ABE 370 Quiz 4

Name:

Problem 1 (6 points). In the shrinking core model there are 3 limiting cases. Identify each and explain what the limiting factor is in each case.

Film controlled – the transportation of the reactant through the film layer surrounding the solid reactant particle controls the overall rate of reaction

'Ash' layer controlled – the diffusion of the reactant through the reacted solid material layer ('ash') controls the overall rate of reaction

Reaction controlled – the intrinsic chemical reaction mechanism controls the overall rate of the reaction

Problem 2 (4 points). Explain what t/τ is for the shrinking core models and how it is related to the conversion of the solid reactant.

t is the reaction time, τ is the time required for the entire solid particle to be reacted
Therefore the quantity t/τ is the % of the time it takes to completely react a solid particle.
The conversion (mass % of solid particle converted) is a function of time. The functional dependency is controlled by the shape, size, solid reactant density, and concentration of the fluid reactant.
For film controlled systems, t/τ is equal to the conversion, X.
For reacted layer diffusion and chemical reaction controlled systems, t/τ is a more complex function of X.