1. Using Fick's First law and the information provided, calculate the diffusive flux of methylene chloride through a butyl rubber glove.
   - Methylene chloride is a common ingredient of paint removers. Besides being an irritant, it also may be absorbed through skin. When using this paint remover, protective gloves should be worn. If butyl rubber gloves (0.04 cm thick) are used.
   - Data:
     diffusion coefficient in butyl rubber:
     $D = 110 \times 10^{-8}$ cm^2/s
     surface concentrations:
     $C_1 = 0.44$ g/cm^3
     $C_2 = 0.02$ g/cm^3

2. Pure iron is exposed to carbon rich gas at a concentration of 2.0 kg/m^3. How long will it take for the carbon concentration of the iron to reach a value of 0.2 kg/m^3 at a depth of 0.5 mm below the surface?

   Given: The diffusion coefficient for carbon in iron at the temperature of the gas is 6.55×10^{-12} m^2/s.

   Hint: This is a non steady state diffusion problem that applies Fick's Second Law. Make sure to use the table of data to interpolate.

$$\frac{c_x - c_0}{c_s - c_0} = 1 - \text{erf}\left(\frac{x}{2\sqrt{Dt}}\right)$$

Values for the variables are as follows:

$c_x = 0.2$ kg/m^3

$c_s = 2.0$ kg/m^3

$c_0 = 0$ kg/m^3 (because it is pure iron, so the initial concentration is zero)

$x = 0.5$ mm

$D = 6.55 \times 10^{-12}$ m^2/s

$t =$ unknown

z	erf(z)	z	erf(z)	z	erf(z)
0	0	0.55	0.5633	1.3	0.9340
0.025	0.0282	0.60	0.6039	1.4	0.9523
0.05	0.0564	0.65	0.6420	1.5	0.9661
0.10	0.1125	0.70	0.6778	1.6	0.9763
0.15	0.1680	0.75	0.7112	1.7	0.9838
0.20	0.2227	0.80	0.7421	1.8	0.9891
0.25	0.2763	0.85	0.7707	1.9	0.9928
0.30	0.3286	0.90	0.7970	2.0	0.9953
0.35	0.3794	0.95	0.8209	2.2	0.9981
0.40	0.4284	1.0	0.8427	2.4	0.9993
0.45	0.4755	1.1	0.8802	2.6	0.9998
0.50	0.5205	1.2	0.9103	2.8	0.9999