Magnetism #1

p654 MC 5, 7
p655 C 13
p656 Problems 4, 37, 38
p660 Read 57, 58, 59, 60

p654 – Multiple Choice

(10)

2) metal bar magnet on swivel
negatively charged rod near both ends
observe?
d) Both poles attract to rod (at not magnets)

(2)

5) Objects that produce magnetic fields?
- current carrying wires
- permanent magnets
- a compass
- charged rod on moving trucks
- current in solenoid

× charged rod stationary

7) current carrying wire produce magnetic field
double I, what happens to B?

$B = \frac{\mu_0}{2\pi}\frac{I}{r}$ · double B

p655 - Concept

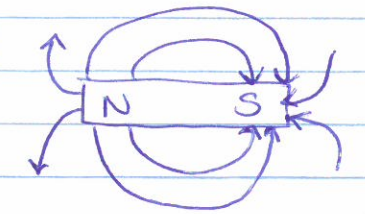
13) How can you determine if ther is a magnetic field in certain region?

One possible way to detect magnetic fields is to place a current carrying wire in the region. If the direction of the current is not in the same direction as the magnetic field, then there'll be a force on the wire, causing it to bend. (1)

Another possibility is to use a compass. Its needle will deflect to align w/ the magnetic field

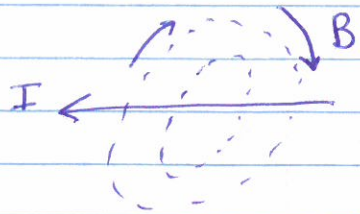
p656 - Problems

4) Choose magnetic field for diagrams

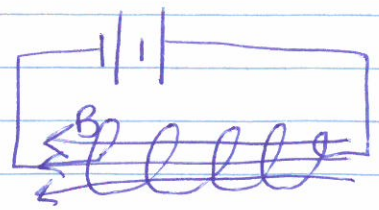
A) 

out of N

(1)

B) 

RHR - thumb I fingers curl

C) 

RHR - finger curl in coil
thumb point in B

37) Two long // wires separated by 2.0m
current carrying opposite directions
$I = 30A$

magnitude → no direction given

a) B_{net} mid way

⊙ ↑↑ ⊗
add

$$B = B_1 + B_2 = \frac{\mu_0}{2\pi}\cdot\frac{I}{r} + \frac{\mu_0}{2\pi}\frac{I}{r}$$

$$= 2\frac{\mu_0}{2\pi}\frac{I}{r} = \frac{2\left(4\pi \times 10^{-7}\ \frac{Tm}{A}\right)}{2\pi}\cdot\frac{(30A)}{1.0m}$$

$$= 1.2 \times 10^{-5}\ T$$

b) B_{net} 1.0m from one, 3.0m from other

⊙ ↑↑ ⊗ ↑↓
opposites

$$B = B_1 - B_2 = \frac{\mu_0}{2\pi}\cdot\frac{I}{r} - \frac{\mu_0}{2\pi}\frac{I}{r}$$

magnitude → current not direction given

$$= \frac{\left(4\pi \times 10^{-7}\ \frac{Tm}{A}\right)(30A)}{2\pi\,(1.0m)} - \frac{\left(4\pi \times 10^{-7}\ \frac{Tm}{A}\right)(30A)}{2\pi\,(3.0m)}$$

$$= 4.0 \times 10^{-6}\ T$$

38). WWII mines activated by changing B field of ~~magnetic~~ metal ship
- English boats tow long current carrying coils of wire to activate mines

a) $I = ?$
$B = .0050\ T$
$d = 20m$
μ_0 water $\sim \mu_0$ air

$B = \frac{\mu_0}{2\pi} \cdot \frac{I}{r}$ $\quad I = \frac{B \cdot 2\pi r}{\mu_0}$

(1)

$I = \frac{(.0050T)(2\pi \cdot 20m)}{4\pi \times 10^{-7}\ Tm/A}$

$I = 5 \times 10^5\ A$

b) Create field w/ smaller current?

online essay → Use coils w/ more turns + smaller current will produce same field as long straight wire

- Reading

57) Ratio of B_{wire} to B_{earth}

① $B = \frac{\mu_0}{2\pi}\frac{I}{r} = \frac{(4\pi \times 10^{-7}\ Tm/A)(100A)}{2\pi\ (50m)}$

$= 4 \times 10^{-7}\ T$

(4) ② $ratio = \frac{B_{wire}}{B_{earth}} = \frac{4\times10^{-7}T}{4\times10^{-5}T} = .01$

58) $P = 550W$ $\quad V = 110V$ $\quad I = ?$

$I = \frac{P}{V} = \frac{550W}{110V} = 5A$

59) $B = ?$ $\quad r = .4m$

① $B = \frac{\mu_0}{2\pi}\frac{I}{r} = \frac{4\pi\times10^{-7}\ \frac{Tm}{A}}{2\pi}\frac{(5A)}{.4m}$

$B = 2.5\times10^{-6}\ T$

② $ratio = \frac{B_{wire}}{B_{earth}} = \frac{2.5\times10^{-6}T}{4\times10^{-5}T} = .0625$

60) Leukemia rates decline but B wires increases
Can we rule it out as cause?

- Perhaps power lines cases increased but other causes decreased