Assignment 10

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

The assignment 10 of CRE-II is from the topics covered in Week 10 lectures.

1) Which one of the plot below is true for the shrinking core model for the ash layer controlling conditions? Note that the symbols and notations have the usual meaning.

w10q1_fig

No, the answer is incorrect.

Score: 0

Accepted Answers: A

2) Consider the shrinking core model, and match the following information required to complete the statements.

w10q2_match

No, the answer is incorrect.

Score: 0

Accepted Answers: A-3, B-5, C-1, D-4, E-2

3) What is the time needed to burn to completion the particles of graphite (\( \text{diameter} = 5 \text{ mm}, \rho = 2.2 \text{ g/cc}, \) \( \text{heat} \) \( \text{transfer} \) \( \text{rate} \) \( \text{constant} \) \( \text{reaction} \) \( \text{temperature} \) \( \text{atmospheric} \) \( \text{pressure} \) \( \text{Hint: Use ideal gas law for oxygen concentration} \) \( 0.76 \) \( 1.53 \) \( 0.51 \) \( \text{h} \) \(\) \(\) \(\) \(\) \(\)

Due on 2019-04-10, 23:59 IST.
4) Spherical ZnS particles of size 1 mm are roasted in 8% (v/v) oxygen stream at 900°C and 1 atm. Assuming that reaction proceeds by shrinking core model, calculate the time needed for complete conversion of a particle. Given that:

\[
\text{ZnS + Oxygen} \rightarrow \text{Zinc oxide + Sulfur dioxide (Do the stoichiometry yourself!)}
\]

- Density of solid, \( \rho_B = 0.0425 \text{ mol/cm}^3 \)
- Reaction rate constant, \( k' = 2 \text{ cm/s} \)
- Effective diffusivity of gas into ZnS = 0.08 \( \text{cm}^2/\text{s} \)
- Gas film resistance is neglected.
- Gas is fed according to the stoichiometry.

No, the answer is incorrect.
Score: 0
Accepted Answers:
1.53 h

5) In the above question, what is the percentage contribution of each resistance if gas film mass transfer coefficient, \( k_g = 2 \text{ cm/s} \)?

- 24% - Reaction, 57% - Ash layer, 19% - Gas film
- 30% - Reaction, 70% - Ash layer, 0% - Gas film
- 57% - Reaction, 24% - Ash layer, 19% - Gas film
- 57% - Reaction, 19% - Ash layer, 24% - Gas film

No, the answer is incorrect.
Score: 0
Accepted Answers:
57% - Reaction, 24% - Ash layer, 19% - Gas film

6) A data given below is obtained for the reduction of uniform sized particles of \( \text{UO}_3 \) to \( \text{UO}_2 \) in the uniform environment. Assuming Shrinking core model, find the controlling mechanism.

w10q5_data_table

- Gas film controlling
- Ash layer controlling
- Gas layer controlling with Stokes regime
- Reaction controlling

No, the answer is incorrect.
Score: 0
Accepted Answers:
Reaction controlling

7) In the above problem, what is the time required to completely convert the particles into...
8) An antibiotic drug is contained in a solid inner core ($D_i = 3 \text{ mm}$) and is surrounded by an outer coating ($D_o = 4 \text{ mm}$) that makes it palatable. The outer coating and drug are dissolved at different rates in the stomach, owing to their differences in equilibrium solubility. Based on the given properties and assuming negligible shear stress, what is the approximate time required to completely dissolve the whole drug?

- Amount of drug in inner core = 500 mg
- Solubility of outer layer at stomach condition = $1.0 \text{ mg/cm}^3$
- Solubility of inner layer at stomach condition = $0.4 \text{ mg/cm}^3$
- $Sh = 2$ and $D_{AB} = 6 \times 10^{-6} \text{ m}^2/\text{s}$
- Reaction rate = mass transfer rate

- 6.0 h
- 1.4 h
- 4.6 h
- 7.9 h

No, the answer is incorrect.
Score: 0
Accepted Answers: 6.0 h