(6) *Figures to the right indicate full marks.*

(7) *For multiple choice type questions, only the first attempt will be considered for evaluation.*

(8) *Physical constants :*

(i) Avogadro Number = $N_A = 6.022 \times 10^{23}$

(ii) Gas constant = R = 0.08206 L–atm. K^{-1}. mol^{-1}

(iii) 1 Faraday = F = 96500 Coulomb

SECTION - A

Q. 1. Select and write the correct answer for the following multiple choice type of questions : **[10]**

(i) The electrolyte used in $H_2 - O_2$ fuel cell is _____.

(a) aqueous KCl (b) aqueous KOH

(c) aqueous HCl (d) aqueous KNO_3

(ii) The oxidation state of bromine in $HOBrO_2$ oxoacid is _____.

(a) + 7 (b) + 5

(c) + 3 (d) + 1

(iii) Acetonitrile may be prepared by heating the following reactants :

(a) Ethyl chloride with alcoholic KCN

(b) Ethyl chloride with alcoholic AgCN

(c) Methyl chloride with alcoholic KCN

(d) Methyl chloride with alcoholic AgCN

(iv) The carbonated water is an example of _____.

(a) solid in liquid solution

(b) liquid in liquid solution

(c) gas in liquid solution

(d) liquid in gas solution

(v) The unit of rate constant is per second, the order of reaction is –

(a) Zero

(b) First

(c) Second

(d) Third

(vi) A system releases 10 kJ of heat and performs 15 kJ of work on the surrounding. Hence the change in internal energy is :

(a) + 5 kJ (b) – 5 kJ

(c) + 25 kJ (d) – 25 kJ

(vii) The co-ordination complex ions $[Co(NH_3)_5(NO_2)]^{2\oplus}$ and $[Co(NH_3)_5(ONO)]^{2\oplus}$ are _____ of each other.

(a) ionization isomers

(b) solvate isomers

(c) linkage isomers

(d) co-ordination isomers

(viii) The correct order for basic strength of amines and ammonia is _____.

(a) $NH_3 > R-NH_2 > R_2NH > R_3N$

(b) $NH_3 > R_3N > R_2NH > R-NH_2$

(c) $NH_3 < R-NH_2 > R_3N > R_2NH$

(d) $NH_3 < R-NH_2 < R_2NH > R_3N$

(ix) Amongst the following 3d-series elements, having highest value of first ionization enthalpy is _____.

(a) Zn (b) Cu

(c) Co (d) Sc

(x) The pOH of 0.01 M HCl solution is _____.

(a) 1 (b) 2

(c) 11 (d) 12

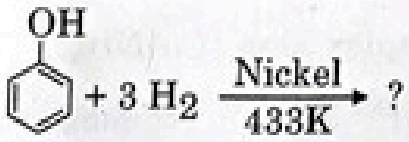
Q. 2. Answer the following questions : **[8]**

(i) Write the name of product obtained, when selenium is treated with magnesium metal.

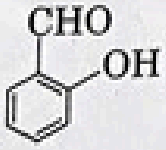
(ii) Write the SI unit of cell constant.

(iii) Write the name of radioactive element in lanthanide series.

(iv) Complete the following reaction :



(v) Write the IUPAC name of :



(vi) Copper has fcc structure with edge length 495 pm. What is the radius of copper atom in pm?

(vii) Write the chemical name of Teflon.

(viii) Write the name of nanoparticle which acts as highly effective bacterial disinfectant.

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SECTION - B

Attempt any EIGHT of the following questions : **[16]**

Q. 3. Define :

(a) Isomorphism

(b) Unit Cell

Q. 4. Explain the trends in the following properties of group 17 elements :

(i) Atomic radii

(ii) Electronegativity

Q. 5. Explain Homoleptic and Heteroleptic complexes with example.

Q. 6. (a) Write the reaction of bromine water on glucose.

(b) Define – Enantiomers

Q. 7. (i) Write example of one dimensional nanostructure of size less than 100 nm.

(ii) Write the hydrolysis reaction of ethyl methyl ether.

