Homework Week 7

113-2 General Physics II

Due before 4:10 PM on April 07, 2025

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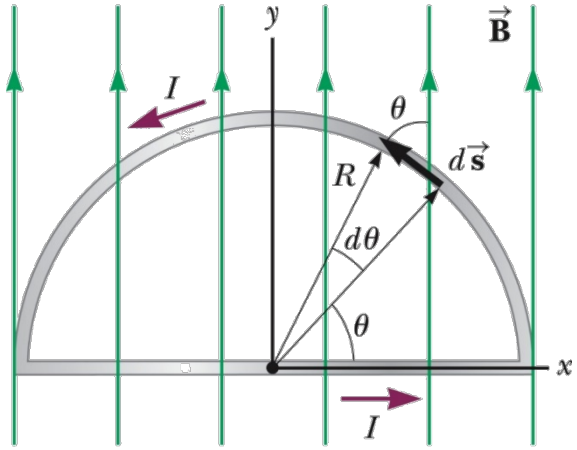
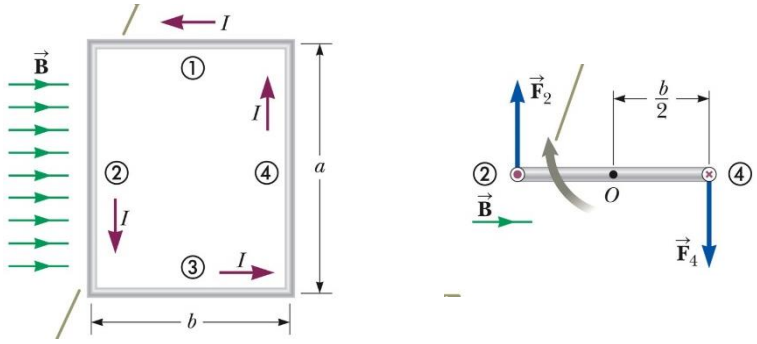
1. [10 points] **Quick Quiz 28.1**
   An electron moves in the plane of this paper toward the top of the page. A magnetic field is also in the plane of the page and directed toward the right. What is the direction of the magnetic force on the electron? (a) toward the top of the page (b) toward the bottom of the page (c) toward the left edge of the page (d) toward the right edge of the page (e) upward out of the page (f) downward into the page

2. [10 points] **Example 28.2 A Proton Moving Perpendicular to a Uniform Magnetic Field**
   A proton is moving in a circular orbit of radius 14 cm in a uniform 0.35-T magnetic field perpendicular to the velocity of the proton. Find the speed of the proton.

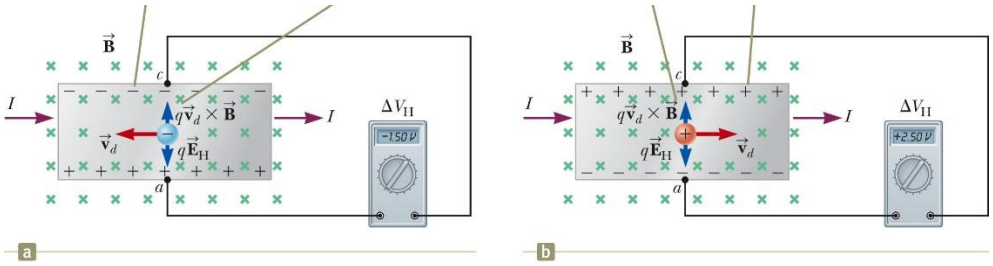
3. [20 points] **Example 28.4 Force on a Semicircular Conductor**
   A wire bent into a semicircle of radius R forms a closed circuit and carries a current I. The wire lies in the xy plane, and a uniform magnetic field is directed along the positive y axis as in the figure below. Find the magnitude and direction of the magnetic force acting on (a) [10 points] the straight portion of the wire and on (b) [10 points] the curved portion.



4. [20 points] **A current Loop**. The rectangular loop carries a current I in a uniform magnetic field. Calculate (a) [10 points] the total net force (b) [10 points] the max torque around the point O.



