B.K. Birla Centre For Education

Date: 17-12-2025 PRE BOARD EXAMINATION-II **Duration**: 3 Hrs
Class: XII Chemistry **Total Marks** : 70

Instructions to the Students

- Write only question numbers clearly outside the margin (1, 2, 3.i, 5.b, 4.c.ii, etc.).
- Do not write questions or any titles. (For ex. - Do not write **II. Answer the following**).
- After every answer, give a one-line space.
- For Multiple choice Questions - Both Option and Answer should be written.
- Bullet points & Sub-points should be written inside the margin.
- Do not fold / staple the paper.

Section A

1. The fragrance of the aldehyde and ketone are used for perfume and similar uses depend on : [1]

a) on its reactivity with other functional groups.
b) size and solubility of the aldehyde and ketone molecule.
c) only solubility of aldehydes and ketones.
d) moisture of the air.

Answer

b) size and solubility of the aldehyde and ketone molecule. (1)

2. Which one is the correct increasing order of bond strength of C-X bond? [1]

a) C-I < C-Br < C-Cl < C-F
b) C-F < C-Cl < C-Br < C-I
c) C-Cl < C-F < C-I < C-Br
d) C-Br < C-I < C-F < C-Cl

Answer

a) C-I < C-Br < C-Cl < C-F (1)

3. The correct IUPAC name of $[Pt(NH_3)_2Cl_2]^{2+}$ is [1]

a) Diamminedichloridoplatinum (II)
b) Diamminedichloridoplatinum (IV)
c) Diamminedichloridoplatinum (O)
d) Diamminedichloridoplatinate (IV)

Answer

b) Diamminedichloridoplatinum (IV) (1)

4. Aniline does not undergo Friedel–Crafts alkylation or acylation because: [1]

a) The $-NH_2$ group is strongly activating and causes polyalkylation.
b) The $-NH_2$ group withdraws electrons and deactivates the ring.
c) The $-NH_2$ group reacts with the catalyst ($AlCl_3$), which deactivates the ring
d) The reaction mixture produces too much heat and decomposes.

Answer

c) The $-NH_2$ group reacts with the catalyst ($AlCl_3$), which deactivates the ring (1)

5. On mixing 30 ml of acetone with 20 ml of chloroform, the total volume of solution is: [1]

a) equal to 10 ml b) less than 50 ml c) greater than 50 ml d) equal to 50 ml

Answer

b) less than 50 ml (1)

6. Which of the following molecules has a chiral centre correctly labelled with an asterisk(*)? [1]

a) $CH_3C^*HBrCH_3$

b) $CH_3C^*HClCH_2Br$

c) $HOCH_2C^*H(OH)CH_2OH$

d) $CH_3C^*Br_2CH_3$

Answer

b) $CH_3C^*HClCH_2Br$ (1)

7. Which of the following compound will not undergo azo coupling reaction with benzene diazonium chloride ? [1]

a) Phenol b) Aniline c) Nitrobenzene d) Anisole

Answer

c) Nitrobenzene (1)

8. Which of the following statements is not true about glucose ? [1]

a) It is an aldohexose.

b) On heating with HI it forms n-hexane.

c) It exists in furanose form.

d) It does not give Schiff's test.

Answer

c) It exists in furanose form. (1)

9. Elements in which the differentiating electron enters the (n–2)f orbital are known as: [1]

a) Transition elements

b) Inner transition elements

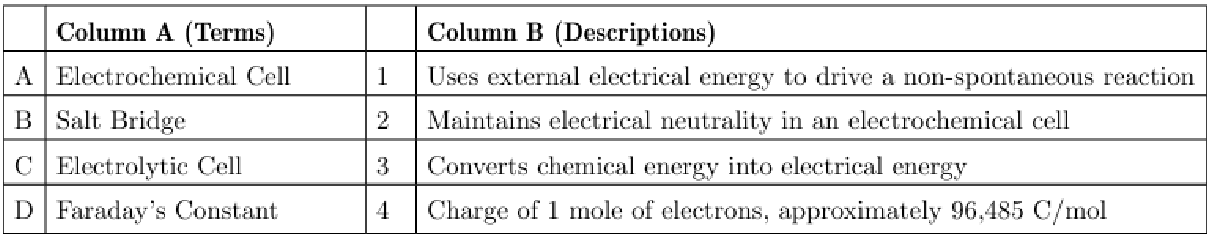
c) Representative elements

d) s-block elements

Answer

b) Inner transition elements (1)

10. Match the following terms with their correct descriptions: [1]



	Column A (Terms)		Column B (Descriptions)
A	Electrochemical Cell	1	Uses external electrical energy to drive a non-spontaneous reaction
B	Salt Bridge	2	Maintains electrical neutrality in an electrochemical cell
C	Electrolytic Cell	3	Converts chemical energy into electrical energy
D	Faraday's Constant	4	Charge of 1 mole of electrons, approximately 96,485 C/mol

a) A - 2 B - 3 C - 4 D - 1

b) A - 1 B - 2 C - 4 D - 3

c) A - 2 B - 1 C - 3 D - 4

d) A - 3 B - 2 C - 1 D - 4

Answer

d) A - 3 B - 2 C - 1 D - 4 (1)

