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 Physics)

AUCH131.2d: Principles of Chemistry

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

SECTION – A

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

1. State the Heisenberg's uncertainty principle ?
2. Write the Schrodinger wave equation and explain the terms.
3. The hybridization of S in SF_6 molecule is _____.
4. If a molecule contains unpaired electrons, its magnetic nature is _____.
5. The H–O–H bond angle in water molecule is _____.
6. Give the mathematical expression for the First law of thermodynamics.
7. The _____ of the universe always increases in the course of every spontaneous change.
8. A system which can exchange energy but not matter with its surroundings is called a / an _____.
9. How is ΔG related to ΔS and ΔH ?
10. Standard enthalpies of all elements are arbitrarily fixed as _____.

(10 x 1 = 10 Marks)

SECTION – B

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

11. Calculate the wavelength of the spectral line obtained in the Lyman series if the electron in the hydrogen atom has been excited to the 3^{rd} energy level. Rydberg constant = $1.097 \times 10^7\ m^{-1}$.
12. What are the n, l, and m values for an electron in the $3p_z$ orbital ?

13. Write the electronic configuration of Cu (At. No: 29) and account for its extra stability.
14. Compare the bond order, bond distance and stability of O_2, O_2^{2-}, O_2^{2+}.
15. The boiling point of o – nitrophenol is higher than that of p – nitrophenol. Explain.
16. State and explain Fajan's rule.
17. Differentiate between extensive and intensive properties with examples.
18. In a process, 750 J of heat is absorbed by the system while it does work equivalent to 1200 J in expansion. Calculate the internal energy change in the process.
19. State the Second law of thermodynamics in terms of entropy.
20. Give the relationship between heat of reaction at constant volume and constant pressure and explain the terms involved.
21. State and illustrate Hess's law of constant heat summation.
22. The enthalpy of neutralization of any strong acid by a strong base is a constant. Comment.

(8 x 2 = 16 Marks)

SECTION – C

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

23. What are quantum numbers ? Discuss the significance of each quantum number.
24. Discuss the different rules that determine the ground state electronic configuration of atoms.
25. Write a note on the concept of electronegativity and various scales for it.
26. Predict the geometry of $BeCl_2$, BF_3, CH_4 and PCl_5 on the basis of VSEPR theory.
27. The bond dissociation enthalpy of N_2 molecule is very high. Explain on the basis of MOT.
28. Derive the relationship between Cp and Cv for n moles of an ideal gas.
29. What is meant by a spontaneous process ? Explain the criteria for spontaneity and equilibrium in terms of free energy change.
30. The standard enthalpies of formation of $CO_2(g)$ and $H_2O(l)$ are -393.5 and -285.8 $KJmol^{-1}$ respectively. The standard enthalpy of combustion of ethane is -1560.0 $KJmol^{-1}$. Calculate the standard enthalpy of formation of ethane.
31. Write notes on 1) Enthalpy of combustion and 2) Enthalpy of Hydration.

(6 x 4 = 24 Marks)

SECTION – D

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

32. (i). What are the postulates of the Bohr's atomic theory ?
    (ii). How is the hydrogen spectrum explained on the basis of Bohr's theory ?
33. Explain the Born – Haber cycle for NaCl. Discuss its applications.
34. (i). Derive an expression for the work done in a reversible isothermal expansion of an ideal gas.
    (ii). Calculate the maximum work done when 5 moles of an ideal gas expands reversibly and isothermally from a pressure of 10 atm to 2 atm at 390 K. Also calculate the change in internal energy, change in enthalpy and heat absorbed by the system.
35. (i). Derive the Kirchoff's equation and arrive at its integrated form.
    (ii). Calculate ΔH at 298 K for the reaction $H_2O\,(g) \longrightarrow H_2\,(g) + \frac{1}{2}\,O_2\,(g)$. Given: ΔH at 291 K is 241.75 KJ; the molar heat capacities at constant pressure for H_2, O_2, and H_2O are 28.83, 29.12, and 33.56 $JK^{-1}mol^{-1}$ respectively.

(2 x 15 = 30 Marks)

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