HW # 10 Solutions

1) $\mathcal{E}mf = N \dfrac{\Delta \Phi}{\Delta t}$

Single loop : $N = 1$

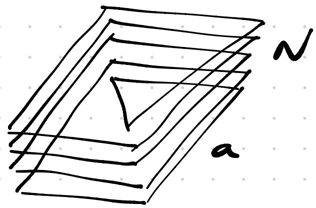
$\Phi = BA\cos\theta$

$A = \pi r^2$

$\theta = 0°$ ($\vec{B} \perp$ loop)

$\longrightarrow$

$\mathcal{E}mf = \dfrac{\Delta \Phi}{\Delta t} = \pi r^2 \dfrac{\Delta B}{\Delta t}$



2) $I = \dfrac{\mathcal{E}mf}{R}$

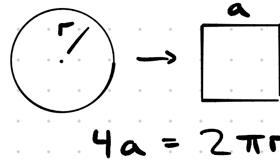
$\mathcal{E}mf = N \dfrac{\Delta \Phi}{\Delta t} = NA \dfrac{\Delta B}{\Delta t} \cancelto{1}{\cos\theta}$

$= Nab \dfrac{\Delta B}{\Delta t}$

$\longrightarrow \dfrac{\Delta B}{\Delta t} = \dfrac{IR}{Nab}$

3) $\mathcal{E}MF = N \dfrac{\Delta \Phi}{\Delta t} = NB \dfrac{\Delta A}{\Delta t} \cancelto{1}{\cos\theta}$

Perimeter fixed



$\Delta A = \pi r^2 - \left(\dfrac{\pi}{2}\right)^2 r^2$

$= \pi r^2 \left(1 - \dfrac{\pi}{4}\right)$

$4a = 2\pi r$

$\longrightarrow a = \dfrac{\pi}{2} r$

4) ALL THREE AFFECT EMF

$$\text{emf} = N \frac{\Delta \Phi}{\Delta t}$$

I II III

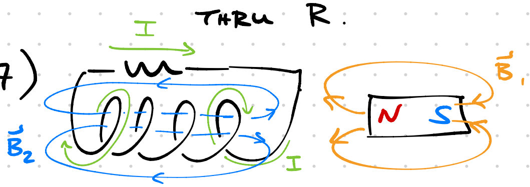
5) NO FORCE! NO CURRENT IN RING SINCE CURRENT IN COIL IS CONSTANT.

6) FROM RHR #2, $\vec{B}$ INCREASING OUT OF THE PAGE:

CURRENT I INDUCED WHICH GENERATES $\vec{B}_2$ FIELD WHICH OPPOSES THIS INCREASE.

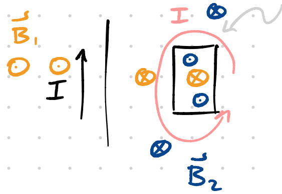
- THIS CURRENT I RUNS LEFT → RIGHT THRU R.

7)



LEFT-WARDS FLUX INCREASING AS MAGNET MOVES TOWARDS COIL. CURRENT I INDUCED WHICH GENERATES FIELD $\vec{B}_2$ WHICH OPPOSES THE INCREASE IN LEFT-WARDS FLUX.

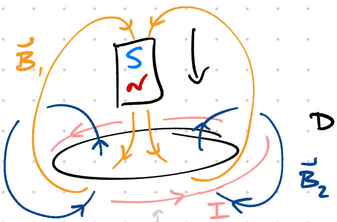
8) SEE 7)

9) 

DOWN-WARDS FLUX INCREASING.

I INDUCED WHICH GENERATES $\vec{B}_2$ WHICH OPPOSES INCREASE IN DOWN-WARDS FLUX.

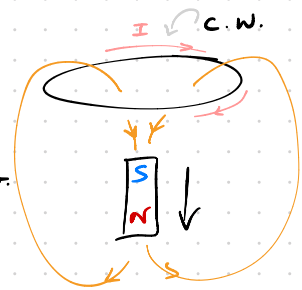
10) REMOVED. IDENTICAL TO EARLIER PROBLEM.

11) 

C.C.W. (FROM TOP)

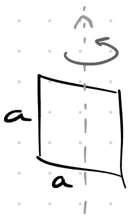
DOWNWARDS FLUX INCREASING.

DOWN-WARDS FLUX DECREASING.



12) $\text{Emf} = 2\pi f N B A$

$= 2\pi f N B a^2$



f : FREQUENCY OF ROTATION $\left(\frac{\text{REVOLUTIONS}}{\text{UNIT TIME}}\right)$

13) $$\text{Emf} = N \frac{\Delta \Phi}{\Delta t} = N B A \frac{\Delta \cos\theta}{\Delta t}$$

$$\theta : 0^\circ \longrightarrow 90^\circ$$

$$\Delta \cos\theta = \cos 0^\circ - \cos 90^\circ = 1 - 0 = 1$$

$$\longrightarrow B = \frac{\text{Emf}\ \Delta t}{N A} = \frac{\text{Emf}\ \Delta t}{N \pi \left(\frac{d}{2}\right)^2}$$

14) $\varepsilon mf = 2\pi f NBA$

15) $I = \dfrac{\varepsilon mf}{R}$

16) $\varepsilon mf = 2\pi f NBA = 2\pi f NB\pi r^2$

17) $V_2 = \dfrac{N_2}{N_1} V_1$ ~~18)~~

19) SEE 17) 20) $\dfrac{N_1}{N_2} = \dfrac{V_1}{V_2}$

$\left[(V_1, N_1) : \text{PRIMARY}, (V_2, N_2) : \text{SECONDARY} \right]$