5. [10 points] Derive the Hall Voltage $\Delta V_H = \frac{IB}{nqt}$



6. [5 points] According to our course schedule, what topics will be covered in the next lecture? _____ of the Magnetic Fields [10 points].

7. [25 points] (A) 重複 HW Week 4 最後一題的問題。[5 points] (B) Google 搜尋關鍵字 or 查閱維基有無文章 (注意維基不見得正確)。[20 points]

   螢幕截圖/照相，或是附上出處，線上繳交。如前面手寫，可分開繳交。

有問就給分，鼓勵同學多方閱讀，自己整理資訊。

答案範例:

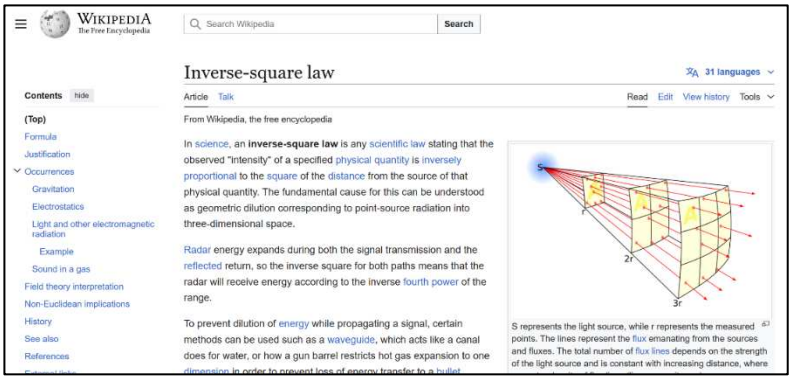
1. 庫侖定律為什麼不是

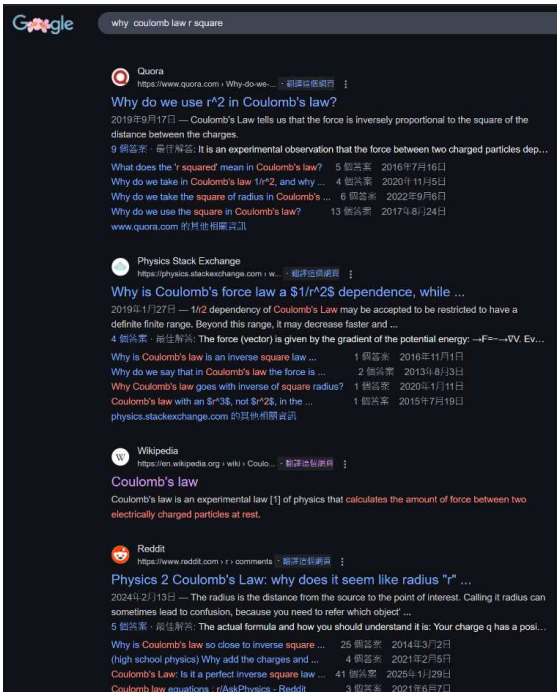
$$\frac{kQq}{r^{2.000000000000000000000000000000000000000000000000000000001}}?$$

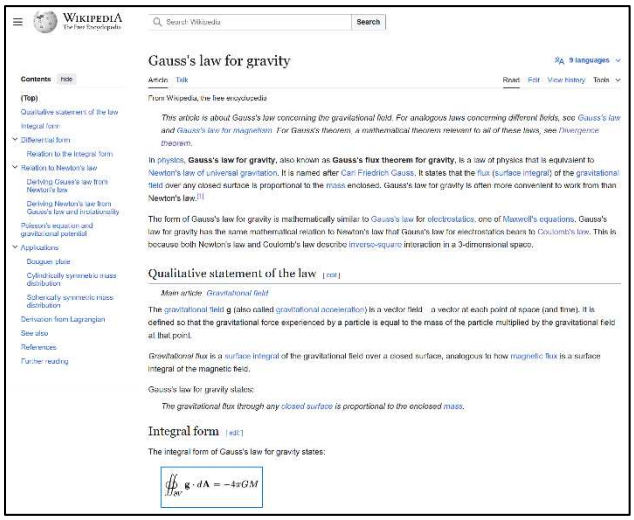
   萬有引力為什麼不是

$$\frac{GMm}{r^{2.000000000000000000000000000000000000000000000000000123456789}}?$$

