विषय कोड Subject Code : 043

परीक्षा का दिन एवं तिथि
Day & Date of the Examination : SATURDAY, 07/03/2020

उत्तर देने का माध्यम
Medium of answering the paper : ENGLISH

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	56/5/1	① ② ③ ④

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Each letter be written in one box and one box be left blank between each part of the name. In case Candidate's Name exceeds 24 letters, write first 24 letters.

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SECTION-A

Ans 1: Halogens have outer shell configuration ns^2np^5 and it is just short of one electron to attain a noble gas configuration. The electron gain enthalpy is the energy released (hence negative) when one electron is added to an atom. As the halogens readily accept an electron to gain stability they release a large amount of energy and hence have maximum negative electron gain enthalpy in a period.

Ans 2: Fluorine shows anomalous behaviour due to a number of reasons:

1. very small size (smallest size in the group 17)
2. absence of d-orbital and hence can't expand its octet
3. maximum electronegativity in periodic table
4. low bond dissociation energy of F_2 molecule

Ans 3: Decreasing order of reducing characters of hydrogen halides $HI > HBr > HCl > HF$. This trend is followed due to

increasing bond dissociation energies of the molecules HX
low bond dissociation energy means they can easily loose an H-atom and get oxidised to X_2 and hence showing reducing character.

Ans4: Fluorine shows strong oxidising power (is stronger oxidising agent) than chlorine because of low bond dissociation enthalpy of F_2 molecule and high negative hydration enthalpy of F^-. Due to these F_2 tend to get reduced to F^- easily and hence show stronger oxidising power. Actually F_2 is the strongest oxidising agent

Ans5: X – Bigger size as bigger halogen
X' – Smaller size as lower halogen
Eg: ClF_3 where X = Cl and X' = F

Ans6: Zinc-Amalgum (Mercury) cell is used in watches, hearing aids because their Potential remains constant throughout their life

A: $Zn(Hg) + H_2O \longrightarrow ZnO + 2\bar{e} + 2OH^- - 2H^+$

C: $HgO + 2\bar{e} + 2OH - 2H^+ \longrightarrow Hg + H_2O$

Cell Reaction: $Zn(Hg)_{(s)} + HgO_{(s)} \longrightarrow ZnO_{(s)} + Hg_{(l)}$

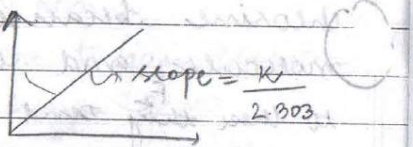
Ans7: MnO_4^- (+7) $+ 5\bar{e} \longrightarrow Mn^{2+}$ ⊕ charge required = 5F

5 moles $\bar{e}$ required to reduced 1 mole MnO_4^-

Ans8: $Kt = 2.303 \log \frac{[R_0]}{[R]}$: 1st order reaction

$\Rightarrow \log \frac{[R_0]}{[R]} = \left(\frac{K}{2.303}\right) \cdot t$

value of slope $= \frac{K}{2.303}$



Ans9: Sucralose

Ans10: Bakelite

Ans11: (c) CO

Ans12: (b) a substitution reaction

Ans13: (c) CH_3NH_2

Ans 14. (a) O

Ans 15. (c) Amphoteric

Ans 16. $K_a \propto C$ (A X R ✓) Ans: D Assertion wrong, Reason correct

Ans 17. slightly more (A X, R ✓) Ans: D Assertion wrong, Reason correct

Ans 18. $\Delta t < P$ Ans: A Both correct, R is correct explanation

Ans 19. A ✓ R X Ans: C A correct, R wrong

Ans 20. A X R ✓ Ans: D A wrong, R correct

SECTION-B

Ans 21. Raoult's law state that in a solution of volatile components, the partial pressure of each volatile component is directly proportional to their mole fraction in the solution.

Let 2 volatile components be A and B

then, $p_A \propto x_A$ and $p_B \propto x_B$

$\Rightarrow p_A = p^\circ_A x_A$ $\Rightarrow p_B = p^\circ_B x_B$

p°_A, p°_B: proportionality constants.

On the other hand, Henry law states, the partial pressure of a (volatile) gas in a liquid is directly proportional to its mole fraction.

