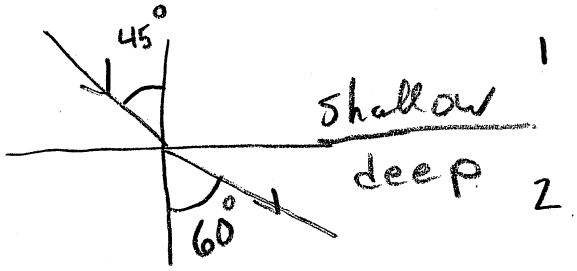
(1)



(a) $\frac{\sin\theta_1}{\sin\theta_2} = \frac{v_1}{v_2}$

$\frac{\sin 45}{\sin 60} = \frac{v_1}{v_1}$

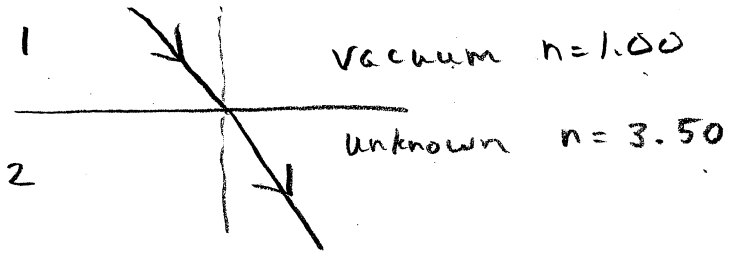
$\frac{v_1}{v_2} = .82$

(b) $\frac{v_1}{v_2} = .82$

$\frac{v_1}{0.25} = .82$

$v_1 = 0.20\ m/s.$

(2)

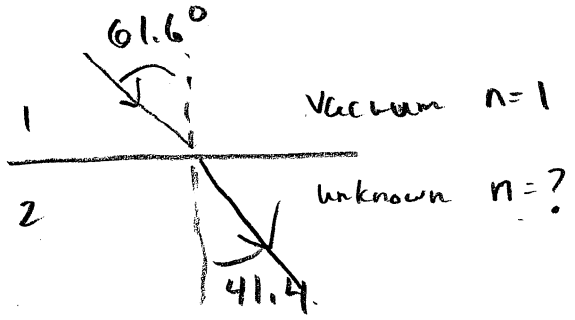


$\frac{n_2}{n_1} = \frac{v_1}{v_2}$

$\frac{3.50}{1.00} = \frac{3\times10^8\ m/s.}{v_2}$

$v_2 = \frac{1\ (3\times10^8)}{3.50} = 8.57\times10^7\ m/s$

(3)

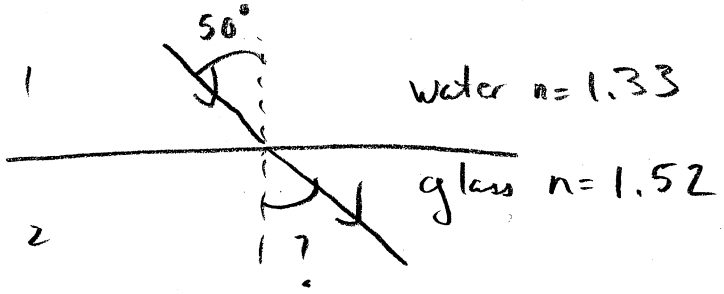


$$\frac{n_2}{n_1} = \frac{\sin\theta_1}{\sin\theta_2}$$

$$\frac{n_2}{1} = \frac{\sin 61.6}{\sin 41.4}$$

$$n_2 = 1.33$$

(4)



$$\frac{n_2}{n_1} = \frac{\sin\theta_1}{\sin\theta_2}$$

$$\frac{1.52}{1.33} = \frac{\sin 50}{\sin\theta_2}$$

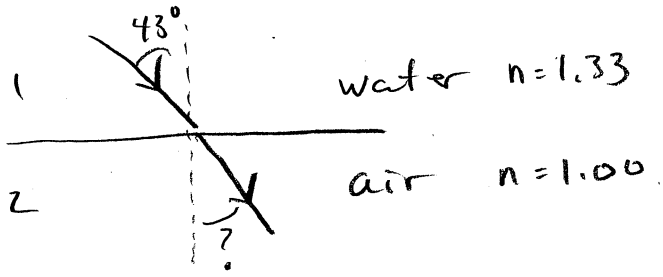
$$\sin\theta_2 = \frac{1.33 \sin 50}{1.52}$$

$$\sin\theta_2 = 0.6703$$

$$\theta_2 = \sin^{-1}(0.6703)$$

$$\theta_2 = 42.1^\circ$$

(5)



$$\frac{n_2}{n_1} = \frac{\sin\theta_1}{\sin\theta_2}$$

$$\frac{1.00}{1.33} = \frac{\sin 43}{\sin\theta_2}$$

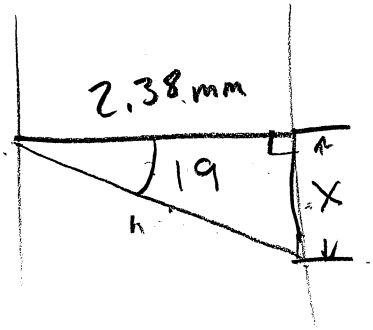
$$\sin\theta_2 = \frac{1.33 \sin 43}{1.00}$$

$$\sin\theta_2 = .9071$$

$$\theta_2 = \sin^{-1}(.9071)$$

$$\theta_2 = 65.1$$

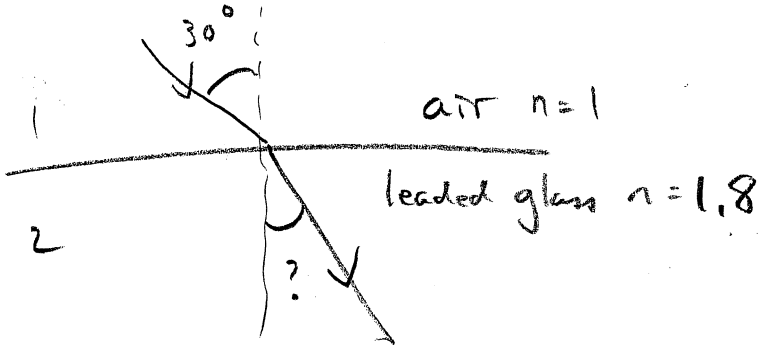
(6)



