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19/ENG05/017

MECHATRONICS ENGINEERING

Question 1:

Using the concept of Newton's second 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.

It can be said that magnitude and direction of the electric field is constant in the closed space because the electric field is uniform so an electron which is negatively charged (1.6*10^-19 Coulombs), will migrate to the direction of the positive terminal of the electric field. Therefore, the electron will be acted upon by an electric force that will be directed opposite to the electric field, which means that force is downward direction

From Newton 2nd law of motion;

Force =Mass(m) x Acceleration(a)

F=unit charge(q) x electric field(E)

F=ma

F=qE

qE=ma

a=q x E/m

Therefore, since the field is constant, the force will be constant and the magnitude of the acceleration will be constant while the direction of acceleration will be downward.

Question 2:

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

1. ELECTRIC FIELD: Electric field can be described as a region created by an electric charge that extends outward into the surrounding space and a second or more charge act towards or against and this create an electric force.
   The direction of the force is the same as that of the electric field is the same if the second or test charge is positive, but will be opposite in direction if the test charge is negative.

2. MAGNETIC FIELD: Magnetic field are produced by moving electric charges and integral magnetic moment of the charged particles. Moving electric charges placed in a magnetic field will experience a magnetic force. A moving charge in a magnetic field feels a force which is perpendicular to its own velocity and to the magnetic field.
3. ELECTRIC CURRENT: These are known as moving electric current. It is a stream of charged particles such as electrons or ion moving through an electrical conductor or space.

   The movement of electric charge in a conductor is not a fast one, it is a continuous transfer of charges from one particle to another in the conductor.

   For instance, consider a wire AB of length 55 mm with C.S.A of 10 mm2, electrons are assumed to have been positioned from each other at negligible distance, so when electricity is supplied, there will be transfer of electron from A to B, looking like a motion of a single electron has been performed without any collision.