11. Phenol undergoes a specific type of chemical reaction in order to be converted into salicylaldehyde. Which of the following reactions is responsible for this transformation? [1]

a) Kolbe's reaction

b) Reimer–Tiemann reaction

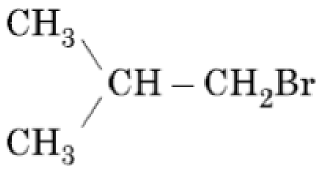
c) Friedel–Crafts acylation

d) Cannizzaro reaction

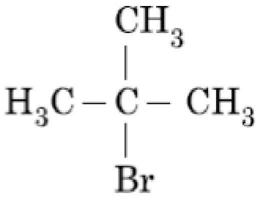
Answer

b) Reimer–Tiemann reaction (1)

12. Arrange the following compounds in increasing order of their boiling points: [1]

(i) 
$(CH_3)_2CH-CH_2Br$

(ii) $CH_3CH_2CH_2CH_2Br$

(iii) 
$H_3C-C(CH_3)(Br)-CH_3$

The correct order is

a) (ii) < (i) < (iii)	b) (i) < (ii) < (iii)
c) (iii) < (i) < (ii)	d) (iii) < (ii) < (i)

Answer 🔑

c) (iii) < (i) < (ii) (1)

13. **Assertion(A) :** Tertiary butylamine can be prepared by the action of NH_3 on tert-butylbromide. [1]

Reason(R) : Tertiary butyl bromide being 3° alkyl halide prefers to undergo elimination on the treatment with a base.

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 correct but (R) is wrong
d) (A) is wrong but (R) is correct

Answer 🔑

d) (A) is wrong but (R) is correct (1)

14. **Assertion (A) :** Henry's law constant (K_H)decreases with increase in temperature. [1]

Reason (R) : As the temperature increases, solubility of gases in liquids decreases.

a) Both Assertion (A) and Reason (R) are true & Reason (R) is the correct explanation of the Assertion (A).
b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
c) Assertion (A) is true, but Reason (R) is false.
d) Assertion (A) is false, but Reason (R) is true.

Answer 🔑

d) Assertion (A) is false, but Reason (R) is true. (1)

15. **Assertion (A)**: All naturally occurring a-amino acids except glycine are optically active. [1]

Reason (R) : Most naturally occurring amino acids have L-configuration

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 correct but (R) is wrong
d) (A) is wrong but (R) is correct

Answer 🔑

b) Both (A) and (R) are true but (R) is not the correct explanation of (A) (1)

16. **Assertion(A) :** An electrochemical cell can be set-up only if the redox reaction is spontaneous. [1]

Reason(R) : A reaction is spontaneous if the free energy change is negative.

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 correct but (R) is wrong
d) (A) is wrong but (R) is correct

Answer 🔑

a) Both (A) and (R) are true but (R) is the correct explanation of (A) (1)

Section B

17.I. (a) A and B liquids on mixing show rise in temperature. Which type of deviation from Raoult's law is there and why ? [2]

(b) Why can azeotropic mixture not be separated by fractional distillation ?

Answer

(a) This is a negative deviation from Raoult's law. It occurs because A–B intermolecular interactions are stronger than A–A and B–B interactions. Due to stronger attractions, energy is released, leading to a rise in temperature. (1)

(b) Azeotropic mixtures boil at a constant temperature and behave like a single pure component. Since their vapour composition is the same as liquid composition, they cannot be separated by fractional distillation. (1)

(OR)

17.II. I. When 50 mL of phenol and 50 mL of aniline are mixed, predict whether the volume of the solution is equal to, greater than or less than 100 mL. Give reason to support your answer. [2]

II. Ritesh suggested adding salt to the box containing ice. He said this would keep the cold drink bottles cold for a longer time. How will Ritesh justify his suggestion?

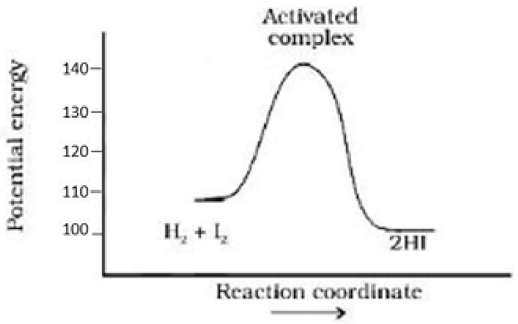
Answer

I. The volume will be less than 100 ml. The intermolecular forces between phenol and aniline is stronger than phenol-phenol and aniline aniline which results in decrease in volume. (1)

II. Salt lowers the freezing point of water ie. it leads to depression in freezing point. This will delay the melting of ice. (1)

18. Consider the graph for the reaction [2]

$H_2 + I_2 \rightleftharpoons 2HI$



I. Calculate enthalpy of reaction and activation energy for the backward reaction.
II. How will the catalyst affect the rate of this reaction? Explain.

