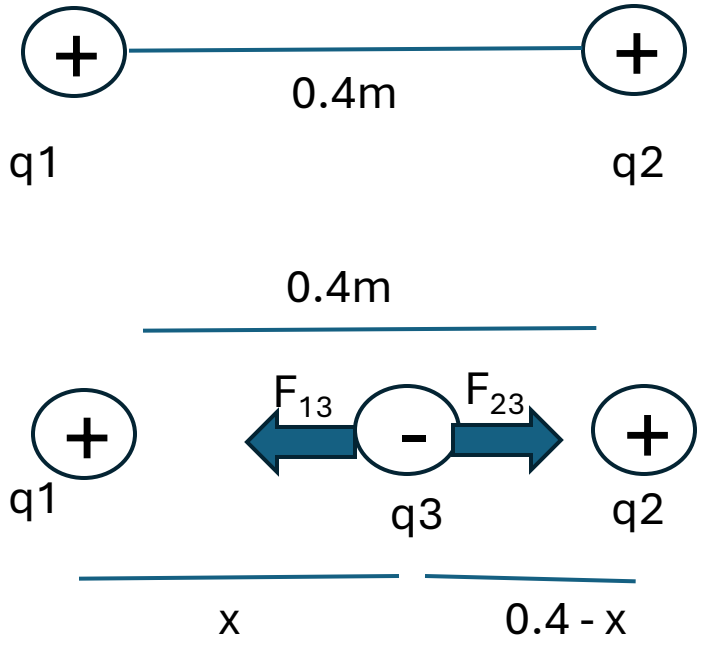
Chapter16&17 problems

Dr. Tareq Afaneh

Problem 21 page 582

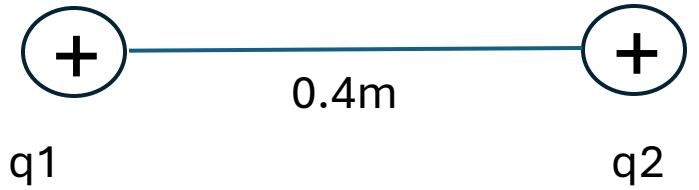
21. A charge of +3.5 nC and a charge of +5.0 nC are separated by 40.0 cm. Find the equilibrium position for a –6.0 nC charge.

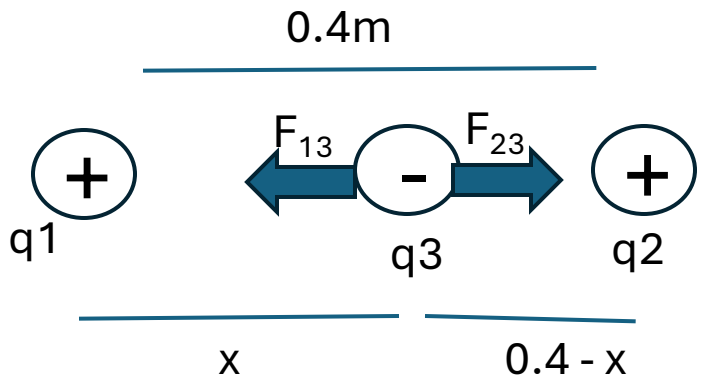
- Q1 = 3.5 x 10^{-9} C, Q1 = 5 x 10^{-9} C,
- Distance between charges 0.4m
- Equilibrium ---> Ftotal = 0
- For two charges with same sign, the equilibrium point is between them
- If we assume it at distance (x) from q1
- --->it is at distance (0.4 - x) from q2
- Ftotal = 0 ---> F13 = F23
- K q1 q3/$d_{13}^{\ 2}$ = K q2 q3/$d_{23}^{\ 2}$ =



Problem 21 page 582

21. A charge of +3.5 nC and a charge of +5.0 nC are separated by 40.0 cm. Find the equilibrium position for a –6.0 nC charge.

