B.Sc. 2352 - Chemistry-II (Physical Chemistry)

P. Pages : 2

GUG/S/19/1259

Time : Three Hours

0957

Max. Marks : 50

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Notes : 1. All five questions are compulsory and carry equal marks.
2. Draw diagrams and give equations wherever necessary.
3. Use of calculator is permitted.

1. a) Describe Joule-Thomson experiment and show that Joule Thomson expansion is an isenthalpic process. **5**

b) State and explain Hess's law of constant heat summation. **5**
    Calculate the enthalpy of formation of ammonia from the following bond dissociation energy data :

(N-H) bond $= 389$ kJ mol^{-1}.

(H-H) bond $= 435$ kJ mol^{-1} and

$(N \equiv N)$ bond $= 945.36$ kJ mol^{-1}.

OR

c) Define: **2½**
    i) Isolated system.   ii) Cyclic process.
    State first law of thermodynamics in two different ways.

d) Calculate maximum work done when 10.5g of nitrogen expand from a volume of 5 lit. to 25 lit. at 298 K. **2½**
$\left(R = 8.314 \text{ Jk}^{-1}\text{mol}^{-1} \right)$.

e) Derive Kirchhoff's equation. **2½**

f) Explain **2½**
    i) Intensive property.   ii) Extensive property.

2. a) Derive Gibbs-Helmholtz equation in terms of free energy and enthalpy change at constant pressure. **5**
    Calculate the entropy change for the fusion of 1 mole of a solid which melts at 300K.
The latent heat of fusion is 2.51 kJ mol^{-1}.

b) Derive Van't Hoff's reaction isotherm. **5**
OR
c) State the need of second law of thermodynamics. **2½**

d) Discuss entropy as criteria of spontaneity and equilibrium. **2½**

e) Define work function. Explain its physical significance. **2½**

f) Calculate equilibrium constant at 27ºC for the chemical reaction if its standard free energy change is 112.64 kJ mol^{-1}. $\left(R = 8.314 \text{ Jk}^{-1}\text{mol}^{-1} \right)$. **2½**

3. a) Draw labelled phase diagram of water system and discuss its main features. **5**

b) State and explain Nernst Distribution law. Calculate the amount of substance extracted from 100 ml. of an aqueous solution containing 9 g of it using 50 ml. chloroform at a time in two instalments. The distribution co-efficient of solute between chloroform and water is 5.0. **5**

OR

c) State phase rule and explain meaning of each terms involved in it. **2½**

d) Discuss nicotine water system with diagram. **2½**

e) State and explain Henry's law. What are its limitations. **2½**

f) Derive Clausius Clapeyron equation upto its integrated form. **2½**

4. a) Explain. **5**
   i) Law of constancy of interfacial angles.   ii) Law of rational indices.

b) Derive Bragg's equation for X-ray diffraction by crystals. Discuss Laue's method for the study of crystal structure. **5**

OR

c) A plane makes intercepts 2a and 3b on X-axes and Y-axes respectively and does not cut the Z-axis at all. What are the miller indices of the plane. **2½**

d) Explain the crystal structures of NaCl with suitable diagram. **2½**

e) State the law of symmetry. Explain different elements of symmetry present in crystals. **2½**

f) What are Bravais Lattices. Name the seven crystal systems and give their corresponding number of Lattices. **2½**

5. Attempt **any ten.** **10x1 =10**

   i) Find the efficiency of an heat engine for which source is at 500K and sink at 300K.
   ii) Define heat capacity. State the relation between heat capacity at constant volume and heat capacity at constant pressure.
   iii) What are state functions and path functions?
   iv) Write an expression that showing change in free energy with temperature at constant pressure.
   v) What are partial molar quantities?
   vi) Give any two statement of second law of thermodynamics.
   vii) State Raoult's law of ideal solution.
   viii) Calculate the degree of freedom for $S_R \rightleftharpoons S_M$ Sulphur system.
   ix) Define steam distillation.
   x) What is diad axis.
   xi) Define unit cell and space lattice.
   xii) List the various elements of symmetry present in a cubic lattice.

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