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[4657]-566

S.E. (Chemical) (II Sem.) EXAMINATION, 2014

CHEMISTRY—II

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Answer *four* questions.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of calculator is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) Explain mutarotation of glucose. [4]

(*b*) What are vitamines and hormones ? [4]

(*c*) Give an account of CFT for octahedral complexes. [4]

Or

2. (*a*) Explain the secondary structure of proteins. [4]

(*b*) Explain $[NiCl_4]^{2-}$ is tetrahedral whereas $[Ni(CN)_4]^{2-}$ is square planner. [4]

(*c*) Manganese forms ions with oxidation state ranging from, 1+ to 7+, explain. [4]

P.T.O.

3. (a) Explain the different types of indicators used in precipitation titrations. [4]

(b) What are titration curves in acid-base titrations ? [4]

(c) Explain and derive the Langmuir adsorption isotherm when it is reduced to Freundlich adsorption isotherm. [4]

Or

4. (a) What are acid-base indicators ? Explain the colour change interval of any visual indicators is 2pH units. [4]

(b) Write a short note on Wacker process. [4]

(c) What is a zeolite catalyst ? Give its types. Explain the structure of sodalite as building block of zeolites. [4]

5. (a) Discuss the conformations of cyclohexane with the help of energy profile diagram. [5]

(b) Explain geometrical isomerism with a suitable example. [4]

(c) Explain staggered conformation of *n*-butane is stable. [4]

Or

6. (a) What do you understand by the term conformations ? Draw all conformations of *n*-butane. [5]

(b) Draw chair and boat conformations of cyclohexane, showing axial and equatorial hydrogens. [4]

(c) What is optical isomerism ? Define the term enantiomers, diastereomers giving examples. [4]

7. (a) Explain continuous nitration process. [4]

(b) Give mechanism and kinetics involved in sulphonation reaction. [5]

(c) Discuss the commercial processes in preparation of vinyl chloride. [4]

Or

8. (a) Write a note on sulfonating agents and their principal applications. [4]

(b) Give mechanism and kinetics involved in nitration reaction. [5]

(c) Discuss the design and construction of equipment for halogenation. [4]

Total No. of Questions—06] [Total No. of Printed Pages—2+1

[4657]-570

S.E. (Chemical Engg.) (II Sem.) EXAMINATION, 2012

MECHANICAL OPERATIONS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. (i)Neat diagrams must be drawn wherever necessary.

(ii) Figures to the right indicate full marks.

(iii) Your answers will be valued as a whole.

(iv) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(v) Assume suitable data, if necessary.

1. (*a*) Why there is a need of size reduction in chemical process Industries ? [4]

(b)Explain closed circuit grinding and open circuit grinding with the help of Flow sheets (6)

(*c*) How is the particle size measured ? Explain the various techniques used for particle size measurement. [6]

Or

2. (*a*) How is the screen analysis performed on standard screen series ? Explain in detail. [6]

(*b*) A material is crushed in a Blake Jaw Crusher such that the average size of particles is reduced from 50 mm to 10 mm with the consumption of energy of 13.0 kW/(kg/s). What would be the consumption of energy needed to crush the same material of average particle size 75 mm to an average size of 25 mm :

(i) Assuming Rittinger's Law applies

(ii) Assuming Kick's Law applies

Which of these results would be regarded as being more realistic and why ? [10]

3. (*a*) Define the following terms (any *two*) : [4]

(i) Sphericity and shape factor

(ii) Screen Effectiveness (*iii*) Angle of Repose.

Describe with a neat sketch the working of rag and flight conveyors. [6]

(*c*) Describe with neat sketch construction of Bucket Elevators. List advantages, disadvantages and applications. [6]

Or

4. Write short notes on : [16]

(i) Screw Conveyor

(ii) Pneumatic Conveyors

(iii) Belt Conveyor

(iv) Storage of Solids.

5. Write short notes on : [18]

(i) Scrubbers

(ii) Gravity settling tank

(iii) Fabric filters (*iv*) ESP.

Or

6. (*a*) Explain Jigging separation technique with neat diagram. [6]

(b) Explain froth floatation with neat diagram. [6]

(c) Explain capacity and effectiveness of screen. [6]

Or

8. (*a*) Give the criteria for the choice of a refrigerant. [6]

(*b*) A heat pump is used for heating the inside of a building in the winter and for air-conditioning in summer. The average winter temperatures are 278 K outside and 293 K inside. The average summer temperature are 303 K outside and 299 K inside. A 5 K temperature approach is kept in all cases. Determine the work required in both cases as a fraction of heat input assuming ideal cycle. [7]

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[4657]-567

S.E. (Chemical Engineering) (Second Semester)

EXAMINATION, 2014

CHEMICAL ENGINEERING THERMODYNAMICS—I

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Answer Q. Nos. **1** *or* **2**, Q. Nos. **3** *or* **4**, Q. Nos. **5** *or* **6**, Q. Nos. **7** *or* **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of calculator is allowed.

(*v*) Assume suitable data if necessary.

1. (*a*) What are the characteristics of a reversible process ? [4]

(*b*) Ten kgs of an equimolar mixture of CO and H_2 at 1500 K and 1 bar is cooled at constant pressure to 350 K. Assume that the gases are ideal. Determine the heat given off during cooling, the change in internal energy and the work done on the gas. The specific heats in J/mol K are are : [8]

$C_{P,H_2} = 29.086 - 8.3694 \times 10^{-4}T + 2.013 \times 10^{-6}T^2$ and

$C_{P,CO} = 26.553 + 7.6682 \times 10^{-3}T - 1.1727 \times 10^{-6}T^2$.