Answer

I. Ea for backward reaction = 40 kJ/mol, Δ H= 10 kJ/mol (1)

II. Catalyst will increase the rate of reaction as the activation energy required to form intermediate activated complex between reactant and catalyst is lower than the activation energy required for forming complex without catalyst. (0.5)

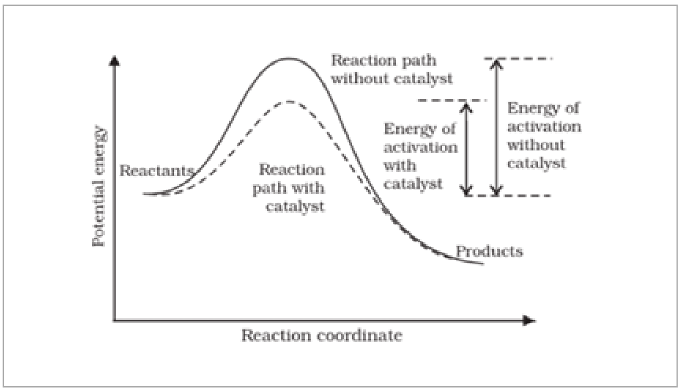


DIAGRAM (0.5)

19. In a chemistry practical class, the teacher gave his students an amine 'X' having molecular formula C_2H_7N, and asked the students to identify the type of amine. One of the students, Neeta, observed that it reacts with $C_6H_5SO_2Cl$, to give a compound which dissolves in NaOH solution. Can you help Neeta to identify the compound 'X'? [2]

Answer

The molecular formula C_2H_5N corresponds to an amine, specifically ethylamine. (1)

The reaction with $C_6H_5SO_2Cl$ indicates that it is a primary amine, as only primary amines can react with sulfonyl chlorides to form sulfonamides. The compound X is therefore ethylamine ($C_2H_5NH_2$). (1)

20. When a coordination compound $CrCl_3.6H_20$ is mixed with $AgNO_3$, two moles of AgCl are precipitated per mole of the compound. What is the structural formula and IUPAC name of the compound? [2]

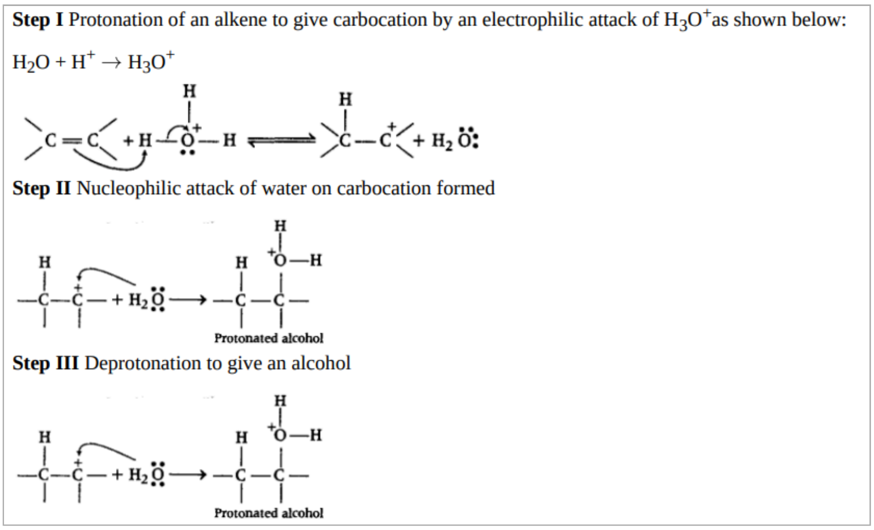
Answer

Formula : Cr(H2O)5Cl]Cl2.H2O (1)

Iupac name: Pentaaquachloridochromium(III) chloride monohydrate (1)

21. Explain the mechanism of acid catalysed hydration of an alkene to form corresponding alcohol. [2]

Answer



Step I Protonation of an alkene to give carbocation by an electrophilic attack of H_3O^+ as shown below:

$H_2O + H^+ \rightarrow H_3O^+$

Step II Nucleophilic attack of water on carbocation formed

Protonated alcohol

Step III Deprotonation to give an alcohol

Protonated alcohol

0.5 marks for each step (1.5)

0.5 mark for proper stuctures and arrows. (0.5)

Section C

22. A solution of glucose (molar mass 180 g mol^{-1}) in water has a boiling point of 100.20 °C. Calculate the freezing point of the same solution. Molal constants for water K_f and K_b are 1.86 K kg mol^{-1} and 0.512 K kg mol^{-1} respectively. [3]

Answer

1) $\Delta T_b \quad = K_b \times m \quad \frac{\Delta T_b}{K_b}$ (0.5)

m

2) $m \;=\; \frac{0.20}{0.512}$ =0.390 mol/kg (0.5)

3) $\Delta T_f \;=\; K_f$ X m = $1.86 \mathrm{Kkgmol}^{-1} \times 0.390 \text{ mol kg}^{-1}$ (0.5)

4) $\Delta T_f \;=\; 0.725$ K (0.5)

5) $Freezingpointofthesolution \;=\; 273.15 \text{ K} - 0.725 \text{ K}$ (0.5)

6) $Freezingpointofthesolution \;=\; 272.425 \text{ K}$ (0.5)

23. Calculate E_{cell} of a galvanic cell in which the following reaction takes place at 25°C : [3]

$Zn(s) + Pb^{2+}(0{\cdot}02\ M) \longrightarrow Zn^{2+}(0{\cdot}1\ M) + Pb(s)$

[Given : $E^\circ_{Zn^{2+}/Zn} = -0{\cdot}76\ V$, $E^\circ_{Pb^{2+}/Pb} = -0{\cdot}13\ V$;
$\log 2 = 0{\cdot}3010$, $\log 4 = 0{\cdot}6021$, $\log 5 = 0{\cdot}6990$].

