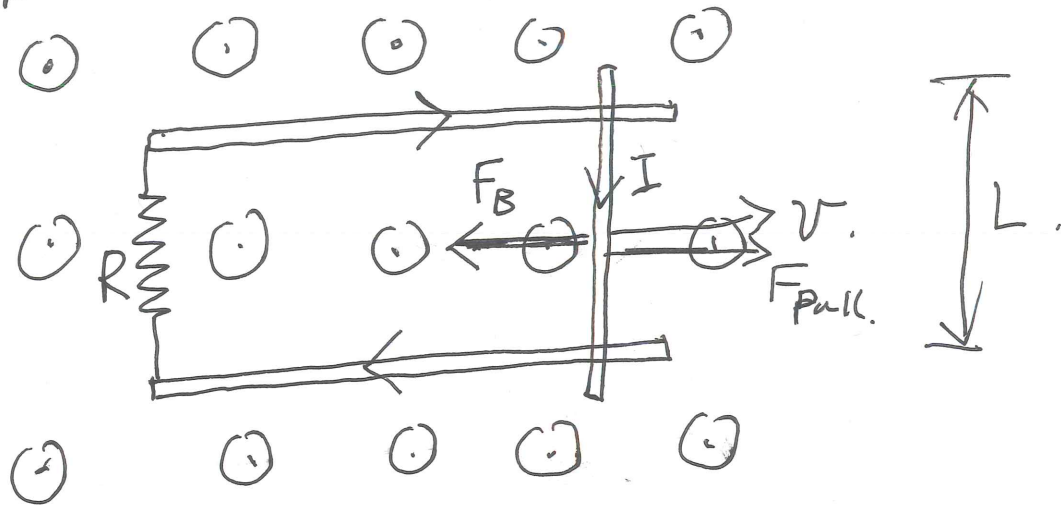


$\vec{B}$ (constant)



$$|\vec{F}_B| = ILB \sin 90^\circ = ILB.$$

$$|\vec{F}_{pull}| = ILB.$$

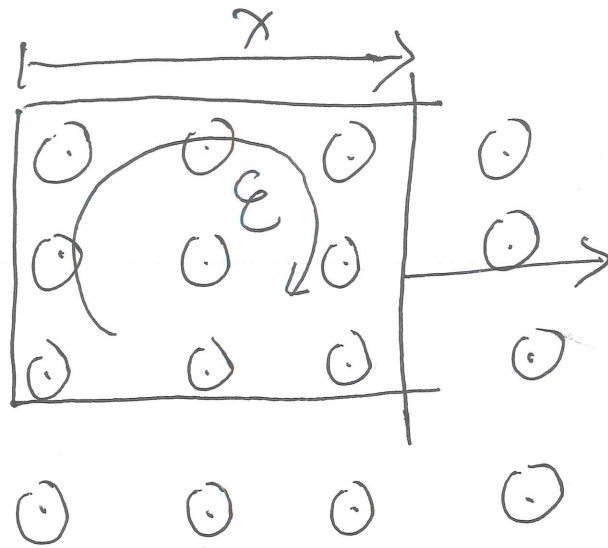
Work done by F_{pull} = Energy dissipated in R .

$$ILBv = I^2 R$$

$$\Rightarrow I R = LBv.$$

$$\mathcal{E} = LBv$$

$\mathcal{E}$ Motion Emf.



Starting from Lorentz Force law

$$\vec{F} = I d\vec{l} \times \vec{B}$$

we got

$$|\mathcal{E}| = LBv.$$

$$|\mathcal{E}| = LB \frac{dx}{dt} = B \frac{d(Lx)}{dt}.$$

$$= B \frac{dA}{dt}.$$

$$= \frac{d(BA)}{dt} = \frac{d\Phi}{dt}.$$

Faraday's Law. $\rightarrow \mathcal{E} = -\frac{d}{dt} \oint \vec{B} \cdot d\vec{A}$

$$= -\oint \frac{\partial \vec{B}}{\partial t} \cdot d\vec{A} - \oint \vec{B} \cdot d\left(\frac{\partial \vec{A}}{\partial t}\right)$$

