 

[TP] When the color of light is changed from orange to green, ...

13% 1. its frequency is increased
13% 2. its frequency is decreased
13% 3. its wavelength is increased
13% 4. its wavelength is decreased
13% 5. 1 and 3
13% 6. 1 and 4
13% 7. 2 and 3
13% 8. 2 and 4

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# Lecture 6 CH101 A1 (MWF 9 am)

Monday, September 19, 2016

For today ...

- Review: Molecular mass spectra
- Mass spectra of compounds with Br (or Cl)
- Light, wavelength, frequency, and wavenumber

Next lecture: Continue: Light, wavelength, frequency, and wavenumber; IR spectra

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

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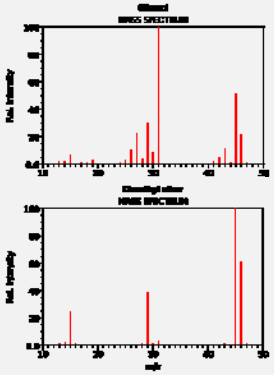
## Ethanol and dimethyl ether, $C_2H_6O^+$



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## Important isotopes (Table 3.4, p 68)

| Element | Isotope | Relative Abundance | Exact Mass | Isotope | Relative Abundance | Exact Mass |
|---|---|---|---|---|---|---|
| carbon | $^{12}C$ | 98.90% | 12.00000 | $^{13}C$ | 1.10% | 13.00335 |
| oxygen | $^{16}O$ | 99.76% | 15.99491 | $^{18}O$ | 0.20% | 17.99916 |
| nitrogen | $^{14}N$ | 99.63% | 14.00307 | $^{15}N$ | 0.37% | 15.00011 |
| hydrogen | $^{1}H$ | 99.99% | 1.00783 | $^{2}H$ | 0.01% | 2.01410 |
| chlorine | $^{35}Cl$ | 75.78% | 34.968852 | $^{37}Cl$ | 24.20% | 36.965902 |
| bromine | $^{79}Br$ | 50.69% | 78.918337 | $^{81}Br$ | 49.31% | 80.916291 |

C, O, N and H each have a one important isotope
F has one important isotope
Cl has two important isotopes: $^{35}Cl$ : $^{37}Cl$ :: 3:1
Br has two important isotopes: $^{79}Br$ : $^{81}Br$ :: 1:1

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Mass spectra of compounds with Br (or Cl)

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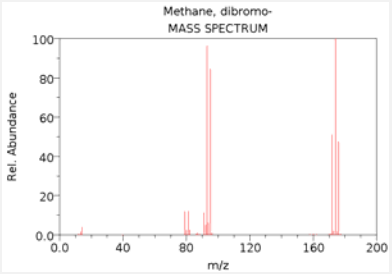
## $CH_2Br_2$ mass spectrum




What accounts for each of these singly-charged ion peaks?

Peaks at largest m/z always due to molecular ion, here $CH_2Br_2^+$

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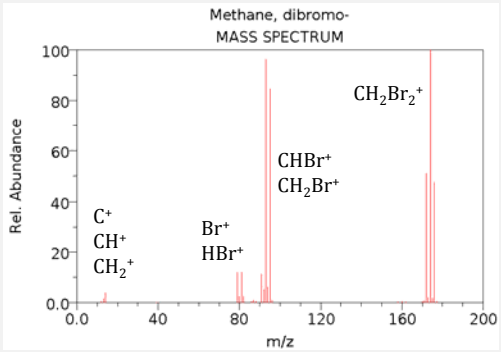
## $CH_2Br_2$ mass spectrum

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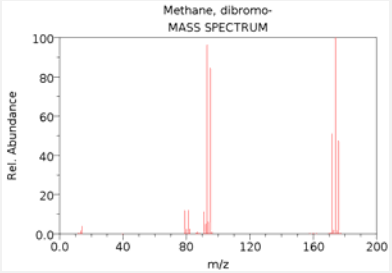
## $CH_2Br_2$ mass spectrum




| | $^{79}Br$ ½ | $^{81}Br$ ½ |
|---|---|---|
| $^{79}Br$ ½ | | |
| $^{81}Br$ ½ | | |

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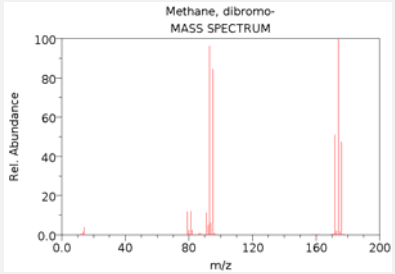
## $CH_2Br_2$ mass spectrum




| | $^{79}$Br ½ | $^{81}$Br ½ |
|---|---|---|
| $^{79}$Br ½ | ½ x ½ = ¼ | ½ x ½ = ¼ |
| $^{81}$Br ½ | ½ x ½ = ¼ | ½ x ½ = ¼ |

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[Quiz] Which of
$CH_4$, $CH_3Br$, and $CH_2Br_2$
has the greatest number of molecular ion peaks?

20% 1. $CH_4$
20% 2. $CH_3Br$
20% 3. $CH_2Br_2$
20% 4. $CH_3Br$ and $CH_2Br_2$
20% 5. They each have the same number of molecular ion peaks

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Wavelength, frequency, and wavenumber

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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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## 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/iqi7h4rchic3kk?cid=192

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