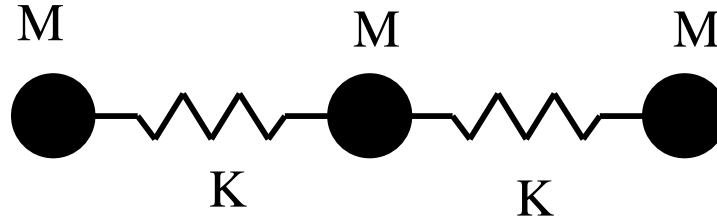


Triatomic Molecule

Consider a linear triatomic molecule made of three identical atoms. The molecule can be likened to a system made up of a central mass M connected by equal springs of spring constant K to two masses other masses M as shown in the picture.



- (a) Consider the motion of the atoms only along the line joining their centers. Call the displacement of the atom on the left x_1 , the one in the middle x_2 and the one on the right x_3 . Write down the equations of motion for the three masses.
- (b) We want to find the normal frequencies for the 3 normal modes of the molecule. To do so, assume only one normal mode is active, so that each mass moves sinusoidally: $x_1(t) = A\exp(i\omega t)$, $x_2(t) = B\exp(i\omega t)$, $x_3(t) = C\exp(i\omega t)$. Plug these expressions into the equations of motion and show that there are three solutions for ω^2 corresponding to the 3 normal frequencies:

$$\omega^2 = 0 \quad \omega^2 = K/M \quad \omega^2 = 3K/M$$

- (c) Describe the motion of the atoms in each normal mode.