THE VILLAGE
INTERNATIONAL SCHOOL
"We Nurture Dreams"

SAMPLE

PAPER(2023-24)CHEMISTRY

THEORY(043)

MM:70 Time:3hours

GeneralInstructions:

Readthefollowinginstructionscarefully.

a) There are 35questions in this questionpaper with interna lchoice.
b) SECT ION A consists of18 multiple-choicequestionscarrying1 markeach.
c) SECTION B consists of 7 veryshortanswer questions carrying 2marks each.
d) SECTION C consistsof 5 shortanswer questionscarrying 3 markseach.
e) SECTION D consistsof 2 case-based questionscarrying 4 markseach.
f) SECTION E consists of 3longanswerquestionscarrying 5 markseach.
g) Allquestionsarecompulsory.
h) Use oflogtablesandcalculatorsis notallowed

SECTIONA

Thefollowingquestionsaremultiple-choicequestionswithonecorrectanswer.Eachquestioncarries 1mark.Thereis nointernal choiceinthissection.

1. Themajorproductof acid catalysed dehydration of 1-methylcyclohexanolis:

a. 1-methylcyclohexane
b. 1-methylcyclohexene
c. 1-cyclohexylmethanol
d. 1-methylenecyclohexane

2. Whichone ofthefollowingcompoundsismorereactivetowards$S_N1$reaction?

a. $CH_2=CHCH_2Br$
b. $C_6H_5CH_2Br$
c. $C_6H_5CH(C_6H_5)Br$

d. $C_6H_5CH(CH_3)Br$

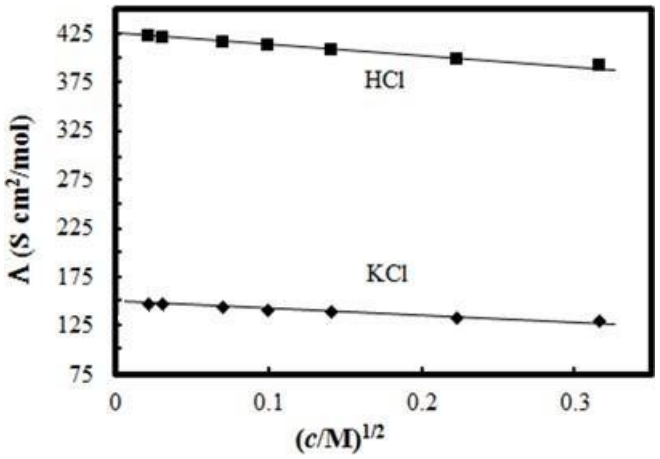
3. Which among the following is true about the metal carbonyls.

a. There is a π bond between filled d orbital of ligand and vacant orbital of metal.
b. There is a sigma bond between filled orbital of ligand and vacant orbital of metal.
c. Only strong sigma bond is present.
d. There is a sigma bond between the vacant orbital of ligand and filled orbital of metal.

4. The product obtained when glucose is treated with bromine water is:

a. Gluconic acid
b. Succinic acid
c. Adipic acid
d. n- hexane

5. The molar conductivity of CH_3COOH at infinite dilution is 390 Scm^2/mol. Using thegraphandgiveninformation, themolar conductivityofCH_3COOKwillbe:



a. 100Scm^2/mol
b. 115Scm^2/mol
c. 150Scm^2/mol
d. 125Scm^2/mol

6. TheCFSEof$[CoCl_6]^{3-}$is18000cm^{-1}theCFSEfor$[CoCl_4]^{-}$willbe:a.180
00cm^{-1}
b.8000cm^{-1}
c.2000cm^{-1}
d.16000cm^{-1}

