Newton's Academy

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.

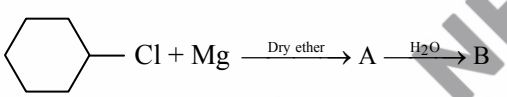
(6) Figures to the right indicate full marks.

(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.

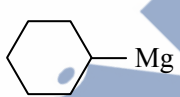
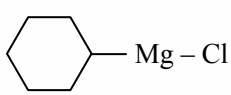
No mark(s) shall be given, if ONLY the correct answer or the alphabet of the correct answer is written. Only the first attempt will be considered for evaluation.

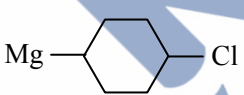
SECTION – A

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

(i) 

the product 'B' is _____.

(a)  (b) 

(c)  (d) 

(ii) General electronic configuration of 3d series of 'd' block elements is _____.
(a) $[Ar]\ 3d^{1-10}\ 4s^2$ (b) $[Xe]\ 3d^{1-10}\ 6s^2$
(c) $[Kr]\ 3d^{1-10}\ 5s^2$ (d) $[Rn]\ 3d^{1-10}\ 7s^2$

(iii) Correct IUPAC name of tert-butyl alcohol is _____.
(a) 2-Methyl butan-1-ol (b) 2-Methyl butan-2-ol
(c) 2-Methyl propan-2-ol (d) 2-Methyl propan-1-ol

(iv) The standard emf of the following cell at 298K is _____.
$Zn(s)\,|\,Zn^{+2}(1M)\,||\,Cr^{+3}(0.1M)\,|\,Cr(s)$
$E^{\circ}_{Zn} = -0.76V,\ E^{\circ}_{Cr} = -0.74V$
(a) –0.02V (b) +0.02V (c) –0.2V (d) +0.2 V

(v) In the following oxyacid, chlorine has +7 oxidation state:
(a) HOCl (b) $HClO_2$ (c) $HClO_3$ (d) $HClO_4$

(vi) The work done during isothermal irreversible expansion of 2 moles of helium from $2dm^3$ to $4\ dm^3$ at 1 bar pressure and at 298K is _____.
(a) 2.0 kJ (b) –2.0 kJ (c) 0.2 kJ (d) –0.2 kJ

(vii) The correct relation between edge length and radius of an atom in simple cubic lattice is _____.

(a) $2a = r$ (b) $\sqrt{3}a = 4r$

(c) $a = 2r$ (d) $\sqrt{2}a = 4r$

(viii) Lactose on hydrolysis gives _____.

(a) galactose + glucose (b) 2 molecules of glucose

(c) fructose + glucose (d) fructose + galactose

(ix) ZWT in green chemistry stands for:

(a) zero waiting time (b) zero waste technology

(c) zubl water technology (d) zhen wu tang

(x) The most basic amine amongst the following is _____.

(a) $CH_3 - NH_2$ (b) $(CH_3)_2 NH$

(c) $(CH_3)_3 N$ (d) $C_2H_5 - NH_2$

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

(i) Write relation between molar conductivity and conductivity of solution.

(ii) Calculate effective atomic number of Co^{+3} in $[Co(NH_3)_6]^{3+}$ complex.

(iii) Write the name of reaction during conversion of phenol to salicylic acid.

(iv) Write the IUPAC name of α-methylpropionic acid.

(v) Write the formula of Hinsberg's reagent.

(vi) Write the name of monomer used for preparation of Nylon 6.

(vii) Write cell representation of standard hydrogen electrode.

(viii) Write chemical composition of Zieglar-Natta catalyst.

SECTION – B

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

Q.3. Define:

(i) Osmotic pressure

(ii) Ebullioscopic constant

Q.4. The pH of solution is 3.12. Calculate the concentration of H_3O^+ ion.

Q.5. State Kohlrausch Law of independent migration of ions. Write one application of Kohlrausch Law of independent migration of ions.

Q.6. Distinguish between Schottky and Frenkel defect.

Q.7. Derive the relationship between ΔH and ΔU for gas phase reactions.

Q.8. What is the action of chlorine on the following:

(i) NH_3 (excess)

(ii) phosphorous?

