Reg.No.									

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

II SEMESTER B.S. DEGREE EXAMINATION – APRIL/ MAY 2017

SUBJECT: CHEMISTRY (CH 121A)

(NEW SCHEME)

(BRANCH: COMMON)

DDMMYYY

Time: 3 Hours **Max. Marks: 100**

- ✓ **Answer ANY FIVE full Questions.**
- ✓ **Missing data, if any, may be suitably assumed**

1A. i) Explain the origin of single electrode potential with a suitable example. How is this potential measured?

ii) Mention two drawbacks of Arrhenius theory of electrolytic dissociation. Derive an expression for the relation between degree of dissociation and the dissociation constant of an weak electrolyte.

1B. i) Ionization constant of acetic acid and ionic product of water at 25°C are 1.75×10^{-5} and 1×10^{-14} respectively. Calculate the hydrolysis constant of sodium acetate and it's degree of hydrolysis in 0.1 M solution at 25°C.

ii) Give reason for the following

a) He_2 cannot exist

b) Oxygen in paramagnetic in nature

1C. i) When are the following terms used while naming an organic compound according to IUPAC?

i) neo ii) tertiary carbon iii) alkyl iv) cyclo

(8+8+4)

2A. i) Calculate the change in enthalpy for the reaction given below

$CO(g)+NO(g) \rightarrow CO_2(g)+1/2N_2(g)$ $\Delta H = ?$

Given the following information

$CO(g)+1/2O_2(g) \rightarrow CO_2(g)$ $\Delta H = -283.0$ KJ

$N_2(g)+O_2(g) \rightarrow 2NO(g)$ $\Delta H = 180.6$ KJ

ii) Write the mechanism for the bromination of benzene

2B. i) Differentiate beween the following

a) position and functional isomersim

b) geometrical and optical isomerism

c) electrophilic addition and necleophilic substitution

d) carbanion and carbene

ii) Explain the formation of CH_4 and $BeCl_2$ molecules on the basis of Valence Bond Theory.

2C. Describe the construction and working of a glass electrode. Write any two of it's disadvantages. Write the reaction involved during the working of Calomel electrode.

(8+8+4)

3A. i) For the reaction A+B→C+D, the rate constant at 7°C is 7.0×10^{-7} s^{-1} and the rate constant at 57°C is 9×10^{-4} s^{-1}. What is the activation energy in KJ/mol? (Given R = 1.987 cal K^{-1} mol^{-1})

ii) Distinguish between the following.

a) Molar heat capacity and specific heat capacity.
b) Intensive and Extensive properties.
c) Isolated and closed system.
d) Enthalpy and entropy of a system

3B. i) State the law of mass action and derive an expression for the equilibrium constant of a reversible reaction.

ii) Explain the Saytzeff rule with an example. Write the mechanism for the reduction of ketone by lithium aluminium hydride.

3C. Explain the shape of water and ammonia molecules on the basis of VSEPR theory.

(8+8+4)

4A. i) Justify the following statements:

a. Boiling point of o-nitrophenol is lower than that of p-nitrophenol
b. Sulfur dioxide gas is easily liquefiable.

ii) The rate constant for the conversion of cyclopropane to propene is 9.2 s^{-1}.What is the half-life of the reaction? Derive Arrhenius equation for the energy of activation of a reaction.

4B. i) What effect do the following changes have on the position of equilibrium for the reversible reaction: $PCl_{5\,(g)} + \text{heat} \leftrightarrow PCl_{3\,(g)} + Cl_{2\,(g)}$

a) Addition of Cl_2
b) Decrease in pressure.
c) Increasing the temperature
d) Removal of PCl_5

ii) Describe the secondary bonds present in $CHCl_3$ (chloroform) molecules and N_2 molecules.

4C. What is liquid junction potential? How does it arise? How can it be avoided?

(8+8+4)

5A. i) A mixture containing 8.07 mol of H_2 and 9.27 mol of I_2 is heated at 448°C till equilibrium is established. It is found that 13.38 mol of HI are obtained. Calculate the equilibrium constant for the reaction: $H_2(g)+I_2(g) \leftrightarrow 2HI(g)$.

ii) Explain the effect of concentration and temperature on the rate of a reaction on the basis of collision theory.

5B. i) Explain the Born-Haber Cycle for the formation of NaCl. Write any two characteristic features of ionic compounds.

ii) Derive an expression for the rate constant of a first order reaction. What are second order reactions? Give two examples.

5C. Derive an expression for the Gibbs Helhmoltz equation. Calculate the free energy change (ΔG) which occurs when 1 mole of an ideal gas expands reversibly and isothermally at 37°C from an initial volume of 55 dm^3 to 1000 dm^3.

(8+8+4)

6A. i) For the cell, $Fe / Fe^{2+}(0.01M) \| Ag^{+}(0.1M) / Ag$, write the cell reaction and calculate the emf of the cell at 298 K, if $E^o_{Fe2+/Fe}$ and $E^o_{Ag+/Ag}$ are - 0.44 V and + 0.8 V respectively.

ii) Give reason for the following statements

a) An aqueous solution of a salt of a weak base and a strong acid is acidic.

b) The addition of sodium acetate to a solution of acetic acid suppresses the dissociation of acetic acid.

6B. i) State the first and second law of thermodynamics. Mention any one of the limitations of the first law. Define the heat capacity of a system.

ii) How does Molecular Orbital Theory explain the bond order of CO and N_2 molecules.

6C. Explain Morkovnikov's rule and metamerism with an example

(8+8+4)

7A. i) Define half life period of a chemical reaction. Derive an expression for the half life period of the first and second order reactions.

ii) What is a standard cell? Explain the construction and working of Weston Cadmium cell

7B. i) If K_a of HF is 6.8×10^{-4}, find the K_b of F^-. Find the molar concentration of NaOH if 20g of it are present in 5 litres of a solution

ii) Derive Nernst equation for a single electrode. Why is NaCl not preferred in a salt bridge? What are the functions of a salt bridge?

7C. i) What is meant by internal energy of a system? Why is it called as a state function?
ii) What is meant by dipole moment of a molecule? How is it measured?

(8+8+4)

8A. i) Differentiate molecularity and order of a reaction. How does the transition state theory explain the formation of products from molecules?
ii) Explain the Le Chatelier's principle for vapour pressure of a liquid and the effect of pressure on boiling point of a liquid.

8B. i) A glass electrode dipped in a solution of pH = 2.8 offered an emf of 0.24 V with SCE at 298 K. When dipped in a solution of unknown pH at the same temperature, the recorded emf was 0.26 V. calculate the pH of the solution [E_{SCE} = 0.2412 V]
ii) Mention the factors governing the formation of ionic bond. Write two characteristic features of these compounds.

8C. Write the structures for the following organic molecules.
i) 2-chloro-5-nitrohexane
ii) 3-methylbutanoic acid
iii) 1,6-Hexanedial
iv) 2-methyl-1-butanol

(8+8+4)