I. CHOOSE THE CORRECT ANSWER: (15 x 1= 15)

1. The rate constant of a reaction is 5.8 x10^{-2} s^{-1}. The order of the reaction is Ans: B) First order
2. Aspirin is _____ Ans: B) acetyl salicylic acid
3. In acid medium, potassium permanganate oxidizes oxalic acid to Ans: D) Carbon dioxide
4. IUPAC name of the complex $K_3[Al(C_2O_4)_3]$ is Ans: C) potassiumtrioxalatoaluminate(III)
5. Among the following which will not be hydrolysed? Ans: D) Ammonium nitrate
6. Among the following cells
I. Leclanche cell II. Nickel – Cadmium cell III. Lead storage battery IV. Mercury cell
Primary cells are ..... Ans: B) (i) and (iv)
7. In the electrolytic refining of copper, which one of the following is used as anode?
Ans: D) Impure copper
8. Assertion: monoclinic sulphur is an example of monoclinic crystal system.
Reason: for a monoclinic system, a ≠ b ≠ c and α = γ = 90° , β ≠ 90°.
Ans: (B) Both assertion and reason are true but reason is not the correct explanation of assertion.
9. The formation of cyanohydrin from acetone is an example of Ans: C) nucleophilic addition.
10. Which of the following is not sp^2 hybridised? Ans: C) dry ice
11. The oxidizing agent used to stop the oxidation of primary alcohol at the aldehyde stage is
Ans: D) PCC
12. Which of the following is strongest acid among all? Ans: B) HI
13. When aniline reacts with acetic anhydride the product formed is Ans: C) acetanilide
14. The pyrimidine bases present in RNA are Ans: C) cytosine and uracil
15. Activity of iron catalyst is increased by the _____ compound. Ans:

II. ANSWER ANY SIX QUESTIONS. Q.NO. 24 IS COMPULSORY 6×2=12

16. What is calcinations?

- Calcination is the process in which the concentrated ore is strongly heated in the absence of air.
- During this process water of crystallisation present in the hydrated oxide escapes as moisture.
- During the calcination of carbonate ore, carbon dioxide is liberated.

$$PbCO_3 \xrightarrow{\Delta} PbO + CO_2\uparrow$$

17. How will you convert boric acid to boron nitride?

Fusion of urea with $B(OH)_3$, in an atmosphere of ammonia at 800 - 1200 K gives boron nitride.

$$B(OH)_3 + NH_3 \xrightarrow{\Delta} BN + 3H_2O$$

18. Sulphuric acid is a dehydrating agent. Justify with an example.

- Sulphuric acid is highly soluble in water.
- It has a strong affinity towards water.
- When dissolved in water, it forms mono ($H_2SO_4.H_2O$) and dihydrates ($H_2SO_4.2H_2O$) and the reaction is exothermic.
  Ex: $C_{12}H_{22}O_{11} + H_2SO_4 \rightarrow 12C + H_2SO_4.11H_2O$

19. Explain common ion effect with an example.

- When a salt of a weak acid is added to the acid itself, the dissociation of the weak acid is suppressed further. Acetic acid is a weak acid. It is not completely dissociated in aqueous solution.
  $CH_3COOH\ (aq) \rightleftharpoons H^+(aq) + CH_3COO^-\ (aq)$
- Addition of sodium acetate salt , completely dissociates to produce Na^+ and CH_3COO^- ion.
  $CH_3COONa\ (aq) \rightarrow Na^+\ (aq) + CH_3COO\ (aq)$
- Hence, the overall concentration of $CH3COO^-$ is increased, and the acid dissociation equilibrium is disturbed.

20. Can Fe^{3+} oxidises Bromide to bromine under standard conditions?

Given : $E^\circ_{Fe3+|Fe3+}$= 0.771 $E^\circ_{Br2|Br-}$=1.09V

Required half cell reaction

$2Br^- \rightarrow Br_2 + 2e^-$ $(E^\circ ox) = -1.09V$

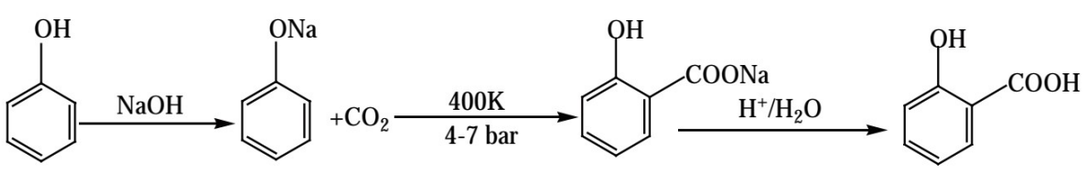
$2Fe^{3+} + 2e^- \rightarrow 2Fe^{2+}$ $(E^\circ red) = +0.771V$

