Q.P. Code :19993

[Time: Three Hours] **[Marks:100]**

Please check whether you have got the right question paper.

N.B:
1. All questions are compulsory.
2. Answer to the same question must be written together.
3. Figure to the right indicate full marks.
4. Use of non-programmable calculator is allowed.

Q.1 A) Select the correct option and complete the following sentences. **12**

i) State functions are_____.
a) Path dependent b) Inexact differential c) Path independent

ii) 1 ppm solution of KCl contains_____.
a) 1 mg of KCl per dm^3 b) 1 g of KCl per dm^3 c) 1 µg of KCl per dm^3

iii) Molar heat capacity is _____.
a) Extensive property b) Intensive property c) Neither a nor b

iv) For endothermic reaction, enthalpy change is _____.
a) Negative b) Positive c) Zero

v) 3s orbital has _____ radial nodes
a) Zero b) One c) Two

vi) In Layman series of hydrogen spectrum, the value of n_1 is _____.
a) Three b) Two c) One

vii) The shape of P orbital is _____
a) Spherical b) Dumb bell c) Elliptical

viii) In ground state of an atom, the electron occupies the _____ energy orbitals available to them.
a) Highest b) Lowest c) Middle

ix) Bond angle in methane molecule is _____.
a) $107°$ b) $104°.5^I$ c) $109°28^I$

x) Carbon-carbon bond length is maximum in _____ bond.
a) Triple b) Double c) Single

xi) The group _____ exhibits –I effect.
a) $-C_2H_5$ b) $-CH_3$ c) $-Cl$

xii) _____ is non polar molecule.
a) CCl_4 b) H_2O c) HCl

B) State the following statements are true or false **03**

i) When 30 g of HCl is present in 100g of solution then it is weight/volume method of expressing concentration.

ii) Splitting of spectral lines under the influence of electric field is called stark effect

iii) Triphenyl methyl radical is a stable radical.

C) Match the columns. **05**

Column P	Column Q
a) Equivalent weight of $KMnO_4$ in acidic solution	i) R-COOR'
b) Density	ii) Nobel gas
c) Mg^{+2}	iii) Intensive property
d) Ar	iv) 158
e) Ester	v) 31.6
	vi) Ten electrons

Q.2 A) i) Derive the equation $\Delta H_2 - \Delta H_1 = \Delta C_p(T_2 - T_1)$ where terms have their usual meaning **05**

ii) Define heat capacity at constant volume. Calculate the value of ΔE on heating 4 moles of oxygen from $0°C$ to $100°C$. **03**
Given : $C_v = 20.92\ J.\ K^{-1}.mol^{-1}$.

OR

i) What is standard enthalpy of formation? Calculate the standard enthalpy of reaction **05**
$4\ CO(g) + 2\ NO_2\ (g) \rightarrow 4CO_2(g) + N_2(g)$
$\Delta H°_f\ (CO) = -110.5 kJ\ mol^{-1}$
$\Delta H°_f\ (NO_2) = 33.2\ kJ\ mol^{-1}$
$\Delta H°_f\ (CO_2) = -393.5\ kJ\ mol^{-1}$

ii) State and explain Zeroth law of thermodynamics. Why is it called so? **03**

B) i) Two moles of an ideal gas at 10 atmosphere and $0°C$ converted to 2 atmosphere at $60°C$. Find ΔE and ΔH for the change. **05**
Given : - $Cv = 20.92\ J.K^{-1}\ mol^{-1}$
$R = 8.314\ J.K^{-1}\ mol^{-1}$

ii)Calculate the weight of the following substances that will be required to prepare $500 cm^3$ of 0.2N solution of each of the following **03**
a) $C_{12}H_{22}O_{11}$ (Cane sugar)
b) Oxalic acid $C_2\ H_2\ O_4\ .2H_2O$
(Given molar mass of cane sugar $= 342.29$
Molar mass of oxalic acid dihydrate $= 126.064$

OR

B) i) Define work. **05**

Calculate q , w and ΔE when 3 moles of monoatomic gas expands adiabatically against constant external pressure of 2 atmosphere from a volume of 3dm^3 to 20dm^3 at 300K.