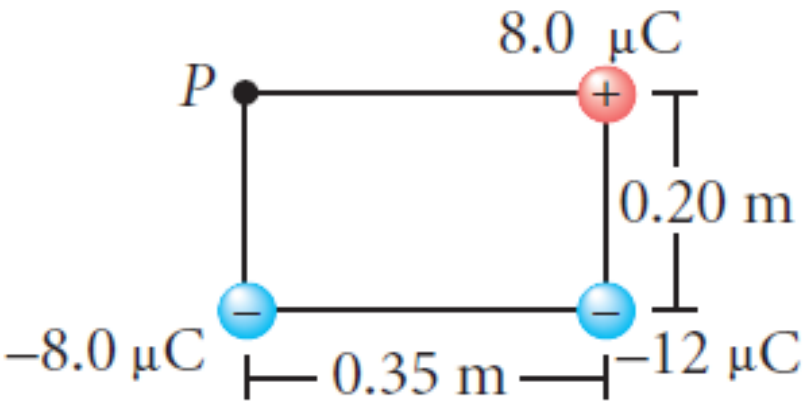


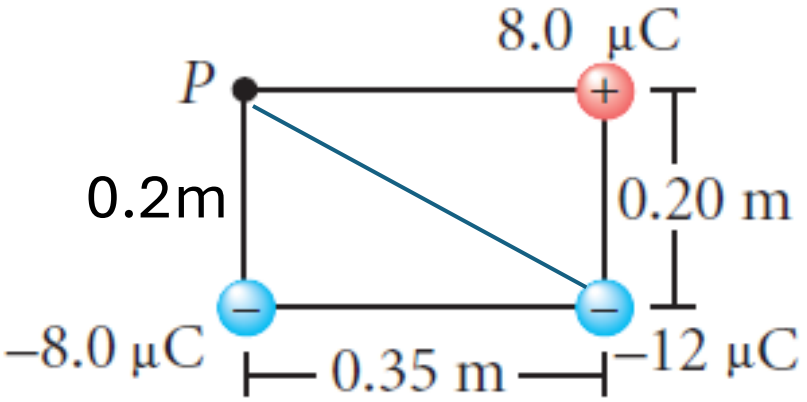


- Ftotal = 0 ---> F13 = F23
- K q1 q3/d_{13}^2 = K q2 q3/d_{23}^2 =
- $Q1/X^2 = q2/(0.4-X)^2$
- ---> $\sqrt{(q1/X^2)} = \sqrt{(q2/(0.4-X)^2)}$.
- ---> $\sqrt{q1/X} = \sqrt{q2/(0.4-X)}$
- ---> $\sqrt{(3.5x10^{-9})} / X = \sqrt{(5x10^{-9})} / (0.4 - X)$
- ---> $5.9x10^{-5} / X = 7.1 \times 10^{-5} / (0.4 - X)$
- ---> $5.9x10^{-5} (0.4 - X) = 7.1 \times 10^{-5} (X)$
- $2.36x10^{-5} – 5.9x10^{-5} X = 7.1 \times 10^{-5} X$
- $2.36x10^{-5} = 5.9x10^{-5} X + 7.1 \times 10^{-5} X$
- $2.36x10^{-5} = 13x10^{-5} X$
- ---> $X = 2.36x10^{-5}/13x10^{-5}$ ---> X = 0.18m from q1

Problem9 page 626

9. In the figure below, find the electric potential at point *P* due to the grouping of charges at the other corners of the rectangle.

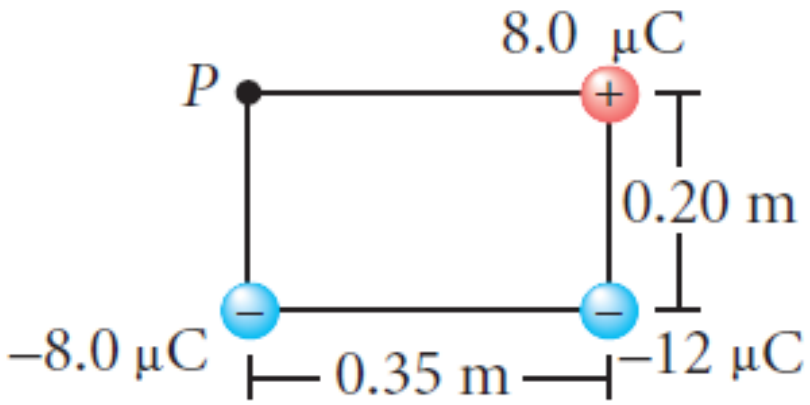


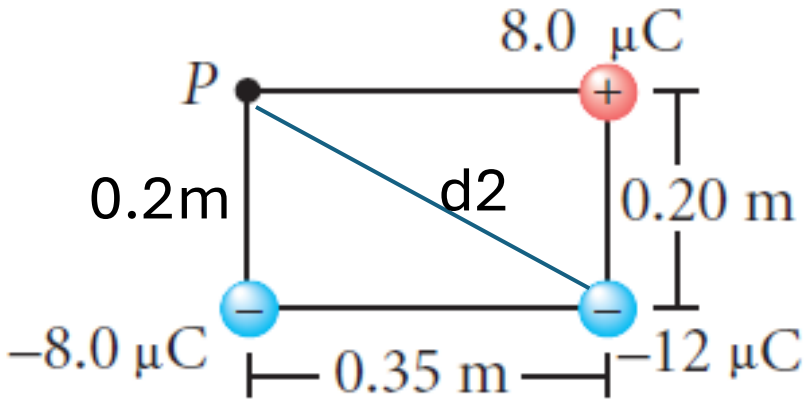


- Q1 = 8×10^{-6}C, Q2 = -12×10^{-6}C, Q3 = -8×10^{-6}C
- To find V for point P for the 3 charges
- ---> Find V for each charge at the distance from point P and add them
- Vtotal = V1 + V2 + V3
- To find V for each charge
- $V = Ed = k\,q\,d\,/d^2 = k\,q\,/\,d$
- **$V = k\,q\,/\,d$**
- $V1 = k\,q1/d1 = (9 \times 10^{9})\,(+8 \times 10^{-6})\,/\,(0.35) = +0.206V$

Problem9 page 626

9. In the figure below, find the electric potential at point P due to the grouping of charges at the other corners of the rectangle.





- V2 = k q2/d2
- To find d2 ---> right triangle (مثلث قائم الزاوية)
- $(d2)^2 = (0.2)^2 + (0.35)^2$
- $(d2)^2 = 0.04 + 0.1225$
- $(d2)^2 = 0.1625$ ---> d2 = 0.4m
- $= (9x10^9)\ (-12x10^{-6}) / (0.4) = -0.27V$
- $V3 = k\ q3/d3 = (9x10^9)\ (-8x10^{-6}) / (0.2) = -0.36V$
- Vtotal = V1 + V2 + V3
- Vtotal = +0.206 + (-0.27) + (-0.36) = -0.424V

Problem32 page 627

32. How long does it take a total charge of 10.0 C to pass through a cross-sectional area of a copper wire that carries a current of 5.0 A?

- Q = 10C , I = 5A
- I = Q/t
- 5 = 10 / t
- T = 10/5 = 2 s

Problem55 page 628

55. A computer is connected across a 110 V power supply. The computer dissipates 130 W of power in the form of electromagnetic radiation and heat. Calculate the resistance of the computer.

- V = 110V, P = 130W
- $P = V^2/R$
- $130 = (110)^2 / R$
- 130 = 12100/R
- R = 12100/130
- $R = 93\ \Omega$