

SEAT No. \_\_\_\_\_

[48/A-28]

SARDAR PATEL UNIVERSITY  
M. Sc. [Semester-I] Examination

Tuesday, 11<sup>th</sup> April, 2017

10:00 a.m. to 01:00 p.m.

Chemistry: PSO1CCHE01

[Inorganic Chemistry]

No. of printed pages: 02

Note:- Figures to the right indicate full marks.

Total Marks:- 70

$[h = 6.626 \times 10^{-34} \text{ J.S.}, 1J = 6.24 \times 10^{18} \text{ ev}, 1\text{ev} = 8.06 \times 10^3 \text{ cm}^{-1}]$

Que. 1. Answer the following.

[8]

- The sum of kinetic energy and potential energy is \_\_\_\_\_  
(a) Laplacian operator (c) Momentum operator  
(b) Hamiltonian operator (d) Hermitian operator
- Which of the following is the correct sentence for hermitian operator:  
(a) Eigen value of hermitian operator is real  
(b) Eigen function of hermitian operator corresponding to different value are not orthogonal to each other  
(c) Both  
(d) None of them
- The \_\_\_\_\_ is zero point energy for harmonic oscillator.  
(a)  $1/2 h \nu$  (b)  $3/2 h \nu$  (c)  $h \nu$  (d)  $5/2 h \nu$
- \_\_\_\_\_ operator has not zero value.  
(a)  $(d/dy, x)\psi$  (b)  $(x, d/dy)\psi$  (c)  $(d/dx, d^2/dx^2)\psi$  (d)  $(d, d/dx)\psi$
- The term symbol for  $L=3$  and  $S=0$  system is \_\_\_\_\_  
(a)  $^1F_3$  (b)  $^1D_3$  (c)  $^3F_2$  (d)  $^3D_2$
- The symbol corresponds to Laplacian operator is \_\_\_\_\_  
(a)  $\nabla^2$  (b)  $\nabla$  (c)  $L$  (d)  $L^2$
- The expression for the second order and third order perturbation energy is \_\_\_\_\_:  
(a)  $\langle \psi^1 | \hat{V} | \psi^1 \rangle$  and  $\langle \psi^1 | \hat{V} | \psi^2 \rangle$   
(b)  $\langle \psi^0 | \hat{V} | \psi^1 \rangle$  and  $\langle \psi^0 | \hat{V} | \psi^2 \rangle$   
(c)  $\langle \psi^1 | \hat{V} | \psi^2 \rangle$  and  $\langle \psi^1 | \hat{V} | \psi^3 \rangle$   
(d)  $\langle \psi^0 | \hat{V} | \psi^2 \rangle$  and  $\langle \psi^1 | \hat{V} | \psi^3 \rangle$
- According to VBT,  $O_2$  molecule is \_\_\_\_\_:  
(a) Paramagnetic (b) Diamagnetic (c) Both (d) None of them

Que. 2. Answer the following. [Any seven]

[14]

- Define the term: (i) Zero point energy (ii) Constant of motion
- Explain the commutative property giving suitable examples.
- Explain: The Schmidt orthogonalisation process.
- Determine L, S, J & term symbol arising out of coupling between an electron in s-orbital and another in p-orbital.
- Derive the radial eigen function for  $n=1$  &  $l=0$  system.
- Explain Dirac notation.
- Derive the  $n^{\text{th}}$  order perturbation energy equation.
- Explain the ionic contribution for hydrogen molecule on the basis of VBT.
- Explain electro density and bonding in  $H_2^+$  ion on basis of MOT.

