K24P 0270

Reg. No. : .....

Name : .....

**IV Semester M.Sc. Degree (CBSS – Reg./Supple. – (One Time Mercy Chance)/Imp.) Examination, April 2024**
**(2014 Admission Onwards)**
**CHEMISTRY**
**CHE4E.05 : Nanomaterial Chemistry**

Time : 3 Hours Max. Marks : 60

SECTION – A

(Answer **all** questions in **one** word or **one** sentence. **Each** carries **one** mark.)

1. How does the catalytic property of a material vary with the size (nano) of the material ?
2. Why quantum dots are called zero-dimensional nanomaterials ?
3. Give any two advantages of TEM over SEM in the analysis of nanomaterial.
4. Write down a method for the preparation of carbon nanotube.
5. What is meant by photolithography ?
6. What are conducting polymers ? Give an example.
7. What is the role of ligands in the chemical synthesis of nanoparticles ?
8. Give any two applications of nanotechnology in healthcare. **(8×1=8)**

SECTION – B

(Answer **any 8** questions. Answer may be **two** or **three** sentences. **Each** question carries **2** marks.)

9. Differentiate the electronic and structural properties of carbon nanotube and Fullerene.
10. What are nanoclusters ? Give examples.

**P.T.O.**

11. What are the limitations of photolithography ?

12. Write down the advantages of the bottom-up approach over the top-down synthesis of nanostructures.

13. SEM cannot be an appropriate method to characterize nanoclusters. Why ?

14. Differentiate AFM and STM based on the characterization.

15. Metal nanoparticles are used as nanosensors. Why ?

16. Which nanomaterial is used for the application of LED devices ? Give an example.

17. Comment on the role of Raman Spectroscopy in characterizing carbon-based nanostructures.

18. How nanotechnology contributes to the miniaturization of devices ?

19. Why the optical microscopy is not helpful for the characterization of nanomaterials ?

20. What is meant by self-assembled monolayer ? Give an example. **(8×2=16)**

## SECTION – C

(Short paragraph questions. Answer **any 4** questions. **Each** carries **3** marks.)

21. Write a short note on carbon nanomaterials.

22. Explain the processes of physical vapour deposition of semiconductor nanomaterial preparation with two appropriate examples.

23. Explain the principle and applications of scanning electron microscopy.

24. Explain briefly on the :
    i) Ellipsometry and
    ii) Confocal microscope.

25. Write a short note on bottom-up synthetic strategies of nanomaterials.

26. Briefly discuss the principle and applications of NSOM. What is its advantage over a conventional microscope ?

27. What are magnetic nanoparticles ? Give a synthetic method with an example.

28. Compare the catalytic property of gold in bulk and in nano dimension. **(4×3=12)**

SECTION – D

(Answer **all** questions. **Each** question carries **6** marks.)

29. A) Explain briefly on Chemical synthesis (at least two examples) of
    i) Metal nanostructures
    ii) Semiconductor nanostructures.

    OR

    B) Explain briefly on the Physical methods for the synthesis of Carbon nanostructures.

30. A) Give a brief description about the characterization of nanomaterials by spectroscopic methods (Explain at least two methods).

    OR

    B) Explain in detail the usage of nanomaterials for the solar energy conversion and storage.

31. A) Discuss the principles and applications of TEM and XRD for characterization of crystalline and amorphous nanomaterials with examples.

    OR

    B) Briefly explain the following techniques :
    i) Contact angle measurements
    ii) FTIR and
    iii) ESR.

32. A) What are nanomaterials ? Explain the classification and significance of nanomaterials.

    OR

    B) Give a short note on the following :
    i) Quantum confinement and
    ii) Magnetic nanoparticles. **(4×6=24)**

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K24P 0269

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**IV Semester M.Sc. Degree (CBSS – Reg./Supple. – (One Time Mercy Chance)/Imp.) Examination, April 2024**
**(2014 Admission Onwards)**
**CHEMISTRY**
**CHE4C.12 : Inter Disciplinary Topics and Instrumentation Techniques**

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **all** questions in **one** word or **one** sentence. **Each** question carries **1** mark.

1. How many ESR lines are expected for benzene anion radical ?
2. Distinguish between inter and intra-molecular hydrogen bonding.
3. What are ionic liquids ?
4. How the amount of scattering from the same particle will change with respect to the wavelength of light ?
5. What is the basic force behind $\pi$–$\pi$ interaction ?
6. What are green solvents ?
7. Why electron microscopy is an important characterisation technique for nanomaterials ?
8. Explain the term 'quantum confinement'.

