

THE VILLAGE INTERNATIONAL SCHOOL  
THODUPUZHA

SECOND MODEL EXAMINATION 2023-24

GRADE:12

TIME:3 HRS

DATE:10/1/24

CHEMISTRY(043)

MARKS:70

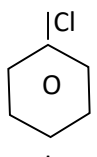
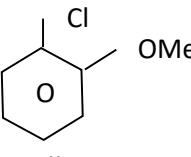
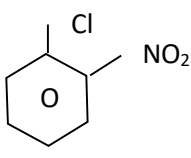
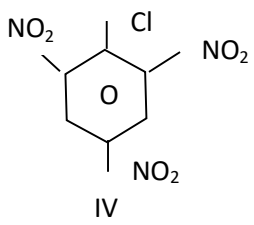
**General Instructions:**

- (a) There are 33 questions in this question paper with internal choice.
- (b) SECTION A comprises 16 multiple - choice questions carrying 1 mark each.
- (c) SECTION B comprises 5 short answer questions carrying 2 marks each.
- (d) SECTION C comprises 7 short answer questions carrying 3 marks each.
- (e) SECTION D comprises 2 case - based questions carrying 5 marks each.
- (f) SECTION E comprises 3 long answer questions carrying 5 marks each.
- (g) All questions are compulsory.
- (h) Use of log tables and calculators is not allowed.

**SECTION A**

1	The major product of acid - catalysed dehydration of 1-methyl cyclohexanol is (a) 1-methyl cyclohexane (b) 1-methyl cyclohexene (c) 1-cyclohexyl methanol (d) 1-methylene cyclohexane	1
2	Which of the following is most stable complex species? (a) $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$ (b) $[\text{Fe}(\text{CN})_6]^{3-}$ (c) $[\text{Fe}(\text{CO})_6]$ (d) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$	1

3	<p>Which of the following is not true about amino acids</p> <p>(a) They are monomers of proteins</p> <p>(b) Alanine has one NH<sub>2</sub>, and one COOH group</p> <p>(c) Mostly amino acids have D-Configuration</p> <p>(d) Glycine is optically inactive</p>	1
4	<p>What is the quantity of charge needed to convert 1 mole of Cr<sub>2</sub>O<sub>7</sub><sup>2-</sup> to Cr<sup>3+</sup> in acidic medium</p> <p>(a) 1F</p> <p>(b) 3F</p> <p>(c) 6F</p> <p>(d) 2F</p>	1
5	<p>Heating of phenyl methyl ether with HI produces</p> <p>(a) Iodobenzene</p> <p>(b) phenol</p> <p>(c) benzene</p> <p>(d) Ethyl iodide</p>	1
6	<p>If the rate constant for a first order reaction is K, the time required for the completion of 99% of the reaction is given by</p> <p>(a) <math>t = \frac{2.303}{K}</math></p> <p>(b) <math>t = \frac{0.693}{K}</math></p> <p>(c) <math>t = \frac{6.909}{K}</math></p> <p>(d) <math>t = \frac{4.606}{K}</math></p>	1
7	<p>Which of the following will not give test for Cl<sup>-</sup> with AgNO<sub>3</sub> at 25 °C</p> <p>(a) CoCl<sub>3</sub>.5NH<sub>3</sub></p> <p>(b) CoCl<sub>3</sub>.3NH<sub>3</sub></p> <p>(c) CoCl<sub>3</sub>.6NH<sub>3</sub></p> <p>(d) CoCl<sub>3</sub>.4NH<sub>3</sub></p>	1

8	<p>Identify the compound that will react with Hinsberg reagent to give a solid, which dissolves in alkali</p> <p>(a) <math>(\text{CH}_3 - \text{CH}_2)_2\text{NCH}_3</math></p> <p>(b) <math>\text{CH}_3 \text{CH}_2\text{NO}_2</math></p> <p>(c) <math>\text{CH}_3\text{CH}_2\text{NHCH}_3</math></p> <p>(d) <math>\text{CH}_3\text{CH}_2\text{NH}_2</math></p>	1										
9	<p>Match the following</p> <table border="1" data-bbox="311 616 1300 907"> <thead> <tr> <th>Column I</th> <th>Column II</th> </tr> </thead> <tbody> <tr> <td>P Vit A</td> <td>(I) Scurvy</td> </tr> <tr> <td>Q Vit B<sub>2</sub></td> <td>(II) Xerophthalmia</td> </tr> <tr> <td>R Vit B<sub>1</sub></td> <td>(III) Cheilosis</td> </tr> <tr> <td>S Vit C</td> <td>(IV) Beriberi</td> </tr> </tbody> </table> <p>(a) P - (II) Q - (III) R - (IV) S - (I)</p> <p>(b) P - (I) Q - (II) R - (III) S - (IV)</p> <p>(c) P - (IV) Q - (III) R - (II) S - (I)</p> <p>(d) P - (III) Q - (II) R - (IV) S - (I)</p>	Column I	Column II	P Vit A	(I) Scurvy	Q Vit B <sub>2</sub>	(II) Xerophthalmia	R Vit B <sub>1</sub>	(III) Cheilosis	S Vit C	(IV) Beriberi	1
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10	<p>The correct order of nucleophilic substitution reactions</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>I</p> </div> <div style="text-align: center;">  <p>II</p> </div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 20px;"> <div style="text-align: center;">  <p>III</p> </div> <div style="text-align: center;">  <p>IV</p> </div> </div> <p>(a) I &gt; II &gt; III &gt; IV</p> <p>(b) IV &gt; III &gt; I &gt; II</p> <p>(c) IV &gt; III &gt; II &gt; I</p> <p>(d) III &gt; IV &gt; I &gt; II</p>	1										

