

This question paper contains 4+2 printed pages}

Your Roll No.....

903

B.Sc.(Hons.)/I

C

CHEMISTRY- Paper III

(Physical Chemistry--I)

Time : 3 Hours

Maximum Marks : 38

(Write your Roll No. on the top immediately on receipt of this question paper)

Attempt six questions in all, selecting at least two questions from each section. Question No. 1 is compulsory. Use of scientific calculator is allowed.

($R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$, $N = 6.023 \times 10^{23} \text{ mol}^{-1}$)

$k = 1.38 \times 10^{-23} \text{ JK}^{-1}$).

1. Explain briefly giving reasons (any four) : 2×4=8
- (a) Viscosity of glycerol is much more than that of an ether.

P.T.O.

- (b) It is not possible to liquefy an ideal gas.
- (c) The enthalpy of neutralization of a strong acid with a strong base is always a constant.
- (d) Entropy of the universe always increases.
- (e) The barometric equation is not strictly obeyed.
- (f) Work can be completely converted to heat but heat cannot be completely converted into work.

Section A

- 2
- (a) Write the definition of the mean free path.
 - (b) Calculate the mean free path of oxygen at 25°C and a pressure of 10^{-3} mm of Hg. The collision diameter is 3.61×10^{-8} cm.
 - (c) At Boyle's temperature a real gas behaves as if it is an ideal gas. Why ?

3. (a) State the law of equipartition of energy.
- (b) Write the equation for the energy of rotation whenever :
- (i) Molecule is linear
- (ii) Molecule is non-linear.
- (c) Calculate the root mean square, average and the most probable speeds for oxygen molecule at 25°C. 2,2,2

4. (a) Write van der Waals' equation in the virial form and evaluate the second virial coefficient.
- (b) Show that the height at which atmospheric pressure is reduced to one half of its value, is given by the expression :

$$x = 0.6909 RT/Mg.$$

- (c) State the law of corresponding states. 3,2,1

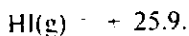
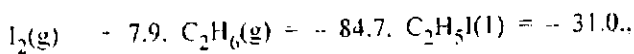
5. (a) What is surface tension ? What is its importance in daily life ?
- (b) Discuss the structure of liquid as obtained from the study of radial distribution function.
- (c) How the viscosity of a highly viscous liquid like oil can be determined experimentally ? . 2,2,2

Section B

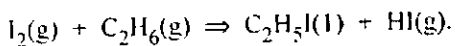
6. Explain the following (any three) 2×3=6
- (i) Integral heat of solution
- (ii) Joule-Thomson's coefficient
- (iii) Maximum flame temperature
- (iv) Intensive properties.
7. (a) Show that :
- $$dS_{\text{system}} + dS_{\text{surrounding}} = 0$$
- for an infinitesimal reversible process.
- (b) Calculate the entropy change involved in the isothermal expansion of 5 moles of an ideal gas from a volume of 10 liters to 100 liters at 300 K.

(c) Why in adiabatic expansion of an ideal gas, cooling is produced ? 2,3,1

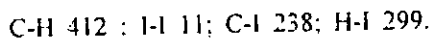
8. (a) Give the following standard enthalpies of formation in kJ mol^{-1} (at 298 K and 1 atm pressure) :



Calculate the enthalpy change for the reaction :



(b) Given the following average bond energies in kJ mol^{-1} :



Calculate the enthalpy change for the same reaction in part (a) of this question.

(c) What is the difference between Bond energy and Bond dissociation energy ? 2,3,1

9. (a) Define $C_{p,m}$ and $C_{v,m}$ and then derive the relation between them for n moles of an ideal gas.
- (b) For van der Waals' gas derive the expressions for work done, heat, internal energy change and enthalpy change for isothermal expansion. 3,3