Om Pathshala
Physics

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Numerical based on Electrical Force and Potential

1. If three charges $Q_1 = 0.000126$ Coulomb, $Q_2 = -7.2 \times 10^{-5}$ Coulomb and $Q_3 = 6.3 \times 10^{-5}$ Coulomb are placed at three points. As A (4,6) , B (13,3) and C (10,8) then Find Net electrostatic force on charge at C and net eletrostatic potential at the mid point of AB line.
2. If the Charge of a particle is 1.08$\times10^{-5}$ Coulomb and is at a distance of 0.2 meter from a positve charge of 2.16$\times10^{-6}$ Coulomb . Then find the Electrostatic Force between them and locate the neutral point between the charges also find total electrical potential at neutral point.
3. If the Charge of a particle is -1.2$\times10^{-6}$ Coulomb and is at a distance of 1.2 meter from a positve charge of -1.44$\times10^{-6}$ Coulomb . Then find the Electrostatic Force between them and locate the neutral point between the charges also find total electrical potential at neutral point.
4. If three charges Q_1 = 3.2$\times10^{-5}$ Coulomb, Q_2 = -6.4$\times10^{-5}$ Coulomb and Q_3 = 0.000168 Coulomb are placed at three points. As A (2,9) , B (10,11) and C (8,17) then Find Net electrostatic force on charge at C and net eletrostatic potential at the mid point of AB line.
5. If Four charges Q_1 = -1.8$\times10^{-5}$ Coulomb, Q_2 = 1.2$\times10^{-5}$ Coulomb , Q_3 = -2.6$\times10^{-5}$ Coulomb Q4 = 3.2$\times10^{-5}$ Coulomb are placed at three points. As A (5,7) , B (6,3) , C (4,10) and D (6,2) then Find Net electrostatic force on charge at D and Net electrostatic Potential at the mid point of AB.
6. If the Charge of a particle is -2.4$\times10^{-6}$ Coulomb and is at a distance of 0.8 meter from a positve charge of -1.92$\times10^{-6}$ Coulomb . Then find the Electrostatic Force between them and locate the neutral point between the charges also find total electrical potential at neutral point.
7. If three charges Q_1 = -3.8$\times10^{-5}$ Coulomb, Q_2 = 1.4$\times10^{-5}$ Coulomb and Q_3 = -4$\times10^{-5}$ Coulomb are placed at three points. As A (3,7) , B (3,6) and C (2,3) then Find Net electrostatic force on charge at C and net eletrostatic potential at the mid point of AB line.
8. If three charges Q_1 = -1.7$\times10^{-5}$ Coulomb, Q_2 = 8$\times10^{-6}$ Coulomb and Q_3 = -2$\times10^{-5}$ Coulomb are placed at three points. As A (2,6) , B (1,6) and C (18,16) then Find Net electrostatic force on charge at C and net eletrostatic potential at the mid point of AB line.
9. If the Charge of a particle is -3$\times10^{-7}$ Coulomb and is at a distance of 1.2 meter from a positve charge of -3.6$\times10^{-7}$ Coulomb . Then find the Electrostatic Force between them and locate the neutral point between the charges also find total electrical potential at neutral point.
10. If three charges Q_1 = -1.1$\times10^{-5}$ Coulomb, Q_2 = 8$\times10^{-6}$ Coulomb and Q_3 = -2.5$\times10^{-5}$ Coulomb are placed at three points. As A (5,8) , B (10,11) and C (13,18) then Find Net electrostatic force on charge at C and net eletrostatic potential at the mid point of AB line.
11. If the Charge of a particle is -1.2$\times10^{-6}$ Coulomb and is at a distance of 0.4 meter from a positve charge of -4.8$\times10^{-7}$ Coulomb . Then find the Electrostatic Force between them and locate the neutral point between the charges also find total electrical potential at neutral point.
12. If the Charge of a particle is -9$\times10^{-7}$ Coulomb and is at a distance of 0.4 meter from a positve charge of -3.6$\times10^{-7}$ Coulomb . Then find the Electrostatic Force between them and locate the neutral point between the

charges also find total electrical potential at neutral point.

13. If three charges $Q_1 = 3.6\times10^{-5}$ Coulomb, Q_2 = -1.8×10^{-5} Coulomb and $Q_3 = 1.5\times10^{-5}$ Coulomb are placed at three points. As A (1,4) , B (2,3) and C (4,4) then Find Net electrostatic force on charge at C and net eletrostatic potential at the mid point of AB line.

14. If Four charges Q_1 = 2.7×10^{-5} Coulomb, Q_2 = -2.4×10^{-5} Coulomb , Q_3 = 0.000108 Coulomb Q4 = -7.2×10^{-5} Coulomb are placed at three points. As A (5,5) , B (11,13) , C (7,7) and D (-1,21) then Find Net electrostatic force on charge at D and Net electrostatic Potential at the mid point of AB.

15. If Four charges Q_1 = 0.000133 Coulomb, Q_2 = -5.6×10^{-5} Coulomb , Q_3 = 0.000266 Coulomb Q4 = -2.1×10^{-5} Coulomb are placed at three points. As A (3,3) , B (13,-1) , C (1,-2) and D (4,11) then Find Net electrostatic force on charge at D and Net electrostatic Potential at the mid point of AB.

16. If three charges $Q_1 = 3.9\times10^{-5}$ Coulomb, Q_2 = -2.4×10^{-5} Coulomb and $Q_3 = 3.3\times10^{-5}$ Coulomb are placed at three points. As A (7,2) , B (7,3) and C (18,14) then Find Net electrostatic force on charge at C and net eletrostatic potential at the mid point of AB line.

17. If the Charge of a particle is 3.6×10^{-6} Coulomb and is at a distance of 0.6 meter from a positve charge of 2.16×10^{-6} Coulomb . Then find the Electrostatic Force between them and locate the neutral point between the charges also find total electrical potential at neutral point.

18. If the Charge of a particle is 3.6×10^{-6} Coulomb and is at a distance of 0.2 meter from a positve charge of 7.200001×10^{-7} Coulomb . Then find the Electrostatic Force between them and locate the neutral point between the charges also find total electrical potential at neutral point.

19. If Four charges Q_1 = 2.4×10^{-5} Coulomb, Q_2 = -2.1×10^{-5} Coulomb , Q_3 = 5.1×10^{-5} Coulomb Q4 = -1.5×10^{-5} Coulomb are placed at three points. As A (9,6) , B (5,1) , C (11,9) and D (2,9) then Find Net electrostatic force on charge at D and Net electrostatic Potential at the mid point of AB.

20. If three charges $Q_1 = 4.2\times10^{-5}$ Coulomb, Q_2 = -5.4×10^{-5} Coulomb and Q_3 = 0.000108 Coulomb are placed at three points. As A (6,5) , B (14,1) and C (2,11) then Find Net electrostatic force on charge at C and net eletrostatic potential at the mid point of AB line.