SECTION – B

Answer **any eight** questions. **Each** question carries **2** marks.

9. How do you distinguish J and H aggregates ?
10. What do you understand about host-guest chemistry ? Explain with an example.
11. What are the environmental effects of green reactions ?

**P.T.O.**

12. How reaction time is important in green chemistry ?

13. How do you calculate the atom efficiency of a chemical reaction ?

14. How terabutylammonium chloride act as a phase-transfer catalyst ?

15. Explain the importance of nanoCAD.

16. What are smart materials ? Explain.

17. What are the applications of nanomaterials in optics ?

18. What is Mössbauer effect in chemistry ?

19. Explain the term 'hyper fine splitting' in ESR spectroscopy.

20. Explain any two applications of nephelometry.

## SECTION – C

Answer **any four** questions. **Each** question carries **3** marks.

21. What are the advantages of microwave assisted organic synthesis ?

22. Explain how π-πstaking and cation-π interactions help the formation of supramolecular assemblies.

23. Write a short note on the relevance of green chemistry.

24. Explain the working principle of supramolecular (i) electronic devices and (ii) switching devices.

25. Explain the principles of thermometric titration.

26. How UV -Vis spectroscopy can be used to characterize nanomaterials ? Explain with an example.

27. Explain the nucleation and growth processes during the synthesis of nanoparticles.

28. What is a thermochemical analyser ? Explain its working.

SECTION – D

Answer **four** questions. **Each** question carries **6** marks.

29. Explain the principles of ESR spectroscopy. Explain the ESR spectroscopy of inorganic radicals.

OR

Explain the following terms (i) Chemical isomer shift (ii) Doppler effect and (iii) Quadrupole effect in Mössbauerspectroscopy.

30. Explain the applications of nanomaterials in (i) Electronics (ii) Biomedical and (iii) Telecommunication.

OR

Explain the following methods used for the preparation of nanomaterials (i) Lithography (ii) Self-assembly (iii) Polymerization.

31. Explain the role of green chemistry in (i) Sustainability of environment (ii) Energy management and (iii) Solvent selection.

OR

Explain the green synthesis of (i) Cannizaro reaction (ii) Aldol condensation and (iii) Grignard reaction.

32. How supramolecules are used for the molecular recognition ? Explain with examples.

OR

Explain any three common experimental techniques used in supramolecular chemistry.

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K24P 0268

**Reg. No. : .....**

**Name : .....**

**IV Semester M.Sc. Degree (C.B.S.S. – Reg./Supple. – (One Time Mercy Chance)/Imp.) Examination, April 2024**
**(2014 Admission Onwards)**
**CHEMISTRY**
**CHE4C.11 : Inorganic Chemistry – III**

Time : 3 Hours Max. Marks : 60

SECTION – A

(Answer **all** questions in **one** word or **one** sentence. **Each** carries **one** mark.)

1. Why Eu and Yb exhibit +2 oxidation state ?
2. Define half wave potential in polarography.
3. What is the structure of iron pentacarbonyl ?
4. What is the necessary condition for a molecule to be IR active ?
5. What are essential elements ?
6. Which are the detectors used in UV-Visible spectroscopy ?
7. Arrange the following in the increasing order of their magnetic moment. 1) $Eu^{3+}$, 2) $Gd^{3+}$, 3) $Tb^{3+}$ , 4) $Dy^{3+}$.
8. If the absorbance value of $K_2CrO_4$ solution is 0.762, calculate the percentage of radiation absorbed by it. **(8×1=8)**

SECTION – B

(Answer **any 8** questions. Answer may be **two** or **three** sentences. **Each** question carries **2** marks.)

9. State and explain EAN rule. Give an example for a metal carbonyl that doesn't obey EAN rule.
10. What is meant by a zinc finger ? What are its functions ?

**P.T.O.**

11. What are chemical interferences in AAS ?

12. Compare the relative tendencies of lanthanides and actinides to form complexes.

13. Explain Frost diagram.

14. Mention a method for the preparation of metal carbonylate anions.

15. Myoglobin gets saturated with oxygen at a faster rate than haemoglobin. Why ?

16. Write an account of Pt based anticancer drugs.

17. Mention any 2 properties of plutonium.

18. Explain the application of EPR spectroscopy in inorganic Chemistry.

19. "$NO^+$ is a three-electron donor while $NO^-$ is one-electron donor". Justify.

20. What is meant by a reference electrode in potentiometry ? Give 2 examples. **(8×2=16)**

## SECTION – C

(Short paragraph questions. Answer **any 4** questions. **Each** carries **3** marks.)

