

Homework 2 Polymer Processing

- 1) A pan of water and jello powder is boiling on a stove. The jello is dissolving from a powder while the water boils. Explain, using drawings, words and a few simple equations how the laws of mass, momentum and heat continuity and constitutive equations might be applied to this problem. (Chapter 5)
(Define a problem or several problems to be addressed, draw a control volume or volumes, consider equations of continuity and constitutive equations which are appropriate to get the answer, list standard assumptions which simplify these equations (constant temperature, concentration, no convective mass flow etc.)
This problem should demonstrate that you know the difference between a constitutive equation and an equation of continuity.)
- 2) Book, Chapter 5 problem 2, pp. 141
- 3)
 - a) Explain why the total stress tensor, \mathbf{T} , (eq. 5.1-16) is broken down into two components? What does hydrostatic pressure mean? What is p (5.1-17)? How many independent components do \mathbf{T} , P and \mathbf{T} have (pp. 112). What is Cauchy's stress principle (pp. 112)?
 - b) Why is the velocity gradient tensor $\mathbf{Del v}$ broken down into two components? How many independent components do $\mathbf{Del v}$, \mathbf{D} and \mathbf{W} have?
 - c) Explain the assumption of incompressibility in terms of tensor notation.
- 4)
 - a) How are flow of a thin film of oil and flow in a polymer extruder related?
 - b) What is the Reynold's number? Where is it found in the Reynold's Equation?
 - c) Compare heat transfer to fluid flow.
 - (i.) What problem in heat transfer corresponds to the lubrication approximation in fluid flow?
 - (ii.) Write an equation for $T(y)$, the temperature as a function of y , in this problem.

Homework 2 Answers