21. If Four charges $Q_1 = 3.6\times10^{-5}$ Coulomb, Q_2 = -5.4×10^{-5} Coulomb , Q_3 = 0.00015 Coulomb Q4 = -7.2×10^{-5} Coulomb are placed at three points. As A (0,5) , B (12,4) , C (5,0) and D (6,11) then Find Net electrostatic force on charge at D and Net electrostatic Potential at the mid point of AB.

22. If the Charge of a particle is 1.8×10^{-6} Coulomb and is at a distance of 0.6 meter from a positve charge of 1.08×10^{-6} Coulomb . Then find the Electrostatic Force between them and locate the neutral point between the charges also find total electrical potential at neutral point.

23. If the Charge of a particle is 3.6×10^{-6} Coulomb and is at a distance of 1.4 meter from a positve charge of 5.04×10^{-6} Coulomb . Then find the Electrostatic Force between them and locate the neutral point between the charges also find total electrical potential at neutral point.

24. If Four charges Q_1 = 0.000104 Coulomb, Q_2 = -4×10^{-5} Coulomb , Q_3 = 4×10^{-5} Coulomb Q4 = -0.000176 Coulomb are placed at three points. As A (6,2) , B (4,-2) , C (0,-2) and D (-4,25) then Find Net electrostatic force on charge at D and Net electrostatic Potential at the mid point of AB.

25. If three charges $Q_1 = 4.5\times10^{-5}$ Coulomb, Q_2 = -3.6×10^{-5} Coulomb and $Q_3 = 4.5\times10^{-5}$ Coulomb are placed at three points. As A (8,2) , B (9,10) and C (7,19) then Find Net electrostatic force on charge at C and net eletrostatic potential at the mid point of AB line.

26. If Four charges Q_1 = 0.00012 Coulomb, Q_2 = -3.2×10^{-5} Coulomb , Q_3 = 7.2×10^{-5} Coulomb Q4 = -0.000112 Coulomb are placed at three points. As A (9,1) , B (6,13) , C (14,2) and D (4,4) then Find Net electrostatic force on charge at D and Net electrostatic Potential at the mid point of AB.

27. If Four charges $Q_1 = 6\times10^{-6}$ Coulomb, Q_2 = -2.1×10^{-5} Coulomb , $Q_3 = 4.5\times10^{-5}$ Coulomb Q4 = -6.6×10^{-5} Coulomb are placed at three points. As A (4,1) , B (3,4) , C (2,19) and D (-3,-2) then Find Net electrostatic

force on charge at D and Net electrostatic Potential at the mid point of AB.

28. If the Charge of a particle is 3.6×10^{-6} Coulomb and is at a distance of 0.8 meter from a positve charge of 2.88×10^{-6} Coulomb . Then find the Electrostatic Force between them and locate the neutral point between the charges also find total electrical potential at neutral point.

29. If Four charges $Q_1 = 4.5\times10^{-5}$ Coulomb, Q_2 = -3.6×10^{-5} Coulomb , Q_3 = 0.000342 Coulomb Q4 = -0.000144 Coulomb are placed at three points. As A (1,2) , B (3,0) , C (9,4) and D (0,21) then Find Net electrostatic force on charge at D and Net electrostatic Potential at the mid point of AB.

Answer Sheet

1. Solution: According to Coulomb's Law :(a) Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_C} = \overrightarrow{F_{AC}} + \overrightarrow{F_{BC}}$
$= \frac{1}{4\pi\epsilon_0}[\frac{Q_A \times Q_C}{|\overrightarrow{r_{AC}}|^3} \times \overrightarrow{r_{AC}} + \frac{1}{4\pi\epsilon_0}\frac{Q_B \times Q_C}{|\overrightarrow{r_{BC}}|^3} \times \overrightarrow{r_{AC}}] = 9 \times 10^9 \times [(0.000126 \times 6.3 \times 10^{-5}) \times (6i + 2j)/252.9822 + (-7.2 \times 10^{-5} \times 6.3 \times 10^{-5}) \times (-3i + 5j)/198.2524]$
$= 9.0 \times 10^9 \left[2.5691 \times 10^{-10}i - 5.1644 \times 10^{-11}j\right]$ = 2.312154 i + -0.4647982 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| = 2.358409$ Newton

(b) According to Coulomb's Law : Electro static Potential V is given as $V = \frac{1}{4\pi\epsilon_0} \times \frac{Q}{R}$. So Net electrostatic Potential at mid point say P will be given as:
$V_P = V_{AP} + V_{BP} + V_{CP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}} + \frac{Q_B}{r_{BP}} + \frac{Q_C}{r_{CP}}] = 9 \times 10^9 \times [(0.000126/(4.743416)) + (-7.2 \times 10^{-5}/(4.743416)) + (6.3 \times 10^{-5}/(3.807887)) = 9.0 \times 10^9 \times 2.7929 \times 10^{-5}$
$\Rightarrow V_P$ = 251359.3 Volt

2. SOLUTION: (a) As we know Electrostatic force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$
$= 9 \times 10^9 \times [\ 1.08 \times 10^{-5} \times 2.16 \times 10^{-6} / (\ 0.04)]$ = 5.2488 Newton
(b) Let the neutral point is at a distance of $\times$ meter from First charge towards second charge . As net electrostatic force at neutral point is zero means $\left|\overrightarrow{F_{1n}}\right| = \left|\overrightarrow{F_{2n}}\right|$
$\Rightarrow 9 \times 10^9 \times (1.08 \times 10^{-5}/x^2) = 9 \times 10^9 \times (2.16 \times 10^{-6}/(0.2 - x)^2)$, Solution is : $\{x = .3618\}$, $\{x = .1382\}$ meter from first charge towards second charge
(c) Let the potential at midpoint say P between the chages is Vp . So Vp will be given as : $V_P = V_1 + V_2 = 9 \times 10^9 \times [(1.08 \times 10^{-5}/(0.1)) + (2.16 \times 10^{-6}/(0.1))]$
$= 9.0 \times 10^9 \times 1.296 \times 10^{-4} = 1.1664 \times 10^6 =$ 1166400Volt

3. SOLUTION: (a) As we know Electrostatic force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$
$= 9 \times 10^9 \times [-1.2 \times 10^{-6} \times (-1.44 \times 10^{-6}/(1.44)] = 9.0 \times 10^9 \times 1.2 \times 10^{-12}$ = 0.0108 Newton
(b) Let the neutral point is at a distance of $\times$ meter from First charge towards second charge . As net electrostatic force at neutral point is zero means $\left|\overrightarrow{F_{1n}}\right| = \left|\overrightarrow{F_{2n}}\right|$
$\Rightarrow 9 \times 10^9 \times (-1.2 \times 10^{-6}/x^2) = 9 \times 10^9 \times (-1.44 \times 10^{-6}/(1.2 - x)^2)$, Solution is : $\{x = .57267\}$, $\{x = -12.573\}$ meter from first charge towards second charge
(c) Let the potential at midpoint say P between the chages is Vp . So Vp will be given as :
$V_P = V_1 + V_2 = 9 \times 10^9 \times [(-1.2 \times 10^{-6}/(0.6)) + (-1.44 \times 10^{-6}/(0.6))] = 9.0 \times 10^9 \left[-4.4 \times 10^{-6}\right]$
$= -39600$ Volt

