39. The elastic and bulk moduli are taken from Table 9-1 in chapter 9. The densities are taken from Table 10-1 in chapter 10.

(*a*) For water: $v=\sqrt{B/\rho}=\sqrt{\dfrac{2.0\times10^{9}\ \text{N/m}^2}{1.00\times10^{3}\ \text{kg/m}^3}}=\boxed{1.4\times10^{3}\ \text{m/s}}$

(*b*) For granite: $v=\sqrt{E/\rho}=\sqrt{\dfrac{45\times10^{9}\ \text{N/m}^2}{2.7\times10^{3}\ \text{kg/m}^3}}=\boxed{4.1\times10^{3}\ \text{m/s}}$

(*c*) For steel: $v=\sqrt{E/\rho}=\sqrt{\dfrac{200\times10^{9}\ \text{N/m}^2}{7.8\times10^{3}\ \text{kg/m}^3}}=\boxed{5.1\times10^{3}\ \text{m/s}}$

41. To find the time for a pulse to travel from one end of the cord to the other, the velocity of the pulse on the cord must be known. For a cord under tension, we have $v=\sqrt{\dfrac{F_T}{m/L}}$.

$$v=\frac{\Delta x}{\Delta t}=\sqrt{\frac{F_T}{m/L}}\ \rightarrow\ \Delta t=\frac{\Delta x}{\sqrt{\dfrac{F_T}{m/L}}}=\frac{28\ \text{m}}{\sqrt{\dfrac{150\ \text{N}}{(0.65\ \text{kg})/(28\ \text{m})}}}=\boxed{0.35\ \text{s}}$$

47. (*a*) Assuming spherically symmetric waves, the intensity will be inversely proportional to the square of the distance from the source. Thus Ir^2 will be constant.

$$I_{\text{near}}r_{\text{near}}^2=I_{\text{far}}r_{\text{far}}^2\ \rightarrow$$

$$I_{\text{near}}=I_{\text{far}}\frac{r_{\text{far}}^2}{r_{\text{near}}^2}=\left(2.0\times10^{6}\ \text{W/m}^2\right)\frac{(48\ \text{km})^2}{(1\ \text{km})^2}=4.608\times10^{9}\ \text{W/m}^2\approx\boxed{4.6\times10^{9}\ \text{W/m}^2}$$

(*b*) The power passing through an area is the intensity times the area.

$$P=IA=\left(4.608\times10^{9}\ \text{W/m}^2\right)\left(5.0\,\text{m}^2\right)=\boxed{2.3\times10^{10}\,\text{W}}$$

53. The fundamental frequency of the full string is given by $f_{\text{unfingered}}=\dfrac{v}{2L}=294\ \text{Hz}$. If the length is reduced to 2/3 of its current value, and the velocity of waves on the string is not changed, then the new frequency will be

$$f_{\text{fingered}}=\frac{v}{2\left(\frac{2}{3}L\right)}=\frac{3}{2}\frac{v}{2L}=\left(\frac{3}{2}\right)f_{\text{unfingered}}=\left(\frac{3}{2}\right)294\ \text{Hz}=\boxed{441\ \text{Hz}}$$

56. Since $f_n=nf_1$, two successive overtones differ by the fundamental frequency, as shown below.

$$\Delta f=f_{n+1}-f_n=(n+1)f_1-nf_1=f_1=350\ \text{Hz}-280\ \text{Hz}=\boxed{70\ \text{Hz}}$$

58. From Equation (11-19b), $f_n=\dfrac{nv}{2L}$, we see that the frequency is proportional to the wave speed on the stretched string. From equation (11-13), $v=\sqrt{\dfrac{F_T}{m/L}}$, we see that the wave speed is proportional to the square root of the tension. Thus the frequency is proportional to the square root of the tension.

$$\sqrt{\frac{F_{T2}}{F_{T1}}} = \frac{f_2}{f_1} \rightarrow F_{T2} = \left(\frac{f_2}{f_1}\right)^2 F_{T1} = \left(\frac{200 \text{ Hz}}{205 \text{ Hz}}\right)^2 F_{T1} = 0.952\, F_{T1}$$

Thus the tension should be $\boxed{\text{decreased by } 4.8\%}$.

63. The angle of refraction can be found from the law of refraction, Equation (11-20).

$$\frac{\sin\theta_2}{\sin\theta_1} = \frac{v_2}{v_1} \rightarrow \sin\theta_2 = \sin\theta_1 \frac{v_2}{v_1} = \sin 34^\circ \frac{2.1 \text{ m/s}}{2.8 \text{ m/s}} = 0.419 \rightarrow \theta_2 = \sin^{-1} 0.419 = \boxed{25^\circ}$$

64. The angle of refraction can be found from the law of refraction, Equation (11-20). The relative velocities can be found from the relationship given in the problem.

$$\frac{\sin\theta_2}{\sin\theta_1} = \frac{v_2}{v_1} = \frac{331 + 0.60T_2}{331 + 0.60T_1} \rightarrow \sin\theta_2 = \sin 25^\circ \frac{331 + 0.60(-10)}{331 + 0.60(10)} = \sin 25^\circ \frac{325}{337} = 0.4076$$

$$\theta_2 = \sin^{-1} 0.4076 = \boxed{24^\circ}$$