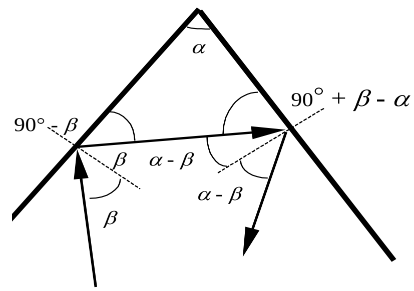
1. (c).
2. (b).
3. (d).
4. The angle of reflection will $\boxed{\text{never}}$ be smaller than the angle of incidence. $\boxed{\text{They are always equal}}$, according to the law of reflection.
7. Since $\theta_i = \theta_r$, the angle between the beams is $35° + 35° = \boxed{70°}$.
8. $\theta_i = \theta_r = 32°$ from the normal. So the angle between the surface and the beam is $90° - \theta_r = \boxed{58°}$.

$\boxed{10}$. (a) If the angle of incidence is β, the angle of reflection is also β.

So the angle formed by the left mirror and the reflecting light off the left mirror is $90° - \beta$.
Then the angle between the right mirror and the light incident on the right mirror is $180° - [(90° - \beta) + \alpha] = 90° + \beta - \alpha$.
Therefore the angle of incidence on the right mirror is $90° - [90° + \beta - \alpha] = \alpha - \beta$. The angle of reflection off the right mirror is also $\alpha - \beta$, so the answer is $\boxed{(4)\ \alpha - \beta}$.

(b) For $\alpha = 60°$ and $\beta = 40°$, the angle of reflection off the right mirror is $\alpha - \beta = 60° - 40° = \boxed{20°}$.



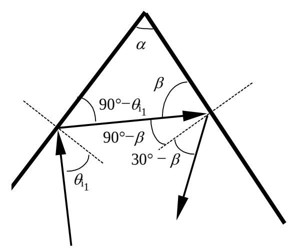
$\boxed{14}$. According to the law of reflection,

$\beta = 180° - [\alpha + (90° - \theta_{i_1})] = 90° - \alpha + \theta_{i_1}$.

So the angle of reflection from the second mirror is $\theta_{r_2} = 90° - \beta = \alpha - \theta_{i_1}$.

(a) $\theta_{r_2} = 70° - 35° = \boxed{35°}$.

(b) $\theta_{r_2} = 115° - 60° = \boxed{55°}$.



16. (b), because $n_1 \sin\theta_1 = n_2 \sin\theta_2$. When $n_1 > n_2$, $\theta_1 < \theta_2$, so the refracted ray is bent away from the normal.
17. (d).
18. Both (a) and (c) must be satisfied.
19. It is because $\boxed{\text{light speed depends on medium}}$. For example, light speed is different in air than in water. Due to the speed difference, light changes direction when entering a different medium at an angle of incidence that is not zero.
20. $\boxed{\text{Yes}}$, wavelength changes. $\boxed{\text{No}}$, frequency does not change. $\boxed{\text{Yes}}$, speed changes since $v = \lambda f$.
24. $n = \dfrac{c}{v} = \dfrac{3.00 \times 10^8 \text{ m/s}}{2.13 \times 10^8 \text{ m/s}} = \boxed{1.41}$.
30. $\theta_c = \sin^{-1}\dfrac{n_2}{n_1}$, ☞ $n_1 = \dfrac{n_2}{\sin\theta_c} = \dfrac{1}{\sin 41.8°} = \boxed{1.50}$.
31. $n_1 \sin\theta_1 = n_2 \sin\theta_2$, ☞ $\sin\theta_1 = \dfrac{n_2 \sin\theta_2}{n_1} = \dfrac{(1.46)\sin 30°}{1} = 0.73$. So $\theta_1 = 47°$.

    Therefore the angle of reflection is also $\boxed{47°}$, according to the law of reflection.
33. The frequency does not change and is still $\boxed{6.5 \times 10^{14}\text{ Hz}}$.

    $\lambda = \dfrac{\upsilon}{f} = \dfrac{c}{fn} = \dfrac{3.00 \times 10^8 \text{ m/s}}{(6.5 \times 10^{14}\text{ Hz})(1.66)} = \boxed{2.8 \times 10^{-7}\text{ m}}$.
38. Use the result of Exercise 37b. $d' = \dfrac{d}{n} = \dfrac{3.2 \text{ m}}{1.33} = \boxed{2.4 \text{ m}}$.