- Que: 3 [A]** Butadiene contains 4 electron each of which moves freely from one end of the molecule to the other. Treat the molecule as a one dimensional box whose box length is equal to the length of carbon chain plus half C-C bond length on either other sides. The average C-C bond length is 0.14 nm. [6]
- (i) Calculate the total ground state energy of the molecule.
- (ii) Calculate the lowest absorption frequency(in  $\text{cm}^{-1}$ ) and wave length(in nm) of light absorbed.
- (Given :  $h = 6.626 \times 10^{-34}$  JS,  $1\text{J} = 6.24 \times 10^{18}$  and  $1\text{eV} = 8.06 \times 10^3 \text{eV cm}^{-1}$ )

OR

[B] Answer the following:

- (i) Explain: Normalization of wave function for a rotational motion of a particle in a ring. [3]
- (ii) Discuss the translation motion of a cubical box. [3]
- Que. 4. [A]** Assuming harmonic oscillator model for C-C, C=C and C≡C with frequency  $14000\text{cm}^{-1}$ ,  $17000\text{cm}^{-1}$ ,  $21000\text{cm}^{-1}$  respectively. Calculate the bond strength, lowest vibrational energy and energy gap between two levels. [6]

- Que: 4 [B]** Considering NO as a rigid rotator in a (I) XY-plane (II) three dimension. [6]
- (I) Calculate the frequency and wave length of light emitted when transition takes place from excited stage to ground state, i.e.  $n=3$  to  $n=2$
- (II) Calculate the angular momentum and first three rotational energy level.
- [Given: Radius =  $1.15 \times 10^{-10}$  m,  $h = 6.626 \times 10^{-34}$  JS,  $C = 3 \times 10^8$  m/sec]

OR

- [B] Derive the radial function for large, small and intermediate value of  $\rho$ . [6]
- Que. 5. [A]** Write the condition for the perturbation treatment. Discuss the first order perturbation theory for degenerate energy level. [6]
- [B] Discuss the wave function for many electron system. [6]

OR

- [B] Answer the following:
- (i) Explain the Hartree self consistent field method for obtaining better wave function. [3]
- (ii) Explain the commutation with Hamiltonian. [3]
- Que. 6. [A]** Explain: Born Oppenheimer approximation and derive the electronic and nuclear Schrodinger equation. [6]
- [B] Molecular orbital theory of bonding in  $\text{H}_2$  Molecule. [6]

OR

- [B] Derive the energy equation  $H_{AA} = 2E_H + 1/R - J$  for hydrogen molecule on the basis of Heitler-London theory. [6]

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No of Printed pages: 03

[53/A-36]

**SARDAR PATEL UNIVERSITY**

M.Sc. Organic Chemistry, Semester-I Examination

Date: 13-04-2017, Thursday

Subject: Organic Chemistry [PS01CCHE02]

Time: 10.00 am to 01.00 pm

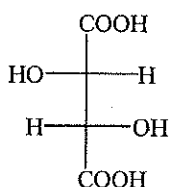
Total Marks : 70

N.B. (1) Figures to the right indicate Marks.

Q.1 : Answer the following multiple choice questions.

[08]

i) The configuration of the following compound is ----- .



- a) 2R,3R      b) 2S,3S      c) 2S,3R      d) 2R,3S

ii) Methylene hydrogens in cis-1, 2-dibromocyclopropane are ----- .

- a) homotopic      b) diastereotopic      c) enantiotopic      d) chirotopic

iii) ----- reaction involves carbene as the intermediate.

- a) Chichibabin      b) Favorskii      c) Rieme-Tiemann      d) Hunsdiecker

iv) Which of the following method is used for the generation of free radical?

- a) Thermolysis      b) Photolysis      c) Redox reaction      d) All

v) Double bond formation is favoured between less substituted carbon is a statement based on ----- .

- a) Hoffmann elimination      b) Saytzeff elimination      c)  $\alpha$ -elimination      d) syn elimination

vi) Among the alkyl halides, increasing  $E_1$  - elimination occurs along the series is----- .

- a)  $1^\circ > 2^\circ > 3^\circ$       b)  $1^\circ < 2^\circ < 3^\circ$       c)  $1^\circ > 3^\circ > 2^\circ$       d) None

vii) When bromoethane reacts with HBr to give ----- as a major product.