$p \propto x \Rightarrow p = K_H x$

K_H = Henry's constant

By comparing the two equations, we see they are very similar and it seems as the Raoults law is special case of Henry's law in which $K_H = p^\circ$

Ans 22: (a) dil NaCN plays the role of converting Gold into a complex form so it can be easily freed from the impurities. NaCN don't react with the impurities, only react with gold.

$4Au + 8CN^- + O_2 + 2H_2O \rightarrow 4[Au(CN)_2]^- + 4OH^-$ (dicyanoaurate)

(b) CO is used for reduction of iron oxides (haematite

or magnetite) to iron metal as CO is a strong reducing agent at high temperature

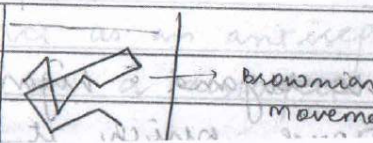
$$Fe_2O_3 + CO \longrightarrow Fe_3O_4 + CO_2$$
$$Fe_3O_4 + CO \longrightarrow FeO + CO_2$$
$$FeO + CO \longrightarrow Fe + CO_2$$

iron metal.

This process is carried out in a blast furnace at high temperatures.

Ans 23: Brownian movement is the continuous and random zig-zag movement of colloidal particles in the dispersion medium. They are caused due to unbalanced bombardment of colloidal particles with the particles of the dispersion medium.

When they collide, they exert a stirring effect on each other and hence prevents settling down of colloidal particles and hence accounts for its stability.



Ans 24: (a) $[Fe^{+3}(CN)_6]^{3-}$

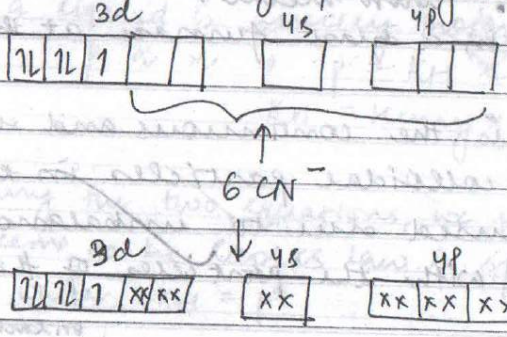
IUPAC: Hexacyanidoferrate (III) ion

hybridization:

$Fe_{26} = [Ar]^{18}\ 4s^2\ 3d^6$

$Fe^{3+} = [Ar]^{18}\ 4s^0\ 3d^5$

as CN^- is a strong field ligand and causes pairing up of $\bar{e}$



Hence its hybridisation is d^2sp^3

shape: Octahedral.

(b) Ambidentate ligand: ligands having two different atoms through which it can act as a ligand.

For eg: $CN^{\ominus}$: $\leftarrow C \equiv N$ or $\ddot{C} = \ddot{N}: \rightarrow$
cyanido-C cyanido-N

whereas, chelating ligand are polydentate ligands and act as ligands with 2 or more of its atoms and hence form a ring like structure called chelate

For eg: ethane-1,2-diamine CH_2-CH_2 : bidentate ligand
NH_2 NH_2

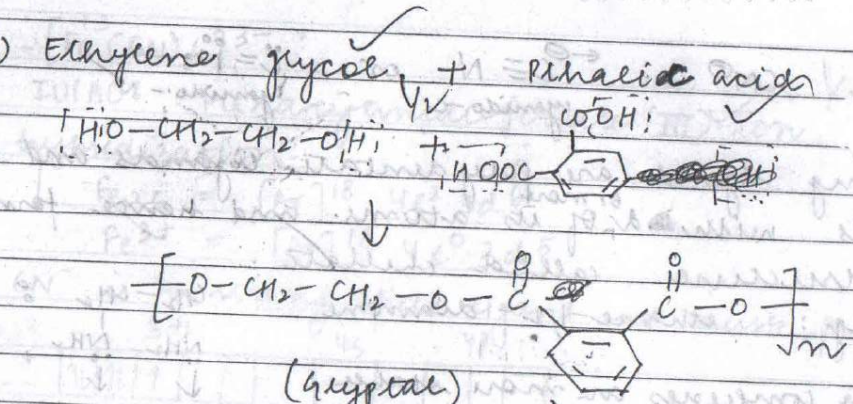
chelating compexes are more stable

Ans 25: Antiseptics are antimicrobials that are applied on living tissues like wounds to inhibit growth of pathogens. They can't be ingested in human body.

