Introductory E&M Practice Problems

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November 11, 2012

Topics Covered

- Electric Charge
- Coulomb's Force Law
- Charging Objects
- Electric Field

Question #1

In a hydrogen atom a proton is separated from an electron by an average distance of about 5.3×10^{-11} meters. Using the information shown below, calculate the electrostatic force of attraction by the proton on the electron.

Useful Constants

Electron Mass = 9.11×10^{-31} kg
Proton Mass = 1.67×10^{-27} kg
Elementary Charge = 1.602×10^{-19} C
Coulomb's Constant = 8.99×10^{9} Nm^2/C^2
Avogadro's Number = 6.02×10^{23} atoms/mole

Question #2

Suppose I place a charge of Q1 = +1 C at the point (1 m, 0 m) and a charge of Q2 = -2 C at the point (0 m, 0 m). At what point in the xy-plane could I put a negative charge of Q3 = -5 C such that Q3 would feel no net electrostatic force?

1 Question #3

Using the information shown below, estimate the number of electrons in a 1.0 kg of copper that has been charged to +10 μC

Useful Constants

Electron Mass = 9.11×10^{-31} kg
Proton Mass = 1.67×10^{-27} kg
Elementary Charge = 1.602×10^{-19} C
Coulomb's Constant = 8.99×10^{9} Nm^2/C^2
Avogadro's Number = 6.02×10^{23} atoms/mole
Atomic Mass of Copper = 29
Molar Mass = 55.8 g/mole

Question #4

I bring a charged insulator close to an uncharged conductor (not touching). I then ground the conductor. This method of charging the conductor is called charging by _____.

Question #5

Suppose I place four charges (each +Q) at the four vertices of a square. What is the magnitude of the net force on a positive point charge located at the center of the square?

Question #6

An electron is fired into a uniform electric field. The initial velocity of the electron is given by: $\vec{v} = 500\hat{x} + 100\hat{y} - 300\hat{z}$

given by: $\vec{E} = 100\hat{x} + 200\hat{y} - 150\hat{z}$

Answers

- 8×10^{-5} N
- 8×10^{-5} N
- 8×10^{-5} N