

Spectroscopy

Exercises Chapter 3A

1. Classify each of the following molecules as spherical, symmetric, or asymmetric top.

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| a. CH ₄ | d. SF ₆ | g. cis-SF ₄ Br ₂ |
| b. CH ₃ F | e. SF ₅ Br | i. H ₂ S |
| c. CH ₃ D | f. trans-SF ₄ Br ₂ | h. HCN |

2. The moment of inertia for a linear triatomic molecule is given by

$$I = \frac{1}{M} (m_1 m_2 r_{12}^2 + m_1 m_3 r_{13}^2 + m_2 m_3 r_{23}^2)$$

The lowest frequency microwave transitions of ¹H¹²C¹⁴N and ²H¹²C¹⁴N occur at 88'631 MHz and 72'415 MHz, respectively (these are for the ground vibrational state). Calculate the bond distances in HCN.

3. A triatomic molecule has the formula A₂B. Its microwave spectrum shows a progression of strong lines at 15 MHz, 30 MHz, 45 MHz, 60 MHz,... and no other lines. Which of the following structures are compatible with this spectrum:

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| a. Linear AAB | b. linear ABA | c. bent AAB | d. bent ABA |
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