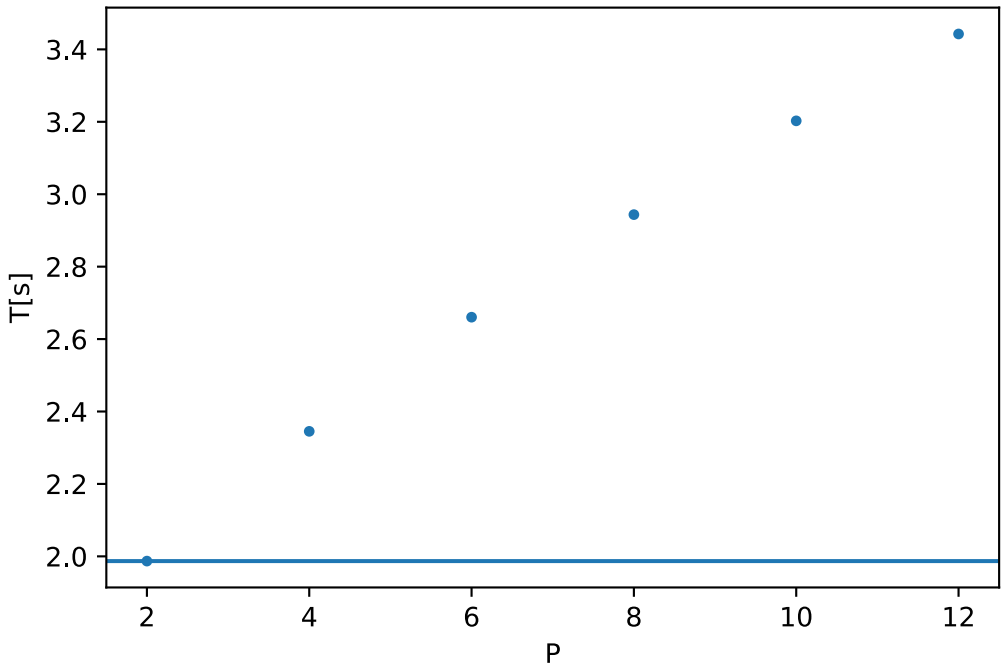
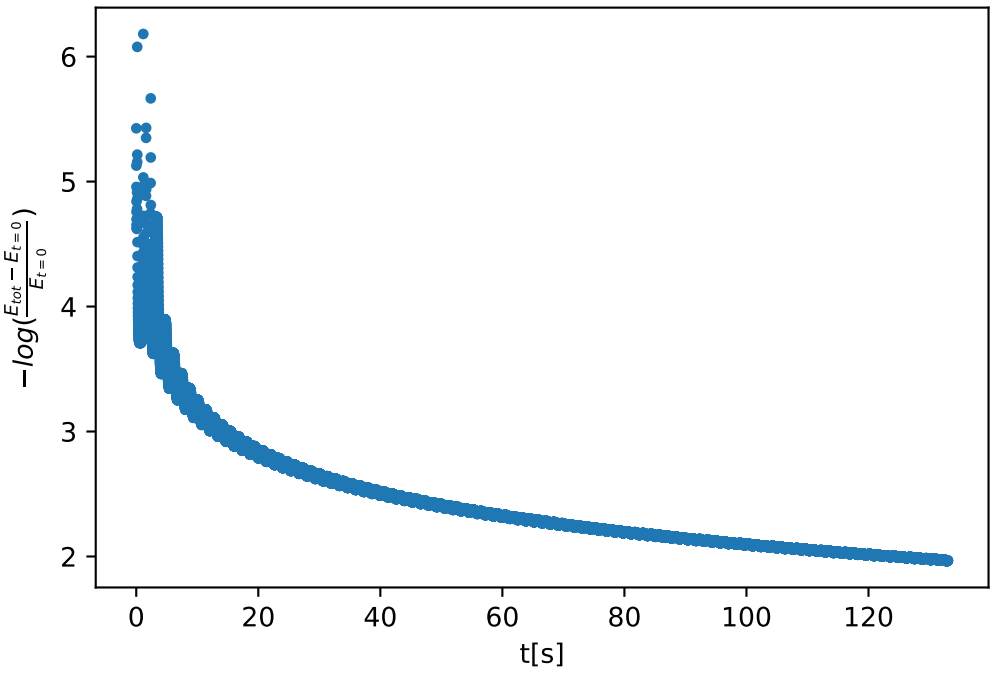
(2) To verify that the motion for a p-value of 6 was not harmonic, I plotted the period vs. the p-value for oscillators with the same initial amplitude, spring constants, and masses. I also calculated what the period of a harmonic oscillator should be, represented by the horizontal like. After P = 2, the periods do not agree with the harmonic period, indicating that the motion is non-harmonic.



(3) Looking at the plots of kinetic (KE), potential (PE), and total energy for different times (not included because they're really wide and difficult to see in this document), it appears the general relationship between KE, PE and total energy remain the same, though the shape changes slightly. In all of the plots, we see that the energy appears to remain constant, and that when KE is at a maximum, PE is at a minimum and vice versa. However, if you look at the shapes of the KE and PE functions, you see that as P increases, the functions "plateau" at their maximum values. I think this is a consequence of the non-oscillatory behavior. If you look at the velocity vs. time plot for the non-harmonic oscillators, it displays a similar 'plateau-ing' trend at it's maximum velocity values.

(4) I find at small t-values, that is when the oscillator first starts, the relative error is very small, causing a large -log value. However, t increases, the relative error increases, causing the -log function to decrease. This indicates that the simulation is not obeying energy conservation. If it was perfect, you would get a value of infinity for the log of the relative error for the duration of the oscillations. (-log(0/E(0)) = infinity)



(5) Using the viral theorem, I find:

P	$< KE >$	$\frac{p}{2} < PE >$	Relative error
2	2.50258648480839	2.5036274076762	0.000415938819349014
4	1.67008474182494	1.67416579730053	0.00244362179558059
6	1.25550067648216	1.25982679151001	0.00344572895012014
8	1.00782464065154	1.00957754317699	0.00173929318131851
10	0.842999252583128	0.842686815890981	0.000370625111694498
12	0.725492207448011	0.723641406580815	0.00255109682529378

Given the small relative error, I find my solution is consistent with the viral theorem.