

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



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

**THIRD SEMESTER – NOVEMBER 2019**

**17/18PCH3MC01 – MAIN GROUP ELEMENTS AND NUCLEAR CHEMISTRY**

Date: 29-10-2019

Dept. No.

Max. : 100 Marks

Time: 09:00-12:00

**Part-A**

*Answer ALL questions.*

**(10 × 2= 20)**

1. What are cryptands? Give an example.
2. Differentiate the conducting behaviour of graphite from diamond based on their structures.
3. Calculate the number of  $3c-2e^-$  bonds present in  $B_4H_{10}$ .
4. Give the mechanism of hydroboration reaction.
5. Complete the following reactions:  
 $SiCl_4 + LiR \quad ?$   
 $[Be(CH_3)_2]_n + 2nPH_3 \quad ?$
6. How does transmetallation reaction influence the preparation of organometallic reagents?
7. Write the uses of chloramines.
8. Comment on the superstructures of LaOF.
9. What are fissile and fertile nuclei? Give an example for each.
10. What are radiopharmaceuticals? Mention any two applications of them.

**Part-B**

*Answer any EIGHT questions.*

**(8 × 5= 40)**

11. Derive the possible styx number and predict the most stable structure of  $B_5H_9$ .
12. Discuss the structure of  $C_{60}$  fullerenes.
13. What are Ionophores? Discuss the structure and biological role of valinomycin.
14. Write a brief note on BN polymer.
15. Describe Alfol process and write its industrial use.

16. How are Grignard reagents prepared? Give any two applications of this reagent.
17. Comment on the chemistry and structures of sulfur fluorides.
18. Explain the structures of  $\text{XeO}_3$  and  $\text{XeOF}_4$  based on VB theory.
19. Write the preparation, properties and structure of a beryllium alkyl compound.
20. How many  $\alpha$  and  $\beta$  particles are emitted in the following conversions?  
(i)  ${}_{90}\text{Th}^{234} \rightarrow {}_{82}\text{Pb}^{206}$  (ii)  ${}_{92}\text{U}^{234} \rightarrow {}_{82}\text{Pb}^{207}$
21. How is radioactivity measured by scintillation counter?
22. How is energy generated in a nuclear reactor?

### Part-C

*Answer any FOUR questions.*

(4 × 10 = 40)

- 23 a. Write a brief note on PSEPT theory. (5)
- b. Predict the structure of  $\text{Cp}_2\text{Fe}_2(\text{Me}_4\text{C}_4\text{B}_8\text{H}_8)$ . (5)
- 24 a. How are silicates classified? (5)
- b. Why is zeolite considered as molecular sieve? Explain. (5)
- 25a. Discuss the synthesis of water-soluble silsesquioxane based nanoparticles by hydrolytic condensation of hydroxyl functionalized triethoxysilanes. (6)
- b. Write an example for the fluorinating action of  $\text{BrF}_3$ ,  $\text{SF}_4$ ,  $\text{SbF}_3$  and  $\text{SbF}_5$ . (4)
- 26 a. Describe the preparation and reactions of  $\text{ClO}_2$ . (5)
- b. Write the preparation and chemical properties of  $\text{NCl}_3$  and  $\text{NF}_3$ . (5)
27. Explain the structural features of the following compounds.  
(i) Borazine (ii) Diborane (5+5)
28. Discuss the following factors in determining the stability of nuclei. (4 × 2.5)
- (i) n/p ratio (ii) packing fraction
- (iii) binding energy (iv) magic number of nucleons

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