Answer

1) $E_{Cell} = (E^o{}_c - E^o{}_a) - \frac{0.059}{2}\log\left[\frac{Zn^{2+}}{Pb^{2+}}\right]$ (1)

2) $= [(-0\cdot 13) - (-0\cdot 76)] - \frac{0.059}{2}\log\frac{0.1}{0.02}]$ (1)

3) $= 0.61V$ (1)

24. Explain the following: [3]

I. Toluene on treatment with Cl_2 in sunlight gives benzyl chloride whereas when treated with Cl_2 in dark gives o-chlorobenzene and p-chlorobenzene.

II. Finkelstein reaction is carried out in the presence of dry acetone.

III. neo pentylchloride has lower boiling point than isopentylchloride.

Answer

I. Cl_2 in presence of sunlight forms free radical as an intermediate, and hence toluene undergoes free radical substitution of the alkyl group to form benzyl alcohol, whereas Cl_2 in dark forms Cl^+, an electrophile as an intermediate, making toluene undergo electrophilic substitution and form o-chlorobenzene and p-chlorobenzene. (1)

II. NaI is soluble in dry acetone but NaCl is insoluble. NaCl precipitates out of the reaction mixture and shifts the equilibrium towards the right accoding to Le Chatelier's principle. (1)

III. The branching of the chain in neo pentylchloride is more than iso pentylchloride, which makes the molecule more compact and decreases its surface area. This decrease the magnitude of the Van der Waal's forces of attraction existing between the two molecules of neopentyl chloride. and consequently the boiling point decreases and is less than isopentyl chloride (1)

25. (i) What is Lanthanoid contraction? [3]

(ii) In which way the electronic configuration of d block elements differs from representative elements?

(iii) Calculate the magnetic moment of Mn^{2+} in Bohr Magneton.

Answer

(i)Lanthanoid contraction refers to the gradual decrease in atomic and ionic radii of the lanthanoids with increasing atomic number due to poor shielding effect of 4f electrons (1)

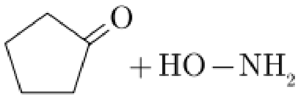
ii) d-block elements have the general outer configuration: $(n-1)d^{1-10}\, ns^{0-2}$, (0.5)

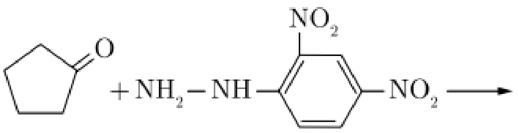
whereas representative (s- and p-block) elements have either s- or p-orbitals being progressively filled, not d-orbitals. (0.5)

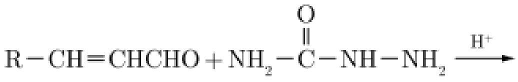
iii) $Mn^{2+} \rightarrow [Ar]\ 3d^5 \rightarrow$ 5 unpaired electrons (0.5)

Magnetic moment $(\mu) = \sqrt{n(n+2)} = \sqrt{5(5+2)} = \sqrt{35} \approx 5.92$ BM (0.5)

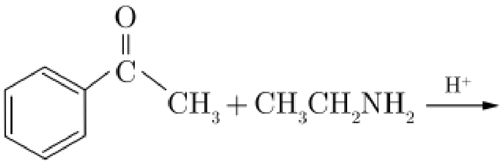
26. Predict the products of the following reactions.(any 3) [3]

(i)


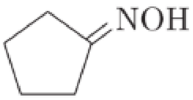
(ii)


(iii)


$$R-CH=CHCHO+NH_2-\overset{O}{\overset{\|}{C}}-NH-NH_2 \xrightarrow{H^+}$$

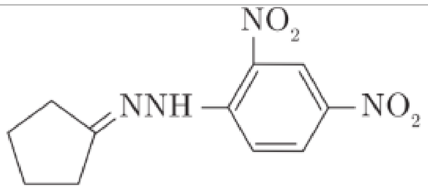
(iv)


Answer

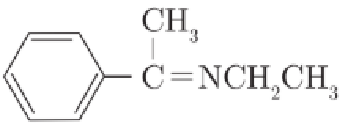
(i)


Cyclopentanone oxime

i (1)

(ii)


(iii) $R-CH=CH-CH=NNHCONH_2$

(iv)


any 2 (2)

