# Chapter 2

Additional Problems

## Problem Types

Percent of incident light reflected at a surface
Refraction at a plane surface
Critical Angle
Apparent Position

**Percent of incident light reflected at a surface**

1. What percentage of light incident normally on a lens surface with an index of 1.49 is reflected back into the air?

Remember

$$\%Reflected = \left( \frac{\{n' - n\}}{\{n' + n\}} \right)^2 x100$$

2. Which lens material will reflect the most incident light (incident normal to surface)?

    a. CR39 (n=1.49)
    b. Trivex (n=1.53)
    c. Polycarbonate (n=1.586)

**Refraction at a plane surface**

1. What is the angle of refraction of a light ray with an angle incidence of 40 degrees incident on a plane surface with an index of 1.53? (ray coming from air)

Snell's <u>Law</u> :

$$n\sin\theta = n'\sin\theta'$$

2. After refraction at a plane surface a light ray has an angle of 20 degrees. If the angle of incidence is 30.6 degrees, what is the index of the lens material?

**Critical Angle**

1. What is the critical angle of crown glass (n = 1.523) in air?

$$sin\theta c = \frac{n'}{n}$$

2. The critical angle at the interface between two optical media is 35 degrees. If light travels in the second medium at a velocity of $2.75 \times 10^8$ m/s. What is the index of the first medium?

**Apparent Position**

1. A coin placed on the bottom of a pool that is 4m deep appears from above the surface to be 3m below the surface. What is the index of the liquid in the pool?

$$\frac{n}{l} = \frac{n'}{l'}$$

n = index of object space
n' = index of image space
l = object distance (distance from surface)
l' = image distance (apparent distance from surface)

2. A postage stamp is covered by a plate of glass that is 3cm thick. If viewed from above what is the apparent position of the stamp if the index of the glass is 1.60?