$2Fe^{3+} + 2Br^- \rightarrow 2Fe^{2+} + Br_2$ $(E^\circ cell = ?)$

$E^\circ cell = (E^\circ ox) + (E^\circ red) = -1.09 + 0.771 = -0.319\ V.$

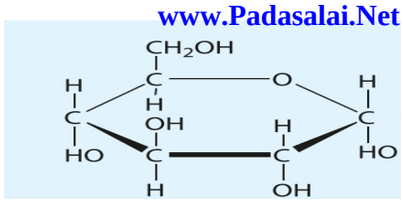
E°Cell is - ve, ΔG is +ve and the cell reaction is non-spontaneous. Hence Fe^{3+} cannot oxidises Br^- to Br_2.

21. Write Kolbe's reaction.

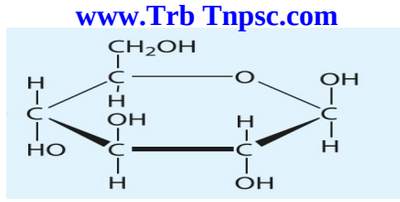


phenol sodium phenoxide sodium salicylate Salicyclic acid

22. Write the structure of the following: α-D-Glucopyranose and β-D-Glucopyranose



α-D-Glucopyranose



β-D-Glucopyranose

23. What are antibiotics?

The medicines that have the ability to kill the pathogenic bacteria are grouped as antibiotics.

Ex: Penicillin, Amoxicillin

24. What is an order of a reaction?

Order of a reaction is the sum of powers of concentration terms involved in the experimentally determined rate law. It is assigned for overall reaction.

III. ANSWER ANY SIX QUESTIONS. Q.NO. 33 IS COMPULSORY (6×3=18)

25. Give the uses of helium.

- Helium and oxygen mixture is used by divers in place of air oxygen mixture. This prevents the painful dangerous condition called bends.
- Helium is used to provide an inert atmosphere in the electric arc welding of metals.
- Helium has the lowest boiling point hence used in cryogenics.
- It is much less denser than air and hence used for filling air balloons.

26. Which is more stable? Fe^{3+} or Fe^{2+} – explain.

- Electronic configuration of Fe^{3+} = [Ar] $3d^5$. It consists of 5 unpaired electrons. Half filled and stable.
- Electronic configuration of Fe^{2+} = [Ar]$3d^6$. It consists of 4 unpaired electrons, partially filled d subshell.
- Hence Fe^{3+} is more stable than Fe^{2+}.

27. Aluminium crystallizes in a cubic close packed structure .Its metallic radius is 125pm. Calculate the edge length of unit cell.

Cubic close packing is based on face centred cubic unit cell.

Given, Radius (r) = 125 pm

Edge length of unit cell (a) = ?

$r = \frac{a\sqrt{2}}{4}$ (or) $r = \frac{a}{2\sqrt{2}}$

$a = r \times 2 \times g\sqrt{2}$

$= 125 \times 2 \times 1.414$

$a = 353.5$ pm

28. Write Arrhenius equation and explain the terms involved.

The Arrhenius equation is an expression that provides a relationship between the rate constant (of a chemical reaction), the absolute temperature, and the A factor.

$$k = Ae^{-Ea/RT}$$

A = Arrhenius factor (frequency factor) R = Gas constant k = Rate constant

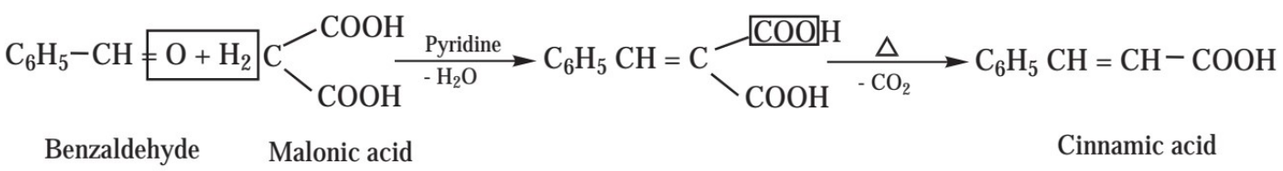
E_a = Activation energy T = Absolute temperature (in K)

