

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

No. of Printed Pages:02

[59]

SARDAR PATEL UNIVERSITY

M.Sc. Semester-III: Analytical Chemistry Examination (CBCS)

November-2017, Marks: 70

Friday, Date: 03.11.2017

Time: 02.00 p.m. to 05.00 p.m., Paper: PS03CANC02

Subject: Elements of Analytical Chemistry

N.B.: i) The numbers of the marks carried by each question is indicated at the end of the question  
ii) Assume suitable data if considered necessary and indicate the same clearly.

- Q.1** Answer by highlighting the right response. [08]
- i) Which of the following is responsible for bias?
    - a) Random error
    - b) Personal error
    - c) Both a) and b)
    - d) Determinate error
  - ii) Which of the following technique is/are not deals with electromagnetic radiation?
    - a) ICP
    - b) FT-IR
    - c) Mass
    - d) Both a) and c)
  - iii) The typical laboratory recorder is an example of a \_\_\_\_\_
    - a) servo system
    - b) battery
    - c) filter
    - d) transistor
  - iv) What is the function of transistor?
    - a) amplification
    - b) switching
    - c) current regulator
    - d) both (a) and (b)
  - v) Relative standard deviation (RSD) can be given express by \_\_\_\_\_
    - a)  $S/X$
    - b)  $s/\bar{x}$
    - c)  $S/X^2$
    - d)  $S/X \times 100$
  - vi) Demerit(s) of automation is/are \_\_\_\_\_
    - a) Reproducible results
    - b) Initial cost
    - c) Process control
    - d) All
  - vii) Which of the detector(s) can be used in FIA is/are?
    - a) Fluorimeter
    - b) Biosensors
    - c) Ion-selective electrode
    - d) All
  - viii) What is the meaning of 'z' in confidence interval?
    - a) Value of 't' at  $n = \infty$
    - b) Standard deviation
    - c) Variance
    - d) Value of 't'
- Q.2** a) Attempt any SEVEN [14]
- i) What is the sensitivity of analytical instrument? Discuss its significance.
  - ii) Explain the selectivity of instrumental techniques.
  - iii) Discuss the function of transformer.
  - iv) Differentiates microprocessor and microcomputers.
  - v) Discuss the AC and DC currents.
  - vi) Explain the stopped flow measurements.
  - vii) Discuss the term 'confidence interval'.
  - viii) Describe in brief 'source of instrumental error'.
  - ix) Discuss the significance of statistical treatment for analytical data.

- Q.3** a) What is the source of bias? Discuss the 'precision' and 'bias' of analytical method. [06]  
 b) Explain 'detection limit' and 'dynamic range'. Why  $C_m$  is not considered as LOQ? [06]

**OR**

- b) Give the classification of analytical techniques. Explain the classification and comparisons of instrumental methods.  
**Q.4** a) Give the detailed account on semiconductor devices and transducer. [06]  
 b) Discuss the data domain map. Why digital domain span is in both electrical and non-electrical domain? [06]

**OR**

- b) Explain the off-line, on-line, in-line and intra-line computer conjugation with analytical instruments and its applications.  
**Q.5** a) Explain automated elemental analyzer and discuss chromatographic method for elemental analysis with diagram. [06]  
 b) Explain the principle of flow injection analysis. Why radial and convection diffusion process are important in FIA? [06]

**OR**

- b) Explain chemical analysis and devices for unit operations for automated system. Discuss the merits and demerits of automation.  
**Q.6** a) Explain the frequency distributions of data. Discuss histogram and frequency polygon. [06]  
 b) A chemist reported 0.084, 0.089 and 0.079 as % age of alcohol content in blood in its three different samples respectively. Calculate 95% Confidence Interval of mean assuming (a) the three results obtained are only indication of the precision of method and (b) from previous experience on hundreds of samples, we know that the standard deviation of the method  $s = 0.005\%$  alcohol and is good estimate of  $\sigma$ . [use value of  $t=4.30$ ;  $z= 1.96$ ] [06]

**OR**

- b) Discuss F, Q and T test for analytical data and its importance.

-F-I-N-I-S-H-

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

No. of Printed Pages: 02

**(144) SARDAR PATEL UNIVERSITY**

**M.Sc. Semester-III: Analytical Chemistry Examination (CBCS)**

**November-2017, Date: 07.11.2017**

**Tuesday, Time: 2.00 p.m. to 5.00 p.m.**

**Paper code: PS03CANC03**

**Subject: Basic and thermal methods of analysis, Total marks: 70**

*N.B.: i) Figure to the right indicate marks.  
ii) Assume the suitable data if necessary and indicate clearly.*

- Q.1.** Attempt MCQs with correct choice or answer highlighted [08]
- i) During precipitation, lower degree of Q-S/S favors.....
    - a) Lower nucleation rate      b) Larger size of particles
    - c) Heterogeneous nucleation      d) All
  - ii) A technique dealing with measurement of heat-flow is.....
    - a) DTA      b) DSC
    - c) EGA      d) TMA
  - iii) For a reaction  $HgCl_2 + H_2S = HgS + 2HCl$  favoring towards right..
    - a)  $Hg^{2+}$  is a hard acid      b)  $S^{2-}$  is a hard base
    - c)  $H^+$  is a soft acid      d)  $Cl^-$  is a hard base
  - iv) Identify polar, protic solvent(s)
    - a) Water      b) Ethanol
    - c) Ammonia      d) All
  - v) Identify indicator employed in Mohr's titration method...
    - a)  $K_2Cr_2O_7$       b)  $K_2CrO_4$
    - c)  $Na_2Cr_2O_7$       d)  $Cr_2O_3$
  - vi) For redox titration to be feasible,  $\Delta pE/0.1mL$  at equiv. point is..
    - a) At least 0.4 V      b) At least 0.2 V
    - c) At least 4.0 V      d) At least 2.0 V
  - vii) A form of EDTA ( $H_4Y$ ) existing dominantly above pH10 is..
    - a)  $[HY^{3-}]$       b)  $[H_3Y^{1-}]$
    - c)  $[H_2Y^{2-}]$       d)  $[Y^{4-}]$
  - viii) A pair components of which leading to complex formation is
    - a)  $[CN^{1-}]$  &  $[Ag^{1+}]$       b)  $[Ba^{2+}]$  &  $[SO_4^{2-}]$
    - c)  $[H_3O^{1+}]$  &  $[OH^{1-}]$       d) None

- Q.2.** Answer any **Seven** [14]
- i) What is DTA? Draw and discuss DTA of calcium oxalate monohydrate.
  - ii) State 'homogeneous precipitation', with suitable examples.
  - iii) Calculate the pH of 0.2M of  $NH_4Cl$  solution(aq) [ $K_b(NH_3)$  and  $K_w(\text{water})$  are  $1.8 \times 10^{-5}$  and  $1.0 \times 10^{-14}$  respectively].
  - iv) State hard and soft acid-base theories. Arrange aqua acids;  $[Cu(OH_2)_6]^{2+}$ ,  $[Fe(OH_2)_6]^{2+}$  and  $[Fe(OH_2)_6]^{3+}$ , in order of their acid strength [Cu(II) is smaller than Fe(II) in size].
  - v) State theory of acid-base indicators with suitable examples.
  - vi) Illustrate 'autoprotolysis' and 'autoprotolysis constant'.
  - vii) Precipitation titrations are generally called argentometric titrations! Explain
  - viii) Calculate equiv. point pE of a redox titrimetry reaction  $MnO_4^- + 5Fe^{2+} + 8H^+ \leftrightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O$  [ $E^\circ_{MnO_4^-} = 1.51 V$ ,  $E^\circ_{Fe^{3+}} = 0.77 V$ ].

(P.T.O.)

①

- ix) Describe ways of detecting end point in the complexometry.
- Q.3. a) State 'relative super saturation (RSS)'. Some 0.05 mL of 0.1 M  $\text{Ag}^{1+}$  solution was added to 100 mL of 0.1M  $\text{Cl}^{1-}$  solution. Calculate RSS achieved. [ $K_{sp}(\text{AgCl}(s))=1.82 \times 10^{-10}$ , Solubility of  $\text{AgCl}(s)$  micro-particle = Solubility of  $\text{AgCl}(s)$  macro-particle] [06]
- b) State working principle of TG method and give its applications. Discuss TG analysis of a mixture containing  $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ ,  $\text{SrC}_2\text{O}_4 \cdot \text{H}_2\text{O}$  and  $\text{BaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ . [06]

OR

- b) What is 'co-precipitation'? Describe various types of co-precipitation processes giving suitable examples.
- Q.4 a) Derive equation of pH for a dibasic acid monosodium salt  $\text{NaHA}$  solution (aq). Calculate first equiv. point pH of titration-50 mL, 0.1 M acid  $\text{H}_2\text{A}$  solution (aq) Vs 0.1M  $\text{NaOH}$  solution (aq) [For acid,  $K_{a1}=1.0 \times 10^{-3}$  and  $K_{a2}=1.0 \times 10^{-6}$ ]. [06]
- b) What do you understand by very weak acids and bases? Derive an equation of pH for solution of aniline in water. [06]

OR

- b) State 'indicator pH range'. Some 50 mL of 0.05 F formic acid solution (aq) was titrated against 0.1F of  $\text{KOH}$  solution (aq). Calculate pH range, allowing titration error not more than  $\pm 0.05$  mL [use  $K_a = 1.74 \times 10^{-4}$ ].
- Q.5. a) Answer the following [06]
- i) Derive a balanced chemical reaction for redox system  $\text{MnO}_4^- + \text{VO}^{2+} \leftrightarrow \text{Mn}^{2+} + \text{V}(\text{OH})_4^{1+}$  in acidic medium.
- ii) Describe in brief FAJAN method.
- b) State 'formal potential'. Show how redox reaction  $2[\text{Fe}(\text{CN})_6]^{4-} + \text{I}_2 \leftrightarrow 2[\text{Fe}(\text{CN})_6]^{3-} + 2\text{I}^-$  will lead to erroneous conclusion when studied in a highly acidic condition [ $E^\circ_{[\text{Fe}(\text{CN})_6]^{3-}} = 0.36$  V and 0.71 V (in acidic condition),  $E^\circ_{\text{I}_2} = 0.54$  V]. [06]


OR

- b) Describe principle of precipitation titrations. Some 50 mL of 0.1M  $\text{NaI}$  solution (aq) was titrated against 0.1 M  $\text{AgNO}_3$  solution (aq). Derive titration curve 'pI Vs Volume of 0.1 M  $\text{AgNO}_3$  solution added' [ $K_{sp}(\text{AgI}(s))= 8.3 \times 10^{-17}$ ].
- Q.6 a) Some 50.0 mL of 0.005 M of  $\text{Ca}^{2+}$  solution (aq) was titrated against 0.01 M of EDTA ( $\text{H}_4\text{Y}$ ) solution (aq). Derive complexometry titration curve 'pCa Vs EDTA Volume' calculating pCa at least 0.05 mL before and after the equiv. point, and at the equiv. point of the titration [Consider  $K_f(\text{CaY}^{2-}) = 5.0 \times 10^{10}$ , and  $\alpha_4$  at pH 10 = 0.35]. [06]
- b) State masking and de-masking strategies, in complexometry. How will you determine metal ions  $\text{Zn}^{2+}$ ,  $\text{Pb}^{2+}$  and  $\text{Cu}^{2+}$  present in mixture by complexometry. Suggest the strategy. [06]

OR

- b) Discuss 'auxiliary reagent' and 'metallochromic indicators', describing their significant roles in the complexometry.

