Newton's Academy

CHEMISTRY

Time: 3 Hours   **Total 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 contain **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 MCQ**, correct answer must be written along with its alphabet, e.g. (a) …….. / (b) …….. (c) …….. / (d) …….. etc.

8. Physical constant:

   Avogadro's Number = $N_A = 6.022 \times 10^{23}$

Section-A

Q.1. Select and write correct answer of the following questions: **[10][7]**

i. Identify synthetic polymer amongst the following:

   (A) Linen   (B) Jute   (C) Silk   (D) Terylene

ii. Which among the following hydrides is NOT a reducing agent?

   (A) H_2O (B) H_2S (C) H_2Te (D) H_2Se

iii. During oxidation of ferrous sulphate using mixture of dil. H_2SO_4 and potassium dichromate; oxidation state of chromium changes from _____.

   (A) + 6 to + 2   (B) + 6 to + 3   (C) + 6 to + 1   (D) + 6 to + 4

iv. Identify complex ion in which effective atomic number of the central metal ion is 35.

   (Given At. Number of Co = 27, Fe = 26, Zn = 30)

   (A) $[Zn(NH_3)_4]^{2+}$ (B) $[Fe(CN)_6]^{4-}$ (C) $[Fe(CN)_6]^{3-}$ (D) $[Co(NH_3)_6]^{3+}$

v. Conversion of methyl chloride into methyl fluoride is known as _____.

   (A) Finkelstein reaction   (B) Swarts reaction

   (C) Williamson's synthesis   (D) Wurtz reaction

vi. The number of moles of methyl iodide required to prepare tetramethyl ammonium iodide from 1 mole of methyl amine is/are:

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

vii. Name the reagent which on reaction with glucose confirms the presence of five hydroxyl groups in glucose:

   (A) Hydroxyl amine   (B) Bromine water

   (C) Dilute nitric acid   (D) Acetic anhydride

viii. Identify antibiotic drug amongst the following:
    (A) Codeine   (B) Equanil
    (C) Penicillin   (D) Valium

ix. The number of atoms per unit cell of body centred cube is:
    (A) 1   (B) 2
    (C) 4   (D) 6

x. Calculate the work done during the reactions represented by the following thermochemical equation at 300 K:

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
(g)   (g)   (g)   (l)
($R = 8 \cdot 314 \ JK^{-1} mol^{-1}$)
    (A) $+ 4 \cdot 988$ kJ   (B) $- 4 \cdot 988$ kJ
    (C) $- 49 \cdot 88$ kJ   (D) $+ 49 \cdot 88$ kJ

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

i. What is the concentration of dissolved oxygen at 50°C under pressure of one atmosphere if partial pressure of oxygen at 50°C is 0.14 atm.
(Henry's law constant for oxygen = $1.3 \times 10^{-3} \ mol \ dm^{-3} atm^{-1}$)

ii. Write structural formula of the alcohol that results when acetaldehyde is reacted with CH_3MgBr in the presence of dry ether and the product is hydrolysed.

iii. Write balanced chemical reaction for preparation of acetic anhydride using acetic acid.

iv. Write the chemical reaction involved in the formation of ethylamine using acetaldoxime.

v. What is electromatallurgy?

vi. For the reaction:
$N_2O_4 \rightarrow 2NO_2$
 (g)   (g)
($\Delta H° = + 57 \cdot 24$ kJ, $\Delta S° = 175 \cdot 8 \ Jk^{-1}$)
At what temperature the reaction will be spontaneous?

vii. The standard e.m.f. of the following cell is 0.463 V
$Cu | Cu^{++} | | Ag^+ | Ag$
 (s) (lM)   (lM) (s)

If the standard potential of Ag electrode is 0.800 V, what is the standard potential of Cu electrode?

viii. Write the mathematical relation between half life of zero order reaction and its rate constant.

Section-B

Attempt any EIGHT of the following questions: **[16]**
Q.3. State and explain Hess's law of constant heat summation.

