1D Diffusion simulation

Time step for mass diffusion.

In [6]:
```
def time_step(D0, Dt, dt, D, dx):
    Dt[0] = (D0[0] + ((2*(dt)*(D)*((D0[1])-(D0[0])))/((dx)**2)))
    Dt[-1] = (D0[-1] + ((2*(dt)*(D)*((D0[-1])-(D0[-2])))/((dx)**2)))
    Dt[1:-1] = (D0[1:-1] +((dt)*(D)*((D0[2:])+(D0[0:-2])-(2*(D0[1:-1]))))/((dx
    return Dt

def stability(dt,D,dx):
    Von_neu = ((2*dt*D)/(dx**2))
    if Von_neu <= 1:
        print("Von_Neumann Stability Conditiion is satisfied")
        return 1
    else:
        print("Von_Neumann Stability Conditiion is not satisfied")
        return 0
```

Main code for system simulation for mass diffusion

In [ ]:
```
import numpy as np
import time
import matplotlib.pyplot as plt
from matplotlib.colors import LogNorm

nx = 10                         #Size of system [unit = A]
dx = 1                          #Pos Increment [unit = A]
D  = 0.260                      #Diffusion coefficient [unit = (A)^2/s]
Ci = 100                        #Concentration [unit = (A)^(-3)]

pos = [1,2,3,4,5,6,7,8,9,10]
D0 = np.zeros(10)
Dt = np.zeros(10)
Dt[0]= Ci                       #Creating high conc gradient in first positio

T  = 10                         #Time [unit = s]
dt = 0.1                        #Time increment [unit = s]
Tt = int(T/dt)                  #Total time steps

Von = stability(dt,D,dx)

x = 0

if Von == 1:

    for x in range(Tt+1):

        D0 = Dt

        #Plotting Position vs Concentration
        title = ("Diffusion at Time: "+str(x*dt)+"s")
        plt.title(title)
        plt.plot(Dt)
        plt.xlabel("Position [A]")
        plt.ylabel(r'Concentration [$A^{-3}$]')
        plt.show()
```

```
        #Plotting Position vs Concentration for animation
        plt.title(title)
        plt.pcolormesh([Dt])
        plt.xlabel("Position [A]")
        plt.ylabel(r'Concentration [$A^{-3}$]')
        ax = plt.gca()
        ax.axes.yaxis.set_ticklabels([])
        plt.colorbar()
        plt.show()

        #Diffusion Equation
        Dt = time_step(D0, Dt, dt, D, dx)

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```