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

No. of Printed Pages: 02

[ ] SARDAR PATEL UNIVERSITY

M.Sc. Examination, Third Semester (CBCS)

Date: 01-11-2017

Wednesday,

Time: 2.00 p.m. to 5.00 p.m.

Subject: Spectroscopy-I Paper: PS03CANC01

[Total Marks: 70]

- N.B. (1) Figures to the right indicate full marks.  
(2) Attempt all questions.

/ PS03CINC01  
/ PS03CIPC01  
/ PS03CPHC01

**Q. 1** Select the correct answer from each of the following: (08)

- Which molecules show highest phosphorescence intensity?  
(a) Iodo Naphthalene (b) Chloro Naphthalene  
(c) Bromo Naphthalene (d) Fluoro Naphthalene
- The collision energy of the filler gas ions is utilized to vaporize atoms from the cathode surface in a process known as \_\_\_\_\_  
(a) Sputtering device (b) Electric arcs (c) Flame atomization (d) AC spark
- In tungsten electron gun, tungsten have work function of ;  
(a) 4.2 eV (b) 5.4 eV (c) 4.5 eV (d) 2.4 eV
- Which element does capable of show MNN auger effect?  
(a) Mn (b) Cd (c) Fe (d) Co
- What component is present in a simultaneous ICP-AES instrument but absent from a sequential ICP-AES:  
(a) a light dispersing element (b) a nebulizer  
(c) multiple detectors (d) a light source
- \_\_\_\_\_ measures the electrical conductance between the probe tip and the surface of sample.  
(a) SEM (b) STM (c) TEM (d) AFM
- In AES, an instrument is to be used as a high-sensitivity depth profile and a high lateral resolution microprobe, \_\_\_\_\_ electron guns may be required to realize the optimum use to each operating mode.  
(a) one (b) two (c) three (d) four
- Which of the following compound exhibit fluorescence?  
(a) Indole (b) Furan (c) Pyridine (d) None of all

**Q. 2** Answer the following: (Any Seven) (14)

- Explain how structural rigidity affects the fluorescence?
- Define the term "Work function" in electron spectroscopy.
- Draw the neat and labeled schematic diagram of SEM.
- Give a comparison of AES and XPS techniques.
- Explain recombination delayed fluorescence.

- [vi] Give basic principle of SEM.
- [vii] Why generally alkali metals are detected by flame photometry?
- [viii] Write sequence of events taking place in emission of photons from the sample (MX) in ICP?
- [ix] Define the Zeeman effect.
- 3 [a] Write the major advantages and limitations of FES and ICP. (6)
- [b] Answer the followings: (6)
- (i) Simultaneous multielement spectrometer used in ICP instrument.
- (ii) Calculate the observed frequency of the radiation emitted from a sodium atom in a vacuum if the atom is moving toward the detector at a velocity of  $8.00 \times 10^5$  m/s and if the wavelength of radiation emitted by Sodium with no motion is 588.995 nm. ( $C = 2.99795 \times 10^8$  m/s)
- OR**
- [b] Explain instrumentation of ICP-AES and applications of plasma emission spectroscopy. (6)
- 4 [a] Discuss the instrumentation of spectrofluorometer. (6)
- [b] Explain in detail on factors affecting on photoluminescence. (6)
- OR**
- [b] Write a note on Collisional deactivation and Collisional activation process. (6)
- 5 [a] Explain in brief on instrumentation of X-ray photoelectron spectroscopy (XPS). (6)
- OR**
- [a] Answer the following: (6)
- [i] Explain in brief on chemical shift in ESCA.
- [ii] Write a short note on Shake-up and Shake-off satellite peaks in XPS.
- [b] Discuss in detail on auger electron spectroscopy (AES). (6)
- 6 [a] Answer the following: (6)
- [i] Discuss types of electrons guns. Explain the advantages of field emission gun with their types.
- [ii] Differentiate AFM and SEM techniques.
- [b] Discuss the instrumentation of STM and describe the functions of components. (6)
- OR**
- [b] Explain various modes of operation in AFM. Enlists advantages and disadvantages of AFM. (6)

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No. of Printed pages: 3

SARDAR PATEL UNIVERSITY

M.Sc. (SEMESTER-III) EXAMINATION

2017

Tuesday, 07<sup>th</sup> November

2.00 p.m. to 5.00 p.m.

INORGANIC CHEMISTRY: PS03CINC03

(Organometallic compounds and complex equilibria)

TOTAL MARKS: 70

Note: Numbers at the right show full marks.

Q.1. Answer the followings:

[8]

1. Which one is an example of organometallic compound? [*n*Bu: *n*-butyl]

- (a)  $\text{Ti}(\text{O-}n\text{Bu})_4$ , (b)  $\text{Zr}(\text{O-}n\text{Bu})_4$ ,  
 (c)  $\text{Li-}n\text{Bu}$ , (d) All of these

2. Grignard reagents are stable in.

- (a) air, (b) ether,  
 (c) water, (d) alcohol

3. Hydroboration reactions involve \_\_\_\_\_ of hydro-/ organoboron reagents on C=C bond.

- (a) Nucleophilic addition, (b) Markovnikov addition,  
 (c) Anti-Markovnikov addition, (d) Markovnikov and Anti-Markovnikov addition

4. Wilkinson catalyst is employed in \_\_\_\_\_.

- (a) Hydrocyanation, (b) Hydrogenation of alkene,  
 (c) Carbonylation of alkyl halide, (d) Cross metathesis

5. \_\_\_\_\_ is a petro-fuel additive organometallic compound used as octane rating booster.

- (a) Ferrocene, (b) Tetraethyl lead,  
 (c) Zeise salt, (d) Dimethyl zinc

[P.T.O.]

6. \_\_\_\_\_ organometallic compounds are used as pesticides in agriculture.

- (a) Organotin, (b) Organozinc,  
(c) Organoaluminum, (c) Organopotassium

7. The  $C_A - [A]/C_M$  is known as \_\_\_\_\_; where  $C_A$  = total concentration of ligand in the solution,  $C_M$  = total concentration of metal ions in the solution and  $[A]$  = total concentration of free ligand in the solution at equilibrium.

- (a) Formation function ( $n$ ), (b) Degree of complex formation ( $\phi$ ),  
(c) Stability constant, (c) Fraction of complex formation ( $\alpha_c$ )

8. Among  $Fe^{2+}$ ,  $Co^{2+}$ ,  $Ni^{2+}$  and  $Cu^{2+}$  ions, \_\_\_\_\_ gives highly stable complex with ethylenediamine.

- (a)  $Fe^{2+}$ , (b)  $Co^{2+}$ ,  
(c),  $Ni^{2+}$ , (d)  $Cu^{2+}$

**Q.2. Answer any SEVEN of the followings:**

[14]

1. What are  $\pi$ -bonded organometallic compounds? Give examples.
2. Define oxymercuration-demercuration reactions?
3. Write a short note on bridged organometallic compounds.
4. Explain the hydroboration reactions with examples.
5. Discuss about the organomercury compounds of medicinal importance.
6. Write a short note on environmental methylation.
7. Write about the degree of complex formation ( $\phi$ ).
8. Define the stability constant giving an example?
9. Write the principle of Ion exchange method for determining stability constant.

**Q.3.A. Discuss the uses of Organoboranes in organic synthesis.**

[6]

**B. Discuss the general characteristics of the organometallic compounds.**

[6]

**Or**

**B. Discuss the classification of the organometallic compounds.**

[6]

[P.T.O.]



**Q.4.A.** Discuss the steps involved in catalysis by organometallic compounds giving a suitable example. [6]

**B.** Discuss the mechanism of Wacker process. [6]

**Or**

**B.** Discuss the mechanistic pathway of a polymerization reaction using Zeigler-Natta catalyst. [6]

**Q.5.A.** Write a short note on the use of the organometallic compounds as catalysts in various industrially important organic reactions. [6]

**B.** Discuss the applications of the organometallic compounds as medicines. [6]

**Or**

**B.** Discuss the applications of organometallic compounds in agriculture and horticulture. [6]

**Q.6.A.** Explain the factors affecting the stability constants of complexes. [6]

**B.** Discuss the solubility method for the determination of stability constant. [6]

**Or**

**B.** Discuss the relation between complex formation function ( $n$ ) and degree of complex formation ( $\phi$ ). [6]



[61]

**SARDAR PATEL UNIVERSITY**  
**M.Sc. Chemistry, (Semester III) Examination**  
**(Industrial Polymer Chemistry)**  
**Friday, 3<sup>rd</sup> November, 2017**  
**Time : 2:00pm to 5:00pm**

SC

**PS03CIPC02 : Manuf., Properties and Applications of Thermosets & Rubbers**

**Total Marks : 70**

**Note: Figures to the right indicate full marks.**

- Que.1** Give the appropriate answer of the following multi choice questions. [8]
- A.** Sunmica laminate is produced from \_\_\_\_\_.
- (i) Phenolics (ii) UF resin  
 (iii) Polyurethane (iv) MF resin.
- B.** Alkyd resins which contain less than 50 % oil are generally termed as
- (i) Short oil resin (ii) medium oil resin  
 (iii) long oil resin (iv) semi-drying oil resin
- C.** The Degree of unsaturation involved in the polyester is due to the-
- (i) Adipic acid (ii) Isophthalic anhydride  
 (iii) Phthalic anhydride (iv) Maleic anhydride.
- D.** What type of polymer can be considered as Novolac?
- (i) Branched (ii) Cross-linked  
 (iii) Linear (iv) (i)&(ii)
- E.** EPDM is \_\_\_\_\_.
- (i) Ethene-propyne copolymer (ii) styrene-butadiene copolymer  
 (iii) Ethylene-propylene copolymer (iv) non elastic polymer
- F.** Hypalon 45 means?
- (i) 24 % Cl<sub>2</sub> & 1 % S (ii) 24 % Cl<sub>2</sub> & 1.4 % S  
 (iii) 43 % Cl<sub>2</sub> & 1 % S (iv) 24 % Cl<sub>2</sub> & 1.1 % S
- G.** \_\_\_\_\_ are used for manufacture of tyres.
- (i) Low cis PB, high vinyl PB (ii) Low cis PB, low vinyl PB  
 (iii) High trans PB, low vinyl PB (iv) High cis PB, high vinyl PB
- H.** Antimony Sulphide gives \_\_\_\_\_ to the rubber product.
- (i) Red colour (ii) yellow colour  
 (iii) white colour (iv) crimson colour

**Que. 2** Answer of the following. (Any Seven). [14]

- i. Write the properties of flexible Polyurethane forms.
- ii. List the epoxy curing agent such as amines.
- iii. Differentiate between EPDM and EPM.
- iv. Write a note on Vulcanizing techniques.
- v. What are silicones? Write various products of silicon elastomers.
- vi. Write a note on poly (vinyl carbazole) polymer.
- vii. Give the examples of few synthetic substituted Phenols.
- viii. Write synthesis of Bisphenol-A and Epichlorohydrin
- ix. Write an applications and properties of Nitrile Rubber.

