



**WEST BENGAL STATE UNIVERSITY**  
B.Sc. Honours 6th Semester Examination, 2022

**CEMADSE06T-CHEMISTRY (DSE3/4)**  
**POLYMER CHEMISTRY**

Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.*  
*Candidates should answer in their own words and adhere to the word limit as practicable.*  
*All symbols are of usual significance.*

**Answer any *three* questions taking *one* from each group**

**GROUP-A**

**(Unit 1, 2 and 3)**

1. (a) What is meant by constitutional repeating unit (CRU) of a polymer? Demonstrate, how it differs from repeating unit using polyethylene as an example. 1+2
  - (b) What is functionality factor? Assuming a value of 0.999 for  $p$  (extent of reaction), what would be the DP of a polyester prepared from equimolar quantities of difunctional reactants in the presence of 1.5 mol% of acetic acid? Let the mol% difunctional reactants both be 98.5. 1+3
- $$\left[ \text{Given, } DP = \frac{2}{2 - pf_{avg}} \right]$$
- (c) Differentiate between suspension polymerization and emulsion polymerization. 2
  - (d) Show that for cationic polymerization rate of propagation is proportional to the square of monomer concentration (if the termination occurs via simple dissociation of the macro carbocation gegenion complex). 4
2. (a) Explain, why nylon 6,6 has a higher melting temperature than nylon 6,10. What is meant by cohesive energy density of a polymer? 2+1
  - (b) Derive Carothers' expression relating average functionality, extent of reaction and degree of polymerization for polycondensation reaction carried out for a time period  $t$ . 3
  - (c) What is the role of inhibitor in free radical polymerization? The following are data for the polymerization of styrene in benzene at 60°C with benzoyl peroxide as the initiator.  $[M] = 3.34 \times 10^3 \text{ mol/m}^3$ ,  $[I] = 4.0 \text{ mol/m}^3$ ,  $k_p^2/k_t = 0.95 \times 10^{-6} \text{ m}^3/\text{mol-s}$ . If the spontaneous decomposition rate of benzoyl peroxide is  $3.2 \times 10^{-6} \text{ s}^{-1}$ , calculate the initial rate of polymerization. 3
  - (d) Show that for a self catalyzed polyesterification reaction of a glycol and a dicarboxylic acid (assume equimolar presence of two components) plot of  $1/(1-p)^2$  vs time is a straight line. [ $p$  is the extent of reaction]. 4

**GROUP-B**  
**(Unit 4, 5, 6 and 7)**

3. (a) Outline the factors on which the degree of crystallinity of a polymer depends. 2  
 (b) Explain, why atactic polystyrene is amorphous while the isotactic variety is semi crystalline. 2  
 (c) Schematically represent how specific volume changes at glass transition temperature ( $T_g$ ). Briefly describe, how the volume changes inside a polymer when the glass transition temperature is crossed. 2  
 (d) What do you mean by polydispersity index (PDI)? How PDI is significant in polymer study? 2  
 (e) The following data were obtained in the determination of average weight of a polymer, 4

Molecular weight	Weight (g)
80,000	1.0
50,000	3.0
30,000	5.0
10,000	6.0

Calculate, (i) Number average molecular weight  $M_n$  (ii) Weight average molecular weight  $M_w$  and (iii) Polydispersity index.

- (f) What is polymorphism? Name a polymer which exhibits polymorphism. 2
4. (a) Discuss in brief, the theory underlying the determination of viscosity average molar mass of a sample of polymer by measurement of viscosity. 3  
 (b) Discuss why polymers crystallize in a chain folded fashion rather than the thermodynamically preferred extended chain form. 3  
 (c) Osmotic pressure measurement of a polymer solutions at 27°C yielded a plot of  $\pi/C$  vs  $C$ , which on extrapolation to zero concentration gave an intercept with ordinate equal to  $3.47 \times 10^{-4}$  litre atmosphere/g. What is the molecular weight of the polymer? 3  
 (d) (i) What is the major difference between glassy state and molten state of a polymer? 1  
 (ii) Why is glass transition temperature,  $T_G$  referred as a second order transition? 2  
 (e) Explain, why insertion of rigid bulky groups, like aromatic rings in linear aliphatic polymer chains significantly enhance their physical properties. 2

**GROUP-C**  
**(Unit 8 and 9)**

5. (a) Using Flory-Huggins theory for polymer solution, deduce an expression for the entropy of mixing. 5  
 (b) Write short note on (any *two*): 3+3  
 (i) Polyacrylamide, (ii) Novalac resin, (iii) Poly (vinyl acetate)  
 (c) Describe the synthesis of polyaniline. 2