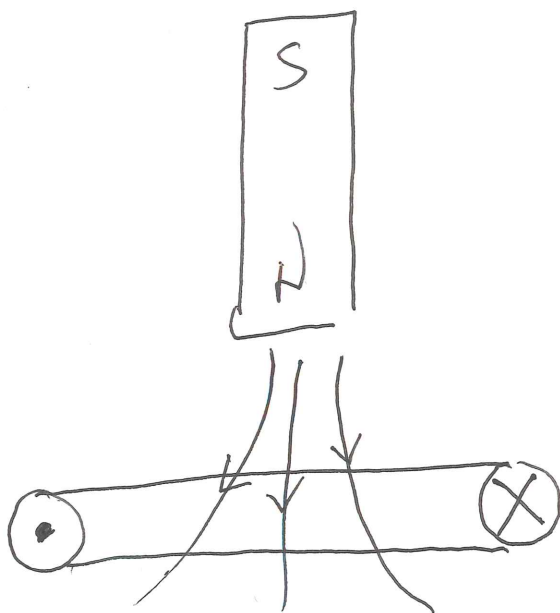
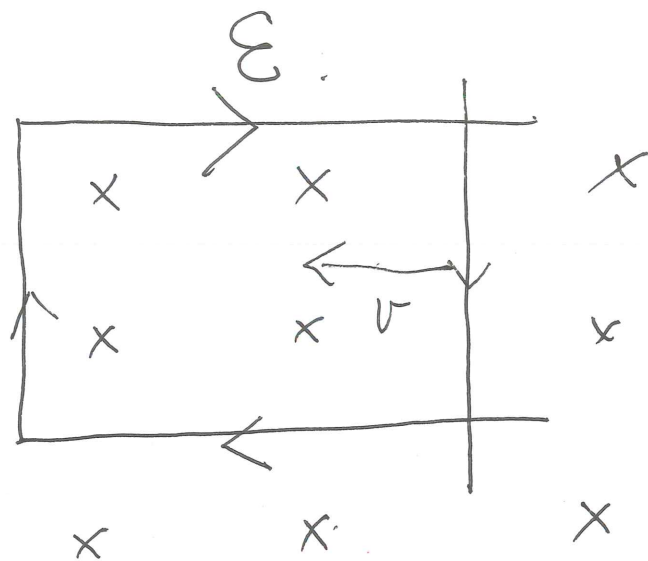
$\swarrow$
Maxwell's 4th Eq.

$\searrow$
From $\vec{F} = I d\vec{l} \times \vec{B}$.

- 1). What is the direction of the external B_{ext} field. (provide you a reference).

- 2). With respect to a loop, is the flux increasing or decreasing?

