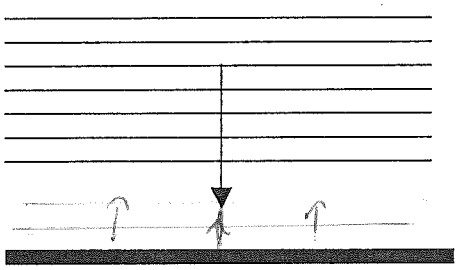
Phys 11/11H: Reflection, Diffraction, and Refraction Practice (test prep)

For questions 1 through 12, ***sketch*** the wave front and ray (direction of motion of the wave) a few moments later. In the diagrams shown, a thick solid line represents a solid barrier and a dashed line represents the boundary between two different mediums. For each diagram:

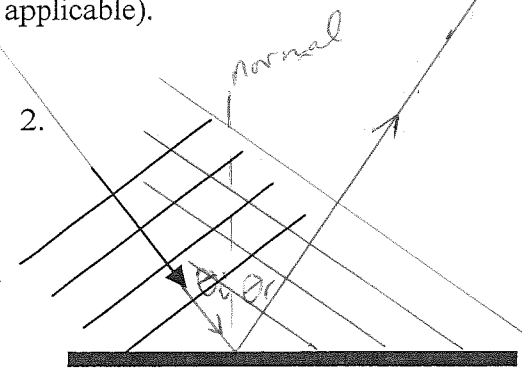
i. Sketch the **wave front** and **ray** (direction of motion of the wave) a few moments later.
ii. In each case indicate whether the situation represents *reflection, refraction, or diffraction.*
iii. Where applicable, label the angles of incidence and reflection or refraction, and state their measured values in degrees (for the cases of refraction, estimate angles for your diagram, but state the actual measurement of the angle that you chose). In cases where these measures are not applicable, write "N/A" (= not applicable).

1.



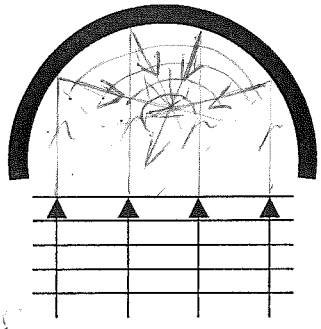
reflection/refraction/diffraction? _____
angle of incidence 0°
angle of reflection 0°

2.



reflection/refraction/diffraction? _____
angle of incidence 36°
angle of reflection 36°

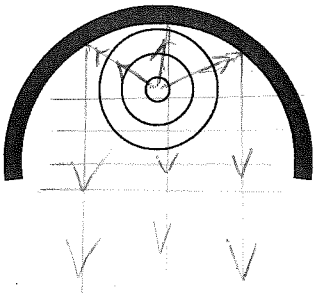
3.



reflected wave is circular

reflection/refraction/diffraction? _____
angle of incidence _____
angle of reflection many - wide range of angles

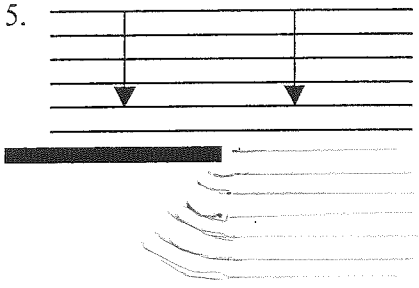
4.



reflected wave is ≈ straight

reflection/refraction/diffraction? _____
angle of incidence _____
angle of reflection wide range of angles

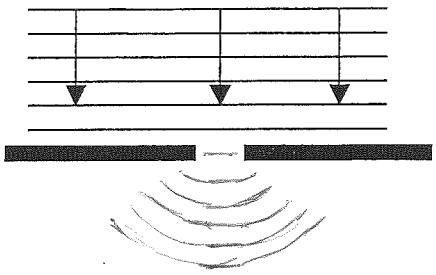
5.



diffracted straight

reflection/refraction/diffraction? _____
angle of incidence NA
angle of reflection _____

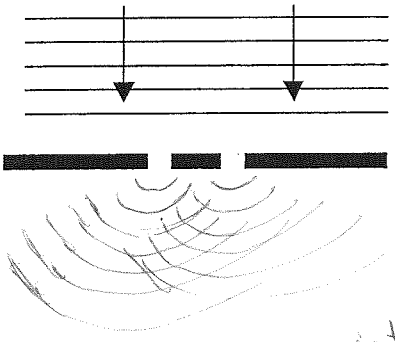
6.



strongly curved diffraction pattern due to narrow gap

reflection/refraction/diffraction? _____
angle of incidence NA
angle of reflection _____

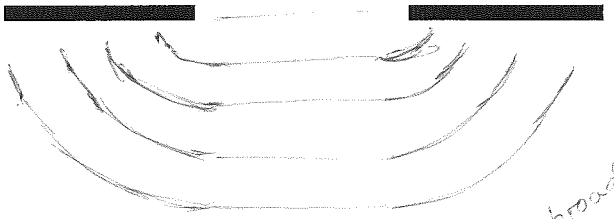
7.



interference pattern

reflection/refraction/diffraction? _____
angle of incidence NA
angle of reflection _____

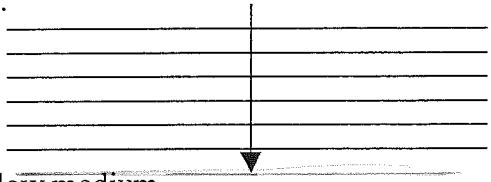
8.



broader diffraction pattern than 5/6 due to longer λ

reflection/refraction/diffraction? _____
angle of incidence NA
angle of reflection _____

9.



