Answer to Question #69621, Physics / Electric Circuits

Question:

01. The electrostatic force between two charges is 10 N when they are 10 mm apart. What is the force between them when the distance is 5 mm?

a. 40 N b. 20 N c. 5.0 N d. 2.5 N

Solution:

The force between two charges in the first case can be calculated as

$$F_1 = \frac{kq_1q_2}{r_1^2}$$

In the second case

$$F_2 = \frac{kq_1q_2}{r_2^2}$$

So

$$kq_1q_2 = F_1r_1^2 = F_2r_2^2 \rightarrow \boldsymbol{F_2} = \frac{F_1r_1^2}{r_2^2} = 10 * \frac{10^2}{5^2} = \boldsymbol{40\ N}$$

The answer is a)

Question:

04. The electric potential energy of two fixed particles is 100 J. If both particles are allowed to move, each particle will have a maximum kinetic energy of

a. 200 J b. 100 J c. 50 J d. 25 J

Solution:

The total kinetic energy bought particles can acquire after they are released is equal to initial potential energy. There for the maximum kinetic energy of each particle will be 100 J (Imagine an apple falling on earth, the potential energy of the apple is completely transformed in to its kinetic energy. The earth is not fixed, it is just very heavy)

The answer is b)

Question:

05. The electric field in a capacitor is 1.8 x 104 N/C. What will be the new electric field when a dielectric of K= 6 is inserted between its plates?

a. 1.1 x10^5 N/C b. 1.8 x10^4 N/C c. 3.0 x10^3 N/C d. 6 N/C

Solution:

The voltage between the plates of the capacitor in the first case can be calculated as

$$V_1 = \frac{Q}{C_1} = \frac{Q}{\frac{A\varepsilon}{d}} = E_1 d$$

Where A is the area of the plates and d is the distance between them. ε is a permittivity of vacuum.

In the second case

$$V_2 = \frac{Q}{C_2} = \frac{Q}{\frac{KA\varepsilon}{d}} = E_2 d$$

Now, the charge on the plates of the capacitor does not change if the dielectric is inserted, so

$$Q = E_1 d * \frac{A\varepsilon}{d} = E_2 d * \frac{KA\varepsilon}{d}$$

$$E_1 = E_2 * K$$

$$\boldsymbol{E_2 = \frac{E_1}{K} = \frac{(1.8 \text{ x } 10^4)}{6} = \ 3.0 \text{ x} 10^3 \text{ N/C}}$$

The answer is c)

Question:

06. A particle with a charge of 1.6 μC experiences an electrostatic force of 3.2 x10^{-6} N 1.0 cm from the source of the field.. What is the electric field at the location of the charge? a. 4.8 N/C b. 3.2 N/C c. 2.0 N/C d. 1.6 N/C

Solution:

The electric field at the location of the charge can be calculated as

$$\boldsymbol{E = \frac{F}{q} = \frac{3.2 * 10^{-6}}{1.6 * 10^{-6}} = 2 \ \frac{N}{C}}$$

The answer is c)