p. 449 # 1-6; p. 458 # 1, 7, 7, 10

1. $\theta_1 = 65°$ DO NOT DO!

2. $n_1 = 1.0003$
$\theta_1 = 47.5°$
$\theta_2 = 34.0°$
$n_2 = ?$

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

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

$= \dfrac{(1.0003)(\sin 47.5°)}{(\sin 34.0°)}$

$= 1.31 \rightarrow$ ice.

3. $n_2 = ?$
$n_1 = 1.0003$
$\theta_1 = 35°$
$\theta_2 = 25°$

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

$= \dfrac{(1.0003)(\sin 35°)}{\sin 25°}$

$= 1.36$

4. $V_d = ?$
$\theta_1 = 30°$
$\theta_2 = 12°$
$V_a = 3.0 \times 10^8 m/s$

$n_a = \dfrac{c}{V_a} = 1$

$n_a \sin\theta_1 = n_d \sin\theta_2$

$n_d = \dfrac{n_a \sin\theta_1}{\sin\theta_2}$

$n_d = \dfrac{(1)\sin 30°}{\sin 12}$

$n_d = 2.4$

$n_d = \dfrac{c}{V_d} \Rightarrow V_d = \dfrac{c}{n_d} = \dfrac{3.0 \times 10^8 m/s}{2.4} = 1.2 \times 10^8 m/s.$

p. 449 # 1-6; p. 458 # 1, 7, 9, 10

5. $\lambda_q = ?$
$\lambda_v = 5.6 \times 10^{-7}\ m$
$n_q = 1.46$

$$n_q = \frac{\lambda_v}{\lambda_q} \Rightarrow \lambda_q = \frac{\lambda_v}{n_q}$$

$$\lambda_q = \frac{5.6 \times 10^{-7}\ m}{1.46}$$

$$= 3.8 \times 10^{-7}\ m$$

6. $f_g = ?$
$\lambda = 450\ nm$
$= 450 \times 10^{-9}\ m$
$n = 1.45$

$$n = \frac{c}{v} \Rightarrow v = \frac{c}{n}$$

$$v = f\lambda \Rightarrow f = \frac{v}{\lambda}$$

$$f = \frac{c}{n\lambda} = \frac{3.0 \times 10^{8}\ m/s}{(1.45)(450 \times 10^{-9}\ m)}$$

$$f = 4.6 \times 10^{14}\ Hz$$

p. 458 # 1 When light is refracted, it enters the medium at angle. It is "bent" because part of the wave is slowing while the other is travelling at the same speed.

7. $n_1 = 1.33$
$n_2 = 1.0003$
$\theta_1 = 50.0°$
$\theta_2 = ?$

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

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

$$\sin\theta_2 = \frac{(1.33)(\sin 50.0°)}{1.0003}$$

$$\theta_2 =$$

p. 449 # 1-6 , p. 458 # 1, 7, 9, 10

9. $n_a = 1.0003$
$n_m = 1.30$
$\theta_m = 45°$
a) $\theta_a = ?$

$n_a \sin\theta_a = n_m \sin\theta_m$

$\sin\theta_a = \dfrac{n_m \sin\theta_m}{n_a}$

$\sin\theta_a = \dfrac{(1.30)(\sin 45°)}{1.0003}$

$\theta_a = 67°$

b) For critical angle, $\theta_2 = 90°$

$1 \sin\theta_1 = \dfrac{n_2 \sin\theta_2}{n_1}$

$\sin\theta_1 = \dfrac{(1.30)(\sin 90°)}{1.0003}$

$\theta_1 = 1.30°$

10. $n_1 = 1.33$
$n_2 = 1.63$
$\theta_1 = 30.0°$

a) $\sin\theta_2 = \dfrac{n_1 \sin\theta_1}{n_2}$

$\sin\theta_2 = \dfrac{(1.33)\sin 30.0°}{1.63}$

$\theta_2 = 23.5°$

b) No, because travelling from faster to slower, the ray will bend towards the normal.