4. Solution: According to Coulomb's Law :(a) Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_C} = \overrightarrow{F_{AC}} + \overrightarrow{F_{BC}}$
$= \frac{1}{4\pi\epsilon_0}[\frac{Q_A \times Q_C}{|\overrightarrow{r_{AC}}|^3} \times \overrightarrow{r_{AC}} + \frac{1}{4\pi\epsilon_0}\frac{Q_B \times Q_C}{|\overrightarrow{r_{BC}}|^3} \times \overrightarrow{r_{AC}}]$
$= 9 \times 10^9 \times [(3.2 \times 10^{-5} \times 0.000168) \times (6i + 8j)/1000 + (-6.4 \times 10^{-5} \times 0.000168) \times (-2i + 6j)/252.9822] = 9.0 \times 10^9 \left[1.1726 \times 10^{-10}i - 2.12 \times 10^{-10}j\right]$ = 1.055322 i + -1.907983 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| = 2.180391$ Newton

(b) According to Coulomb's Law : Electro static Potential V is given as $V = \frac{1}{4\pi\epsilon_0} \times \frac{Q}{R}$. So Net electrostatic Potential at mid point say P will be given as $V_P = V_{AP} + V_{BP} + V_{CP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}} + \frac{Q_B}{r_{BP}} + \frac{Q_C}{r_{CP}}] = 9 \times 10^9 \times [(3.2 \times 10^{-5}/(4.123106)) + (-6.4 \times 10^{-5}/(4.123106)) + (0.000168/(7.28011)) =$

$9.0 \times 10^9 \times 1.5315 \times 10^{-5}$
$\Rightarrow V_P$ = 137838.9 Volt

5. Solution: According to Coulomb's Law : Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_D} = \overrightarrow{F_{AD}} + \overrightarrow{F_{BD}} + \overrightarrow{F_{CD}} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A \times Q_D}{|\overrightarrow{r_{AD}}|^3} \times \overrightarrow{r_{AD}} + \frac{Q_B \times Q_D}{|\overrightarrow{r_{BD}}|^3} \times \overrightarrow{r_{BD}} + \frac{Q_C \times Q_D}{|\overrightarrow{r_{CD}}|^3} \times \overrightarrow{r_{CD}}]$
$= 9 \times 10^9 \times [(-1.8 \times 10^{-5} \times 3.2 \times 10^{-5}) \times (1i + -5j)/132.5745 + (1.2 \times 10^{-5} \times 3.2 \times 10^{-5}) \times (0i + -1j)/1 + (-2.6 \times 10^{-5} \times 3.2 \times 10^{-5}) \times (2i + -8j)/560.7424]$
$= 9.0 \times 10^9 \left[-7.3122 \times 10^{-12} i - 3.5041 \times 10^{-10} j\right] = -0.06580999i + -3.153658j$ Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| = 3.154344$ Newton

(b) According to Coulomb's Law : Electro static Potential due to charges Q is given as $V = \frac{1}{4\pi\epsilon_0} \times \frac{Q}{R}$. So Net electrostatic Potential on P will be given as:
$V_P = V_{AP} + V_{BP} + V_{CP} + V_{DP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}} + \frac{Q_B}{r_{BP}} + \frac{Q_C}{r_{CP}} + \frac{Q_D}{r_{DP}}] = 9 \times 10^9 \times [(-1.8 \times 10^{-5}/2.061553) + (1.2 \times 10^{-5}/2.061553) + (-2.6 \times 10^{-5}/5.220153) + (3.2 \times 10^{-5}/3.04138)1$
$= 9.0 \times 10^9 \times 2.6304 \times 10^{-6} = 23674.$Volt

6. SOLUTION: (a) As we know Electrostatic force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$
$= 9 \times 10^9 \times [-2.4 \times 10^{-6} \times (-1.92 \times 10^{-6}/(0.64)]$
$= 9.0 \times 10^9 \times 7.2 \times 10^{-12}$ = 0.06480001 Newton
(b) Let the neutral point is at a distance of$\times$ meter from First charge towards second charge . As net electrostatic force at neutral point is zero means $\left|\overrightarrow{F_{1n}}\right| = \left|\overrightarrow{F_{2n}}\right|$
$\Rightarrow 9 \times 10^9 \times (-2.4 \times 10^{-6}/x^2) = 9 \times 10^9 \times (-1.92 \times 10^{-6}/(0.8 - x)^2)$, Solution is : $\{x = .42229\}$, $\{x = 7.5777\}$ meter from first charge towards second charge
(c) Let the potential at midpoint say P between the chages is Vp . So Vp will be given as : $V_P = V_1 + V_2 = 9 \times 10^9 \times [(-2.4 \times 10^{-6}/(0.4)) + (-1.92 \times 10^{-6}/(0.4))]$
$= 9.0 \times 10^9 \left[-1.08 \times 10^{-5}\right]$ = -97200.01 Volt

7. Solution: According to Coulomb's Law :(a) Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_C} = \overrightarrow{F_{AC}} + \overrightarrow{F_{BC}}$
$= \frac{1}{4\pi\epsilon_0}[\frac{Q_A \times Q_C}{|\overrightarrow{r_{AC}}|^3} \times \overrightarrow{r_{AC}} + \frac{1}{4\pi\epsilon_0}\frac{Q_B \times Q_C}{|\overrightarrow{r_{BC}}|^3} \times \overrightarrow{r_{AC}}] = 9 \times 10^9 \times [(-3.8 \times 10^{-5} \times (-4 \times 10^{-5}) \times (-1i + -4j)/70.0928 + (1.4 \times 10^{-5} \times (-4 \times 10^{-5}) \times (-1i + -3j)/31.62278]$
$= 9.0 \times 10^9 \left[-3.9768 \times 10^{-12} i - 3.3616 \times 10^{-11} j\right] = -0.03579102i + -0.3025429j$ Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| = 0.3046526$ Newton

(b) According to Coulomb's Law : Electro static Potential V is given as $V = \frac{1}{4\pi\epsilon_0} \times \frac{Q}{R}$. So Net electrostatic Potential at mid point say P will be given as$V_P = V_{AP} + V_{BP} + V_{CP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}} + \frac{Q_B}{r_{BP}} + \frac{Q_C}{r_{CP}}] = 9 \times 10^9 \times [(-3.8 \times 10^{-5}/(0.5)) + (1.4 \times 10^{-5}/(0.5)) + (-4 \times 10^{-5}/(3.640055)) = 9.0 \times 10^9 \left[-5.8989 \times 10^{-5}\right]$
$\Rightarrow V_P$ = -530899.6 Volt

8. Solution: According to Coulomb's Law :(a) Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_C} = \overrightarrow{F_{AC}} + \overrightarrow{F_{BC}}$
$= \frac{1}{4\pi\epsilon_0}[\frac{Q_A \times Q_C}{|\overrightarrow{r_{AC}}|^3} \times \overrightarrow{r_{AC}} + \frac{1}{4\pi\epsilon_0}\frac{Q_B \times Q_C}{|\overrightarrow{r_{BC}}|^3} \times \overrightarrow{r_{AC}}] = 9 \times 10^9 \times [(-1.7 \times 10^{-5} \times (-2 \times 10^{-5}) \times (16i +$

