NEB - GRADE XII
2077 (2020)
Chemistry

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Time: 1:30 hrs. **Full Marks (Condense): 30**

Group 'A'

Attempt any **five** questions. 5x2=10

1. What are hybrid orbitals? Draw hybrid structure of methane.
2. What do you mean by normality of a solution is 1N?
3. Distinguish between electrochemical equivalent and chemical equivalent.
4. On what factors the Rate of reaction depends?
5. Write the chemical formula of Green Vitriol.
6. Give an example of Coupling reaction.
7. Draw the structure of Glucose and fructose.

Group 'B'

Attempt any **two** questions. 2x5=10

1. Define the terms:
   i. Titration error ii. Standard solution
   Calculate the volume of 1M NaOH required to neutralize 200cc of 2M HCl. What mass of sodium chloride are produced from the neutralized reaction?
2. Name a primary reference electrode and mention its one important use.
   For a cell;
   $Mg(s)/Mg^{++}(1M)//Cu^{++}(1M)/Cu(s)$
   $E^{o}\ Mg(s)/Mg^{++} = 2.37$ V and $E^{o}Cu^{++}/Cu = +0.34$ V
   i. Indicate cathode and anode
   ii. Write the reaction taking place at electrode.
   iii. Calculate the emf at 1M solution of its ions.
3. How would you separate 1^{o}, 2^{o}, 3^{o} amines from their mixture by Hoffmann's method?

Sub.Code : 212 'D'

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Time: 1:30 hrs. **Full Marks (Condense): 30**

Group 'A'

Attempt any **five** questions. 5x2=10

1. What is the mode of hybridization of B in BF_3? Write any two important features of this hybridization.
2. Distinguish between end point and equivalence point of reaction.
3. What is meant by single electrode potential? How is it measured?
4. Define enthalpy of formation giving an example of it.
5. Give the balanced chemical reaction for the preparation of black oxide from blue vitriol. How is black oxide converted into red oxide?
6. What is Williamson's etherification reaction?
7. A primary haloalkane (X), if allowed to react with KCN yields a compound(Y), which on acidic hydrolysis gave propanoic acid. Identify (X) and (Y).

Group 'B'

Attempt any **two** questions. 2x5=10

8. Are all standard solutions, primary standard solutions or not? Give reason. 1 g of a divalent metal was dissolved in 25mL of 2N H_2SO_4 (f = 1.01). The excess acid required 15.1mL of 1N NaOH (f = 0.8) for complete neutralization. Find the atomic weight of the metal.
9. What is meant by enthalpy of formation? Calculate the enthalpy of formation of ethane at 298 K, if the enthalpies of combustion of C, H and C_2H_6 are - 94.14, - 68.47 and - 373.3 KCal respectively.
10. An Organic Compound (A) reacts with PBr_3 to give (B). Compound B produces (C) when heated with alc. KOH. The compound (C) undergoes ozonolysis to yield ethanal and methanal as major products. The compound A responses iodoform test. Identify A, B, C and write reactions involved. How is (A) obtained from CH_3MgBr?

Contd...

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Group 'C'

Attempt any **one** question. 1x10=10

11. Give a suitable chemical reaction for the laboratory preparation of trichloromethane. What happens when trichloromethane reacts with

i. Phenol ii. Nitric acid

iii. Silver powder iv. Atmospheric air.

12. Define the terms (i) activation energy (ii) order of reaction (iii) molecularity of reaction (iv) effective collision (v) rate law equation.

Why does powder sugar dissolve faster than grain sugar?

