Pre Board Exam, 2020-21
Chemistry, (043) Theory
Class – XII

Time: 3 hr
MM: 70

General Instructions:

Read the following instructions carefully.
a) There are 33 questions in this question paper. All questions are compulsory.
b) Section A: Q. No. 1 to 16 are objective type questions. Q. No. 1 and 2 are passage based questions carrying 4 marks each while Q. No. 3 to 16 carry 1 mark each.
c) Section B: Q. No. 17 to 25 are short answer questions and carry 2 marks each.
d) Section C: Q. No. 26 to 30 are short answer questions and carry 3 marks each.
e) Section D: Q. No. 31 to 33 are long answer questions carrying 5 marks each.
f) There is no overall choice. However, internal choices have been provided.
g) Use of calculators and log tables is not permitted.

SECTION A (Objective Type)

1. Read the passage given below and answer the following questions: 4x1

   Solids may be classified as amorphous and crystalline. Amorphous solids are isotropic whereas crystalline solids are anisotropic. Solids can also be classified on the basis of type of forces of attraction as ionic, covalent, metallic and molecular solids. Unit cells represent crystal lattice. Types of cubic crystal lattice-bcc, fcc and simple cubic. The packing efficiency of fcc is 74%, bcc is 68% and simple cubic packing is 52%. The vacant sites are called voids, tetrahedral and octahedral voids are being most common. There are defects in crystal lattice, point defects like Frenkel and Schottky. Non-stoichiometric defects are metal excess type, metal deficient type and impurity defects. These defects affect the properties of solids.

   i. Name the vacancy defect which reduces the density of a crystal.
      a. Frenkel defect.
      b. Schottky defect.
      c. Impurity defect.
      d. All the above.

   ii. The crystal which show both Frenkel as well as Schottky defect is…
      a. AgBr
      b. ZnS
      c. NaCl
      d. CsBr

iii. An example for amorphous solid is…

    a. Common salt

    b. Zinc sulphide

    c. Glass

    d. Iron.

<div align="center">OR</div>

An example for solid with strong electrostatic force is…

    a. Potassium chloride.

    b. Quartz

    c. Diamond

    d. Graphite.

iv. The colour of LiCl becomes ------- when it is heated in excess of Li.

    a. Yellow

    b. Lilac

    c. Green

    d. Pink.

2. Read the passage given below and answer the following questions: 4x1

The substitution reactions of alkyl halides occur in SN^1 and SN^2 mechanism. Whatever mechanism alkyl halides follow for substitution reaction to occur; the polarity of carbon-halogen bond is responsible for the substitution reaction. The rate of SN^1 reactions are governed by the stability of carbocation where as for SN^2 reactions steric factor is the deciding factor. If the starting compound is a chiral compound, we may end up with an inverted product or racemic mixture depending up on the type of mechanism followed by alkyl halides. Cleavage of ethers with HI is also governed by steric factor and stability of carbocation which indicates that in organic chemistry, these two major factors help us in deciding the kind of product formed.

i. The compound which undergo faster SN^2 mechanism is….

    a. Methyl chloride.

    b. Ethyl chloride.

    c. 2-chloro-2-methyl propane

    d. Methyl iodide.

ii. Which of the following undergoes nucleophilic substitution exclusively by SN^1 mechanism?

    a. Benzyl chloride

    b. Chlorobenzene

    c. Isopropyl chloride

    d. Ethyl chloride.

iii. $CH_3\text{-}Cl + NaOH \longrightarrow CH_3\text{-}OH + NaBr$. Which of the following statement is correct about this reaction?

    a. The given reaction follows SN^1 mechanism.

    b. The order of this reaction is 2.

    c. The carbon in the product is Sp^2 hybridized.

    d. All the above.

iv. Choose the more stable carbocation from the following:

    a. Isopropyl carbocation.

    b. Ethyl carbocation.

    c. Tert. Butyl carbocation.

    d. Methyl carbocation.

       Q.No. 3 -12 are multiple choice questions carrying 1 mark each:

3. Glycine is an example for: 1

    a. Essential amino acid.
    b. Non-essential amino acid
    c. Beta amino acid
    d. None of these.

