

Lecture 7 CH101 A1 (MWF 9 am) Fall 2016 Copyright © 2016 Dan Dill dan@bu.edu

[TP] Which bonded atoms would jiggle **slowest**?

25% 1. C–S
25% 2. C=N
25% 3. C=O
25% 4. C–H

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Response Counter 10 1

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Wednesday, September 21, 2016

For today ...

- What is light
- Jiggling of bonded atoms
- Wavelength, frequency, and wavenumber

Next lecture: Continue ch3: IR spectra
<http://quantum.bu.edu/CDF/101/IRFrequency.cdf> ;
Begin ch4: only sections 4.1, 4.3, and 4.4

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

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What is light?

"Light is synchronized oscillating electric and magnetic fields. These fields exert rhythmic tugs on charges in matter, and in this way are able to exchange energy with matter."
<https://piazza.com/class/iqi7h4rhcic3kk?cid=192>

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What is light?

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What is light?

A "light wave" 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.

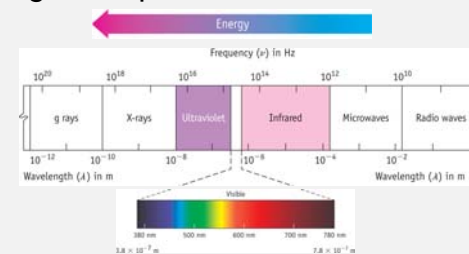


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Electromagnetic spectrum



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

Visible region is $\lambda = 780 - 380 \text{ nm}$



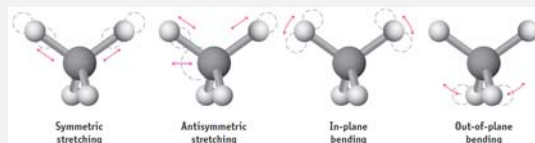
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Jiggling can involve more than two bonded atoms

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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25% 3. C=O
25% 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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[TP] Which bonded atoms would jiggle **fastest**?

25% 1. C-S
25% 2. C=N
25% 3. C=O
25% 4. C-H

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IR spectra detect function groups

Lighter faster; stronger faster; dissimilar approaches lighter

4000 3500 3000 2600 2200 2000 1800 1600 1400 1200 1000 800

Wavenumber (cm⁻¹)


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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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