[TP] What is the relative height of the molecular ion peak in the mass spectrum of dichloromethane, CH_2Cl_2, with $m/z = 86$?

20% 1. 1/16
20% 2. 3/16
20% 3. 6/16
20% 4. 9/16
20% 5. Something else

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Response Counter 10 1

Lecture 7 CH101 A1 (MWF 9:05 am)

Wednesday, September 20, 2017

For today ...

- Example: Mass spectra of compounds with Br (or Cl)
- Complete: What is light
- Jiggling of bonded atoms

Next lecture: Wavelength, frequency, and wavenumber; Infrared (IR) spectra
http://quantum.bu.edu/CDF/101/IRFrequency.cdf ;

Memorize: Figs 3.19 (p75) and 3.24 (p 80)
Do not memorize: Table 3.5 (p 78)

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[TP] What is the relative height of the molecular ion peak in the mass spectrum of dichloromethane, CH_2Cl_2, with $m/z = 86$?

20% 1. 1/16
20% 2. 3/16
20% 3. 6/16
20% 4. 9/16
20% 5. Something else

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Molecular ions of dichloromethane, CH_2Cl_2

...^{35}Cl ¾ × ^{35}Cl ¾ = 9/16 at $m/z = 84$

...^{35}Cl ¾ × ^{37}Cl ¼ = 3/16 at $m/z = 86$

...^{37}Cl ¼ × ^{35}Cl ¾ = 3/16 at $m/z = 86$

...^{37}Cl ¼ × ^{37}Cl ¼ = 1/16 at $m/z = 88$

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What is light?

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What is light?

A "light wave" is a graph of how the strength and direction of tugging changes with time. This direction and strength is proportional to the electric field.

For this reason we say that "light is an oscillating electric field" that exerts rhythmic tugs on matter.

In the visible region of oscillations, the tugs are on electron clouds. Such tugging produces color that we see.

In the IR region of oscillations, the tugs are on the bonds between atoms. Such tugging is responsible for the warmth we feel.

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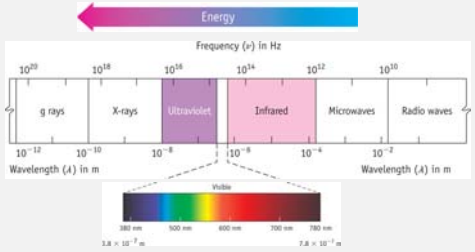
Electromagnetic spectrum



IR region is $\nu = 10^{12}$ — 4×10^{14}/s

Visible region is $\lambda = 780$ — 380 nm

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[Quiz] Which of the following statements is correct?

13% 1. The electric field of visible light changes direction at least 10^{14} times a second.
13% 2. The wavelength of UV light is less than 380 nm = 380×10^{-9} m.
13% 3. The wavelength of microwave light is longer than that of IR light.
13% 4. The wavelength of visible light is about the size of an atom, 8×10^{-8} cm.
13% 5. 1 and 2
13% 6. 2 and 3
13% 7. 1, 2, and 3
13% 8. 1, 2, 3, and 4

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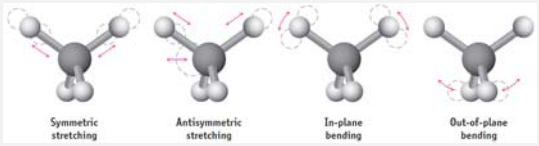
Jiggling can involve more than two bonded atoms

1. Atoms connected by covalent bonds behave like weights connected by springs
2. IR light causes bonded atoms to jiggle



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Jiggling of bonded atoms

Mass and bond strength

Lighter faster; stronger faster

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[TP] Which bonded atoms would jiggle slowest?

0% 1. C–S
0% 2. C=N
0% 3. C=O
0% 4. C–H

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Jiggling of bonded atoms

Relative mass

Effective mass less than either

The more dissimilar, motion mostly of lighter mass

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Jiggling of bonded atoms

Lighter faster; stronger faster; dissimilar approaches lighter

Interactive exploration

http://quantum.bu.edu/CDF/101/IRFrequency.cdf

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[TP] Which bonded atoms would jiggle fastest?

0% 1. C−S
0% 2. C=N
0% 3. C=O
0% 4. C−H

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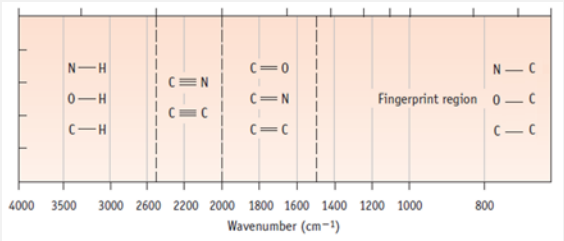
IR spectra detect function groups

Lighter faster; stronger faster; dissimilar approaches lighter



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