29. Explain the effect of temperature and pressure on physisorption and chemisorptions.

- Effect of temperature:
  When temperature is raised chemisorption first increases and then decreases. whereas physisorption decreases with increase in temperature.
- Effect of pressure:
  Chemical adsorption is fast with increase in pressure, it cannot alter the amount of adsorption. In Physisorption the extent of adsorption increases with increase in pressure.

30. Explain Knoevenagal reaction.

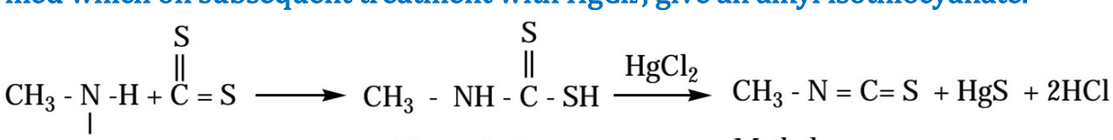
Benzaldehyde condenses with malonic acid in presence of pyridine forming cinnamic acid, Pyridine act as the basic catalyst.



Benzaldehyde Malonic acid Cinnamic acid

31. Write the reaction of primary amine with Carbon disulphide.

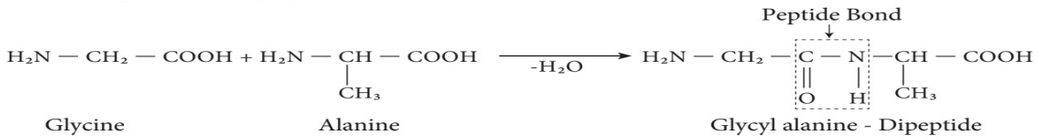
When primary amines are treated with carbon disulphide (CS_2), N - alkyldithio carbamic acid is formed which on subsequent treatment with $HgCl_2$, give an alkyl isothiocyanate.



Methylamine N - methyl dithiocarbamic acid Methyl isothiocyanate (Mustard oil smell)

32. Write a short note on peptide bond.

The amino acids are linked covalently by peptide bonds. The carboxyl group of the first amino acid react with the amino group of the second amino acid to give an amide linkage between these amino acids. This amide linkage is called peptide bond.



33.

IV. ANSWER THE FOLLOWING QUESTIONS: (5 x 5 =25)

34. A) i) What are the difference between minerals and ores?

MINERALS	ORES
The naturally occurring substance which contain metal in the free state or in forms of its compounds	An ore is a mineral which contain high percentage of metal which it can be easily and economically extracted.
All minerals are not ores Ex. Clay	All ores are minerals . Ex. Bauxite

ii) What is the role of Silica in the extraction of Copper?

- Silica act as a flux.
- It combines with ferrous oxide and removed as ferrous silicate called as slag.
- $FeO + SiO_2 \rightarrow FeSiO_3$

[OR]

B) i) Give the uses of Boric acid.

Boric acid is

- Used in the manufacture of pottery glazes, glass, enamels and pigments.
- Used as an antiseptic.
- Used as an eye lotion.
- Used as a food preservative.

ii) What are silicates?

The mineral which contains silicon and oxygen in tetrahedral $[SiO_4]^{4-}$ units linked together in different patterns are called silicates.

Nearly 95 % of the earth crust is composed of silicate minerals and silica.

35. a) What is lanthanoid contraction ? Give reason. Explain its consequences.

- As we move across 4f series, the atomic and ionic radii of lanthanoids show gradual decrease with increase in atomic number.
- This decrease in ionic size is called lanthanoid contraction.

Effects (or) Consequences of lanthanoid contraction:

1. Basicity differences: As we move from Ce^{3+} to Lu^{3+} , the basic character of Ln^{3+} ions decrease. Due to the decrease in the size of Ln^{3+} ions, the ionic character of Ln – OH bond which results in the decrease in the basicity.
2. Similarities among lanthanoids – In the complete f-series only 10 pm decrease in atomic radii and 20 pm decrease in ionic radii is observed. Because of this very small change in radii of lanthanoids, their chemical properties are quite similar.

