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AB-233751

M.Sc. (Semester-IV) Examination, June-2025

(Backlog)

CHEMISTRY

(Electrochemical Energy Materials and Nuclear Chemistry)

Time Allowed : Three Hours

Maximum Marks : 70

Note : Question paper is divided into **four** sections. Attempt questions of **all four** sections as per direction. Distribution of marks is given in each section.

SECTION-A

(Objective Type Questions)

Note : Attempt **any ten** questions. Each question carries **1** mark. [10×1=10]

1.A. (i) What is the main disadvantage of a primary cell compared to a secondary cell?

(a) Non-rechargeable

(b) Higher Cost

(c) Maintenance

(d) Lower energy density

(ii) What is the main idea of the bottom up approach in nanoparticle synthesis?

(a) Breaking down large particles into smaller ones

(b) Assembling atoms or molecules to build nanoparticles

(c) Dissolving nanoparticle in water

(d) Using high pressure to crush materials

(iii) Which of the following is not a biological macromolecule?

(a) Protein

(b) Nucleic acid

(c) Lipid

(d) Fructose

(iv) The unit of nuclear cross section is :

(a) Joule (J)

(b) Barn (B)

(c) Tesla (T)

(d) Coulomb (C)

(v) What is the primary reason for the instability of radioactive isotopes?

(a) Excess electron in the nucleus

(b) Imbalanced neutron to proton ratio

(c) High electron affinity

(d) Low molecular mass

(vi) What is the electrolyte used in lead acid battery?

(a) NaoH

(b) HNO_3

(c) H_2SO_4

(d) HCL

B. Fill in the blanks :

(vii) Water splitting is a chemical process in which water is broken down into_____and_____.

(viii) ____is a widely used oxide ceramic for biomedical implants due to its excellent wear resistance and biocompatibility.

(ix) Calixarenes are composed of phenolic units linked by_____bridges.

(x) The_____isotopes is commonly used fuel in nuclear reactors.

(xi) The age of organic materials like fossils can be estimated using the radioactive isotope_____.

(xii) An a nuclear reactor, the material used to slow down fast neutrons to thermal energies is called_____.

SECTION-B

(Very Short Answer Type Questions)

Note: Attempt **any five** questions. Each question carries 2 marks.(Word limit : 25-30 words) : [5×2=10]

2. (i) Why do super capacitors have lower energy density than batteries?

(ii) Mention one drawback of the ball milling method for nanoparticle synthesis.

(iii) Which interaction stabilizes DNA base pair?

(iv) What are the magic number in nuclear chemistry?

(v) What is carrier-free isotope?

(vi) Which radio isotope is commonly used in thyroid diagnosis and treatment?

(vii) What is an electrochemical biosensor?

SECTION-C

(Short Answer Type Questions)

Note: Attempt **any five** questions. Each question carries **4** marks.(Word limit : 250 words) [5×4=20]

3. (i) Write note on components of an electrochemical sensor.

(ii) Write note on oxide ceramics.

(iii) Write note on Cyclophanes.

(iv) What are the nuclear fission products?

(v) How does radiochemistry contribute to Crop improvement?

(vi) Define self assembly in supramolecular systems.

(vii) What is sol-gel method?

SECTION-D

(Essay Type Questions)

Note: Attempt **any three** questions. Each question carries **10** marks.(Word limit : 500 words) [3×10=30]

4. (i) Explain the various types of fuel cells.

(ii) Discuss the principles, advantages and limitation of TEM and SEM technique in nanoparticle characterization.

(iii) Discuss about the following :

(a) Supramolecular interaction

(b) Molecular recognition

(iv) Explain the liquid drop model of the nucleus. Discuss its assumptions the semi-empirical mass equation and its success and limitations in predicting nuclear behaviour.

(v) Explain the role of radiochemistry in age determination.

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