TEST # 3. PHYS 204. SPRING 2003. 05/08/03

NAME:

1. **Refraction of Light** (20 points).

The observer in the figure is positioned so that the far edge of the bottom of the empty glass is just visible. When the glass is filled to the top with water, the center of the bottom of the glass is just visible to the observer. Find the height, H, of the glass, given that its width is $W = 6.2$cm. $[n_{water} = 1.33]$.

2a. Diffraction from a single slit. (8 points)

Monochromatic light from a distance source is incident on a slit 0.8 mm wide. On a screen 3 m away, the distance from the central maximum of the diffraction pattern to the first minimum is measured to be 1.25 mm. Calculate the wavelength of the light.

2b. Diffraction and interference. (14 points)

An interference pattern is produced by monochromatic light incident on two identical parallel slits of width a and separation (between centers) $d = 3a$. Which interference maxima m_i will be missing in the pattern.

2c. (6 points) If the two-slit experiment were done with white light, what would be seen?

3. Relativity.

A spacecraft of length 100m (as measured by a person on the spacecraft) travels away from earth with speed $0.7c$ relative to the earth.

3a. (12 points) Calculate the length of the spacecraft as observed by a person in the earth.

3b. (12 points) If a person in the spacecraft measures a time interval of 8s, calculate the measurement of the time interval for the observer in earth.

4. Relativity.

4a. (7 points) Describe some of the everyday consequences that would follow if the if the speed of light were 10 m/s instead of its actual value.

4b. (7 points) Some distant galaxies are moving away from us at speeds greater than $0.5c$. What is the speed of the light received on Earth from these galaxies? Explain.

4c. (7 points) How would velocities add if the speed of light were infinitely large?

4d. (7 points) Two events occur at the same space point in a particular frame of reference and are simultaneous in that frame. Is it possible that they may not be simultaneous in another frame? Explain.