

Answer on Question #45986 – Physics – Electromagnetism

Question.

Charges of +2 C and -2C are situated at points P and Q respectively which are at a distance apart. A point X is mid-way between P and Q. Which of the following correctly describes the electric field and the electric potential at point X?

- electric field is toward Q, electric potential is zero
- electric field is toward Q, electric potential is negative
- electric field is toward P, electric potential zero
- electric field is toward P, electric potential is positive

$$q_1 = 2 \text{ C}$$
$$q_2 = -2 \text{ C}$$

Solution.

By definition the electric field created by point charge is defined the following:

$$E = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2} \sim \frac{q}{r^2}$$

And the potential is defined as:

$$\varphi = \frac{1}{4\pi\epsilon_0} \frac{q}{r} \sim \frac{q}{r}$$

Let use the superposition principle for the electric field and electric potential:

$$E = |E_1| + |E_2|$$

$$\varphi = \varphi_1 + \varphi_2$$

In the middle point (the distance from each charge to middle point is d) we will receive the following:

$$E \sim \frac{q_1 + |q_2|}{d^2}$$

$$\varphi \sim \frac{q_1 + q_2}{d} = 0$$

So, we can see that potential will be equal zero in the middle point between the charges q_1 and q_2 . And we know that electric field is directed from positive charge to negative charge. In our case, electric field is directed to point Q, where negative charge q_2 is situated.

Thus, answer is the following: electric field is toward Q, electric potential is zero.

Answer.

electric field is toward Q, electric potential is zero