Disinfectants are antimicrobials that are applied on inanimate (non-living) objects like floors, tiles to prevent growth of microbes. They have higher concentrations than antiseptics.

0.2% phenol solution act as an antiseptic and its 1% solution acts as a disinfectant.

Ans26: i) Ethylene glycol + Phthalic acid

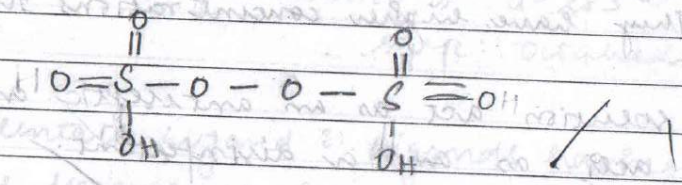


(Glyptal)

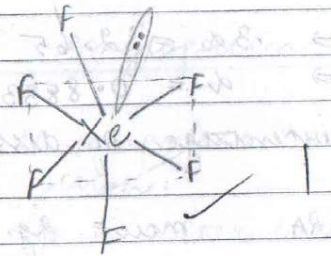
ii) Acrylonitrile : $H_2C = CH$ (CN) — Ethenenitrile

$$\left[H_2C - CH(CN)\right]_n$$: Polyacrylonitrile (PAN) or Orlon

Ans27: i) $H_2S_2O_8$:



(ii) XeF_6 : distorted octahedral structure (due to 1 LP of Xe)



SECTION - C

Ans 28: $\Delta T_f = 0.068$ $K_f = 1.86$ $m = 0.01$ $i = ?$

$\Delta T_f = i K_f m$ ½

$\Rightarrow 0.068 = i \times \frac{1.86 \times 0.01}{10}$ ½

$\Rightarrow i = \frac{680}{186} = 3.65$ ½

Now,

	$AlCl_3$	$\rightleftharpoons$	Al^{3+}	+	$3Cl^-$
$t=0$	1		0		0
$t=t$	$1-\alpha$		α		3α

$i = \frac{1-\alpha+\alpha+3\alpha}{1} = 1+3\alpha = 3.65$ ½

Rough

680 | 340
186 | 93 | 3.6
93 | 340 | 279
610
558
52
46
5
24
24
10
9
10
3.65
186 | 680 | 558
1220
1116
1040
930
1100

$\Rightarrow 3\alpha = 2.65$

$\Rightarrow \alpha = 0.8833$

percentage of dissociation = 88.33%

Ans 29: $i = 2A$ $\quad m_{Cu} = 2g$ $\quad Cu^{2+} \rightarrow Cu + 2e$ $\quad n_{fac} = 2$

According to faraday's 1st law: $m = zit$ where $z = \frac{\text{eq wt}}{96500} = \frac{\text{mol. wt}}{n_{fac} \times 96500}$

$\Rightarrow m_{Cu} = zit$

$\Rightarrow 2 = \frac{63.5}{2 \times 96500} \times 2 \times t$

$\Rightarrow t = \frac{2 \times 96500}{\frac{63.5}{127}} = 3.0393 \times 10^3$ sec.

$= 3040$ sec $= 3.04 \times 10^3$ sec

$= 0.84$ hrs.

NOW; $Zn^{2+} \rightarrow Zn + 2e$ $\quad n = 2$

$m_{Zn} = \frac{65}{2 \times 96500} \times 2 \times \frac{2 \times 96500 \times 10}{\frac{63.5}{127}}$

$= 2.0472$ gm.

