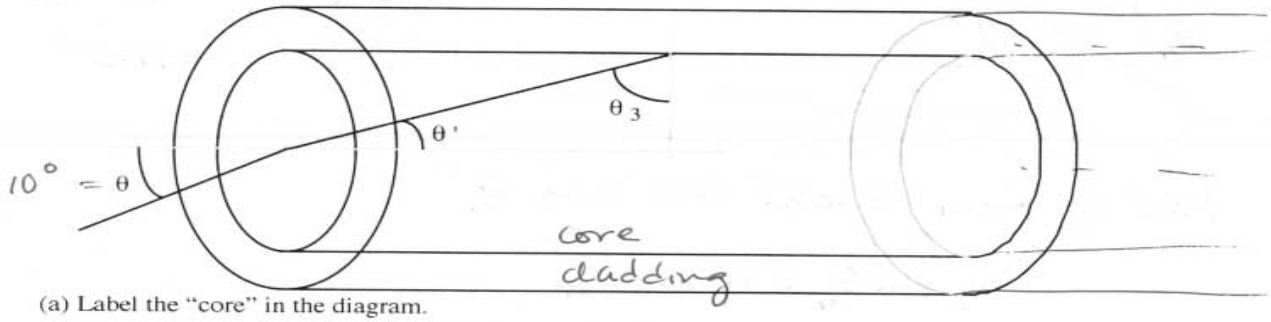
SPSP 320 Name _____ Table _____

Date _____ Others present _____

Fiber Optics 1 -- Intro

1. For the fiber shown below, the core index n1 = 1.46, the cladding index n_2 = 1.40, and the fiber is surrounded by air of index n_0 = 1. Recall: Snell's Law: $n_1 \sin\theta_1 = n_2 \sin\theta_2$



(a) Label the "core" in the diagram.

(b) Label the "cladding" in the diagram.

(c) The incoming ray shown makes an angle θ = 10.0° with the axis of the fiber as it enters the fiber. Calculate the angle θ ' it makes with the axis inside the fiber.

$n_0 \sin\theta = n_1 \sin\theta'$

$1 \sin 10^\circ = 1.46 \sin\theta'$

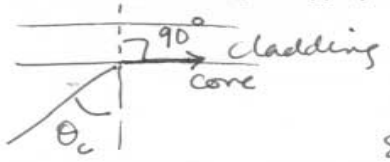
$\sin\theta' = \frac{\sin 10^\circ}{1.46} = 0.1189 \rightarrow \theta' = 6.83^\circ$

(d) Calculate the angle θ_3 it makes with the vertical.

$\theta_3 + \theta' = 90^\circ$

$\theta_3 = 90 - 6.83 = 83.2^\circ$

(e) Is θ_3 **larger** or **smaller** than the critical angle for total internal reflection? (Circle one)
Explain your choice by showing the appropriate calculation.



$n_1 \sin\theta_c = n_2 \sin 90^\circ$

$\sin\theta_c = \frac{n_2}{n_1} = \frac{1.40}{1.46} = 0.9589$

$\theta_c = 73.5^\circ$

(f) **Sketch** the possible path(s) of the ray as it continues through the fiber.

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