

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



B.Sc. DEGREE EXAMINATION – CHEMISTRY

THIRD SEMESTER – APRIL 2022

UCH 3503 – THERMODYNAMICS

Date: 23-06-2022

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

Part-A

Answer ALL questions.

(10 x 2= 20)

1. Define state and path functions with examples.
2. Prove that for an ideal gas, dV is an exact differential, treating V as a function of T and P .
3. Why heat of neutralisation of a strong acid by a strong base is a constant?
4. Differentiate bond energy from bond dissociation energy.
5. Which one in the following pair will have a high value of entropy? Why?
 CO_2 gas (or) dry ice
6. Calculate the maximum efficiency of an engine operating between $100^\circ C$ and $0^\circ C$.
7. How would the equilibrium reaction of dissociation of PCl_5 be affected by
(a) addition of Cl_2 (b) decreasing the volume of container
8. Distinguish between homogeneous and heterogeneous equilibria with examples.
9. Find the value of $\ln(100!)$ using Stirling's approximation.
10. Write the exceptions of third law of thermodynamics.

Part-B

Answer any EIGHT questions.

(8 x 5= 40)

11. Discuss the effect of temperature on molecular velocities.
12. Derive van der Waals equation of state.
13. State first law of thermodynamics and deduce its mathematical expression for it.
14. One mole of an ideal gas expands isothermally and reversibly from a volume of 20 L at $27^\circ C$. Calculate the work done and change in internal energy.
15. Explain Nernst heat theorem and state third law of thermodynamics.
16. Show that Joule-Thomson expansion is isoenthalpic and adiabatic.
17. Explain the principle of working of a refrigerator.
18. Derive Gibbs-Helmholtz equation and mention its applications.
19. Obtain the relation between K_p and K_c .
20. Derive van't Hoff equation quantitatively the effect of temperature on chemical equilibrium.
21. Write the assumptions of Maxwell-Boltzmann statistics.
22. Define partition function of a system and obtain the relation between partition function and energy.

Part-C

Answer any FOUR questions.

(4 x 10 = 40)

23. Obtain the mathematical expression for kinetic theory of gases and deduce the gas laws from the expression.
24. (a) Derive Kirchoff's equation.
(b) Illustrate Hess's law of heat of summation with suitable example. (5+5)
25. Describe in detail the Carnot reversible cycle for stabilising the maximum convertibility of heat into work.
26. Discuss the dissociation of PCl_5 using Le-Chatelier principle.
27. Explain the determination of absolute entropy of a substance with the help of third law of thermodynamics.
28. Prove that the following are constants for a reversible adiabatic expansion of an ideal gas. (i) $TV^{\gamma-1}$
(ii) PV^γ

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