11	Magnetic moment of the divalent ions in aqueous solution with Z-25 is (a) 2.84 BM (b) 3.87 BM (c) 4.90 BM (d) 5.92 BM	1
12	The oxidation of toluene to benzaldehyde by chromyl chloride is called (a) Stephen reduction (b) Etard reaction (c) Reimer-Tiemann reaction (d) Cannizzaro reaction	1

Given below are two statements labeled as Assertion (A) and Reason (R). Select the most appropriate from the options given below.

- A) Both A and R are true and R is the correct explanation of A
- B) Both A and R are true but R is not the correct explanation of A
- C) A is true but R is false
- D) A is false but R is true

13	Assertion (A) - Phenols are more acidic than aliphatic alcohols. Reason (R) - The phenoxide ion is more resonance stabilised than alkoxide ion.	1
14	Assertion - Hydrolysis of methyl ethanoate is a pseudo first order reaction Reason - Water is present in large excess and therefore its concentration remained constant throughout the reaction	1
15	Assertion - Lanthanoid contraction is more than actinoid contraction Reason - Actinoids have 5f orbitals being filled which are more dispersed in space compare to 4f orbitals	1

16	<p>Assertion - Nucliphilic substitution of an optically active 3<sup>o</sup> halides gives a mixture of enantiomers</p> <p>Reason - SN<sub>2</sub> reactions of optically active halides are accompanied by inversion of configuration</p>	1
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### SECTION B

This section Contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

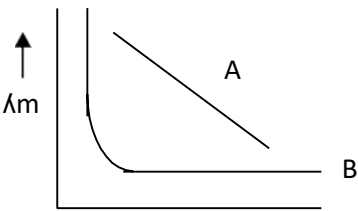
17	<p>(i) Which ion amongst the following is colourless and why Ti<sup>4+</sup>, Cr<sup>3+</sup>, V<sup>3+</sup> [Atomic number of Ti = 22, Cr = 24, V=23]</p> <p>(ii) Cu (I) compounds are unstable in aqueous solution. Why?</p>	1+1
18	<p>(a) [Fe(CN)<sub>6</sub>]<sup>4-</sup> and [Fe(H<sub>2</sub>O)<sub>6</sub>]<sup>2+</sup> are of different colours in dilute solution. Why?</p> <p>(b) Write the formula of the following co-ordination compound potassium tetracyanonickelate -(II)</p>	1+1
19	<p>Give reason</p> <p>(a) Aniline on nitration gives good amount of m-nitro aniline, though NH<sub>2</sub> group is ortho-para directing in electrophilic Substitution reaction.</p> <p>(b) Ammonolysis of alkyl halide is not a good method to prepare pure primary amines.</p> <p style="text-align: center;">OR</p> <p>Write the structures of the main products formed when benzene diazonium chloride reacts with the following reagents ;</p> <p>(a) CH<sub>3</sub>CH<sub>2</sub>OH                      (b) HBF<sub>4</sub></p>	1+1
20	<p>The rate constant for the first order reaction is 60s<sup>-1</sup>. How much time will it take to reduce the initial concentration to its 1/16<sup>th</sup> value. [log 16 = 1.2042 , log 4 = 0.6021 log 2 = 0.3010]</p>	2

21	<p>Arrange the following as indicated</p> <p>(a) n-Butane, 1-propanol, propanal, Acetone, methoxymethane [increasing order of boiling point]</p> <p>(b) Acetaldehyde, Acetone, propanal, propanone [increasing order of nucleophilic addition reaction]</p>	2
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### SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each