2. (中英皆可)



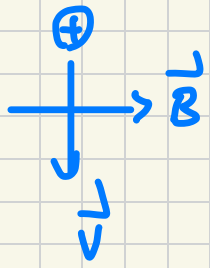




勇敢地提出**笨**的問題，

有一天就會問到**對**的問題

1. (c)



$$\vec{F}_B = q\,\vec{v}\times\vec{B}$$

2.
$$F_B = qvB = \frac{mv^2}{r} = F_c$$

$$\Rightarrow r = \frac{mv}{qB}$$

$$0.14 = \frac{(1.67\times10^{-27})\,v}{(1.6\times10^{-19})\,0.35}$$

$$\Rightarrow v \approx 4.7\times10^{6}\ (m/s)$$ #

3. (a)
$$\vec{F}_1 = I\int_a^b d\vec{s}\times\vec{B}$$

$$= I\int_{-R}^{R}(dx\,\hat{i})\times(B\,\hat{j})$$

$$= IB\int_{-R}^{R} dx\,(\hat{i}\times\hat{j})$$

$$= 2IRB\,\hat{j}$$ → out of the plane #

(b)
$$\vec{F}_2 = I\int_a^b d\vec{s}\times\vec{B}$$

$$= I \int_0^{\pi} ds\, B \sin\theta\, (-\hat{k})$$

$$= -I \int_0^{\pi} R\, d\theta\, B \sin\theta\, \hat{k}$$

$$= -IBR \int_0^{\pi} \sin\theta\, d\theta\, \hat{k}$$

$$= -IBR \left[-\cos\theta\right]_0^{\pi} \hat{k}$$

$$= IBR \left[\cos\pi - \cos 0\right] \hat{k}$$

$$= IBR \left[-1 - 1\right] \hat{k}$$

$$= -2IBR\,\hat{k} \quad \#$$ ✓

4. (a) 0

(b) $\vec{\tau} = I \vec{A} \times \vec{B}$

$$\max |\vec{\tau}| = IAB$$

$$= IabB \quad \#$$ ✓

5. $\because F_B = qv_dB = qE_H = F_E$

$$\Rightarrow E_H = v_dB$$

2° $V_H = E_H d$

$= V_d B d$

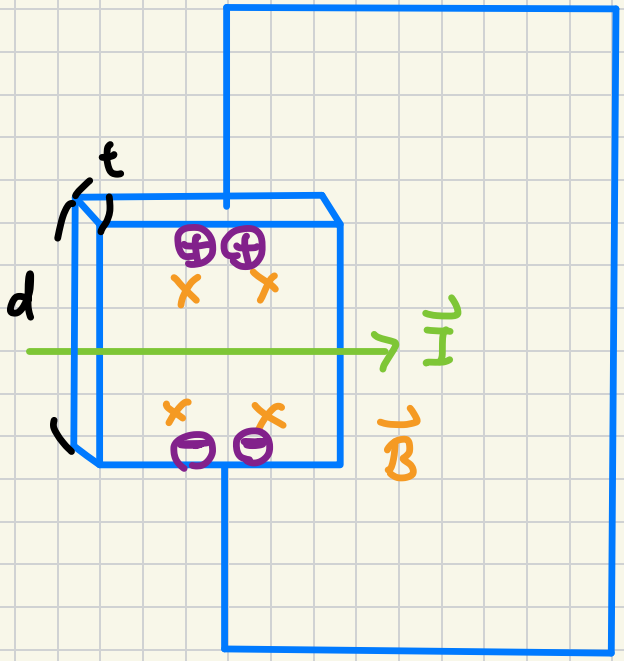
$= \frac{IB}{nqt}$

$I = nqAv_d$

$\Rightarrow v_d = \frac{I}{nqA}$

$= \frac{I}{nqtd}$

#



5. How can Hall voltage be used to determine the type of charge carriers in a material?

https://pressbooks.online.ucf.edu/osuniversityphysics2/chapter/the-hall-effect/?utm_source=chatgpt.com