

## Solution

CHE 304, Section #02  
Transport Phenomena III

## Quiz # 4

Name

ID #

A charcoal briquette, approximately spherical in shape with a 2.54-cm radius, has an initial moisture content of  $350 \text{ kg/m}^3$ . It is placed in a forced air dryer. The moisture content of the air inside the dryer maintains a surface moisture content of  $12 \text{ kg/m}^3$ . If the diffusivity of water in charcoal is  $1.3 \times 10^{-6} \text{ m}^2/\text{s}$  and the surface resistance is negligible, estimate the time required to dry the center of the briquette to a moisture content of  $50 \text{ kg/m}^3$ .

$$Y = \frac{w_{A'} - w_{A_s}}{w_{A_0} - w_{A_s}} = \frac{\frac{C_A}{\rho_{\text{solid}}/M_c} - \frac{C_{A_s}}{\rho_s/M_c}}{\frac{C_{A_0}}{\rho_s/M_c} - \frac{C_{A_s}}{\rho_s/M_c}}$$

$$= \frac{C_A - C_{A_s}}{C_{A_0} - C_{A_s}} = \frac{50 - 12}{350 - 12} = 0.112$$

$$n = 0$$

$$m = 0$$

Fig F.9  $x_D = 0.29 = D_{AB} t / R^2$

$$t = \frac{0.29 R^2}{D_{AB}} = \frac{0.29 (0.0254 \text{ m})^2}{1.3 \times 10^{-6} \text{ m}^2/\text{s}}$$

$$t = 144 \text{ sec}$$