$10j)/6716.995 + (8 \times 10^{-6} \times (-2 \times 10^{-5}) \times (17i + 10j)/7672.279]$
$= 9.0 \times 10^9 \left[4.5536 \times 10^{-13}i + 2.9764 \times 10^{-13}j\right]$ = 0.004098267 i + 0.002678722 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| = $ 0.004896054 Newton

(b) According to Coulomb's Law : Electro static Potential V is given as $V = \frac{1}{4\pi\epsilon_0} \times \frac{Q}{R}$. So Net electrostatic Potential at mid point say P will be given as $V_P = V_{AP} + V_{BP} + V_{CP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}} + \frac{Q_B}{r_{BP}} + \frac{Q_C}{r_{CP}}] = 9 \times 10^9 \times [(-1.7 \times 10^{-5}/(0.5)) + (8 \times 10^{-6}/(0.5)) + (-2 \times 10^{-5}/(19.29378)) = 9.0 \times 10^9 \left[-1.9037 \times 10^{-5}\right]$
$\Rightarrow V_P$ = -171329.4 Volt

9. SOLUTION: (a) As we know Electrostatic force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$
$= 9 \times 10^9 \times [-3 \times 10^{-7} \times (-3.6 \times 10^{-7}/(1.44)] = 9.0 \times 10^9 \times 7.5 \times 10^{-14}$
= 0.000675 Newton
(b) Let the neutral point is at a distance of $\times$ meter from First charge towards second charge . As net electrostatic force at neutral point is zero means $\left|\overrightarrow{F_{1n}}\right| = \left|\overrightarrow{F_{2n}}\right|$
$\Rightarrow 9 \times 10^9 \times (-3 \times 10^{-7}/x^2) = 9 \times 10^9 \times (-3.6 \times 10^{-7}/(1.2 - x)^2)$, Solution is : $\{x = .57267\}$, $\{x = -12.573\}$ meter from first charge towards second charge
(c) Let the potential at midpoint say P between the chages is Vp . So Vp will be given as :
$V_P = V_1 + V_2 = 9 \times 10^9 \times [(-3 \times 10^{-7}/(0.6)) + (-3.6 \times 10^{-7}/(0.6))] = 9.0 \times 10^9 \left[-1.1 \times 10^{-6}\right] =$ -9900Volt

10. Solution: According to Coulomb's Law :(a) Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_C} = \overrightarrow{F_{AC}} + \overrightarrow{F_{BC}}$
$= \frac{1}{4\pi\epsilon_0}[\frac{Q_A \times Q_C}{\left|\overrightarrow{r_{AC}}\right|^3} \times \overrightarrow{r_{AC}} + \frac{1}{4\pi\epsilon_0}\frac{Q_B \times Q_C}{\left|\overrightarrow{r_{BC}}\right|^3} \times \overrightarrow{r_{AC}}] = 9 \times 10^9 \times [(-1.1 \times 10^{-5} \times (-2.5 \times 10^{-5}) \times (8i + 10j)/2100.225 + (8 \times 10^{-6} \times (-2.5 \times 10^{-5}) \times (3i + 7j)/441.7148]$
$= 9.0 \times 10^9 \left[-3.1084 \times 10^{-13}i - 1.8601 \times 10^{-12}j\right]$ = -0.00279752 i + -0.01674074 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| = $ 0.01697288 Newton

(b) According to Coulomb's Law : Electro static Potential V is given as $V = \frac{1}{4\pi\epsilon_0} \times \frac{Q}{R}$. So Net electrostatic Potential at mid point say P will be given as $V_P = V_{AP} + V_{BP} + V_{CP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}} + \frac{Q_B}{r_{BP}} + \frac{Q_C}{r_{CP}}] = 9 \times 10^9 \times [(-1.1 \times 10^{-5}/(2.915476)) + (8 \times 10^{-6}/(2.915476)) + (-2.5 \times 10^{-5}/(10.12423)) = 9.0 \times 10^9 \left[-3.4983 \times 10^{-6}\right]$
$\Rightarrow V_P$ = -31484.84 Volt

11. SOLUTION: (a) As we know Electrostatic force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$
$= 9 \times 10^9 \times [-1.2 \times 10^{-6} \times (-4.8 \times 10^{-7}/(0.16)]$ = 0.0324 Newton
(b) Let the neutral point is at a distance of $\times$ meter from First charge towards second charge . As net electrostatic force at neutral point is zero means $\left|\overrightarrow{F_{1n}}\right| = \left|\overrightarrow{F_{2n}}\right|$
$\Rightarrow 9 \times 10^9 \times (-1.2 \times 10^{-6}/x^2) = 9 \times 10^9 \times (-4.8 \times 10^{-7}/(0.4 - x)^2)$, Solution is : $\{x = .24503\}$, $\{x = 1.0883\}$ meter from first charge towards second charge
(c) Let the potential at midpoint say P between the chages is Vp . So Vp will be given as : $V_P = V_1 + V_2 = 9 \times 10^9 \times [(-1.2 \times 10^{-6}/(0.2)) + (-4.8 \times 10^{-7}/(0.2))]$ = -75600Volt

12. SOLUTION: (a) As we know Electrostatic force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$
$= 9 \times 10^9 \times [-9 \times 10^{-7} \times (-3.6 \times 10^{-7}/(0.16)]$
$= 9.0 \times 10^9 \times 2.025 \times 10^{-12} = $ 0.018225 Newton
(b) Let the neutral point is at a distance of $\times$ meter from First charge towards second charge . As net electrostatic force at neutral point is zero means $\left|\overrightarrow{F_{1n}}\right| = \left|\overrightarrow{F_{2n}}\right|$

$\Rightarrow 9 \times 10^9 \times (-9 \times 10^{-7}/x^2) = 9 \times 10^9 \times (-3.6 \times 10^{-7}/(0.4 - x)^2)$, Solution is : $\{x = .24503\}$, $\{x = 1.0883\}$ meter from first charge towards second charge
(c) Let the potential at midpoint say P between the chages is Vp . So Vp will be given as : $V_P = V_1 + V_2 = 9 \times 10^9 \times [(-9 \times 10^{-7}/(0.2)) + (-3.6 \times 10^{-7}/(0.2))] = 9.0 \times 10^9 \left[-6.3 \times 10^{-6}\right]$
= -56700Volt

