Name:

Homework for Lecture 28, 29

The oxidation of silicon ($Si + O_2 \rightarrow SiO_2$) is a typical way to form an insulating oxide layer on silicon wafer (as shown in the diagram below). The oxidation rate (i.e., the increase rate of SiO_2 layer thickness) follows Wagner's parabolic model, $x^2 = Kt$, with the rate constant K following the experimentally-determined values in an atmosphere of dry oxygen as shown in the table below:

Temperature (°C)	1200	1100	1000	920	800
Oxidation rate constant (*K*) ($\mu m^2/h$)	0.0450	0.0270	0.0117	0.0049	0.0011

Note: 1 µm = 10^{-6} m

(data are from a J. W. Mayer and S. S. Lau 1990 Book)

1). Calculate how long will be needed to grow a 0.1 µm thick of SiO_2 layer under 1000 °C.
2). The oxidation rate constant (*K*) depends on temperature as evidenced by the data shown in the Table. Make a plot of ln*K* versus 1/T to check if the temperature dependence of *K* follows the Arrhenius equation as discussed in Lecture 1 and 2, i.e., K = const × $e^{-\Delta G_A / RT}$, and estimate the activation energy ΔG_A.
(hint: you will need to convert the temperature unit from Celsius to Kelvin, K)