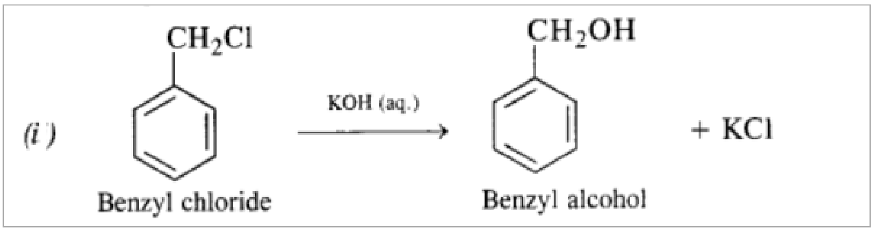
27. How are the following conversions carried out? [3]

(i) Benzyl chloride to Benzyl alcohol

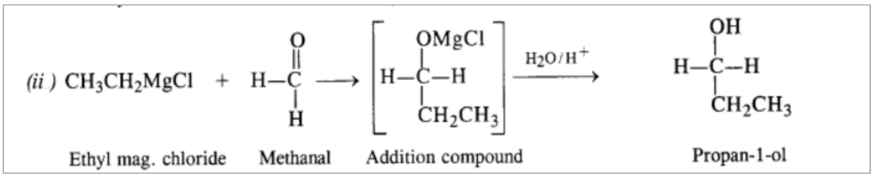
(ii) Ethyl magnesium chloride to Propan-1-ol

(iii) Methyl mag. bromide to 2-Methylpropan-2-ol.

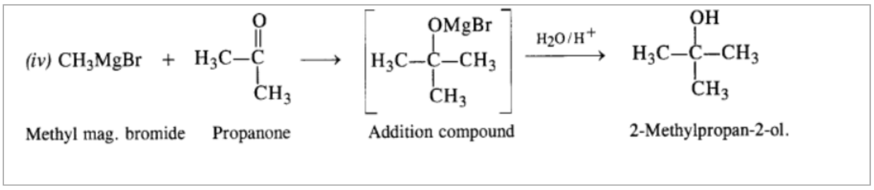
Answer



i (1)



ii (1)



iii (1)

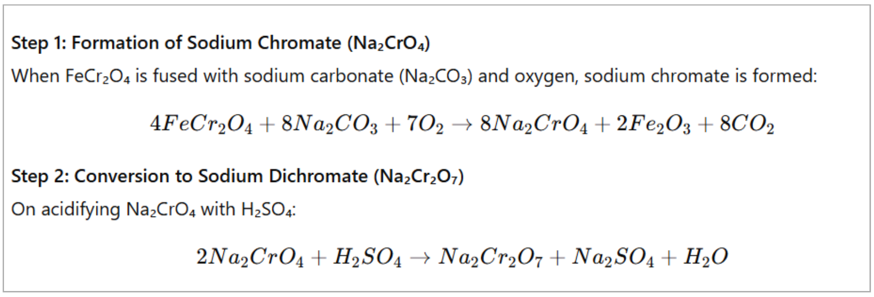
28. (i) Name two elements of 3d series which show anomalous electronic configuration. [3]

(ii) Write the preparation of $KMnO_4$ from Pyrolusite ore (MnO_2)

Answer

Chromium (Cr): [Ar] $3d^5\ 4s^1$ (instead of $3d^4\ 4s^2$) (0.5)

Copper (Cu): [Ar] $3d^{10}\ 4s^1$ (instead of $3d^9\ 4s^2$) These anomalies arise due to extra stability of half-filled and fully-filled d-orbitals. (0.5)



Step 1: Formation of Sodium Chromate (Na_2CrO_4)

When $FeCr_2O_4$ is fused with sodium carbonate (Na_2CO_3) and oxygen, sodium chromate is formed:

$$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$$

Step 2: Conversion to Sodium Dichromate ($Na_2Cr_2O_7$)

On acidifying Na_2CrO_4 with H_2SO_4:

$$2Na_2CrO_4 + H_2SO_4 \rightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$$

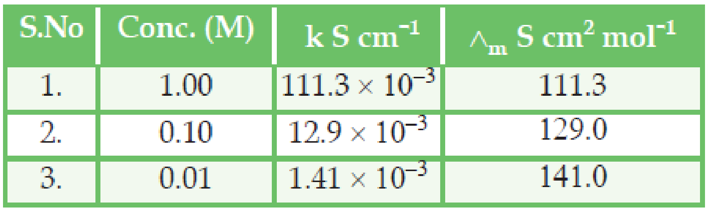
step 1 (1)

step2 (1)

Section D

29. Rahul set-up an experiment to find resistance of aqueous KCl solution for different concentrations at 298 K using a conductivity cell connected to a Wheatstone bridge. He fed the Wheatstone bridge with A.C. power in the audio frequency range 0 to 5000 cycles per second. Hence the resistance was calculated from null point, he also calculated the conductivity K and

molar conductivity Λm and recorded his readings in tabular form.