**Que. 3 (A)** What are the alkyd resins? Explain the type of alkyd resins. How are they prepared by the Fatty acid process? [6]

**(B)** Write a note on unsaturated Polyester resin. [6]

**OR**

**(B)** Write a note on Polyurethane forms and its applications.

**Que. 4 (A)** Resol are referred to as “one step” resins while Novolak referred as “two step” resins. Explain them briefly. [6]

**(B)** Describe the manufacturing process of Urea-Formaldehyde (UF) and Melamine-Formaldehyde (MF) resins. [6]

**OR**

**(B)** Describe the manufacturing process of commercial epoxy resin with reaction route.

**Que. 5 (A)** What is compounding and list the various agents which are added during compounding of the rubber, Explain them briefly. [6]

**(B)** Describe the manufacturing process of Polyisoprene Rubber with flow chart. [6]

**OR**

**(B) (i)** What is vulcanization? Write properties and applications of vulcanization rubber.

**(ii)** Write a note on Ribbed Smoked sheet.

**Que.6 (A)** Describe the manufacturing process of Neoprene Rubber with flow chart. [6]

**(B)** Write note on Thiokol Rubber. [6]

**OR**

**(B)** Discuss various grades of Hypalon.

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

No. of Printed Pages : 2 SC

SARDAR PATEL UNIVERSITY

M.Sc.-Chemistry III<sup>rd</sup> - Semester Examination(CBCS)

Date: 07/11/2017,

Tuesday

Industrial Polymer Chemistry(IPC)

02.00 pm -05.00 pm

Course:PS03CIPC07 :Polymer Structure and Properties-I

Total Marks: /70/

Note: Figures to the right indicates maximum marks.

QUE.1 Give the Answer of the following Multi Choice Question. 8

- a. Copolymerization occurs when \_\_\_\_\_.  
(i) more than one initiator is used (ii) more than two monomer used  
(iii) more than one catalyst is used (iv) more than one monomer is used
- b. Extensive cross-linking formed by \_\_\_\_\_ bonds.  
(i) secondary (ii) covalent (iii) anionic (iv) cationic
- c. In \_\_\_\_\_ polymers, sharp melting point causes difficulty in processing.  
(i) thermoset (ii) crystalline (iii) oriented (iv) amorphous.
- d. If a homogeneous polymer has narrow MWD, than  $M_w/M_n$  will be -  
(i) ~8-10 (ii) ~5-10 (iii) ~1.5-2 (iv) ~20-50.
- e. At lower temperature the monomer molecules are:  
(i) pack in to neat orderly crystalline arrangement.  
(ii) pack into amorphous and crystalline arrangement.  
(iii) pack in to random crystalline arrangement.  
(iv) pack in to neat orderly amorphous arrangement.
- f. The \_\_\_\_\_ ring in terephthalates produce high strength and high melting point.  
(i) o-phenylene, (ii) m-phenylene, (iii) both (a) and (b), (iv) p-phenylene
- g. The atom/molecule attached to \_\_\_\_\_ covalent bond can't rotate freely.  
(i) C-C (ii) C=C (iii) C≡C (iv) none of them
- h. The polycyclic structures such as diphenyl and naphthyl groups resonating in a \_\_\_\_\_ plane.  
(i) double (ii) triple (iii) single (iv) None of them.

QUE.2 Answer the following questions in short (Any Seven). 14

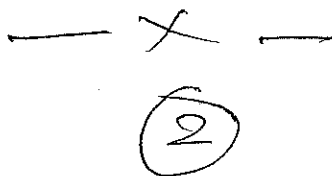
- i. Give the two examples of monomer having three functionality.
- ii. What is an inverse emulsion polymerization?
- iii. Enlist the various properties on which the molecular structure affects.
- iv. Write only the equations for the determination of  $\bar{M}_n$ ,  $\bar{M}_w$ ,  $\bar{M}_v$  and  $\bar{M}_z$ .
- v. Define amorphous, crystalline and oriented state of polymeric materials.
- vi. Draw the Zig-zag and Helical confirmation of isotactic vinyl polymers.
- vii. What will be the effect of chain branching upon crystallinity of PE.
- viii. Mention briefly the motion of a segment in a polymer chain while increasing the temperature.
- ix. How steric hindrance affects in polymers having longer alkyl groups?

1

(P.T.O)

- QUE.3** 12
- A. Name the different MW determination techniques based on colligative properties and describe vapour pressure osmometry.
- B. Differentiate and discuss the bulk and solution polymerization techniques.
- OR**
- B. Giving a neat sketch of a schematic diagram, describe the gel permeation chromatography as a method for determination of MW of polymers.
- QUE.4** 12
- A. Elaborate effects on molecular weight on thermal properties.
- B. Write a note on Conversion to High molecular weight of polymers during Processing.
- OR**
- B. Discuss the mechanical properties with respect to reversible rigidity.
- QUE.5** 12
- A. Write a short note on kinetic factors affecting rate and extent of crystallization.
- B. (i) Describe briefly the relationship between orientation and crystallization.  
(ii) Give the significance of mobility during orientation by explaining warm and wet stretching.
- OR**
- B. Explain the effect of orientation on following properties:  
(i) Mechanical.  
(ii) Thermal.
- QUE.6** 12
- A. Explain the effects of Double bond, Small rings and Resonance on main-chain structures for molecular flexibility.
- B. Write a note on restriction of rotation for Side-chain structure.
- OR**
- B. Explain the following structural features of frequent importance in molecular flexibility.  
(i) Polarity.  
(ii) Polyelectrolyte solutions.

\*\*\*



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

[687A-16]

No of printed pages: 03

SARDAR PATEL UNIVERSITY

M.Sc. Chemistry (III Semester Examination)

Wednesday, 1<sup>st</sup> November 2017

Spectroscopy-I (PS03CORC01)

N.B. 1) Figures to right indicates full marks

Total Marks: 70

2) Attempt all questions

Time : 2.00 pm to 5.00 pm

Q. 1 : Select the correct answer from each of the following.

[08]

- 1) In ESCA , the calibration of spectrophotometer is carried out by measuring kinetic energy of standard -----
  - a) Gold
  - b) Lithium
  - c) Iron
  - d) Nickel
- 2) The plasma sources operate at temperature-----<sup>o</sup>C
  - a) 4000
  - b) 7500
  - c) 5727
  - d) 5000
- 3) The standard used in fluorescence spectroscopy is ----- .
  - a) DSS
  - b) TMS
  - c) Acetanilide
  - d) Rhodamine
- 4) Which of the following compound shows maximum fluorescence quantum yield?
  - a) Benzene
  - b) Fluorene
  - c) Biphenyl
  - d) Cyclohexane
- 5) A high powered microscope that produces an image from scattered secondary electron is -----
  - a) SEM
  - b) STM
  - c) TEM
  - d) AFM
- 6) In AFM cantilever tip is made up of -----
  - a) Diamond
  - b) Graphite
  - c) Silicon nitride
  - d) Gold
- 7) In AAS, high concentration of gaseous atom causes ----- of absorption lines.
  - a) Sputtering
  - b) Splitting
  - c) Pressure broadening
  - d) Disappearance
- 8) In ESCA, chemical shift cannot be observed by following element.
  - a) Hydrogen
  - b) Helium
  - c) Sodium
  - d) a and b

**Q. 2: Answer the following short questions (Any 7)**

**[14]**

- 1) Give neat & labeled diagram of STM instrument.
- 2) Explain the term "Sensitized fluorescence".
- 3) Define Binding energy & work function in electron spectroscopy.
- 4) Why aniline gives fluorescence but nitrobenzene does not give fluorescence?
- 5) Write the sequence of events taking place in atomization of sample in flame atomizer (in AAS).
- 6) Explain the total consumption burner with diagram.
- 7) Describe the importance of surface analysis in science & technology.
- 8) Write a note on tunneling current.
- 9) Define : Photoelectric effect.

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

**[06]**

- i) Name the different sources of radiation used in atomic spectroscopy. Explain any one line source with diagram.
- ii) Write the major advantages and limitations of AAS.

**B) Discuss the principle & instrumentation of ICP – AES and write applications of plasma emission spectroscopy.**

**[06]**

**OR**

**B) Write a note on**

**[06]**

- 1) Doppler effect
- 2) Zeeman background correction

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

**[06]**

- i) Write a note on intersystem crossing and external conversion in molecular fluorescence process.
- ii) Discuss about quenching in photoluminescence.



**B) Discuss the various factors which are affecting fluorescence. [06]**

**OR**

**B) Answer the following questions. [06]**

i) Describe the advantages & limitations of spectrofluorometer.

ii) Write a note on chemiluminescence.

**Q.5. A) Give an account on instrumentation of ESCA. [06]**

**B) i) Discuss in brief on source used in auger electron spectroscopy (AES) and draw the schematic diagram of AES. [06]**

ii) Describe various applications of X-PES.

**OR**

**B) Answer the following questions. [06]**

i) Differentiate between ESCA & Auger electron spectroscopy (AES).

ii) Write a short note on detectors used in electron spectrophotometer.

