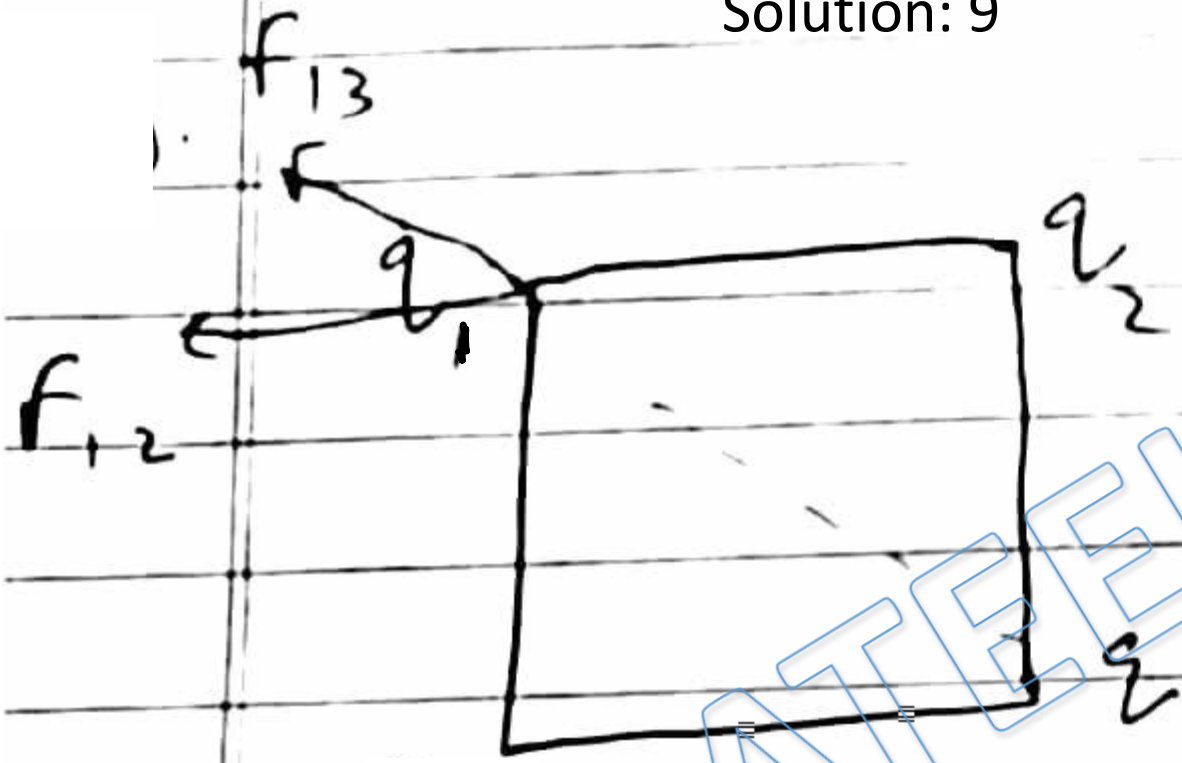
Ans. b

Solution: 8



Ans. b

Solution: 9



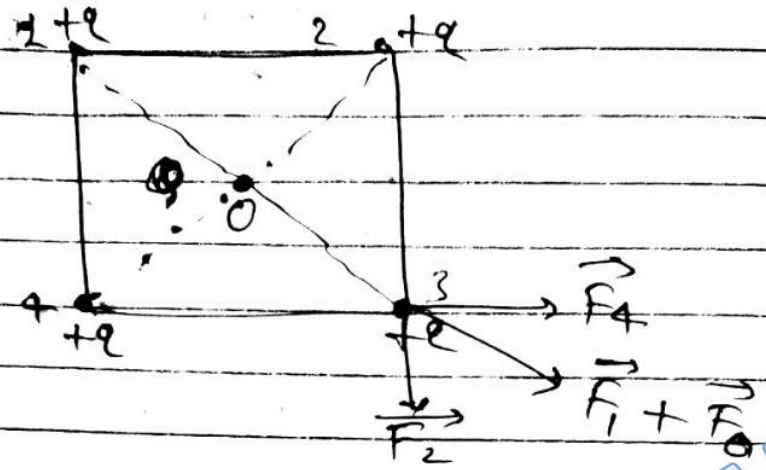
$$f_{13} = \frac{kq^2}{(\sqrt{2}a)^2} = \frac{kq^2}{2a^2}$$

$$f_{12} = \frac{kq^2}{a^2}$$

$$\therefore \frac{f_{12}}{f_{13}} = \frac{\frac{kq^2}{a^2}}{\frac{kq^2}{2a^2}} = 2$$

Ans. c

Solution: 10



For equilibrium, net force on each charge should be zero.

Let net force of charge 3 is $\vec{F}_{net}$

then $\Rightarrow \vec{F}_{net} = \vec{F}_2 + \vec{F}_1 + \vec{F}_0 + \vec{F}_4$

$\therefore |\vec{F}_2| = |\vec{F}_4| = \frac{kq \cdot q_0}{a^2}$

& $\vec{F}_2$ & $\vec{F}_4$ are perpendicular;

so, their resultant will be $\vec{F} = \sqrt{2}\frac{kqq}{a^2}$ in the direction of force $\vec{F}_1$ & $\vec{F}_0$

$\therefore$ net force of charge '3'

$$\vec{F}_{net} = \vec{F} + \vec{F}_1 + \vec{F}_0$$

$$= \sqrt{2}\frac{kq \cdot q_0}{a^2} + \frac{kq \cdot q_0}{(\sqrt{2}a)^2} + \frac{kqQ}{(a/\sqrt{2})^2} = 0$$

$$= \frac{kq}{a^2}\left[\sqrt{2}q + \frac{q}{2} + 2Q\right] = 0$$

$$2Q = -\left[\sqrt{2}q + \frac{q}{2}\right]$$

$$Q = -\frac{1}{2}\left[\sqrt{2}q + \frac{q}{2}\right]$$

$$Q = -\frac{1}{4}\left[2\sqrt{2}q + q\right]$$

$$Q = -\frac{q}{4}\left[2\sqrt{2} + 1\right]$$

$$\boxed{Q = -0.96q}$$

Ans. c

For Video Solution of this DPP, Click on below link

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/51

Video Solution on YouTube:- https://youtu.be/pHxYqEbyIfw

Written Solution on Website:- https://physicsaholics.com/note/notesDetalis/40

@Physicsaholics

@Physicsaholics_prateek

@NEET_Physics
@IITJEE_Physics

physicsaholics.com

CLICK

Chalo Niklo