A particle of mass is subject to the one-dimensional harmonic oscillator potential. Write down the first three normalised eigenfunctions and the corresponding eigenvalues.

Initially the wavefunction is in a mixed state of the form

where. Let be written in terms of the normalised eigenfunctions of the harmonic oscillator

Calculate the coefficients. Hence determine the possible outcomes and associated probabilities of a measurement of the particle’s energy. What will the energy be after making a measurement?