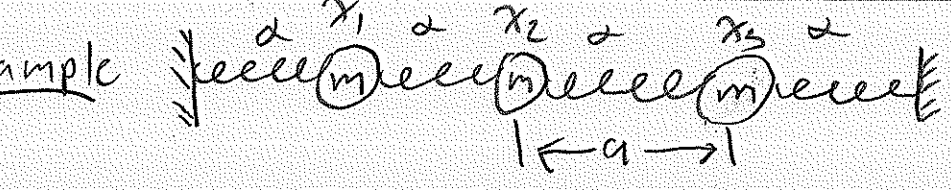
Example



(i) What k-values represent the 3-normal modes?

$\lambda_1 = 8a \Rightarrow k_1 = \pi/4a$

$\lambda_2 = 4a \Rightarrow k_2 = \pi/2a$

$\lambda_3 = \frac{2}{3}a \Rightarrow k_2 = 3\pi/4a$

(ii) What is the equation of $x_2(t)$ for

a. 1st normal mode, $k_1 = \pi/4a$

$x_n(t) = A \sin(kna) \sin \omega_n t$

$x_2(t) = A \sin\left(\frac{\pi}{4a}(2)a\right) \sin \omega_{n_1} t$

$= A \sin \omega_{n_1} t$

b. 2nd normal mode, $k_2 = \pi/2a$

$x_2(t) = A \sin\left(\left(\frac{\pi}{2a}\right)(2)a\right) \sin(\omega_{n_2} t)$

$= 0$

In 1D; n masses/atoms $\Rightarrow$ n normal modes

2D; n " $\Rightarrow$ 2n " "

3D; n " $\Rightarrow$ 3n " "

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