- a) 1,2-dibromoethane      b) ethane      c) 1,1-dibromoethane      d) None

viii) The correct order of reactivity towards electrophilic substitution of phenol(I),

Benzene(II) and nitro benzene(III) is----- .

- a) I > II > III      b) II > III > I      c) III > II > I      d) III > I > II

**Q. 2 : Answer the following questions.(Any Seven)**

[14]

- Define: i) Atropisomerism and ii) Prochiral centre.
- Explain the procedure to determine chirality descriptor for a compound with chiral plane.
- How would you detect benzyne intermediate using Mass spectroscopy?
- What is the principle of microscopic reversibility?
- What is Bredt's rule? Give at least one example of it.
- Explain the 1,1-elimination reaction with example.
- Why halogens are considered to be deactivators but still ortho para directing groups?
- 'Ozonolysis of alkene involves molozone' Justify the statement.
- Explain the following conversion with suitable reagents.



**Q. 3 : A) Answer the following.**

[06]

- How topicity can be decided by symmetry operation? Explain with proper example.
- Calculate and draw the possible stereoisomers of 2,3-dibromobutane. Convert each of Fischer projection into Newmann projection via Sawhorse projection.

**B) Answer the following.**

[06]

- Explain the term pseudo-chirogenicity by citing proper example.
- Show that chirality is neither necessary nor the sufficient condition for occurrence of diastereotopic ligands.

OR

**B) Answer the following.**

[06]

- Enantiotopic and diastereotopic ligands co-exists in 3-pentanol. Justify it.
- Calculate total no. of stereoisomers of 2,3,4,5-tetrabromo hexane. Draw Fisher projection for optically inactive isomers only with configurational symbols.

**Q. 4 : A) Answer the following.**

[06]

- State Hammond's postulate. Justify Markonikoff's rule by using the postulate.
- Write a note on Wagner-Meerwein rearrangement.

**B) Answer the following.**

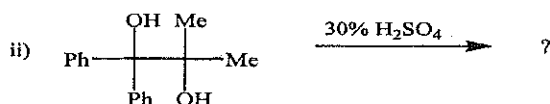
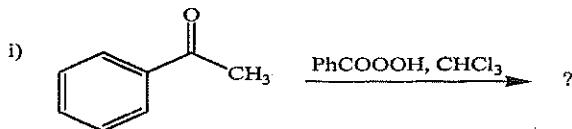
[06]

- Schmidt reaction is more advantageous over Beckmann reaction. Justify it.
- Show that nitration of benzene is two step reaction by using primary kinetic isotope effect.

OR

B) Write the product and suggest the mechanism of following reaction .

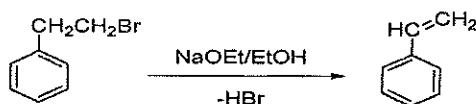
[06]



Q. 5 : A) Answer the following.

[06]

- Highlight the differences between  $E_1$  and  $E_{1cb}$  mechanism.
- Comment on mechanism of following reaction using isotope exchange technique.



B) Explain the following statements.

[06]

- Any crowding in transition state favours the Hoffmann elimination.
- Neomenthyl chloride undergoes dehydrochlorination reaction faster than that of methyl chloride.

OR

B) Answer the following.

[06]

- How Chugaev and Cope elimination reaction differ from each other?
- Discuss the factors favouring  $E_2$  mechanism.

Q. 6 : A) Answer the following.

[06]

- What is ipso substitution? Give proper examples and conditions required for its occurrence.
- Show that hydroxylation of alkenes using peracids is stereospecific.

B) Justify the following statements.

[06]

- Electrophilic aromatic substitution is addition followed by elimination.
- Sulphonation of naphthalene at  $80^\circ\text{C}$  gives  $\alpha$ -substituted product whereas  $\beta$ -substitution is favoured at  $160^\circ\text{C}$ .