<div align="center">OR</div>

Dinucleotide is obtained by joining two nucleotides together by phosphodiester linkage. Between which carbon atoms of pentose sugars of nucleotides are these linkages present?

    a. 5^1 and 3^1
    b. 1^1 and 5^1
    c. 5^1 and 5^1
    d. 3^1 and 3^1

4. The carbonyl compound formed when ethanol gets oxidised using this copper-based catalyst can also be obtained by ozonolysis of: 1
    a. But-1-ene
    b. But-2-ene
    c. Ethene
    d. Pent-1-ene

<div align="center">OR</div>

Benzyl alcohol on treatment with this copper-based catalyst gives a compound 'A' which on reaction with KOH gives compounds 'B' and 'C'. Compound 'B' on oxidation with KMnO4- KOH gives compound 'C'. Compounds 'A', 'B' and 'C' respectively are:
    a. Benzaldehyde, Benzyl alcohol, potassium salt of Benzoic acid
    b. Benzaldehyde, potassium salt of Benzoic acid, Benzyl alcohol
    c. Benzaldehyde, Benzoic acid, Benzyl alcohol
    d. Benzoic acid, Benzyl alcohol, Benzaldehyde

5. The increasing order of rate of HCN addition to compound i to iv is   1

i. HCHO (ii). $CH_3\text{- }CO\text{- }CH_3$ (iii) Ph-CO-CH$_3$ (iv) Ph- CO- Ph (Ph is phenyl group)

    a. iv< ii< iii< i
    b. iv< iii< ii< i

c. iii< iv< ii< i

d. i< ii< iii< iv

6. The correct IUPAC name for $CH_2=CHCH_2\,NHCH_3$ is: 1

    a. 2-amino-4-pentene.

    b. Allyl methylamine

    c. 4-amino pent-1-ene

    d. N-methylprop-2-en-1-amine.

7. A first order reaction has a rate constant $10^{-2}\,sec^{-1}$. How much time it will take for 20g of reactant to reduce to 5g?   1

    a. 138.6 s

    b. 346.5 s

    c. 238.6 s

    d. 693.0 s

8. H_2 gas is adsorbed on activated charcoal to a very little extent in comparison to easily liquefiable gases due to -------   1

    a. Very strong Van der Waal's interaction

    b. Very weak Van der Waal's interaction and very low critical temperature.

    c. Very high critical temperature.

    d. All the above.

9. Which of the following will not acts as an oxidizing agent?   1

    a. CrO_3

    b. MoO_3

    c. $(Cr_2O_7)^{2-}$

    d. $(MnO4)^-$

10. Choose the strong field ligand from the following: 1

    a. CO

    b. OH^-

    c. $(OX)^{2-}$

    d. Cl^-

<div align="center">OR</div>

Choose the ambident ligand from the following:

    a. Ethane-1,2-diamine.

    b. SCN^-

    c. CO

    d. NO

11. Which of the following is isoelectronic pair?   1

    a. ICl_2, ClO_2

    b. BrO_2^-, BrF_2^+

    c. CN^-, O_3

    d. ClO_2, BrF.

12. In which of the following pairs, both the ions are coloured in aqueous solutions?   1

    a. Sc^{3+}, Ti

    b. $Sc^{3+,}$ Co^{2+}

    c. Ni^{2+}, Cu^+

d. Ni^{2+}, Ti^{3+}

(Atomic number of Sc=21, Ti=22, Co=27,Ni=28, Cu=29).

For question numbers 13,14, 15 and 16, two statements are given- one labelled **Assertion (A)** and the other labelled **Reason (R)**. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

a. Both A and R are true, and R is correct explanation of the assertion.
b. Both A and R are true, but R is not the correct explanation of the assertion.
c. A is true, but R is false.
d. A is false, but R is true.

