

**ABE 457**  
**Homework 8**  
**Spring 2018**

Due: 4/16/18

1. Problem 3.1-8 of Geonkoplis.
2. Problem 3.1-12 of Geonkoplis.
3. (i) Calculate the emulsion drop size made in a homogenizer under the following conditions:  
Homogenizer pressure =  $10^8$  Pa . The path length in the homogenizer is  $10^{-2}$  m The dispersed phase fraction is 0.3. The interfacial tension is 20 mN/m. The density of the continuous phase is  $980 \text{ kg/m}^3$ . The viscosity of the continuous phase is 1.2 cp.  
(ii) Calculate the creaming velocity. Apply the following correction to the Stokes velocity in order to account for particle-particle interaction.

$$v = v_{\text{stokes}} \left( 1 - \frac{\phi}{0.74} \right)^{0.74}$$

4. Vegetable oil ( of viscosity 0.95 cp) is to be emulsified in water (with emulsifiers and proteins) using a colloid mill.  $D = 0.12 \text{ m}$ .  $h = 200 \mu\text{m}$  ,  $N = 60,000 \text{ rpm}$   $\gamma = 10 \text{ mN/m}$ . Calculate the mean drop size of the emulsion.