PG (CBCS) EVEN SEMESTER EXAMINATION, 2023

CHEMISTRY

4th Semester

Course No. : CHMCC - 402

(Chemistry of Advanced Materials)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

(Answer five questions, selecting one from each unit)

UNIT-I

1. (a) What are nanomaterials? How nano gold differ from bulk gold (Au)? Account the effect ofquantum confinement and surface-to-volumeratio (Size effects) in nanoparticle properties. 1+2+4=7

   (b) Describe the classification of nanomaterials based on their dimensionality. Show the density of states (DOS) as a function of dimensionality. 5

   (c) Describe synthetic strategies to nanomaterials using chemical vapour deposition (CVD). 5

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2. (a) Give the schematic diagram for the synthesis of gold nanoparticles using chemical reductionmethod and explain. 4

(b) Why lithium is commonly used in rechargeable battery? Explain the working principle of lithium-ion battery (LIB), their charging and discharging process. Write the advantages of nanomaterials in LIB. 2+4+2 = 8

(c) Mention the environmental remediation by nanoparticles. 2

UNIT-II

3. (a) Delineate the progression of the three generations of photosensitisers (PSs), along with structures, that have been employed for the treatment of cancers under photodynamic therapy (PDT). Provide the deficiencies of the first and second generations of PSs. 6 +2 = 8

(b)Define combinatorial therapy? Explain how PDT along with chemotherapy can be achieved by citing an example. What are the advantages of combinatorial therapy? 1 + 1 + 2 = 4

(c) Explain the pathway for the formation of superoxide anions through the process of PDT with the aid of equations. 2

4. (a) Why are nanoparticles of metals or their oxides not approved by agents like FDA for clinical use in the treatment of cancer? Declare six advantages of functionalizing Fe_3O_4 nanoparticles with porphyrins. Do not repeat any claim made to highlight the advantages. 1+6= 7

(e) What is partition co-efficient of a drug? What is the importance of partition co-efficient in drug activity? 1+2=3

UNIT-V

9. (a) Define blister agents of chemical warfare agent? What is sulfur muster, nitrogen muster and Lewisites? What are target organ and symptom of sulfur muster toxicity? Provide the current treatment of sulfur muster toxicity and lewisite toxicity. 1+2+2+2= 7

(b) Define blood agent of mass destruction. How CN-affect human body? Discuss the symptoms and treatment of victims affected by blood agent. 1+2+4= 7

10. (a) Discuss the principle of thermonuclear weapons. 4

(b) Write short note on : 3+3+4= 10

(i) Nerve agent

(ii) Biological weapon

(iii) Chemical weapon convention

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(b) What are the benefits of the post PDT process? How can the beneficial post-PDT be achieved during the process of PDT? 2 + 1 = 3

(c) Describe how normal healthy cells are different from cancer cells or tissues? Provide four distinct differences. 4

UNIT-III

5. (a) What is Order parameters? What are the ranges of Order parameter in Smectic and Nematic phases? 2+1=3

(b) What is Thermotropic liquid crystal? How Smectic A, Smectic C, and Nematic mesophases differ from each other in terms of molecular arrangement? 2+3=5

(c) By using suitable examples, discuss that supramolecules can catch objects, move and rotate. 3

(d) How the spacer ligand azobipyridine (azobpy) is involved for the photonic switching property of the molecule, $[Ru(bpy)_2(azbpy)Os(bpy)_2]^{4+}$? Briefly discuss. 3

6. (a) Provide structure of compounds exhibiting (i) Nematic mesophases only, (ii) Smectic A and Nematic mesophases. 1+2=2

(b) What is cholesteric mesophase? Provide schematic presentation of molecular arrangement in cholesteric mesophase? Draw the structure of a compound exhibiting cholesteric mesophase. 1+2+1=4

(c) Two molecular logic devices (AND gate and XOR gate) can perform simple mathematics. Explain by taking a suitable example. 4

(d) Explain the electrochemical sensing of methyl red by using α-cyclodextrin modified gold electrode and a redox probe, hydroquinone. 4

UNIT-IV

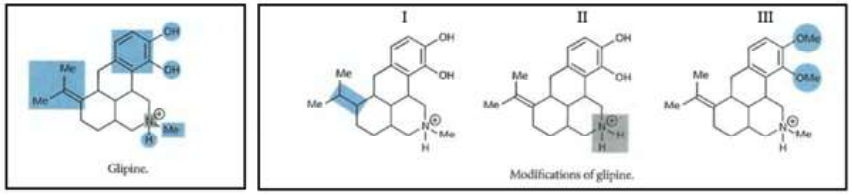
7. (a) What is Pro-drug? Why Pro-drugs are required? What is the ideal requirement of a Pro-drug? Classify Pro-drugs based on their functional groups (with example). 2+2+2+4=10

(b) What is ADMET? On what factors Distribution of a drug in the body depends on? 1+2=3

(c) What is QSAR? 1

8. (a) What is meant by Competitive inhibitor and Non-competitive inhibitor? 1+1=2

(b) What is Lead structure in drug discovery? In the following case, Glipine is a Lead compound. A lead modification is required to increase solubility. Which modification is expected serve the purpose and why? 2+1+2=5



(c) Discuss the binding role of carboxylic acid in drug-target interaction? 3

(d) What is pharmacophore? 1