**Q.6. A) Explain the instrumentation and mode of operation of scanning electron microscopy (SEM). [06]**

**B) Answer the following questions. [06]**

i) Differentiate AFM & STM techniques.

ii) Explain instrumentation of electron microprobe with labeled diagram .

**OR**

**B) Discuss in brief atomic force microscope (AFM). [06]**

\*\*\*\*\*



[147/A59]

Roll No. \_\_\_\_\_

No. of Printed Pages:03

SARDAR PATEL UNIVERSITY  
M.Sc. Chemistry (Third Semester) Examination  
Tuesday, 7<sup>th</sup> November 2017  
Heterocyclic Chemistry (PS03CORC03)

Time: 2:00 pm to 5:00 pm

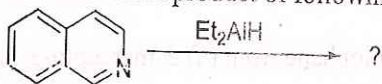
Total marks: 70

Note: (i) Figure to the right indicates Marks

(ii) Attempt all Questions

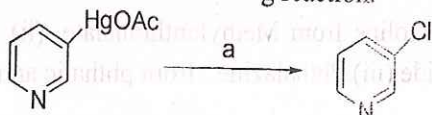
Que: 1 Choose the correct answer from the following multiple choice of questions [08]

- Which of the following compound is produced, when 3-methylbenzofuran react with  $K_2Cr_2O_7$  and Concentrated  $H_2SO_4$ ?  
(a) 2-Hydroxybenzoic acid (b) 3-hydroxybenzoic acid  
(c) 2-hydroxyacetophenone (d) 3-hydroxyacetophenone
- Which of the following products is obtained by Hantzsch reaction of Thioamide and  $\alpha$ -haloacetone?  
(a) Thiazole (b) Oxazole (c) 2,4-dimethylthiazole (d) 2,4-dimethyloxazole
- Which one of the following synthesis is not used for preparation of quinoline and its derivatives?  
(a) Dobner-Miller synthesis (b) Friedländer synthesis  
(c) Combe's synthesis (d) Passerini synthesis
- Choose the correct product of following reaction.



- (a)  (b)  (c)  (d) B & C both

5. Find correct 'a' in following reaction.



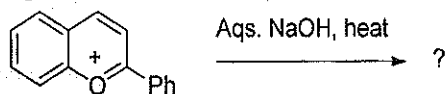
- (a)  $Cl_2$ , Pyridine,  $PdCl_2$  (b)  $Cl_2$ ,  $AlCl_3$ ,  $100^\circ C$   
(c)  $Cl_2$ , 60% oleum (d)  $NaCl$ ,  $180^\circ C$
- Resonance energy of Pyridine is ....  
(a) 27.9 K.cal/mole (b) 36.0 K.cal/mole  
(c) 46.9 K.cal/mole (d) 42.9 K.cal/mole
  - Which of the following oxygen containing heterocycles synthesized by Pechmann synthesis?  
(a) Chromone (b) Coumarin (c) Isocoumarin (d) Benzopyrylium
  - Which of the following carbon in 2-benzopyrylium is favorable for addition of azide?  
(a) C1 (b) C2 (c) C3 (d) C4

(P.T.O.)

**Que: 2 Answer the following (Any seven)**

[14]

- (i) Give synthesis of 2,3-dimethylindole by Fischer-Indole method.
- (ii) Draw the correct structure of following.
  - (a) 1,4,3-oxathiazine
  - (b) pyrrolo[1,5-a]pyrimidine.
- (iii) Give preparation of Ethyl red.
- (iv) Give the synthesis of 5-nitrophthalazine from 3-nitrophthalic acid.
- (v) Explain: structure and properties of Imidazole.
- (vi) Justify: 2-Hydroxypyridine is predominantly exist in keto form rather than enol.
- (vii) Explain: proton exchange reaction of 2, 4, 6-Triphenylpyrylium salt.
- (viii) Explain: reaction of 2-pyrone with (i)  $\text{HClO}_4$  (ii)  $\text{Me}_2\text{OBF}_4$ .
- (ix) Complete and rewrite the following reaction.



**Que: 3 (a)** Give the synthesis of indole derivatives via bischler method from aniline with  $\alpha$ -halo,  $\alpha$ -hydroxy &  $\alpha$ -arylamines ketones in presence of acid catalyst. Also brief the Grangberg Synthesis for tryptamine. [6]

**(b) Answer the following**

[6]

- (i) Give the reaction of benzofuran with (a) carbene (b) cycloaddition reaction (c) nucleophile.
- (ii) Give the synthesis of benzothiophene from (a) 2-mercapto-3-phenylacrylic acid (b) thiophenol.

**OR**

**(b)** Discuss the reactivity of 1,2-azoles and 1,3-azoles. Brief any two reactions of each. [6]

**Que: 4 (a)** Give the synthesis of (i) Cinnoline from Methylanthranilate, (ii) Quinazoline from Anthranilic acid and Acetamide (iii) Phthalazine from phthalic anhydride. [6]

**(b) Answer the following:**

[6]

- (i) Give the Bischler-Napieralski Synthesis of isoquinoline
- (ii) Give the oxidative products of benzodiazine and also provide the reaction of Quinoxaline with (i)  $\text{R-Mg-X}$  (ii)  $\text{HCN}$  (iii)  $\text{LiAlH}_4$

**OR**

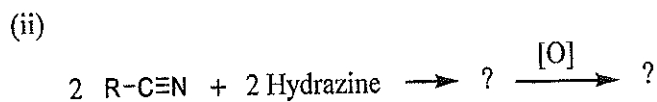
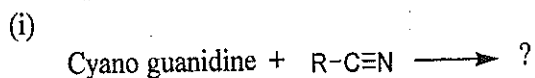
**(b)** Write the Reissert reaction of quinoline and isoquinoline and give their mechanism. [6]

**Que: 5 (a)** Explain: (i) Pyridine undergo nucleophilic aromatic substitution preferentially at C-2 and C-4. (ii) Important role of pyridine and its derivatives. [6]

(2)

(b) Complete the following reaction and give their mechanism:

[6]



OR

(b) Give quaternization and oxidation reactions of (i) pyridazine, pyrimidine and pyrazine. Also provide the reaction and mechanism of pyrimidine with hydrazine. [6]

Que: 6 (a) Describe any two reactions of each (i) Chromones (ii) Coumarins (iii) Isocoumarins. [6]

(b) Answer the following: [6]

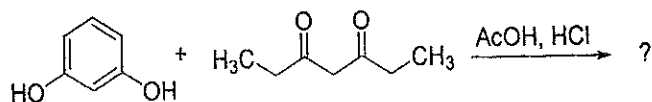
(i) Explain: Pyrylium cation gives nucleophilic substitution reaction easily but not electrophilic substitution reaction.

(ii) Discuss the reactivity of 2-pyrone and 4-pyrone.

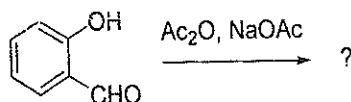
OR

(b) Complete the following reaction and give their mechanism [6]

(i)



(ii)



\*\*\*\*\* Best of Luck \*\*\*\*\*

3

.....

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

No of pages: 04

[62]

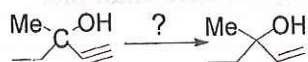
SARDAR PATEL UNIVERSITY  
M.Sc. (Organic Chemistry) Semester-III (CBCS) Examination  
Friday, 3<sup>rd</sup> November 2017  
PS03CORCO2: Organic Synthesis – A Disconnection Approach

Time: 2:00 pm to 05:00pm

Total Marks: 70

Q.1 Attempt following MCQs with the correct answer highlighted [08]

- i) Criteria of good disconnection include(s)  
(a) It gives stable molecules  
(b) It should have reasonable mechanism  
(c) It gives logical synthons  
(d) Above all
- ii) Synthetic equivalent KCN is used for which of the following the synthons?  
(a)  $\text{CH}_3^{\oplus}$  (b)  $\text{COOH}^{\ominus}$   
(c)  $\text{OH}^{\ominus}$  (d)  $\text{Ph}^{\ominus}$
- iii) Which of the following is used in olefin synthesis?  
(a) Wittig reaction (b) Wurtz reaction  
(c) Aldol Condensation (d) Mannich reaction
- iv) A reaction known for accessing  $\alpha, \beta$ -epoxy ester is  
(a) Aldol condensation (b) Michael reaction  
(c) Darzens condensation (d) Wittig reaction
- v) First re-connection concept is applicable to..  
(a) 2,3-diCO Compound (b) 5,6-diCO Compound  
(c) 3,4-diCO Compound (d) 1,6-diCO Compound
- vi) The THP derivative is used for the protection of...  
(a) Phenol (b) Carboxylic Acid  
(c) Alcohol (d) Ketone
- vii) Which of the following dihydroxylates olefin  
(a)  $\text{H}_2\text{O}_2$  (b)  $\text{OsO}_4$   
(c)  $\text{KMnO}_4$  (d)  $\text{SeO}_2$
- viii) Identify reaction condition

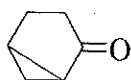


- (a)  $\text{H}_2\text{O}/\text{H}^+$  (b)  $\text{CrO}_3$   
(c)  $\text{H}_2/\text{Pd-C}$  (d) None of these

Q.2 Answer **any seven** of the following

[14]

- i) Define the term FGI with suitable examples.
- ii) Give significance of control and activation in organic synthesis, with suitable examples.
- iii) Give mechanism of Benzoin condensation.
- iv) Describe method to synthesize symmetrical 1, 2-diol, with suitable example.
- v) Illustrate the term 'illogical electrophile'.
- vi) Write about the protection of alcohol with example.
- vii) Use of sulphur ylide in preparation of epoxide.
- viii) Design the synthesis of compound below.

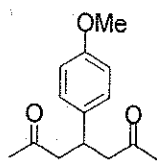


- ix) What do you understand by umpolung approach? Design the synthesis of following compound by this approach.

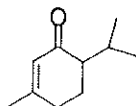


Q.3 a) Do the disconnection and plan the synthesis of target molecules below

[06]



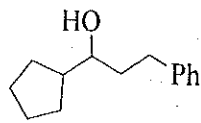
i)



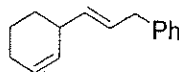
ii)

b) Disconnect the following target molecules and describe steps involved in their syntheses.

[06]



i)



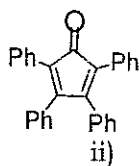
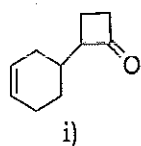
ii)

OR

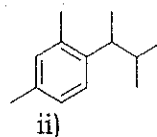
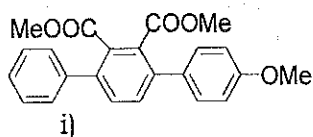
b) State the term acyloin condensation. Discuss the general reaction mechanism of acyloin condensation giving suitable example.



