Chemistry 163C Problem Set #8
Due Thursday, 5/29 at the beginning of class

1) Show that the function for $N(x,t)$ is a solution of the diffusion equation.

$$N(x,t) = \frac{N_o}{2A\sqrt{\pi D t}} e^{\frac{-x^2}{4Dt}}$$

2) Given the relationship between flux J and concentration gradient that we developed in class

$$J(x,t) = -D\frac{dN(x,t)}{dx}$$

use the expression for $N(x,t)$ from problem 1 to calculate the flux. Sketch $J(x,t)$ vs x for a value of $t > 0$, thereby showing that the flux has a maximum. How do you interpret this result? Next, find the value of x at the flux maximum and determine how its position varies with time. You should get a familiar result.

3) The radial distance from a starting point in 3D is related to the Cartesian coordinates by

$$r^2 = x^2 + y^2 + z^2$$

If a particle is undergoing diffusion in 3D, show that $r_{rms} = \sqrt{6Dt}$. What would be the displacement if the particle was confined to a 2D surface?

From Engel & Reid 3rd Edition, Chapter 17, Problems: 1, 4, 7, 8, 10, 13, 24, 32, 33