Chem. 542
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Time-Dependent Perturbation Theory – Problem 1

Consider a harmonic oscillator of frequency ω in its ground state. At $t = 0$ a time-independent perturbation $\hat{H}_1(t) = \lambda \hat{x}$ is turned on. Using first order time-dependent perturbation theory, calculate as a function of time the probability for the system to make a transition to

a) the first excited state of the unperturbed harmonic oscillator,

b) the second excited state of the unperturbed harmonic oscillator.

Comment on the physical interpretation of your results.