Homework Week 10

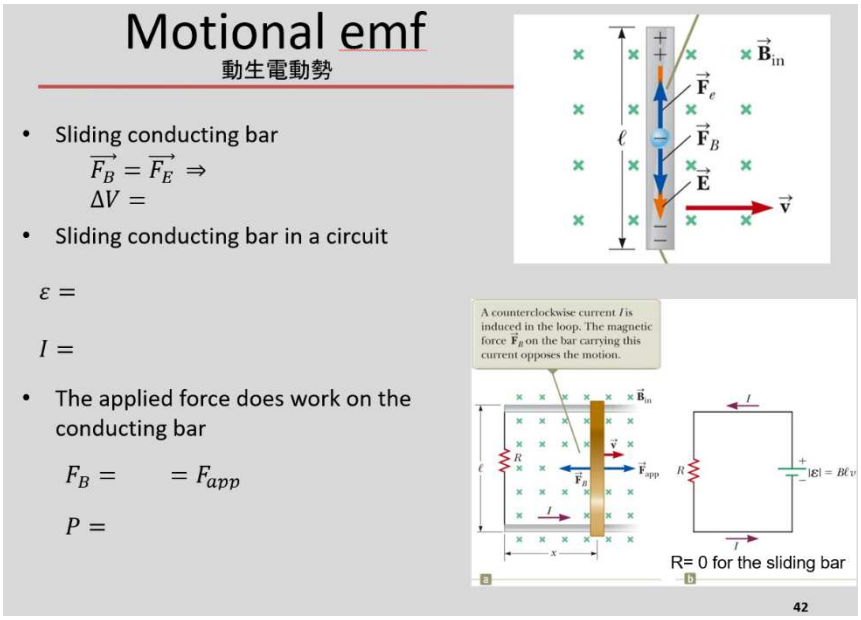
113-2 General Physics II

Due before 4:10 PM on April 28, 2025

Name 徐宏宇

1. [20 points] **Derivation of the motional emf (Force model vs Faraday's law)**

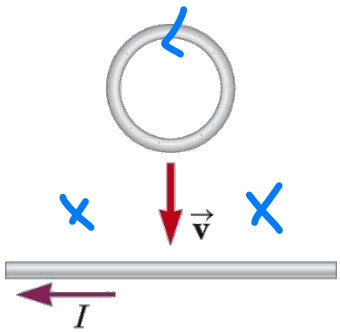
   寫下推導每個步驟



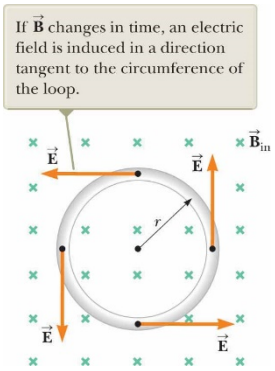
2. [5 points] **Quick Quiz 31.3**

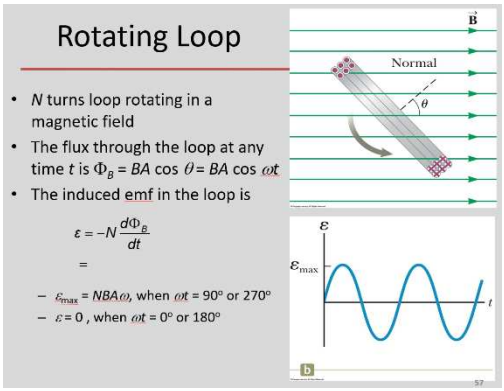
   Figure 31.12 shows a circular loop of wire falling toward a wire carrying a current to the left. What is the direction of the induced current in the loop of wire?

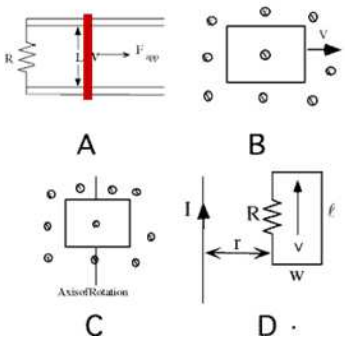
   (a) clockwise **(b)** counterclockwise **(c)** zero **(d)** impossible to determine



3. [20 points] **The General Form of Faraday's Law**







4. [5 points] **The induced emf in a rotation loop**

5. [5 points] **Quiz**
For which of the following is an emf induced?
A. conducting rod is pulled on conducting rails that are placed in a uniform magnetic field directed into the page.
B. conducting loop moves through a uniform magnetic field directed into the page.
C. conducting loop rotates in a uniform magnetic field directed into the page.
D. conducting loop moves in a magnetic field produced by an infinite current-carrying wire.

6. [5 points] According to our course schedule, what topic will be covered in the next lecture? _____.

7. [10 points] 銀河便車指南”說，「42」是生命、宇宙和一切的終極答案。如果我們看不懂答案，是因為一開始就不知道問題是什麼。**真正重要的，是**_____。

當眼界不夠開闊的時候，我們可能會問錯問題。因此，我們必須保持對世界的好奇，拓展知識的邊界，勇敢地提出笨的問題，有一天就會問到對的問題。

學習物理，要連結日常生活，把物理圖像化。

8. [30 points] 有沒有覺得課堂、作業、考試可以如何調整，幫助學習？

此題可留白，無論是否作答都給分，但禁止使用生成式 AI 工具

勇敢地提出笨的問題，有一天就會問到**對**的問題

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1. • Sliding Conducting Bar

$$F_B = F_E \Rightarrow qvB = qE \Rightarrow E = vB$$

$$\Delta V = El = vBl$$

• Sliding conducting bar in a circuit

$$\mathcal{E} = -\frac{d\Phi_B}{dt} = -\frac{d(Blx)}{dt} = -Blv$$

$$I = \frac{|\mathcal{E}|}{R} \text{ (Ohm's Law)} = \frac{Blv}{R}$$

• The applied force F_{app} does work on the conducting bar

$$F_{app} = I\vec{L}\times\vec{B} = IlB = F_B$$

$$P = \frac{dW}{dt} = \vec{F}\cdot\frac{d\vec{s}}{dt} = \vec{F}_{app}\cdot\vec{v}$$

$$= (IlB)\cdot v \quad \leftarrow F_{app} = IlB$$

$$= \frac{B^2l^2v^2}{R}$$ ✓

2. (B into the plane) ⊗

$\Longrightarrow$ (Lenz's Law) generates B out of the plane

$\Longrightarrow$ (R+R) ✓ counterclockwise I

3. The General Form of Faraday's Law

$$\mathcal{E} = -\frac{d\Phi_B}{dt}$$

$$\Rightarrow \int \vec{E} \cdot d\vec{s} = -\frac{d(BA)}{dt}$$

$$\Rightarrow E(2\pi r) = -\frac{dB}{dt}(\pi r^2)$$

$$\Rightarrow E = -\frac{r}{2}\frac{dB}{dt} \quad \#$$ ✓

4. the Induced emf in a rotational loop

$$\mathcal{E} = -N\frac{d\Phi_B}{dt} \quad \text{(Faraday's Law)}$$

$$= -N\frac{d(BA\cos\theta)}{dt}$$

$$= -NBA\frac{d\cos(\omega t)}{dt} \quad \theta = \omega t$$

$$\left(\frac{d\cos(\omega t)}{dt} = -\omega\sin(\omega t)\right)$$

$$= \omega NBA\sin(\omega t) \quad \#$$ ✓

5. AC ✓

6. inductance ✓

7. 3 解決問什麼樣的問題 ✓

8.