7. Whatwouldbethemajorproductofthefollowingreaction?

C_6H_5-CH_2-OC_6H5+HBr□A+B

a. A=$C_6H_5CH_2OH$,B=C_6H_6
b. A=$C_6H_5CH_2OH$,B=C6H5Br
c. A=$C_6H_5CH_3$,B= C_6H_5Br
d. A=$C_6H_5CH_2Br$,B=C_6H_5OH

8. Which will anwer iodoform test?
a.propan-2-one
b.pentan-3-one
c. ethanal
d.ethanoic acid

9. Whichofthe followingtests/reactionsisgiven byaldehydes as well as ketones?

a. Fehling'stest
b. Tollen'stest
c. 2,4DNPtest
d. Cannizzaroreactio

10. The number of ions formed on dissolving one molecule of
$FeSO_4.(NH_4)_2SO_4.6H_2O$inwateris:

a. 3
b. 4
c. 5
d. 6

11. The oxidation of toluene tobenzaldehydebychromylchloride iscalled

a. Etard reaction
b. Riemer-Tiemannreaction
c. Stephen's reaction
d. Cannizzaro'sreaction

12. Given beloware twostatements labelledas Assertion (A) andReason(R)

Assertion (A): An ether is more volatile than an alcohol of comparable molecularmass.
Reason(R): Ethersarepolarinnature.

Selectthemost appropriateanswerfromthe optionsgivenbelow:
a. Both AandR aretrue andRis the correctexplanation ofA
b. BothAandR aretrue butRisnot the correct explanationofA.
c. AistruebutRis false.
d. Ais false butRistrue.

13. Givenbeloware two statementslabelledasAssertion(A)andReason(R)

Assertion (A): Proteins are found to have two different types of secondarystructures vizalpha-helixand beta-pleatedsheet structure.
Reason (R): The secondary structure of proteins is stabilized by hydrogenbonding.

Selectthemost appropriateanswerfromtheoptionsgivenbelow:
a. Both AandR aretrue andRis the correctexplanation ofA
b. BothAandR aretrue butRisnot the correct explanationofA.
c. AistruebutRis false.
d. Ais false butRistrue.

14. Given beloware twostatements labelledas Assertion (A) andReason(R)

Assertion :p-dichloro benzene has higher melting point than ortho dichloro benzene**.**
Reason: p-dichloro benzene has intermolecular hydrogen bonding.

Selectthemostappropriateanswerfromtheoptionsgivenbelow:
a. Both AandR aretrue andRis the correctexplanation ofA
b. BothAandR aretrue butRisnot the correct explanationofA.
c. AistruebutRis false.
d. Ais false butRistrue.

15. Given beloware twostatements labelledas Assertion (A) andReason(R)

Assertion (A): Benzaldehyde is less reactive than propanal in nucleophilic addition reactions.

Reason(R): The polarity of carbonyl group is reduced due to resonanace.

Selectthemostappropriateanswerfromtheoptionsgivenbelow:

a. BothAandR aretrueandRisthe correctexplanation ofA
b. BothAandR aretrue butRisnot the correct explanationofA.
c. AistruebutRis false.
d. Ais false butRistrue.

SECTIONB

This section contains 7 questions with internal choice in two questions. The followingquestionsareveryshortanswertypeandcarry2markseach.

16. Using E^0 value of A and B predict which is better for coating the surface of iron and why ?
E^0 (Fe2+/Fe)= -0.44V. Given:E^0 A^{2+}/A =-2.37 V ,E^0 B^{2+}/B= -.0.14 V

17. Accountforthefollowing:
    a. There are5OHgroupsinglucose
    b. Glucoseis areducingsugar

OR

WhathappenswhenD–glucoseistreatedwiththefollowingreagents
    a. Bromine water
    b. HNO_3

18. Give reasonforthefollowing:
    a. During the electrophilic substitution reaction of haloarenes, parasubstituted derivativeisthemajorproduct.
    b. Theproductformed during S_N1 reactionisaracemicmixture.

OR

    a. Name the suitable alcohol and reagent, from which 2-Chloro-2-methylpropanecanbeprepared.
    b. Out of theChloromethane andFluoromethane,which one ishas higherdipole momentandwhy?

