PQ 1 Coulomb's Law

Questions

Q1

- What is the total charge of 75.0 kg of electrons?

The mass of *one* electron is 9.11×10^{-31} kg

Q2

A point charge of $+3.00 \times 10^{-6}\,\mathrm{C}$ is $12.0\,\mathrm{cm}$ distant from a second point charge of $-1.50 \times 10^{-6}\,\mathrm{C}$. Calculate the magnitude of the force on each charge.

Q3

What must be the distance between point charge $q_1 = 26.0\,\mu\text{C}$ and point charge $q_2 = -47.0\,\mu\text{C}$ for the electrostatic force between them to have a magnitude of $5.70\,\text{N}$?

Q4

The most common isotope of hydrogen contains a proton and an electron separated by about 5.0×10^{-11} m. The mass of a proton is approximately 1.7×10^{-27} kg. The mass of the electron is approximately 9.0×10^{-31} kg.

a) Use Newton's law of universal gravitation to calculate the gravitational force between the electron and proton in the hydrogen atom.

b) Use 1.6×10^{-19} C as the elementary unit of charge to determine the force of attraction between the two particles.

Q5

Two positive charges of 6.0×10^{-6} C are separated by 0.50 m. Draw a force diagram for each of the charges, considering only electrostatic forces. What is the magnitude of the force between the charges? Is this force repulsive or attractive?

Q6

A negative charge of 2.0×10^{-4} C and a positive charge of 8.0×10^{-4} C are separated by 0.30 m. What is the magnitude of the force between the charges? Is this force repulsive or attractive?

Q7

A young man accumulates a charge q_1 of $+2.0 \times 10^{-5}$ C while sliding out of the front seat of a car. His girlfriend, who had been waiting in the wind, has picked up some extra electrons and now has a charge q_2 of -8.0×10^{-5} C.

Draw a sketch of the situation. Estimate the magnitude of the electrical force that each person exerts on the other when separated by a distance of 6.0 m. Is the force attractive or repulsive?

Q8

A charge of 5.67×10^{-18} C is placed 3.5×10^{-6} m away from another charge of -3.79×10^{-19} C. What is the force of attraction between them?

electrical proportionality constant = 9.0×10^{9} Nm^2/C

charge of a proton = +1 = 1.6×10^{-19} C

charge of an electron = -1 = -1.6×10^{-19} C

Q9

What is the magnitude of electrical force of attraction between an iron nucleus (26 protons) and its innermost electron if the distance between them is 1.0×10^{-12} m?

$q_1 = 26+$
$q_2 = 1-$
$d = 1.0 \times 10^{-12}$ m

$$F_e = k\frac{q_1 q_2}{d^2}$$

electrical proportionality constant = 9.0×10^{9} Nm^2/C
charge of a proton = +1 = 1.6×10^{-19} C
charge of an electron = -1 = -1.6×10^{-19} C

Q10

How far apart must two electrons be if the force between them is 1.0×10^{-12} N?

$q_1 = 1-$
$q_2 = 1-$
$F_e = 1.0 \times 10^{-12}$ N
$k = 9 \times 10^{9}$

electrical proportionality constant = 9.0×10^{9} Nm^2/C
charge of a proton = +1 = 1.6×10^{-19} C
charge of an electron = -1 = -1.6×10^{-19} C