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ELECT/ELECT ENGINEERING

19/ENG04/055

BASIC ELECT (ENG 221)

QUESTION 1

Newton's Second Law 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. The equation can be summed as follows:

$$\mathbf{a = F_{net} / m}$$

$$\mathbf{F_{net} = m \bullet a}$$

$$\mathbf{F=qE}$$

$$\mathbf{qE=ma}$$

$$\mathbf{a=qE/m}$$

Where F= force in newton, a= acceleration in meter per second^2, m= mass, E= charge of particle (electron = 1.6*10^-19).

Applying Newton's Second Law, 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. Since the field is directed upward, positive charges move upward to the negative side of the field. An electron fired horizontally into the field will be deflected and directed downwards towards the positive plates. This happens because negatively charged particles are attracted to positively charged particles. Hence, the magnitude of the acceleration will remain constant and the acceleration will be directed downwards.

QUESTION 2

I. An electric field is the physical field that surrounds each electric charge and exerts force on all other charges in the field, either attracting or repelling them. Electric fields originate from electric charges. It is the electric force per unit charge. The direction of the field is taken to be the direction of the force it would

exert on a positive test charge. The electric field is radially outward from a positive charge and radially in toward a negative point charge.

II. A magnetic field is a region around a magnetic material or a moving electric charge within which the force of magnetism acts. Magnetic fields exert forces on moving charges. The magnetic force on a free moving charge is perpendicular to both the velocity of the charge and the magnetic field with direction given by the right hand rule. The force is given by the charge times the vector product of velocity and magnetic field. The relation is expressed mathematically as follows:

$$F=qvBSin\theta$$

Where F is the magnetic force on the charge, q is the magnitude of the charge, v is the charge's velocity, B is the magnetic field vector of the magnetic field and Sinθ is the sine of the angle between v and b.

III. An electric current is a stream of charged particles, such as electrons or ions, moving through an electrical conductor or space. It is measured as the net rate of flow of electric charge past a region. The moving particles are called charge carriers, which may be one of several types of particles, depending on the conductor. In electric circuits the charge carriers are often electrons moving through a wire. In semiconductors they can be electrons or holes.