Q1. An electron and a proton are moving under the influence of mutual forces. In calculating the change in the kinetic energy of the system during motion, one ignores the magnetic force of one on another. This is, because

(a) the two magnetic forces are equal and opposite, so they produce no net ' effect

(b) the magnetic forces do not work on each particle

(c) the magnetic forces do equal and opposite (but non-zero) work on each particle

(d) the magnetic forces are necessarily negligible

Sol: (b)

Key concept: To calculate the change in kinetic energy of the system during motion we have to apply work-energy, theorem. According to this theorem, Net work done = Final kinetic energy – Initial kinetic energy of the object The above statement shows the connection between work and kinetic energy as: "The work done by the net force acting on an object is equal to the change in the kinetic energy of that object".

Net work done (IF) on a particle equals change in kinetic energy of the particle.

$\Sigma W=K_2-K_1$

According to the problem as the electron and proton are moving under the influence of mutual forces, the magnetic forces will be perpendicular to their motion, hence, it acts as a centripetal force for the particle. In this way the particle performs the uniform circular morion, this implies speed will remain constant. So, there is no change in kinetic energy of the particle. Hence no work is done by these forces.

$$\overrightarrow{F_m} = q(\vec{v} \times \vec{B}) \cdot F_m$$

(magnetic force) will be perpendicular to both B and v, where B is the external magnetic field and v is the velocity of particle. That is why one ignores the magnetic force of one particle on another.