

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

Answer

Electric field is defined as the electric force per unit charge or a region around a charged particle.

$\vec{E} = \frac{\vec{F}}{q}$ - The Electric field is radially outward from a positive charge and radially in towards a negative point charge.

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 is perpendicular to its own velocity and to the magnetic field.

Electric current: is a stream of charged particles, such as electrons or ions moving through an electrical conductor or space.

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Petroleum Engineering

Eng 221

1. Determine the magnitude and direction of the acceleration of an electron being shot horizontally into a closed space with a uniform field being directed upward.

Solution:

First of all, a gas of atoms is ionized by firing a beam of particles of the gas, which either adds electrons to the atoms or knocks a few of the electrons off depending on the type of particles, beam used - which gives the atom an electric charge. The ions are then sent through a tube in which they are subjected to both electric and magnetic fields. The fields exert force on the ions and the strengths of the two forces causes the ions to change speed, while the magnetic field bend their path. Here, the magnetic force supplies the centripetal force.

$$F = \frac{mv^2}{r}, \quad F = qvB$$

$$\therefore qvB = \frac{mv^2}{r} \quad \therefore r = \frac{mv}{qB}$$

By Newton's 2nd law of Motion, $F = ma$ rearranged as $m = F/a$, dividing the total force acting on the ions by their resultant acceleration to determine the ion's mass.