

## Phys1120 Post Exam 3 Review:

### Inductors

$$\Phi_M = LI \quad (\text{Definition of } L)$$

$$\mathcal{E} = -L \frac{dI}{dt} \quad (\text{from } \Phi_M = LI, \frac{d\Phi_M}{dt} = L \frac{dI}{dt} + \text{Faraday's Law})$$

LR circuits:

- I thru L cannot change instantly
- In steady state, I = constant,  $V_L = 0$  so L acts like a short.
- time constant  $\tau = L/R$

$$\text{Magnetic energy density} = u_M = \frac{U_M}{\text{vol}} = \frac{1}{2\mu_0} B^2$$

$$\text{Magnetic energy of inductor} = U = \frac{1}{2} LI^2$$

### AC Circuits

$$V(t) = V_{\text{peak}} \sin(\omega t), \quad V_{\text{rms}} = \sqrt{V^2} = \frac{V_{\text{peak}}}{\sqrt{2}}$$

All the DC voltage formulas  $V = IR$ ,  $P = IV = I^2/R = V^2/R$   
work OK with  $I_{\text{rms}}$ ,  $V_{\text{rms}}$ , and  $P_{\text{avg}}$

**Transformers** only work for AC voltages only  $\frac{V_{\text{out}}}{V_{\text{in}}} = \frac{V_S}{V_P} = \frac{N_S}{N_P}$

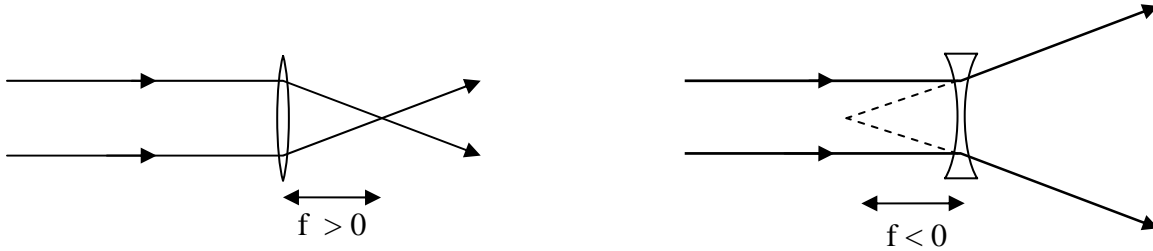
$$P_{\text{out}} = P_{\text{in}} \Rightarrow I_S V_S = I_P V_P \Rightarrow \frac{I_S}{I_P} = \frac{V_P}{V_S} = \frac{N_P}{N_S}$$

### EM Waves

- Light is an electromagnetic wave which is created by accelerating electric charge.
- Know what a plane wave is.
- $\lambda f = c = \text{speed of light} = \text{constant}$ , EM spectrum (radio, visible, IR, UV, etc)
- intensity ( $\text{W/m}^2$ ) =  $\frac{\text{power}}{\text{area}}$ ,  $I = \frac{P}{A}$

## Ray Optics

- Snell's Law:  $n_1 \sin \theta_1 = n_2 \sin \theta_2$ , where index of refraction =  $n = \frac{c}{v}$
- total internal reflection, critical angle  $\theta_c$ :  $n_1 \sin \theta_c = n_2 \underbrace{\sin(90^\circ)}_1 = n_2$
- Converging and diverging lenses, focal length



- Ray diagrams, image formation, real vs. virtual images
- Camera vs. eye
- image/object math:  $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$ ,  $|M| \equiv \frac{|h_i|}{h_o} = \frac{|d_i|}{d_o}$

## Are you ready for the Final Exam?

If so, you should know and understand.

- The definition of the electric field.
- The definition of the magnetic field.
- Coulomb's Law.
- The E-field due to a point charge and how to derive it.
- Gauss's Law.
- The definition of electric flux and magnetic flux.
- The definition of voltage difference.
- Voltage due to a point charge and how to derive it.
- The definition of capacitance.
- Kirchhoff's Laws for circuits (voltage law and current law)
- The Biot-Savart Law.
- Gauss's Law for B-fields.
- Faraday's Law.
- The definition of inductance.
- Snell's Law.

You should invent a problem in which you use

### To prepare for any exam:

- Study the online lecture Notes.
- Review Concept Tests, CAPA problems, and Tutorial HW. (Read question and try to remember reasoning that gets to the answer)
- Prepare your formula sheet. Prioritize: which are the important equations?
- Take the practice exam.
- It is no good to memorize answers. You have to understand and remember how you got the answers.