Answer to Question #69623, 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 the two particles can be calculated as

$$\mathrm{F} = \frac{\mathrm{kq_1 q_2}}{\mathrm{r^2}}$$

so for the first case

$$\mathrm{kq_1 q_2} = \mathrm{F_1} * \mathrm{r_1^2}$$

for the second case

$$\mathrm{kq_1 q_2} = \mathrm{F_2} * \mathrm{r_2^2}$$

together this leads us to

$$\mathrm{F_1} * \mathrm{r_1^2} = \mathrm{F_2} * \mathrm{r_2^2}$$

$$\mathbf{F_2} = \mathrm{F_1} * \frac{\mathrm{r_1^2}}{\mathrm{r_2^2}} = 10 * \frac{100}{25} = \mathbf{40N}$$

Answer: 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

Explanation:

The potential energy of two particles together will transform to the kinetic energy and will be distributed between them if they are allowed to move. The maximum energy each of the particle can have is the total potential energy the system had (the energy gained by the second particle is then 0)

Answer: 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 x105 N/C b. 1.8 x104 N/C c. 3.0 x103 N/C d. 6 N/C

Solution:

The voltage on the capacitor is calculated as

$$V = \frac{Q}{C} = \frac{Q}{\frac{A\varepsilon_0\varepsilon}{d}} = Ed$$

As a result the charge of the capacitor is equal to

$$Q = Ed * \frac{A\varepsilon_0\varepsilon}{d} = EA\varepsilon_0\varepsilon$$

and it stays unchanged when the dielectric is inserted so

$$E_1 A\varepsilon_0\varepsilon_1 = E_2 A\varepsilon_0\varepsilon_2$$

For vacuum $\varepsilon_1 = 1$, and for the dielectric $\varepsilon_2 = K = 6$ so

$$\boldsymbol{E_2} = \frac{E_1}{K} = \mathbf{3.0 * 10^3\ N/C}$$

Answer: 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 is equal to:

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

Answer: c