3.The elements of second and third transition series resemble each other more closely than the elements of first and second transition series due to lanthanoid contraction.

[OR]

b) i) Write a short notes on double salts and co-ordination compounds.

Double Salts	Coordination Compounds
1. Lose their identity	Do not lose their identity
2. Dissociate into their constituent simple ions in solutions	Never dissociate to give simple ions.
3. (eg) Mohr's salt $FeSO_4(NH_4)_2SO_4.6H_2O$	$K_3[Fe(SCN)_6]$
4. Answer the tests for simple ions Fe^{2+}, NH^{4+}, SO_4^{2-} - ions.	Does not answer for simple ions Fe^{3+}, SCN^-

ii) Give an example of a coordination compound used in medicine and two examples of biologically important coordination compounds.

Medical uses of coordination compounds:

- Ca-EDTA chelate is used in the treatment of lead and radioactive poisoning.
- Cis-platin is used as an antitumor drug in cancer treatment.

Biological importance of coordination compounds:

- A red blood corpuscles (RBC) is composed of heme group, which is Fe^{2+} Porphyrin complex.it plays an important role in carrying oxygen from lungs to tissues and carbon dioxide from tissues to lungs.

36. A) Calculate the percentage efficiency of packing in case of simple cubic crystal.

Let us consider a cube with an edge length 'a'.

Volume of the cube = a × a × a = a^3.

Let 'r' is the radius of the sphere.

From the figure a = 2r; r = a/2

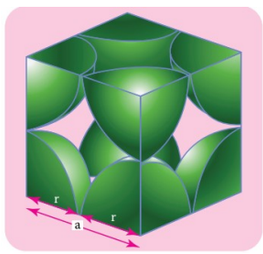
∴ Volume of the sphere with radius 'r'

$$= \frac{4}{3}\pi r^3$$

$$= \frac{4}{3}\pi\left(\frac{a}{2}\right)^3$$

$$= \frac{4}{3}\pi\left(\frac{a^3}{8}\right)$$

$$= \frac{\pi a^3}{6} \quad \ldots (1)$$



In a simple cubic arrangement, number of spheres belongs to a unit cell is equal to one

$$\therefore \text{ Total volume occupied by the spheres in sc unit cell} = 1 \times \left(\frac{\pi a^3}{6}\right) \quad \ldots (2)$$

Dividing (2) by (3)

$$\text{Packing fraction} = \frac{\left(\frac{\pi a^3}{6}\right)}{(a^3)} \times 100 = \frac{100\,\pi}{6}$$

$$= 52.38\%$$

[OR]

B) i) Derive integrated rate law for a zero-order reaction A → product.

A reaction in which the rate is independent of the concentration of the reactant over a wide range of concentrations is called zero-order reactions. Such reactions are rare. Let us consider the following hypothetical zero-order reaction.

The rate law can be written as,

$$\text{Rate} = k\,[A]^0$$

$$\frac{-d[A]}{dt} = k \ (1) \qquad (\therefore [A]^0 = 1)$$

$$\Rightarrow \ -d[A] = k\,dt$$

Integrate the above equation between the limits of $[A_0]$ at zero time and [A] at some later time 't',

$$-\int_{[A_0]}^{[A]} d[A] = k\int_0^t dt$$

$$-([A])_{[A_0]}^{[A]} = k\,(t)_0^t$$

$$[A_0] - [A] = kt$$

$$k = \frac{[A_0] - [A]}{t}$$

Equation (2) is in the form of a straight line $y = mx + c$

Ie., $[A] = -kt + [A_0]$

$$\Rightarrow y = c + mx$$

ii) Define Buffer index.

It is defined as the number of gram equivalents of acid or base added to 1 litre of the buffer solution to change its pH by unity.

