Index of Refraction & Snell's Law Questions

Wednesday, April 25, 2018 10:00 AM

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(1) a) 2.26×10^8 m/s
b) 1.24×10^8 m/s
c) 1.99×10^8 m/s

(2) a) 1.43
b) 2.00

(3) $2.73 \times 10^8 \frac{m}{s}$

(4) $18.5°$
b) $10.1°$
c) $16.3°$

(5)

	$\theta_r = 15°$	$\theta_r = 25°$
a)	MORE	LESS
b)	1.76	1.08
c)	$2.26 \times 10^8 \frac{m}{s}$	$2.26 \times 10^8 \frac{m}{s}$
	$1.70 \times 10^8 \frac{m}{s}$	$2.79 \times 10^8 \frac{m}{s}$

(6) $v = 1.75 \times 10^8 \frac{m}{s}$

$n = 1.71$

PAGE (2) What the Refraction are you Talking About?

1) $n_1 \sin\theta_1 = n_2 \sin\theta_2$

$1 \cdot \sin 45.0° = n_2 \sin 35.0°$

$n_2 = \frac{\sin 45}{\sin 35} = 1.23$

(2) $n_1 \sin\theta_1 = n_2 \sin\theta_2$

$1.20 \sin 45° = 1 \cdot \sin\theta_2$

$\theta_2 = \sin^{-1}(1.20 \sin 45°)$

$= 58°$

(3) ASSUME IN AIR (OR VACUUM)

$\sin\theta_c = \frac{1}{n}$

$\theta_c = \sin^{-1}\left(\frac{1}{1.62}\right)$

$\theta_c = 38°$

(4) $v = \frac{c}{n}$

$= \frac{3.00 \times 10^8 \frac{m}{s}}{1.98}$

$= 1.52 \times 10^8 \frac{m}{s}$

$$\theta_c = 38^\circ$$

(5) $\sin\theta_c = \frac{1}{n}$ (IN AIR)

I $\therefore n_{GLASS} = \frac{1}{\sin 35.0^\circ} = 1.74$

II $\therefore n_{REL} = \frac{n_2}{n_1} = \frac{1.74}{1.33} = 1.31$

III $\sin\theta_c = \frac{1}{n_{REL}}$

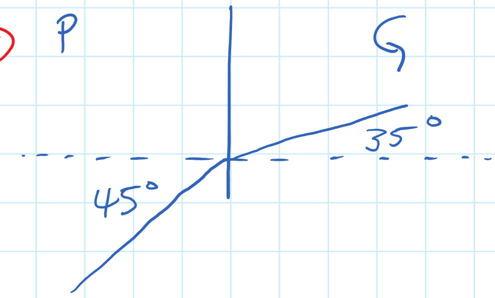
$$\theta_c = \sin^{-1}\left(\frac{1}{1.31}\right)$$

$$\theta_c = 49.7^\circ$$

$$= 1.52 \times 10^8 \ \frac{m}{s}$$

(6) I $n_p = \frac{3 \times 10^8}{2.20 \times 10^8} = 1.3636$

II



$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

$$1.36 \sin 45^\circ = n_G \sin 35^\circ$$

$$n_G = 1.6811$$

III $n_p \sin\theta_p = n_G \sin\theta_G$

$$\therefore \theta_G = \sin^{-1}\left(\frac{n_p \sin\theta_p}{n_G}\right)$$

$$= \sin^{-1}\left(\frac{1.3636 \sin 30.0^\circ}{1.6811}\right)$$

$$\theta_G = 23.9^\circ$$