

16. First, we note that – *relative to the water* – the index of refraction of the carbon tetrachloride should be thought of as  $n = 1.46/1.33 = 1.1$  (this notation is chosen to be consistent with problem 15). Now, if the observer were in the water, directly above the 40 mm deep carbon tetrachloride layer, then the apparent depth of the penny as measured below the surface of the carbon tetrachloride is  $d_a = 40 \text{ mm}/1.1 = 36.4 \text{ mm}$ . This “apparent penny” serves as an “object” for the rays propagating upward through the 20 mm layer of water, where this “object” should be thought of as being  $20 \text{ mm} + 36.4 \text{ mm} = 56.4 \text{ mm}$  from the top surface. Using the result of problem 15 again, we find the perceived location of the penny, for a person at the normal viewing position above the water, to be  $56.4 \text{ mm}/1.33 = 42 \text{ mm}$  below the water surface.