6. (a) What do you mean by Hildebrand solubility parameter ( $\delta$ )? Under what condition (with reference to  $\delta$ ) solubility becomes an entropy effect? 2
- (b) How the Flory-Huggins parameter ( $\chi_{12}$ ) is related to Hildebrand solubility parameters  $\delta_1$  and  $\delta_2$ ? 2
- (c) How can you prepare polyurethanes commercially? Explain, why the melting point of polyurethane is much less than that of the corresponding polyamide. 3
- (d) What are polycarbonates? How can you prepare a polycarbonate using bisphenol-A and diphenylcarbonate? 3
- (e) What do you mean by synthetic metal? Mention two conditions for a polymer to be conducting. 3

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**WEST BENGAL STATE UNIVERSITY**

B.Sc. Honours 6th Semester Examination, 2022

**CEMADSE05T-CHEMISTRY (DSE3/4)**

**INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**

Time Allotted: 2 Hours

Full Marks: 40

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Candidates should answer in their own words and adhere to the word limit as practicable.  
All symbols are of usual significance.*

**Answer any *three* questions taking *one* from each group**

**GROUP-A**

**(Unit 1 and 2)**

1. (a) What is CAN fertilizer? Write down its method of preparation, two properties and two uses. 1+2+2+2
- (b) Write down the structure and two uses of carbon fibres. 2+1
- (c) Give a brief description on coloured glass and photosensitive glass. 2+2
2. (a) What is mixed fertilizer? Write down its advantages. 1+2
- (b) Discuss about the three general properties of ceramics. 2
- (c) Write a short note on carbon nanotubes. 3
- (d) Write down the main ingredients of cement with their functions. 2+4

**GROUP-B**

**(Unit 3, 4 and 5)**

3. (a) What are the main objectives of coating surfaces? 3
- (b) Briefly describe the processes of eco-friendly and plastic paintings. 4
- (c) What are enamels and emulsifying agents? 4
- (d) Briefly describe the process metal spraying and anodizing. 3
- (e) What are the differences between water and oil paints? 2
4. (a) How will you define primary and secondary batteries? 4
- (b) Write down the working functions of fuel cell and solar cell. 4

- (c) What are ferrous and non-ferrous alloys? 4
- (d) Write down the composition and properties of different types of steel. 4

**GROUP-C**  
**(Unit 6 and 7)**

5. (a) Discuss the elementary steps for heterogeneous catalysis. 3
- (b) Negative catalysts are not catalysts — Comment. 2
- (c) Organic nitro-compounds are very often explosive in nature — Explain. 2
- (d) Give an example of secondary explosive. How is it prepared? 3
6. (a) Give an example of each of solid and liquid propellant. 2
- (b) Discuss the industrial applications of catalysts. 3
- (c) Discuss the preparation of lead azide. How is it stored? 3
- (d) What do you mean by deactivation of catalysts? 2

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**WEST BENGAL STATE UNIVERSITY**  
B.Sc. Programme 6th Semester Examination, 2022

**CEMGDSE03T-CHEMISTRY (DSE2)**

**INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**

Time Allotted: 2 Hours

Full Marks: 40

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*প্রান্তিক সীমার মধ্যস্থ সংখ্যাটি প্রশ্নের মান নির্দেশ করে।  
পরীক্ষার্থীরা নিজের ভাষায় যথাসম্ভব শব্দসীমার মধ্যে  
উত্তর দিতে হবে। সমস্ত প্রতীক স্বাভাবিক তাৎপর্যপূর্ণ।*