22	<p>A reaction is first order in A and second order in B.</p> <p>(a) Write differential rate equation</p> <p>(b) How is the rate affected on increasing the concentration of B three times</p> <p>(c) How is the rate affected when the concentration of both A and B are doubled</p>	1+1+1
23	<p>Calculate the boiling point of solution when 4g of <math>\text{MgSO}_4</math> [<math>M = 120\text{g/mol}</math>] was dissolved in 100g of water assuming <math>\text{MgSO}_4</math> undergoes complete dissociation. <math>K_b</math> for water = <math>0.52\text{ kkg/mol}</math></p>	3
24	<p>(a) The formula <math>\text{CO}(\text{NH}_3)_5\text{CO}_3\text{Cl}</math> could represent a carbonate or a chloride. Write the structures and names of possible isomers.</p> <p>(b) How many ions are formed when <math>\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}</math> is dissolved in water. Is it double salt or complex compound.</p> <p style="text-align: center;">OR</p> <p>(a) Write electronic configuration of <math>d^5</math> ion according to CFT (crystal field theory) when <math>\Delta_0 &lt; P</math></p> <p>(b) Which is more stable out of <math>[\text{Fe}(\text{CN})_6]^{4-}</math> or <math>[\text{Fe}(\text{CN})_6]^{3-}</math>. Give reason [Atomic mass of Fe = 26]</p> <p>(c) Draw the structures of geometrical isomers of <math>[\text{CrCl}_2(\text{OX})_2]^{2-}</math></p>	2+1

25	<p>An organic Compound A having molecular formula <math>C_6H_6O</math> gives a characteristic colour with neutral <math>FeCl_3</math> solution when A is treated with <math>CO_2</math> and <math>NaOH</math> at <math>400k</math> under pressure 'B' is formed. The compound 'B' on acidification gives 'C' which reacts with acetyl-chloride to form 'D' which is popular pain killer. Write the structures of A,B, C and D.</p>	3
26	<p>i) Account for the following            (a) Transition metals form complex compounds            (b) Chromium is a typical hard metal while mercury is a liquid</p> <p>ii) Complete the following  <math>MnO_4^- + H^+ + I^- \longrightarrow</math></p>	1+1+1
27	<p>In the plot of molar conductivity (<math>\Lambda_m</math>) Vs square root of concentration (<math>\sqrt{C}</math>) following curves are obtained A and B</p> <div style="text-align: center;">  </div> <p>(a) Predict the nature of electrolytes A and B            (b) What happens on extrapolation of <math>\Lambda_m</math> to concentration approaching zero for electrolytes A and B            (c) Predict the product of electrolytes of aqueous solution of <math>H_2SO_4</math> using platinum electrode.</p>	1+1+1
28	<p>Write the structure of A, B and C in the following conversion</p> <p>(a) <chem>O=C1CCCCC1</chem> <math>\xrightarrow[\Delta]{NH_3}</math> A <math>\xrightarrow{Br_2/KOH}</math> B <math>\xrightarrow[Base]{CH_3Cl}</math> C</p> <p>(b) <math>CH_3CH_2Br \xrightarrow{KCN}</math> A <math>\xrightarrow{LiAlH_4}</math> B <math>\xrightarrow[273k]{HNO_2}</math> C</p>	1.5+1.5

### SECTION D

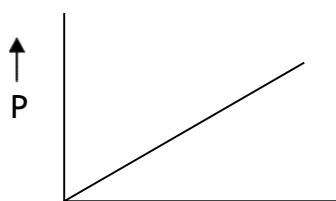
The following questions are case-based questions. Each question has an internal choice and carried 4 [1+1+2] marks each. Read the passage carefully and answer the questions.

29 Solubility of gas in liquids increases with increase in pressure and decreases with increase in temperature. It is governed by Henry's law.

It states that partial pressure of gas in vapour phase ( $p$ ) is proportional to the mole fraction of gas ( $X$ ) in solution

$$p = k_H X$$

where  $k_H$  is Henry's law constant. If we draw a graph between partial pressure of gas Vs mole fraction of gas in solution, we will get a straight line.



$X(\text{HCl})$  in cyclohexane

Different gases have different  $k_H$  values at same temperature as  $k_H$  shown in the table given below

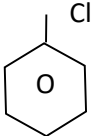
Gas	T	$k_H/\text{kbar}$	Gas	T	$k_H/\text{kbar}$
$\text{H}_1$	293 k	144.97	Argon	298 k	40.3
$\text{H}_2$	293 k	69.16	$\text{CO}_2$	298 k	1.61
$\text{N}_2$	293 k	76.48	Formaldehyde	298 k	$1.83 \times 10^{-5}$
$\text{O}_2$	293 k	34.86	Methanol	298 k	0.413

Observe the table carefully following questions.

