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Question Paper Code: 50941

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Fourth Semester

Chemical Engineering

15UCH401 - CHEMICAL ENGINEERING THERMODYNAMICS - I

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- All spontaneous processes are
 - Reversible
 - Irreversible
 - Reversible adiabatic
 - Adiabatic
- A closed system exchanges
 - nothing with its surroundings
 - both mass and energy with its surroundings
 - mass but not the energy with its surroundings
 - energy but no the mass with its surroundings
- The compressibility of a gas is defined as the ratio of
 - volume of real gas to volume of ideal gas
 - volume of ideal gas to volume of real gas
 - heat capacity of real gas to density of ideal gas
 - heat capacity of ideal gas to heat capacity of real gas
- The reduced pressure of a substance is the ratio of
 - partial pressure to vapour pressure
 - actual pressure to the critical pressure
 - critical pressure to the actual pressure
 - vapour pressure to critical pressure

5. It is desired to bring about certain change in the state of a system by performing work on the system under adiabatic conditions
 - (a) the amount of work needed is path dependent
 - (b) work alone cannot bring about such a change of state
 - (c) the amount of work needed is independent of path
 - (d) more information is needed to conclude anything about the path-independent or otherwise of the work needed

6. The third law of thermodynamics deals with
 - (a) chemical reactions
 - (b) quantitative equivalence between heat and work
 - (c) rate of change of a process
 - (d) absolute entropy of perfect crystalline substances

7. For a reversible process occurring at constant temperature and pressure, the decrease in Gibbs free energy measures
 - (a) the maximum reversible work
 - (b) the maximum reversible work, other than the electrical work
 - (c) the maximum reversible work, other than the work of expansion
 - (d) the heat supplied

8. The difference between the heat supplied and the work extracted in a steady flow process in which the kinetic and potential energy changes are negligible, is equal to
 - (a) the change in kinetic energy
 - (b) the change in enthalpy
 - (c) the change in work function
 - (d) the change in Gibbs free energy

9. Carnot cycle consists of the following steps
 - (a) two isothermals and two isentropics
 - (b) two isobarics and two isothermals
 - (c) two isochorics and two isobarics
 - (d) two isothermals and two isochorics

10. The work required for an isothermal compression is
 - (a) greater than the work required for isentropic compression
 - (b) less than the work required for isentropic compression
 - (c) equal to the work required for isentropic compression
 - (d) may be greater or less than the work required for isentropic compression depending on the other conditions

PART - B (5 x 2 = 10 Marks)

11. Define intensive and extensive properties of a thermodynamic system.
12. Show that $C_p - C_v = R$ for an ideal gas.
13. State the Carnot theorem.
14. Define residual properties and give examples.
15. What is enthalpy?

PART - C (5 x 16 = 80 Marks)

16. (a) Write a detailed note on the reversible and irreversible processes. Also comment on the statement that "The path of an irreversible process cannot be determined" with the help of quasi-equilibrium process and rapid processes. (16)

Or

- (b) (i) Provide a detailed description about the types of equilibrium of a thermodynamic system. (8)
 - (ii) "Heat and work are the energies in transition". Justify this statement using thermodynamic concepts. (8)
17. (a) (i) Write a note on generalized equation of state. (8)
 - (ii) How is the temperature of an ideal gas related to pressure and volume in an adiabatic process? (8)

Or

- (b) Describe the importance of PVT behavior of fluids and also describe the mathematical representation in detail. (8)
18. (a) From basic principles and first law of thermodynamics, derive the steady flow energy balance for an open system? (16)

Or

- (b) (i) Give the mathematical definition of entropy and explain the terms involved. (8)
 - (ii) How does the concept of thermodynamics temperature follow from the Carnot principle? (8)
19. (a) Derive the various forms of Maxwell's equations. (16)

Or

(b) (i) Show that $dH = C_p dT + [V - T \left(\frac{\partial V}{\partial T}\right)_P] dP$. (8)

(ii) Show that $dS = C_p \frac{dT}{T} - \left(\frac{\partial V}{\partial T}\right)_P dP$. (8)

20. (a) Discuss on the effect of clearance on the work required for compression and on the volumetric efficiency of the compressor. (16)

Or

(b) Write a short notes

(i) Jet and rocket engines. (8)

(ii) Steam power plant. (8)
