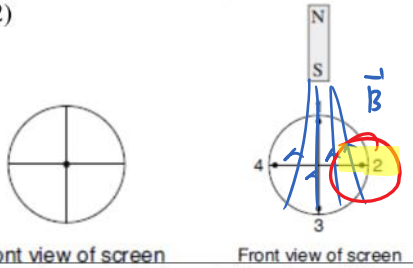
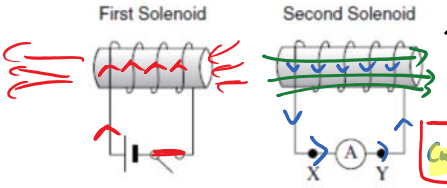
Physics 12 – Electromagnetism Review Worksheet

1. An electron beam strikes the center of a CRT screen. A magnet is then placed near the CRT. Which of the four dots shows the new position of the electron beam? (2)



2. Two solenoids are placed together as shown. As the switch is closed, what is the direction of the current through the ammeter, and the direction of the induced magnetic field inside the second solenoid? (I travels from X to Y & B is directed to right)

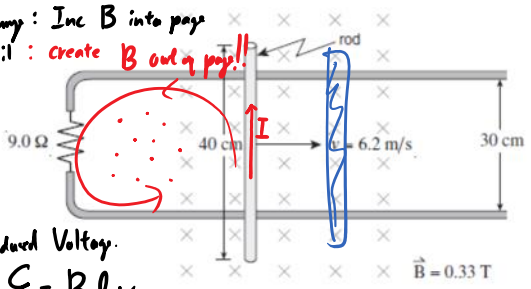
Change: ↑ B Left.
coil: Create B right.



Current from X → Y

3. What are the magnitude and direction of the current induced in the rod? (68mA, up)

Change: Inc B into page
coil: create B out of page!!



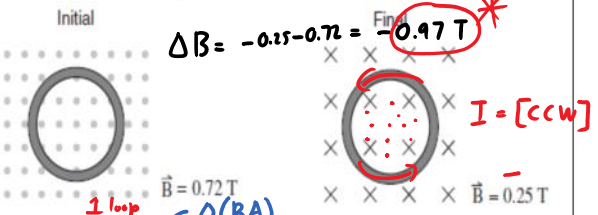
Induced Voltage.

$\mathcal{E} = Blv$

$\mathcal{E} = 0.33(0.3m)(6.2) = 0.6138\ V$

$V = IR \quad I = \frac{V}{R} = \frac{0.6138}{9} = 0.068\ A$

4. A single loop of wire encloses an area of 0.035m^2. The magnetic field changes in a time of 0.060s. What is the induced emf and direction of the current flow in the loop? (0.57V, counterclockwise)



$\Delta B = -0.25 - 0.72 = -0.97\ T$

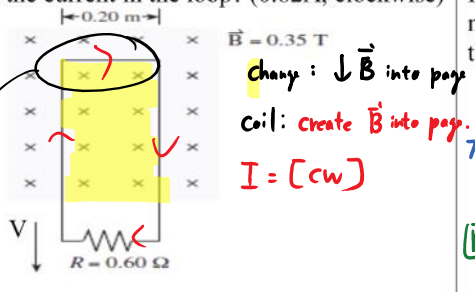
I = [ccw]

1 loop $\quad \Delta(BA)$

$\mathcal{E} = N\frac{\Delta\Phi}{\Delta t} = \frac{\Delta B \cdot A}{t} = \frac{(0.97)(0.035)}{0.06s}$

$\mathcal{E} = 0.57\ V$

5. A rectangular wire loop is pulled out of a magnetic field with a speed of 7.0m/s. What is magnitude and direction of the current in the loop? (0.82A, clockwise)



Change: ↓ B into page
coil: create B into page.
I = [cw]

$\mathcal{E} = Blv = 0.35(0.2m)(7m/s) = 0.49\ V$

$V = IR \quad I = \frac{V}{R} = \frac{0.49}{0.6\Omega} = 0.82\ A$

6. A block of metal moves N perpendicular to a B field. If an e$^-$ in the block experiences a 7.2*10^{-18} N force vertically upwards out of the page, what are the magnetic field strength and direction, and emf across the block? (0.25T E, 6.8V)

