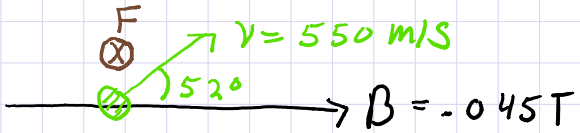
Example 1

Monday, April 14, 2014 7:45 AM

EXAMPLE 1

1) An alpha particle travels at a velocity ***v*** of magnitude *550 m/s* through a uniform magnetic field ***B*** of magnitude *0.045 T*. The angle between ***v*** and ***B*** is *52°*. What are the magnitudes of:
a) The force F_B acting on the particle due to ***B***
b) The acceleration of the particle.
c) Does the speed of the particle increase, decrease or remain the same?
(An alpha particle has a charge of $+3.2\times10^{-19}C$ and a mass of 6.6×10^{-27} kg.)

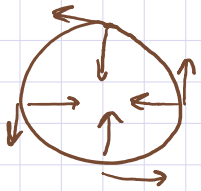
m q



a) $F = qvB\sin\phi$ $\frac{N}{C\ m/s}$

$F = (3.2\times10^{-19}C)(550\ m/s)(.045T)\sin(52°)$

$F = 6.24\times10^{-18}\ N$



b) $a = \frac{F}{m}$ $\frac{kg\ m/s^2}{kg}$

$a = \frac{6.24\times10^{-18}\ N}{6.6\times10^{-27}\ kg}$

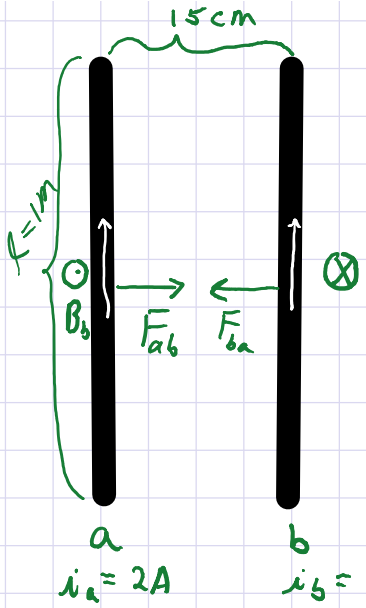
$a = 9.45\times10^{8}\ m/s^2$

Example 3

Monday, April 21, 2014 7:46 AM

Example 3

3) Two long straight parallel wires are 15 cm apart. Wire A carries 2.0 A. Wire B's current is 4.0 A in the same direction.
a) Determine the magnetic field magnitude due to wire A at the position of wire B.
b) Determine the magnetic field magnitude due to wire B at the position of wire A.
c) Are these two magnetic fields equal and opposite?
d) Determine the force on wire A due to wire B.
e) Determine the force on wire B due to wire A.
f) Are these forces equal?



a) $B_b = \frac{\mu_0 i_b}{2\pi r}$

$B_b = \frac{(4\pi \times 10^{-7}\ T\cdot m/A)(4A)}{2\pi(.15m)}$

$B_b = 5.3 \times 10^{-6}\ T$

$B_a = \frac{\mu_0 i_a}{2\pi r}$

$B_a = \frac{(4\pi \times 10^{-7}\ T\cdot m/A)(2A)}{2\pi(.15m)}$

$B_a = 2.67 \times 10^{-6}\ T$

d) $F_{ab} = i_a l B_b \sin\phi$ ($\sin\phi = 1$)

$F_{ab} = (2A)(1m)(5.33 \times 10^{-6}\ T)$

$F_{ab} = 1.07 \times 10^{-5}\ N$

e) $F_{ba} = i_b l B_a \sin\phi$ ($\sin\phi = 1$)

$F_{ba} = (4A)(1m)(2.67 \times 10^{-6}\ T)$

$F_{ba} = 1.07 \times 10^{-5}\ N$