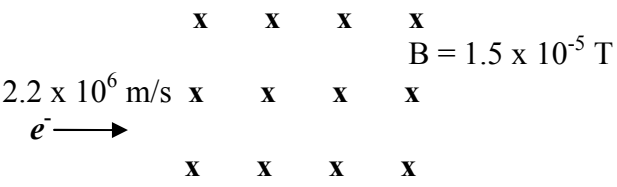
PHYSICS 12 MAGNETIC FIELDS WORKSHEET 2

1. An electron moves through a magnetic field of intensity 1.2×10^{-1} T at a speed of 4.2×10^{6} m/s perpendicular to the field. What will the rate of acceleration of this charge be in the field?

2. A proton travels east through a downward (into the page) magnetic field of 0.024 T at a speed of 1.8×10^{6} m/s.
   a) What is the magnitude and direction of the force acting on the proton?
   b) What is the centripetal acceleration of the proton?
   c) What would be the acceleration of an electron under the same conditions?

3. An electron enters a magnetic field of strength 1.5×10^{-5} T with a velocity of 2.2×10^{6} m/s perpendicular to the field. What is the radius of its path once in the field?



4. From question #3, how would the radius change if:
   a) the mass of the moving particle was doubled?
   b) the charge of the moving particle was tripled?
   c) the speed of the particle was halved?
   d) the magnetic field strength was quadrupled while the mass was reduced to one-third its original value?

5. A cathode ray beam is bent in a circular of radius 2.0 cm by a field of magnetic intensity 4.5×10^{-3} T. Calculate the velocity of the electrons.

6. An alpha particle and electron enter, at the same speeds and from the same direction, a strong magnetic field that curls them in opposite directions. How does the radius of the path of the alpha particle compare to that for the electron?

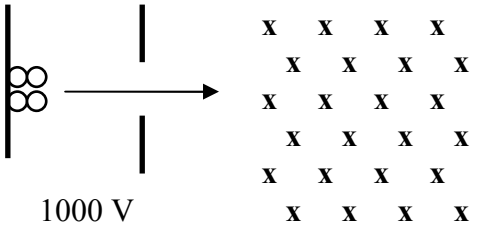
7. A proton enters a magnetic field in the same direction as the field at a speed of 3.8×10^{6} m/s. If the magnetic field intensity is 1.5×10^{-3} T, then what is the amount of magnetic force acting on the proton?

8. An ion with a charge of $2e^{-}$ in a magnetic field of intensity 4.3×10^{-2} T moves in a circle with radius 2.65 m. If the speed of the particle is 4.2×10^{4} m/s, what is its mass?

9. a) What speed must electrons in a beam going through a velocity selector have if the beam is undeflected by crossed electric and magnetic fields of strengths 6.0×10^{3} V/m and 0.0030 T respectively?
   b) If the electric field is shut off, what would the radius of the beam become due to the unbalanced magnetic force?

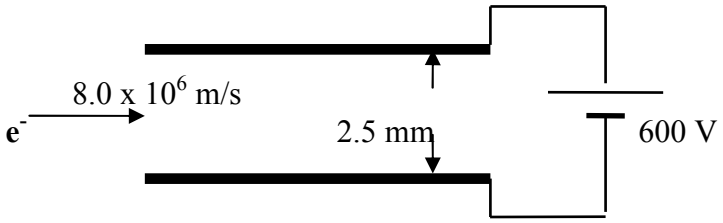
10. In a special experiment, an electron beam is passed through perpendicular electric and magnetic fields. If the electrons have a speed of 2.6×10^{4} m/s, and the magnetic field is 2.5×10^{-4} T,
    a) what electric field strength is needed so that the electrons are undeflected?
    b) if the distance between the plates that causes electrical deflection is 0.40 cm, what voltage must be applied to the plates?
    c) if the electric field is shut off, what would the radius of the beam become due to the unbalanced magnetic force?

11. Alpha particles (2 protons, 2 neutrons) are accelerated from rest as shown through a potential difference of 1000 V and then enter a magnetic field of intensity 0.20 T perpendicular to their direction of motion. Calculate the radius of their path and sketch that path on the diagram.



12. In a similar set-up to question #4, electrons are accelerated across a potential difference of 320 V, producing a radius of orbit of 0.256 m in a magnetic field. What is the strength of this magnetic field?

13. In the diagram shown, an electron is sent between charged plates at a speed of 8.0×10^6 m/s.



a) What magnetic field **B** is required so that the electron passes through undeflected?

b) Where must the field lines be directed for this to happen? Draw on the diagram.

c) If the voltage across the deflecting plates is now doubled, what new speed is required for an electron beam to remain undeflected?

d) If all this occurs in a CRT, what accelerating voltage is needed for this <u>new</u> electron speed to be attained (assuming they started from rest)?

14. A charged particle with a momentum of 4.00×10^{-19} kg-m/s enters at right angles a magnetic field of strength 0.650 T and goes into a circular orbit of radius 4.80 cm. What is the charge of this particle?

1. 8.85×10^{16} m/s 2. a) 6.9×10^{-15} N b) 4.1×10^{12} m/s^2 c) 7.6×10^{15} m/s^2 3. 0.84 m 4. a) 1.67 m b) 0.28 m c) 0.42 m d) 0.70 m 5. 1.58×10^7 m/s 6. $R_\alpha = 3.65 \times 10^3 [R_\varepsilon]$ 7. 0 8. 8.68×10^{-25} kg 9. a) 2.0×10^6 m/s b) 3.8 mm 10. a) 6.5 N/C b) 0.026 V c) 5.9×10^{-4} m 11. 3.23×10^{-2} m 12. 2.36×10^{-4} T 13. a) 0.030 T b) into page c) 1.6×10^7 m/s d) 730 V 14. 1.28×10^{-17} C