19. TheformulaCo$(NH_3)_5CO_3$Cl couldrepresent acarbonate or achloride.Writethestructures andnamesofpossibleisomers.

20. Corrosion is an electrochemical phenomenon. The oxygen in moist air reacts asfollows:

$O_2(g)+2H_2O(l)+4e^- \rightarrow 4OH^-(aq)$.

Write down the possible reactions for corrosion of zinc occurring at anode, cathode, andoverallreactiontoformawhitelayerofzinchydroxide.

21. Write the mechanism of dehydration of alcohols to form ether at 413 K.

22. Write the reaction and IUPAC name of the product formed when 2-Methylpropanal(isobutyraldehyde)istreatedwithethylmagnesiumbromidefollowedbyhydrolysis.

SECTIONC

This section contains 5 questions with internal choice in two questions. The followingquestionsareshortanswertypeandcarry 3markseach.

23. Writetheequationsforthe following reaction:
    a. Salicylicacidistreatedwithaceticanhydridein thepresenceofconc. H_2SO_4
    b. Tertbutyl chloride istreatedwith sodium ethoxide.
    c. Phenolis treatedwithchloroforminthepresence ofNaOH

24. Using Valence bond theory, explain the following in relation to the paramagneticcomplex$[Mn(CN)_6]^{3-}$
    a. typeof hybridization
    b. magneticmoment value
    c. typeofcomplex–inner,outerorbitalcomplex

25. Answerthefollowing questions with reason:
    a. Aldehydes are more reactive than ketones.
    b. Boiling point of acids are higher than alcohols .

26. How are the following compounds formed with acetaldehyde?Write equations/
    a. Cyanohydrin
    b. Acetal
    c. Schiffs base.

27. Complete the following:

    a C_6H_5OH --------> ?
    Br 2 water

    b. $CH_3CH_2OH + I_2 + NaOH$------> ?

c. $CHCl_3 + 3\ KOH$ -----> ?

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28. Explain the following:

a C-X bond length in halobenzene is smaller thn C-X bond length in CH3-X.

b Hloalkanes dissolve in organic solvents.Why?

c Why is butan-1-ol optically inactive while butan-2-ol is optically inactive.

29. a.Identifythemajorproductformedwhen2-cyclohexylchloroethaneundergoes a dehydrohalogenation reaction. Name the reagent which isused tocarry outthereaction.

b. Why are haloalkanes more reactive towards nucleophilic substitutionreactionsthanhaloarenesandvinylichalides?

OR

a. Namethepossiblealkeneswhichwillyield1-chloro-1-methylcyclohexaneontheirre actionwithHCl.Writethereactionsinvolved.

b. Allylchloride is hydrolysed morereadilythann-propyl chloride.Why?

SECTIOND

The following questions are case-based questions. Each question has an internalchoice and carries 4 (1+1+2) marks each. Read the passage carefully and answer thequestionsthatfollow.

30. StrengtheningtheFoundation: ChargaffFormulates His"Rules"

Many people believe that James Watson and Francis Crick discovered DNA in the1950s. In reality, this is not the case. Rather, DNA was first identified in the late1860sbySwisschemistFriedrichMiescher.Then,inthedecadesfollowingMiescher'sdis covery,otherscientists--notably,PhoebusLeveneandErwinChargaff--carried out a series of research efforts that revealed additional detailsabouttheDNAmolecule,includingitsprimarychemicalcomponentsandthewaysin which they joined with one another. Without the scientific foundation providedbythesepioneers,WatsonandCrickmayneverhavereachedtheirgroundbreaking conclusion of 1953: that the DNA molecule exists in the form of athree-dimensionaldoublehelix.

Chargaff, an Austrian biochemist, as his first step in this DNA research, set out tosee whether there were any differences in DNA among different species. Afterdeveloping a new paper chromatography method for separating and identifyingsmall amountsoforganic material, Chargaffreachedtwomajor conclusions:

(i) the nucleotide composition ofDNA varies amongspecies.

