

Chem 442: Homework for lecture L7

(only turn in **BOLD** assignment first lecture next week; do all assignments)

1. Turn in Go to the “QM demo” from lecture L4 online, and start the “1D quantum applet.” (As always, wait a minute after clicking the link, and hit “Run” when it asks you to run it.) Now solve the time-dependent Schrödinger equation using the program.

a. Select “Setup: harmonic oscillator,” and “Mouse: translate function.” Take the wavepacket centered at $x=0$, and move it to the left to start the molecule vibrating. Time how long it takes to do an oscillation. (You can time 10 oscillations and divide by 10 to get a more accurate answer). Now move the wavepacket more, so it vibrates with bigger amplitude (higher energy). Again determine the period of an oscillation. Is the period at higher energy smaller, the same, or larger than the period at lower energy?

b. Select “Setup: quartic oscillator,” and shift the wavepacket a little to start the motion. Is it as nicely behaved as the harmonic oscillator? The quartic oscillator potential is $V(x) \sim x^4$ instead of $V(x) \sim x^2$. That small difference causes quite a difference in the behavior of the time-dependent wave packet.