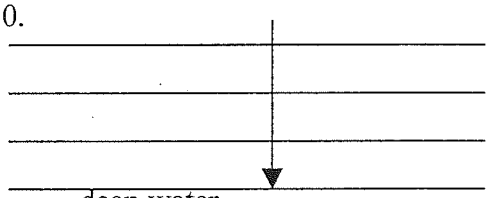
slow medium

fast medium

longer λ due to increased v

reflection/refraction/diffraction? _____
angle of incidence 0° 0°
angle of reflection _____
refracted

10.



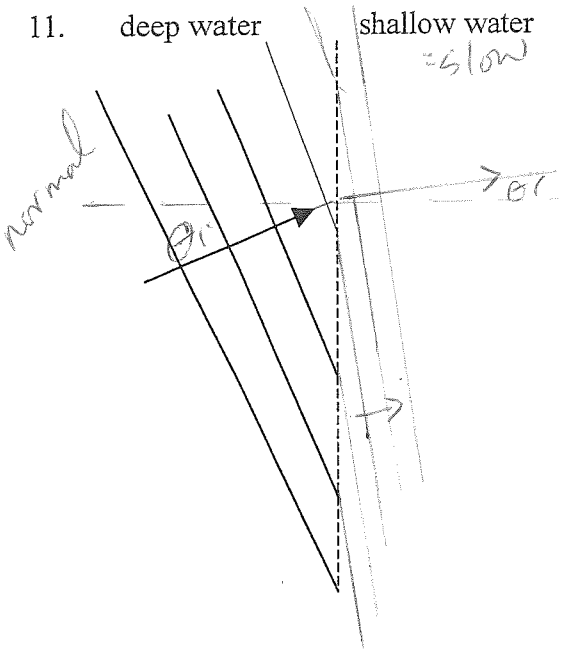
deep water

shallow water

reduced λ due to reduced v

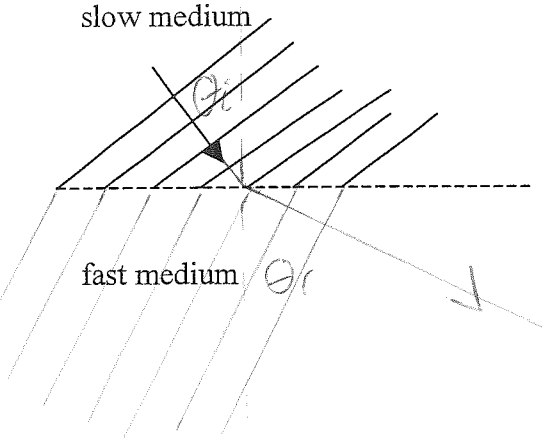
reflection/refraction/diffraction? _____
angle of incidence 0°
angle of reflection 0°

11. deep water shallow water



reflection/refraction/diffraction? _____
angle of incidence _____
angle of reflection _____

12.



reflection/refraction/diffraction? _____
angle of incidence _____
angle of reflection _____

SOLVE Problems 13 and 14 (show all steps and calculate)

13. Water waves of wavelength 0.56 m and frequency 0.85 Hz pass to a region of a different depth. In the new depth, the wavelength changes to 1.2 m. (a) What is the speed of the waves in the first medium? (b) What is the speed in the second medium?

A $\lambda_A = 0.56\text{m}$
$f = 0.85\text{Hz}$
B $\lambda_B = 1.2\text{m}$

(a) $v_A = f\lambda_A = (0.85\text{Hz})(0.56\text{m}) = \boxed{0.48\text{m/s}}$

(b) $v_B = f\lambda_B = (0.85\text{Hz})(1.2\text{m}) = \boxed{1.0\text{m/s}}$

14. Sound waves of frequency 656 Hz travel at 345 m/s in air. They then pass in to a region with hot air and the speed increases to 365 m/s. What is the wavelength of the sound in the second medium?

$f = 656\text{Hz}$
$v_A = 345\text{m/s}$
$v_B = 365\text{m/s}$

$\lambda_B = \frac{v_B}{f} = \frac{365\text{m/s}}{656\text{Hz}} = \boxed{0.556\text{m}}$

SOLVE problem 15(a) with logic, calculate 15(b) and solve 15(c) by drawing a scale diagram (use a ruler and protractor)

15. Water waves in the deep end of a ripple tank are measured to have a speed 3.0 cm/s and a wavelength of 1.5 cm.

a. When the waves pass into shallower water their wavelength changes. Which of the following wavelengths is possible?

i. 1.0 cm ii. 2.0 cm iii. 3.0 cm

b. Using the wavelength you determined in part (a), calculate the speed of the waves in the shallow water part of the ripple tank.

$f = \frac{v_{deep}}{\lambda_{deep}}$ $v_{shallow} = f\lambda_{shall.}$ $\left[\frac{v_{deep}}{\lambda_{deep}}\right]\lambda_{shallow} = \left[\frac{3.0\,cm/s}{1.5\,cm}\right](1.0\,cm) = 2.0\,cm/s$

c. Draw a scale diagram to show the motion of the waves if they hit the transition plane from deep water to shallow at an angle of incidence of 40.0°.