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Question Paper Code: 57903

B.E./B.Tech. DEGREE EXAMINATION, DEC 2021

Seventh Semester

Chemical Engineering

15UCH703 – CHEMICAL REACTION ENGINEERING - II

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The surface area of γ alumina can be in the range of CO1- R
(a) 1 – 10 m²/gm (b) 50 – 100 m²/gm
(c) 100 – 300 m²/gm (d) 500 – 1000m²/gm
2. BET apparatus CO1- R
(a) Measures the catalyst surface area directly
(b) Operates at very high temperature. (more than boiling point of water)
(c) Uses water as adsorbate
(d) None of the above
3. Adsorption data are frequently reported by CO2- R
(a) Adsorption isotherms (b) Catalyst deactivation
(c) Sigmoidal curve (d) none of the above
4. Adsorption term in rate equation of heterogeneous catalytic reaction does not contain partial pressure of _____ CO2- R
(a) Adsorbed inert (b) Un adsorbed reactant
(c) Dissociated adsorbate (d) Adsorbed product
5. A temperature gradient exists in CO3- R
(a) Within the pellet (b) Across the fluid film
(c) Both (a) & (b) (d) None of the above

6. Thiele Modulus is defined as CO3- R
- (a) Surface reaction rate /convective mass transfer rate
- (b) Surface reaction rate/ diffusion rate
- (c) Convective mass transfer rate/ surface reaction rate.
- (d) Diffusion rate / surface reaction rate
7. Find the time required for complete burning of graphite particle CO4- R
when chemical reaction controls with the following data $\rho_B = 0.183$ mol/cm³, $R = 0.5$ cm, $b = 1$, $k = 20$ cm/s and $C_{Ag} = 8.31 \times 10^{-7}$.
- (a) 5505.4 sec (b) 4000.6sec
- (c) 100.8 sec (d) none of the above
8. In the heterogeneous non-catalytic reaction, if the chemical reaction is rate CO4-App
controlling step what is the time need for complete conversion for 10 mm
particle.(time need for complete conversion of 5 mm particle is 5 minutes)
- (a) 10 minutes (b) 25 minutes (c) 50 minutes (d) 5 minute
9. SO₂ can be absorbed in absorbers using -----as solvent CO5- R
- (a) Dimethyl aniline (b) NaOH (c) Na₂CO₃ (d) K₂CO₃
10. If $M_H > 2$, reaction occurs in the _____ CO5- R
- (a) Gas film (b) Liquid film
- (c) Main body of liquid (d) Main body of gas

PART – B (5 x 2= 10 Marks)

11. Why adsorption takes place on solid surface? CO1- R
12. What are heterogeneous reactions? CO2- R
13. Define effectiveness factor CO3- R
14. Plot the conversion vs. time curve for different controlling regime in non- CO4- R
catalytic heterogeneous catalytic reaction.
15. Define Hatta number. CO5- R

PART – C (5 x 16= 80 Marks)

16. (a) Explain in detail the assumptions and steps followed in BJH CO1-U (16)
Method
- Or
- (b) Discuss in detail about the pore analysis conducted on catalysts. CO1-U (16)
17. (a) Discuss in detail about surface reaction in a heterogeneous reaction. CO2-U (16)

Or

- (b) Discuss in detail about the molecular (or) non dissociated CO₂-U adsorption. (16)
18. (a) Demonstrate expressions for internal diffusion that takes place in a single cylindrical pore with first order reactions. CO₃-U (16)
- Or
- (b) Derive the performance equations for reactors containing porous catalysts. CO₃-U (16)
19. (a) Discuss in detail on shrinking core model and derive expression for diffusion through ash layer. CO₄-U (16)
- Or
- (b) Discuss in detail on Shrinking core model and derive expression for diffusion through gas film CO₄-U (16)
20. (a) Explain in detail about film theory, penetration theory and surface renewal theories. CO₅-U (16)
- Or
- (b) Discuss in detail the design considerations of various types of gas-liquid reactors. CO₅-U (16)