BOARD QUESTION PAPER : FEBRUARY 2024

CHEMISTRY

Time: 3 Hrs. **Max. Marks: 70**

General Instructions:

*The question paper is divided into **four** sections.*

(1) ***Section A:*** *Q. No. **1** contains **Ten** multiple choice type of questions carrying **One** mark each. Q. No. **2** contains **Eight** very short answer type of questions carrying **One** mark each.*

(2) ***Section B:*** *Q. No. **3** to Q. No. **14** are **Twelve** short answer type of questions carrying **Two** marks each. (Attempt **any Eight**).*

(3) ***Section C:*** *Q. No. **15** to Q. No. **26** are **Twelve** short answer type of questions carrying **Three** marks each. (Attempt **any Eight**).*

(4) ***Section D:*** *Q. No. **27** to Q. No. **31** are **Five** long answer type of questions carrying **Four** marks each. (Attempt **any Three**).*

(5) Use of log table is allowed. Use of calculator is not allowed.

(6) Figures to the right indicate full marks.

(7) For each multiple choice type of question, it is mandatory to write the correct answer along with its alphabet. e.g. (a)……/(b)……/(c)……/(d)……. etc.

No mark(s) shall be given, if ONLY the correct answer or the alphabet of the correct answer is written. Only the first attempt will be considered for evaluation.

Given:

$R = 8.314\ J.K^{-1}.\ mol^{-1}$

$N_A = 6.022 \times 10^{23}$

$F = 96500C$

SECTION – A

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

i. The spin only magnetic moment of Cr^{3+} cation is _____.

(A) 3.742 BM (B) 3.755 BM (C) 3.873 BM (D) 3.633 BM

ii. The linkage present in lactose is _____.

(A) α,β-1,2-glycosidic linkage (B) α-1,4-glycosidic linkage

(C) β-1,4-glycosidic linkage (D) α-1,4-glycosidic linkage

iii. The product of the following reaction is

$$C_2H_5 - \overset{\overset{O}{\|}}{C} - CH_3 \xrightarrow[\Delta]{H_2/Ni} ?$$

(A) $CH_3 - CH_2 - CH_2 - CH_2 - OH$ (B) $CH_3 - \underset{\underset{OH}{|}}{CH} - CH_2 - CH_3$

(C) $CH_3 - CH_2 - CH_2 - CH_3$ (D) $CH_3 - CH_2 - CH_2 - COOH$

iv. The pH of 0.001M HCl solution is _____.

(A) 10 (B) 3 (C) 2 (D) 11

v. The correct structure of complex having IUPAC name sodium hexanitrocobaltate (III) is

(A) $Na_3[Co(NO_2)_5]$ (B) $Na_4[Co(NO_2)_6]$ (C) $Na_3[Co(NO_2)_6]$ (D) $Na_4[Co(NO_2)_5]$

vi. The number of particles present in face centred cubic unit cell is/are _____.

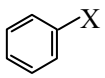
(A) 1 (B) 2 (C) 3 (D) 4

vii. The monomer used in preparation of teflon is _____.

(A) ε-caprolactum (B) vinyl chloride (C) styrene (D) tetrafluoroethene

viii. Among the following vinylic halide is ____.

(A) $R - \underset{\underset{X}{|}}{CH} - R$ (B) $CH_2 = CH - X$

(C)  (D) $CH_2 = CH - CH_2 - X$

ix. The product of hydrolysis of propyne in the presence of 1% $HgSO_4$ and 40% H_2SO_4 is _____.

(A) methanal (B) ethanal (C) propanal (D) propanone

x. If unit of rate constant is mol $dm^{-3}s^{-1}$, the order of reaction would be _____.

(A) zero (B) 1 (C) 2 (D) 3

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

i. Write the name of metal nanoparticle used to remove *E.coli* bacteria from water.

ii. Write the name of reduction product formed when ethyl cyanide is treated with sodium and alcohol.

iii. Complete the reaction: $CH_3CH_2Cl \xrightarrow[\text{alc. }\Delta]{AgCN} ?$

iv. Calculate effective atomic number of $[Co(NH_3)_6]^{3+}$ ion.

v. The compounds of Ti^{4+} ions are colourless due to _____.

vi. Write SI unit of molar conductivity.

vii. Write the sign convention of work done during expansion of gas.

viii. Write the condition of reverse osmosis.

SECTION – B

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

Q.3. Derive an expression for maximum work obtainable during isothermal reversible expansion of an ideal gas from initial volume (V_1) to final volume (V_2).