- 3). If the flux is increasing, the current ~~due it~~ should flow in the direction producing a field opposite to B_{ext} .
 " " is decreasing, " "
 ~~~~~~  
 . . . . . in the same direction as  $B_{\text{ext}}$ .

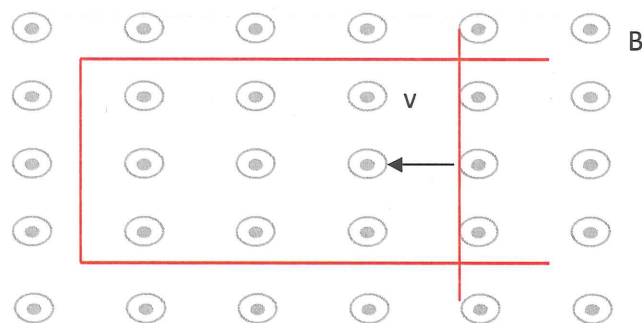


PHY 232 Fall 2017 Classwork  
Class 37. – Lenz's Law

Indicate the induced emf direction in the red loop in each of the following questions:

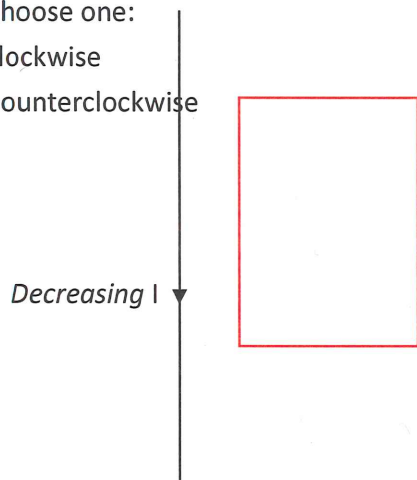
1. Choose one:

- a. Clockwise
- b. Counterclockwise



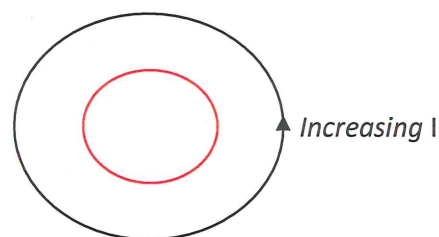
2. Choose one:

- c. Clockwise
- d. Counterclockwise



