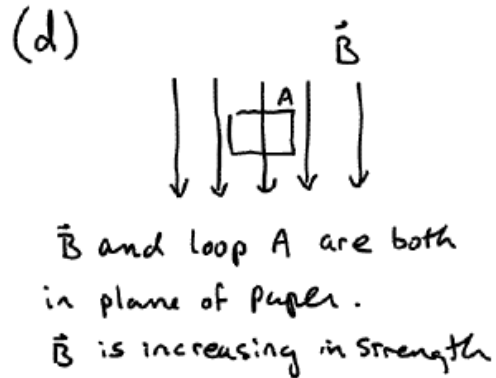
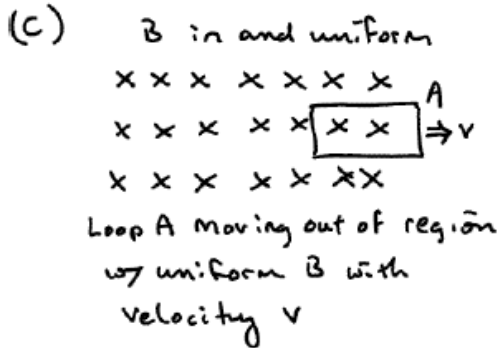
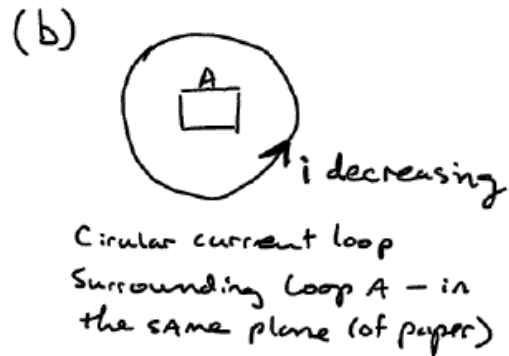
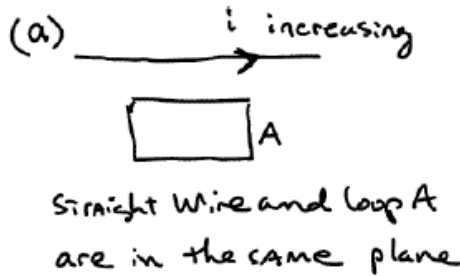


### Exam 3 (April 25, 2006)

Please read the problems carefully and answer them in the space provided. Write on the back of the page, if necessary. Show your work. Partial credit will be given.

**Problem 1 (16 pts, no partial credit for each part, no need to justify answer):**

In each of the four cases below, indicate the direction of current flow in the rectangular wire loop "A". In all instances, the rectangular loop is in the plane of the paper. If you think no current is induced in the given situation, write "no induced current" by that diagram.



**Problem 2 (12 pts, show work/logic to get credit):**

You place a single loop of wire 0.5 m by 0.3 m perpendicular to a field of 2.0 T. In 30 ms you turn the loop until it is parallel with the field. The average emf induced in this loop is

- a) 0.3 V
- b) 10 V
- c) 5.0 V
- d) 67 V
- e) 20 V

**Problem 3 (15 pts, show work/logic to get credit):**

A real object is placed 42 cm from a diverging lens with a focal length of 21 cm.

a) What is the power of this lens (in diopters)?

b) What is the location of the image?

c) Is the image real or virtual?

d) How does the height of the image compare to the height of the object?

e) Is the image upright or inverted?

