Magnetism #~~4~~3 p654 MC 6 C20, 25 ~~4~~ 3
p657 Problems 40, 43
online - Charged Particles Move
- Mass Spectrometer

- Multiple Choice (9)

6) Difference btt magnetic + electric fields?

- magnetic field lines don't start/end anywhere
- electric field lines do have begin + end

(3)

- Concept

20) ⊖ v ↓

Find direction of B to create effect

LHR thumb down, palm right, fingers out

B out of page

25) e⁻ enters solenoid

If the velocity of the e⁻ has a component parallel to B, the path will be helical. With only perpendicular component, its path would be circular

~~4~~ 3

- Problems

40) Blood flow meter

$\Delta V = 8.0 \times 10^{-5} V$
diameter $= 4.0 \times 10^{-3} m$
$q = 1.6 \times 10^{-19} C$

a) $F_e = ?$ $\quad F_e = Eq = \frac{\Delta V}{d} q$

$$= \frac{(8.0 \times 10^{-5} V)(1.60 \times 10^{-19} C)}{4.0 \times 10^{-3} m}$$

$$F_e = 3.2 \times 10^{-21} N$$

b) Speed to balance by F_B from B 1 to flow

$v = ?$
$B = .040 T$

$F_B = F_e$
$qvB = F_e$
$v = \frac{F_e}{qB} \left(\pm \frac{\Delta V q}{d q B} \right)$

$\left(v = \frac{\Delta V}{Bd} \right)$

$$v = \frac{3.2 \times 10^{-21} N}{1.60 \times 10^{-19} C (.040 T)} = .50 \, m/s$$

~~(1)~~ 3

43) electrons in oscilloscope

oscilloscope face E
e^- move ⊥ B

$q = -|e| = 1.60\times10^{-19}\,C$
$v_o = 0\,m/s$
$\Delta V = 28\,kV = 28\times10^{3}\,V$
$B = 3.5\times10^{-5}\,T$

a) $v = ?$ $\quad E_o = E_f \quad U_e = K \quad q\Delta V = \frac{1}{2}mv^2$

$$v = \sqrt{\frac{2q\Delta V}{m}} = \sqrt{\frac{2(1.60\times10^{-19}C)(28\times10^{3}V)}{9.11\times10^{-31}kg}}$$

$$v = 9.92\times10^{7}\,m/s$$

b) $F_B = ?$ $\quad F_B = qvB = (1.60\times10^{-19}C)(9.92\times10^{7}m/s)(35\times10^{-5}T)$

(2)

$$F_B = 5.56\times10^{-16}\,N$$

c) $a = ?$ $\quad a = \frac{F_{net}}{m} = \frac{5.56\times10^{-16}N}{9.11\times10^{-31}kg}$

$$a = 6.10\times10^{14}\,m/s^2$$

d) $r = ?$ $\quad F_B = F_C$

$$F_B = \frac{mv^2}{r} \qquad r = \frac{mv^2}{F_B}$$

$$= \frac{(9.11\times10^{-31}kg)(9.92\times10^{7}m/s)^2}{5.56\times10^{-16}N}$$

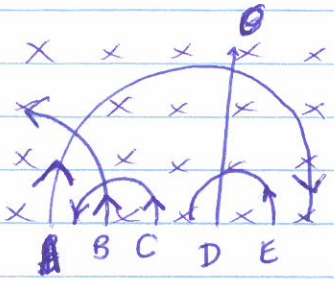
$$r = 16.1\,m$$

~~(4)~~ 3

– Online

① Charged Particles moving if B Rank

equal m particles



A) neutral

D (no deflection)

B) negative

A (LHR - only one pushed to right)

(1)

c) Rank based on speed

$F_B = F_C$

$qvB = \frac{mv^2}{r}$ $\quad v = \frac{qBr}{m}$ $\quad \uparrow v \uparrow r$

• same m, same B

* Cannot determine $\quad \uparrow q \not\uparrow r \downarrow$

b/c don't know q

d) now assume same q (except D)

↑ neutral

$\uparrow v \uparrow r$

A B C=E

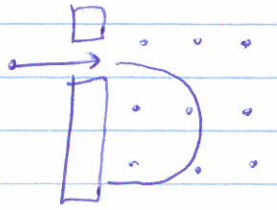
~~4~~ 3

② Mass Spectrometer

- Singly ionized uranium atoms ^{235}U ^{238}U
- Same velocity & charges

^{238}U follow

A) Will ^{235}U strike above/below?



$F_B = F_c$

$qvB = \frac{mv^2}{r}$

$r = \frac{mv}{qB}$ ↑m ↑r

Above

^{235}U less m, smaller r

(1)

B) B increases, spacing?

$r = \frac{mv}{qB}$ spacing $= r_1 - r_2$

$\frac{m_1 v}{qB} - \frac{m_2 v}{qB}$

decrease

spacing $= \frac{\Delta m v}{qB}$ ↑B ↓space

c) V_o increases, spacing? increases

spacing $= \frac{\Delta m v}{qB}$ ↑v ↑spacing

d) Cabon used, spacing compare to U

decrease spacing $= \frac{\Delta m v}{qB}$

- Same v
- Same q
- Same B

Δm carbon = 2
U = 3