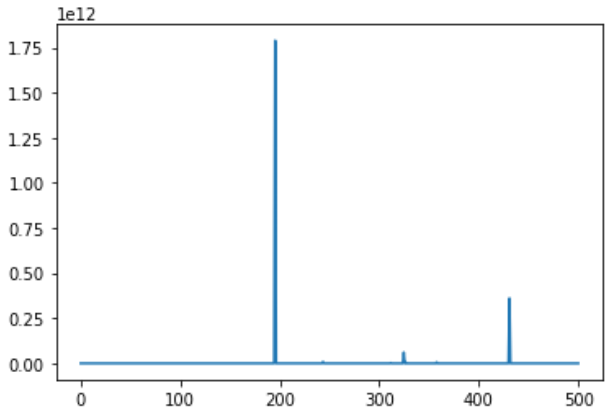
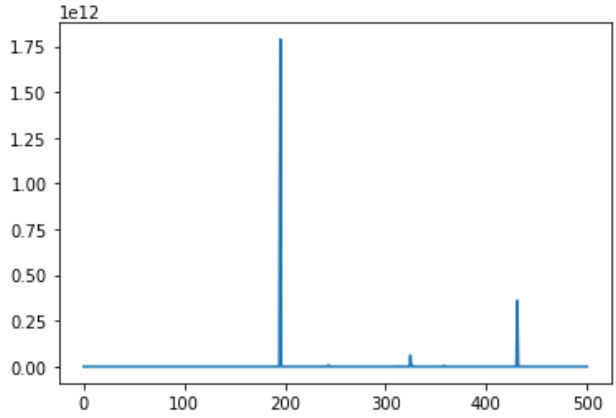
In my simulation I considered N = 30 particles inside a cubic box with edges having length L= 10.

I found the total energy not to be conserved by this method. The behaviour of the energy as a function of time depends on how big the timestep is. I plotted the total, potential and kinetic energy for three timesteps sizes respectively: 10e-2 (500 timesteps), 10e-3(1000 timesteps) , 10e-4 (500 timesteps).

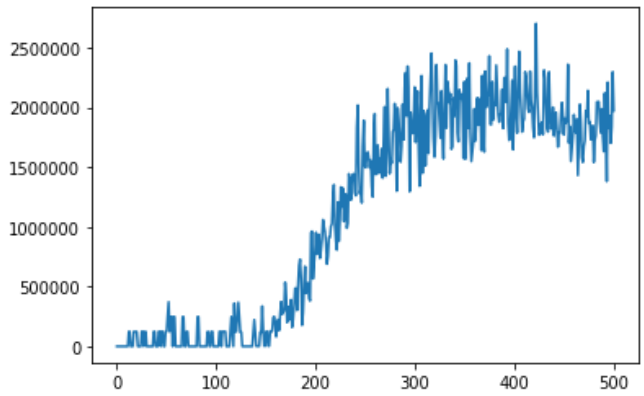
Total energy for dt = 10e-2



Potential energy for dt = 10e-2



Kinetic energy for dt = 10e-2

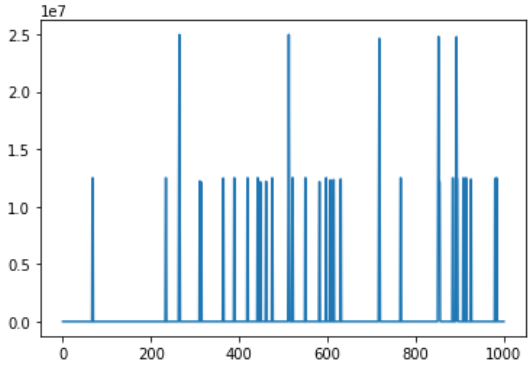


As it is possible to see the total energy is not conserved and its value is strongly peaked at some specific times. I believe that this happens because the following mechanism takes place. Since the timestep is relatively big (10e-2) the chance of two particles getting close to one another is higher than it would be for smaller timesteps. When two particles get very close the potential energy has a peak, and the total energy does as well, this is visible in the first two graphs above. Further, when two particles get close, they experience strong forces that lead to high velocities. When this happens, there are two possible outcomes. “Reabsorption”: The two fast particles get slower due to the pull of other particles. “Explosion”: If a particle is fast it has more chances of getting closer to other particles, and if it manages to do that, also the new particles involved will become very fast. This might cause an “explosion” effect that is visible in the shape of the kinetic energy at the time t=150.

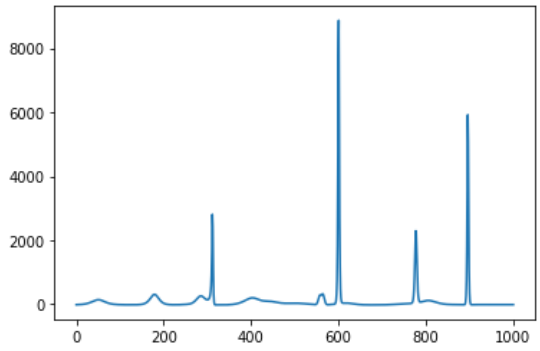
As the timestep becomes smaller the chances of the particles to get close to one another decrease, and so does the chance of having the “explosion” effect or even the peaks in energy. Respectively, in two other simulations with timesteps 10-e3(1000 timesteps) and 10-e4(500 timesteps), I found the explosion not to

take place (for the 10-e3 one) and not even the peaks to take place (for the 10-e4 one). The respective graphs are shown below:

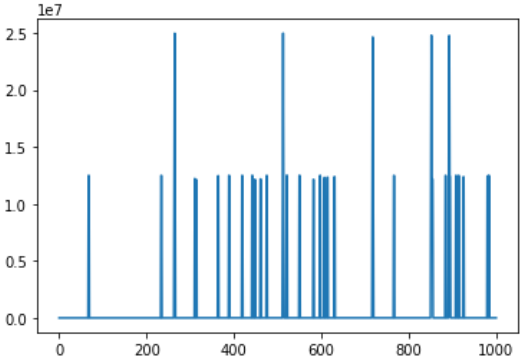
Total energy for dt = 10e-3



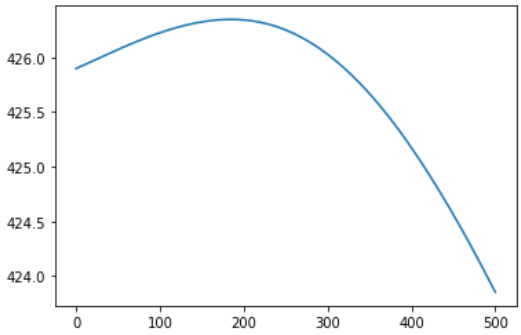
Potential energy for dt = 10e-3



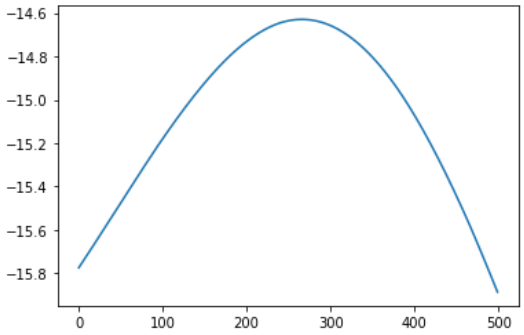
Kinetic energy for dt = 10e-3



Total energy for dt = 10e-4



Potential energy for dt = 10e-4



Kinetic energy for dt = 10e-4