(i) Printed Pages : 4] Roll No. .....

(ii) Questions : 9] Sub. Code : 0252

Exam. Code : 0003

B.A./B.Sc. (General) 3rd Semester Examination

1127

CHEMISTRY

(Physical Chemistry-A)

Paper : XI

(Same for B.Sc. Microbial & Foot Technology)

Time : 3 Hours] **[Max. Marks : 22**

Note :- (i) Attempt *five* questions in all, selecting at least *one* question from each section. Section A to D carry equal marks. Section E is compulsory.

(ii) Use of log tables and simple calculator is allowed.

Section–A

1. (a) Briefly explain, how the structure of liquids can be studied. Briefly explain 'Hole Theory' and 'Free Volume Theory' of liquid state. 2

(b) State and explain Le-chatelier's principle. With the help of this principle, explain the following :

(i) Effect of temperature on the dissolution of O_2 in water. (Exothermic phenomenon)

(ii) Effect of pressure on the boiling point of a liquid. 2

2. (a) What are 'Liquid Crystals' ? Why are they so called ? Briefly explain different types of liquid crystals. 2

(b) What do you understand by 'Liquid Crystal Display' ? Briefly explain the application of liquid crystals in electronic industry. What type of liquid crystals are used in it. 2

Section–B

3. (a) Derive 'Van't Hoff Equation' in terms of K_p as well as K_c. 3

(b) Why $\Delta G°$ obtained from K_p and K_c has different values ? When these values will be same ? 1

4. (a) Starting from basic principle derive the relationship

$$\Delta G° = - RT \ln K_p.$$ 2

(b) Boiling point of water is 373K. Calculate the vapour pressure of water at 353K. The enthalpy of vapourisation of water is 9·8 K cals mol^{-1}. 2

Section–C

5. (a) Derive an expression for the entropy change of an ideal gas when the temperature changes from T_1 to T_2 and volume changes from V_1 to V_2. 2

   (b) Calculate the maximum efficiency of a steam engine operating between 100°C and 20°C. What would be the efficiency of the engine of the boiler temperature is increased by 30°C, the temperature of the sink remaining the some ? 2

6. (a) Show that for a thermodynamically irreversible process.

$$\Delta S_{system} + \Delta S_{surroundings} > 0$$ 2

   (b) Derive an expression for the entropy change when n_1 moles of an ideal gas (A) are mixed with n_2 moles of another ideal gas (B). Comment upon the sign of ΔS_{mixing}. 2

Section–D

7. (a) Explain the term 'Helmboltz Function' ? How can you deduce that for a process occurring at constant temperature, the decrease in Helmholtz function ($-\Delta A$) is equal to maximum work done by the system ? 2

   (b) What is 'Nernst Heat Theorem' ? What results follow from it regarding entropy change and heat capacity change of a system ? How does it lead to the definition of 'Third Law of Thermodynamics'. 2

8. (a) Derive 'Gibbs' Helmholtz Equation' in the form

$$\frac{\partial(\Delta G / T)}{\partial T} = \frac{-\Delta H}{T^2}.$$ 2

(b) The pressure of two moles of an idal gas at 298K falls from 10 bar to 0·4 bar. Calculate the change in free energy.

[R = 8·314 JK^{-1} mol^{-1}] 2

Section–E

9. (a) Define 'Carnot Heat Theorem'.

(b) What is the difference between Helmholtz Function and Gibbs' Function ?

(c) Which out of the following has higher value of entropy ?

(i) CO_2 at 15°C and 1 atmosphere

(ii) Dry ice at 1 atmosphere.

(d) Under what conditions 'Thermodynamic Equilibrium Constant' in terms of activities (K_a) becomes equal to K_p and K_c ?

(e) How is the 'Free Energy Change' of a reaction in a given state related to its reaction quotient (QP) in that state and the equilibrium constant (K_p) ?

(f) What do you understand by Thermography ? Explain briefly. 6