Given $1\text{dm}^3.\text{atm} = 101.325\ \text{J}$

ii). 20g of NaCl is dissolved in 500 g of water. Calculate mole fraction of NaCl in water. **03**

Molar mass of NaCl $= 58.5$

C) i) Define **02**

1) Closed system

2) Isothermal process

ii).Explain the term millimoles **02**

OR

i) Define **02**

1) Reversible process

2) Isobaric process

ii) Explain the term ppb **02**

Q.3 A) I) Explain the term stationary orbits based on Bohr's postulates of theory of atomic structure. Give any two limitations of Bohr's atomic model. **05**

II) An atom of an element contains 29 electrons and 35 neutrons. Deduce i) the numbers of protons ii) atomic mass and iii) the electronic configuration of the element. **03**

OR

i) Why did Rutherford's atomic model fail to explain stability of atom? **05**

ii) What are hydrogenic species? Give two examples. **03**

B) I) State modern periodic law. Explain briefly classification of elements as main group and transition elements with two examples of each. **05**

II) State factors influencing ionization enthalpy values. First ionization enthalpy of nitrogen is higher than that of oxygen. Explain. **03**

OR

i) Explain the term electronegativity of an element based on Pauling's method. Calculate electronegativity of chlorine based on Pauling's method. **05**

Given Electronegativity of Hydrogen =2.1

Resonance energy of HCl is $92.1\ \text{kJ mol}^{-1}$

ii) Calculate effective nuclear charge experienced by a 3d electron in zinc. **03**

(Zinc atomic number 30)

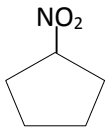
C) For a 3d electron name four quantum numbers and write their all possible values. **04**

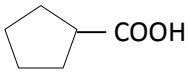
OR

State and explain Heisenberg uncertainty principle. **04**

Q.4 A) i) Write IUPAC names of the following compounds. **05**

1) $CH_3 - O - CH_2 - CH_3$

2) 

3) 

4) $H_3C - CH_2 - CH_2 - COOH$

5) $H_3C - CH_2 - CH_2 - CHO$

ii). Discuss the orbital structure of ethene. **03**

OR

i) Draw structures of the following compounds. **05**

1) n-butane
2) Methyl cyclopentane
3) Propanone
4) N- Methyl 1- butanamine
5) Nitroethane

ii) Explain sp^3 hybridisation of oxygen with suitable example. **03**

B) i) Explain the relative acidities of mono, di and trichloroacentic acids on the basis of inductive effect **05**

ii). Explain stability of benzyl radical on the basis of resonance. **03**

OR

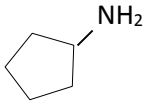
i) Explain the following terms with examples **06**

i) Nucleophiles
ii) Electrophiles
iii) Hypercojugation

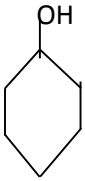
ii) Give one example of following reactions **02**

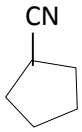
1) Elimination Reaction
2) Addition Reaction

C) Write IUPAC names of the following compounds **04**

1) 

2) $H_3C - CH_2 - CH_2 - CH_2 - Cl$

3) 

4) 

OR

D) Draw structures of the following **04**
1) Propanamide
2) Cyclobutene
3) Pentanoic acid
4) Cyclopentanone

Q.5 Attempt any four of the following

A) What is enthalpy of combustion? What are its applications? **05**

B) Calculate the molarity of the following solutions **05**
a) 20 g of $CuSO_4 . 5H_2O$ in 1 dm^3 of solution
b) 9.5 g of $NiSO_4 . 6H_20$ in 700 cm^3 of solution
Molar mass of $CuSO_4.5H_2O$ = 249.68
Molar mass of $NiSO_4 . 6H_2O$ = 262.85

C) What are the necessary conditions for a wave function Ψ to give physically acceptable solutions? **05**

D) State Aufbau Principle. What is meant by electron spin? Write the quantum number and its possible values which designate electron spin. **05**

E) Explain sp hybridization with suitable example. **05**

F) Explain structure of free radicals. **05**

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