OR

B) Answer the following.

[06]

- Show that Friedel Craft acylation is more advantageous over Friedel Craft alkylation in preparation of ethylbenzene from benzene .
- How dimedone can be synthesized by using 4-methyl-3-penten-2-one and diethyl malonate.

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[36][A-22]

SEAT No. \_\_\_\_\_

No. of Pages: 2

## SARDAR PATEL UNIVERSITY

M. Sc. First SEMESTER Examination 2017

Monday, 17<sup>th</sup> April 2017,

Time: 10.00a.m. To 1.00 a.m.

PS01CCHE03,

## CHEMICAL THERMODYNAMICS

N.B. Figures to the right indicate marks.

Total Marks: 70

Q.1 Choose correct answer (Only Code).

08

- 1 Variation of fugacity of a gas with pressure is
 

(a) $(d \ln f / dP)_T = V/RT$	(b) $(d \ln f / dT)_P = V/RT$
(c) zero	(d) one
- 2 In mechanical equilibrium which of the following is constant
 

(a) temperature	(b) pressure
(c) Volume	(d) mass
- 3 If the reaction is spontaneous then
 

(a) $J_a = K$	(b) $J_a < K$
(c) $J_a > K$	(d) $J_a = 0$
- 4 Idealize form of Raoult's law is
 

(a) $f_i = N_i C$	(b) $f_i = N_i P$
(c) $f_i = N_i f_i^0$	(d) $f_i = 0$
- 5 The activity  $a_i$  of a solution is related to
 

(a) chemical potential	(b) free energy
(c) A and B both	(d) none of these
- 6 At which condition the values of partial molar and apparent molar properties becomes identical
 

(a) infinite dilution	(b) dilution
(c) concentrated	(d) molten state
- 7 Which of the following pair gives negative deviation in Vapour pressure curve
 

(a) Dioxane-water	(b) Benzene-Toluene
(c) Acetone-CS <sub>2</sub>	(d) Water-HCl
- 8 Example of extensive property is
 

(a) Pressure	(b) density
(c) Volume	(d) Temperature

PTO

- Q.2** Answer any **SEVEN** of the following 14
- 1 Write limitations of thermodynamics?
  - 2 Differentiate between ideal and non ideal gas.
  - 3 Show that the values of activity are directly proportional to fugacity for real gaseous mixture.
  - 4 State thermodynamics significance of reaction isotherm.
  - 5 Prove that :  $\ln f = \ln p^* + \frac{1}{RT} (PV - RT - \int_{p^*}^p P dV)$
  - 6 How one can use the freezing point method for determining the molecular weight of the solute in the dilute solution?
  - 7 Explain activity of solvent from vapour pressure measurement?
  - 8 State Henry's law and Raoult's law.
  - 9 Define partial properties and apparent molar properties?
- Q.3** A Define fugacity? Derive an expression  $\ln f = \ln P - \frac{1}{RT} \int_0^p \alpha dp$  06
- B State and discuss the Lewis Randall rule. 06
- OR**
- B Given for a gas at 25<sup>0</sup>C from 0 to 10 atm.,  $PV = RT (1-0.0052P)$ . Where P 06  
is in atm. Calculate the ratio of fugacity to pressure at pressure of 1,5 and 10 atm.
- Q.4** A Derive equilibrium constant for metathetic reaction? 06
- B What are free energy functions? How to determine the standard free energy change of the gaseous reaction by free energy functions? 06
- OR**
- B Discuss integration of Van't Hoff equation for a long rang of temperature with no limits and limits of integration 06
- Q.5** A Discuss the osmotic pressure method for determination of activity of solution. 06
- B Discuss fundamental equations for partial molar properties. 06
- OR**
- B What is meant by non ideal solution? Discuss about the solutions exhibiting positive as well as negative deviations from ideal behavior. 06
- Q.6** A Write note on: Isopiestic method. 06
- B Determine the mean ionic molality of a 0.5 molal solution of sodium sulfate 06
- OR**
- B Discuss method of intercept for determining partial molar properties. 06