Or

2. (*a*) What are the limiting conditions for equations of state for real gases ? [6]

(*b*) Heat is transferred to 10 kg of air which is initially at 100 kPa and 300 K until its temperature reaches 600 K. Determine the change in internal energy, the change in enthalpy and work done if the process is carried out (*i*) under constant volume conditions and (*ii*) under constant pressure conditions. Assume that air behaves ideally. C_P = 20.099 J/mol K and C_V = 20.785 J/mol K. [6]

3. (*a*) CO at 1000 K is burnt with air at 800 K in 90% excess. The products of combustion leave the reactor chamber at 1250 K. Calculate the heat evolved in the reaction chamber per kmol of CO burned. The standard heat of reaction at 298 K is – 283.028 kJ/mol CO. The mean specific heats applicable in this range of temperature are 29.38, 49.91, 33.13 and 31.43 J/mol K for CO, CO_2, O_2 and N_2 respectively. [7]

(*b*) Give the various statements for the Second Law of Thermodynamics. [6]

Or

4. (*a*) A block of copper at a temperature of 825 K and weighing 5 kg is dropped into water at 300 K. If there are no heat losses, what is the change in entropy of (*i*) Copper (*ii*) water and (*iii*) copper and water both considered together. Specific heats of copper and water are 0.4 and 4.2 kJ/kgK respectively. [7]

(*b*) What is Clausius inequality ? [4]

(*c*) State the Hess law. [2]

5. (*a*) Derive the Maxwell relations. [7]

(*b*) Develop equations for evaluating the change in internal energy and change in entropy for an ideal gas. [5]

Or

6. (*a*) Explain the mnemonic diagram. [6]

(*b*) Explain the H-S diagram in detail. [6]

7. (*a*) Explain the vapour compression cycle with diagrams. [7]

(*b*) A refrigeration system requires 1 kW of power for a refrigeration rate of 3 kJ/s. Determine the (*i*) COP, (*ii*) heat rejected by the system and (*iii*) the lowest temperature the system can attain if the heat is rejected at 308 K. [6]

7. (a) Write the material and energy balance for single effect evaporator. [7]

(b) Define the following : [6]

(i) Boiling point elevation

(ii) Capacity

(iii) Steam economy of the evaporator.

Or

8. (a) An aqueous sodium chloride solution (10 wt%) is fed into a single effect evaporator at a rate of 10000 kg/hr. It is concentrated to a 20 wt% sodium chloride solution. The rate of consumption of steam in the evaporator is 8000 kg/hr. Calculate capacity (kg/hr) and economy of the evaporator. [8]

(b) Explain the construction and working of Calendria type Evaporator with a neat sketch. [5]

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[4657]-568

S.E. (Chemical) (II Sem.) EXAMINATION, 2014

HEAT TRANSFER

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (i) Neat diagrams must be drawn wherever necessary.

(ii) Assume suitable data, if necessary.

(iii) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

1. (a) State and explain : [6]

(i) Fourier law of heat conduction

(ii) Newton's law of cooling

(iii) Stefan-Boltzmann's law of radiation.

(b) Derive an expression for the rate of heat transfer through a composite plane wall considering of three heterogeneous layers having thermal conductivities k_1, k_2 and k_3 respectively. [6]

Or

2. (a) Derive an expression for steady state rate of heat flow through composite cylinder. [6]

P.T.O

(b) Define the following : [6]

(i) Thermal Conductivity

(ii) Heat Transfer Coefficient

(iii) Critical thickness of Insulation

3. (a) Compare between Filmwise and Dropwise Condensation. [3]

(b) Write short note on any *one* : [3]

(i) Thermal Boundary Layer

(ii) Significance of Prandtl Number and Grashoff Number.

(c) Two very large parallel planes with emissivities 0.3 and 0.8 exchange the heat. Estimate the percent reduction in heat transfer when a polished aluminium radiation shield with emissivity 0.04 is placed between them. [6]

Or

4. (a) Explain any *two* [6]

(i) Specular and Diffuse Reflection

(ii) Black body

(iii) Radiation Shield.

(b) Water at 80°C is flowing at a velocity of 3 m/s through a tube of 16 mm diameter maintained at constant wall temperature of 297 K. If the exit temperature of water is 309 K, determine the rate of heat transfer per meter length of tube.

Data :

Properties of water at mean bulk temperature,

Dynamic viscosity : 485×10^{-6} N.s/m^2

Density : 984 kg/m^3

Thermal Conductivity : 0.657 W/m K

Specific heat : 4187 J/kg K [6]

5. (a) Define effectiveness and Capacity Ratio of Heat Exchanger. [5]

(b) Describe heat transfer in agitated vessels [4]

(c) Write a short note on the Log Mean Temperature Difference (LMTD). [4]

Or

6. (a) Water enters a counter flow double pipe heat exchanger at 288 K flowing at a rate of 1300 kg/hr. It is heated by oil flowing at rate of 550 kg/hr from an inlet temperature of 367 K. Determine the total heat transfer and outlet temperature of oil and water for 1 m^2 area of heat transfer.

Data :

Specific heats of oil and water are 2000 J/kg.K and 4187 J/kg.K

Overall heat transfer coefficient is 1075 W/m^{2}K [8]

(b) What is Fouling factor ? Explain. [5]