**Answer any three questions taking one from each Group**

প্রতি গ্রুপ থেকে একটি করে প্রশ্ন নিয়ে যে-কোনো তিনটি প্রশ্নের উত্তর দাও

**GROUP-A**  
**(Unit- 1 & 2)**

1. (a) What is photosensitive glass? Mention its use. 2  
ফোটোসেনসিটিভ গ্লাস কি? এর ব্যবহার লেখো।
- (b) How will you differ silicate glass from non-silicate glass? 2  
নন-সিলিকেট গ্লাস থেকে সিলিকেট গ্লাস কিভাবে পার্থক্য করবে?
- (c) Write a short note on fullerene. 3  
ফুলারিনের সংক্ষিপ্ত টীকা লেখো।
- (d) What is feldspar? 2  
ফেল্ডস্পার কি?
- (e) How calcium ammonium nitrate is prepared? What is calcium ammonium nitrate is used for? 3  
ক্যালসিয়াম অ্যামোনিয়াম নাইট্রেট কিভাবে প্রস্তুত করা হয়? ক্যালসিয়াম অ্যামোনিয়াম নাইট্রেট কি কাজে ব্যবহৃত হয়?
- (f) What is setting of cement? Write the flow chart of the production of cement. 4  
সেটিং অফ্ সিমেন্ট কি? সিমেন্ট উৎপাদনের রেখাচিত্রটি লেখো।
2. (a) What is superphosphate? What does superphosphate do to the soil? Write a short note on chemical fertilizer. 1+1+3  
সুপার ফসফেট কি? সুপার ফসফেট মাটিতে দিলে কি হয়? রাসায়নিক সারের উপর সংক্ষিপ্ত টীকা লেখো।
- (b) How is coloured glass obtained? Name the compounds for manufacturing red and green coloured glass. 1+1+1  
রঙীন কাঁচ কিভাবে পাওয়া যায়? লাল ও সবুজ কাঁচ তৈরীতে ব্যবহৃত যৌগ দুটির নাম লেখো।

- (c) What is the role of gypsum in cement? What is slag cement? Write its use. 2+1+1  
সিমেন্টে জিপসামের ভূমিকা কি ? স্ল্যাগ সিমেন্ট কি ? ইহার ব্যবহার লেখো।
- (d) What is high technology ceramic? What are the main applications of these ceramics? 2+2  
High technology সেরামিক কি ? এই সেরামিকের মুখ্য প্রয়োগ লেখো।

**GROUP-B**  
**(Unit- 3, 4 & 5)**

3. (a) What is the function of pigment extenders or fillers? 2  
রঙে ফিলারের ভূমিকা কি ?
- (b) Write down the main components of oil varnish. 2  
ভার্ণিশের মুখ্য উপাদানগুলি লেখো।
- (c) What are the benefits of using Li ion battery in electronic devices? 2  
ইলেক্ট্রনিক যন্ত্রে লিথিয়াম আয়ন তড়িৎ কোষ ব্যবহারের উপযোগিতা বিবৃত করো।
- (d) What is the composition of Stainless steel? Write down the uses of Stainless steel. 2+2  
স্টেইনলেস স্টিলের উপাদানগুলি কি কি ? স্টেইনলেস স্টিলের ব্যবহার লেখো।
- (e) Mention the characteristic composition and application of carbon steel and alloy steel. 2+2  
কার্বন ইস্পাত এবং সংকর ইস্পাতের গঠন এবং ব্যবহারিক প্রয়োগ বিবৃত করো।
- (f) Briefly describe the process of metal spraying. 2  
ধাতু স্প্রে করার প্রক্রিয়া সংক্ষেপে বর্ণনা করো।
4. (a) What is the function of a binder in a paint? 2  
রঙে বন্ধনকারকের ভূমিকা কি ?
- (b) What do you mean by vehicle in paint? Explain with a suitable example. 2+2  
রঞ্জকের বাহক বলতে কি বোঝো ? উপযুক্ত উদাহরণসহ ব্যাখ্যা করো।
- (c) Write down the working functions of fuel cell. 2  
জ্বালানি কোষের কার্যপদ্ধতি বর্ণনা করো।
- (d) What is a toner? 2  
টোনার বলতে কি বোঝো ?
- (e) What is solid state electrolyte battery? Give one use of it. 3  
কঠিন তড়িৎবিশ্লেষ্য কোষ বলতে কি বোঝো ? এর একটি ব্যবহার উল্লেখ করো।
- (f) What are ferrous and non-ferrous alloys? 3  
ফেরাস এবং নন-ফেরাস সংকর ধাতু কাকে বলে ?

