

PHYSICS 12 MAGNETIC FIELDS WORKSHEET 2

- 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?
- 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.
 - What is the magnitude and direction of the force acting on the proton?
 - What is the centripetal acceleration of the proton?
 - What would be the acceleration of an electron under the same conditions?
- 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?

2.2×10^6 m/s
 $e^- \longrightarrow$

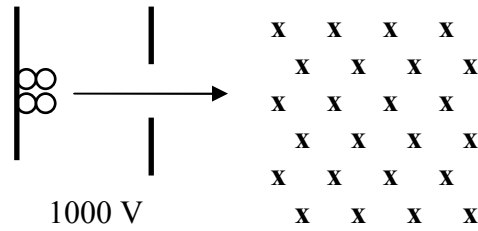
x x x x

$B = 1.5 \times 10^{-5}$ T

x x x x

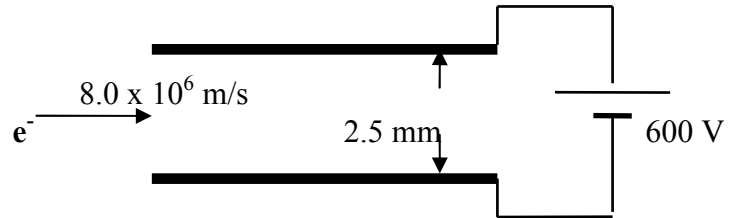
x x x x
- From question #3, how would the radius change if:
 - the mass of the moving particle was doubled?
 - the charge of the moving particle was tripled?
 - the speed of the particle was halved?
 - the magnetic field strength was quadrupled while the mass was reduced to one-third its original value?
- 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.
- 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?
- 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?
- 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?
- 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?
 - If the electric field is shut off, what would the radius of the beam become due to the unbalanced magnetic force?
- 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,
 - what electric field strength is needed so that the electrons are undeflected?
 - if the distance between the plates that causes electrical deflection is 0.40 cm, what voltage must be applied to the plates?
 - 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.



- What magnetic field \mathbf{B} is required so that the electron passes through undeflected?
 - Where must the field lines be directed for this to happen? Draw on the diagram.
 - If the voltage across the deflecting plates is now doubled, what new speed is required for an electron beam to remain undeflected?
 - If all this occurs in a CRT, what accelerating voltage is needed for this new 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/s² c) 7.6×10^{15} m/s² 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. $R_\alpha = 3.65 \times 10^3 [R_e]$ 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