Q.4. Write the cell reaction and calculate E° cell of the following electrochemical cell:
$Al | Al^{3+} | | Zn^{2+} | Zn$
 (s) (aq.)   (aq.) (s)
      (1M) (1M)
$E°_{Al} = - 1.66$ V
$E°_{Zn} = - 0.76$ V

Q.5. Distinguish between order and molecularity of a reaction.

Q.6. Write two uses of each of the following:
    a. Helium
    b. Neon

Q.7. Write the name and chemical formula of one ore of zinc,
Define: Quaternary ammonium salt.

Q.8. What is the action of acidified potassium dichromate on the following:
a. KI
b. H_2S

Q.9. Define optical activity. How many optical isomers are possible for glucose?

Q.10. Explain continuous etherification process for the preparation of diethyl ether.

Q.11. Identify 'A' and 'B' in the following reaction:

$$\bigcirc + CH_3\,COCl \xrightarrow[-\,HCl]{AlCl_3} A \xrightarrow[\substack{Conc.HCl \\ \Delta}]{Zn-Hg} B + H_2O$$
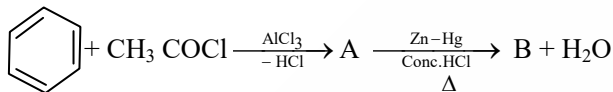
Q.12. Write Howorth projection formula of
$\alpha - D - (+) -$ glucopyranose.
Define hormones.

Q.13. Classify the following solids into different types:
(A) Silver   (B) P_4
(C) Diamond   (D) NaCl

Q.14. Define:
a. Molality
b. Osmotic pressure

Section-C

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

Q.15. Define flux.
Write a note on leaching process.

Q.16. Draw the structure of sulphurous acid.
Explain why nitrogen does not form pentahalides.

Q.17. Write the general electronic configuration of lanthanoids. Why are most of the compounds of transition metals coloured?

Q.18. Calculate the effective atomic number (e.a.n) of copper in $[Cu(NH_3)_4]^{2+}$ · [Z of Cu = 29]
Explain ionisation isomerism in coordination compounds with a suitable example.

Q.19. Write the chemical reactions of chlorobenzene with respect to:
a. Sulphonation
b. Acetylation
c. Nitration

Q.20. How is ethanol prepared from the following compounds?
a. Ethanal
b. Ethene
c. Bromoethane

Q.21. How are primary, secondary and tertiary nitroalkanes distinguished using HNO_2?

Q.22. What are monosaccharides? Explain denaturation of proteins.

Q.23. Define non-biodegradable polymer.
Write the preparation of terylene.

Q.24. What are soaps? How are soaps prepared? Define antiseptic.

Q.25. Unit cell of a metal has edge length of 288 pm and density of 7.86 g cm^{-3}. Determine the type of crystal lattice. [Atomic mass of metal = 56 g mol^{-1}]

Q.26. Define instantaneous rate of reaction. Explain pseudo first order reaction with suitable example.

Section-D

Attempt any THREE of the following questions: [12]

Q.27. Define the terms:
    a.   Electrochemical series
    b.   Corrosion
    Write two applications of electrochemical series.

Q.28. Explain interhalogen compounds. How is oxygen prepared from the following compounds?
    a. $KClO_4$
    b. PbO_2

Q.29. Explain the mechanism of aldol addition reaction. Mention two uses of carboxylic acids.
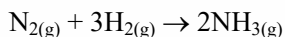
Q.30. Derive the mathematical expression between molar mass of a non-volatile solute and elevation of boiling point.
    State and explain van't Hoff-Avogardo's law.

Q.31. Define:
    a.   Reversible process
    b.   Standard enthalpy of combustion
        Calculate the enthalpy change for the reaction:
        $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$
        The bond enthalpies are:

Bond	$N \equiv N$	$H - H$	$N - H$
ΔH° kJ mol^{-1}	946	435	389