Phys 112 2019

Review 2

Weds / Thurs PRELABS

Weds: Exam II in class 50 minutes

Covers: Ch 22, 23.1 → 23.3, 24, 25.1 → 25.4

Bring: Calculator

Original note card, second 3"x5" single side

Study 2012 Exam 2 all except Q7

2013 Exam 2 v1, v2 all questions

HW, Discussion / quizzes

Concept quizzes

Chapter 22.1 → 22.6, 23.1 → 23.3 (series)

Formulas: $I = \frac{\Delta Q}{\Delta t}$ $\Delta V = IR$ $R = \rho \frac{L}{A}$

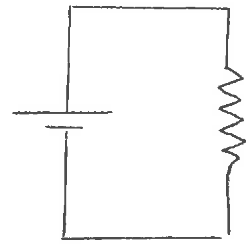
$P = \frac{\Delta E}{\Delta t}$ $P = I\Delta V$ $\Delta V = I R_{equiv}$ $R_{equiv} = R_1 + R_2$

Rules for currents in circuits

Quiz 1

Example: A heater is required to deliver 960 W of power when connected to a 120V power supply. Determine the resistance of the heater (assume that it obeys Ohm's law)

Answer: The circuit is as illustrated. Then



$$P = I\,\Delta V$$

and

$$\Delta V = IR$$

gives $960W = I\ 120V \Rightarrow I = \dfrac{960W}{120V} = 8.0A$

Then $\Delta V = IR \Rightarrow 120V = 8.0A \times R$

$$\Rightarrow R = \frac{120V}{8.0A} = 15\,\Omega \quad \boxtimes$$

Quiz 2

Chapter 24.1 → 24.7

Formulas: Know: * meaning of $\vec{B}$ field / compasses
* bar magnet fields.
* $\vec{B}$ from r.h. rule for currents

$B = \dfrac{\mu_0 I}{2\pi r}$ (long straight) $\quad B = \dfrac{\mu_0 I}{2R}$ (center loop) $\quad B = \mu_0 \dfrac{N}{L} I$ (solenoid)

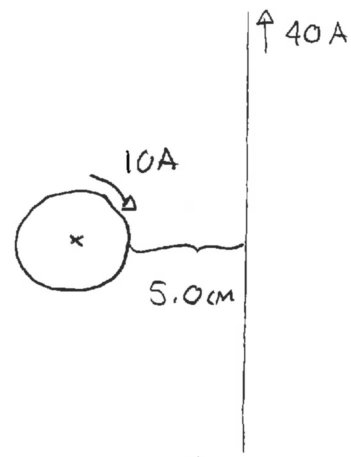
Know: * $\vec{B}$ exerts force on charge / current r.h. rule

$F = |q| v B \sin\alpha \qquad F = ILB\sin\alpha \qquad F = \dfrac{\mu_0 I_1 I_2 L}{2\pi d}$ (parallel currents)

Circular motion in unif field $r = \dfrac{mv}{|q|B}$

Quiz 3

Example: A loop with radius 5.0cm is placed next to a long straight wire as illustrated. These wires carry the illustrated currents. Determine the net magnetic field at the center of the loop.



Answer: $\vec{B} = \vec{B}_{loop} + \vec{B}_{straight}$

Credit

We have to add two vectors. We need to consider their directions.

The vectors are (by r.h. rule).

$\vec{B}_{wire}$ ⊙ $\vec{B}_{loop}$ ⊗

Then $B_{loop} = \frac{\mu_0 I}{2R} = \frac{4\pi \times 10^{-7} \times 10A}{2 \times 0.050m} = 1.26 \times 10^{-4} T$ (into)

$B_{wire} = \frac{\mu_0 I}{2\pi r} = \frac{4\pi \times 10^{-7} \times 40A}{2\pi \times 0.10m} = 0.80 \times 10^{-4} T$ (out)

Then $B_{net} = B_{loop} - B_{wire}$ (into)

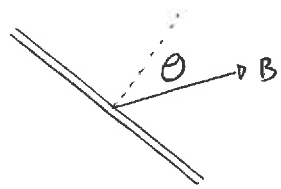
$= 1.26 \times 10^{-4} T - 0.80 \times 10^{-4} T = 0.46 \times 10^{-4} T$ (into)

credit

Quiz 4

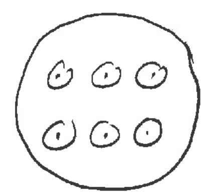
Chapter 25.1 → 25.4

Formulas: $\Phi = AB\cos\theta$ $\qquad \mathcal{E} = \left|\frac{\Delta\Phi}{\Delta t}\right|$ $\qquad$ Lenz's law



Quiz5

Example: A loop with radius 0.25m and resistance 2.0Ω is placed in a uniform magnetic field as illustrated. The field increases from 0T to 5.0×10^{-4}T in 0.008s. Determine the current in the loop during this period



Answer: First

$$\mathcal{E} = \left|\frac{\Delta\Phi}{\Delta t}\right|$$

gives the EMF. Then $\mathcal{E} = IR$ gives the current

For the EMF,

$$\Phi = BA\cos\theta = B\pi r^2\cos\theta$$

Initially $\Phi_i = 0$.

Later $\Phi_f = B\pi r^2\cos\theta = 5.0\times10^{-4}T\times\pi\times(0.25m)^2\cos0^\circ$

$= 9.82\times10^{-5}$ Wb

Thus $\mathcal{E} = \left|\frac{\Phi_f - \Phi_i}{t_f - t_i}\right| = \frac{9.82\times10^{-5}\,Wb}{0.0080s} = 1.2\times10^{-2}V = 12mV$

Then $\mathcal{E} = IR \Rightarrow 1.2\times10^{-2}V = I\ 2.0\Omega \Rightarrow$ $\boxed{I = 6.1\times10^{-3}A}$