The following data were obtained for a hypothetical reaction

$x + y \longrightarrow z$

Expt	[x] mol L^{-1}	[y] mol L^{-1}	Formation of z mol L^{-1} S^{-1}
1	0.20	0.20	$3x10^{-3}$
2	0.40	0.20	$1.2x10^{-2}$
3	0.60	0.40	$6x10^{-3}$
4	0.80	0.20	$9x10^{-3}$

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Group 'A'

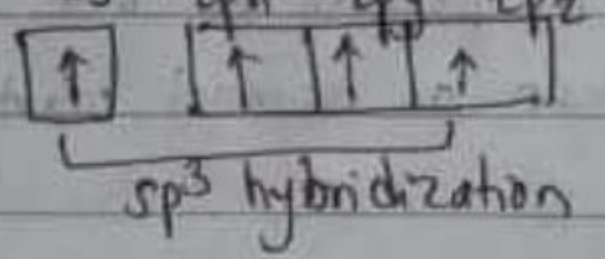
1) What are hybrid orbitals? Draw hybrid structure of methane?

Ans: The process of mixing of dissimilar atomic orbitals of same atom giving rise to equal number of a new set of orbitals having same energy is known as hybridization and new orbital is called hybrid orbitals.

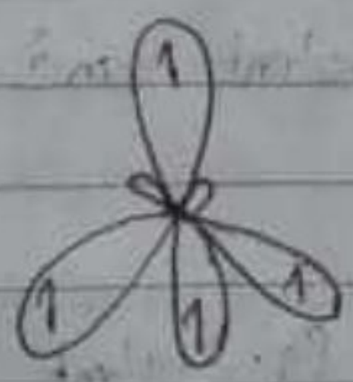
Methane (CH_4)

$_6C = 1s^2\ 2s^2\ 2p^2$

$_6C = 1s^2\ 2s^1\ 2p_x^1\ 2p_y^1\ 2p_z^1$

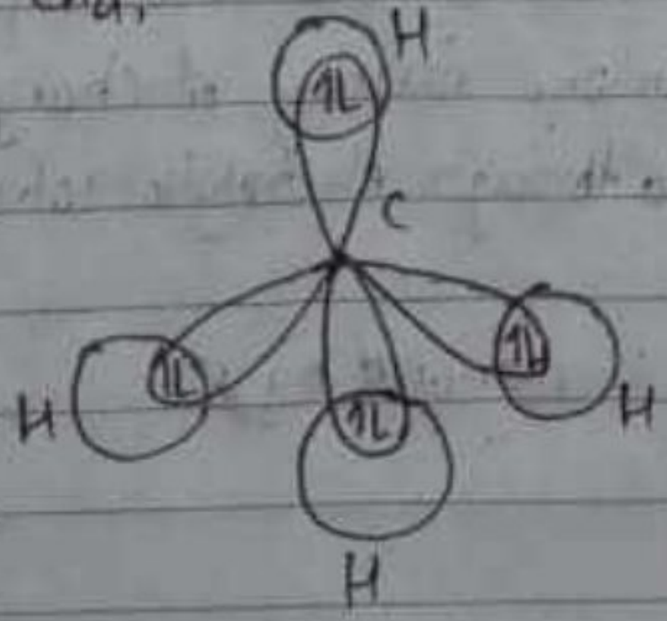


for C,



for H

for CH_4,



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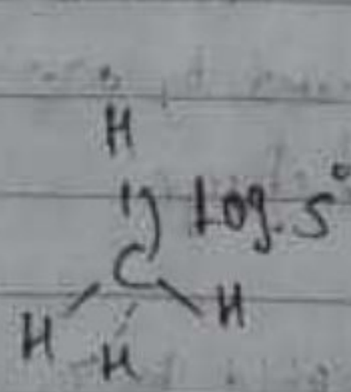

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2) What do you mean by normality of a solution is 1 N?

Ans:

Normality is defined as the number of gram equivalent of solute present in one litre of solution. It is denoted by N.

Normality = $\frac{\text{no of gram equivalent of solute}}{\text{volume of solution in litre}}$

Normality of a solution is 1 N means that one gram equivalent of substance is present in one litre of its solution. It is also known as normal solution.

3) Distinguish between electrochemical equivalent and chemical equivalent.

Ans.

Electrochemical equivalent	Chemical Equivalent
1. The mass of substance deposited or liberated by one coulomb of charge.	1. The mass of substance deposited when one faraday of charge is passed through electrolytic solution
2. It is denoted by Z.	2. It is denoted by E.

