Problems of Electric field

1) A charge of −13 μC is located 1.6 m to the right of other charge of 15 μC. Find the magnitude and direction of the electrostatic force on the negative charge.
Data: Coulomb's constant $k_e = 8.988\times10^9$ N·m^2/C^2.
Answer: 0.6846 N, to the left.

2) At what separation will two charges, each of magnitude 7 μC, exert a force of 0.122 N on each other?
Data: Coulomb's constant $k_e = 8.988\times10^9$ N·m^2/C^2.
Answer: 1.9 m.

3) Calculate the magnitude of the electric field due to a 7 mC charge at a point 0.6 m away.
Data: Coulomb's constant $k_e = 8.988\times10^9$ N·m^2/C^2.
Answer: 1.748×10^8 N/C.

4) A metal sphere has a charge of 15 μC. Find the magnitude and direction of the electric field it produces at a point 70 cm away.
Data: Coulomb's constant $k_e = 8.988\times10^9$ N·m^2/C^2.
Answer: 2.751×10^5 N/C, The electric field points away from metal sphere.

5) Find the magnitude and direction of the electric force on a charge of −13 μC at a point where the electric field is 30 N/C and is directed along the −*OX* axis.
Answer: 3.90×10^{-4} N, +*OX* direction.

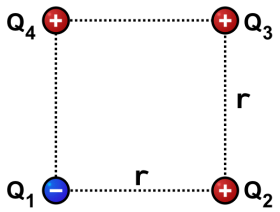
6) Calculate the electric force on a charge of 50 μC when it is at a point where the electric field intensity is 800 N/C.
Answer: 0.04 N.

7) A charge of 27 μC experiences a force of 10 N when in an electric field. Calculate the strength of the electric field at the point where the charge is located.
Answer: 3.70×10^5 N/C.

8) How much charge does a particle have that experiences a force of 15 N at a point where the electric field strength is 188 N/C?
Answer: 80 mC.

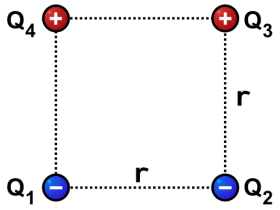
Problems of Electric field

9) Four charges are at the vertices of a square. Find the magnitude of the electric force on the charge Q_1.
Given: $Q_1 = -81$ mC, $Q_2 = 33$ mC, $Q_3 = 33$ mC, $Q_4 = 33$ mC
$r = 24$ cm. Coulomb's constant $k_e = 8.988\times10^9$ N·m^2/C^2.



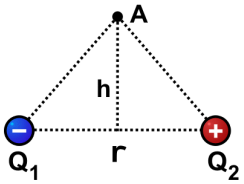
Answer: 7.984×10^8 N.

10) Four charges are located in the corners of a square. Calculate the magnitude of the electric field at the center of the square.
Given: $Q_1 = -84$ µC, $Q_2 = -84$ µC, $Q_3 = 84$ µC, $Q_4 = 84$ µC
$r = 18$ m. Coulomb's constant $k_e = 8.988\times10^9$ N·m^2/C^2.



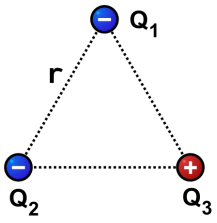
Answer: 13180 N/C.

11) Two charges $Q_1 = -36$ µC and $Q_2 = 36$ µC are at a distance of 30 m from each other. Find the magnitude and direction of the electric field at point A.
Data: $h = 13$ m, Coulomb's constant $k_e = 8.988\times10^9$ N·m^2/C^2.



Answer: 1241 N/C, to the left.

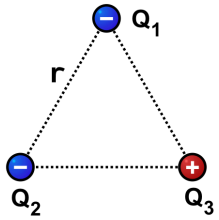
12) Three charges are located in the vertices of an equilateral triangle. Calculate the magnitude and direction of the electric force on the charge Q_1.
Given: $Q_1 = -37$ µC, $Q_2 = -83$ µC, $Q_3 = 83$ µC, $r = 16$ cm.
Coulomb's constant $k_e = 8.988\times10^9$ N·m^2/C^2.



Answer: 1078 N, to the right.

Problems of Electric field

13) Three charges are located in the corners of an equilateral triangle. Find the magnitude of the electric field at the center of the triangle.
Given: $Q_1 = -74$ mC, $Q_2 = -74$ mC, $Q_3 = 74$ mC, $r = 10$ m.
Coulomb's constant $k_e = 8.988\times10^9$ N·m^2/C^2.



Answer: 3.991×10^7 N/C.

14) The work required to move an 83 μC charge from point *A* to point *B* is 4.98×10^{-3} J. Find the potential difference between the two points.
Answer: 60 V.

15) An electron ($q = 1.602\times10^{-19}$ C) gains 3.04×10^{-16} J as it moves between two parallel plates. Calculate the potential difference on the plates.
Answer: 1900 V.

16) An electron ($m = 9.109\times10^{-31}$ kg, $q = 1.602\times10^{-19}$ C) placed between two charged parallel plates separated by 0.8 m is observed to accelerate at 3.05×10^{14} m/s^2. Find the voltage on the plates.
Answer: 1390 V.

17) An electron ($q = 1.602\times10^{-19}$ C) moves between two parallel plates 1.3 m apart with a potential difference of 75 V between them. Find the force that acts on the electron.
Answer: 9.24×10^{-18} N.

18) An electron ($m = 9.109\times10^{-31}$ kg, $q = 1.602\times10^{-19}$ C) is accelerated from rest between two parallel plates. The potential difference between the plates is 1200 V. Find the speed of the electron when it reaches the positive plate.
Answer: 2.05×10^7 m/s.

19) A completely ionized carbon atom (net charge = $+6e$) is accelerated through a potential difference of 60 V. Calculate the increase in kinetic energy (in Joules and eV) of the ionized atom.
Data: $e = 1.602\times10^{-19}$ C, 1 eV = 1.602×10^{-19} J.
Answer: 5.77×10^{-17} J = 360 eV.