Forces and Magnetic Fields PROBLEM SET#1

For each of the questions you **MUST** draw a diagram (noting that **up** is out-of-page and **down** is into-page

1. A magnetic field of 0.825 Tesla is pointing straight upwards. A wire of the length 1.75 m lies in the horizontal plane and carries a current of 4.60 A towards the east. What is the magnitude and direction of the magnetic force acting on this wire?

2. The nucleus of a hydrogen atom (a proton of charge +1 e) is travelling towards the west through a magnetic field that points straight upwards. What is the direction of the magnetic force that acts on the proton?

3. An electron is travelling towards the west through a magnetic field that point straight upwards. What is the direction of the magnetic force that acts on the electron?

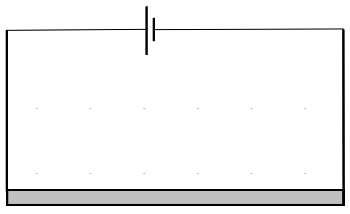
4. A 4.70 g bullet moves with a speed of 200.0 m/s [West], perpendicular to the earth's magnetic field of 5.00×10^{-5} T [North]. If the bullet possesses a charge of 6.80×10^{-9} C, what force acts on it?

5. What is the Magnitude and direction of a magnetic field if an **electron** moving through it at 2×10^{6} m/s experiences a magnetic force of 5.1×10^{-14} N West when the electron is moving North?

6. A proton having a speed of 5×10^{6} m/s in a magnetic field feels a force of 8×10^{-14} N towards the West when it moves vertically upward. When moving horizontally in a Northerly direction, it feels zero force. What is the magnitude and direction of the magnetic field in this region?

7. A uniform magnetic field directed out of the page has a field strength of 0.3 T. An electron enters the magnetic field at 6×10^{6} m/s, moving East. What is the magnitude and direction of the magnetic force on the electron?

8. The conductor suspended by light flexible wires in the diagram below has a length of 20 cm and a mass of 0.008 kg. What current must exist in the conductor if the tension in the supporting wires is to be zero? Assume the strength of the magnetic field is 0.8 T, and points into the page. In what direction must the current run? (The battery shown is **not** necessarily connected properly, the positive side of the battery is usually indicated by the longer side of the parallel plates)



Grade 12 Physics – Forces and Magnetic Fields Answers

1. 6.64N [South]
2. North
3. South
4. 6.8×10^{-11} N [down]
5. 0.16T [down]
6. 0.1 T [North]
7. 2.9×10^{-13} N [North]
8. 0.49A [counter-clockwise] – this means the battery is drawn correctly.

1. Determine the magnitude and direction of the magnetic force on a proton moving horizontally northward at 8.6×10^{4} m/s, as it enters a magnetic field of 1.2 T directed vertically upward. (The mass of a proton is 1.67×10^{-27} kg.)

1.7×10^{-14} N [E]

2) An electron moving through a uniform magnetic field with a velocity of 2.0×10^{6} m/s [up] experiences a maximum magnetic force of 5.1×10^{-14} N [left]. Calculate the magnitude and direction of the magnetic field.

0.16 T [horizontal, toward observer]

3) Calculate the radius of the path taken by an α particle (He^{2+} ion, of charge 3.2×10^{-19} C and mass 6.7×10^{-27} kg) injected at a speed of 1.5×10^{7} m/s into a uniform magnetic field of 2.4 T, at right angles to the field.

0.13 m