

2022

M.Sc.

2nd Semester Examination (CCAEE)

CHEMISTRY

PAPER—CEM-203

INORGANIC CHEMISTRY-II

*Full Marks : 40**Time : 2 Hours**The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.**Illustrate the answers wherever necessary.***Group—A**

Answer any four questions.

4×2

1. What is boron neutron capture therapy? Give at least two examples of 1st and 2nd generation BNCT agents.
2. "Mono-capped octahedral structure of $\text{Os}_7(\text{CO})_{21}$ is in accordance with the nature of valence electrons available" - Justify.

(Turn Over)

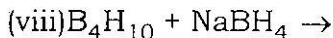
3. '[Os₂Cl₈]²⁻ displays staggered structure' – Explain.
4. Determine the characters of irreducible representations of C_{2v} point group.
5. Write down the orbital selection rule for electronic transitions.
6. What is standard reduction formula? Explain each term in the formula.

Group—B

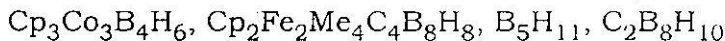
Answer any *four* questions.

4×4

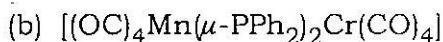
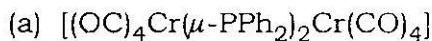
7. (i) $B_4H_{10} + N(CH_3)_3 \rightarrow$
- (ii) $B_4H_{10} + C_2H_4 \rightarrow$
- (iii) $B_5H_9 + C_2H_4 \xrightarrow{AlCl_3}$
- (iv) $B_{10}H_{14} + I_2 \rightarrow$
- (v) $B_{10}H_{14} + NaCN + H_2O \rightarrow$
- (vi) $B_2H_6 + 2NaH \rightarrow$
- (vii) $B_5H_9 + C_2H_2 \rightarrow$



8. Classify the following compounds with respect to closo, nido, arachno and hypo



9. Calculate the M-M bond order for the following species:



10. How many vibrational modes can occur in NH_3 molecule? Sketch all the modes.
11. Write down all the symmetry elements and irreducible representations of NH_3 molecule.
12. What do you mean by the term 'interstitial cluster'? Find the geometry and draw the structure of the following interstitial clusters (i) $[HCo_6(CO)_{16}]^-$
(ii) $[Os_5C(CO)_{15}]$

Group—C

Answer any *two* questions. 2×8

13. Calculate the styx number of $[B_{10}H_{12}]^{2-}$, $[B_9H_{13}]$ and established the most probable structure.

14. With the help of styx number 5040 and 4150 derive the formula of the boron hydride and draw the probable structures of these.
 15. Construct C_{3v} character table by employing the properties of irreducible representations.
 16. What are charge-transfer spectra? Show the $\pi-\pi^*$ transition with a suitable molecular orbital diagram.
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