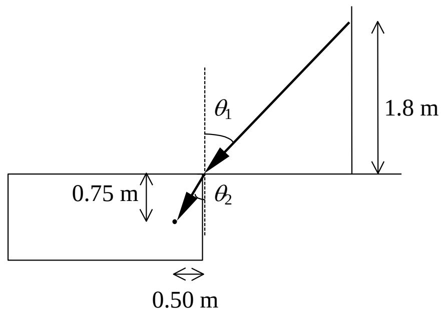
43. $\theta_c = \sin^{-1}\frac{n_2}{n_1} = \sin^{-1}\frac{1}{1.33} = 49°$. The 50° angle will be totally reflected, and the 40° angle will refract through.

Therefore light is $\boxed{\text{seen for 40° but not for 50°}}$.

48. Use the result of Exercise 37b. $d' = \frac{d}{n} = \frac{2.5\text{ cm}}{1.52} = \boxed{1.6\text{ cm}}$.

49. $n_1 \sin\theta_1 = n_2 \sin\theta_2$, ☞ $n_2 = \frac{n_1 \sin\theta_1}{\sin\theta_2} = \frac{(1.33)\sin 45°}{\sin 35°} = \boxed{1.64}$.

53. $\theta_2 = \tan^{-1}\frac{0.50\text{ m}}{0.75\text{ m}} = \tan^{-1} 0.667 = 33.7°$.



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

so $\sin\theta_1 = \frac{n_2 \sin\theta_2}{n_1} = \frac{(1.33)\sin 33.7°}{1} = 0.738$.

Therefore $\theta_1 = 47.5°$.

Thus $d = (1.8\text{ m})\tan\theta_1 = (1.8\text{ m})\tan 47.5° = \boxed{2.0\text{ m}}$.

56. (d).

57. (b).

58. (b).

$\boxed{64}$. (a) $\boxed{\text{Blue}}$ will experience more refraction, because its index of refraction differs more than for red, compared with the index of refraction of air. According to Snell's law, blue will have a smaller angle of refraction or deviates more from the angle of incidence.

65. $n_1 \sin\theta_1 = n_R \sin\theta_R = n_B \sin\theta_B$, ☞ $\sin\theta_R = \frac{n_1 \sin\theta_1}{n_R} = \frac{(1)\sin 30°}{1.4925} = 0.33501$.

So $\theta_R = 19.573°$. $\Delta\theta = \theta_R - \theta_B$, ☞ $\theta_B = \theta_R - \Delta\theta = 19.573° - (0.00131\text{ rad}) \times \frac{180°}{\pi\text{ rad}} = 19.498°$.

Therefore $n_B = \frac{(1)\sin 30°}{\sin 18.498°} = \boxed{1.498}$.

66. We calculate the critical angle for both colors.

$\theta_{cR} = \sin^{-1}\frac{1}{n_R} = \sin^{-1}\frac{1}{1.515} = 41.30°$, and $\theta_{cB} = \sin^{-1}\frac{1}{1.523} = 41.04°$.

Because the angle of incidence is 41.15°, $\boxed{\text{only red}}$ will be refracted out into the air. Blue is internally reflected.

$\boxed{71}$. (a) $\theta_c = \sin^{-1}\frac{n_2}{n_1}$, where $n_2 = 1$ (air). Red light will have a smaller index of refraction, because its critical angle is greater. Also because $v = \frac{c}{n}$, red light will have a higher speed of light than blue light. For the same time interval red light will travel $\boxed{\text{(1) more than}}$ 1.000 m.

(b) $n_R = \frac{1}{\sin(\theta_c)_R} = \frac{1}{\sin 41.11°} = 1.521$. $n_B = \frac{1}{\sin(\theta_c)_B} = \frac{1}{\sin 41.04°} = 1.523$.

$\Delta d = \Delta v t = (v_R - v_B)t = v_B t\left(\frac{v_R}{v_B} - 1\right) = v_B t\left(\frac{n_B}{n_A} - 1\right)$.

Since $v_B t = 1.000$ m, $\Delta d = \left(\frac{1.523}{1.521} - 1\right)(1.000\text{ m}) = 0.0013\text{ m} = \boxed{1.3\text{ mm}}$.