- Q.4 a)** Disconnect the target molecules shown below, and design their syntheses [06]

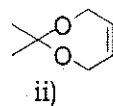
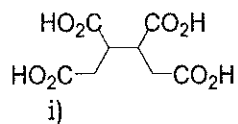


- b)** Design synthesis of following target molecules. [06]

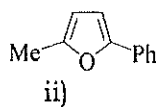
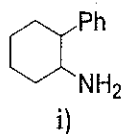


**OR**

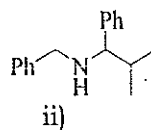
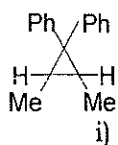
- b)** Do the disconnection and plan the synthesis for the following molecules.



- Q.5 a)** Do the disconnection and plan the synthesis for the following molecules. [06]

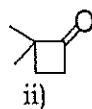
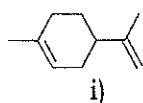


- b)** Do the disconnection and plan the synthesis for the following molecules. [06]



**OR**

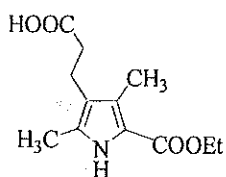
- b)** Do the disconnection and plan the synthesis for the following molecules.



- Q.6** a) Discuss the protection of acid functionality, aldehyde and ketone. [06]  
b) Answer the following [06]  
(i) Protection of amines by urethans and formation of phthalimides.  
(ii) Preparation of 1, 3-dithiane derivatives for synthesis of carbonyl group, giving suitable example.

**OR**

- b) Describe synthetic route to following pyrrole derivative—an intermediate in the synthesis of Mesoporphyrin IX.



\*\*\*\*

[63]

**Sardar Patel University**

M. Sc THIRD SEMESTER (Physical Chemistry) Examination – 2017

Friday, 3<sup>rd</sup> November 2017

2.00 p.m. to 5.00 p.m.

**PS03CPHC 02, Nuclear Chemistry**

- N. B. (i) Attempt all questions  
 (ii) Figures to the right indicate full marks  
 (iii)  $u = 1.6605 \times 10^{-27}$  kg,  $h = 6.6262 \times 10^{-34}$  J.s,  $1\text{eV} = 1.6022 \times 10^{-19}$  J  
 $m^1\text{H} = 1.0078$  u,  $m^2\text{H} = 2.0141$  u,  $m^3\text{H} = 3.0160$  u

8

**1. Multiple Choice Questions**

- (i) Which of the following condition facilitates symmetric fission ?  
 (a)  $Z^2/A \leq 18$  (b)  $Z^2/A \geq 18$  (c)  $Z^2/A^3 \geq 18$  (d)  $A^2/Z \leq 18$
- (ii)  ${}_{11}^{22}\text{Na} \rightarrow {}_{10}^{23}\text{Ne}$  is an example of  
 (a) negatron emission (b) positron emission (c) alpha – emission (d) beta – emission
- (iii) The reaction in which all the isotopes of hydrogen appears is:  
 (a) (d,p) (b) (p,n) (c) (n,p) (d) (p,d)
- (iv)  $E_b - E_f$  represents  
 (a) excitation energy (b) potential barrier (c) threshold energy (d) fission barrier
- (v) In carbon dating, the estimation is made for:  
 (a)  ${}^{14}\text{C}$  (b)  ${}^{12}\text{CO}_2$  (c)  ${}^{13}\text{CO}$  (d)  ${}^{12}\text{C}_2\text{H}_2$
- (vi) Suppose x is active and y is inactive, then the analysis belongs to  
 (a) IDA (b) IIDA (c) SSIDA (d) DA
- (vii) Confined time is given by  
 (a)  $T_C$  (b)  $\langle \sigma v \rangle$  (c)  $nT_C$  (d)  $n \langle \sigma v \rangle$
- (viii) Neutron activation analysis is based on:  
 (a) internal standard (b) standard addition (c) quantitation (d) calibration

14

**2. Attempt ANY SEVEN:**

- (i) How isotopes differ from isobars ?  
 (ii) Prove that  $1 \text{ Ci} = 3.7 \times 10^7 \text{ Bq}$   
 (iii) Enlist the changes in A and Z for (n, $\alpha$ ) and ( $\alpha$ ,n) reactions  
 (iv) Why nuclear fission yield is cumulative ?  
 (v) Show the Bethe notation for a reaction in which all the N isotopes are involved  
 (vi) Derive the unit for  $\Delta N$  given that  $\Delta N = N_0 (1 - \exp^{-\lambda t})$   
 (vii) Implosion controls the fusion reaction - briefly explain  
 (viii) Why solid state ionization detectors have exact energy resolution ?  
 (ix) Which of the bonds in  $\text{PCl}_5$  are shorter and why ?

- 3.(a) Show that 1 amu mass loss results into release of 931.2 MeV energy. 6
- (b) (i) Derive the relation and units for decay constant. 3
- (ii) How much would be the activity of  $1.15 \times 10^{-10}$  g of  $^{24}\text{Na}$  ( $t_{1/2} = 15$  h). 3

**OR**

- (b) (i) What are radiative capture reactions ? 3
- (ii) Calculate the de Broglie wave length for nitrogen nucleus given that it is in motion with 100 MeV of energy given. 3
4. (a) What is a fission parameter and how it is related to the ratio of  $Z^2 / A$  ? 6
- (b) (i) Show through a neat sketch how the fission yield curves change with the energy of projectiles. 3
- (ii) Enlist the fusion reactions of general importance. 3

**OR**

- (b) (i) What is a photo fission ? 3
- (ii) Establish that the  $E_{th}$  value for the reaction,  $^{14}\text{N} (\alpha, p) ^{17}\text{O}$  is -1.53 MeV given that its Q value is -1.19 MeV 3

5. (a) Consider the reaction  $^{90}\text{Sr} \xrightarrow[28.7\text{y}]{\beta^-} ^{90}\text{Y} \xrightarrow[64.1\text{h}]{\beta^-} \text{Zr (stable)}$  and derive that the total activity is equal to the double of the parent activity. 6
- (b) (i) Consider a reaction of no equilibria and show how the activities of parent, daughter and over all change. 3
- (ii) Prove with the tracer technique that oxidation occurs directly between the CO and Air in presence of  $\text{MnO}_2$  as catalyst. 3

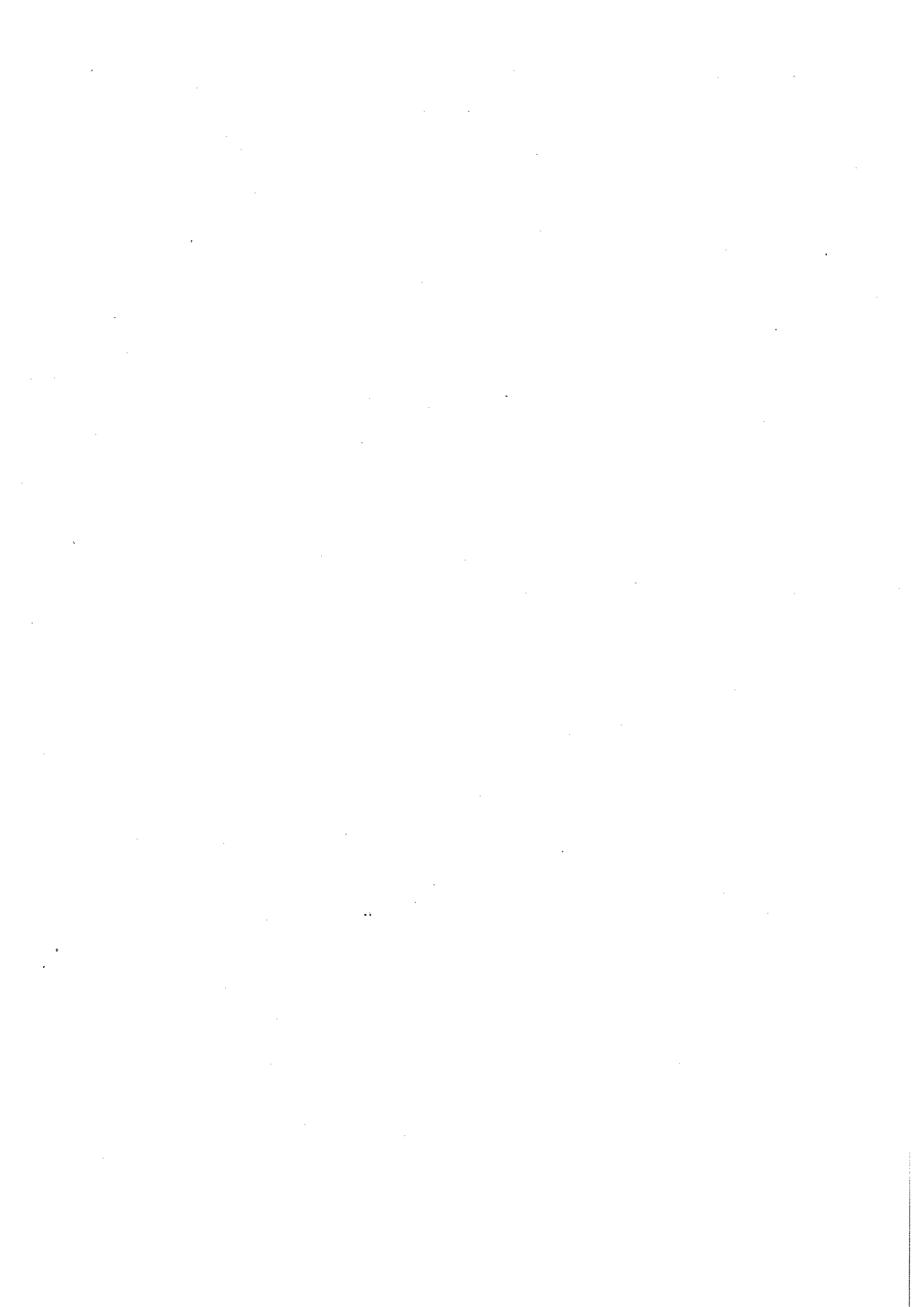
**OR**

- (b) Find the volume of blood in a patient, when one  $\text{cm}^3$  of blood is withdrawn, labeled with  $^{32}\text{P}$  and reinjected in to his body. After homogenization period, one  $\text{cm}^3$  of blood is again withdrawn and the sample showed a total activity of 500 net counts in 20 min and given that  $0.1 \text{ cm}^3$  of labeled blood before injection correspond to an activity of 14000 cpm. 6

6. (a) Give the basic principle of neutron activation analysis (NAA) and describe how this method can be used in analyzing the chromium content of Ruby sample ? 6
- (b) (i) How one can establish the As poisoning using NAA ? 3
- (ii) A wood sample weighing 10 g showed a  $^{14}\text{C}$  ( $t_{1/2} = 5730$  y) activity of 220 counts per 20 min. Find the age of the sample given the present day  $^{14}\text{C}$  activity in atm. is  $15.8 \text{ dm}^{-3}\text{g}^{-1}$  3

OR

- (b) Describe the basic principle and working of a gas flow proportional counter 6



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

[60]

No. of Printed Pages : 03

## Sardar Patel University

M. Sc THIRD SEMESTER (Physical Chemistry) Examination – 2017

Friday, 3<sup>rd</sup> November 2017

2.00 p.m. to 5.00 p.m.

