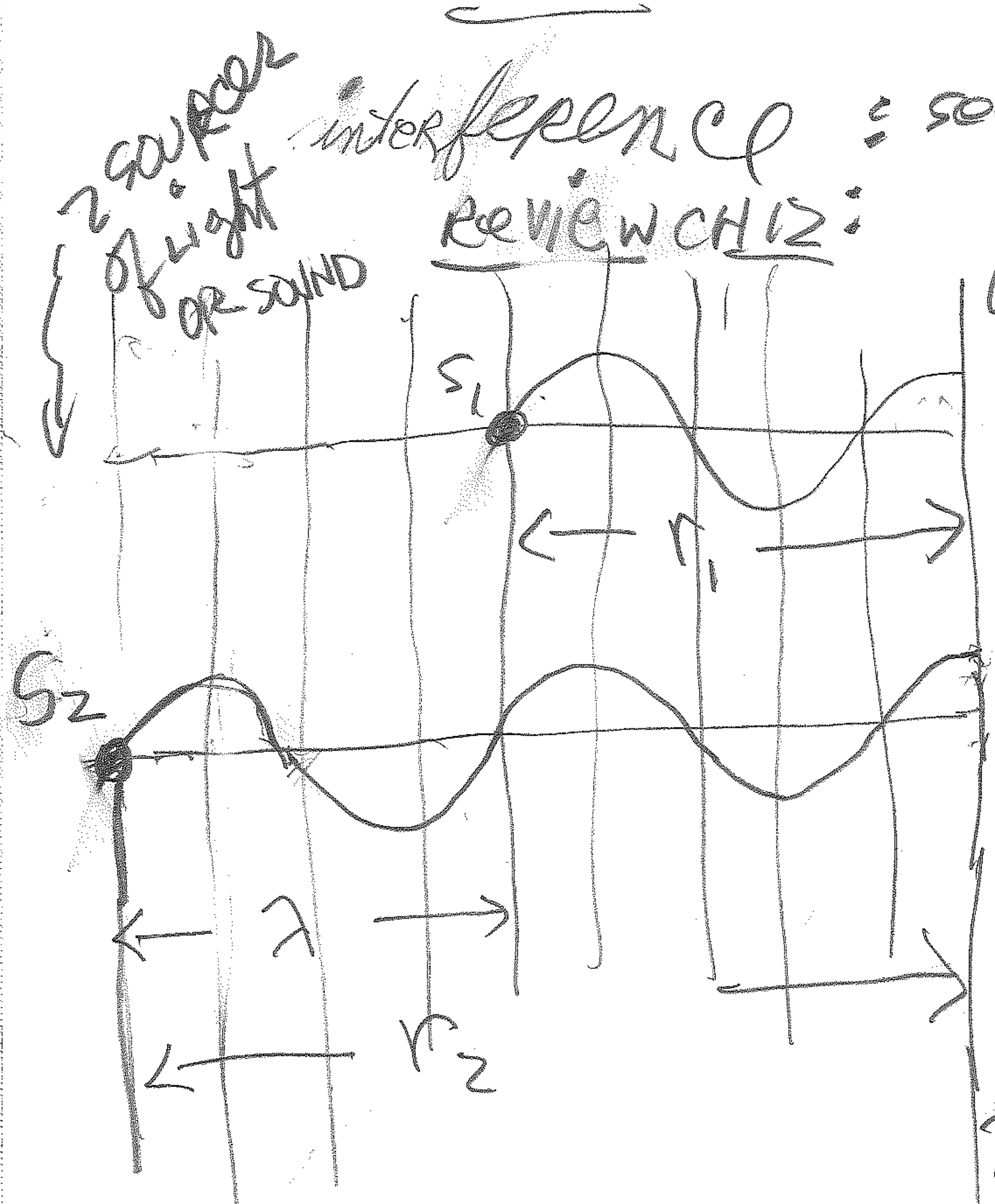
2B 5-2-14 (1)

