

# Absorption spectroscopy



Absorption cross section

Beer-Lambert Law

# The absorption cross section, $\sigma_A$

The absorption cross section has units of area ( $\text{cm}^2$ ). It gives a probability for absorption. We have discussed the probability in terms of the transition dipole moment,  $M_{12}$  and shape in terms of the Franck-Condon factor, FC.

$$\sigma_A(\omega) \propto |M_{12}|^2 FC(\omega)$$

The absorption cross section is proportional to the well known extinction coefficient.

$$\epsilon(\omega) = \frac{\sigma_A(\omega) N_A}{1000}$$

The extinction coefficient has units of  $\text{M}^{-1}\text{cm}^{-1}$ .

# Beer-Lambert Law

$$I = I_0 10^{-A}$$

$$A(\nu) = \epsilon(\nu)cd$$

A is the absorbance.

$\epsilon(\nu)$  is the extinction coefficient.

The unit of  $\epsilon(\nu)$  is  $M^{-1}cm^{-1}$ .

C is the concentration (M).

d is the pathlength (cm).

The exponential attenuation of the intensity is shown in the Figure.

