



**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**

**M.Sc. DEGREE EXAMINATION – CHEMISTRY**

THIRD SEMESTER – APRIL 2018

**16PCH3MC01- MAIN GROUP ELEMENTS AND NUCLEAR CHEMISTRY**

Date: 24-04-2018  
Time: 09:00-12:00

Dept. No.

Max. : 100 Marks

**Part-A**

*Answer ALL questions.*

**(10 × 2 = 20)**

1. What are crown ethers? Mention any one industrial application of them.
2. How many electrons will be contributed to the framework of cluster compounds by the following  
(a)  $\text{Fe}(\text{C}_5\text{H}_5)$  (b)  $\text{Co}(\text{CO})_3$
3. Give the mechanism of hydroboration reaction.
4. Compute the number of 3c-2e bonds in  $\text{B}_6\text{H}_{10}$ .
5. What are polyacids? Give two examples.
6. How is N-trialkyl borazine synthesized from sodium borohydride?
7. What are silicones?
8. Distinguish sub-atomic particles from basic particles.
9. How many  $\alpha$  and  $\beta$  particles are emitted in the conversion of  ${}_{92}\text{U}^{238}$  to  ${}_{82}\text{Pb}^{206}$ .
10. What is meant by orbital electron capture process? Give the equation.

**Part-B**

*Answer any EIGHT questions.*

**(8 × 5 = 40)**

11. Elucidate the structure of diborane.
12. How are hydrides classified? Mention their unique properties with examples.
13. Derive the possible 'styx' number and predict the most stable structure for  $\text{B}_5\text{H}_{11}$ . Discuss the types of bonding in the compound.
14. Discuss the structure, types of bonding in  $\text{C}_2\text{B}_{10}\text{H}_{12}$  and give any three important reactions.
15. What is inorganic benzene? Why is it called so? Discuss its structure.
16. Discuss the preparation, properties and structure of  $\text{I}_2\text{O}_5$ .
17. Discuss the structure of the following compounds using VSEPR theory.  
(i)  $\text{XeO}_2\text{F}_2$  (ii)  $\text{XeO}_3$
18. Give a brief account of mesons and their role in stabilizing the nucleus.
19. Write a brief note on the application of nuclear isotopes in nuclear imaging.
20. What is n/p ratio? Draw a rough n to 'p' plot and explain the stability belt. How does a nucleus stabilize itself while it is not falling within the stability belt?
21. Compare the liquid-drop model and shell model of nuclei.
22. Briefly explain the principle of Fricke Dosimeter.

**Part-C**

*Answer any FOUR questions.*

**(4 × 10= 40)**

- 23a. Discuss the types, structure and bonding of fullerenes.
- b. Discuss the reactivity of fullerene on (i) oxidation (ii) reduction (iii) encapsulation (iv) reaction with alkali metals (6+4)
- 24a. Write a brief note on PSEPT theory and b) Predict the structure of  
(i)  $B_3H_7Fe_2(CO)_6$  (ii)  $B_4C_2H_8$  (iii)  $B_4H_{10}$
- 25a. How are silicates classified? Give two examples for each classification.
- b. What are zeolite and ZSM-5? Mention their applications.
26. Give a detailed account of nuclear waste management.
27. Discuss the working principle of nuclear reactor and explain how is energy generated from nuclear fuel.
28. Briefly explain any five factors affecting the nuclear stability.

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