S.No	Conc. (M)	k S cm^{-1}	$\wedge_m$ S cm^2 mol^{-1}
1.	1.00	111.3×10^{-3}	111.3
2.	0.10	12.9×10^{-3}	129.0
3.	0.01	1.41×10^{-3}	141.0

29.I. Why does conductivity decrease with dilution? [1]

Answer

Conductivity decreases with dilution because it depends upon the number of ions present in the solution. When dilution increases number of available ions decreases. Hence, conductivity decreases. (1)

29.II. If $\Lambda_m{}^0$ of KCl is 150.0 S cm^2 mol^{-1}, calculate the degree of dissociation of 0.01 M KCl. [1]

Answer

$$\propto = \frac{141}{150} = 0.94$$ (1)

29.III. If Rahul had used HCl instead to KCl then would you excpet the Λ_m values to be more or less than those per KCl for a given concentration. Justify [2]

Answer

Molar conductivity of HCl will be high because when it breaks down into ions, it produces HCl → H+ +Cl– (1)

Its H+ (cation) size is smaller then K+ ion. So for same concentration of HCl and KCl, HCl shows high molar conductivity. (1)

30. In spite of the predictions of stable noble gas compounds since at least 1902, unsuccessful attempts at their synthesis gave rise to the widely held opinion that noble gases are not only noble but also inert. It was not until 1962 that this dogma was shattered when Bartlett in Canada published the first stable noble gas compound XePtF6 . This discovery triggered a worldwide frenzy in this area, and within a short time span many new xenon, radon, and krypton compounds were prepared and characterized. The recent discoveries show the ability of xenon to act as a ligand . The discovery by Seppelt's group that more than one xenon atom can attach itself to a metal center which in the case of gold leads to surprisingly stable Au- Xe bonds. The bonding in $[AuXe_4]^{2+}$ involves 4 Xe ligands attached by relatively strong bonds to a single Au(II) center in a square planar arrangement with a Xe-Au bond length of about 274 pm This discovery provides not only the first example of multiple xenon ligands but also represents the first strong metal - xenon bond.
(Source: Christe, K. O. (2001). A renaissance in noble gas chemistry. Angewandte Chemie International Edition, 40(8), 1419-1421.)

30.I. What ligand is Xe in the given complex ? [1]

Answer

unidentate (1)

30.II. What is the hybridization shown by Au in $[AuXe_4]^{2+}$? [1]

Answer

dsp^2 (1)

30.III. What is the difference between a geometrical isomer and an optical isomer in coordination compounds? [2]

Answer

Geometrical isomers occur due to the different spatial arrangements of ligands around the central metal ion in coordination compounds, typically observed in square planar and octahedral complexes (e.g., cis and trans forms). (1)

Optical isomers (enantiomers), on the other hand, are non-superimposable mirror images of each other and occur in chiral complexes. Optical isomers have identical physical properties except for their ability to rotate plane-polarized light in opposite directions (dextrorotatory and levorotatory forms). (1)

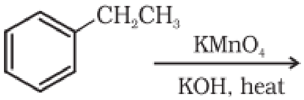
Section E

31.I. (i) Even though the phenoxide ion has more resonance structures than the carboxylate ion, carboxylic acids are stronger acids than phenol. Explain why. [5]

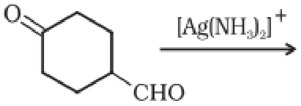
(ii) During the preparation of esters from a carboxylic acid and an alcohol in the presence of an acid catalyst, the water or the ester should be removed as soon as it is formed.

(iii) Give one chemical test to distinguish Phenol and Acetic acid.

(iv) Complete each synthesis by giving missing starting material, reagent or products



(a)

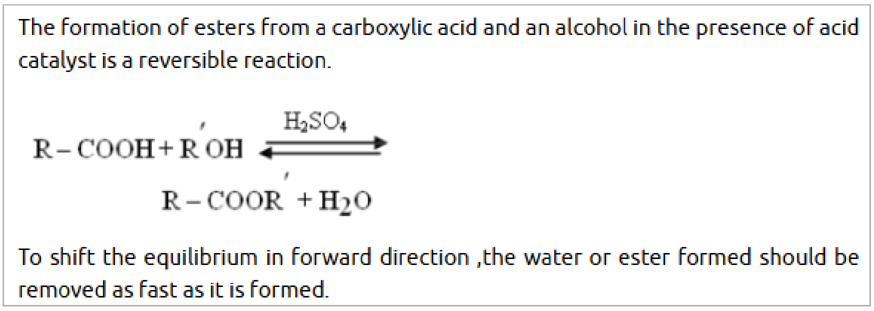


(b)

Answer

(i) Carboxylate ion is more stable because its negative charge is equally delocalised over two equivalent oxygen atoms, whereas phenoxide ion has unequal and less effective resonance. Hence, carboxylic acids are stronger acids than phenol. (1)

(iii) Acetic acid reacts with NaHCO₃ to produce brisk effervescence of CO₂ gas. Phenol does not react with NaHCO₃. Thus, effervescence shows acetic acid; no reaction shows phenol. (1)

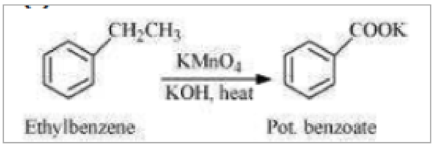


The formation of esters from a carboxylic acid and an alcohol in the presence of acid catalyst is a reversible reaction.

