General Physics II (PHYS 112)
Fall 2024

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Reading Quiz 2, due Monday, October 28, 2024. **This is a firm deadline.**

10/27

Read Chapters 28 - 30 and answer the following questions.

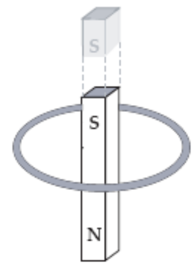
1. __C__ (2 points) "The *emf* induced in a circuit is directly proportional to the time rate of change of magnetic flux through a circuit." This is a statement of
   (A) Coulomb's law.
   (B) Biot-savart law.
   (C) Faraday's law of induction.
   (D) Lenz's law of back *emf.*
   (E) Gauss's law of magnetic flux.

2. __E__ (2 points) Lenz's Law is a consequence of conservation of
   (A) mass.
   (B) momentum.
   (C) charge.
   (D) impulse.
   (E) energy.

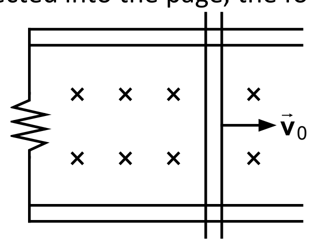
3. __A__ (3 points) A coil is wrapped with 300 turns of wire on the perimeter of a square frame (side length = 20 cm). Each turn has the same area as the frame, and the total resistance of the coil is 1.5 Ω. A uniform magnetic field perpendicular to the plane of the coil changes in magnitude at a constant rate from 0.50 T to 0.90 T in 2.0 s. What is the magnitude of the induced emf in the coil while the field is changing?
   (A) 2.4 V
   (B) 1.6 V
   (C) 3.2 V
   (D) 4.0 V
   (E) 8.4 V

   $\partial B = 0.9 - 0.5 = 0.4T$ $\partial t = 2s$
   $A = 0.04 m^2$ $\theta = 90°$ $N = 300$
   $\mathcal{E} = NA\cos\theta \frac{\partial B}{\partial t}$
   $\mathcal{E} = 300 \cdot 0.04 m^2 \cdot \cos 90 \cdot \frac{0.4}{2}$
   $\mathcal{E} = 2.4V$

4. __C__ (2 points) A bar magnet is dropped from above and falls through the loop of wire shown below. The north pole of the bar magnet points downward towards the page as it falls. Which statement is correct?
   (A) The current in the loop always flows in a clockwise direction.
   (B) The current in the loop always flows in a counterclockwise direction.
   (C) The current in the loop flows first in a clockwise, then in a counterclockwise direction.
   (D) The current in the loop flows first in a counterclockwise, then in a clockwise direction.
   (E) No current flows in the loop because both ends of the magnet move through the loop.



5. __D__ (2 points) A metal bar sliding on parallel rails a length ℓ apart from one another is given initial velocity v_0 to the right. The rails are connected by a resistor of resistance R at their left. If a constant magnetic field is directed into the page, the force on the rod is directed



(A) downward.
(B) upward.
(C) to the right.
(D) to the left.
(E) out of the page.

6. __D__ (3 points) A circular loop is oriented with its plane perpendicular to a uniform magnetic field with $B = 1.5$ T. At an instant when the radius of the loop is equal to 12 cm and is increasing at a rate of 3.0 cm/s, what is the magnitude in mV of the *emf* induced in the loop?

(A) 12
(B) 17
(C) 25
(D) 38
(E) Zero.

$N=1 \quad B=1.5T \quad \theta=0° \quad r=0.12m \quad \frac{dr}{dt}=\frac{0.03m}{1s}$

$\mathcal{E} = NB\cos\theta \frac{dA}{dt} \qquad \frac{dA}{dt} = \frac{d(\pi r^2)}{dt} = 2\pi r \frac{dr}{dt}$

$\mathcal{E} = B\frac{dA}{dt}$

$\mathcal{E} = B \cdot 2\pi r \cdot \frac{dr}{dt} = 1.5 \cdot 2\pi 0.12 \cdot \frac{0.03}{1} = 0.0339 = 34\,mV$

7. __B__ (1 point) What is the magnitude of the *emf* produced when a conducting bar of length ℓ moves perpendicularly through a B field with speed v.

(A) $\frac{a+B}{\ell}$
(B) $B\ell v$
(C) $\frac{B\ell}{v}$
(D) $\frac{Bv}{\ell}$
(E) $\frac{v\ell}{B}$

$\mathcal{E} = \frac{d\Phi}{dt}$

$\mathcal{E} = \frac{Tm^2}{s} = T \cdot m \cdot m/s$

$B \cdot \ell \cdot v$