21. Write a note on Latimer diagram.

22. Comment on the non complementary nature of TG and DTA.

23. Write a note on Trans actinide elements.

24. Write a note on calcium signaling proteins.

25. Explain chelation therapy with an example.

26. Briefly discuss about metal cyano complexes.

27 Discuss the chemical properties of +2 oxidation state of lanthanides.

28. Explain the principle of neutron diffraction method. **(4×3=12)**

SECTION – D

(Essay type – Answer **4** questions. **Each** carries **6** marks.)

29. A) What is lanthanide contraction ? Briefly discuss the causes and consequences of lanthanide contraction.

OR

B) Explain the different steps involved in the isolation of lanthanides from monazite sand.

30. A) Write a note on metal phosphine complexes.

OR

B) Discuss the preparation, properties and structures of iron carbonyls.

31. A) Discuss briefly about the use of iron proteins as sensors.

OR

B) Discuss the nitrogen cycle.

32. A) Explain the principle of EPR spectroscopy and its applications in inorganic Chemistry.

OR

B) Discuss the principle, instrumentation and applications of atomic absorption spectroscopy. **(4×6=24)**

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**K23P 0159**

**Reg. No. : .....**

**Name : .....**

**IV Semester M.Sc. Degree (C.B.S.S. – Reg./Supple./Imp.)**
**Examination, April 2023**
**(2019 Admission Onwards)**
**CHEMISTRY**
**CHE 4C.11 : Inorganic Chemistry – III**

Time : 3 Hours Max. Marks : 60

SECTION – A

(Answer **all** questions in **one** word or **one** sentence. **Each** carries **one** mark.)

1. Name any two important minerals that occur in the beach sands of Kerala and write their approximate composition.
2. Give an example with structure for a non-bridged polynuclear carbonyl.
3. What are non-essential elements ?
4. State Beer Lambert law.
5. What are the experimental parameters measured in DTA and DSC ?
6. What is meant by biomineralization ?
7. Vanadium hexacarbonyl is paramagnetic. Explain.
8. Why do actinides show greater range of oxidation states than the lanthanides ? **(8×1=8)**

SECTION – B

(Answer **any 8** questions. Answer may be **two** or **three** sentences. **Each** question carries **2** marks.)

9. Comment on the structure of $[CO_2(CO)_8]$.
10. Explain the term isomer shift in Mossbauer spectroscopy.

**P.T.O.**

11. Distinguish between active and passive transport in biological system.

12. Which is a good reducing agent $Ce^{3+}$ or $Ce^{4+}$ in aqueous solution ? Justify your answer.

13. How many normal modes of vibration does water molecules have and how many of them are IR active ?

14. Distinguish between chelation therapy and chemotherapy.

15. Explain any two consequences of lanthanide contraction.

16. What is a Frost diagram ? What information do we get from this diagram ?

17. Mention any two differences between Raman spectra and IR spectra.

18. For an 18 electron complex ion, $[Fe(CN)_5(NO)]^{2-}$ what is the expected M-N-O angle ? Why ?

19. Mention any two uses of thorium.

20. How Collmann's reagent is prepared ? Explain its synthetic importance with one example. **(8×2=16)**

SECTION – C

(Short paragraph questions. Answer **any 4** questions. **Each** carries **3** marks.)

21. Explain sodium potassium pump in biological systems.

22. Give an account of the separation of lanthanide elements using ion exchange resin.

23. What is cisplatin ? Explain its use and mode of action.

24. Discuss the principle of neutron diffraction method.

25. Write briefly on different types of indicator electrodes used in potentiometry.

26. Explain how IR spectroscopy can be used to identify different bonding modes of CO in metal carbonyls.

27. Write a short note on metal phosphine complexes.

28. Briefly discuss the hydrogen cycle. **(4×3=12)**

SECTION – D

(Essay type – Answer **4** questions. **Each** carries **6** marks.)

29. A) Compare the magnetic and spectral properties of lanthanides and actinides.

OR

B) What is Ellingham diagram ? Explain the important characteristics and applications of this diagram in metallurgical process.

30. A) Write a note on metal dinitrogen complexes.

OR

B) Explain the structure and bonding in metal carbonyls.

31. A) What are ionophores ? How they are classified ? What are the distinguishing features between them ?

OR

B) Briefly outline the role of haemoglobin and myoglobin in the transportation and storage of oxygen and $CO_2$ in biological systems.

32. A) Briefly discuss about the determination of molecular structure by X ray diffraction.

OR

B) Discuss the principle of Photoelectron spectroscopy. Explain how PES is useful in quantitative analysis. **(4×6=24)**



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