LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – CHEMISTRY

THIRD SEMESTER – NOVEMBER 2022

PCH 3501 – MAIN GROUP ELEMENTS AND NUCLEAR CHEMISTRY

Date: 23-11-2022 Dept. No. Max. : 100 Marks
Time: 09:00 AM - 12:00 NOON

Part - A

Answer ALL Questions. $(10 \times 2 = 20)$

1. How many 3c-2e$^-$ bonds are in B_4H_{10}?

2. How many electrons will be contributed by the following species to framework of cluster

   (a) $Fe(CO)_3$ (b) CpNi

3. Give the chemical formula of garnet and mention which type of silicate it belongs to?

4. What are ultramarines? Mention any one application.

5. What is hydroboration reaction? Give the mechanism with an example.

6. Mention any two silylating agents with their specific functions.

7. How does transmetallation reaction help in synthesizing organometallic compounds?

8. Predict the structure of $XeOF_2$.

9. Complete the following nuclear reaction $_{92}U^{238}$ ($_0n^1$ $_2He^4$) -----; $_{16}S^{32}$(---- $_1H^1$) $_{17}Cl^{35}$.

10. How many alpha and beta particles are ejected out in the conversion of $_{92}U^{238}$ to $_{82}Pb^{206}$?

Part - B

Answer any EIGHT Questions. $(8 \times 5 = 40)$

11. How are molecular hydrides classified? Give their properties with two examples for each.

12. Differentiate the structure of graphite and diamond.

13. Highlight the classification of silicones with suitable examples and their chemical properties. Mention any two application.

14. Zeolite is considered as molecular sieves. Justify.

15 a) What are the different types of fluorinating agent? Explain with examples,

    b) Discuss the specific role of the following reagents.

        (i) CH_3Li (ii) BrF_3

16. Discuss the structure of the following compounds using VSEPR theory.

        (i)XeF_4 (ii) XeO_3

17. Give the synthetic applications of organolithium compounds.

18. Write a brief note on Na^+/K^+ pump in biosystem.

19. Differentiate atom bomb and hydrogen bomb.

20. Explain the working principle of scintillation counter.

21. a) Explain the principle of carbon dating.

b) The amount of ^{14}C in a sample of wood is found to be one-fourth of its amount present in a fresh piece of wood. Calculate the age of the wood ($t_{1/2} = 5577$ years).

22. Describe the working principle of a conventional nuclear reactor.

Part - C

Answer any FOUR questions. **(4 × 10 = 40)**

23. Discuss the structure and types of bonding in B_5H_{11} by computing *styx* code number.

24. a) Elucidate the structure of C_{60} fullerenes.

b) How does it undergo the following types of reactions?

(i) Oxidation (ii) Reduction (iii) encapsulation.

25. How are silicates classified? Give the basic unit and two examples for each classifications.

26. Write a brief note on PSEPT theory and predict the structure of

(a) B_5H_{11} (b) $B_4H_8Fe(C_5H_5)$ (c) $C_2B_{10}H_{12}$

27. a) Write a brief note on sequestering agent used for radioactive materials.

b) Elaborate any one techniques used for synthesizing air sensitive compounds.

28. Explain any two methods in detail to measure nuclear activity.

29. (a) What are radiopharmaceuticals? Discuss the role of technetium and gadolinium in nuclear imaging agent.

(b) Give the principle of a breeder reactor.

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