**GROUP-C**  
**(Unit- 6 & 7)**

5. (a) Write down the full name, structural formula and preparation of PETN. What type of explosive is it? 4  
PETN-এর সম্পূর্ণ নাম, গঠন সংকেত ও প্রস্তুতি লেখো। এটি কোন্ ধরনের বিস্ফোরক ?
- (b) What is catalyst? Give one example of heterogeneous catalyst and describe its use in Industrial preparation. 4  
অনুঘটক কি ? একটি অসমসত্ত্ব অনুঘটকের উদাহরণ দাও এবং শিল্পোৎপাদনে এর ব্যবহার বর্ণনা করো।
6. (a) Describe the preparation with reaction and harmful effects of RDX. 4  
RDX-এর বিক্রিয়া সহ প্রস্তুতি ও ক্ষতিকারক প্রভাব সম্বন্ধে আলোচনা করো।
- (b) Which catalyst is used in contact process to prepare sulphuric acid? Describe the steps for the synthesis of it in this process. 4  
কন্টাক্ট পদ্ধতিতে সালফিউরিক অ্যাসিড উৎপাদনের ক্ষেত্রে কোন্ অনুঘটক ব্যবহার করা হয় ? এই পদ্ধতিতে সালফিউরিক অ্যাসিড উৎপাদনের বিভিন্ন ধাপগুলি বর্ণনা করো।

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**WEST BENGAL STATE UNIVERSITY**  
B.Sc. Honours 6th Semester Examination, 2022

**CEMADSE04T-CHEMISTRY (DSE3/4)**

**GREEN CHEMISTRY**

Time Allotted: 2 Hours

Full Marks: 40

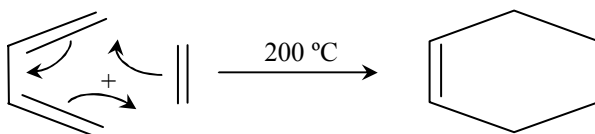
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**Answer any *three* questions taking *one* from each Group**

**GROUP-A**

**(Unit 1 & 2)**

1. (a) What is the main objective of green chemistry? Why catalytic reagents are preferred over stoichiometric reagents? 2+2
- (b) Calculate Atom Economy of the following reaction. 2



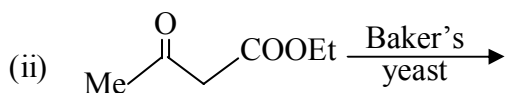
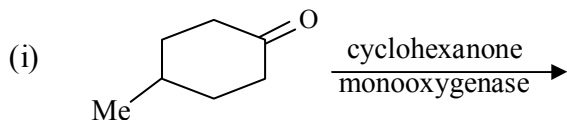
- (c) What are the basic differences between microwave heating and conventional heating? 3
- (d) Why the use of blocking reagents is not preferred in green chemistry? 2
- (e) What is CED (Cohesive Energy Density)? How do the Hydrophobic effect and Hydrogen bonding help to explain the organic reactions in water? 2+4
- (f) Define Fluorous Biphasic Solvent with example. What is asymmetric catalysis? 3+2
2. (a) Write any three Principles of Green Chemistry. 3
- (b) Calculate Atom Economy of the following reaction: 2
- $$\text{MeCH}_2\text{CH}_2\text{OH} + \text{H}_2\text{SO}_4 = \text{MeCH} = \text{CH}_2 + \text{H}_2\text{O}$$
- (c) Write short notes on the following: 3×3
- (i) Homogeneous and Heterogeneous catalyst
  - (ii) Solventless Process
  - (iii) Supercritical CO<sub>2</sub> as Green Solvent
- (d) What is the meaning of ISD? Explain with examples. 2+2
- (e) How does Ionic Liquid facilitate transition metal catalyzed reaction? 2
- (f) What is Sonochemistry?

**GROUP-B****(Unit 3)**

3. (a) Write the names of two natural polymers. Write their chemical constitution. 2+2  
 (b) Describe the synthesis of Iminodiacetic acid (IDA) developed by Monsanto agricultural company. 3  
 (c) What are the advantages of CO<sub>2</sub> cleaning? 3
4. (a) Write short notes on: 3×2 = 6  
 (i) Biofuels  
 (ii) Green Synthesis of Catechol.  
 (b) What are the differences between pigments and dye? 4

**GROUP-C****(Unit 4)**

5. (a) Mention the advantage(s) of enzyme catalyst. 2  
 (b) Define the term Bio mimetic with suitable example. 3  
 (c) Identify the products in the following reactions.  $1\frac{1}{2} \times 2 = 3$



6. (a) What are Multifunctional Reagents? Give Example of two organic reactions using Multifunctional Reagents. 2+2  
 (b) What is the role of oxidation catalyst in Green Chemistry? 2  
 (c) How Green Chemistry helps in sustainable development? 2

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**WEST BENGAL STATE UNIVERSITY**  
B.Sc. Honours 6th Semester Examination, 2022

