Tutorial 7 — Solutions

(Vector quantities are displayed either in italic Bold or with a vector symbol above the quantity)

Q1 A positive charge particle of 1.5×10^{-10} coulomb is moving with velocity of 2×10^{6} m/s from left to right in a uniform downward magnetic field ***B*** of 1 Tesla .

(a) In which direction will it experience a force? Into the paper.

(b) Determine the magnitude of the force.

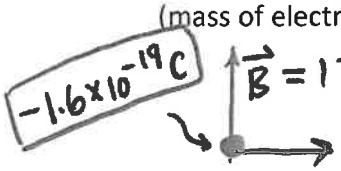
(c) If the charge has a mass of 1.7×10^{-7} kg, what is the magnitude of its acceleration? ($F = m\,a$)

$F = qvB = 1.5\times10^{-10} \times 2\times10^{6} \times 1 = 3\times10^{-4}$ N//

$a = F/m = \frac{3\times10^{-4}}{1.7\times10^{-7}} = 1.8\times10^{3}\ m/s^2$//

Q2 An electron is fired from an electron gun into a uniform upward magnetic field ***B*** of 1 Tesla. The electron is moving at 3×10^{6} m/s from left to right. Determine the force on the electron and the acceleration of the electron. What is the direction of the acceleration of the electron?

(mass of electron is 9.1×10^{-31} kg and $e = 1.6 \times 10^{-19}$ Coulomb)



$F = qvB = 1.6\times10^{-19} \times 3\times10^{-6} \times 1$
$= 4.8\times10^{-13}$ N//

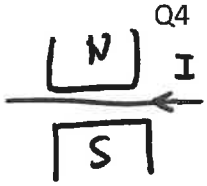
$a = \frac{4.8\times10^{-13}}{9.1\times10^{-31}} = 5.3\times10^{17}\ m/s^2$// into the paper.

Q3 A positive charge particle is moving with velocity *v* in a uniform downward magnetic field ***B*** .

(a) In what direction(s) can it be moving if the magnetic force on it is zero? In line with $\vec{B}$

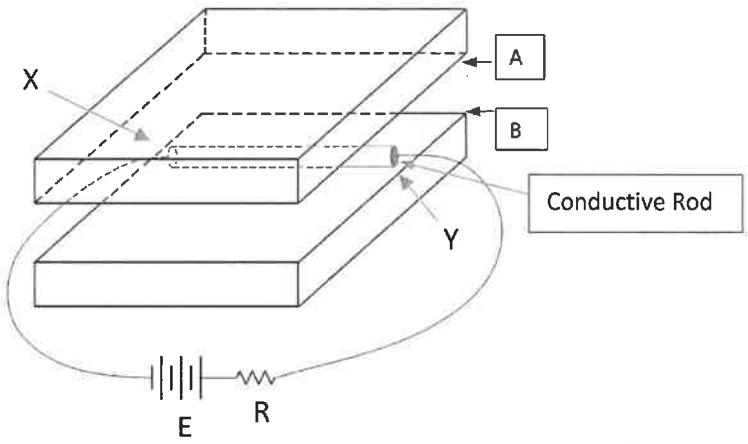
(b) In what directions(s) can it be moving if the magnetic force on it has the largest possible magnitude? $\vec{v}$ is perpendicular to $\vec{B}$. That is, v is in the horizontal directions, left or right.

Q4 A horizontal wire that runs east-west carries a steady current to the west. A C-shaped magnet is placed so that the wire runs between the poles, with the north pole above the wire and the south pole below. What is the direction of the magnetic force on the wire between the poles? Out of the paper.



Q5 The magnet in Q4 has a uniform field of 0.8 Tesla and its width covers 5 cm of the wire. When the current in the wire is 10 A, how much force is developed in the wire?

$F = BIL = 0.8 \times 10 \times 0.05 = 0.4$ N/



This diagram is for answering Q6 to Q9

Q6 Given that A is a North pole and B, a South pole, in which direction is the force acting on the rod? Assume E is 10 V and R is 1 Ω.

The force on the rod is forward/backward/upward/downward

Q7 Given that A is a North pole and B, a South pole, what is the voltage across the 2 ends of the rod if the rod is held in place and not allowed to move? Assume E is 10 V and R is 1 Ω.

The voltage across the 2 ends of the rod is 10V / < 10V / >10 V / 0 V.

No emf is generated if the rod is not moving.

Q8 Given that A is a North pole and B a South pole, what is the voltage across the 2 ends of the rod if the rod is allowed to move? Assume E is 10 V and R is 1 Ω.

The voltage across the 2 ends of the rod is 10V / < 10V / >10 V / 0 V.

Q9 In Q8, what is the direction of the voltage, if any?

The voltage at X is positive/negative/zero with respect to voltage at Y.