Name: KEY

Period: ____

Pre-AP Physics

Magnetic Force Problems

Answer each question in the space provided. Show all work and box your answer(s).

$F_B = qvB$

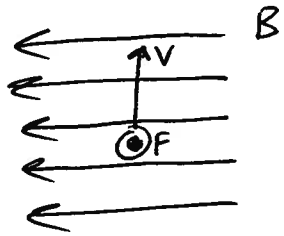
$F_B = ILB$

1. A particle with a charge of 4.8 μC is moving at 1,900 m/s upward (+y) when it enters a magnetic field that has a magnitude of 1.2 T and is directed to the left (-x).
   a. What is the magnitude of the force exerted on the particle?

$F_B = qvB$

$= (4.8\times10^{-6})(1900)(1.2)$

$\boxed{F_B = 0.0109\ N}$



   b. In what direction is the force acting?

Out of the page (+z)

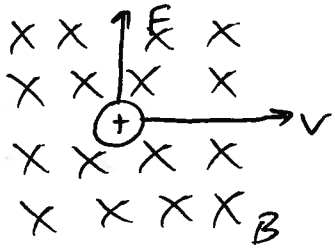
2. In an experiment it is found that when a proton ($q = 1.6\times10^{-19}$ C) enters a magnetic field with a velocity of 950 m/s to the right (+x) it has a force of 4.4×10^{-16} Newtons applied to it in the +y direction.
   a. What is the strength of the magnetic field?

$F_B = qVB$

$B = \frac{F_B}{qV}$

$B = \frac{4.4\times10^{-16}}{(1.6\times10^{-19})(950)}$

$\boxed{B = 2.89\ Tesla}$



   b. In what direction is the magnetic field oriented?

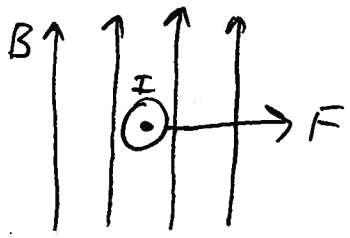
In to the page (-z)

3. A 10.7 meter length of wire is placed in an external B field of 3.4 T that is directed upward (+y). An electric current of 0.55 Amps runs through the wire in the +z direction.
   a. What is the magnitude of the force exerted on the wire?

$F_B = ILB$

$= (0.55)(10.7)(3.4)$

$\boxed{F_B = 20.0\ N}$



   b. Where is the force directed?

To the right (+x)

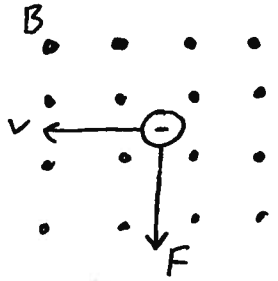
4. A magnetic field with a strength of 19.6 Tesla is created and is directed out of the page (+z). An object with an unknown amount of negative charge is injected into the field with a speed of 1,950 km/s and it experiences a downward (-y) force of 370 Newtons.
   a. What is the magnitude of the charge?

$F_B = qvB$

$q = \frac{F_B}{vB}$

$q = \frac{(370)}{(1{,}950{,}000)(19.6)}$

$q = 9.68 \times 10^{-6} C$



   b. In what direction is the charge moving?

To the Left (-x)

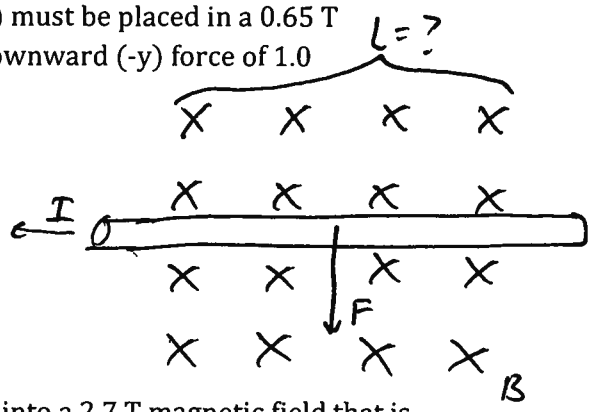
5. What length of wire carrying a current of 0.97 A to the left (-x) must be placed in a 0.65 T magnetic field directed into the page (-z) so that is causes a downward (-y) force of 1.0 Newton?

$F_B = ILB$

$L = \frac{F_B}{IB}$

$L = \frac{1}{(0.97)(0.65)}$

$L = 1.59 m$



6. A +3.7 μC charge is projected to the right (+x) at 1.9×10^5 m/s into a 2.7 T magnetic field that is directed upwards (+y). How much current would need to be present in a 1.35 m wire for it to feel the same amount of force as the charge when placed in the same external magnetic field?

Charge: $F_{B_{charge}} = qvB = (3.7 \times 10^{-6})(1.9 \times 10^5)(2.7) = 1.8981 N$

$F_{Bcharge} = F_{Bwire} = 1.8981 N$

$F_{Bwire} = ILB$

$I = \frac{F_{Bwire}}{LB}$

$I = \frac{(1.8981)}{(1.35)(2.7)}$

$I = 0.52 A$