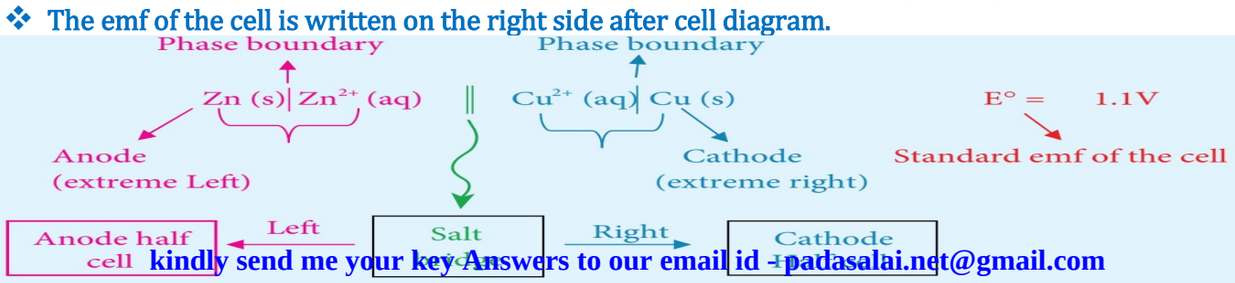
$$\beta = \frac{dB}{d(pH)}$$

dB = number of gram equivalents of acid / base added to one litre of buffer solution.

d(pH) = The change in the pH after the addition of acid / base.

37. A) i) Explain the Galvanic cell notation.

- The galvanic cell is represented by a cell diagram, for example, Daniel cell is represented as
- Zn (s) |Zn^{2+}(aq) || Cu^{2+}(aq) | Cu (s)
- In the above notation, a single vertical bar (|) represents a phase boundary and the double vertical bar (||) represents the salt bridge.
- The anode half cell is written on the left side of the salt bridge and the cathode half cell on the right side.
- The anode and cathode are written on the extreme left and extreme right, respectively.
- The emf of the cell is written on the right side after cell diagram.



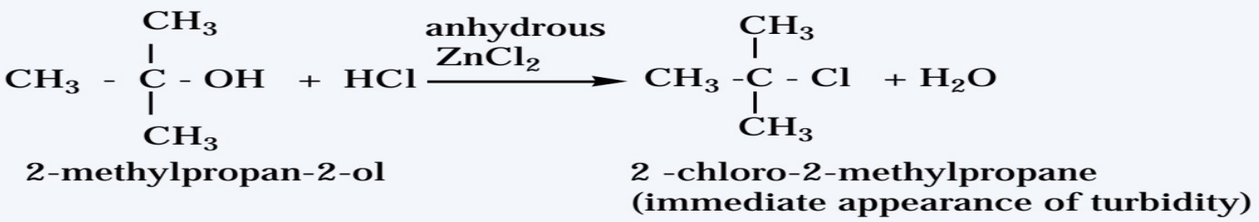
ii) Define Gold number.

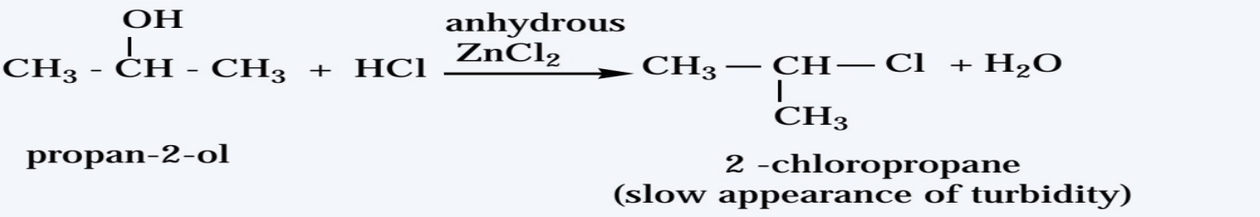
Gold number is defined as the number of milligrams of hydrophilic colloid that will just prevent the precipitation of 10ml of gold sol on the addition of 1ml of 10% NaCl solution. Smaller the gold number greater the protective power.

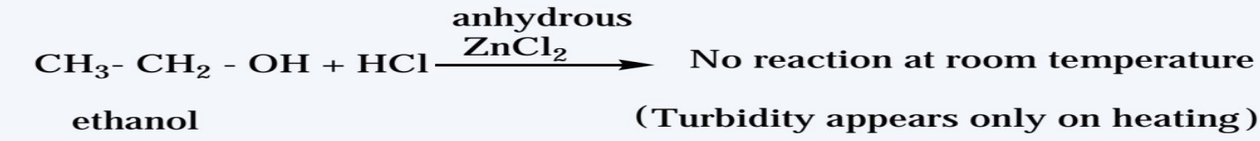
[OR]

B) i) Write notes on Lucas Test.

