SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai - 600 044.
B.Sc.Chemistry - END SEMESTER EXAMINATIONS - APRIL 2025
SEMESTER - VI
22UCHCT6013 - Nuclear Chemistry and Organo Metallics

Total Duration : 2 Hrs.30 Mins. Total Marks : 60

Section B

Answer any **SIX** questions $(6 \times 5 = 30$ Marks)

1. Discuss the concept of magic numbers in the shell model of the nucleus and their role in nuclear stability.
2. Explain the basic principles of nuclear fission as described by the liquid drop model.
3. Apply the 18-Electron Rule, calculate the total electron count for
   (i) $Fe(CO)_3$ (ii) $Cr(C_6H_6)(CO)_3$
4. Outline the synthetic utility of alkyl aluminum compounds in organic synthesis.
5. (i) State the law of radioactive decay. (2)
   (ii) Derive the relationship between the half-life period, disintegration constant, and average life period. (3)
6. Discuss the principle behind the hydrogen bomb and how it utilizes nuclear fusion to release energy.
7. Classify the ligands on the basis of bond type with suitable examples.
8. Analyze the structure of ferrocene and describe how the sandwich structure contributes to its stability and reactivity.

Section C

Answer any **THREE** questions $(3 \times 10 = 30$ Marks)

9. (i) Explain the concept of packing fraction and its relevance in the context of nuclear stability. (5)
   (ii) Discuss the π-meson theory of nuclear forces. How does it explain the strong force between nucleons? (5)
10. Discuss the working principle and applications of Geiger-Müller (GM) counter and scintillation counter for the measurement of radioactivity. How do they differ in detecting different types of radiation? (7)
    (ii) Compare α, β and γ rays. (3)

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11. Critically evaluate
    (i) the principle behind the construction and use of an atomic bomb. How does this relate to nuclear fission?
    (ii) the use of radioisotopes in non-invasive imaging techniques in nuclear medicine.
12. Evaluate the geometry and bonding characteristics of $Ni(CO)_4$ and $Fe(CO)_5$. How does their electron count correlate with their structural preferences and chemical properties?
13. Compare and contrast the reactivities of organolithium, organomercury and organotin compounds in a specific C-C bond formation reaction.

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