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SEAT No. \_\_\_\_\_

No. of Printed pages: 03

[25/A-19]

SARDAR PATEL UNIVERSITY

M.Sc. (Semester-I) (NC) Examination

Wednesday, 19<sup>th</sup> April 2017

Course No.: PS01ECHE01, Polymer Chemistry - I

10:00 AM to 1:00 PM

Total Marks : 70

Q-1 Answer the following:

08

- (i) The determination of  $\bar{M}_w$  from light scattering involves a double extrapolation on the same graph. This grid line figure is called \_\_\_\_\_
- (a) molecular wt. distribution curve
  - (b) chromatogram
  - (c) turbidity plot
  - (d) zimm plot
- (ii) \_\_\_\_\_ is defined as the no. of monomer units consumed per active centre.
- (a) rate of polymerization
  - (b) kinetic chain length
  - (c) rate of growth
  - (d) rate of termination
- (iii) The starting material to prepare polyethylene terephthalate is \_\_\_\_\_
- (a) terephthalic acid + butane-diol
  - (b) maleic acid + ethylene glycol
  - (c) terephthalic acid + ethylene glycol
  - (d) terephthalic acid + adipic acid
- (iv) Living polymers are formed by \_\_\_\_\_
- (a) anionic polymerization
  - (b) free radical polymerization
  - (c) coordination polymerization
  - (d) condensation polymerization
- (v) Autoacceleration occurs in preparing the polymer by which of the following method?
- (a) solution
  - (b) suspension
  - (c) bulk
  - (d) emulsion
- (vi) Micelles are \_\_\_\_\_
- (a) dispersed surfactants
  - (b) polymers
  - (c) molecular aggregates
  - (d) none of the above

(P.T.O)

(vii) When \_\_\_\_\_, the copolymer formed will be richer in  $M_1$ .

(a)  $r_1 = 1, r_2 = 0$

(b)  $r_1 < 1, r_2 > 1$

(c)  $r_1 = r_2 = 1$

(d)  $r_1 > 1, r_2 < 1$

(viii) Dioctyl phthalate is an example of a

(a) plasticizer

(b) antioxidant

(c) curing agent

(d) UV stabilizer

Q-2 Answer the following (ANY SEVEN):

14

(i) Define the terms: Repeating unit and Organic polymers.

(ii) Linear and branched polymers are thermoplastics. Why?

(iii) What is Osmosis?

(iv) Why the polymer build up process is slow in step-growth polymerization method?

(v) Calculate the number average degree of polymerization ( $\bar{X}_n$ ) of an equimolar mixture of hexamethylene diamine and adipic acid for the extent of reaction (p) 0.500, 0.800, 0.900 and 0.995.

(vi) In pearl polymerization, how the size of monomer droplets can be controlled?

(vii) The molecular weight increases with polymerization rate in emulsion polymerization method. Explain.

(viii) What is the function of inert filler in compounding of poly(vinyl chloride)?

(ix) List out the disadvantages of internal plasticizers.

Q-3

(a) Discuss about the classification of polymers on the basis of (i) origin and (ii) thermal response. 06

(b) Calculate  $\bar{M}_n$ ,  $\bar{M}_w$  and polydispersity index for a polymer sample having 100 molecules of molecular weight  $10^3$  each, 200 molecules of molecular weight  $10^4$  each and 200 molecules have molecular weight  $10^5$  each. 06

OR

(b) Discuss about the free radical chain polymerization. 06

- Q-4** (a) Write a short note: Living polymers 06  
(b) Differentiate cationic polymerization and anionic polymerization. 06

