Physics 12 Electromagnetic Force Worksheet 1

Key

Name: _____

F= Bqv sin F= BIL sin

1. Calculate the force on an electron travelling through the magnetic field of 0.003 Tesla (typical fridge magnet) at 500 m/s perpendicular to the field.

The charge on an electron can be found on your data sheet, and is listed at the elementary charge, 1.6×10^{-19} C

$F = BqV = (0.003)(1.6 \times 10^{-19})(500) = 2.4 \times 10^{-19} N$

2. Calculate the acceleration of this electron. The mass of an electron can be found on your data sheet.

$a = \frac{F}{m} = \frac{2.4 \times 10^{-19}}{9.11 \times 10^{-31}} = 2.63 \times 10^{11} m/s^2$

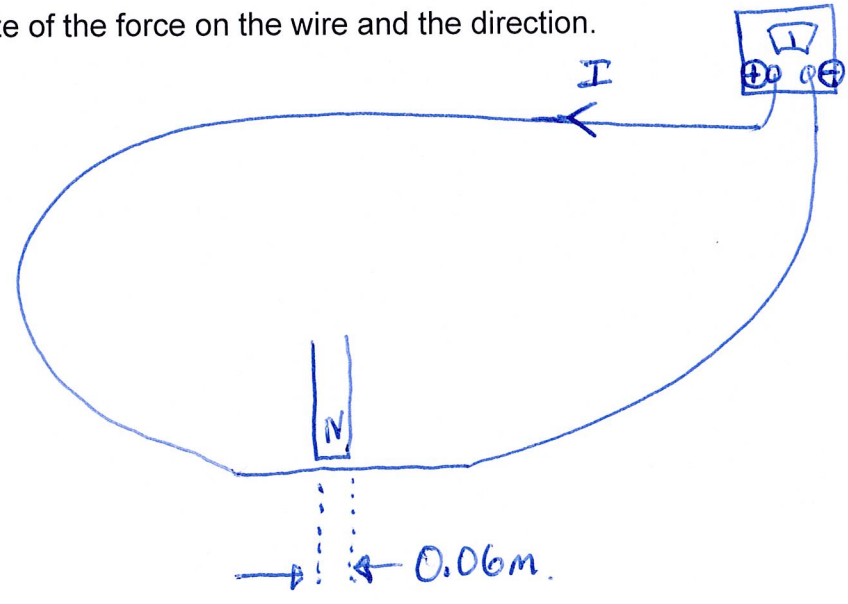
3. Calculate the force on a proton travelling at 100 m/s near a rare earth neodymium magnet (B field is 1.1 Tesla).

The charge on a proton is the same size as the charge on an electron.

$$F = BqV = (1.1)(100)(1.6\times10^{-19}) = 1.76\times10^{-17}$$

4. A wire carries a current of 4 A and passes through a magnetic field of 0.9 T.

Find the size of the force on the wire and the direction.



$$F = BIL = (0.9)(4)(0.06) = 0.216\,N$$

5. a) Find the force on the loop of wire that carries a 0.2 A current and passes through a 1.1 Tesla field perpendicular to the loop.

$C = 2\pi r$

$r = 0.02$ m

$C = L = 2 \times 3.14 \times .02$

$L = 0.1256$

$F = BIL$

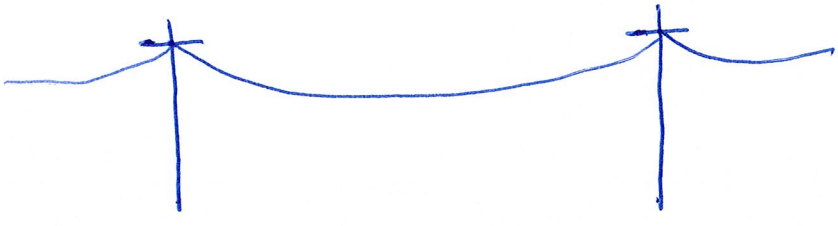
$= (1.1)(0.2)(0.1256) = 0.0276\ N$

b) How many wraps do you need to generate a 5 N force?

$5 = 0.0276 \times \#\ wraps$

$wraps = 181$

6. The Earth's magnetic field is approximately 3×10^{-5} Tesla. How large is the magnetic force on a 32 m wire between two telephone poles that carries 1.6 amp of current?



$F = BIL = (3 \times 10^{-5})(1.6)(32) = 0.00154\ N$