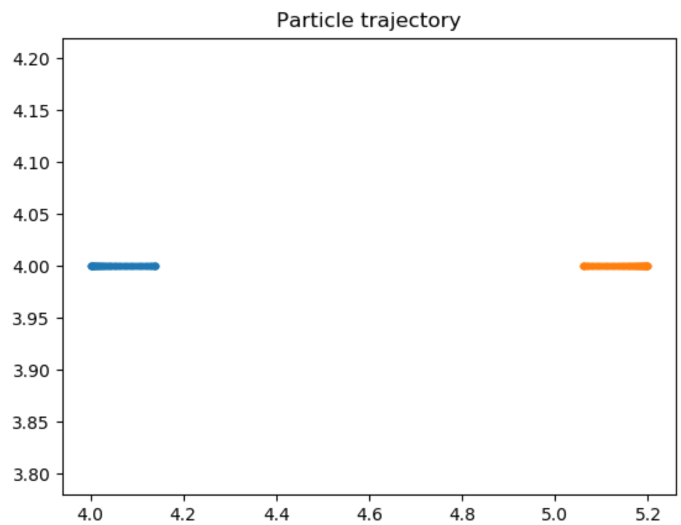
Question1:

b) The pseudo code for the program is shown below, and the actual implementation of the program is in lab7Q1Q3.py as *Question1(array, array)*.

```
def f(x, y):
   distance = (x ** difference between y position) + (y ** difference between y position)
   return 4 * ((1 / (distance ** 6)) - (1 / (distance ** 3))) / sqrt(distance)

def Question1():

   step = 0.01

   initialize arrays for holding particle 1 and 2's position data

   calculate the distance r between two particles

   calculate the inital initial position of particle 1 and 2 for the first iteration

   for x from 0 to 100:

      calculate the positions of the two particles with the inital velocity

      calculate the new relative distance between the particles

      calculate the k value for both x and y for particle 1

      calculate the k value for both x and y for particle 2

      particle 1's x and y velocity plus half of their corresponding k value

      particle 2's x and y velocity plus half of their corresponding k value

      particle 1's x and y velocity plus their corresponding k value

      particle 2's x and y velocity plus their corresponding k value

      store the particle positions into the array we initialized at the start of the program

   plot both particle's trajectory onto the graph.
```

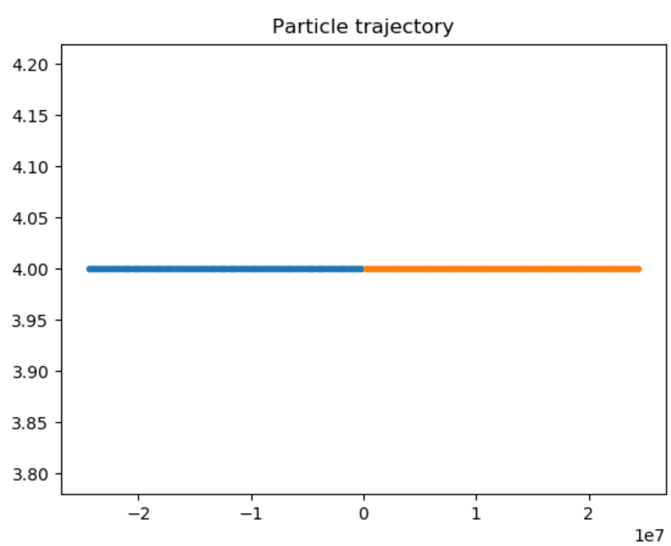
The graph generate by the code is shown below:

Graph generated with Initial condition 1



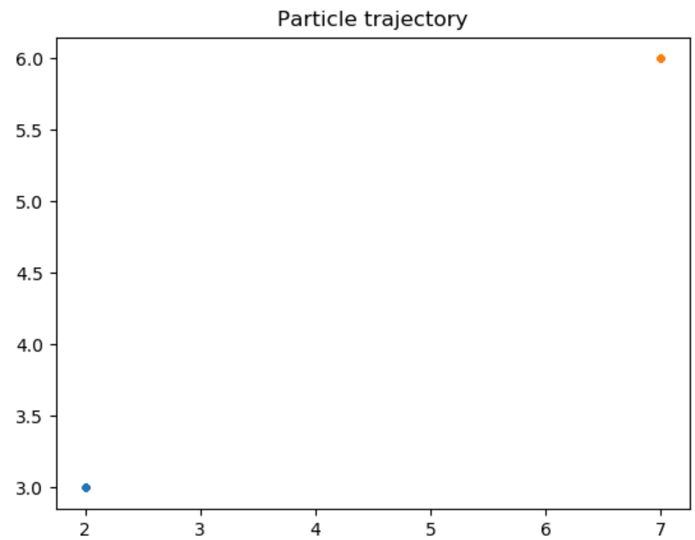
Note: The particle quickly speeds up and slows down when they are approximately 1 unit from each other. Therefore, graph shows two straight line closing on each other.

Graph generated with Initial condition 2



Note: For this graph, since the initial position of the particles are so close, they are catapulted away from each other. That is why the x-axis have such a huge value.

Graph generated with Initial condition 3



Note: Although in this graph, the particles seem stationery, but they are indeed moving, just very slow. If the program simulates with t from 0 to 10,000 it will show the movement of the two particles.

c) The first and third initial condition will lead to an oscillatory motion of the two particles. Since the energy is conserved in this equation, the repulsive force for the second equation will generate more energy than the energy produces by two particles approach each other from infinite distance. Therefore, the second initial condition will not produce an oscillatory motion.

Question3:

a) The implementation of the code is in lab7Q1Q3.py.

c) The graph for Concentration of chemicals is shown below.