(ii) AlmostallDNA,nomatterwhatorganismortissuetypeitcomesfrommaintainscertain properties, even as its composition varies. In particular, the amount ofadenine(A)issimilartotheamountofthymine(T),andtheamountofguanine(G)approximate s the amount of cytosine (C). In other words, the total amount ofpurines (A + G) and the total amount of pyrimidines (C + T) are usually nearlyequal. Thisconclusionisnow knownas"Chargaff'srule."

Chargaff's rule is not obeyed in some viruses. These either have single-strandedDNAorRNAastheirgeneticmaterial.

Answerthefollowingquestions:

a. A segment of DNA has 100 adenine and 150 cytosine bases. What is thetotalnumberofnucleotidespresentinthissegmentofDNA?

b. Asampleofhairandbloodwasfoundattwosites.Scientistsclaimthatthesamples belong to same species. How did the scientists arrive at thisconclusion?

c. Thesampleofaviruswastestedanditwasfoundtocontain20%adenine,20%thymine ,20%guanineandtherestcytosine.Isthegeneticmaterialof this virus (a) DNA-double helix (b) DNA-single helix (c) RNA? What doyouinfer fromthis data?

OR

HowcanChargaff's rulebeusedtoinferthatthegeneticmaterialofanorganismisdouble -helix orsingle-helix?

SECTIONE

Thefollowingquestionsarelonganswertypeandcarry5marks each.Twoquestionshaveaninternalchoice.

31. a.Whydoesthecellvoltageofa mercurycell remainconstant during its lifetime?

b. Write the reaction occurring at anode and cathode and the products

ofelectrolysisofaqKCl.

c. Whatis the pH ofHClsolutionwhen thehydrogengas electrodeshowsapotentialof-0.59Vatstandardtemperature and pressure?

OR

a. Molar conductivityofsubstance"A"is 5.9×10^{3}S/m and "B" is $1x\ 10^{-16}$S/m.Whichofthetwoismost likelytobecoppermetaland why?

b. What is the quantity of electricity in Coulombs required to produce 4.8 g ofMg frommolten $MgCl_2$?How muchCawillbeproducedifthesameamountofelectricitywas passedthrough moltenCaCl_2?(Atomicmass ofMg =24u,atomicmassofCa= 40u).

c. What is the standard free energy change for the following reaction at roomtemperature?Isthereactionspontaneous?

$Sn(s) + 2Cu^{2+}(aq) \rightarrow Sn^{2+}(aq) + 2Cu^{+}(s)$

34.A A hydrocarbon (A) with molecular formula C_5H_{10} on ozonolysis gives twoproducts (B) and (C). Both (B) and (C) give a yellow precipitate when heated with iodine inpresence of NaOH while only (B) give a silver mirror on reaction with Tollen'sreagent.

a. Identify(A),(B) and (C).

b. Writethe reactionof B with Tollen'sreagent

c. Write theequationforiodoformtest forC

d. Writedowntheequationfor aldol condensationreactionof BandC.

OR

An organic compound (A) with molecular formula $C_2Cl_3O_2H$ is obtained when (B)reacts with Red P and Cl_2. The organic compound (B) can be obtained on thereactionofmethylmagnesiumchloridewith dryicefollowedbyacidhydrolysis.

a. IdentifyAand B

b. Write down the reaction for the formation of A from B. What is this reactioncalled?

c. Giveany one methodbywhichorganiccompoundB canbeprepared fromitscorrespondingacidchloride.

d. Whichwillbethemoreacidiccompound(A)or(B)?Why?

e. Writedownthereactionto preparemethanefromthecompound (B).

35. Answerthefollowing:

a What happens when p-hydroxy benzyl alcohol is treated with HCl.

b A primary alkyl halide (A),C4H9Br reacted with hot alcoholic KOH to give compound (B).Compound (B) reacted with HBr to give (C), whch is an isomer of (A).When (A) was reacted with sodium metal ,it gave a compound (D) ,C8H18 which was different than the compound when n-butyl bromide was reacted with sodium..Give the structural formula of A and write th equations.

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