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**SUBJECT CODE NO:- B-2006**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.Sc. S.Y (Sem-III)**  
**Examination November/December-2022**  
**Chemistry Paper-VIII**  
**(Physical Chemistry)**

[Time: 1:30 Hours]

[Max.Marks:50]

Please check whether you have got the right question paper.

- N.B
- i) Attempt all questions.
  - ii) Illustrate your answer with suitable diagram.
- Q.1
- a) What is Helmholtz free energy functions? 10  
Give its variation with respect to temperature and volume.
  - b) State extensive and intensive properties with suitable examples. Calculate the work done, 10  
when a moles of an ideal gas expands from  $2\text{m}^3$  to  $10\text{m}^3$  against a constant external pressure of  $1.026 \times 10^2 \text{ Nm}^{-2}$  at  $27^\circ\text{C}$ .
- OR
- c) Give the various statements of second law of thermodynamics. 10  
A heat engine operating between  $25^\circ$  and  $125^\circ\text{C}$  takes 600J heat from source calculate efficiency and work done by heat engine.
  - d) Define molar heat Capacity at constant pressure and at constant volume. Prove that 10  
 $C_p - C_v = R$ .
- Q.2
- a) Derive an expression for total work done in the Carnot Cycle. 10
  - b) State and explain Le-chatelier's Principle. What is the effect of change of concentration, 10  
pressure and temperature
- OR
- c) Write short notes on any four of the following. 20
    - a) Hess's law of heat summation.
    - b) concept of maximum work
    - c) Need for second law of thermodynamics
    - d) physical significance of entropy
    - e) Law of mass action.
    - f) Clapeyron equation.
- Q.3 Multiple choice questions. 10
1. A process in which no heat enters or leave the system is called.....
    - a) Isothermal
    - b) Isobaric
    - c) Adiabatic
    - d) Isochoric.
  2. The property which depends on the mass or amount of substance is called -----
    - a) Intensive property
    - b) Extensive property
    - c) Adiabatic property
    - d) Isothermal property
  3. The enthalpy of a system is defined by the relation.....
    - a)  $H = E - Pv$
    - b)  $H = pv - s$
    - c)  $H = s + pv$
    - d)  $H = E + Pv$

4. Which of the following is not a state function.  
a) Enthalpy                      b) work                      c) volume                      d) Entropy.
5. Entropy is a measure of ----of the molecules in the system.  
a) Momentum                      b) velocity                      c) Disorder                      d) Efficiency
6. Which of the following is true for cyclic process.  
a)  $q=0$                       b)  $\Delta E = q-w$                       c)  $\Delta E=0$                       d)  $\Delta S=0$
7. A process is in the equilibrium state where  
a)  $\Delta G=0$                       b)  $\Delta G >0$                       c)  $\Delta G <0$                       d)  $\Delta G=-1$
8. The efficiency of heat engine is always.  
a) Zero                      b) Equal to zero                      c) Less than one                      d) Greater than one
9. Consider the following reversible reaction  
$$\text{N}_{2\text{g}} + 3\text{H}_{2\text{g}} \rightleftharpoons 2\text{NH}_{3\text{g}}$$
its equilibrium constant (k) is expressed as  
a)  $\frac{[\text{2NH}_3]}{[\text{N}_2][\text{H}_2]^3}$                       b)  $\frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$                       c)  $\frac{[\text{NH}_3]^2}{[\text{N}_2][3\text{H}_2]}$                       d)  $\frac{[\text{2NH}_3]^2}{[\text{N}_2][3\text{H}_2]^3}$
10.  $\frac{d(\ln p)}{dt} = \frac{\Delta H_v}{RT^2}$  is a \_\_\_\_  
a) Gibb's equation                      b) Clapeyron equation  
c) Vant Hoff 'equation                      d) Clapeyron-Clausius equation.