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4) On what factors the Rate of reaction depend?

Ans Rate of reaction is defined as the change in concentration of reactants or products per unit time. It depends upon the following factors:

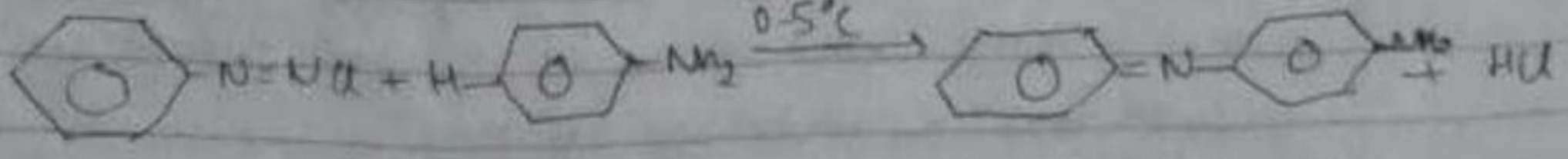
i) Nature of reactant
ii) concentration of reactants
iii) Temperature
iv) Catalyst
v) Surface area of reactants
vi) Light

5) Write the chemical formula of green vitriol.

Ans Ferrous sulphate heptahydrate ($FeSO_4 \cdot 7H_2O$) is the chemical formula of green vitriol.

6) Give an example of Coupling reaction.

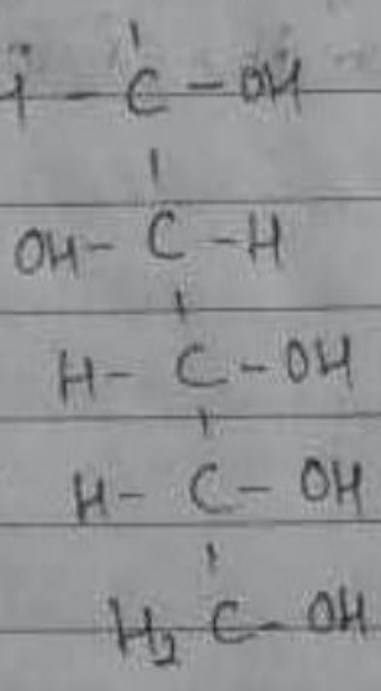
Ans When aniline is treated with benzene diazonium chloride, p-amino azobenzene is obtained. This reaction is known as coupling reaction.



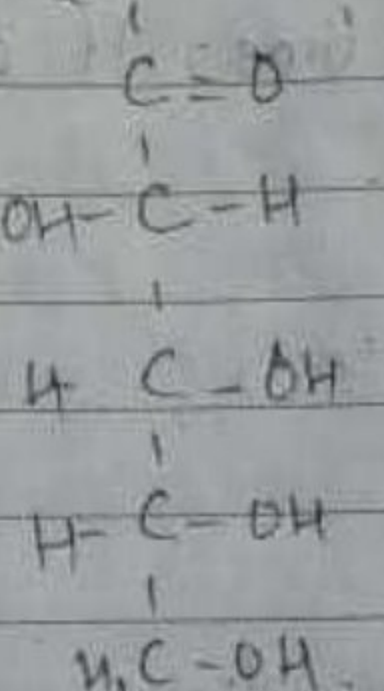
p-aminoazobenzene

7. Draw the structure of Glucose and fructose.

Ans:



Glucose (aldohexose)



fructose (ketohexose)

Group 'B'

1. Define the terms:

i. Titration error: The difference between the equivalence point and end point is called titration error.

ii. Standard solution: The solution whose concentration is known is called standard solution.

Calculate the volume of 1 M NaOH required to neutralize 200cc of 2M HCl. What volume of sodium chloride are produced from the neutralized reaction.

Soln.

$V_1 = ?$ $V_2 = 200cc$

$N_1 = M_1 = 1N$ $N_2 = 2M = 2N$

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Q. Name a primary reference electrode and mention its important use. 3.

