

# Infrared Spectroscopy (IR or Vibrational Spectroscopy) ①

deals with infrared region of electromagnetic spectrum. It is mostly based on absorption spectroscopy.

This technique can be used to identify and study chemicals. Sample may be solid, liquid or gaseous.

The infrared portion of the electromagnetic spectrum is usually divided into three regions; the near-, mid- and far-infrared, named for their relation to the visible spectrum.

⇒ The Higher-Energy near-IR ( $14000 - 4000 \text{ cm}^{-1}$ ) ( $0.8 - 2.5 \mu\text{m}$ )

⇒ The mid-Infrared ( $4000 - 400 \text{ cm}^{-1}$ ) ( $2.5 - 25 \mu\text{m}$ )

⇒ The Far-infrared ( $400 - 10 \text{ cm}^{-1}$ ) ( $25 - 1000 \mu\text{m}$ ), lying adjacent to the microwave region, has low energy and may be used for rotational spectroscopy.

⇒ Vibrational spectroscopy is based on periodic changes in dipole moment caused by molecular vibrations of molecules.

## Degrees of Freedom

is the number of variables required to describe the motion of a particle completely. For an atom moving in 3-dimensional space, three coordinates ( $x, y, z$ ) are adequate so its degree of freedom is three.

If molecule is made of  $N$  atoms, the degree of freedom becomes  $3N$ , because each atom has 3 degrees of freedom.