Q.9. Write the molecular formula of the following minerals:

(i) chalcopyrite

(ii) calamine

Q.10. Show that time required for 99.9% completion of a first order reaction is three times the time required for 90% completion.

Q.11. Convert ethyl bromide to:

(i) ethyl iodide

(ii) ethyl fluoride

Q.12. Explain linkage isomerism in complexes with one example.

Q.13. What is the action of the following on carboxylic acid:
(i) $SOCl_2$
(ii) P_2O_5?

Q.14. Write balanced chemical reactions of the following reagents on carbolic acid:
(i) Br_2 water
(ii) Concentrated HNO_3

SECTION – C

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

Q.15. Write a note on 'aldol' condensation.

Q.16. What is a Lanthanoid contraction? Write similarities between lanthanoids and actinoids.

Q.17. Calculate the standard enthalpy of formation of $CH_3 - OH$, if standard heat of combustion of methyl alcohol are –726 kJ mol^{-1}.
Given data:

(i) $CH_3OH_{(l)} + \frac{3}{2}O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$ $\quad \Delta H° = -726$ kJ mol^{-1}

(ii) $C_{(graphite)} + O_{2(g)} \rightarrow CO_{2(g)}$ $\quad \Delta_C H° = -393$ kJ mol^{-1}

(iii) $H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow H_2O_{(l)}$ $\quad \Delta_f H° = -286$ kJ mol^{-1}

Q.18. What happens when:
(i) Ethene reacts with iodine monochloride.
(ii) Sulphur dioxide is oxidised in presence of V_2O_5.
(iii) Cu heated with concentrated H_2SO_4

Q.19. Calculate the number of atoms and unit cell present in 0.5 g of Niobium if it forms body centred cubic structure. The density of Niobium is 8.55 g cm^{-3} and edge length of unit cell is 330.6 pm.
Write preparation of glucose from sucrose.

Q.20. Define: Nanochemistry.
What happens when vapours of 1° and 2° alcohols are passed over hot Cu metal?

Q.21. 5% aqueous solution of cane sugar has freezing point of 271 K. Calculate freezing point of 5% glucose solution.
[Molar mass of cane sugar = 342 g mol^{-1}]
Complete the reaction
$R' - NO_2 \xrightarrow{Sn/HCl\ conc} ?$

Q.22. What is denaturation of protein? Derive an expression of Ostwald's dilution law for weak acid.

Q.23. Define: Nanotechnology.
Write any two applications of electrochemical series.

Q.24. A chemical reaction occurs in the following steps:
(i) $NO_{2(g)} + F_{2(g)} \rightarrow NO_2F_{(g)} + F_{(g)}$ (slow)
(ii) $F_{(g)} + NO_{2(g)} \rightarrow NO_2F_{(g)}$ (fast)
(a) Write the equation of overall reaction.
(b) Write down rate law.
(c) Identify the reaction intermediate.
Write chemical reaction for preparation of teflon.

Q.25. Define: Elastomer.
Write two postulates of Werner theory of coordinate complexes.

Q.26. Write four salient features of S_N1 mechanism.
Write chemical reaction for carbylamine test.

SECTION – D

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

Q.27. The normal boiling point of ethyl acetate is 77.06°C. A solution of 50 g of non-volatile solute in 150 g of ethyl acetate boils at 84.27°C. Evaluate the molar mass of solute if K_b for ethyl acetate is 2.77 K kg mol^{-1}.
Explain pseudo first order reaction with suitable example.

Q.28. Why does aq. $CuSO_4$ solution turns blue litmus red?
Why compounds of transition metal ions are coloured?

Q.29. State and explain Hess's law of constant heat summation.
What are interhalogen compounds?
Write two uses of neon.

Q.30. Explain homoleptic and heteroleptic complexes with examples.
Convert carboxylic acids to:
(i) ester
(ii) acid amide

Q.31. Define: Green chemistry.
Complete the following reaction and identify A and B.
Isopropyl alcohol $\xrightarrow{P\,Br_3}$ A $\xrightarrow[NH_3\ excess]{}$ B
What is the action of hot HI on glucose?