Ch 26

interference : see 26.1

Review Ch 12:



constructive interference

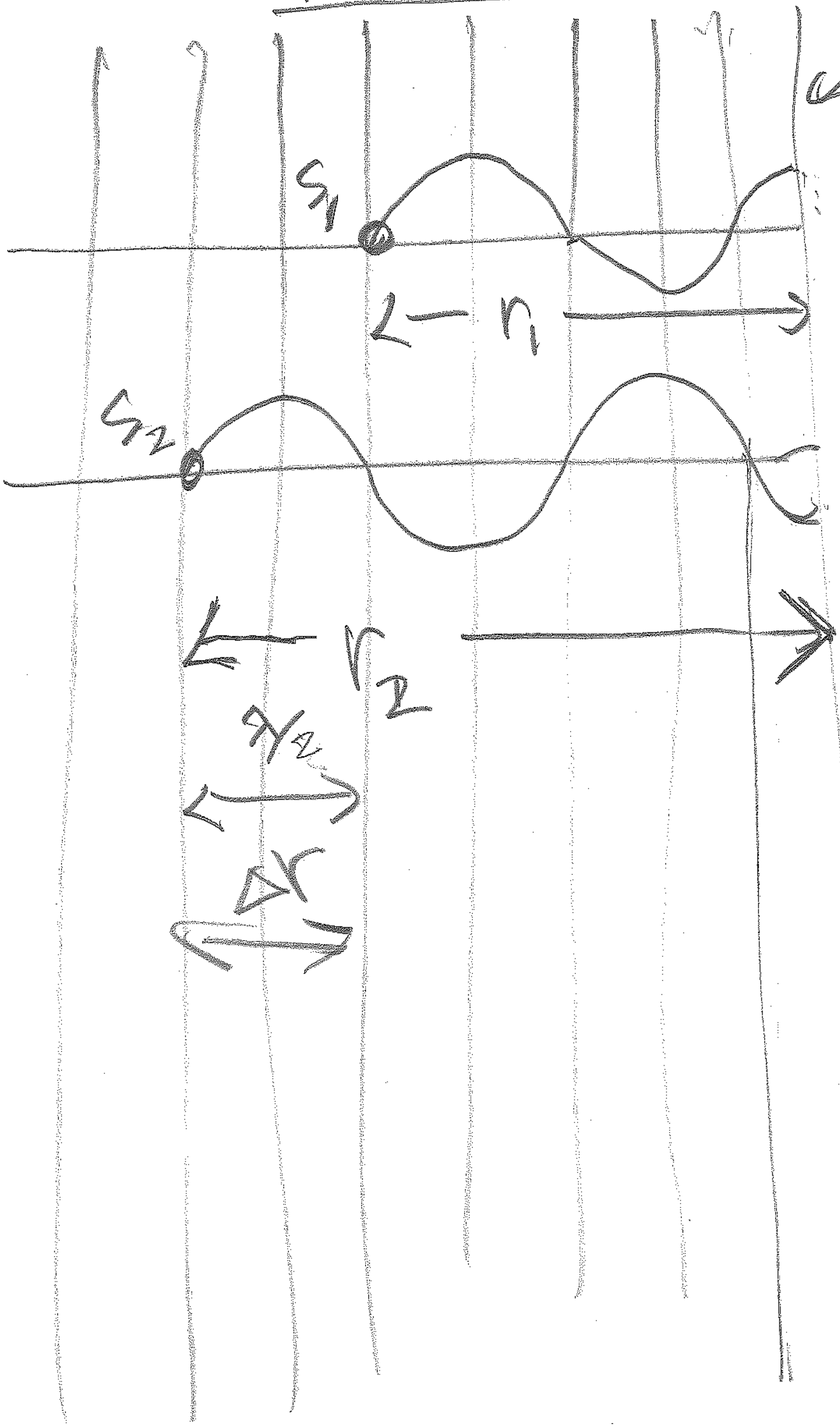
$r_2 - r_1 = \Delta r$

$r_2 - r_1 = \lambda$

$r_2 - r_1 = m\lambda$

$m = 0, \pm 1, \pm 2, \ldots$

Destructive Interference (2)



