

THEORY OF INFRARED ABSORPTION

Adapted from *Infrared Spectroscopy* by C.-P. Sherman Hsu, Ph.D.
<http://www.prenhall.com/settle/chapters/ch15.pdf>

1. Read the sentences below and translate them into Polish.

- a. At temperatures above absolute zero, all the atoms in molecules are in continuous vibration with respect to each other.
- b. When the frequency of a specific vibration is equal to the frequency of the IR radiation directed on the molecule, the molecule absorbs the radiation.
- c. Each atom has three degrees of freedom, corresponding to motions along any of the three Cartesian coordinate axes (x , y , z).
- d. A polyatomic molecule of n atoms has $3n$ total degrees of freedom.
- e. However, 3 degrees of freedom are required to describe translation, the motion of the entire molecule through space.
- f. Additionally, 3 degrees of freedom correspond to rotation of the entire molecule.
- g. Therefore, the remaining $3n - 6$ degrees of freedom are fundamental vibrations for nonlinear molecules.
- h. Linear molecules possess $3n - 5$ fundamental vibrational modes because only 2 degrees of freedom are sufficient to describe rotation.

STUDENT A

2. Read the sentences again and translate the Polish expressions in brackets into English. Student B will check your translation. Then listen to student B and check their translation.

- a. At temperatures above absolute zero, all the atoms in molecules (są w ciągłym drganiu względem siebie).
- b. When **the frequency of a specific vibration is equal to** the frequency of the IR radiation directed on the molecule, the molecule **absorbs the radiation**.
- c. Each atom has three degrees of freedom, (odpowiadające ruchom wzdłuż) any of the three Cartesian (osi układu współrzędnych) (x, y, z).
- d. **A polyatomic molecule** of n atoms has $3n$ total degrees of freedom.
- e. However, 3 degrees of freedom are required to describe translation, (ruchu całej cząsteczki w przestrzeni).
- f. Additionally, 3 degrees of freedom **correspond to rotation of the entire molecule**.
- g. Therefore, the remaining $3n - 6$ degrees of freedom are fundamental (drganiami dla nieliniowych cząsteczek).
- h. **Linear molecules** possess $3n - 5$ fundamental vibrational modes because only 2 degrees of freedom **are sufficient to describe rotation**.

STUDENT B

2. Read the sentences again and translate the Polish expressions in brackets into English. Listen to student A and check their translation (in bold). Then student A will check your translation.

- a. At temperatures above absolute zero, all the atoms in molecules **are in continuous vibration with respect to each other.**
- b. When the (częstotliwość konkretnego drgania jest równa) to the frequency of the IR radiation directed on the molecule, the molecule absorbs the radiation.
- c. Each atom has three degrees of freedom, **corresponding to motions along** any of the three Cartesian **coordinate axes** (x, y, z).
- d. (Wieloatomowa cząsteczka) of n atoms has $3n$ total degrees of freedom.
- e. However, 3 degrees of freedom are required to describe translation, **the motion of the entire molecule through space.**
- f. Additionally, 3 degrees of freedom (odpowiadają rotacji całej cząsteczki).
- g. Therefore, the remaining $3n - 6$ degrees of freedom are fundamental **vibrations for nonlinear molecules.**
- h. (Cząsteczki liniowe) possess $3n - 5$ fundamental vibrational modes because only 2 degrees of freedom (są wystarczające do opisanie obrotów).