GUJARAT TECHNOLOGICAL UNIVERSITY
B.E. Sem-IV Examination June- 2010
Subject code: 140501
Subject Name: Physical and Inorganic Chemistry

Date: 17 / 06 / 2010   Time: 10.30 am – 01.00 pm
                                                              Total Marks: 70

Instructions:
    1. **Attempt all questions.**
    2. **Make suitable assumptions wherever necessary.**
    3. **Figures to the right indicate full marks.**

Q.1 **(a)** Answer the following: **07**
   (i)   What do you understand by the term 'degree of freedom'?
   (ii)   Define dipole moment. State one application of dipole moment.
   (iii) Explain the term 'standard heat (enthalpy) of reaction'.
   (iv) H_2O is liquid at room temperature while H_2S is a gas. Explain why?
   (v)   Define 'cell constant'. What is its importance?
   (vi)   What is 'dry ice'? Why is it called so?
   (vii) Explain 'hybridization' with an illustration.

   (b) State and derive Beer - Lambert's law. What are its limitations and give one   **07**
   application?

Q.2 **(a)** Draw the phase diagram of water system. Discuss its salient features.   **07**
   Explain why the fusion curve of ice has a negative slope whereas the
   sublimation curve has positive slope in phase diagram.
   (b) Draw the phase diagram of a two component simple eutectic system and   **07**
   discuss its main features. Assume that the two components (solids) are
   completely miscible in liquid state.
                                        OR
   (b) Explain Hess's law of constant heat summation, with a suitable example.   **07**
   Discuss about its important applications.

Q.3 **(a)** Derive Kirchoff's equation, when C_p values are independent of   **07**
   temperature.
   The heat of the reaction, $N_2 + 3H_2 \rightarrow 2NH_3$, at 27ºC was found to be −
   21.976 kcal. What will be the heat of reaction at 50ºC? The molar heat
   capacities at constant pressure and at 27ºC for nitrogen, hydrogen and
   ammonia are 6.8, 6.77 and 8.86 cal mol^{-1} $degree^{-1}$ respectively.
   (b) Give an account of electrochemical series and its applications.   **07**
                                        OR
Q.3 **(a)** What is a buffer solution? How does it operate? Explain.   **07**
   Find the pH of a buffer solution containing 0.4 mole per litre CH_3COONa
   and 0.30 mole per litre CH_3COOH. The dissociation constant of acetic acid
   is 1.8×10^{-5}.
   (b) Write short notes on   **07**
   (i) Batteries; (ii) Fuel cells.

Q.4 **(a)** Define the term 'Chromatography'. With a neat schematic diagram of gas **07** chromatography (GC) instrument, explain the principle of gas chromatography technique.

(b) With a neat block diagram of thermogravimetry apparatus, explain **07** thermogravimetric analysis (TGA) by giving a suitable illustration.

OR

Q.4 **(a)** Describe the process of ore dressing by **07** (i) Froth flotation; (ii) Electromagnetic separation.

(b) Mention the effects of nickel, chromium, vanadium and tungsten alloying **07** elements on the properties of steels. Also state the important applications of various alloy steels.

Q.5 **(a)** Compare the properties of ionic compounds and covalent compounds. Give **07** the various steps involved in Born- Haber cycle for the formation of NaCl crystal.

(b) Compare valence bond (VB) and molecular orbital (MO) theories of **07** bonding.
Give the molecular orbital configuration of NO molecule. Calculate the bond order and comment on its magnetic property.

OR

Q.5 **(a)** What are the requirements of an explosive? Describe the manufacture of **07** dynamite and trinitrotoluene (TNT).

(b) What are rocket propellants? Explain the classification of propellants and **07** compare their properties, with suitable examples.

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