When alcohols are treated with Lucas agent (a mixture of concentrated HCl and anhydrous $ZnCl_2$) at room temperature, tertiary alcohols react immediately to form a turbidity due to the formation of alkyl chloride which is insoluble in the medium. Secondary alcohols react within 10 minutes to form a turbidity of alkyl chloride where primary alcohols do not react at room temperature.

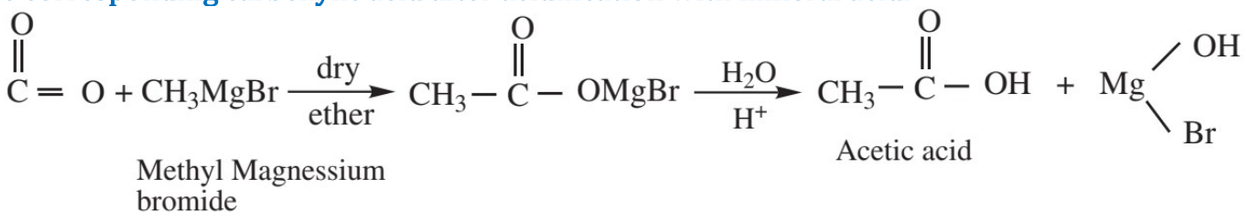






38. A) i) How acetic acid is prepared from Grignard reagent.

Grignard reagent reacts with carbon di oxide (dry ice) to form salts of carboxylic acid which in turn give corresponding carboxylic acid after acidification with mineral acid.



ii) What are biodegradable polymers? Give an Example.

The materials that are readily decomposed by microorganisms in the environment are called biodegradable polymers. Ex. PHB, PHBV

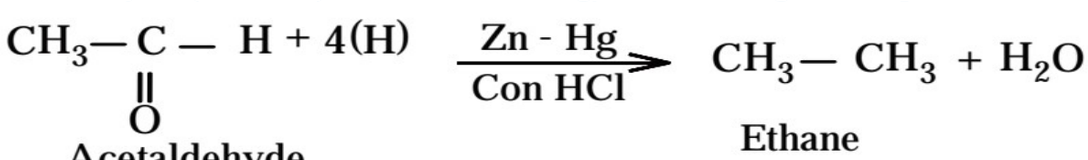
[OR]

B) An organic compound (A) of Molecular formula C_2H_5O reacts with Zn-Hg/ Con.HCl to give compound (B) which reacts with HNO_3 forming compound (C) (as major product) and compound (D). Compound (C) reacts with Con.HCl to give compound (E) (Table vinegar) and hydroxylamine. Identify A,B, C, D and E with suitable reactions.

Answer:

A compound is Acetaldehyde (CH_3CHO)

i) Acetaldehyde (CH_3CHO) reacts with Zn-Hg/ Con.HCl to give compound Ethane (B)



ii) Ethane reacts with reacts with HNO_3 forming compound Nitro ethane (C) (as major product) and compound nitromethane (D).

$$\underset{\text{Ethane}}{CH_3\text{-}CH_3} + HNO_3 \xrightarrow{675\ K} \underset{\text{Nitroethane(73\%)}}{CH_3CH_2\text{-}NO_2} + \underset{\text{Nitromethane (27\%)}}{CH_3NO_2}$$

iii) Compound (C) reacts with Con.HCl to give compound Acetic acid (E) (Table vinegar) and hydroxylamine.

$$\underset{\text{Nitroethane}}{CH_3CH_2 - NO_2} \xrightarrow[\text{Boil}]{HCl\ /\ H_2O} CH_3 - COOH + NH_2OH$$

COMPOUND	NAME	STRUCTURAL FORMULA
A	ACETALDEHYDE	CH_3CHO
B	ETHANE	$CH_3\text{-}CH_3$
C	NITRO ETHANE	$CH_3\text{-}CH_2\text{-}NO_2$
D	NITROMETHANE	$CH_3\text{-}NO_2$
E	ACETIC ACID	$CH_3\text{-}COOH$

PREPARED BY
D.VIGNESH .M.Sc.M.Ed.
P.G.ASSISTANT IN CHEMISTRY,
VIVEKANANDA VIDYALAYA MATRIC HR.SEC.SCHOOL, PANNAIKADU, DINDIGUL(DT).
MOBILE NO: 9042939811