- (a) Is dissolution of gas in liquid endothermic or exothermic process and why.
- (b) What happens to the value of  $k_H$  when temperature is increased? Which gas is least soluble at 293 k out of gases

1+1+2



	<p>given in the table?</p> <p>(c) How many millimoles of N<sub>2</sub> gas will dissolve in 1L of water at 293k. If k<sub>H</sub> is 76.48 kbar, assume N<sub>2</sub> exerts a pressure of 0.987 bar</p> <p style="text-align: center;">OR</p> <p>If solubility of H<sub>2</sub>S gas in water at STP is 0.195m, calculate Henry's law constant</p>	
30	<p>The polarity of C-X bond of alkyl halide is responsible for their nucleophilic substitution, elimination and their reaction with metal atoms to form organo metallic compounds. Alkyl halides are prepared by free radical halogenation of alkanes, addition of halogen acids to alkenes, replacement of -OH group of alcohol with halogens using Phosphorus halides, thionyl chloride or halogen acids. Aryl halides are prepared by electrophilic substitution of arenes. Nucleophilic substitution reactions are categorised into S<sub>N</sub>1 and S<sub>N</sub>2 on the basis of their kinetic properties.</p> <p>(a) What happens when bromo benzene is treated with Mg in presence of dry ether</p> <p>(b) Which compound in each of the following pairs will react faster in S<sub>N</sub>1 reaction with OH<sup>-</sup> ?</p> <p>i) CH<sub>2</sub> = CH - CH<sub>2</sub>Cl or CH<sub>3</sub> - CH<sub>2</sub> - CH<sub>2</sub>Cl</p> <p>ii) (CH<sub>3</sub>)<sub>3</sub> C - Cl or CH<sub>3</sub>Cl</p> <p>(c) Write the equations for the preparation of 1-iodo butane from</p> <p>i) 1-chlorobutane</p> <p>ii) But-1-ene</p> <p style="text-align: center;">OR</p> <p>(d) Write the structure of the major products in each of the following reactions</p> <p>i) <math>\text{CH}_3 - \underset{\text{Br}}{\text{CH}} - \text{CH}_3 + \text{KOH} \xrightarrow[\text{heat}]{\text{Ethanol}}</math></p> <p>ii)  + CH<sub>3</sub>COCl <math>\xrightarrow{\text{Anhy AlCl}_3}</math></p>	1+1+2

### SECTION E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice. Answer the following questions.

31	<p>(a) Draw the structure of ethylene ketal of hexan - 3 - one</p> <p>(b) An organic compound A having molecular formula <math>C_5H_{10}O</math> gives negative tollens test, forms n-pentane in clemmensen reduction, but does not give iodoform test. Identify A and give all the reactions involved</p> <p>(c) Convert the following</p> <p style="margin-left: 20px;">i) Benzene to p-nitrobenzoic acid</p> <p style="margin-left: 20px;">ii) Propanoic acid to acetic acid</p> <p style="text-align: center;">OR</p> <p>(d) Illustrate the following</p> <p style="margin-left: 20px;">i) Etard reaction</p> <p style="margin-left: 20px;">ii) Gattermann - koch</p> <p style="margin-left: 20px;">iii) Cannizzaro reaction</p> <p>(e) Assign the reason for the following</p> <p style="margin-left: 20px;">i) There are two <math>NH_2</math> groups in semi carbazide. However only one is involved in semicarbazone formation</p> <p style="margin-left: 20px;">ii) Benzoic acid do not undergo friedel craft reaction</p>	1+2+2
32	<p>(a) Calculate the emf of the following cell at 298k</p> $Al   Al^{3+} (0.1m)    Cu^{2+} (0.01m)   Cu$ <p>[Given <math>E^\circ_{cell} = 2.00V</math>, <math>\log 10 = 1</math>]</p> <p>(b) Why does mercury cell gives constant voltage over longer period of time?</p> <p>(c) Which electrolyte is used in lead storage battery?</p> <p style="text-align: center;">OR</p> <p>(d) Why is alternating current used instead of direct current in measuring the resistance of electrolytic solution in conductivity cell ?</p>	3+1+1

	<p>(e) A solution of <math>\text{Ni}(\text{NO}_3)_2</math> is electrolysed between platinum electrodes using 5.0 A current for 20 minutes. What mass of Nickel will be deposited on the cathode? [Atomic mass of the Ni = 58.7g/mol]</p> <p>(f) Four metals A,B,C,D have their standard reduction potential values are equal to -0.14V, +0.34V, -1.66V and +0.80V respectively. Arrange these metals in decreasing order of reactivity. Give reason.</p>	
33	<p>Attempt any five of the following</p> <p>(a) Write the product of D-glucose with <math>\text{HNO}_3</math></p> <p>(b) What are the products of hydrolysis of DNA</p> <p>(c) Name two bases common in DNA and RNA</p> <p>(d) What type of forces are involved in tertiary structure of protein.</p> <p>(e) Which nucleic acid helps is protein synthesis?</p> <p>(f) The pentaacetate of glucose does not react with hydroxylamine. What does it indicate?</p> <p>(g) During denaturation which structure of protein lose their biological activity?</p>	5x1=5

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