13. Solution: According to Coulomb's Law :(a) Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_C} = \overrightarrow{F_{AC}} + \overrightarrow{F_{BC}}$
$= \frac{1}{4\pi\epsilon_0}[\frac{Q_A \times Q_C}{\left|\overrightarrow{r_{AC}}\right|^3} \times \overrightarrow{r_{AC}} + \frac{1}{4\pi\epsilon_0}\frac{Q_B \times Q_C}{\left|\overrightarrow{r_{BC}}\right|^3} \times \overrightarrow{r_{AC}}] = 9 \times 10^9 \times [(3.6 \times 10^{-5} \times 1.5 \times 10^{-5}) \times (3i + 0j)/27 + (-1.8 \times 10^{-5} \times 1.5 \times 10^{-5}) \times (2i + 1j)/11.18034]$
$= 9.0 \times 10^9 \left[1.1701 \times 10^{-11} i - 2.415 \times 10^{-11} j\right]$ = 0.1053084 i + -0.2173458 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| = 0.2415141$ Newton
(b) According to Coulomb's Law : Electro static Potential V is given as $V = \frac{1}{4\pi\epsilon_0} \times \frac{Q}{R}$. So Net electrostatic Potential at mid point say P will be given as$V_P = V_{AP} + V_{BP} + V_{CP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}} + \frac{Q_B}{r_{BP}} + \frac{Q_C}{r_{CP}}] = 9 \times 10^9 \times [(3.6 \times 10^{-5}/(0.7071068)) + (-1.8 \times 10^{-5}/(0.7071068)) + (1.5 \times 10^{-5}/(2.54951)) = 9.0 \times 10^9 \times 3.1339 \times 10^{-5}$
$\Rightarrow V_P$ = 282054 Volt

14. Solution: According to Coulomb's Law : Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_D} = \overrightarrow{F_{AD}} + \overrightarrow{F_{BD}} + \overrightarrow{F_{CD}} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A \times Q_D}{\left|\overrightarrow{r_{AD}}\right|^3} \times \overrightarrow{r_{AD}} + \frac{Q_B \times Q_D}{\left|\overrightarrow{r_{BD}}\right|^3} \times \overrightarrow{r_{BD}} + \frac{Q_C \times Q_D}{\left|\overrightarrow{r_{CD}}\right|^3} \times \overrightarrow{r_{CD}}]$
$= 9 \times 10^9 \times [(2.7 \times 10^{-5} \times (-7.2 \times 10^{-5}) \times (-6i + 16j)/4989.698 + (-2.4 \times 10^{-5} \times (-7.2 \times 10^{-5}) \times (-12i + 8j)/2999.819 + (0.000108 \times (-7.2 \times 10^{-5}) \times (-8i + 14j)/4192.374]$
$= 9.0 \times 10^9 \left[1.0264 \times 10^{-11} i - 2.7593 \times 10^{-11} j\right]$ = 0.09237213 i + -0.2483326 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| = 0.2649561$ Newton
(b) According to Coulomb's Law : Electro static Potential due to charges Q is given as $V = \frac{1}{4\pi\epsilon_0} \times \frac{Q}{R}$.
So Net electrostatic Potential on P will be given as:
$V_P = V_{AP} + V_{BP} + V_{CP} + V_{DP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}} + \frac{Q_B}{r_{BP}} + \frac{Q_C}{r_{CP}} + \frac{Q_D}{r_{DP}}] = 9 \times 10^9 \times [(2.7 \times 10^{-5}/5) + (-2.4 \times 10^{-5}/5) + (0.000108/2.236068) + \left(-7.2 \times 10^{-5}\right)/15]$
$= 9.0 \times 10^9 \times 4.4099 \times 10^{-5} = 3.9689 \times 10^5$ Volt

15. Solution: According to Coulomb's Law : Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_D} = \overrightarrow{F_{AD}} + \overrightarrow{F_{BD}} + \overrightarrow{F_{CD}} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A \times Q_D}{\left|\overrightarrow{r_{AD}}\right|^3} \times \overrightarrow{r_{AD}} + \frac{Q_B \times Q_D}{\left|\overrightarrow{r_{BD}}\right|^3} \times \overrightarrow{r_{BD}} + \frac{Q_C \times Q_D}{\left|\overrightarrow{r_{CD}}\right|^3} \times \overrightarrow{r_{CD}}]$
$= 9 \times 10^9 \times [(0.000133 \times (-2.1 \times 10^{-5}) \times (1i + 8j)/524.0468 + (-5.6 \times 10^{-5}) \times (-2.1 \times 10^{-5}) \times (-9i + 12j)/3375 + (0.000266) \times (-2.1 \times 10^{-5}) \times (3i + 13j)/2374.816]$
$= 9.0 \times 10^9 \left[-1.5522 \times 10^{-11} i - 6.9034 \times 10^{-11} j\right]$ = -0.1397 i + -0.6213101 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| = 0.6368221$ Newton
(b) According to Coulomb's Law : Electro static Potential due to charges Q is given as $V = \frac{1}{4\pi\epsilon_0} \times \frac{Q}{R}$.
So Net electrostatic Potential on P will be given as :
$V_P = V_{AP} + V_{BP} + V_{CP} + V_{DP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}} + \frac{Q_B}{r_{BP}} + \frac{Q_C}{r_{CP}} + \frac{Q_D}{r_{DP}}] = 9 \times 10^9 \times [(0.000133/5.385165) + (-5.6 \times 10^{-5}/5.385165) + (0.000266/7.615773) + (-2.1 \times 10^{-5}/10.77033)]$

$= 9.0 \times 10^9 \times 4.7276 \times 10^{-5} = 4.2548 \times 10^5$ Volt

16. Solution: According to Coulomb's Law :(a) Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_C} = \overrightarrow{F_{AC}} + \overrightarrow{F_{BC}}$
$= \frac{1}{4\pi\epsilon_0}[\frac{Q_A \times Q_C}{|\overrightarrow{r_{AC}}|^3} \times \overrightarrow{r_{AC}} + \frac{1}{4\pi\epsilon_0}\frac{Q_B \times Q_C}{|\overrightarrow{r_{BC}}|^3} \times \overrightarrow{r_{AC}}] = 9 \times 10^9 \times [(3.9 \times 10^{-5} \times 3.3 \times 10^{-5}) \times (11i + 12j)/4313.888 + (-2.4 \times 10^{-5} \times 3.3 \times 10^{-5}) \times (11i + 11j)/3764.636]$
$= 9.0 \times 10^9 \left[9.6756 \times 10^{-13} i + 1.2659 \times 10^{-12} j\right]$ = 0.008708032 i + 0.01139308 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| = 0.01433988$ Newton
(b) According to Coulomb's Law : Electro static Potential V is given as $V = \frac{1}{4\pi\epsilon_0} \times \frac{Q}{R}$. So Net electrostatic Potential at mid point say P will be given as $V_P = V_{AP} + V_{BP} + V_{CP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}} + \frac{Q_B}{r_{BP}} + \frac{Q_C}{r_{CP}}] = 9 \times 10^9 \times [(3.9 \times 10^{-5}/(0.5)) + (-2.4 \times 10^{-5}/(0.5)) + (3.3 \times 10^{-5}/(15.91383)) = 9.0 \times 10^9 \times 3.2074 \times 10^{-5}$
$\Rightarrow V_P$ = 288663 Volt