13. Assertion: A protein loses its physical properties and biological activity due to denaturation.   1
    Reason: Coagulation of egg albumin is an example for denaturation.
14. Assertion: Nitration of chloro benzene leads to the formation of m-nitro chlorobenzene.   1
    Reason: $-NO_2$ group is a m-directing group.
15. Assertion: Like bromination of benzene, bromination of phenol is also carried out in presence   1
    of Lewis acid.
    Reason: Lewis acid polarizes the bromine molecule.
16. Assertion: D block elements act as good catalyst.   1
    Reason: It is due to their ability to provide large surface area.

OR

Assertion: Second and third transition row metals resemble in properties.
Reason: It is due to lanthanoid contraction.

SECTION B
The following questions, Q. No 17 – 25 are short answer type and carry 2 marks each.

17.   a. How does sprinkling of salt help in clearing snow covered roads in hilly areas? Explain   2
         the phenomenon involved in the process.
      b. When mercuric iodide is added to an aqueous solution of KI the freezing point is raised,
         Why?

18. Calculate the value of logKc for the reaction at 298K.   2

    $Cu(s) + 2Ag^+{}_{(aq)} \longrightarrow Cu^{2+}{}_{(aq)} + 2Ag(s)$

    Given $E^0{}_{(Ag^+/Ag)} = 0.80V$, $E^0{}_{(Cu^{2+}/Cu)} = 0.34V$.

19.   a. Leather gets hardened after tanning. Why?   2
      b. Out of Sulphur sol and proteins, which one forms multi molecular colloids? Explain.

20. Give a short note on:

      a. Chelates
      b. Crystal field splitting.
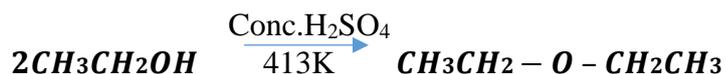   OR
      a. Ambident ligands.
      b. Heteroleptic ligands.

21.   a. K_2PtCl_6 is known but nickel compound is not known. Give reason.   2
      b. The standard reduction potentials of Co^{2+} and Co^{3+} are -0.28V and 1.8V respectively.
         Which should be a better oxidizing agent in water. Explain.

22. Write the mechanism of the following reaction:

$$2CH_3CH_2OH \xrightarrow[413K]{Conc.H_2SO_4} CH_3CH_2-O-CH_2CH_3$$

23. Give the conversions: 2

    a. Benzene to meta bromo aniline.
    b. Ethane nitrile to ethanol.

<div align="center">OR</div>

    a. Aniline to N-phenyl ethanamide.
    b. Aniline to phenol.

24. Give the structure of the compounds formed when glucose is treated with: 2

    a. HI
    b. Bromine water.

<div align="center">OR</div>

    a. Draw the pyranose structure of α-D (+) Glucose.
    b. What are anomers?

25. Give reasons: 2
    a. SF_6 exists but SCl_6 does not.
    b. N_2 is inactive at room temperature.

<div align="center">SECTION- C</div>

Q.No 26 -30 are Short Answer Type II carrying 3 mark each.

26. A solution is prepared by dissolving 8.95mg of a gene fragment in 35mL of water has an osmotic pressure of 0.335torr at 25^0C. Assuming the gene fragment is a non-electrolyte, determine its molar mass. 3

27. Resistance of a conductivity cell filled with 0.1 M KCl solution is 100Ω. If the resistance of the same cell when filled with 0.02 M KCl solution is 520 Ω, calculate the conductivity and molar conductivity of 0.02M KCl solution. (The conductivity of 0.1M KCl solution is 1.29S/m) 3

<div align="center">OR</div>

A potential difference of 20V applied to the ends of a column of 0.1M $AgNO_3$ solution, 4 cm in diameter and 12cm in length gave a current of 0.20 amperes. Calculate the conductivity and molar conductivity of the solution.

28.   a. With suitable explanation give the hybridization, geometry and magnetic behavior of $[Ni(CO)_4]$. 3
    b. Give the IUPAC name of the coordination compound:
       [Co Cl$_2$ (en)$_2$] Cl

<div align="center">OR</div>

    a. Give the IUPAC name of the coordination compounds:
       $K_3[Fe(CN)_5NO]$
       $[CrCl_2(H_2O)_4]NO_3$
    b. Write the formula of the coordination compounds:
       tris(ethane-1,2-diamine) chromium (III) chloride.

