

State Examination Commission – Physics Higher Level, 2005

Question 10

Define electric field strength.

State Coulomb's law of force between electric charges.

(12)

Why is Coulomb's law an example of an inverse square law?

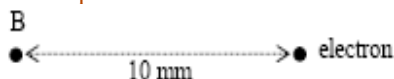
(6)

Give two differences between the gravitational force and the electrostatic force between two electrons.

(6)

Describe an experiment to show an electric field pattern.

(12)



Calculate the electric field strength at the point B, which is 10 mm from an electron.

What is the direction of the electric field strength at B?

A charge of $5 \mu\text{C}$ is placed at B. Calculate the electrostatic force exerted on this charge.

(20)

(permittivity of free space = $8.9 \times 10^{-12} \text{ F m}^{-1}$; charge on the electron = $1.6 \times 10^{-19} \text{ C}$)

Define electric field strength.

State Coulomb's law of force between electric charges.

(12)

Definition – Learn

Why is Coulomb's law an example of an inverse square law?

(6)

Because the force decreases with the square of the distance between the charges

Give two differences between the gravitational force and the electrostatic force between two electrons.

(6)

The electrostatic force can be repulsive or attractive, the gravitational force only attractive.

The gravitational force is miniscule by comparison to the electric force.

Describe an experiment to show an electric field pattern.

(12)

Connect a high voltage source up to two electrodes and dip these electrodes into a shallow dish of olive oil into which some semolina has been sprinkled.

The semolina will be seen to align itself along electric field lines.



Calculate the electric field strength at the point B, which is 10 mm from an electron. What is the direction of the electric field strength at B?

$$\begin{aligned} E &= \frac{Q}{4\pi\epsilon d^2} \\ &= \frac{(1.6 \times 10^{-19})}{4\pi(8.9 \times 10^{-12})(0.01)^2} \\ &= 1.4 \times 10^{-5} \text{ N C}^{-1}, \text{ and its direction is towards the electron.} \end{aligned}$$

A charge of $5 \mu\text{C}$ is placed at B. Calculate the electrostatic force exerted on this charge.

(8)

$$\begin{aligned} F &= Eq = (1.4 \times 10^{-5})(5 \times 10^{-6}) \\ &= 7.2 \times 10^{-11} \text{ N, towards the electron} \end{aligned}$$