### PS03CPHC 02, Nuclear Chemistry

- N. B. (i) Attempt all questions  
(ii) Figures to the right indicate full marks  
(iii)  $u = 1.6605 \times 10^{-27}$  kg,  $h = 6.6262 \times 10^{-34}$  J.s,  $1\text{eV} = 1.6022 \times 10^{-19}$  J  
 $m^1\text{H} = 1.0078$  u,  $m^2\text{H} = 2.0141$  u,  $m^3\text{H} = 3.0160$  u

8

#### 1. Multiple Choice Questions

- (i) Which of the following condition facilitates symmetric fission ?  
(a)  $Z^2/A \leq 18$  (b)  $Z^2/A \geq 18$  (c)  $Z^2/A^3 \geq 18$  (d)  $A^2/Z \leq 18$
- (ii)  ${}_{11}^{22}\text{Na} \rightarrow {}_{10}^{23}\text{Ne}$  is an example of  
(a) negatron emission (b) positron emission (c) alpha – emission (d) beta – emission
- (iii) The reaction in which all the isotopes of hydrogen appears is:  
(a) (d,p) (b) (p,n) (c) (n,p) (d) (p,d)
- (iv)  $E_b - E_f$  represents  
(a) excitation energy (b) potential barrier (c) threshold energy (d) fission barrier
- (v) In carbon dating, the estimation is made for:  
(a)  ${}^{14}\text{C}$  (b)  $\text{CO}_2$  (c)  $\text{CO}$  (d)  $\text{C}_2\text{H}_2$
- (vi) Suppose x is active and y is inactive, then the analysis belongs to  
(a) IDA (b) IIDA (c) SSIDA (d) DA
- (vii) Confined time is given by  
(a)  $T_c$  (b)  $\langle \sigma v \rangle$  (c)  $nT_c$  (d)  $n \langle \sigma v \rangle$
- (viii) Neutron activation analysis is based on:  
(a) internal standard (b) standard addition (c) quantitation (d) calibration

14

#### 2. Attempt ANY SEVEN:

- (i) How isotopes differ from isobars ?  
(ii) Prove that  $1\text{ Ci} = 3.7 \times 10^7$  Bq  
(iii) Enlist the changes in A and Z for (n, $\alpha$ ) and ( $\alpha$ ,n) reactions  
(iv) Why nuclear fission yield is cumulative ?  
(v) Show the Bethe notation for a reaction in which all the N isotopes are involved  
(vi) Derive the unit for  $\Delta N$  given that  $\Delta N = N_0 (1 - \exp^{-\lambda t})$   
(vii) Implosion controls the fusion reaction - briefly explain  
(viii) Why solid state ionization detectors have exact energy resolution ?  
(ix) Which of the bonds in  $\text{PCl}_5$  are shorter and why ?

2/3

- 3.(a) Show that 1 amu mass loss results into release of 931.2 MeV energy. 6
- (b) (i) Derive the relation and units for decay constant. 3
- (ii) How much would be the activity of  $1.15 \times 10^{-10}$  g of  $^{24}\text{Na}$  ( $t_{1/2} = 15$  h). 3

OR

- (b) (i) What are radiative capture reactions ? 3
- (ii) Calculate the de Broglie wave length for nitrogen nucleus given that it is in motion with 100 MeV of energy given. 3

- 4. (a) What is a fission parameter and how it is related to the ratio of  $Z^2 / A$  ? 6
- (b) (i) Show through a neat sketch how the fission yield curves change with the energy of projectiles. 3
- (ii) Enlist the fusion reactions of general importance. 3

OR

- (b) (i) What is a photo fission ? 3
- (ii) Establish that the  $E_{th}$  value for the reaction,  $^{14}\text{N}(\alpha, p)^{17}\text{O}$  is -1.53 MeV given that its Q value is -1.19 MeV 3

- 5. (a) Consider the reaction  $^{90}\text{Sr} \xrightarrow[28.1\text{y}]{\beta^-} ^{90}\text{Y} \xrightarrow[64.1\text{h}]{\beta^-} \text{Zr (stable)}$  and derive that the total activity is equal to the double of the parent activity. 6

- (b) (i) Consider a reaction of no equilibria and show how the activities of parent, daughter and over all change. 3
- (ii) Prove with the tracer technique that oxidation occurs directly between the CO and Air in presence of  $\text{MnO}_2$  as catalyst. 3

OR

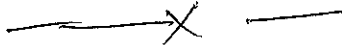
- (b) Find the volume of blood in a patient, when one  $\text{cm}^3$  of blood is withdrawn, labeled with  $^{32}\text{P}$  and reinjected in to his body. After homogenization period, one  $\text{cm}^3$  of blood is again withdrawn and the sample showed a total activity of 500 net counts in 20 min and given that 0,1  $\text{cm}^3$  of labeled blood before injection correspond to an activity of 14000 cpm. 6



6. (a) Give the basic principle of neutron activation analysis (NAA) and describe how this method can be used in analyzing the chromium content of Ruby sample? 6
- (b) (i) How one can establish the As poisoning using NAA? 3
- (ii) A wood sample weighing 10 g showed a  $^{14}\text{C}$  ( $t_{1/2} = 5730$  y) activity of 220 counts per 20 min. Find the age of the sample given the present day  $^{14}\text{C}$  activity in atm. is  $15.8 \text{ dm}^{-3} \text{ g}^{-1}$  3

OR

- (b) Describe the basic principle and working of a gas flow proportional counter 6





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

No. of printed pages : 03

[148]

**SARDAR PATEL UNIVERSITY**  
**M. Sc. (Semester – III) (CBCS) Examination**  
**Tuesday, 07<sup>th</sup> November 2017**  
**2:00 p.m. to 5:00 p.m.**

**PS03CPHC07 : SELECTED TOPICS IN PHYSICAL CHEMISTRY**

Total Marks : 70

Note : Figures to the right indicate full marks.

(Useful constants are,  $h = 6.63 \times 10^{-34}$  J.s,  $R = 1.987$  cal.K<sup>-1</sup> mol<sup>-1</sup>,  $k = 1.38 \times 10^{-23}$  J.K<sup>-1</sup>,  
 $k = 0.695$  cm<sup>-1</sup>,  $N = 6.023 \times 10^{23}$  mol<sup>-1</sup>)

**Q. 1 Select the correct answer from the alternatives given below to the each questions; (08)**

- [i] What current strength in amperes will require to liberate 20 gms of iodine from KI solution in one hour ? (ECE of iodine = 0.00131 g).
- (a) 4.2 amperes (b) 2.4 amperes  
(c) 1.2 amperes (d) 8.4 amperes
- [ii] Due to high \_\_\_\_\_ of water, it is capable to dissolve large number of salts.
- (a) surface tension (b) dielectric constant  
(c) density (d) refractive index
- [iii] Permutation of the word "DEMONETIZATION" is \_\_\_\_\_.
- (a)  $2.7 \times 10^5$  (b)  $2.7 \times 10^7$   
(c)  $2.7 \times 10^9$  (d)  $2.7 \times 10^{11}$
- [iv] Stirling approximation is more valid for \_\_\_\_\_ values of N.
- (a) zero (b) smaller  
(c) larger (d) negative
- [v] Boltzmann constant,  $k =$  \_\_\_\_\_.
- (a) RN (b) R/N  
(c) N/R (d) (RN)<sup>-1</sup>
- [vi] For antisymmetric wave function, which of the following condition is essential;
- (a) one particle will go in one quantum state  
(b) more than one particle will go in one quantum state  
(c) no particle will accommodate in one quantum state  
(d) none of the above
- [vii] Which of the following partition function is volume dependent,
- (a)  $Z_{rot}$  (b)  $Z_{vib}$  (c)  $Z_{trans}$  (d)  $Z_{ele}$
- [viii] Reflection not occurs through \_\_\_\_\_.
- (a) plane (b) mirror (c) two-fold axis (d) point

Conti..... 2

(P.T.O.)

Q.2 Answer the following in short; (ANY SEVEN) (14)

- [a] Enlist the factors affecting degree of dissociation for weak electrolytes.
- [b] What is anodization of metal? How it is useful to prevent corrosion of Al?
- [c] Justify "Partition function is dimension less quantity".
- [d] Derive,  $G = -NKT \ln Z/N$ .
- [e] Write about Glide Plane.
- [f] Explain  $2/m$  in symmetry (with appropriate figure).
- [g] Enlist rules for the formation of frequency distribution.
- [h] Define: Fermions, Bosons
- [i] Enlist steps to evaluate "Miller indices" from intercept along three axes.

