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1. Using the concept of Newton's second law of motion, describe the magnitude and direction of the acceleration of an electron being shot horizontally into a closed space with a uniform field being directed upward.

Answer

Newton's second law of motion states that 'the acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object. ($\vec{F}_{net} = m\vec{a}$)'

In this question, the two constants involved are acceleration and force. In an electric field, negative charges act in the opposite direction of the electric field. Thus, as the electric field is acting upwards / directed upwards, as the electron is shot into the electric field, it would be directed downwards.

The electric field, thus the magnitude of the force acting upwards and that of the acceleration acting upwards is equal to the magnitude of the force and acceleration acting on the electron as it moves downwards. Thus, the magnitude and direction of the acceleration are constant since the electric field is uniform and since the force is constant (Force is directly proportional to acceleration, so both are constant).

2 Describe electric field, magnetic field and electric current with respect to charges

Answer:

Electric field with respect to charges.

Electric field can be defined as the region around a charged particle or object within which a force would be exerted on other charged particles or objects. It can also be defined as the electric force per unit charge. Electric field is related to electric charge with the equation $\vec{E} = \frac{\vec{F}}{q}$ (N/c).

where $\vec{E}$ = electric field, $\vec{F}$ = electric force, q = electric charge. Now, the charge can either be positive or negative. Since the force acting on charge q varies at different points, the value of the electric field would also vary. Also, if the charge is a positive charge, the direction of the force of the charge is along the electric field while that of negative would be acting against the direction of the electric field. Electric field can not be negative, which is why the magnitude of the charge is taken into consideration since the electric field is a vector and has both negative and positive directions.

Magnetic field with respect to charges.

Magnetic field is a vector field that describes the magnetic influence on moving electric charges, electric currents and magnetized materials. A charge that is moving in a magnetic field experiences a force perpendicular to its own velocity and to the magnetic field. Magnetic force in a magnetic field is created when moving charged particles (electric current) detect a magnetic field.

According to the right hand rule, if the thumb of the right hand is in the direction of the current, the other fingers will curl in the direction of the magnetic field.

The magnetic field $\vec{B}$ and charge 'q' are related by $\vec{F} = q\vec{v}\vec{B}\sin\theta$

Electronic current with respect to charges

An electric current is a flow of electronic charge in a circuit. The charges can either be negatively charged electrons or positively charged carriers like protons, positive ions or holes.

Electrical current can be defined as the flow of electrons through a closed circuit when a potential difference is applied across the circuit. In many contexts, the direction of the current in electric circuits is taken as the direction of positive charge flow, the direction opposite to the actual electron drift. When so defined the current is called conventional current.

Current is usually denoted by the symbol I. Ohm's law relates the current flowing through a conductor to the voltage V and resistance R i.e. $V = IR$.

$$\therefore I = \frac{V}{R}$$

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