**Worksheet - Motors, CRT's and Mass Spectrometers**

1. A proton traveling vertically at a speed of 2.10x105 m/s through a horizontal magnetic field experiences a magnetic force of 9.50x10-14 N what is the magnitude of the magnetic field?
2. A copper wire (l = 0.222m) carries conventional current of 0.960A a north through a magnetic field (B=7.50x104 T) that has directed vertically upward what is the magnitude and direction of the magnetic force acting on the wire?
3. Calculate the magnitude and the direction of the magnetic force on an electron traveling north at a speed of 3.52x105 m/s through a vertically upward magnetic field of 2.80x10-1T.
4. Calculate the magnitude and the direction of the magnetic force on an alpha particle traveling south at a speed of 7.40x104 m/s through vertically upward magnetic field of 5.50T.
5. Calculate the magnitude and the direction of the magnetic field that produces a magnetic force of 1.70x10-14N East on a proton that is traveling 1.90x104 m/s North through the magnetic field.
6. An electron experiences an upward force of 7.1x10-14N when it is traveling 2.7x105m/s south through a magnetic field what is the magnitude and direction of the magnetic field?
7. Calculate the magnitude and the direction of the magnetic force on an alpha particle traveling upward at a speed of 2.11 x 105 m/s through a magnetic field that is directed down.
8. A wire in the armature of an electric motor is 2.50x10-1m long and is perpendicular to a magnetic field of 5.00 x 10-1T Calculate the magnetic force on the wire when it carries a current of 3.60 A.
9. An electron is accelerated from rest by a potential difference of 1.70 x103V and then enters a magnetic field of 2.50 x 10-1T moving perpendicular to it what is the magnitude of the magnetic force acting on the electron?
10. An electron is accelerated by a potential difference and then travels perpendicular through a magnetic field of 7.20 x 10-1T where it experiences a magnetic force of 4.1 x 10-13N. Assuming this electron starts from rest through what potential differences is the electron accelerated?
11. Calculate the downward acceleration of an electron that is traveling horizontally at a speed of 6.20x105 m/s perpendicular to a horizontal magnetic field of 2.30x10-1 T.
12. An alpha particle travel through a magnetic field of 4.22 X 10-1 T perpendicular to the field. If the radius of the arc of the deflected particles is 1.50x10-3 m what is the speed of the particles?
13. A proton travels through a magnetic field at a speed of 5.40x105 m/s perpendicular to the field. If the radius of the arc of the deflected proton is 7.20x10-3 m what is the magnetic field strength?
14. Calculate the charge to mass ratio of a particle that is traveling 3.60x105 m/s and is deflected in an arc with a radius of 7.40x10-2 m as it travels through a perpendicular magnetic field of 6.10x10-1 T.
15. Alpha particles travel undeflected through magnetic and electric fields that are perpendicular to each other. The speed of the alpha particles is 7.80x105 m/s and the strength of the magnetic field is 2.20x10-1 T Assuming that the alpha particles are traveling perpendicular to these fields what is the strength of the electric field?
16. Positive charged particles travel undeflected through magnetic and electric fields that are perpendicular to each other. The magnetic field strength is 6.50x10-1 T and the strength of the electric field is 2.10x105 N/C assuming the charged particles are traveling perpendicular to these fields what is the speed of the charged particles?
17. Alpha particles travel through a magnetic field of 3.60x10-1 T and are deflected in an arc with a radius of 8.20x10-2m. Assuming the alpha particles are traveling perpendicular to the field what is the energy of each alpha particle.
18. In a CRT electrons are accelerated from rest by a potential difference of 2.50x103 V. What is the maximum speed of the electrons?
19. In a CRT electron reaches a maximum speed of 4.75x107 m/s if this electron is accelerated from rest what is the potential difference across the tube?
20. In a CRT electrons are accelerated from rest by a potential difference of 1.40x103V These electrons enter a magnetic field with a strength of 2.20x10-2 T Assuming the electrons are traveling perpendicular to the field what id the radius of the arc of the deflected electrons?
21. Electrons are accelerated form rest in a CRT. These electrons now pass through a magnetic field of 1.40 x 10-2 T and through an electric field of 4.20x105 N/C. The fields are perpendicular to each other the electron are no deflected assuming the electrons are traveling perpendicular to these fields what is the potential difference across the CRT?
22. A negatively charged particle with a mass of 8.4x10-27 kg is traveling at a velocity of 5.6x105 m/s perpendicularly through a magnetic field of 2.8x10-1 T If the radius of the path of the particle is 3.5 cm how many excess electrons does this particle carry?
23. Alpha particles travel at a speed of 3.00x106 m/s through a magnetic field. If the magnetic field strength is 4.2x10-2 T what is the radius of the path followed by the alpha particles when the magnetic field is parallel to the direction the alpha particles travel?
24. A proton moves through a 0.75 T magnetic field in a circle with a radius of 0.30m what is the momentum of this proton?
25. Electrons are accelerated from rest through a potential difference these electrons are than deflected along an arc of radius 0.77m when they travel through a 2.2x10-4 T magnetic field. What is the accelerated voltage?
26. An ion with a charge to mass ratio of 1.10x104 C/kg travels perpendicular to magnetic field (B=9.10x10-1 T) in a circular path (r=0.240 m) How long does it take the ion to complete one revolution?

**Answers:**

1. (2.83 T)
2. (1.60x10-4 N East)
3. (1.58x10-14N West)
4. (1.30x10-13 N West)
5. (5.59 T up)
6. (1.6 T West)
7. (0)
8. (4.50x10-1)
9. (9.77x10-13 N)
10. (3.6x101 V)
11. (2.50x1016m/s2)
12. (3.05x104 m/s)
13. (7.83x10-1 T)
14. (7.98x106 C/kg)
15. (1.72x105 N/C)
16. (3.23x105 m/s)
17. (6.71x10-15 J)
18. (2.96x107 m/s)
19. (6.42x103V)
20. (5.74x10-3m)
21. (2.56x103 V)
22. (3)
23. (no deflection)
24. (3.6x10-20 kg\*m/s)
25. (2.5x103V)
26. (6.28x10-4 s)