Q.3 [a] Define Symmetry. Give classification of symmetry. Considering an example of cubic system, discuss various types of external symmetry. (06)

[b] Define proper rotation and improper rotation. With appropriate figure explain,  $\bar{1}, \bar{2}, \bar{3}, \bar{4}, \bar{6}$  and  $\bar{1}, \bar{2}, \bar{3}, \bar{4}, \bar{6}$ . Also tabulate the similarity between them. (06)

OR

[b] [i] Write a note on "axis which is a combination of Rotation followed by translational parallel to axis". (03)

[ii] Calculate the mean of 1, 2, 3, 4, .....17. (03)

Q.4 [a] [i] A sulfuric acid plant makes acid with a mean concentration of 60%. What is the maximum value of the standard deviation to assure that 99% or more of the acid has a concentration between 56% and 64%. (03)

[ii] Derive the following equation for Poisson distribution. (03)

$$P_r = \frac{\lambda^r e^{-\lambda}}{r!}$$

[b] [i] Determine k in equation,  $S = k \ln W$ . (03)

[ii] Show that average energy ( $\bar{\epsilon}$ ) of a single pure translator which is in thermal contact with large heat reservoir is equal to  $3/2 kT$ . (03)

OR

[b] [i] Show that mean of Binomial distribution is  $npq$ . (03)

[ii] The weight of tablets of soap have a mean value of 4 ounces and a standard deviation of 0.2 ounces. Assuming that weights are normally distributed and a tablet is chosen at random. Calculate the probability that has a weight between 3.55 and 3.85 ounces. (03)

Q.5 [a] [i] For a distribution with Symmetric wave function, derive relation; (03)

$$\frac{g_j + N_j}{N_j} = e^{+\alpha} e^{+\beta \epsilon_j}$$

[ii] Derive the relation,  $Z_{trans} = \left(\frac{2\pi m kT}{h^2}\right)^{3/2} \cdot V$  (03)

Conti....3

[ b ] [i] Calculate the translational quantum number ( $n$ ) for one dimension for a Nitrogen ( $N_2$ ) whose kinetic energy is  $\frac{1}{2} kT$  is contained in a box of side  $10^{-2}$  meter at 300 K. (Atomic mass of N = 14.00 g.mol $^{-1}$ ) (03)

[ii] According to Fermi-Dirac statistics, derive the relation for Entropy. (03)

OR

[ b ] [i] Calculate the value of the classical rotational function for carbon monoxide at 20 °C. The atomic masses are C = 12.00 g.mol $^{-1}$  and O = 16.00 g.mol $^{-1}$ . The internuclear distance,  $r = 1.1282 \text{ \AA}$ . (03)

[ii] Discuss the conditions under which all the three distributions namely Fermi-Dirac, Bose-Einstein and Maxwell-Boltzmann distributions are identical. (03)

Q.6 [ a ] What is fuel cell ? Explain various reactions occurring in hydrogen-oxygen fuel cells. Also discuss the role of electrolyte in fuel cell. (06)

[ b ] [i] Enlist various industrial applications of electrochemistry. Discuss electroplating in short. (03)

[ii] A current of 3 amperes passing through silver nitrate solution for 20 minutes deposit 4.0 gms of silver. What is the ECE (Electrochemical equivalent of silver)? (03)

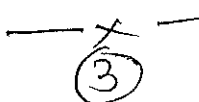
OR

[ b ] [i] Give limitations of Arrhenius Theory for dissociation. (03)

[ii] What is relaxation effect ? How it can be eliminated for an electrolyte. (03)

Proportion of the distribution lying to the right of  $u = u_1$  i.e.  $\frac{1}{\sqrt{2\pi}} \int_{u_1}^{\infty} e^{-u^2/2} du$ .

$u_1$	0	1	2	3	4	5	6	7	8	9
0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641
0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
2.3	.0107	.0104	.0102	.00990	.00964	.00939	.00914	.00889	.00866	.00842
2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139





(170)

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No of Printed Pages: 02

SARDAR PATEL UNIVERSITY

M.Sc. CHEMISTRY

Semester – III, External Examination

November 09, 2017 (Thursday)

Time: 2:00 pm - 05:00 pm

Synthetic Dyes and Pigments [PS03ECHE01]

N.B. Figures to the right indicate full marks

[Total Marks – 70]

Q.1 Answer the following multiple choice questions.

[08]

- 1 Dying of polyester is carried out by \_\_\_\_\_ in most of the cases.  
(a) Disperse dyes (b) Vat dyes (c) Biological dyes (d) Ingrain dyes
- 2 From the following \_\_\_\_\_ is natural dye.  
(a) Turmeric (b) azo (c) Nitroso (d) Anthraquinone
- 3 Nitrobenzene is \_\_\_\_\_.  
(a) An Auxochrome (b) A Chromophore (c) A Chromogen (d) A dye
- 4 \_\_\_\_\_ is used as a food colour from the following.  
(a) Indigo (b) Saframine T (c) Amaranth (d) NIR
- 5 DSC based on a \_\_\_\_\_ is formed between a photo-sensitized anode and an electrolyte, a photo electrochemical system.  
(a) Semiconductor (b) Electrodes (c) Insulators (d) Current
- 6 Security marks and features that are not visible under normal light are made with \_\_\_\_\_.  
(a) Fluorescein (b) Luminescent pigments (c) Special dyes (d) All of above
- 7 complimentary color of blue color is \_\_\_\_\_.  
(a) Red (b) yellow (c) orange (d) gray
- 8 ..... is not application of NIR dyes.  
(a) Biochemical assay (b) Photoreprographic  
(c) Color photocopy (d) Laser photocopy

Q.2 Answer the following questions. (ANY SEVEN)

[14]

- 1 Write a note on Auxochrome-Chromophore theory in brief.
- 2 Describe food colors.
- 3 Write a note on dye bleach process.
- 4 Write synthesis of indigo dye.
- 5 Write a note on Medicinal dyes.
- 6 Write a note on reactive dyes.
- 7 Explain Michler's hydrol is colorless but it's cation is blue.

(P.T.O)

①

- 8 Write structure of Turkey Red and Copper phthalocyanine pigment.  
9 Write synthesis of azoacetoacetanilide pigment.

**Q.3**

[A] Write classification of dyes on the basis of their mode of application. [06]

[B] Write Synthesis of ANY THREE from the following [06]

- 1 Pyrazolone azo
- 2 Aurin
- 3 Chrome Violet.
- 4 Congo Red.
- 5 Fluorescene.

**Q.4**

[A] Write different fastness properties which a good dye need to have and explain them in short. [06]

[B] Write a Brief Note on ANY TWO of the following. [06]

- 1 Explain dye forming process.
- 2 Explain block and screen printing.
- 3 Write a note on Hair dye.
- 4 Explain preparation of dye bath and fiber for dyeing.

**Q.5**

[A] What is Donor-Acceptor chromophore? Explain factors responsible for getting bathochromic shift in dyes containing donor-acceptor chromophores. [06]

[B] Explain the following: [06]

- (I) Liquid crystal dye      (II) Cyanine type chromophore

**OR**

[B] Answer the following [06]

- 1 Write general approach to achieve NIR dyes.
- 2 Explain Medicinal and Security application of colorants.

**Q.6**

[A] What is pigment? Write its classification, explain azo-pigment lake and lake of acids. [06]

[B] Write Synthesis of ANY THREE from the following [06]

- 1 Pilonil white
- 2 Tinopal BV
- 3 Iso indoline
- 4 Blankophore R
- 5 Di-keto pyrrolopyrroles

**BEST OF LUCK**



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(171) SEAT No. \_\_\_\_\_

No. of Printed Pages:02

### SARDAR PATEL UNIVERSITY

M.Sc. Semester-III: Analytical/Inorganic Chemistry, Examination(CBCS)

November-2017, Thursday, Date: 09.11.2017

Time: 02.00 p.m. to 05.00 p.m., Paper: PS03ECHE05

Subject: Separation Methods

Total Marks: 70

N.B.: i) The numbers of the marks carried by each question is indicated at the end of the question  
ii) Assume suitable data if considered necessary and indicate the same clearly.

**Q.1** Answer by highlighting the appropriate option [08]

- i) Which of the following is not example of mass sensitive detector?
 

a) FID	b) ECD
c) FPD	d) TCD
- ii) Paper chromatography is an example of \_\_\_\_\_ chromatography.
 

a) Adsorption	b) Partition
c) Normal phase	d) Reverse phase
- iii) Which of the following are not used as masking agents in solvent extraction process?
 

a) Cyanide	b) Citrate
c) EDTA	d) None
- iv) Which of the following is used as a detector in SFC over HPLC?
 

a) FID	b) TCD
c) ECD	d) None
- v) In normal phase chromatography, if polarity of mobile phase is increases the retention time is \_\_\_\_\_.
 

a) decreases	b) increases
c) unaffected	d) exponentially increases
- vi) Select the right option for Ion exchange chromatography
 

a) destructive	b) non-destructive
c) partly destructive	d) partly non-destructive
- vii) Which one of the following response to FID?
 

a) N <sub>2</sub>	b) CH <sub>4</sub>
c) H <sub>2</sub> S	d) NO <sub>x</sub>
- viii) Which of the following separation technique use for bio- molecules?
 

a) Ion exchange	b) Electrophoresis
c) GC	d) GC-MS

**Q.2** Attempt any SEVEN [14]

- i) Give the principle of column chromatography.
- ii) Discuss the normal and reverse phase chromatography.
- iii) Explain the importance feature of mobile phase in SFC.
- iv) What is the function of sample splitter?
- v) Calculate the HETP and number of plate for a 2.54 m column operated at a flow velocity 9.7 cms<sup>-1</sup>. If the A, B, and C are 0.037, 0.29 and 0.0093.
- vi) What are the important characteristic of an extractant?
- vii) Explain the term 'electro dialysis'.
- viii) Give the introductory note on SEC.
- ix) Discuss the Plate theory.

- Q.3 a) What is the principle of PC? Discuss various types of PC. [06]  
 b) State the principle of adsorption and partition chromatographic techniques. Discuss the factor affecting the column efficiency. [06]

OR

- b) How to prepare TLC plate? Explain spot detection & application of this technique.  
 Q.4 a) Discuss the quantitative treatment of solvent extraction equilibria. [06]  
 b) How SFC is complimentary to GC and HPLC? Draw schematic of SFC instrument and discuss its principle and working. [06]

OR

- b) Write a brief note on modes of extraction process and list out advantages of solvent extraction.  
 Q.5 a) Why earlier invented LC was not popular? Discuss the HPLC pumps. [06]  
 b) What type of information retrieve from Rate theory? How to find  $H_{min.}$  and  $u_{opt.}$  with the Van-Deemter equation? Discuss its consequence. [06]

OR

- b) Explain universal detector and compared it with FID.  
 Q.6 a) Explain various types of ion exchanger. Discuss in detail the applications of IEC. [06]  
 b) Answer the following [06]  
 i) Discuss the instrumentation of GPC.  
 ii) Some 1gm. dry resin equilibrates with 30 mL. 0.1 M  $Mg(NO_3)_2$ . After this equilibration, a 10 mL. aliquot of solution requires 2 mL. 0.011 M EDTA for titration. Calculate distribution co-efficient ( $K_D$ ).

OR

- b) Answer the following  
 i) Discuss gel electrophoresis and gradient gel electrophoresis.  
 ii) Discuss the capillary electrophoresis.