(a) $\tan 19 = \dfrac{X}{2.38\text{ mm}}$

$X = .82\text{ mm}$

(b)



$$\frac{n_2}{n_1} = \frac{\sin\theta_1}{\sin\theta_2}$$

$$\frac{1.8}{1} = \frac{\sin 30}{\sin\theta_2}$$

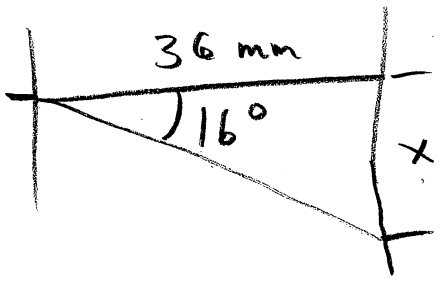
$$\sin\theta_2 = \frac{1 \sin 30}{1.8}$$

$$\sin\theta_2 = .2778$$

$$\theta_2 = \sin^{-1}(.2778)$$

$$\theta_2 = 16°$$

6 b cont'd

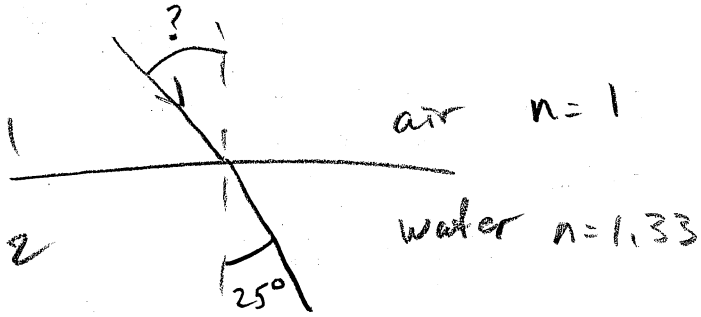


$$\tan 16 = \frac{x}{36}$$

$$x = 36 \tan 16$$

$$x = 10.3 \text{ mm}.$$

(7) (a)



$$\frac{n_2}{n_1} = \frac{\sin\theta_1}{\sin\theta_2}$$

$$\frac{1.33}{1} = \frac{\sin\theta_1}{\sin 25}$$

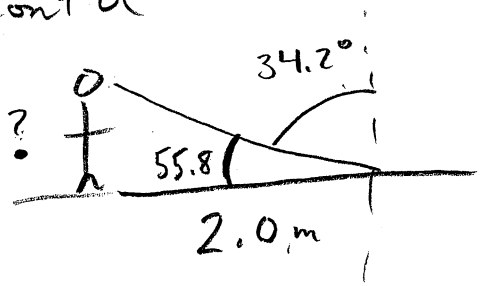
$$\sin\theta_1 = 1.33 \sin 25$$

$$= 0.5621$$

$$\theta_1 = \sin^{-1}(.5621)$$

$$= 34.2^\circ$$

7a cont'd

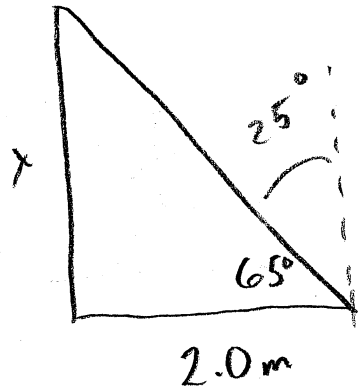


$\tan 55.8 = \frac{?}{2.0\text{m}}$

$? = 2.0 \tan 55.8$

height = 2.94 m

(b)

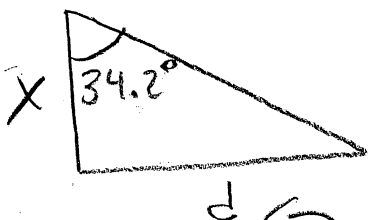


$\tan 65 = \frac{x}{2}$

$x = 2 \tan 65$

$x = 4.29\text{ m}$

(c)

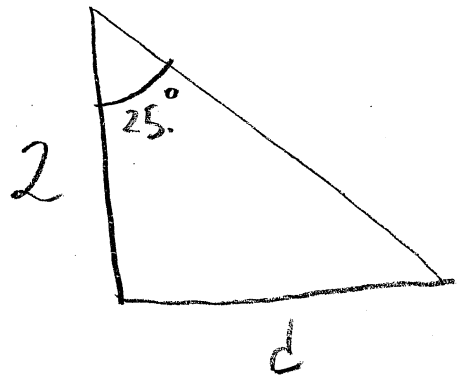


$\tan 34.2 = \frac{d}{x}$

$x = \frac{d}{\tan 34.2}$

$= \frac{0.9326}{\tan 34.2}$

$x = 1.37\text{ m}$



$\tan 25 = \frac{d}{2}$

$d = 2 \tan 25$

$d = 0.9326$