**CEMACOR13T-CHEMISTRY (CC13)**

**INORGANIC CHEMISTRY-V**

Time Allotted: 2 Hours

Full Marks: 40

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**Answer any three questions taking one from each unit**

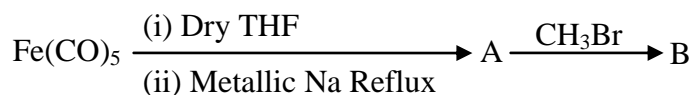
**Unit-I**

1. (a) Name one zinc containing metallo-enzyme and explain its biological function. 1+3
  - (b) What is biological nitrogen fixation? Explain. 3
  - (c) What are the biological functions of the following? 3
    - (i) Myoglobin and
    - (ii) Ferridoxin.
  - (d) Indicate the oxidation state of copper ions in deoxy- and oxy-hemocyanin. What is the oxidation state of O<sub>2</sub> ligand in oxyhemocyanin? 1+1+1
  - (e) How can you differentiate oxygen carrier and oxygen transport proteins? Explain with examples. 3
2. (a) What difference is noted in the binding of oxygen to hemoglobin and hemerythrin? 4
  - (b) Discuss the role of PS-I and PS-II in photosynthesis. Name an electron transport protein involved in the process. 4+1
  - (c) Name two toxic elements and describe their toxic effects. 4
  - (d) What is *cis*-Platin? State its medicinal use. Why is *trans*-isomer not active as a medicine? 3

**Unit-II**

3. (a) What do you mean by hapticity? Cite examples of mono-, tri- and penta haptic cyclopentadienyl complexes. 1+3
- (b) Giving examples explain the different coordination modes of NO. 3
- (c) Discuss the mechanistic steps in Wacker process of oxidation of olefins. 3

- (d) Identify A and B with explanation: 3



- (e) Define with example, oxidative addition reaction. What type of compounds generally undergo this type of reaction? 1+2

4. (a) Illustrate with example that isocyanide stabilize higher oxidation state. 2

- (b) Using 18-electron rule, establish the structure of  $\text{Os}_3(\text{CO})_{12}$  and  $\text{Co}_4(\text{CO})_{12}$ . 4

- (c) Write a method of preparation of ferrocene and give the product of the reaction: 4



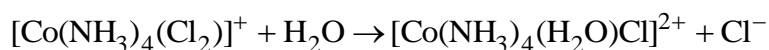
- (d) What is meant by 'hydroformylation' reaction? 2

- (e) Name and describe the catalyst in homogeneous hydrogenation of alkene. How is it different from Ziegler-Natta catalyst? 4

### Unit-III

5. (a) State two factors affecting rate of substitution reaction. 2

- (b) Elucidate the mechanism of the following substitution reaction: 2+2



Explain the effect of charge on the complex.

- (c) Differentiate between labile and inert complex. 2

6. (a) Write down the products (with reaction steps) when the *cis*- and *trans*-isomers of  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$  react with excess thiourea (tu). Explain the reaction with the help of *trans*-effect. 4

- (b) Explain the *trans*-effect phenomenon by polarization theory with example. 2

- (c) Explain the term CFAE and its importance. 2

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## WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 6th Semester Examination, 2022

### CEMACOR14T-CHEMISTRY (CC14)

#### PHYSICAL CHEMISTRY-IV

Time Allotted: 2 Hours

Full Marks: 40

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**Answer any *three* questions taking *one* from each unit**

#### UNIT-I

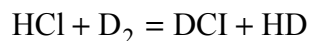
1. (a) Terms having their usual meanings, show that for a diatomic molecule the quantum number ( $J_{\max}$ ) of the rotational energy level with maximum population of molecules is given by the expression. 3

$$J_{\max} = \sqrt{(kT/2Bhc)} - \frac{1}{2}$$

- (b) Given that the spacing of lines in the microwave spectrum of  $^{35}\text{Cl}^{19}\text{F}$  is constant at  $1.033 \text{ cm}^{-1}$ , calculate the moment of inertia and bond length of the molecule ( $m(^{35}\text{Cl}) = 34.9688 \text{ u}$ ,  $m(^{19}\text{F}) = 18.9984 \text{ u}$ ). 3

- (c) What do you mean by Rayleigh, Stokes and anti-Stokes lines in a Raman spectrum? How do the characteristics of a Raman spectrum depend on (i) the nature of substance and (ii) the wave length of the radiation? 4