17. SOLUTION: (a) As we know Electrostatic force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$
$= 9 \times 10^9 \times [3.6 \times 10^{-6} \times 2.16 \times 10^{-6}/(0.36)] = 9.0 \times 10^9 \times 2.16 \times 10^{-11}$
= 0.1944 Newton
(b) Let the neutral point is at a distance of× meter from First charge towards second charge . As net electrostatic force at neutral point is zero means $\left|\overrightarrow{F_{1n}}\right| = \left|\overrightarrow{F_{2n}}\right|$
$\Rightarrow 9 \times 10^9 \times (3.6 \times 10^{-6}/x^2) = 9 \times 10^9 \times (2.16 \times 10^{-6}/(0.6 - x)^2)$, Solution is : $\{x = 2.6619\}$, $\{x = .3381\}$ meter from first charge towards second charge.
(c) Let the potential at midpoint say P between the chages is Vp . So Vp will be given as : $V_P = V_1 + V_2 = 9 \times 10^9 \times [(3.6 \times 10^{-6}/(0.3)) + (2.16 \times 10^{-6}/(0.3))] = 9.0 \times 10^9 \times 1.92 \times 10^{-5}$
= 172800Volt

18. SOLUTION: (a) As we know Electrostatic force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$
$= 9 \times 10^9 \times [3.6 \times 10^{-6} \times 7.200001 \times 10^{-7}/(0.04)] = 9.0 \times 10^9 \times 6.48 \times 10^{-11}$
= 0.5832001 Newton
(b) Let the neutral point is at a distance of× meter from First charge towards second charge . As net electrostatic force at neutral point is zero means $\left|\overrightarrow{F_{1n}}\right| = \left|\overrightarrow{F_{2n}}\right|$
$\Rightarrow 9 \times 10^9 \times (3.6 \times 10^{-6}/x^2) = 9 \times 10^9 \times (7.200001 \times 10^{-7}/(0.2 - x)^2)$, Solution is : $\{x = .3618\}$, $\{x = .1382\}$ meter from first charge towards second charge.
(c) Let the potential at midpoint say P between the chages is Vp . So Vp will be given as :
$V_P = V_1 + V_2 = 9 \times 10^9 \times [(3.6 \times 10^{-6}/(0.1)) + (7.200001 \times 10^{-7}/(0.1))] = 9.0 \times 10^9 \times 4.32 \times 10^{-5}$
= 388800Volt

19. Solution: According to Coulomb's Law : Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_D} = \overrightarrow{F_{AD}} + \overrightarrow{F_{BD}} + \overrightarrow{F_{CD}} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A \times Q_D}{|\overrightarrow{r_{AD}}|^3} \times \overrightarrow{r_{AD}} + \frac{Q_B \times Q_D}{|\overrightarrow{r_{BD}}|^3} \times \overrightarrow{r_{BD}} + \frac{Q_C \times Q_D}{|\overrightarrow{r_{CD}}|^3} \times \overrightarrow{r_{CD}}] = 9 \times 10^9 \times [(2.4 \times 10^{-5} \times (-1.5 \times 10^{-5}) \times (-7i + 3j)/441.7148 + (-2.1 \times 10^{-5} \times (-1.5 \times 10^{-5}) \times (-3i + 8j)/623.7123 + (5.1 \times 10^{-5} \times (-1.5 \times 10^{-5}) \times (-9i + 0j)/729]$
$= 9.0 \times 10^9 \left[1.3634 \times 10^{-11} i + 1.5953 \times 10^{-12} j\right]$ = 0.1227093 i + 0.01435777 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| = 0.1235464$ Newton
(b) According to Coulomb's Law : Electro static Potential due to charges Q is given as $V = \frac{1}{4\pi\epsilon_0} \times \frac{Q}{R}$. So Net electrostatic Potential on P will be given as $V_P = V_{AP} + V_{BP} + V_{CP} + V_{DP}$

$= \dfrac{1}{4\pi\epsilon_0}[\dfrac{Q_A}{r_{AP}} + \dfrac{Q_B}{r_{BP}} + \dfrac{Q_C}{r_{CP}} + \dfrac{Q_D}{r_{DP}}] = 9 \times 10^9 \times [(2.4 \times 10^{-5}/3.201562) + (-2.1 \times 10^{-5}/3.201562) + (5.1 \times 10^{-5}/6.800735) + (-1.5 \times 10^{-5}/7.433034)] = 9.0 \times 10^9 \times 6.4182 \times 10^{-6}$ Volt

20. Solution: According to Coulomb's Law :(a) Electro static Force between two charges is given as $F_e = \dfrac{1}{4\pi\epsilon_0} \times \dfrac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_C} = \overrightarrow{F_{AC}} + \overrightarrow{F_{BC}}$
$= \dfrac{1}{4\pi\epsilon_0}[\dfrac{Q_A \times Q_C}{|\overrightarrow{r_{AC}}|^3} \times \overrightarrow{r_{AC}} + \dfrac{1}{4\pi\epsilon_0}\dfrac{Q_B \times Q_C}{|\overrightarrow{r_{BC}}|^3} \times \overrightarrow{r_{AC}}] = 9 \times 10^9 \times [(4.2 \times 10^{-5} \times 0.000108) \times (-4i + 6j)/374.9773 + (-5.4 \times 10^{-5} \times 0.000108) \times (-12i + 10j)/3811.402]$
$= 9.0 \times 10^9 \left[-3.0025 \times 10^{-11}i + 5.7279 \times 10^{-11}j\right]$ = -0.2702266 i + 0.5155104 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| =$ 0.5820424 Newton
(b) According to Coulomb's Law : Electro static Potential V is given as $V = \dfrac{1}{4\pi\epsilon_0} \times \dfrac{Q}{R}$. So Net electrostatic Potential at mid point say P will be given as $V_P = V_{AP} + V_{BP} + V_{CP} = \dfrac{1}{4\pi\epsilon_0}[\dfrac{Q_A}{r_{AP}} + \dfrac{Q_B}{r_{BP}} + \dfrac{Q_C}{r_{CP}}] = 9 \times 10^9 \times [(4.2 \times 10^{-5}/(4.472136)) + (-5.4 \times 10^{-5}/(4.472136)) + (0.000108/(11.31371)) = 9.0 \times 10^9 \times 6.8627 \times 10^{-6}$
$\Rightarrow V_P$ = 61763.94 Volt

21. Solution: According to Coulomb's Law : Electro static Force between two charges is given as $F_e = \dfrac{1}{4\pi\epsilon_0} \times \dfrac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_D} = \overrightarrow{F_{AD}} + \overrightarrow{F_{BD}} + \overrightarrow{F_{CD}} = \dfrac{1}{4\pi\epsilon_0}[\dfrac{Q_A \times Q_D}{|\overrightarrow{r_{AD}}|^3} \times \overrightarrow{r_{AD}} + \dfrac{Q_B \times Q_D}{|\overrightarrow{r_{BD}}|^3} \times \overrightarrow{r_{BD}} + \dfrac{Q_C \times Q_D}{|\overrightarrow{r_{CD}}|^3} \times \overrightarrow{r_{CD}}] = 9 \times 10^9 \times [(3.6 \times 10^{-5} \times (-7.2 \times 10^{-5}) \times (6i + 6j)/610.9402 + (-5.4 \times 10^{-5} \times (-7.2 \times 10^{-5}) \times (-6i + 7j)/783.6613 + (0.00015 \times (-7.2 \times 10^{-5}) \times (1i + 11j)/1347.534]$
$= 9.0 \times 10^9 \left[-6.3238 \times 10^{-11}i - 7.8888 \times 10^{-11}j\right] =$ -0.5691461 i + -0.7099884 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| =$ 0.909951 Newton
(b) According to Coulomb's Law : Electro static Potential due to charges Q is given as $V = \dfrac{1}{4\pi\epsilon_0} \times \dfrac{Q}{R}$. So Net electrostatic Potential on P will be given as $V_P = V_{AP} + V_{BP} + V_{CP} + V_{DP}$
$= \dfrac{1}{4\pi\epsilon_0}[\dfrac{Q_A}{r_{AP}} + \dfrac{Q_B}{r_{BP}} + \dfrac{Q_C}{r_{CP}} + \dfrac{Q_D}{r_{DP}}] = 9 \times 10^9 \times ((3.6 \times 10^{-5}/6.020797) + (-5.4 \times 10^{-5}/6.020797) + (0.00015/4.609772) + (-7.2 \times 10^{-5}/6.5)) = 1.6626 \times 10^5$ Volt