1)	/16
2)	/12
3)	/15
4)	/12
5)	/15
6)	/15
7)	/15
<hr/>	
tot	/100

**Problem 4 (12 pts, show work/logic to get credit):**

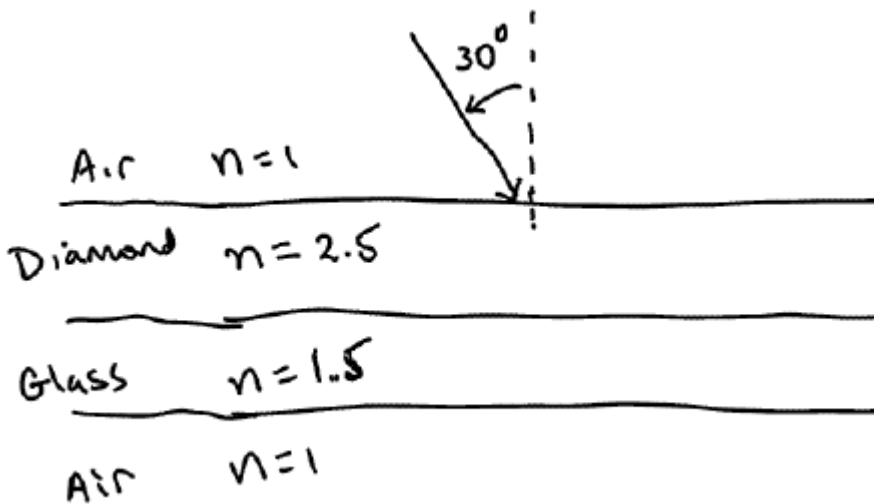
At what distance will a 75-Watt light bulb have the same apparent brightness as a 120-Watt bulb viewed from a distance of 15 m? (*Hint: Think about the total energy produced by the bulb and the area over which that energy is spread as it travels.*)

**Problem 5 (15 pts, show work/logic to get credit):**

The Donald decides that his new building, Trump Castle, needs distinctive windows. So, he has a talented team of window makers coat all of the windows in the building with diamond.

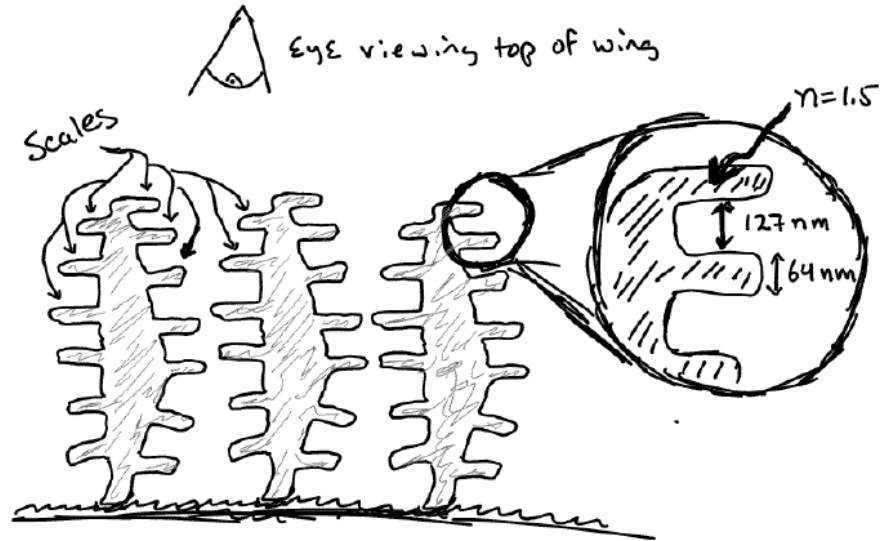
(a) If a light ray is incident on one of the Donald's new windows at an angle of 30 degrees with respect to the normal, at what angle with respect to the normal will this light leave the window on the other side. That is to say, what angle will the transmitted ray make with the normal to the window?

(b) draw schematically the path the light ray takes as it moves through the window.



**Problem 6 (15 pts, show work/logic to get credit):**

Stanly Studmeister, biologist extraordinaire, likes to study butterflies. Recently, he's been trying to figure out the cause of the shimmering blue color on the wings of the *Morpho* butterfly. Knowing that you are a local physics god, Studmeister asks you to help him out. Below is sketch that Stanly made of what he saw through an electron microscope when he inspected the surface of a *Morpho* butterfly's wing. The sketch shows a cross-section of part of the wing. In other words, the wing in the drawing is oriented perpendicular to the paper. What you see are overlapping scale structures as shown in the sketch. Please use the concepts that we have discussed recently to explain briefly to your dear friend Studmeister what causes the shimmering blue color of the wings. (Feel free to use drawings and sketches as necessary. For your reference, the central wavelength of the blue color of the wings is approximately 440 nm. The scales have an index of refraction of 1.5 and the space between the scales is filled with air.)



**Problem 7 (15 pts, show work/logic to get credit):**

**A beam of light is a mixture of linearly polarized light and unpolarized light. When it is sent through a Polaroid sheet (a linearly polarizing sheet), it is found that the transmitted intensity can be varied by a factor of four depending on the orientation of the Polaroid sheet. Find the relative intensities of the two components of the incident beam.**

P114 University of Rochester  
S. Manly Spring 2006

NAME \_\_\_\_\_

**Put in formula sheet**