

Question #51487, Chemistry, Physical Chemistry

For $^{12}\text{C}^{16}\text{O}$, the fundamental frequency is 2143 cm^{-1} . Calculate the fundamental frequency of $^{14}\text{C}^{16}\text{O}$.

Answer:

the force constant k :

$$k = 4\pi^2 c^2 \omega_e^2 \mu$$

the reduced mass:

$$\mu = \frac{m_C m_O}{m_C + m_O}$$

$$k = 4 * 3.14^2 * (2.997 * 10^{10})^2 \text{cms}^{-1} * 2143^2 * 12 * 16 * 1.6605 * 10^{-24} / (12 + 16) = 1852333,55$$

$$\omega_e = (k / 4\pi^2 c^2 \mu_2)^{1/2}$$

$$\omega_e = (1852333.55 / (4 * 3.14^2 * (2.997 * 10^{10})^2 * 14 * 16 * 1.6605 * 10^{-24} / (14 + 16)))^{1/2} = 2053.6\text{ cm}^{-1}$$

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