Ans: A primary reference electrode is an electrode which has a stable and well-known electrode potential. Standard fns
Hydrogen Electrode is an example of primary reference electrode. Its potential is assumed to be zero and used to calculate cell potential using different electrodes.

Numerical:

The given cell notation is as:

$Mg(s) / Mg^{2+}(1M) // Cu^{2+}(1M) / Cu(s)$

Anode	Cathode
-2.37 V	+0.34 V

i. $Mg(s) / Mg^{2+}$ is anode and $Cu^{2+}/Cu(s)$ is cathode.

ii. Mg acts as anode which undergoes oxidation and Cu acts as cathode where reduction takes place.

$Mg \rightarrow Mg^{2+} + 2e^-$ (oxidation)

$Cu^{2+} + 2e^- \rightarrow Cu$ (reduction)

iii. End of cell

$E^\circ cell = E^\circ red (cathode) - E^\circ red (anode)$

$= +0.34 - (-2.37)$

$= +2.71 V$

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from the normality eqn.

$N_1V_1 = N_2V_2$

or, $1 \times V_1 = 200 \times 2$

$\therefore V_1 = 400$ cc

NaCl.

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

40 gm 58.5 gm

for NaOH,

$$w = \frac{NEV}{1000} = \frac{1 \times 400 \times 40}{1000} = 16 \text{ gm}$$

$\therefore$ 40 gm of NaOH gives 58.5 gm of NaCl

16 gm of NaOH gives $\left(\frac{58.5}{40} \times 16\right)$ gm of NaCl

$= 23.4$ gm of NaCl

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3. How would you separate 1°, 2°, 3° amines from their mixture by Hoffmann's method?

Ans: The mixture of 1°, 2° and 3° amines can be separated by treating it with hoffmann's reagent ie diethyl oxalate.

$$2R\text{-}NH_2 + \underset{\underset{COOC_2H_5}{|}}{COOC_2H_5} \longrightarrow \underset{\underset{CONHR}{|}}{CONHR} + 2C_2H_5OH$$

1° amine — diethyl oxamide (solid)

$$R_2\text{-}NH + \underset{\underset{COOC_2H_5}{|}}{COOC_2H_5} \longrightarrow \underset{\underset{COOC_2H_5}{|}}{CONR_2} + C_2H_5OH$$

diethyl oxamic ester (oily liquid)

$$R_3\text{-}N + \underset{\underset{COOC_2H_5}{|}}{COOC_2H_5} \longrightarrow \text{No reaction}$$

Now the mixture containing diethyl oxamide, diethyl oxamic ester, tertiary amine and alcohol are subjected to filtration. The diethyl oxamide is obtained as residue and is treated with aq. KOH to obtain primary amine.

$$\underset{\underset{CONHR}{|}}{CONHR} + \text{aq. KOH} \longrightarrow \underset{\underset{COOK}{|}}{COOK} + R\text{-}NH_2$$

Now the mixture containing diethyl oxamic ester, ethanol and tertiary amine is subjected to fractional distillation.

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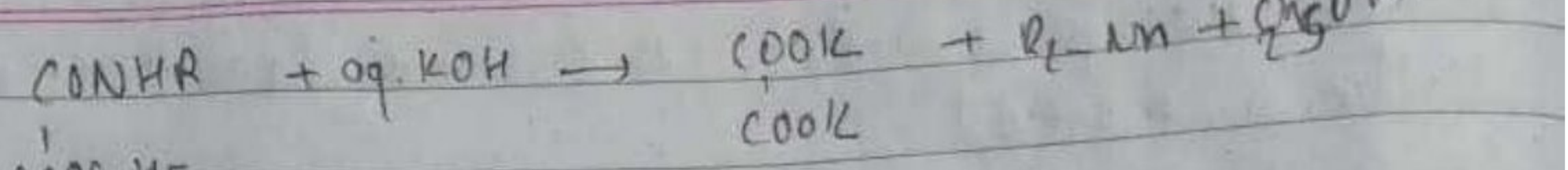

In this way, 1°, 2° and 3° amines are separated.

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