

ENSC 495/851 Problem Workshop 3 Apr. 5, 2015

7. Using the given activation energies for each process, estimate the relative increase in reaction rate for: (a) Silicon dioxide as temperature rises from 434 to 514 °C with $E_a = 0.4$ eV (b) Silicon nitride from 658 to 904 °C with $E_a = 1.8$ eV. (c) Polysilicon from 531 to 747 °C with $E_a = 1.7$ eV; (d) silicon epitaxy (using silane) from 1048 to 1159 °C with $E_a = 1.65$ eV.

By Arrhenius equation, the ratio of the rates is given by:

$$\exp \left\{ \left(\frac{E_a}{k} \right) \left(\frac{1}{T_1} - \frac{1}{T_2} \right) \right\}$$

Hence: (with $k = 8.67E-5$ eVK⁻¹)

	(a) (2 marks)	(b) (2 marks)	(c) (2 marks)	(d) (2 marks)
E_a (eV)	0.4	1.8	1.7	1.65
Ratio of rates	1.94	108.94	183.10	3.08
% increase	94	10794	18210	208

