AP Physics 2 – Reflection and Refraction

1) Complete the following table:

Medium	Speed of Light in Medium	Index of refraction	Wavelength of a 570 nm light wave in this medium
Water	2.25×10^8 m/s		
Glass	1.97×10^8 m/s		
Ethyl Alcohol	2.20×10^8 m/s		
Diamond	1.24×10^8 m/s		

2) A beam of laser light, wavelength 678.8 nm in air, is incident on a block of diamond at an angle of 29.7^o. Find the angle of refraction.

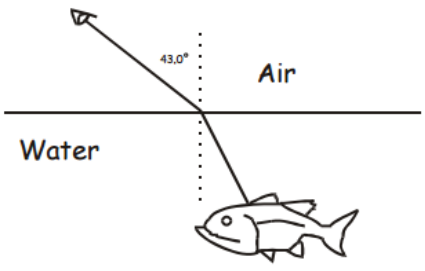
3) A beam of light, wavelength 625 nm in air, is refracted on a block of glass at an angle of 31.5^o. Find the angle of incidence.

4) A 589 nm beam of light is incident on the surface of some clean ice at an angle of 40.0^o with the normal. Part of light is reflected and part is refracted. Find the angle between the reflected and refracted light.

5) A beam of light with a wavelength of 575 nm while traveling in air is incident on a slab of material. The angle of incidence is 28.0^o. The refracted beam makes an angle of 20.4^o. Find the index of refraction for the slab.

6) Calculate the critical angle for light in (a) water, (b) glass, and (c) diamond. Assume that air is on the other side of the materials and use the values from the table above.

7) A beam of light reflects off of a fish that is under the surface of a lake. The ray is refracted at the surface and is seen by a person in a boat. The angle of refraction is 43.0^o.

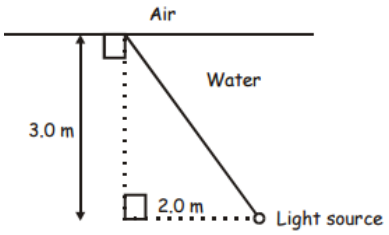


a) Find the angle of incidence made by the ray.

b) If the fish is 2.20 m below the surface, what is its apparent depth?

c) If the fish rises straight up, at what depth will it no longer be visible to the person in the boat?

8) A beam of light from a light source on the bottom of a swimming pool 3.0 m deep strikes the surface of the water 2.0 m to the left of the light source as shown.

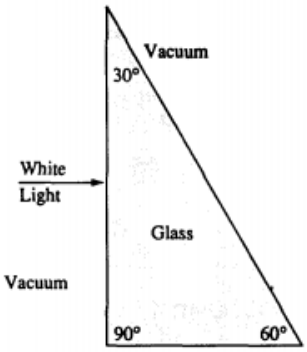


a) Find the angle of reflection made by the ray

b) Find the angle made by the emerging ray with the normal to the surface

9) The glass prism has an index of refraction that depends on the wavelength of the light that enters it. The index of refraction is 1.50 for red light of wavelength 700 nm in vacuum and 1.60 for blue light of wavelength 480 nm in vacuum. A beam of white light is incident from the left, perpendicular to the first surface, as shown in the figure, and is dispersed by the prism into its spectral components.

	Wavelength in Vacuum	Index of Refraction of Glass
Red Light	700 nm	1.5
Blue Light	480 nm	1.6



a. Determine the speed of the blue light in the glass.

b. Determine the wavelength of the red light in the glass.

c. Determine the frequency of the red light in the glass.

d. What is the angle of refraction for the blue and red light incident on the front surface?

e. Calculate the angle of refraction for the blue and red light incident on the far surface.

f. On the figure above, sketch the approximate paths of both these rays as they pass through the glass and back out into the vacuum. Ignore any reflected light. Clearly show the change in direction of the rays, if any, at each surface and be sure to distinguish carefully any differences between the paths of the red and the blue beams.