For a diatomic molecule
$x = R - R_e$ where R is the distance to which atoms are stretched of R_e is the equilibrium distance between the two atoms.

On the basis of wave mechanics the vibrational energy (E_V) of a harmonic oscillator is given by

$$E_V = \left(v + \frac{1}{2}\right) h\nu$$

where v is the vibrational qn. no.

Teacher's Signature ....

$$E = h\nu = \frac{hc}{\lambda} = hc\bar{\nu} = hc\omega_e \qquad (\omega \rightarrow \text{Omega})$$

$\omega \rightarrow$ Omega

$$E = h\nu = \frac{hc}{\lambda} = hc\bar{\nu} = hc\omega_e$$

Experiment No. .... Page No. 4

Date : ....

~~with values 0, 1, 2, 3, ... $\bar{\nu}$ is the frequency of vibration of the oscillator. and putting~~

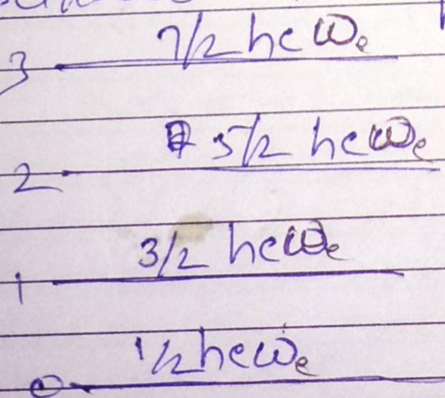
$\cancel{\nu = \frac{c}{\lambda}}$

Which may be zero or an integer of ω_e. ω_e is the equilibrium frequency of vibration of the oscillator

$$\left(\because \nu = \frac{c}{\lambda} = \cancel{c\omega_e} \quad \text{and} \quad \frac{1}{\lambda} = \bar{\nu}\right)$$

$$\therefore E_v = \left(v + \frac{1}{2}\right) hc\omega_e$$

On putting $v = 0, 1, 2, 3$ etc. in the above eqn, the vibrational energy levels of a harmonic oscillator are equally spaced



Teacher's Signature ....

Fig: Equally spaced vibrational energy of a simple ~~harmonic~~ oscillator

Experiment No. .... Page No. ....

Date : ....

5

When $v = 0$, the molecule would have vibrational energy ϵ_0 equal to $\frac{1}{2} h c \omega_e$. This ϵ_0 is called zero point energy.