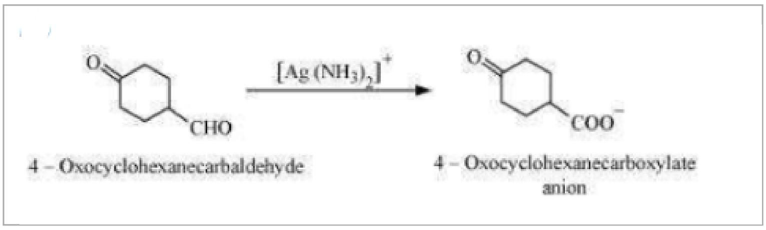
$$R-COOH + R'OH \underset{}{\overset{H_2SO_4}{\rightleftharpoons}} R-COOR' + H_2O$$

To shift the equilibrium in forward direction ,the water or ester formed should be removed as fast as it is formed.

ii (1)



(a) (1)



(b) (1)

(OR)

31.II. (i) $(CH_3)_3C—O—CH_3$ on reaction with HI gives $(CH_3)_3C—I$ and $CH_3—OH$ as the main products and not $(CH_3)_3C—OH$ and $CH_3—I$? [5]

(ii) Give one chemical test to distinguish Methanol and ethanol.

(iii) Two organic compounds, ROH and R′OH, show different behaviours — one acts as a base while the other acts as an acid. How are the groups R and R′ different from each other?

(iv) Predict the products of the following reactions :

a) $CH_3 – CH_2 – CH_2 – CH_2 – OH + SOCl_2 \rightarrow$

b) $CH_3 – CH_2 – CH_2 – O – CH_3 + HBr \rightarrow$

Answer

(i) (CH3)3 is tert. Carbocation which is more stable for SN1 reaction. (1)

(ii) Ethanol (CH_3CH_2OH) gives a positive iodoform test — yellow precipitate of CHI_3 (iodoform). Methanol (CH_3OH) gives no iodoform. (1)

(iii) The R group that makes ROH more basic is an electron-donating group (alkyl group). Electron donation increases electron density on oxygen, so the molecule more readily accepts a proton (acts as a base). (0.5)

The R′ group that makes R′OH more acidic is an electron-withdrawing group (e.g. $–NO_2$, –Cl, an electron-withdrawing aryl substituent). Electron withdrawal stabilizes the conjugate base ($R'O^-$), making loss of H^+ easier (greater acidity). (0.5)

(iii) R is an electron donating R' is an electron withdrawing (1)

iv) a)$CH_3–CH_2–CH_2–CH_2–Cl(+SO_2+HCl)$ (product: 1-chlorobutane) (1)

b)$CH_3Br+CH_3CH_2CH_2OH$ (product: methyl bromide + 1-propanol) (1)

32.I. (i) Starch and cellulose both contain glucose units as monomers yet they are structurally different. [5]

(ii) The two strands of DNA are complementary to each other.

(iii) Mention the difference in anomeric forms of glucose and evidence to support the cyclic forms of glucose.

(iv) How does the formation of glucose pentaacetate during acetylation with acetic anhydride confirm that glucose contains five hydroxyl groups attached to different carbon atoms?

(v) Which vitamin deficiency causes prolonged bleeding, what is one major source of this vitamin, and what role does dietary fibre play in our body?

Answer ⚷

i) Both are made of glucose units, but starch has α-(1→4) linkages (and α-(1→6) in amylopectin), whereas cellulose has β-(1→4) linkages, leading to different structures and properties. (1)

ii) The two DNA strands are complementary because A pairs with T and G pairs with C through specific hydrogen bonding. (1)

iii) Glucose has two anomers, α- and β-glucose, differing in the orientation of the –OH group at C-1. Evidence for cyclic structure: glucose forms α and β-glycosides, does not form addition products with $NaHSO_3$, and shows mutarotation. (1)

iv) When glucose is acetylated with acetic anhydride, it forms glucose pentaacetate, showing that all five –OH groups in glucose react. Since the product is stable, these five hydroxyl groups must be attached to five different carbon atoms. (1)

(v) Deficiency of Vitamin K causes prolonged bleeding; it is found in green leafy vegetables. Dietary fibre aids digestion and prevents constipation. (1)

(OR)

32.II. (i) Which hormone regulates blood sugar in our body, and why should diabetic patients perform mild daily exercises like walking? [5]

(ii) A child shows bone deformities, delayed walking, and severe leg pain. Name the nutritional deficiency the child is suffering from.

(iii) When two nucleotides combine to form a dinucleotide, between which carbon atoms of their pentose sugars is the phosphodiester bond formed?

(iv) How does the oxidation of glucose with bromine water help to confirm that glucose contains an aldehyde group?

(v) A person has not eaten for several hours. Enzymes in the liver start breaking down a highly branched carbohydrate stored in the body to release glucose into the blood. Name this stored carbohydrate.