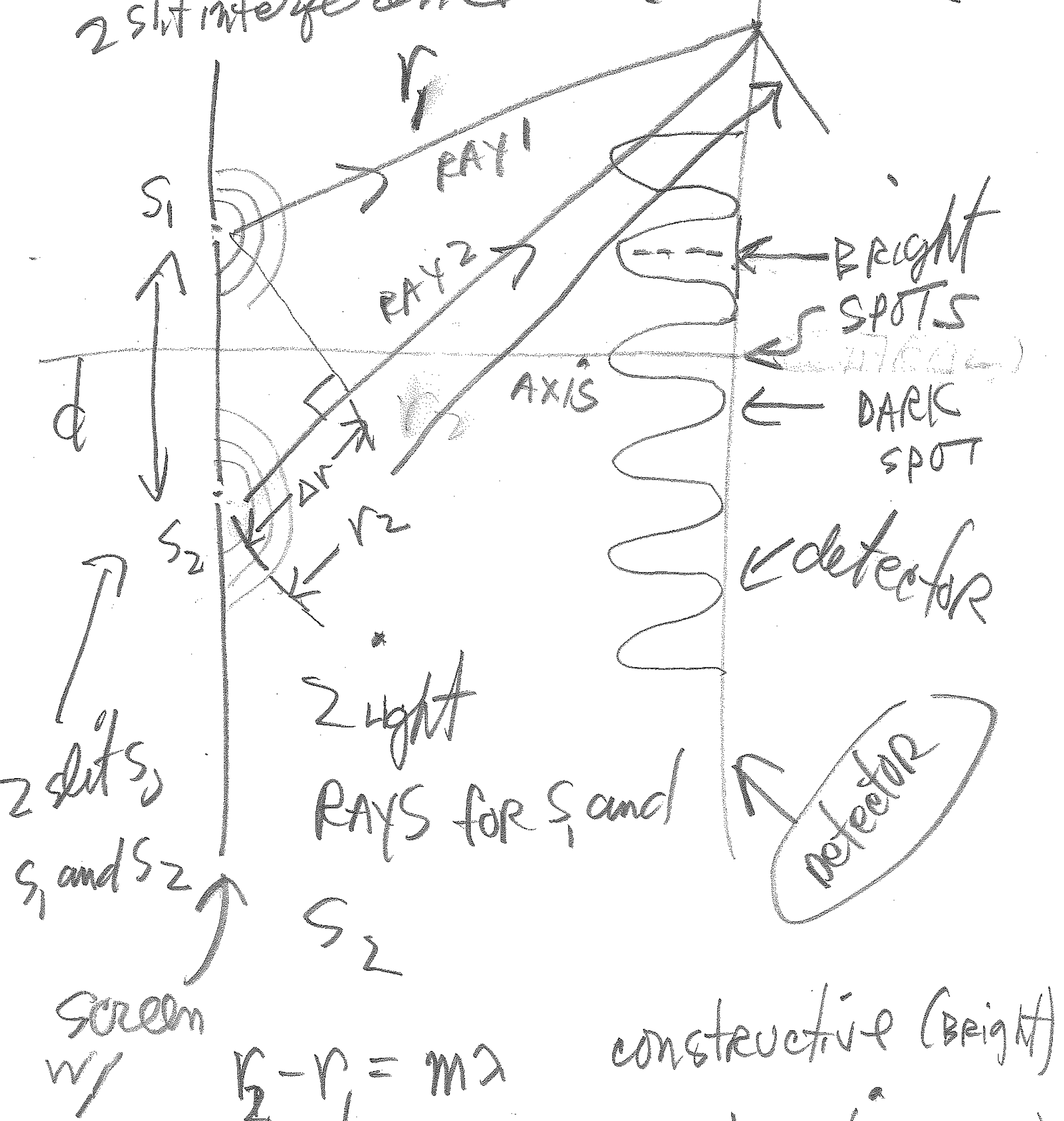
$r_2 - r_1 = \Delta r$

$r_2 - r_1 = \frac{\lambda}{2}$

$r_2 - r_1 = (2m' + 1)\frac{\lambda}{2}$

$m' = 0, \pm 1, \pm 2, \ldots$

2 slit interference sec 26.2



$r_2 - r_1 = m\lambda$ constructive (BRIGHT)

$r_2 - r_1 = (2m+1)\frac{\lambda}{2}$ destructive (DARK)

Index of Refraction

Procedure -----

Fill the empty glass tank with water halfway to the top. Place the slit of the sliding metal bracket over the thin line on the glass wall. Your eye should be near the corner of the painted white grid on the black metal surface which supports the tank. Your sight should be aimed over the grid toward line on the glass wall.