- (d) Vibrational wave number of HCl, DCl,  $\text{D}_2$  and HD at their  $\nu = 0$  vibrational states are 2885, 1990, 2990 and  $3627 \text{ cm}^{-1}$  respectively. Calculate the energy change (in  $\text{kJ mol}^{-1}$ ) associated with the following reaction and indicate whether the reaction is exothermic or endothermic. 4



2. (a) In a roto-vibrational spectra, a Q-band is usually absent, Why? What is the line spacing between the 1<sup>st</sup> P and R line of the roto-vibrational spectra? What will be the relative intensities of these two lines for  $^1\text{H}^{19}\text{F}$  at  $20^\circ\text{C}$  with bond distance  $2.9 \times 10^{-9} \text{ m}$ ? 1+1+4

- (b) What is the nomenclature of the Raman lines obtained at higher wavelength than the incident frequency? The intensity of such lines are more than that of the lower wavelength lines. Justify / criticize the statement. In rotational Raman spectra the line spacing between the 1<sup>st</sup> lines of the O and S bands is given as  $154 \text{ \AA}$ . What is the value of the rotational constant (B)? 1+2+2

- (c) Write the expression for the nuclear magneton and hence derive its SI unit. Calculate the magnetic field needed to satisfy the resonance condition for unshielded proton in a 150MHz radiofrequency field. 3

### UNIT-II

3. (a) State and explain Stark-Einstein law of photochemical equivalence. Is this law always valid for very high intensity LASER radiation? Give reasons for your answer. 4
- (b) Why are low temperature and viscous medium suitable for high intensity phosphorescence? 2
- (c) Rate of formation of CO due to photodecomposition of propionaldehyde with radiation of wavelength 3025 Å is  $2.05 \times 10^{-9}$  mol. s<sup>-1</sup>. If the intensity of the incident radiation is 1500 erg s<sup>-1</sup>, find the quantum yield. 3
- (d) What do you mean by 'photosensitized reactions'? Give example of one such reaction that is useful to living system.  $1\frac{1}{2} + 1\frac{1}{2} = 3$
4. (a) A dye solution (0.01 g/cc) absorbs 40% of blue light in a cell of thickness 1 cm. What would be the concentration to ensure 90% absorption in the same cell? 3
- (b) Plot I<sub>a</sub> (Intensity of absorbed light) vs. Concentration of the solution and explain the nature of the curve. 3
- (c) Define Einstein. At 500 nm the energy absorbed by a sample is 60 W. How many photons does the sample absorb in 1 min? 1+2
- (d) Explain pre-dissociation with a properly labelled potential energy diagram. 3

### UNIT-III

5. (a) "Unimolecular process are always not first order" — Justify the statement using Lindemann mechanism. 2
- (b) Explain the following: 2+2
- (i) Adsorption is accompanied by decrease in enthalpy and entropy of system.
- (ii) Easily liquefiable gases are adsorbed to a large extent.
- (c) Show that when a diatomic gas gets adsorbed as atoms on the surface of solid, the Langmuir adsorption isotherm becomes 3
- $$\theta = \frac{\sqrt{K_p}}{1 + \sqrt{K_p}}$$
- where the symbols have their usual meanings.
- (d) What will be the pressure inside a soap bubble of radius 0.1 mm kept in air? [Given surface tension of soap water is 150 dynes/cm and atmospheric pressure is 76 mm of Hg]. 3
- (e) At 0°C and at a pressure of 1 atm only 0.20 fraction of the surface of a finely divided nonporous solid was covered by CO. Find out ΔG° of the adsorption process at 0°C. 2

6. (a) Electroosmosis is a consequence of existence of electrical double layer at the solid-liquid interface — Justify. 2
- (b) “Adsorption of a gas on solid is exothermic” — Justify or criticize. 2
- (c) Define with an example, a lyophilic colloid. How many such a colloid help in stabilizing a lyophobic colloid like a *gold sol*? Explain what do you mean by the term ‘gold number’. 3
- (d) Why do electrolytes increase the surface tension of a liquid? Explain, with the help of Gibbs adsorption isotherm. 2
- (e) Find the change in surface energy when two identical Hg droplets of diameter 2 mm merged isothermally to form one drop [Surface tension of Hg is 490 dynes  $\text{cm}^{-1}$  at that temperature] 3
- (f) For a soap solution  $\gamma = \gamma_0 - bc$ . Derive the corresponding equation of state of the adsorbed film by assuming Gibbs adsorption isotherm. 2

**N.B. :** *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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