MAR IVANIOS COLLEGE (AUTONOMOUS)
THIRUVANANTHAPURAM

Reg. No. :…… **Name :……**

First Semester B.Sc. Degree Examination, November 2015
First Degree Programme under CBCSS
Complementary Course: Chemistry – I (for Physics)
AUCH131.2d: Principles of Chemistry I
(*for 2015 Admissions Only*)

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

SECTION – A

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

1. A subshell with n = 6 and l = 3 is designated as _____.
2. The lines observed in the visible region of hydrogen spectrum are called _____.
3. State Hund's rule of maximum multiplicity.
4. The bond order of CO molecule is _____.
5. IF_7 molecule has _____ shape.
6. The H–N–H bond angle in NH_3 molecule is _____.
7. Give the relationship between heat of reaction at constant volume and at constant pressure.
8. Define the entropy of a system.
9. Write Kirchoff's equation.
10. The unit of dipole moment is _____.

(10 × 1 = 10 Marks)

SECTION – B

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

11. Differentiate between an orbit and an orbital.
12. Write the Schrodinger wave equation and explain the terms involved.

13. Can both the electrons of helium have the value with m_s = +1/2 with n = 1 ? Why ?
14. How many electrons are permitted in a subshell for which i). l = 0 and ii). l = 3 ?
15. State and explain Fajan's rule.
16. Illustrate Pauli's exclusion principle.
17. What is an endothermic reaction and an exothermic reaction ? What is the sign of ΔH for these reactions ?
18. Derive the relation, $C_p - C_v = R$.
19. Distinguish between isothermal and adiabatic process.
20. What is the physical significance of entropy ?
21. Distinguish between bonding and antibonding molecular orbitals.
22. State first law of thermodynamics. What is its mathematical form ?

(8 × 2 = 16 Marks)

SECTION – C

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

23. Explain the anomalous electronic configurations of i). Chromium (Z = 24) and ii). Copper (Z = 29).
24. Name the various quantum numbers and write the symbols to represent them. What property of electron is specified by each quantum number ?
25. Define lattice energy. Explain the Born – Haber cycle for the determination of lattice energy using any example.
26. Sketch the shapes of p and d orbitals.
27. State Gibbs – Helmholtz equation. How does it predict the spontaneity of a reaction ?
28. Distinguish between intermolecular hydrogen bonding and intramolecular hydrogen bonding with suitable examples. What are the consequences of inter and intramolecular hydrogen bonds ?
29. The enthalpy of reaction (ΔH) for the formation of NH_3 according to the reaction:

$$N_2 + 3H_2 \rightarrow 2NH_3$$

at 27 °C was found to be −91.94 kJ. What will be the enthalpy of reaction (ΔH) at 50 °C ? The molar heat capacities at constant pressure and at 27 °C for N_2, H_2 and NH_3 are 28.45, 28.32 and 37.07 joules respectively.

30. Write short notes on i). Pauling scale of electronegativity ii). Mulliken's approach of electronegativity.
31. State and explain Hess's Law of constant heat summation.

(6 × 4 = 24 Marks)

SECTION – D

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

32. Discuss Bohr theory, highlighting its merits and demerits. Derive an expression for energy of an electron in the n^{th} orbit of an atom.
33. i). Describe the hybridisation of the central atom and explain the geometry and shape of the following molecules with diagrams. (a). SF_6 (b). ClF_3 (c). XeF_2
    ii). Describe the linear combination of s-orbitals to form bonding and antibonding molecular orbitals.
34. i). Draw the molecular orbital energy level diagram of CO.
    ii). Write the molecular orbital electronic configurations of O_2, CO and NO.
    iii). Calculate the bond orders of O_2, O_2^{2+} and O_2^{2-} and compare their magnetic properties.
35. i). Derive an expression for work done in the expansion of an ideal gas in reversible isothermal process.
    ii). Six moles of an ideal gas expands isothermally and reversibly against a constant external pressure of 1 atmosphere from a volume of 1 dm^3 to a volume of 10 dm^3 at 27 °C. Calculate the maximum work done by the gas.

(2 × 15 = 30 Marks)

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