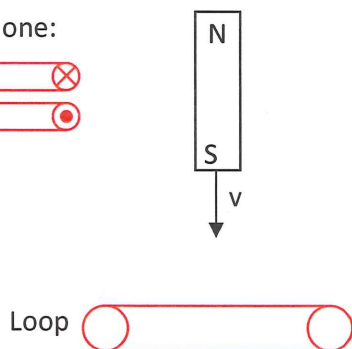
3. Choose one:

- e. Clockwise
- f. Counterclockwise



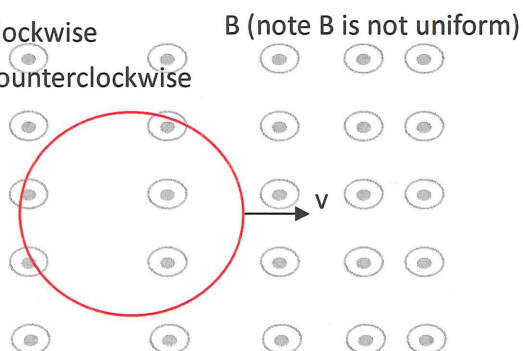
4. Choose one:

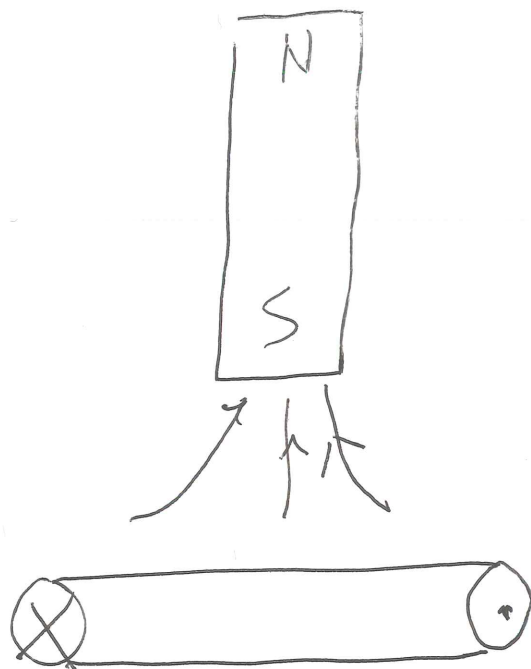
- g.
- h.

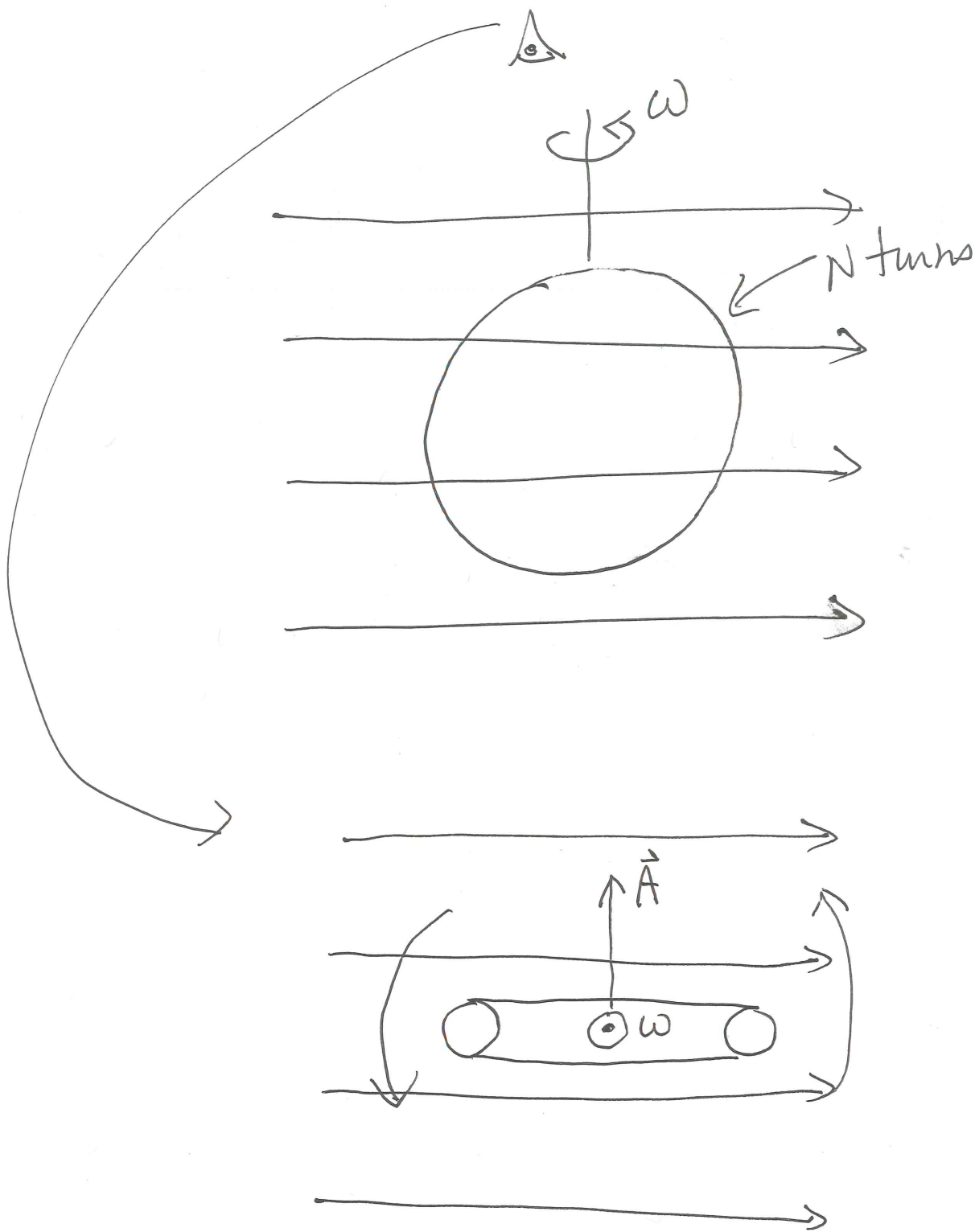


5. Choose one:

- i. Clockwise
- j. Counterclockwise







$$\mathcal{E} = -\frac{d\Phi}{dt} = -\frac{d}{dt}(N\vec{B} \cdot \vec{A}).$$



$$\vec{B} \cdot \vec{A} = BA \cos(90^\circ + \omega t).$$

$$= -BA \sin \omega t.$$

$$\mathcal{E} = -\frac{d}{dt}(-NBA \sin \omega t)$$

$$= NBA \frac{d}{dt} \sin \omega t.$$

$$= NBA \omega \cos \omega t.$$