----- XXX -----

— x —  
 (2)

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

No. of Printed Pages: 03

**SARDAR PATEL UNIVERSITY**  
**M.Sc. Semester-III Examination (CBCS)**

**Subject: Mechanical and Electrical Properties of Polymers-I**

**Examination:** November-2017

**Max. Marks:** 70

**Day:** Thursday

**Date:** 09.11.2017

**Time:** 02:00 p.m. to 05:00 p.m.

**Paper Code:** PS03ECHE06

- N.B.:*
- Attempt all questions.
  - Figures to right indicate full marks.
  - Unless otherwise mentioned, symbols and notations have their usual standard meanings.
  - Neat sketches are to be drawn to illustrate answers, wherever required.
  - Assume suitable data, if necessary and indicate the same clearly.

- Q.1** The question i) to viii) contain Multiple Choice Questions (MCQ). Each MCQ question has up to four alternative responses marked a), b), c) and d). Out of which *only one* is the correct response. Please mark correct response i.e. a) / b) / c) / d). **[08]**
- Dimensions of strain are
    - [L]
    - [M] [L]<sup>-1</sup> [T]<sup>-2</sup>
    - [L]<sup>-1</sup>
    - It's a dimensionless quantity
  - Hooke's law states that
    - extension is inversely proportional to load when elastic limit is not exceeded
    - extension is proportional to load when elastic limit is not exceeded
    - extension is independent of load when elastic limit is not exceeded
    - load is dependent on extension
  - Tensile strain is equal to
    - Force per unit area
    - Force per unit volume
    - Extension per unit length
    - Force per unit length
  - Select the incorrect option from the following option.
    - Immiscible blends are usually opaque
    - Immiscible blends exhibit a single glass transition temperature (T<sub>g</sub>) intermediate between those of individual components
    - Miscible blends are usually clear
    - Immiscible blends exhibit separate T<sub>g</sub>'s characteristics of each component
  - Elastic deformation in polymers is due to \_\_\_\_\_
    - Slight adjust of molecular chains
    - Slippage of molecular chains
    - Straightening of molecular chains
    - Severe of Covalent bonds

(P.T.O.)

1

- vi) The advantage of using conducting polymers in place metals is their  
 a) Cost    b) Thermal conductivity  
 c) Solubility                                        d) Light-weight
- vii) Electrical conductivity of insulators falls within \_\_\_\_\_  
 a)  $10^{-10}(\Omega\text{-mm})^{-1}$                               b)  $10^{-10}(\Omega\text{-cm})^{-1}$   
 c)  $10^{-10}(\Omega\text{-m})^{-1}$                                 d)  $10^{-8}(\Omega\text{-m})^{-1}$
- viii) Fermi energy level for n-type extrinsic semiconductors lies  
 a) At middle of the band gap                    b) Close to conduction band  
 c) Close to valence band                        d) None

Q.2 Answer the following questions as directed (ANY SEVEN). [14]

- Define: Young Modulus (E) and Shear modulus (G)
- Discuss in brief: Actual molecular volume of the liquid molecules and Free volume.
- Define: Creep and Creep compliance  $J(t)$
- Write the limitations and successes of the Normal Mode Theories.
- Define: Occupied volume and the fractional free volume.
- Discuss in brief: Rearrangement time ( $\tau_r$ ) and Relaxation time ( $\tau$ )
- Write the effect of Main Chain Polarity on Glass Transitions.
- Define: Volume resistivity and Absolute permittivity of the material
- Discuss in brief: Poisson's ratio ( $\nu$ ) and Bulk Modulus (K)

Q.3 a) Discuss Components of Stress. Present component of stress in the form of Stress Tensor,  $\sigma_{ij}$ . [06]

b) What is Deformation ratio? Discuss Finite Strain Elasticity. Explain finite strain deformation by the deformation of a cube of unit dimensions in the undeformed state to the rectangular parallelepiped. [06]

OR

b) Write brief account on: Dielectric Breakdown. Discuss Von Hippel Theory of electric dielectric breakdown. [06]

Q.4 a) Derive the relation  $\left(\frac{\partial U}{\partial l}\right)_T = 0$  where U represents Internal Energy and l [06]

initial length and prove the statement "Elasticity arises entirely from changes in entropy".

b) Explain Linear viscoelastic behavior [06]

OR

b) Derive an expression:  $D = \epsilon_0 \epsilon E = \epsilon_0 E + P$  which applies at any point in an Isotropic medium. [06]

Q.5 a) Describe Kelvin model and derive the expression: [06]

$e = J\sigma [1 - \exp(-\frac{t}{\tau})]$  where J is the Spring compliance. Also write limitations of Kelvin model.

- b) i) What would be the trend of Glass Transition temperature for Polyvinyl *n*-butyl ether; Polyvinyl isobutyl ether and Polyvinyl *t*-butyl ether? [03]  
 ii) Why fall in shear modulus over the glass transition region for Polyvinyl fluoride and polychlorotrifluoroethylene (CClF-CF<sub>2</sub>)<sub>n</sub> at between one and two orders of magnitude and the change in modulus or loss factor with temperature or frequencies is much more gradual? [03]

OR

- Q.6 b) Write note on: Dielectric Constant of polar polymers. [06]  
 a) Derive the Williams-Landel-Ferry (WLF) Equation: [06]

$$\log \eta_T = \log \eta_T g + \frac{C_1^g (T - T_g)}{C_2^g (T - T_g)}$$

- b) Derive an expression for predicting relation spectra and time temperature-equivalence for amorphous polymers by using the Normal Mode Theories: [06]

$$\tau_p = \frac{n^2 l^2 \eta_0}{6\pi^2 p^2 kT}$$

Where  $\tau_p$  is the relaxation time of the  $p^{\text{th}}$  mode and  $\eta_0 = \eta/z$  is the friction coefficient per random link and  $nl^2$  the equilibrium mean-square separation of the chain ends.

OR

- b) Discuss Multi-Element Model. [06]

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

No. of Printed Pages: 03

**SARDAR PATEL UNIVERSITY****M.Sc. Semester-III Examination (CBCS)****Subject: Mechanical and Electrical Properties of Polymers-I****Examination:** November-2017**Max. Marks:** 70**Day:** Thursday**Date:** 09.11.2017**Time:** 02:00 p.m. to 05:00 p.m.**Paper Code:** PS03ECHE06

- N.B.:**
- i. Attempt all questions.
  - ii. Figures to right indicate full marks.
  - iii. Unless otherwise mentioned, symbols and notations have their usual standard meanings.
  - iv. Neat sketches are to be drawn to illustrate answers, wherever required.
  - v. Assume suitable data, if necessary and indicate the same clearly.

- Q.1** The question i) to viii) contain Multiple Choice Questions (MCQ). Each MCQ question has up to four alternative responses marked a), b), c) and d). Out of which *only one* is the correct response. Please mark correct response i.e. a) / b) / c) / d). [08]
- i) Dimensions of strain are
    - a) [L]
    - b)  $[M] [L]^{-1} [T]^{-2}$
    - c)  $[L]^{-1}$
    - d) It's a dimensionless quantity
  - ii) Hooke's law states that
    - a) extension is inversely proportional to load when elastic limit is not exceeded
    - b) extension is proportional to load when elastic limit is not exceeded
    - c) extension is independent of load when elastic limit is not exceeded
    - d) load is dependent on extension
  - iii) Tensile strain is equal to
    - a) Force per unit area
    - b) Force per unit volume
    - c) Extension per unit length
    - d) Force per unit length
  - iv) Select the incorrect option from the following option.
    - a) Immiscible blends are usually opaque
    - b) Immiscible blends exhibit a single glass transition temperature ( $T_g$ ) intermediate between those of individual components
    - c) Miscible blends are usually clear
    - d) Immiscible blends exhibit separate  $T_g$ 's characteristics of each component
  - v) Elastic deformation in polymers is due to \_\_\_\_\_
    - a) Slight adjust of molecular chains
    - b) Slippage of molecular chains
    - c) Straightening of molecular chains
    - d) Severe of Covalent bonds

(P.T.O.)

- vi) The advantage of using conducting polymers in place of metals is their
- a) Cost    b) Thermal conductivity
- c) Solubility    d) Light-weight
- vii) Electrical conductivity of insulators falls within \_\_\_\_\_.
- a)  $10^{-10}(\Omega\text{-mm})^{-1}$                                   b)  $10^{-10}(\Omega\text{-cm})^{-1}$
- c)  $10^{-10}(\Omega\text{-m})^{-1}$                                       d)  $10^{-8}(\Omega\text{-m})^{-1}$
- viii) Fermi energy level for n-type extrinsic semiconductors lies
- a) At middle of the band gap                      b) Close to conduction band
- c) Close to valence band                              d) None

**Q.2** Answer the following questions as directed (**ANY SEVEN**). [14]

- i) Define: Young Modulus (E) and Shear modulus (G)
- ii) Discuss in brief: Actual molecular volume of the liquid molecules and Free volume.
- iii) Define: Creep and Creep compliance  $J(t)$
- iv) Write the limitations and successes of the Normal Mode Theories.
- v) Define: Occupied volume and the fractional free volume.
- vi) Discuss in brief: Retardation time ( $\tau$ ) and Relaxation time ( $\tau$ )
- vii) Write the effect of Main Chain Polarity on Glass Transitions.
- viii) Define: Volume resistivity and Absolute permittivity of the material
- ix) Discuss in brief: Poisson's ratio ( $\nu$ ) and Bulk Modulus (K)

- Q.3** a) Discuss Components of Stress. Present component of stress in the form of Stress Tensor,  $\sigma_{ij}$ . [06]
- b) What is Deformation ratio? Discuss Finite Strain Elasticity. Explain finite strain deformation by the deformation of a cube of unit dimensions in the undeformed state to the rectangular parallelepiped. [06]

OR

- b) Write brief account on: Dielectric Breakdown. Discuss Von Hippel Theory of electric dielectric breakdown. [06]

- Q.4** a) Derive the relation:  $\left(\frac{\partial U}{\partial l}\right)_T = 0$  where U represents Internal Energy and  $l$  initial length and prove the statement "Elasticity arises entirely from changes in entropy". [06]

- b) Explain Linear viscoelastic behavior [06]

OR

- b) Derive an expression:  $D = \epsilon_0 \epsilon E = \epsilon_0 E + P$  which applies at any point in an Isotropic medium. [06]

- Q.5** a) Describe Kelvin model and derive the expression: [06]
- $e = J\sigma\left[1 - \exp\left(-\frac{t}{\tau}\right)\right]$  where J is the Spring compliance. Also write limitations of Kelvin model.



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