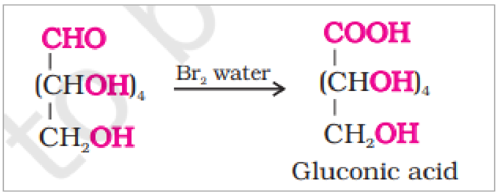
Answer

(i) Insulin regulates blood sugar. Diabetic patients should walk daily because mild exercise increases glucose uptake by cells and helps control blood sugar levels. (1)

(ii) The child is suffering from rickets (Vitamin D deficiency). (1)

(iii) The phosphodiester bond is formed between the 3′ carbon of one pentose sugar and the 5′ carbon of the next. (1)

(v) The stored carbohydrate is glycogen. (1)



$$\begin{array}{c} CHO \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array} \xrightarrow{Br_2\ water} \begin{array}{c} COOH \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array}$$

Gluconic acid

(iv) Glucose is oxidised by bromine water to gluconic acid, which occurs only if an aldehyde group is present, thus confirming the aldehydic nature of glucose. (1)

33.I.i. The following data were obtained for the reaction: [3]

$A + 2B \rightarrow C$

Experiment	[A]/M	[B]/M	Initial rate of formation of C/M min^{-1}
1	0.2	0.3	4.2×10^{-2}
2	0.1	0.1	6.0×10^{-3}
3	0.4	0.3	1.68×10^{-1}
4	0.1	0.4	2.40×10^{-2}

(a) Find the order of reaction with respect to A and B.

(b) Write the rate law and overall order of reaction.

(c) Calculate the rate constant (k).

Answer 🔑

(1)

Rate = $k[A]^{p[}B]^{q}$ On solving (a) Order with respect to A = 2, B = 1

(1)

(b) Rate = $k[A]^2[B]^{1;}$ overall order = 3

(1)

Experiment 1 : $4.2 \times 10^{-2} = k\,(0.2)^2\,(0.3)$; k = 3.5 Experiment 2 : $6.0 \times 10^{-3} = k\,(0.1)^2\,(0.1)$;

33.I.ii. If the activation energy of a reaction is zero. How will the temperature affect the rate of reaction? [2]

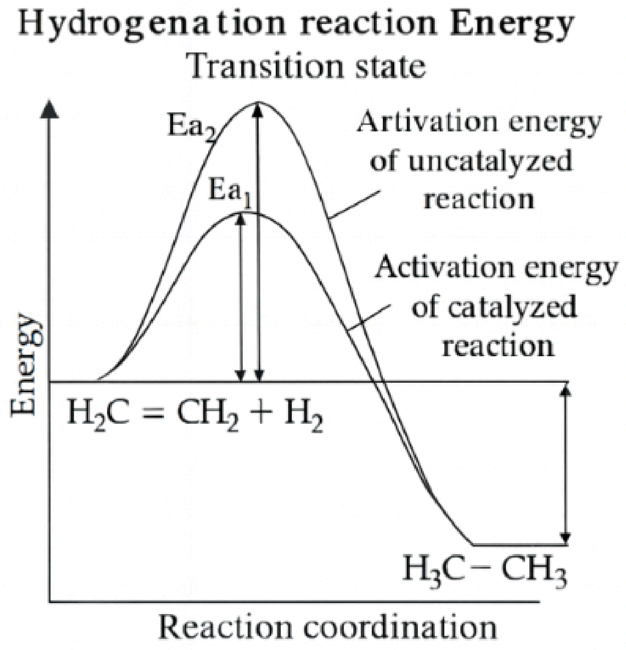
Answer 🔑

If the activation energy of a reaction is zero, temperature will have no effect on the rate of the reaction. (1)

This is because the rate constant of the reaction will be nearly independent of temperature. (1)

(OR)

33.II.i. Observe the potential energy diagram for the hydrogenation of ethene to give ethane. [3]



(a) For the same process, predict why there is a difference in E_{a1} and E_{a2}?

(b) Assuming both the reaction are reversible then in which case the backward reaction will be faster?

(c) Will the ΔG value of this reaction be different in the above two paths? Explain.

Answer ⚩

There is a difference in activation energy because the process with Ea1 is a catalysed reaction which lowers the threshold energy for the formation of intermediate activated complex while. Ea2 path is uncatalysed and has higher threshold energy. (1)

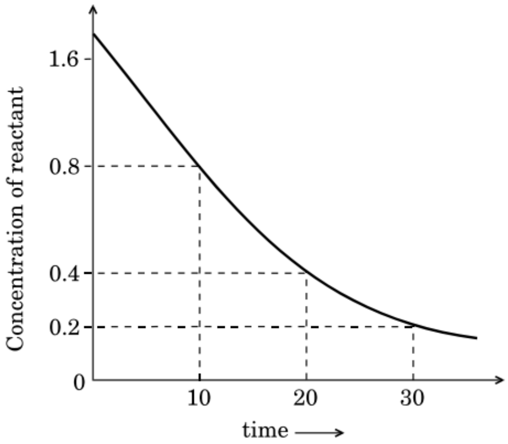
In a reversible catalysed reaction, the rate of both forward and backward reactions are faster than an uncatalysed reaction. (1)

ΔG value is independent of the path taken as Gibbs free energy is a state function and not a path function. (1)

33.II.ii. Analyse the given graph, drawn between concentration of reactant vs. time. [2]

a) Predict the order of reaction.

b) Theoretically, can the concentration of the reactant reduce to zero after infinite time? Explain.



Answer

Given graph is of First order reaction. (1)

No, Theoretically, the concentration of the reactant reduce to zero after infinite time due to exponential relation, the curve never touches the x-axis. hence it doesnot become zero. (1)