**QUESTION BANK**

**THERMODYNAMICS 2017**

**Part – A**

1. Differentiate between –
2. Reversible and irreversible process **3M (Q1,Jan. 2015(Supply))**
3. Adiabatic and isothermal process.
4. Extensive and Intensive properties with examples.
5. Gibbs and Helmholtz free energy **2M( Q3 June 2011 (Main))**
6. How would you predict the spontaneity of a chemical reaction in terms of free energy and entropy?
7. In thermodynamics language what is the meaning of the following terms?

a) Open and closed systems b)Intensive and extensive properties.

1. What is spontaneous process? Give examples.
2. What is state and path functions? Give examples
3. Obtain an expression for work done during reversible isothermal expansion.
4. Explain the terms open, closed and isolated system. Give examples.
5. Calculate the efficiency of a Carnot engine operating between 40°C to 20°C.
6. What is a thermodynamic process? Give a brief account of any two such processes.
7. **‘**q’ is a path function. Under what conditions it will be a state function
8. The change in entropy of a system, in a process is positive. Could the process be a spontaneous one? Explain.
9. Explain why entropy change is zero for reversible process and entropy change is positive for irreversible process for same state change **3M (Q2 June 2014 (Main))**
10. Explain briefly the significance of entropy
11. Calculate the work done when 2 mole of an ideal gas expands isothermally and reversible from 10 atm. to 2 atm pressure at 37 0C (R= 8.314J deg-1mol-1) **3M (Q12 b June 2011 (Main))**
12. What happens to Internal Energy of a system if work is done (i) by the system,(ii) on the system.
13. Explain (1) Work function and (II) Gibbs free energy
14. Define extensive and intensive properties and give suitable examples. **(Q1Dec. 2016(main))**
15. What are limitations of I law of thermodynamics **2M(Q.2Dec. 2016(main), 3M(Q.11b,April. 2007(main)**
16. Give success and limitations of I law and II law of thermodynamics **3M(Q.1,June 2014.(main)**

**20** Derive an expression for variation offree energy with temperature and pressure

**3M (Q2,Jan. 2015(Supply))**

**Part – B**

1. 10 moles of an ideal gas expands isothermally and reversibly from a volume if 5 lit. to 50 lit. at 25°C. What is the maximum work done? Express the result in Joules.
2. Obtain an expression relating T and V in an adiabatic reversible expansion of a gas obeying the equation of state PV = nRT.
3. One mole of an ideal gas at 0°C is compressed adiabatically reversibly to a pressure of 20 times its initial pressure. Calculate the final temperature.(**γ**=1.4)
4. A Heat engine operating between temperatures 500 K and 300 K rejects 6 Kcal of heat to the sink. How much heat it could have absorbed from the high temperature reservoir?
5. Derive the expression PV r = constant for an ideal gas undergoing adiabatic reversible expansion.
6. One mole of H2 at 300 K occupies a volume of 10 lits in a cylinder fitted with a piston. It is expanded isothermally to 20 lits. Assuming ideal behavior for the gas, calculate W, Q, ΔE, ΔH, if the expansion is carried out (i) reversibly, (ii) against a constant external pressure of 0.1 atm., (iii) against zero external pressure (vacuum).
7. Discuss briefly the conditions for equilibrium and spontaneity of a reaction in terms of change of Free energy, Enthalpy and Entropy.
8. In a cyclic process of a system, the heat transfers involved are +14.7 KJ, -25.2 KJ -3.56 KJ, +31.5 KJ. What is the Net work involved in the process.
9. Discuss Entropy change in reversible and irreversible process. Show that the ΔStotal for an irreversible process is greater than ΔStotal for reversible process
10. Give various statements of the second law of thermodynamics
11. One mole of ideal gas is subjected to thermodynamic process in which 512 J of heat flows into the system and 387 J of work is done by the system. Calculate the change in temperature. (C v = 12.47)
12. Derive and Compare the isothermal work expression with adiabatic reversible work expression, which process gives maximum work ,why.? **6M (Q11a** **June 2014.(Main))**
13. Explain why the efficiency of Carnot Engine working between two temperatures is never unity.
14. Calculate the amount of work obtain in isothermal reversible expansion of 20 gm of Hydrogen , at 270C from a pressure of 4 atm to 1 atm.
15. What is a cyclic process .Describe Carnot’s cycle for establishing the maximum convertibility of heat into work?
16. A gas expands against a const external pressure of 1atm from a volume of 20 lit to 30 lit. Calculate the work done in joules.
17. Calculate q, w, ΔE, ΔH for a reversible isothermal expansion of 2 moles of an ideal gas at 300C from 1dm3 to 2dm3.
18. The temperature of 1 mole of an ideal gas increases from 180C to 550C as the gas is compressed adiabatically. Calculate the work done and ΔH for this process assuming that Cv=3/2R. **4M (Q12 b June 2011 (Main))**
19. 2moles of an ideal gas expands isothermally from a volume of 10 to 20 liters at 270C. Calculate change in entropy, change in free energy, and change in enthalpy, work and q reversible for the process.
20. How much heat is absorbed by an engine working in a cyclic process between 4270C and 1270C, if work obtained is 300 J.
21. Two moles of He gas at 1 atm was compressed reversibly and isothermally at 400K to 5 atm pressure. Calculate q, W, ∆E and ∆H.
22. A heat engine working between 00C and 1000C takes up 840J from the high temperature reservoir. Calculate the work done and the efficiency.
23. One mole of an ideal gas is allowed to expand at constant pressure of 1 atm, from 5 L to 20 L at 270C. Calculate W and q for the above process in joules.
24. A certain volume of dry gas at STP is expanded to 3 times its volume adiabatically. Calculate the final pressure and temperature, assuming ideal behavior of the gas (γ=1.4).
25. One mole of ideal gas expands from10 lit to 25 lit at 250C. Calculate the change in free energy of the process.
26. A gas expands isothermally against a constant external pressure of 1 atm from a volume of 10dm3 to a volume of dm3. In this process it absorbs 800J of thermal energy from its surroundings. Calculate ∆E for the process in joules **5M(Q.11Dec. 2016(main))**
27. Define Gibbs and Helmholtz free energy. Derive expressions for variation of free energy with temperature and pressure. **5M (Q.11Dec. 2016(main))**
28. One mole of an ideal gas is heated from 100K to 300K. Calculate ∆S if

(i)the volume is kept constant

(ii) the pressure is kept constant. Assume that Cv =1.5 R **5M (Q16 Dec. 2016(main))**

1. 2 Moles of an ideal gas expands isothermally from a volume of 10 litres to 20 litres at 270C. Calculate entropy change in the process. **3M (Q16 b June 2011 (Main))**
2. . Calculate the entropy change in melting of 5gms of ice at 0oC. Given that molar heat of fusion of ice is 1440Cal **3M(Q.11c,April. 2007(main)**
3. A reversible carnot cycle does work equivalent to 150 KJper cycle if heat supplied by cycle is 225kJ at 2270C per cycle. Calculate

(i)The temperature at which heat is rejected (ii) Thermal efficiency of engine

**4M June 2014.(Main))**

52. Give combined expression of I law and II law of thermodynamics and derive the conditions of equilibrium from it in terms of ∆S, ∆A, ∆G

**7M(Q11a,Jan. 2015(Supply))**

**53.** Two moles of an ideal gas are compressedisothermally at 1000C and reversible from a pressure of 10 to 25 atm..Find the value of G. **3M(Q11b,Jan. 2015(Supply))**