Q. 8. Calculate the osmotic pressure of solution containing 0.822 gm of sucrose in 300 mL of water at 298 K.

[Given : Molar mass of sucrose 342 g/mol, R = 0.08205 dm^3. atm. K^{-1}. mol^{-1}]

Q. 9. Write the mathematical equation of first law of thermodynamics for following processes :

(a) Isochoric process

(b) Adiabatic process

Q. 10. Write two similarities and two differences between lanthanoids and actinoids.

Q. 11. What is the action of following reagents on chlorobenzene?

(i) conc. HNO_3

(ii) fuming H_2SO_4

Q. 12. Explain Cannizzaro reaction with suitable example.

Q. 13. A chemical reaction occurs in two steps :

(i) $NO_2Cl_{(g)} \xrightarrow{slow} NO_{2(g)} + Cl_{(g)}$

(ii) $NO_2Cl_{(g)} + Cl_{(g)} \xrightarrow{fast} NO_{2(g)} + Cl_{2(g)}$

(a) Write down the rate law.

(b) Identify the reaction intermediate.

Q. 14. The standard potential of electrode Cu^{++} (0.02 M) | $Cu_{(s)}$ is 0.337 volt. Calculate its potential in volt.

SECTION - C

Attempt any EIGHT of the following questions : [24]

Q. 15. (i) Derive relationship between relative lowering of vapour pressure and molar mass of non volatile solute.

(ii) Write statement of second law of thermodynamics.

Q. 16. (i) Convert, acetamide into ethyl amine.

(ii) Explain amphoteric nature of water.

Q. 17. Convert the following :

(i) Ethanol into sodium ethoxide.

(ii) Phenol into o-phenol sulfonic acid.

(iii) Bromomethane into methoxyethane.

Q. 18. (i) What is peptide linkage?

(ii) Write general characteristics of interhalogen compounds.

Q. 19. (i) Write observed electronic configuration of chromium (Z = 24).

(ii) Calculate magnetic moment of Ti^{3+} by using spin only formula. (Z of Ti = 22)

(iii) Define Green chemistry.

SEAT NUMBE[redacted]

Q. 20. (i) Write examples of coordination metal complexes in biology.

(ii) Calculate the work done in oxidation of 2 moles of SO_2 at 298K, if $SO_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow SO_{3(g)}$

[Given : R = 8.314 J/K/mol]

Q. 21. (i) Write the formula to measure % atom economy according to green chemistry.

(ii) Convert :

(a) Benzene into benzaldehyde

(b) Cyclohexene into adipic acid

Q. 22. (i) Write a reaction for preparation of Nylon-6.

(ii) The salt of Sc^{3+} ion is colourless and the salt of Mn^{3+} ion is coloured. Explain.

[Z of Sc = 21 and Z of Mn = 25]

Q. 23. (i) Write the postulates of Werner's theory of co-ordination complexes.

(ii) What is the action of ethane –1, 2 – diol on acetone?

Q. 24. (i) Write Tollen's reagent test for acetaldehyde.

(ii) Write the structure of zwitter ion of sulfanilic acid. Write the reaction between benzene diazonium chloride and phenol in alkaline medium.

Q. 25. (i) Define :

Common ion effect.

(ii) Write preparation of glucose from starch.

Q. 26. (i) Draw the structure of 2, 4 – dinitrophenylhydrazone of acetaldehyde.

(ii) The rate of $A + B \rightarrow P$ is 3.6×10^{-2} mol/dm^3/s. When [A] = 0.2 M and [B] = 0.1 M. Calculate the rate constant if reaction is first order in B and second order in A.

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SECTION - D

Attempt any THREE of the following questions : [12]

Q. 27. (i) Define :

(a) Isotonic solution

(b) Molecularity of reaction

(ii) State and explain Hess's law of constant heat summation.

Q. 28. (i) Define :

(a) Schottky defect

(b) Ferromagnetism

(ii) Write the name of catalyst used in preparation of HDP.

(iii) Draw structure of isoprene unit of natural rubber.

Q. 29. (i) Calculate effective atomic number of $Fe^{2\oplus}$ in $[Fe(CN)_6]^{4\ominus}$

[Given : (Z = 26)]

(ii) Draw neat and labelled diagram of lead accumulator.

(iii) Write two advantages of hydrogen – oxygen fuel cell.

Q. 30. (i) Convert, ethanoic acid to ethanol.

(ii) Explain the mechanism of alkaline hydrolysis of bromomethane.

Q. 31. (i) Acetic acid is 5% ionised in its decimolar solution. Calculate the dissociation constant of acetic acid.

(ii) Write chemical formula of epsom salt.

Give two uses of H_2SO_4.

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