Answer on Question #79342, Physics / Electric Circuits

1. The electron and proton atom are separated (on the average) by a distance of 5.3 × 10-11m. Find the magnitude of the electric force and the gravitational force between the two particles.

Solution

Magnitude of the electric force between the two particles:

$$F_{el} = \frac{ke^2}{r^2} = (9 \cdot 10^9)\left(\frac{1.6 \cdot 10^{-19}}{5.3 \cdot 10^{-11}}\right)^2 = 8.2 \cdot 10^{-8} N.$$

Magnitude of the gravitational force between the two particles:

$$F_{el} = \frac{GmM}{r^2} = (6.67 \cdot 10^{-11})\frac{(9.1 \cdot 10^{-31})(1.67 \cdot 10^{-27})}{(5.3 \cdot 10^{-11})^2} = 3.6 \cdot 10^{-47} N.$$

2. Calculate the potential difference between two points x,y in the field of a single charge of

1.5 × 10-6C if the products and the differences of the distance of x and y from the 15cm and 2cm respectively

Solution

$$V_1 - V_2 = (9 \cdot 10^9)(1.5 \cdot 10^{-6})\left(\frac{1}{0.02} - \frac{1}{0.15}\right) = 585\ kV.$$

3. A charge 4.5 × 10-9C is placed in an electric field of magnitude 9.6 × 10-5 NC-1 upwardly directed. What work is done by the electric force in moving the charge 60cm to the left.

Solution

The work is done by the electric force in moving the charge 60cm to the left is zero:

$$W = qEd\cos 90 = qEd(0) = 0\ J.$$

4. A charge 4μC is place 60cm away from a charge of 4μC what is the electric field at point?

a. p midway between the charges

b. at point q 4cm from p and equidistance from the two charges

Solution

a. The electric field at p midway between the equal charges is zero:

$$E = 0\frac{V}{m}.$$

b.

$$E = 2\frac{kq}{r^2}\sin\alpha$$

$$E = \frac{2(9\cdot 10^9)(4\cdot 10^{-6})}{0.03^2+0.04^2}\frac{0.04}{\sqrt{0.03^2+0.04^2}} = 23\cdot 10^6\frac{V}{m}.$$