Problem 1.4

a) An infinitely long cylinder with a diameter of 10 cm is filled with a stationary fluid. A mass input ($M = 0.1$ g CO_2) is introduced instantaneously at $t = 0$ and uniformly at the center of the tube ($x = 0$). Find the time for the CO_2 to reach a concentration (mass fraction) of 1 ppm at $x = 50$ cm for

i) Molecular diffusion in air

ii) Molecular diffusion in water.

Note:

(a) the densities of air and of water are 1.23 and 1000 kg/m3 respectively

(b) the diffusion coefficient of gaseous carbon dioxide is 0.14 cm2/s in air and 1.71x10-5 g/cm3 in water