Q.4. What are interhalogen compounds? Write the chemical reaction, when chlorine reacts with dry slaked lime.

Q.5. What is nanomaterial? Write the reaction involved in sol-gel process during hydrolysis.

Q.6. Write classification of proteins with an example.

Q.7. Calculate the time required to deposit 2.4 g of Cu, when 2.03 A of current passed through $CuSO_4$ solution. (At. mass of Cu = 63.5 g mol^{-1})

Q.8. Why amines are basic in nature? Among dimethylamine ($pK_b = 3.27$) and diethylamine ($pK_b = 3.0$), which one is more basic?

Q.9. Explain buffer action of sodium acetate-acetic acid buffer.

Q.10. Write preparation of

i. Diethyl ether ii. Ethyl cyanide from ethyl bromide.

Q.11. Henry's constant for $CH_3Br_{(g)}$ is 0.159 mol dm^{-3} bar^{-1} at 25 °C. Calculate its solubility in water at 25 °C, if its partial pressure is 0.164 bar.

Q.12. Write the structure and name of monomer of

i. Nylon-6 ii. Natural rubber

Q.13. Define lanthanide contraction. Write the balanced chemical equations when acidified $K_2Cr_2O_7$ reacts with H_2S.

Q.14. Derive the relationship between molar mass, density of the substance and unit cell edge length.

SECTION – C

Attempt any EIGHT of the following questions: **[24]**

Q.15. What is osmotic pressure? How will you determine molar mass of solute from osmotic pressure?

Q.16. Write chemical reactions involved in:

i. Rosenmund reduction

ii. Gatterman Koch formylation

iii. Cannizzaro reaction of methanal

Q.17. Calculate the standard enthalpy of combustion of methane, if the standard enthalpy of formation of methane, carbon dioxide and water are –74.8, –393.5 and –285.8 kJ mol^{-1} respectively.

Q.18. What is the action of following on ethyl bromide?
i. Silver nitrite
ii. Mg in dry ether
iii. Alcoholic sodium hydroxide

Q.19. For the reaction A + B → P.
If [B] is doubled at constant [A], the rate of reaction doubled. If [A] is tripled and [B] is doubled, the rate of reaction increases by a factor of 6. Calculate the rate law equation.

Q.20. Arrange the following in the increasing order of the property mentioned:
i. $HOCl$, $HClO_2$, $HClO_3$, $HClO_4$ (acidic strength)
ii. MF, MCl, MBr, MI (ionic character)
iii. HF, HCl, HBr, HI (thermal stability)

Q.21. Explain Wolf–Kishner reduction reaction. Write preparation of propanone by using ethanoyl chloride and dimethylcadmium.

Q. 22. Write postulates of Werner's theory of co-ordination complexes. Write the name of a hexadentate ligand.

Q.23. Define electrochemical series and write its two applications.

Q.24. Identify 'A', 'B' and 'C' in following chain reaction and rewrite the chemical reactions:

$$CH_3CH_2OH \xrightarrow[Br_2]{red'P'} A \xrightarrow[alc]{KCN} B \xrightarrow[Ether]{LiAlH_4} C$$

Q.25. Define acids and bases according to Bronsted–Lowry theory. Derive relationship between pH and pOH.

Q.26. Write the preparation of potassium dichromate from chromite ore.

SECTION – D

Attempt any THREE of the following questions: **[12]**

Q.27. Convert the following:
i. Acetaldehyde to isopropyl alcohol.
ii. Cumene to phenol.
iii. Anisole to phenol.
Write two uses of neon.

Q.28. Define:
i. Extensive and intensive properties
ii. Isobaric and adiabatic processes
What are enzymes?
Write the atomic numbers of transuranium elements.

Q.29. Predict the type of cubic lattice of a solid element having edge length of 400 pm and density is 6.25 g/mL. (Atomic mass of element = 60)
Define nanoscience.
Write chemical reaction for the preparation of polyacrylonitrile.

Q.30. Derive the relation between half life period and rate constant for first order reaction.
Write the net cell reaction during discharging of lead accumulator.
Draw the structure of peroxymonosulphuric acid.

Q.31. i. Mention the number of unpaired electrons and geometry of following complexes:
a. $[Ni(Cl)_4]^{2-}$
b. $[Ni(CN)_4]^{2-}$
ii. Convert the following:
a. Ethanenitrile into ethanal.
b. Cyclohexane into adipic acid.