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.

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 relation between radius of sphere and edge length in body centered cubic lattice is given by formula:

(A) $\sqrt{3}r = 4a$ (B) $r = \frac{\sqrt{3}}{a} \times 4$

(C) $r = \frac{\sqrt{3}}{4}a$ (D) $r = \frac{\sqrt{2}}{4} \times a$

ii. The pH of weak monoacidic base is 11.2, its OH^- ion concentration is:

(A) 1.585×10^{-3} mol dm^{-3} (B) 3.010×10^{-11} mol dm^{-3}

(C) 3.010×10^{-3} mol dm^{-3} (D) 1.585×10^{-11} mol dm^{-3}

iii. Which of the following correctly represents integrated rate law equation for a first order reaction in gas phase:

(A) $k = \frac{2.303}{t} \times \log_{10} \frac{P_i}{P_i - P}$ (B) $k = \frac{2.303}{t} \times \log_{10} \frac{P_i}{2P_i - P}$

(C) $k = \frac{2.303}{t} \times \log_{10} \frac{2P_i}{P_i - P}$ (D) $k = \frac{2.303}{t} \times \log_{10} \frac{P_i - P}{2P_i}$

iv. The spin only magnetic moment of Mn^{2+} ion is _____.

(A) 4.901 BM (B) 5.916 BM

(C) 3.873 BM (D) 2.846 BM

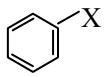
v. The correct formula of a complex having IUPAC name Tetraamminedibromoplatinum (IV) bromide is _____.

(A) $[PtBr(NH_3)_4]Br_2$ (B) $[PtBr_2(NH_3)_4]Br$

(C) $[PtBr_2(NH_3)_4]Br_2$ (D) $[PtBr(NH_3)_4]Br$

vi. The allylic halide, among the following is _____.

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

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

vii. The product of following reaction is

$CH_3 - CH = CH - CH_2 - CHO \xrightarrow[ii)\ H_3O^+]{i)\ LiAlH_4}$ _____?

(A) $CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - OH$ (B) $CH_3 - CH = CH - CH_2 - CH_2 - OH$

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

viii. Ozonolysis of 2, 3 dimethyl but-2-ene, followed by decomposition by Zn dust and water gives _____.

(A) acetaldehyde (B) propionaldehyde and acetone

(C) acetone (D) acetaldehyde and butyraldehyde

ix. The glycosidic linkage present in maltose is _____.

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

(C) β-1, 4-glycosidic linkage (D) α-1, 6-glycosidic linkage

x. The monomer of natural rubber is _____.

(A) Isoprene (B) Acrylonitrile

(C) ε-Caprolactam (D) Tetrafluoroethylene

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

i. Write the name of the technique used to know geometry of nanoparticles.

ii. Write the name of the product formed by the action of $LiAlH_4$/ ether on acetamide.

iii. Write the structure of the product formed when chlorobenzene is treated with sodium metal in the presence of dry ether.

iv. Write the chemical composition of cryolite.

v. Write the name of platinum complex used in the treatment of cancer.

vi. Write the SI unit of cryoscopic constant.

vii. Write the correct condition for spontaneity in terms of Gibbs energy.

viii. Calculate molar conductivity for 0.5 M $BaCl_2$ if its conductivity at 298K is 0.01 Ω^{-1} cm^{-1}.

SECTION – B

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

Q.3. Distinguish between lanthanides and actinides.

Q.4. Calculate the mole fraction of solute, if the vapour pressure of pure benezene at certain temperature is 640 mmHg and vapour pressure of solution of a solute in benzene is 600 mmHg.

Q.5. Define: Green chemistry. Write two advantages of nanoparticle and nanotechnology.

Q.6. Explain the following terms:

i. Substitutional impurity defect

ii. Interstitial impurity defect

Q.7. Write the chemical reactions for the following:

i. Chlorobenzene is heated with fuming H_2SO_4

ii. Ethyl bromide is heated with silver acetate

Q.8. Define : Acidic buffer solution. Write the relationship between solubility and solubility product for PbI_2.

Q.9. What is the action of the following reagents on ethyl amine
i. Chloroform and caustic potash
ii. Nitrous acid

Q.10. Calculate standard Gibbs energy change at 25°C for the cell reaction

$Cd_{(s)} + Sn^{2+}_{(aq)} \longrightarrow Cd^{2+}_{(aq)} + Sn_{(s)}$

$E^{o}_{cd} = -0.403V,\ E^{o}_{Sn} = -0.136V$

Q.11. Write chemical reaction for the preparation of glucose from sucrose. Write structure of D-ribose.

Q.12. Define Extensive property. Calculate the work done during the expansion of 2 moles of an ideal gas from 10 dm^3 to 20 dm^3 at 298 K in vacuum.

Q.13. Write the reactions for the formation of nylon 6,6 polymer.

Q.14. Draw structures of the following compounds:
i. chloric acid
ii. peroxy disulphuric acid

SECTION – C

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

Q.15. Define Osmosis.
How will you determine molar mass of non volatile solute by elevation of boiling point?

Q.16. Convert the following:
i. Ethyl alcohol into ethyl acetate
ii. Phenol into benzene
iii. Diethyl ether into ethyl chloride

Q.17. A weak monobasic acid is 10% dissociated in 0.05 M solution.
What is percent dissociation in 0.15 M solution?

Q.18. Explain dehydrohalogenation reaction of 2-chlorobutane. Write use and environmental effect of CFC.

Q.19. 2000 mmol of an ideal gas expanded isothermally and reversibly from 20 L to 30 L at 300 K, calculate the work done in the process ($R = 8.314\ JK^{-1}\ mol^{-1}$).

Q.20. What are interstitial compounds? Give the classification of alloys with examples.

Q.21. Draw labelled diagram of $H_2 - O_2$ fuel cell. Write two applications of fuel cell.

Q.22. Explain formation of $[CoF_6]^{3-}$ complex with respect to
i. Hybridisation
ii. Magnetic properties
iii. Inner / outer complex
iv. Geometry

Q.23. What is Pseudo first order reaction? Derive integrated rate law equation for zero order reaction.

Q.24. Explain Aldol condensation of ethanal.

Q.25. Explain anomalous behaviour of oxygen in group 16 with respect to:
i. Atomicity
ii. Magnetic property
iii. Oxidation state

Q.26. Write chemical reactions for the following conversions:
i. Acetic acid into acetic anhydride
ii. Acetic acid into ethyl alcohol
Write IUPAC name and structure of methylphenylamine.

SECTION – D

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

Q.27. Show that, time required for 99.9% completion of a first order reaction is three times the time required for 90% completion.
Give electronic configuration of Gd (Z = 64).
Write the name of nano structured material used in car tyres to increase the life of tyres.

Q.28. Derive relationship between ΔH and ΔU for gaseous reaction.
Define: Vulcanization
What is peptide bond?

Q.29. Silver crystallizes in fcc structure. If edge length of unit cell is 400 pm, calculate density of silver (Atomic mass of Ag = 108).
Write a note on Haloform reaction.

Q.30. Define: Distereoisomers.
Give cis and trans isomers of $[Co(NH_3)_4Cl_2]^+$.
What is reference electrode?
Give reason: Bleaching action of ozone is also called dry bleach.

Q.31. Write Dow process for preparation of Phenol. What is the action of bromine water on phenol?
Give reason: Group 16^{th} elements have lower ionisation enthalpy compared to group 15^{th} elements.
Write two uses of dioxygen.