

Molecular Actions (particulate level)

Chapter 8

1st ionization energies of C, N, O, F

Chapter 8

ionization energy of Mg^{2+}

Chapter 9

C-H bond energy

Soph Organic

C-H stretch

R-O-H bend

hydrogen bond strength

kT: boiling water

kT: room temperature

kT: liquid nitrogen

Chapter 12

(kT: kinetic energy of matter at temperature T)

1H NMR at 500MHz

Radiation & Energy

Wavelength
(meters)

Energy
(kJ mol⁻¹)

γ -ray

8

7

X-ray

6

5

4

Vacuum UV

3

Near UV

2

Visible

1

IR

0

Far IR

-1

Microwave

-2

Microwave

-3

Radio (RF)

-4

10X (logarithmic scales)

Spectroscopy (observables at the macroscopic level)

excitation of electrons from inner shell orbitals to outer (unoccupied) orbitals or to the continuum

X-ray diffraction, scattering

excitation of outer shell electrons (highest occupied) from one orbital to another (lowest unoccupied).

Vibrational Spectroscopy
bond vibrations, bending modes

Rotational Spectroscopy
bond rotational modes

EPR

NMR, MRI