22. SOLUTION: (a) As we know Electrostatic force between two charges is given as $F_e = \dfrac{1}{4\pi\epsilon_0} \times \dfrac{Q_1 \times Q_2}{r^2}$
$= 9 \times 10^9 \times [1.8 \times 10^{-6} \times 1.08 \times 10^{-6}/(0.36)] = 9.0 \times 10^9 \times 5.4 \times 10^{-12}$
$=$ 0.04860001 Newton
(b) Let the neutral point is at a distance of$\times$ meter from First charge towards second charge . As net electrostatic force at neutral point is zero means $\left|\overrightarrow{F_{1n}}\right| = \left|\overrightarrow{F_{2n}}\right|$
$\Rightarrow 9 \times 10^9 \times (1.8 \times 10^{-6}/x^2) = 9 \times 10^9 \times (1.08 \times 10^{-6}/(0.6 - x)^2)$, Solution is : $\{x = 2.6619\}$, $\{x = .3381\}$ meter from first charge towards second charge.
(c) Let the potential at midpoint say P between the chages is: Vp . So Vp will be given as :
$V_P = V_1 + V_2 = 9 \times 10^9 \times [(1.8 \times 10^{-6}/(0.3)) + (1.08 \times 10^{-6}/(0.3))] = 9.0 \times 10^9 \times 9.6 \times 10^{-6} =$ 86400.01Volt

23. SOLUTION: (a) As we know Electrostatic force between two charges is given as $F_e = \dfrac{1}{4\pi\epsilon_0} \times \dfrac{Q_1 \times Q_2}{r^2}$
$= 9 \times 10^9 \times [3.6 \times 10^{-6} \times 5.04 \times 10^{-6}/(1.96)] = 9.0 \times 10^9 \times 9.2571 \times 10^{-12}$
$=$ 0.0833143 Newton
(b) Let the neutral point is at a distance of$\times$ meter from First charge towards second charge . As net electrostatic force at neutral point is zero means $\left|\overrightarrow{F_{1n}}\right| = \left|\overrightarrow{F_{2n}}\right|$

$\Rightarrow 9\times10^9\times(3.6\times10^{-6}/x^2) = 9\times10^9\times(5.04\times10^{-6}/(1.4-x)^2)$, Solution is : $\{x=-7.6413\}$, $\{x=0.64126\}$ meter from first charge towards second charge.
(c) Let the potential at midpoint say P between the chages is Vp . So Vp will be given as :
$V_P = V_1+V_2 = 9\times10^9\times[(3.6\times10^{-6}/(0.7))+(5.04\times10^{-6}/(0.7))] = 9.0\times10^9\times1.2343\times10^{-5}$ = 111085.7Volt

24. Solution: According to Coulomb's Law : Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0}\times\frac{Q_1\times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_D} = \overrightarrow{F_{AD}}+\overrightarrow{F_{BD}}+\overrightarrow{F_{CD}} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A\times Q_D}{|\overrightarrow{r_{AD}}|^3}\times\overrightarrow{r_{AD}}+\frac{Q_B\times Q_D}{|\overrightarrow{r_{BD}}|^3}\times\overrightarrow{r_{BD}}+\frac{Q_C\times Q_D}{|\overrightarrow{r_{CD}}|^3}\times\overrightarrow{r_{CD}}] = 9\times10^9\times[(0.000104\times(-0.000176)\times(-10i+23j)/15775.24+(-4\times10^{-5}\times(-0.000176)\times(-8i+27j)/22331.08+(4\times10^{-5}\times(-0.000176)\times(-4i+27j)/20334.54]$
$= 9.0\times10^9\left[1.0466\times10^{-11}i-2.7523\times10^{-11}j\right]$ =0.09419206 i + -0.2477036 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| = 0.265008$ Newton
(b) According to Coulomb's Law : Electro static Potential due to charges Q is given as $V=\frac{1}{4\pi\epsilon_0}\times\frac{Q}{R}$.
So Net electrostatic Potential on P will be given as:
$V_P = V_{AP}+V_{BP}+V_{CP}+V_{DP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}}+\frac{Q_B}{r_{BP}}+\frac{Q_C}{r_{CP}}+\frac{Q_D}{r_{DP}}] = 9\times10^9\times[(0.000104/2.236068)+(-4\times10^{-5}/2.236068)+(4\times10^{-5}/5.385165)+(-0.000176/26.57066)]$
$= 9.0\times10^9\times2.9426\times10^{-5} = 2.6483\times10^5$ Volt.

25. Solution: According to Coulomb's Law :(a) Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0}\times\frac{Q_1\times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_C} = \overrightarrow{F_{AC}}+\overrightarrow{F_{BC}}$
$= \frac{1}{4\pi\epsilon_0}[\frac{Q_A\times Q_C}{|\overrightarrow{r_{AC}}|^3}\times\overrightarrow{r_{AC}}+\frac{1}{4\pi\epsilon_0}\frac{Q_B\times Q_C}{|\overrightarrow{r_{BC}}|^3}\times\overrightarrow{r_{AC}}] = 9\times10^9\times[(4.5\times10^{-5}\times4.5\times10^{-5})\times(-1i+17j)/4938.522+(-3.6\times10^{-5}\times4.5\times10^{-5})\times(-2i+9j)/783.6613]$
$= 9.0\times10^9\left[3.7244\times10^{-12}i-1.1634\times10^{-11}j\right]$ = 0.03351958 i + -0.1047084 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| = 0.1099428$ Newton
(b) According to Coulomb's Law : Electro static Potential V is given as $V=\frac{1}{4\pi\epsilon_0}\times\frac{Q}{R}$. So Net electrostatic Potential at mid point say P will be given as $V_P = V_{AP}+V_{BP}+V_{CP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}}+\frac{Q_B}{r_{BP}}+\frac{Q_C}{r_{CP}}] = 9\times10^9\times[(4.5\times10^{-5}/(4.031129))+(-3.6\times10^{-5}/(4.031129))+(4.5\times10^{-5}/(13.08625))]$
$= 9.0\times10^9\times5.6713\times10^{-6}\Rightarrow V_P$ = 51042.14 Volt

