ARUNACHAL PRADESH PUBLIC SERVICE COMMISSION, ITANAGAR

CHEMISTRY

Time: 3 hours

Full Marks: 200

Note: Question No.1 is compulsory and any four from the remaining seven questions. All questions carry equal marks.

Q. No.1. Attempt any 10 (ten) 10X4 =40

A. Write the differences of order and molecularity of a reaction.
B. What is meant by critical temperature and critical pressure?
C. Explain why C_p is always greater than C_v.
D. Define autocatalysis with example.
E. What do you understand by Pauli's exclusion principle?
F. Explain, electron affinities of halogens are very high.
G. Find oxidation number of (i) Cr in CrO_2Cl_2 and (ii) Pt in $H_2[Pt\ Cl_6]$.
H. Arrange the following in order of increasing acid strength
   (i) HNO_3, HPO_3, $HAsO_3$.
   (ii) CCl_3COOH, CBr_3COOH, $C\ I_3COOH$.
I. What is inductive effect?
J. Name the following compounds:
   (i) CH_3-CH (CH_3)-CH_2-CH_2-CH_3 (ii) CH_3-C (CH_3) =C (CH_3)-CH_3
   (iii) CH_3-CH_2-C≡C-CH_3 (iv) CH_3–C(=O)–CH (Br)-COOH.
K. Write the geometrical isomers of the following
   (i) Monobromopropene (ii) Pent-2-ene.
L. Complete the following reaction

(i) $CH{\equiv}CH + H_2O \xrightarrow{HgSO_4/H_2SO_4}$ (ii) $CH_3CH_2OH \xrightarrow{K_2Cr_2O_7/H^+}$

Q.No.2. Attempt any 8(eight) 8X5=40

A. Express the rate of the following reaction in terms of different reactants and products
   $4NH_3 + 5\ O_2 \longrightarrow 4NO + 6H_2O$
B. State and explain Carnot's theorem. How can the efficiency of a heat engine be increased?
C. Differentiate between Gibb's free energy and Helmholtz free energy.
D. Discuss Faraday's laws of electrolysis.
E. What are sub shells possible in n=3 energy level?
F. Explain Soddy-Fajan's principle with example.
G. What do you mean by conjugate acid-base pairs on the basis of Bronsted-Lowry concept?
H. Explain clearly electromeric effect.
I. Write note on nucleophiles.

J. Write structural formula of the following.

(i) 2-bromo-1-methoxypropane (ii) 1-chloro-2-ethylcyclohexane
(iii) 2-methyl-2-propanol (iv) methanal
(v) Ethoxyethane

Q.No.3.Attempt any 5 (five) 5X8=40

A. How will you determine the order of a reaction if two initial concentrations and corresponding two half life periods are given?

B. The value of Kp for the water gas reaction $CO + H_2O = CO_2 + H_2$ is 1.06×10^5 at 25^0C. Calculate the standard state free energy change (ΔG^0) of the reaction at25^0 C. ($R=8.314 JK^{-1}mol^{-1}$)

C. Write the electronic configuration of Cu, Zn^{2+}, Cr and Ag.

D. What are the different blocks constituting the periodic table? Explain.

E. Name and write four main ores of each iron and nickel.

F. What are the conditions of mesomeric effect?

G. What happens when

(i) Chloroethane is treated with aqueous KOH.
(ii) Pent-2-ene is treated with O_3 and then the product is treated with Zn/H_2O
(iii) But-1-ene is treated with HBr in presence of benzoyl peroxide.
(iv) Benzene is treated with CH_3Cl in presence of anhydrous $AlCl_3$.

Q. No. 4. Attempt any 4 (four) 4X10=40

A. Explain the behavior of real gas equation (i) at low pressure, (ii) at moderate pressure and (iii) at high pressure.

B. Give Lewis definition of acid and base with examples.

C. Write a note on cracking of petroleum.

D. Describe the mechanism of aldol condensation.

E. Discuss the variation of equivalent conductance and molar conductance with dilution.

Q.No. 5. Attempt any 2 (two) 2X20=40

A. Derive the critical constants V_c, T_c, P_c from van der Waal's equation where 'a' and 'b' are van der Waal constants.

B. Discuss the structure of diborane.

C. What are carbocation and carbanion? Discuss their characteristics, stability and structure.

Q. No. 6. Derive an expression for the rate constant of A + B→ Products where the initial concentrations are different. Describe the characteristics and half life period of Second order reaction. 40

Q. No. 7. What are chief ores of copper? How is copper extracted from its chief ore? 40

Q. No. 8. Discuss and establish the open chain structure of glucose. 40