32. Using $v = f\lambda$ with $v = 331$ m/s (see Table 18-1) with Eq. 20-2 and Eq. 20-25 leads to

$$f = \frac{v}{\left(\frac{1}{\sqrt{2}\,\pi\, d^2 (N/V)}\right)} = (331\,\mathrm{m/s})\pi\sqrt{2}\left(3.0\times 10^{-10}\,\mathrm{m}\right)^2\left(\frac{nN_\mathrm{A}}{V}\right) = \left(8.0\times 10^7\,\frac{\mathrm{m}^3}{\mathrm{s\cdot mol}}\right)\left(\frac{n}{V}\right)$$

Using the ideal gas law, we substitute $n/V = p/RT$ into the above expression and find

$$f = \left(8.0\times 10^7\,\frac{\mathrm{m}^3}{\mathrm{s\cdot mol}}\right)\left(\frac{1.01\times 10^5\,\mathrm{Pa}}{\left(8.31\,\frac{\mathrm{J}}{\mathrm{mol\cdot K}}\right)(273.15\,\mathrm{K})}\right) = 3.5\times 10^9\ \mathrm{Hz}\ .$$

If we instead use $v = 343$ m/s (the "default value" for speed of sound in air, used repeatedly in Ch. 18), then the answer is 3.7×10^9 Hz.