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Total No. of Questions : 09

**B.Sc.(BT) (2013 to 2017)    (Sem.–2)**
# PHYSICAL CHEMISTRY
### Subject Code : BSBT-106
### Paper ID : [F0233]

Time : 3 Hrs.                                                Max. Marks : 60

**INSTRUCTION TO CANDIDATES :**
1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

## SECTION-A

1. **Compulsory Question :**

   a) Using colligative properties, why are abnormal molecular weights observed in certain cases.

   b) Prove that for an ideal solution, $\Delta H_{mixing} = 0$ and $\Delta V_{mixing} = 0$.

   c) Give two examples each of very fast reactions and very slow reactions.

   d) Show that $(\delta G/\delta T)_P = -S$.

   e) How does the addition of catalyst affect the equilibrium constant of a reaction?

   f) Why Helmoltz free energy is now called Helmoltz work function?

   g) Describe and explain the term chemical potential.

   h) Show that for an irreversible process, $\Delta S_{system} + \Delta S_{surr.} > 0$.

   i) How is supercooled water an example of metastable equilibrium? Also define stable equilibrium.

   j) Distinguish between state function and path function.

**SECTION-B**

2. Prove thermodynamically that Joule-Thomson coefficient for an ideal gas is zero. Also deduce expression for Joule-Thomson coefficient for real gases in terms of Van der Waals constants 'a' and 'b'.

3. Assume that Helium behaves as an ideal gas and $C_v = 3/2$ R. One mole of helium gas is heated from 300 K to 600 K. Calculate the entropy change if volume is kept constant and if pressure is kept constant.

4. A current of dry air was passed through a solution of 2.5 g of non-volatile substance 'X' in 100g of water and then through water alone. The loss of weight of former was 1.25g and that of latter was 0.05g. Calculate molecular weight of substance 'X'.

5. Draw a phase diagram of water system. Label it and discuss the importance of various points, lines and areas at equilibrium. Discuss the effect of change of temperature at constant pressure.

6. How is the kinetics of '*thermal decomposition of acetaldehyde*' and '*saponification of ethyl acetate by alkali*' studied? Discuss both in details.

**SECTION-C**

7. a) Calculate the osmotic pressure of a solution obtained by mixing 100ml of 1.5% solution of urea (MW = 60) and 100ml of 3.42% solution of cane sugar (MW = 342) at 20°C. [R = 0.082 litre atm/deg/mol].

   b) Show that $\Delta G = \Delta H + T [\delta (\Delta G)/ \delta T]_P$.

8. a) After 24 hours, only 0.125g out of the initial quantity of lg of a radioisotope remains behind. What is its half-life period?

   b) Discuss clearly the criteria for reversibility and irreversibility in terms of S, E, H, A and G. What do you mean by reversible and an irreversible process?

9. a) For the reaction, 2 NO + Cl$_2$ $\rightarrow$ 2 NOCl, it is found that doubling the concentration of both the reactants increases the rate 8 times but doubling the chlorine concentration alone doubles the rate. What is the order of the reaction *w.r.t.* NO and Cl$_2$?

   b) State phase rule. Discuss the application of the phase rule to the system consisting of KI and water.