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Matric No: 19/ENG06/051

Dept: Mechanical Engineering

Course code: ENG 221

Assignment

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

The Mass Spectrometer Experiment applies both the knowledge of electric and magnetic Field to determine the mass of an atom. First of all, a gas of atoms is ionized by firing a beam of particles at the gas, which either adds electrons to the atoms it hit or knocks a few of their electrons off depending on the type particle beam used. This gives the atoms now known as "ions" – a net negative or positive electric charge. Next the ions are send through a tube in which they are subjected to electric and magnetic Fields. Both of these fields exert a force on the ions, and the strengths of the two forces are proportional to the ions charge. The electric force causes the ions to change speed, while the magnetic field bend their path. Magnetic force is always perpendicular to velocity, so that it does no work on the charged particle. Here, the magnetic force supplies the centripetal force.

$F_c = mv^2/r$, Nothing that $\sin\theta = 1$, we see that $q = qvB$ Because the magnetic force F supplies the centripetal force we have $\left[qvB = \frac{mv^2}{r} \right]$

Solving for r yields

$\left[r = \frac{mv}{qB} \right]$

By way of vectors, 2nd law of motion, F=ma, dividing the total force acting on the ions by their resulting acceleration to determine the ions mass.

(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 or object within which another charged particles or objects.

$\vec{E} = \frac{F}{q}$, The direction of the field is taken to be the direction of the force it would exact on a positive charge and radially inward on 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 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. It is measured at the net rate of flow of electric charge past a region.

$I = \frac{V}{R}$, $I = \frac{Q}{t}$.