29. a. Explain why OH group in phenols is more strongly held as compared to OH group in alcohols.   3

    b. $(CH_3)_3C-O-CH_3$ on reaction with HI gives $(CH_3)_3C-I$ and CH_3-OH as the main products and not $(CH_3)_3C-OH$ and CH_3-I. Explain with proper reason.

30. Give the chemical equations: 3

    a. Carbylamine reaction.

    b. Hinseberg's reaction for N-methyl methanamine.

   c. Reaction of aniline with bromine water.

SECTION - D
Q. No 31 to 33 are long answer type carrying 5 marks each.

31. a. Complete the balanced chemical equations: 5

      i. $XeF_6 + H_2O$ complete hydrolysis   ⟶

      ii. $NH_3 + Cl_2$ (excess)   ⟶

    b. Bond enthalpy of chlorine is higher than that of F_2. Give reason.

    c. What inspired N. Bartlett for carrying out reaction between Xe and PtF6? Give the formula of Xenon compound synthesized by Bartlett.

OR

    a. Draw the structure of:

      i. $H_2S_2O_7$.

      ii. H_2SO_4.

    b. Bleaching action of Cl_2 is permanent where as that of SO_2 is temporary. Give reason.

    c. What are the products obtained when copper metal treated with Conc. Nitric acid? Give the chemical equation.

    d. 'Supersonic jet aero planes may be a threat to ozone layer.' Comment on the statement.

32. a. Derive an expression for the rate constant of a first order reaction. Also deduce an expression for half-life of a first order reaction.   5

    b. Plot of time vs log[R] to calculate the rate constant for the first order reaction is given below. Answer the following questions:
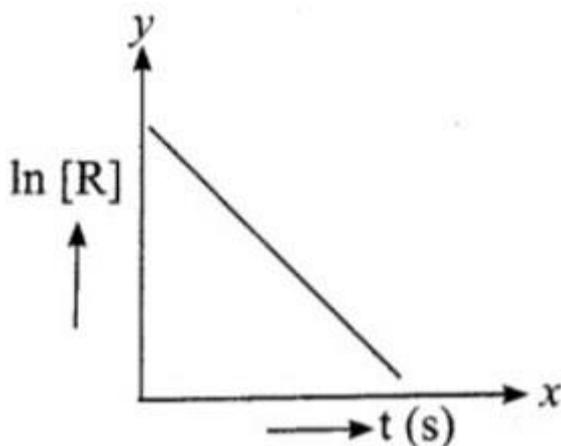
      i.   Give the slope of above line.

      ii.   Plot a graph between $\ln [R]_0 /[R]$ Vs time. Identify the slope from the graph.

a. For a reaction the rate law expression is represented as follows:
Rate = k [A][B]$^{1/2}$ Can the reaction be an elementary reaction? Explain.

b. The following data were obtained during the first order thermal decomposition of
$N_2O_5(g)$ at constant volume. $2N_2O_5(g) \longrightarrow 2N_2O_4(g) + O_2 (g)$

SL.No.	Time(s)	Total pressure(atm)
1	0	0.5
2	100	0.512

Calculate the rate constant. (Given: log 1.0504=0.0214)

33.   a. An alkene A (C_5H_{10}) on ozonolysis gives a mixture of two compounds B and C.   5
Compound B gives positive Fehling's test and forms iodoform on treatment with I_2
and NaOH. Compound C does not give Fehling's test but forms iodoform. Identify
compounds A, B and C. Write the reaction for ozonolysis and formation of iodoform
from B and C.

OR

a. Give a chemical test to distinguish between:
    i.   Acetophenone and benzophenone.
    ii.   Benzaldehyde and acetaldehyde.

b. Give reasons:
    i.   Methanoic acid does not undergo HVZ reaction.
    ii.   Carboxylic acids do not give reactions of carbonyl group.
    iii.   Ethanoic acid is more acidic than phenol.

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