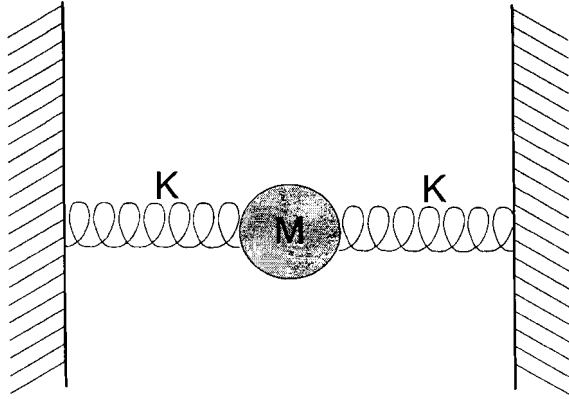


A particle of mass M is constrained to move horizontally along the x -axis. Initially it is attached to two identical massless springs, each with spring constant K as shown in the figure. Each spring is at its equilibrium length when the particle is at the center $x = 0$.



- (a) Write down the eigenvalues of the quantized states in terms of the parameters defined above, and state the allowed range of quantum numbers.
- (b) Give an explicit expression for the normalized ground state wave-function $\psi_0(x)$. Sketch the lowest three eigenstates of the system, $\psi_i(x)$, $i = 0, 1, 2$.
- (c) Consider the case where the system is initially in the ground state. If one spring is suddenly removed give the probability that the system will be in the ground state of the modified system immediately after one spring is removed.
- (d) For the situation in part (c) describe (i) the probability the system will be in the first excited state of the system immediately after one spring is removed, and (ii) the probability the system will be in any of the higher states $i = 2, 3, \dots$. It is sufficient to state your conclusions and briefly give your reasoning.