Solutions to Homework #3

$$t_{oxide}(t) = \frac{1}{2}A\left[\sqrt{\frac{t+\tau}{\frac{A^2}{4B}}} - 1\right]$$

1.) A.) From Table 4.1, A=0.165 um, B=0.0117 um^2/hr and τ=0.37 hr. Thus, assuming no preexisting oxide (even though we use a non-zero τ that accounts for the discrepancy in the Deal and Grove model for the shorter oxidation times),

$$t_{oxide}(t = 1hr) = \frac{1}{2}(0.165)\left[\sqrt{1 + \frac{1+0.37}{\frac{(0.165)^2}{4(0.0117)}}} - 1\right]$$

$$\boxed{t_{oxide}(t = 1hr) = 686A}$$

B.) From Table 4.1, A=0.226 um, B=0.287 um^2/hr and τ=0 hr.

$$t_{oxide}(t = 1hr) = \frac{1}{2}(0.226)\left[\sqrt{1 + \frac{1+0.0}{\frac{(0.226)^2}{4(0.287)}}} - 1\right]$$

$$\boxed{t_{oxide}(t = 1hr) = 4345\,A}$$

2.)

A.) Using the parameters and equations in 1A, the time required would be 362 days.

B.) Using the parameters and equations in 1B, the time required would be 14.8 days.

C.) Noting that the parabolic rate coefficient is proportional to the partial pressure of the oxidant, and 6400 torr is 10 times the pressure quoted in table 4.1, the new B would be 2.87 um^2/hr. Note that A remains the same (unaffected by pressure changes). Using this new value for B in the above equations, the time required is 1.48 days.

Obviously, these are ridiculously long making thermal oxides of this thickness impractical. We will later discuss Chemical Vapor Deposition (CVD) deposited oxides.