# MAR IVANIOS COLLEGE (AUTONOMOUS) THIRUVANANTHAPURAM

Reg. No. :.....................          Name :.....................

**First Semester B.Sc. Degree Examination, November 2014**
**First Degree Programme under CBCSS**
**Complementary Course: Chemistry – I (for Botany and Zoology)**
**AUCH131.2a / AUCH131.2e: Theoretical Chemistry**

Time: **3** Hours                                                        Max. Marks: **80**

## SECTION – A

*Answer **ALL** questions in a word or one or two sentences.*

1.  Write the Rydberg equation for hydrogen.

2.  Principal quantum number *n* represents _____ of electrons.

3.  How many radial nodes are there in $3p$ orbitals ?

4.  Hybridisation in $BF_3$ molecule is _____.

5.  Ammonia molecule has _____ structure.

6.  *Ortho* – nitrophenol is volatile due to _____ hydrogen bonding.

7.  Give an example for a secondary standard in volumetric analysis.

8.  Name an indicator that used in complexometric titrations.

9.  Grignard reagents are prepared by the reaction of _____ metal with an alkyl halide in a solution of dry ether.

10. Write one application of organotin compounds.

**(10 x 1 = 10 Marks)**

## SECTION – B

*Answer any **EIGHT** questions, not exceeding a paragraph.*

11. Distinguish between the terms orbit and orbital.

12. State Heisenberg's uncertainty principle and indicate its significance.

P.T.O.

13. What are the possible values of the azimuthal, magnetic and spin quantum number for the cases where the principal quantum number $n$ has the value 3 ?

14. What is bond order ? Discuss it significance.

15. Oxygen molecule is paramagnetic. Why ?

16. Define lattice energy. How is lattice energy affected by size of the ions ?

17. Differentiate between normality and molarity.

18. What are the characteristics of a primary standard ?

19. Sketch the titration curve for the titration HCl *vs* NaOH.

20. How is ferrocene prepared ?

21. What is hydroboration? What is its importance in organometallic chemistry ?

22. Write a note on preparation and applications of organosilicon compounds.

**(8 x 2 = 16 Marks)**

## SECTION – C

*Short essay type : Answer any **SIX** questions.*

23. Wrote a short notes on (a) Azimuthal quantum number $l$ (b) Magnetic quantum number $m_l$.

24. What are lanthanides ? Discuss the consequences of lanthanide contraction.

25. Explain Born – Haber cycle and show how it is useful in determining lattice energy of ionic crystals.

26. State Fajan's rules. Explain the transition of a chemical bond from ionic to covalent with suitable examples.

27. Explain the hybridisation and geometry of (a) $PCl_3$ (b) $PCl_5$.

28. Briefly explain the theory behind acid – base indicators.

29. Distinguish intermolecular and intramolecular hydrogen bonding with examples. Explain the effect of hydrogen bonding on boiling point, volatility and solubility.

30. Give a brief account on the medical applications of organometallic compounds.

31. Discuss the adverse effects of organomercuric compounds on our environment.

**(6 x 4 = 24 Marks)**

## SECTION – D

*Long essay type : Answer any **TWO** questions.*

32. (i) Discuss Bohr atom model, highlighting its merits and demerits.

    (ii) Explain the importance of

    (a) Pauli's exclusion principle, and

    (b) Hund's rule in determining the electronic configuration of atoms.

33. (a) Discuss the molecular orbital theory of diatomic molecule.

    (b) Calculate the bond order and comment on the magnetic properties of $O_2$, $O_2^{2+}$, $O_2^{2-}$.

34. Briefly explain the principle and features of

    (a) Acid – base titrations.

    (b) Redox titration.

    (c) Complexometric titrations, using suitable examples.

35. Discuss briefly the preparation and synthetic applications of organometallic magnesium and lithium reagents.

**(2 x 15 = 30 Marks)**

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