With your sight <u>over</u> the surface of the water in the tank, construct a line between the slit nearest your eye and the slit on the opposite wall of the tank. This line should be parallel to the white line painted on the horizontal grid.

Now, with your sight aimed <u>below</u> the surface of the water, construct another line, this time between the <u>image</u> (below the water) of the slit on the opposite wall, and the slit on the wall nearest your eye.

(Q-1) From the angle between the two lines that you have constructed, determine the angle of refraction for light passing from water to air. Also record the angle of incidence.

(Q-2) From the known value of the index of refraction of air, calculate the index of refraction of the water. Compare with the accepted value of the index of refraction.

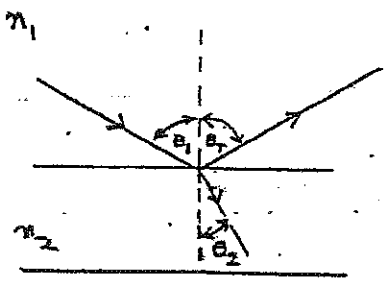


Figure 1

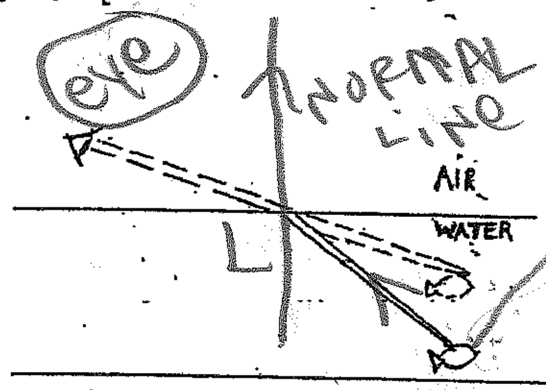


Figure 2

Physics [redacted]

Index of Refraction

Objectives --- The purpose of the laboratory is to verify the law of refraction of radiation through measurements with microwaves and visible light.

Concepts--- You should know that:

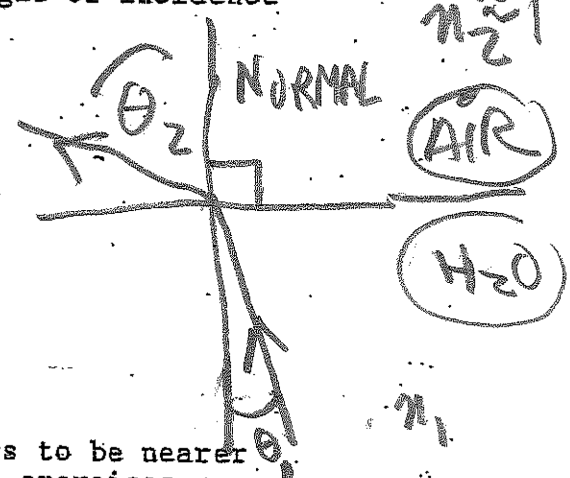
When light incident on a surface passes from one medium to another more optically dense medium, the angle of refraction is less than the angle of incidence. When light enters into a less optically dense medium then the angle of refraction is greater than the angle of incidence.

INTRODUCTION

A ray of light incident on a surface at at angle θ_1 with the normal is partly reflected at angle θ_r, which is equal to θ_1 (Figure 1). The process of refraction occurs when the light ray bends as it passes into the second medium. The angle of refraction θ_2, also measured with respect to the normal, is generally not equal to the angle of incidence θ_1. The angle of refraction depends on the ratio of the speeds of the waves in the two media, as well as on the angle of incidence. It is related to the index of refraction of the original medium, that of the second medium, and the angle of incidence by