$F_m = QvB$

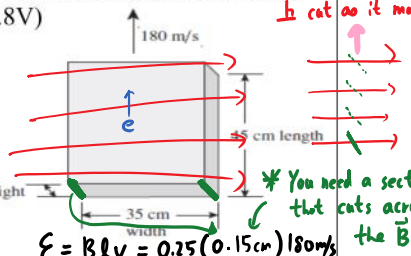
$7.2\times10^{-18} = 1.6\times10^{-19}(180)B$

$B = 0.25\ T$

Dir: e^- ↑ (middle) 15 cm height, Force ⊙ out of page

RHR #3

B ⇒ [East] (index)



$\mathcal{E} = Blv = 0.25(0.15m)180m/s$

$\mathcal{E} = 6.75\ V$

⊥ cut as it move.

* You need a section that cuts across the B lines

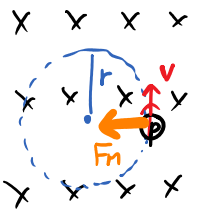
$\Phi = BA$

$\Delta\Phi = \Delta B \cdot A$

$\Delta\Phi = B\,\Delta A$

7. A proton enters a 0.65T magnetic field. The velocity of the proton is perpendicular to the field causing the proton to travel in a circular arc of radius 1.1cm. What is the momentum of the proton? ($1.1*10^{-21}$ kg*m/s)

$p = mv$



$F_c = F_m$

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

$mv = QBr$

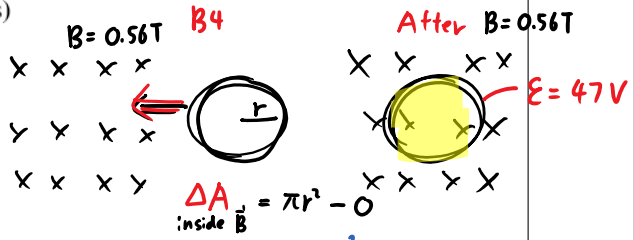
momentum $p = mv$

$= QBr$

$= (1.6\times10^{-19})(0.65)(0.011)$

$= 1.1\times10^{-21}$ kg m/s

8. A 520 turn circular coil of radius 0.26m is initially outside a 0.56T magnetic field. The coil is moved into a magnetic field, inducing an emf of 47V. How much time did it take to move the coil into its new position? (1.3s)



ΔA inside $\vec{B} = \pi r^2 - 0$

$\Delta A = \pi (0.26)^2 = 0.2124\ m^2$

$\varepsilon = N\frac{\Delta\Phi}{t}$ $\quad 47V = 520\frac{(0.56T)(0.2124)}{t}$ (B, ΔA)

$t = 1.3$ sec

9. A 15cm long solenoid with 8400 turns produces a magnetic field of 0.22T. How much current flows through the solenoid? If the solenoid was brought towards a secondary solenoid, describe how the direction of the induced magnetic field would relate to the primary magnetic field? (3.1A)

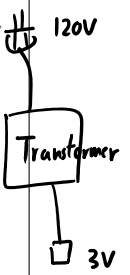
$B = \mu_0 n I \Rightarrow$

$0.22T = 4\pi\times10^{-7}\left(\frac{8400}{0.15}\right) I$

$I = 3.13$ A

* If brought towards a 2nd solenoid, the induced $\vec{B}$ on 2nd solenoid will always point opposite the dir of $\vec{B}$ in the first solenoid.

10. An AC transformer converts 120V into 3.0V. An electronic device draws 4.5mA from the transformer. If the secondary coil has 50 turns, what is the number of turns, current, and power in the primary coil? (2000 turns, $1.1*10^{-4}$A, 0.013W)



$V_1 = 120V$ $\quad V_2 = 3.0V$

$I_1 = ?$ $\quad I_2 = 0.0045A$

$N_1 = ?$ $\quad N_2 = 50$ turns

$P_1 = ?$

a) $\frac{N_1}{N_2} = \frac{V_1}{V_2}$ $\quad \frac{N_1}{50} = \frac{120}{3}$ $\quad N_1 = 2000$ turns

b) $\frac{V_1}{V_2} = \frac{I_2}{I_1}$ $\quad \frac{120}{3} = \frac{0.0045}{I_1}$ $\quad I_1 = 1.125\times10^{-4}$ A

c) $P_1 = V_1 I_1 = 120V(1.125\times10^{-4}) = 0.0135$ Watt