**OR**

- (b) Explain in detail about coordination polymerization. 06

- Q-5** (a) Describe the solution polymerization method. 06  
(b) Write briefly about the ring opening polymerization with suitable examples 06

**OR**

- (b) Give the merits and demerits of bulk, solution, suspension and emulsion polymerization methods. 06

- Q-6.** (a) Discuss in details about the Q-e scheme proposed by Alfrey and Price including the general conclusions drawn from the said scheme. 06  
(b) Classify the additives and discuss any two in details. 06

**OR**

- (b) Write about the following: 06  
(i) General rules for polymer solubility  
(ii) Antioxidants

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[ 26 ]

SEAT No. \_\_\_\_\_

No. of Printed Pages : 2

**SARDAR PATEL UNIVERSITY**  
**M.Sc. (SEMESTER-I) EXAMINATION**  
**Wednesday, 19<sup>th</sup> April 2017**  
**TIME: 10.00 A.M. to 01.00 P.M.**  
**APPLIED AND INDUSTRIAL CHEMISTRY: PS01ECHE02**

Note: Figure to the right indicate full marks.

Total marks: 70

**Q. 1. Choose the correct answers from the options given below.**

**[8]**

- \_\_\_\_\_ is not a part of unit operation.  
(a) Drying (b) Filtration (c) Oxidation (d) Crystallization
- The Driving force of Distillation operation is \_\_\_\_\_ difference.  
(a) Boiling Point (b) Pressure Point (c) Vapor- pressure (d) Reflux
- The Venturi effect is the reduction in \_\_\_\_\_ that results when a fluid flows through a constricted section of pipe.  
(a) Fluid pressure (b) Kinetic energy (c) Flow (d) None of above
- Heat sensitive material is distilled by \_\_\_\_\_ distillation.  
(a) Low heat (b) Vacuum (c) Column (d) Heating
- Drying involves the removal of water at \_\_\_\_\_ the temperature.  
(a) Above (b) Below (c) Medium (d) None
- Sodium hypochlorite (NaOCl) in basic condition, act as \_\_\_\_\_ agent.  
(a) Oxidizing (b) Chlorinating (c) Reduction (d) Inert
- Active component of BHC is \_\_\_\_\_.  
(a)  $\gamma$ -HCH (b) DDT (c) Alum (d) none of above
- "Lead compound" in medicinal chemistry term, is a \_\_\_\_\_ material for drug discovery.  
(a) First Prescribed (b) Lead metal (c) Starting (d) A & B

**Q. 2. Answer the following. [Any seven]**

**[14]**

- Explain the principle of orifice meter.
- Write the mechanism of crystallization operation.
- Write the importance of Thermal Insulators.
- Explain the advantages of continuous process.
- Describe the unit process of p-nitro acetanilide.
- List down the types of some special Glasses.
- Write the application and properties of stainless Steel.
- Explain the effect of heat on milk.
- Explain the composition of Ghee.

(1)

- Q. 3. [A] Explain Reynolds's experiment in detail. [6]  
[B] Explain the modes of Heat transfer with suitable examples. [6]  
**OR**
- [B] (i) Explain the difference between drying and evaporation. [3]  
(ii) Write a note on Tray Dryer. [3]
- Q. 4. [A] Explain the synthesis of Chlorobenzene by unit process. [6]  
[B] Write a note on continuous nitration of benzene by unit process. [6]  
**OR**
- [B] (i) Write a note on oxidizing agents. [3]  
(ii) What is the difference between sulfonation and sulfation? [3]
- Q. 5. [A] Describe about the raw material of Glass. [6]  
[B] Explain the manufacturing process of cement by dry process. [6]  
**OR**
- [B] Write Brief note on mixing of additives to cement. [6]
- Q. 6. [A] Write a note on Pasteurization. [6]  
[B] How homologation chain branching and ring chain transformation helps in designing newer drug? [6]  
**OR**
- [B] Write a short note on composition of Ice-cream and Cheese. [6]

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(2)