26. Solution: According to Coulomb's Law : Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0}\times\frac{Q_1\times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_D} = \overrightarrow{F_{AD}}+\overrightarrow{F_{BD}}+\overrightarrow{F_{CD}} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A\times Q_D}{|\overrightarrow{r_{AD}}|^3}\times\overrightarrow{r_{AD}}+\frac{Q_B\times Q_D}{|\overrightarrow{r_{BD}}|^3}\times\overrightarrow{r_{BD}}+\frac{Q_C\times Q_D}{|\overrightarrow{r_{CD}}|^3}\times\overrightarrow{r_{CD}}] = 9\times10^9\times[(0.00012\times(-0.000112)\times(-5i+3j)/198.2524+(-3.2\times10^{-5}\times(-0.000112)\times(-2i+-9j)/783.6613+(7.2\times10^{-5}\times(-0.000112)\times(-10i+2j)/1060.596]$
$= 9.0\times10^9\left[4.0585\times10^{-10}i-2.5974\times10^{-10}j\right]$ = 3.65263 i + -2.337699 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| = 4.336651$ Newton
(b) According to Coulomb's Law : Electro static Potential due to charges Q is given as $V=\frac{1}{4\pi\epsilon_0}\times\frac{Q}{R}$.
So Net electrostatic Potential on P will be given as:
$V_P = V_{AP}+V_{BP}+V_{CP}+V_{DP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}}+\frac{Q_B}{r_{BP}}+\frac{Q_C}{r_{CP}}+\frac{Q_D}{r_{DP}}] = 9\times10^9\times((0.00012/6.184659)+(-3.2\times10^{-5}/6.184659)+(7.2\times10^{-5}/8.20061)+(-0.000112/4.609772))$
$= -11589.$ Volt

27. Solution: According to Coulomb's Law : Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_D} = \overrightarrow{F_{AD}} + \overrightarrow{F_{BD}} + \overrightarrow{F_{CD}} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A \times Q_D}{|\overrightarrow{r_{AD}}|^3} \times \overrightarrow{r_{AD}} + \frac{Q_B \times Q_D}{|\overrightarrow{r_{BD}}|^3} \times \overrightarrow{r_{BD}} + \frac{Q_C \times Q_D}{|\overrightarrow{r_{CD}}|^3} \times \overrightarrow{r_{CD}}] = 9 \times 10^9 \times [(6 \times 10^{-6} \times (-6.6 \times 10^{-5}) \times (-7i + -3j)/441.7148 + (-2.1 \times 10^{-5} \times (-6.6 \times 10^{-5}) \times (-6i + -6j)/610.9402 + (4.5 \times 10^{-5} \times (-6.6 \times 10^{-5}) \times (-5i + -21j)/10059.56]$
$= 9.0 \times 10^9 \left[-5.8601 \times 10^{-12}i - 4.7222 \times 10^{-12}j\right] =$ -0.0527405 i + -0.04249993 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| =$ 0.06773333 Newton

(b) According to Coulomb's Law : Electro static Potential due to charges Q is given as $V = \frac{1}{4\pi\epsilon_0} \times \frac{Q}{R}$. So Net electrostatic Potential on P will be given as:
$V_P = V_{AP} + V_{BP} + V_{CP} + V_{DP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}} + \frac{Q_B}{r_{BP}} + \frac{Q_C}{r_{CP}} + \frac{Q_D}{r_{DP}}] = 9 \times 10^9 \times ((6 \times 10^{-6}/1.581139) + (-2.1 \times 10^{-5}/1.581139) + (4.5 \times 10^{-5}/16.56804) + (-6.6 \times 10^{-5}/7.905694))$
$= -1.3607 \times 10^5$ Volt

28. SOLUTION: (a) As we know Electrostatic force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$
$= 9 \times 10^9 \times [3.6 \times 10^{-6} \times 2.88 \times 10^{-6}/(0.64)] = 9.0 \times 10^9 \times 1.62 \times 10^{-11}$
$=$ 0.1458 Newton
(b) Let the neutral point is at a distance of$\times$ meter from First charge towards second charge . As net electrostatic force at neutral point is zero means $\left|\overrightarrow{F_{1n}}\right| = \left|\overrightarrow{F_{2n}}\right|$
$\Rightarrow 9 \times 10^9 \times (3.6 \times 10^{-6}/x^2) = 9 \times 10^9 \times (2.88 \times 10^{-6}/(0.8 - x)^2)$, Solution is : $\{x = 7.5777\}$, $\{x = 0.42229\}$ meter from first charge towards second charge.
(c) Let the potential at midpoint say P between the chages is Vp . So Vp will be given as : $V_P = V_1 + V_2 = 9 \times 10^9 \times [(3.6 \times 10^{-6}/(0.4)) + (2.88 \times 10^{-6}/(0.4))] = 9.0 \times 10^9 \times 1.62 \times 10^{-5}$
= 145800Volt

29. Solution: According to Coulomb's Law : Electro static Force between two charges is given as $F_e = \frac{1}{4\pi\epsilon_0} \times \frac{Q_1 \times Q_2}{r^2}$. So Net electrostatic force on C will be given as $\overrightarrow{F_D} = \overrightarrow{F_{AD}} + \overrightarrow{F_{BD}} + \overrightarrow{F_{CD}} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A \times Q_D}{|\overrightarrow{r_{AD}}|^3} \times \overrightarrow{r_{AD}} + \frac{Q_B \times Q_D}{|\overrightarrow{r_{BD}}|^3} \times \overrightarrow{r_{BD}} + \frac{Q_C \times Q_D}{|\overrightarrow{r_{CD}}|^3} \times \overrightarrow{r_{CD}}] = 9 \times 10^9 \times [(4.5 \times 10^{-5} \times (-0.000144) \times (-1i + 19j)/6887.52 + (-3.6 \times 10^{-5} \times (-0.000144) \times (-3i + 21j)/9545.941 + (0.000342 \times (-0.000144) \times (-9i + 17j)/7117.092]$
$= 9.0 \times 10^9 \left[6.1589 \times 10^{-11}i - 1.2411 \times 10^{-10}j\right] =$ 0.5542991 i + -1.116955 j Whose magnitude will be given as : $\left|\overrightarrow{F_C}\right| =$ 1.246931 Newton

(b) According to Coulomb's Law : Electro static Potential due to charges Q is given as $V = \frac{1}{4\pi\epsilon_0} \times \frac{Q}{R}$. So Net electrostatic Potential on P will be given as :
$V_P = V_{AP} + V_{BP} + V_{CP} + V_{DP} = \frac{1}{4\pi\epsilon_0}[\frac{Q_A}{r_{AP}} + \frac{Q_B}{r_{BP}} + \frac{Q_C}{r_{CP}} + \frac{Q_D}{r_{DP}}] = 9 \times 10^9 \times ((4.5 \times 10^{-5}/1.414214) + (-3.6 \times 10^{-5}/1.414214) + (0.000342/7.615773) + (-0.000144/20.09975))$
$= 3.9696 \times 10^5$ Volt