

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086  
(For candidates admitted during the academic year 2008-09 & thereafter)

SUBJECT CODE: CH/MC/PC44

B.Sc. DEGREE EXAMINATION, APRIL 2011  
BRANCH IV - CHEMISTRY  
FOURTH SEMESTER

Reg. No .....

COURSE : MAJOR – CORE  
PAPER : PHYSICAL CHEMISTRY-I  
TIME : 30 MINUTES

MAX. MARKS : 30

SECTION – A

TO BE ANSWERED ON THE QUESTION PAPER ITSELF.

ANSWER ALL THE QUESTIONS.

(30x1=30)

I. Choose the correct answer:

- Which is not an intensive property?  
a. Temperature                      b. Entropy                      c. Molar volume                      d. Viscosity
- The relationship between  $\Delta H$  and  $\Delta G$  is  
a.  $\Delta G = \Delta S + T \Delta H$     b.  $\Delta S = \Delta G - T \Delta H$     c.  $\Delta S = \frac{(\Delta H - \Delta G)}{T}$     d.  $\Delta H = \frac{(\Delta S - \Delta G)}{T'}$
- Which one of the following has zero entropy at zero Kelvin  
a. H<sub>2</sub>O                      b. pure NaCl                      c. pure crystalline NaCl                      d. CO
- In the combustion of ethanol at room temperature which one of the following is correct?  
a.  $\Delta H = \Delta E$                       b.  $\Delta H > \Delta E$                       c.  $\Delta H < \Delta E$                       d.  $\Delta H = 0$
- If  $K_C$  for the reaction  $H_2 + I_2 \rightleftharpoons 2HI$  is 49 at 500 °C, then the equilibrium constant for  $HI \rightarrow \frac{1}{2} H_2 + \frac{1}{2} I_2$  at the same temperature is  
a.  $\frac{1}{49}$                       b.  $\frac{1}{7}$                       c. 7                      d.  $\frac{1}{\sqrt{7}}$
- For an adiabatic reversible expansion of an ideal gas  
a.  $P \propto \frac{1}{V}$                       b.  $PV^\gamma = \text{constant}$                       c.  $PV = RT$                       d.  $(PV)^\gamma = \text{constant}$

II. Fill in the Blanks:

- In an isolated system there can be exchange of \_\_\_\_\_ and \_\_\_\_\_.
- In an isochoric process \_\_\_\_\_ of the system remains constant.
- Enthalpy of combustion is always \_\_\_\_\_.
- The variation of chemical potential with temperature is given by the equation \_\_\_\_\_.
- For an adiabatic reversible process  $\Delta S$  is \_\_\_\_\_.
- For an equilibrium process  $\Delta G$  is \_\_\_\_\_ at equilibrium.

**III. State Whether the following are True or False:**

13. The equilibrium constant of a reaction is independent of T.
14. The standard enthalpy of formation of any compound is zero.
15. For an ideal gas  $\left(\frac{\partial E}{\partial V}\right)_T$  is zero.
16. When a gas at higher pressure expands into a region of low pressure, its T will always decrease.
17. Mixing of gases by diffusion is a reversible process.
18.  $Q_{rev}/T$  is state function.

**IV. Match the following:**

- |                          |   |  |
|--------------------------|---|--|
| 19. Heat Capacity        | - | $\Delta H < 0$ & $\Delta S > 0$          |
| 20. Spontaneous process  | - | $\Delta H = T \Delta S$                  |
| 21. Equilibrium process  | - | There is exchange of energy but not mass |
| 22. Evaporation of water | - | Extensive property                       |
| 23. Closed system        | - | Intensive property                       |
| 24. Specific heat        | - | $\Delta S$ is positive                   |

**V. Answer in a Line or Two:**

25. State the third law of thermodynamics.
  
26. Write the reaction isotherm.
  
27. Give the physical significance of entropy.
  
28. Define standard heat of formation.
  
29. Write the van der Waal's equation.
  
30. Define chemical potential.



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**MAX. MARKS : 70**

**SECTION – B**

**ANSWER ANY FIVE QUESTIONS:**

**(5x6=30)**

1. Differentiate state and path functions with examples.
2. Show that for an ideal gas  $C_p - C_v = R$ .
3. Derive Kirchoff's equation and explain.
4. Write a note on thermodynamic scale of temperature.
5. Derive van't Hoff isochore.
6. Derive entropy of mixing.
7. State and explain zeroth law and first law.

**SECTION – C**

**ANSWER ANY TWO QUESTIONS:**

**(2x20=40)**

8. a. Derive the Gibbs – Duhem equation. (10)  
b. State and explain Hess's law. (3)  
c. Calculate the entropy change when 1 mole of nitrogen is mixed with 1 mole of hydrogen at 27°C assuming the gases to be ideal. (3)  
d. Give the significance of van der Waal's constants a & b. (4)
9. a. Derive Maxwells relations. (10)  
b. Explain Joule Thomson effect and inversion temperature. (4)  
c. What is the need for second law and state two different forms of second law. (6)
10. a. Calculate the maximum work done when two moles of an ideal gas at a pressure of 10 atm. and 27°C undergoes isothermal reversible expansion to a pressure 2 atm. (4)  
b. Define enthalpy of neutralization and explain why the value is constant for the reaction between strong acids and strong bases. (6)  
c. Derive Clausius – Clapeyron equation and explain its use. (10)
11. a. Explain Le-Chatliar principle and the criteria for spontaneity? (10)  
b. Define the terms: Activity, Activity co-efficient and Fugacity. How are they related to each other. (6)  
c. For the equilibrium  $2SO_2 + O_2 \rightleftharpoons 2SO_3$ , derive the relationship between  $K_p$  and  $K_c$ . (4)



