SEAL

960247

CHEMISTRY

Paper-II

Time: 3 Hours | Full Marks: 100

Insturctions : *(1) Answer **all** questions.*

(2) The figures in the right-hand margin indicate full marks for the questions.

1. Answer any **eight** questions : 2×8=16

(a) Discuss the shape of XeF_4 based on VSEPR theory.

(b) State the Arrhenius definition of acids and bases.

(c) Acetic acid is a weak acid. Explain, why.

(d) The reaction of combustion of methane is

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

How many moles of methane are required to produce 44 g of CO_2?

(e) Write the structure formulae of—

(i) 2,4-Dimethylhexane-3-one;

(ii) Prop-2-en-1-nitrile.

(f) Draw keto-enol structures of acetone and predict which form exhibits better stability.

(g) What is ozonolysis?

(h) How will you detect the presence of unsaturation in an organic compound?

(i) Write the Hund's rule of maximum multiplicity.

2. Answer any **fifteen** questions : 3×15=45

(a) Write the Octet rule. State its significance and limitations.

(b) Explain why bond angle in water is less than that of ammonia.

(c) What is meant by conjugate acid-base pair? Find the conjugate acid-base pair in the following reaction :

$$NH_2NH_2 + H_2O \rightarrow NH_2NH_3^+ + OH^-$$

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(d) Identify the following redox reaction as displacement, disproportionation reactions :

(i) $Cl_2(g) + 2OH^-(aq) \rightarrow ClO^-(aq) + Cl^-(aq) + H_2O(l)$

(ii) $CuSO_4(aq) + Zn(s) \rightarrow Cu(s) + CuSO_4(aq)$

(iii) $Mg(s) + 2H_2O(l) \rightarrow Mg(OH)_2(s) + H_2(g)$

(e) Name one anti-knocking agent. Write its merits and demerits (one each).

(f) Predict the structure of reduction products obtained when but-2-yne is reduced with (i) Lindlar's catalyst and (ii) Na in liquid NH_3.

(g) Calculate the gross and net calorific value of a coal sample having the following composition :

C = 80%; H = 7%; S = 3.5%; N = 2.1% and ash = 4.4%

(h) Discuss Ritter test to distinguish primary, secondary and tertiary alcohols.

(i) Write the ground state electronic configurations of the following :

(i) C

(ii) F

(iii) Ca

(j) The ionization energy of H is 13.6 eV. What is the difference in energy between the $n = 1$ and $n = 6$ levels?

(k) How many orbitals are possible for $n = 4$? Which of these may be described as gerade?

(l) Account for the large decrease in the electron affinity between Li and Be despite the increase in nuclear charge.

(m) Determine the number of unpaired electrons in the ground state of the following ions :

(i) Ti^{3+}

(ii) Mn^{2+}

(iii) Cu^{2+}

(n) Using Slater's rule, calculate Z^* for the following electrons :

(i) a $3p$ electron in P

(ii) a $4s$ electron in Co

(o) Describe the factors which influence the electron affinity of halogens.

(p) What are the isotopes of hydrogen? How is H_2 prepared from CH_4?

(q) Describe the extraction of Cu from its mineral, chalcopyrite.

3. Answer any **three** questions : 4×3=12

(a) What is acid-base indicator? Explain the working principle of acid-base indicator with the help of an example.

(b) What is singlet oxygen? Write the chemical properties of O_2.

(c) Determine the ground state term symbol of the following free atoms :

(i) B

(ii) N

(d) Briefly describe hyperconjugation with an example.

4. Answer any **three** questions : 5×3=15

(a) Define molecular formula and empirical formula. The elemental composition of a compound is H: 4.07 %; C: 24.27 % and Cl: 71.65%. The molar mass of the compound is 98.96 g. What are its empirical and molecular formulae?

(b) What is the relation between pH and pOH? If 0.40 g of NaOH is dissolved in water to give 1000 ml of solution at 25°C. Calculate the concentrations of potassium and hydroxyl ions. Calculate the pH.

(c) What are silicones? How $(CH_3)_2SiCl_2$ can be synthesized? Write the hydrolysis product of $(CH_3)_2SiCl_2$ and their corresponding polymer.

(d) Write three major iron ores along with their chemical formulae. Describe whether Fe_3O_4 exhibits spinel or inverse spinel structure.

5. Complete the following reactions (any **six**) : 12

(i) $B(OH)_3 + (CH_3CO)_2O \rightarrow$

(ii) $(CN)_2 + N_3H \rightarrow$

(iii) $Mg + Si$ (Δ in absence of air) $\rightarrow$

(iv) $CO + I_2O_5 \rightarrow$

(v) $BF_3 + NaBH_4$ (in ether) $\rightarrow$

(vi) $B(Me)_3 + NH_3 \rightarrow$

(vii) $CO_2 + OH^- \rightarrow$

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