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

CH 23



where

n_1 = index of refraction, medium 1

n_2 = index of refraction, medium 2

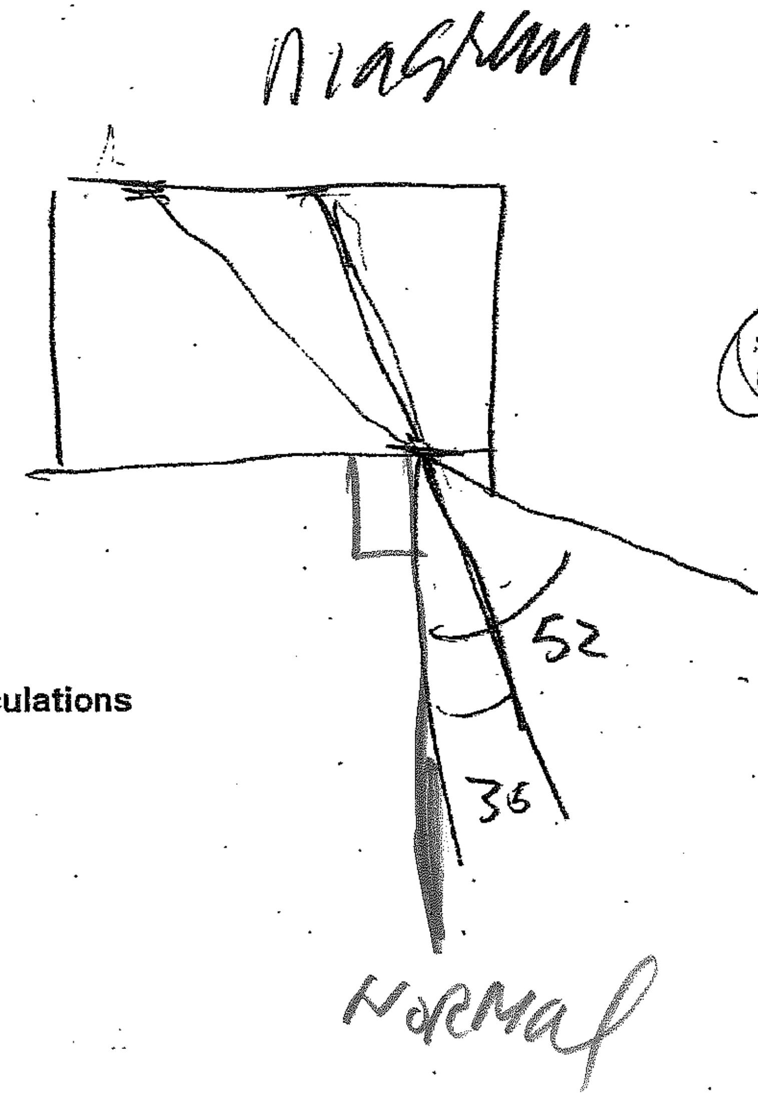
$$n_1 = \frac{n_2 \sin\theta_2}{\sin\theta_1}$$

EXERCISES

Because of refraction, a submerged object appears to be nearer to the surface than it actually is (Figure 2). In the exercises, you will take advantage of this effect to measure the angle of refraction of light passing from water into air.

You are already familiar with the reflection of visible light from the surfaces of polished metal, sunglasses, glass, etc. Microwaves also reflect from surfaces, and as you will see, they also refract when passing from one medium into another. But since microwaves have a much longer wavelength than visible light, they don't behave identically to visible electromagnetic radiation. You will become aware of the differences between the two types of radiation as you measure the refraction due to materials that are transparent to microwaves, but block visible light.

Draw diagram



Show Calculations

← convert radians

DATA SHEET

	$\Delta\theta inst$ = LC/2 [redacted] FILL IN	
θi	θ_{ai} a θ_{bi} b c d	LC = 0.25 degree convert to RADIANS SMALLEST DIVISION
	Average θi = $\frac{\theta_1+\theta_2+\theta_3+\theta_4}{4}$	
	$\Delta\theta inst$ =	
	(θmax - θmin)/4 =	
	$\Delta\theta$ = (the larger of the previous two.)	
θf	θ_{af} a θ_{bf} b c d	Find n_w 4 times from each of 4 pairs of θ_i and θ_f
	Average θf =	
	$\Delta\theta inst$ = LC/2 (RADIANS)	
	(θmax - θmin)/4 =	
	$\Delta\theta$ = (the larger of the previous two.)	
n_w	n_{best} = n_w	Example:
	Overall error in n_{best} =	$n_{w_a} = \frac{(1) \sin\theta_{af}}{\sin\theta_{ai}}$
	Compare $\lvert n_{best} - n_w \rvert$ with the overall error, which gives the range, as discussed in class. Does the accepted value fall within the range centered at the average value?	

Repeat for b, c, d PAIRS.