Ans 30: (ii) (a)

Amylose	Amylopectin
1) It compromises 15–30% of starch	1) It comprises 80–85% of starch
2) It is water soluble	2) It is water insoluble
3) It consists of linear chain polymers of α-D glucose with C_1–C_4 linkage	3) It consists of branched chain polymers of αD glucose with C_1–C_4 linkage and C_1–C_6 linkage between the 2 linear chains

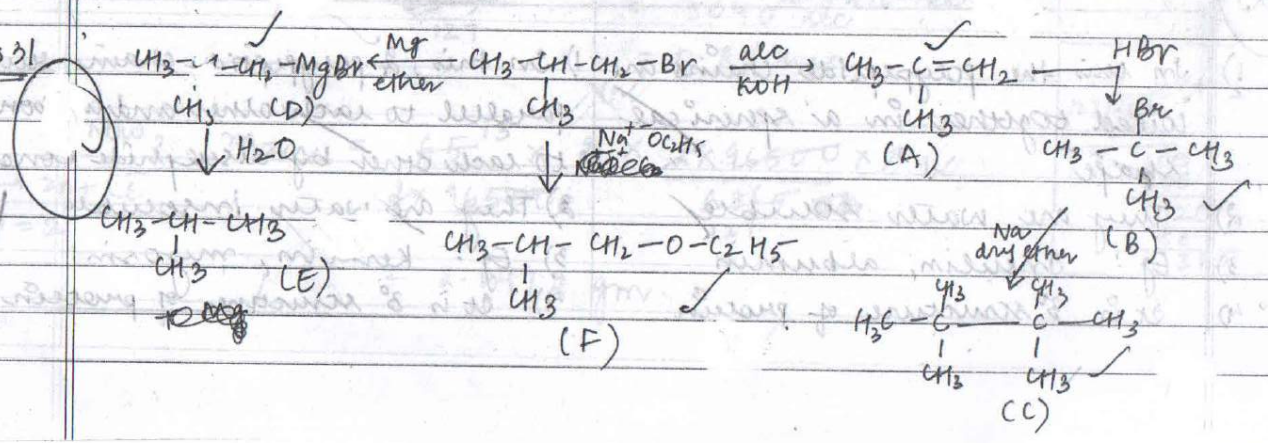
(b)(ii)

Globular Protein	Fibrous protein
1) In this the polypeptide chains are coiled together in a spherical shape	1) In this, 2 polypeptide chains run parallel to each other and are bonded to each other by disulphide bonds
2) They are water soluble	2) They are water insoluble
3) Eg: Insulin, albumin	3) Eg: Keratin, myosin
4) It is 3° structure of protein	4) It is 3° structure of protein

(iii) (e)

Nucleotide	Nucleoside
(phosphorous — base sugar)	(sugar / Base)
1) When the phosphorous compounds are attached to 5' position of the sugar moety which already has a base attached to its 1' positide	1) When the nitrogin base pairs are attached with the 1' position of sugar (Ribos sugar or β-D-2deoxy ribose sugar)
2) It polymeriss to form poly-nucleotides through phospho-diester linkages	2) It first attaches itself to phosphorous compounds at 5' and then form polynucleorides.

Ans 31



A: $CH_3-\underset{CH_3}{\overset{}{C}}=CH_2$

B: $CH_3-\underset{CH_3}{\overset{Br}{C}}-CH_2$ Major product

C: $CH_3-\underset{CH_3}{\overset{CH_3}{C}}-\underset{CH_3}{\overset{CH_3}{C}}-CH_3$

D: $CH_3-\underset{CH_3}{CH}-CH_2-MgBr$

E: $CH_2-\underset{CH_3}{CH}-CH_3$

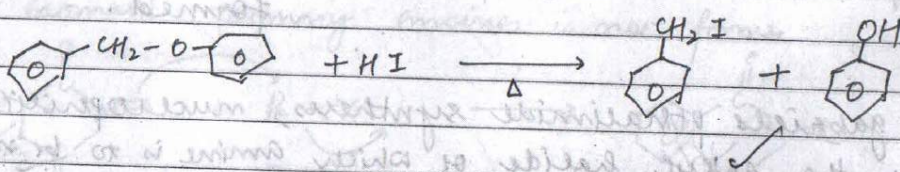
F: $CH_3-\underset{CH_3}{CH}-CH_2-O-C_2H_5$

Ans 32:

(i) $3\,CH_3-CH=CH_2 \xrightarrow[H_2O_2/OH^-]{(BH_3)_2} 3\,CH_3-CH-CH_2-OH$

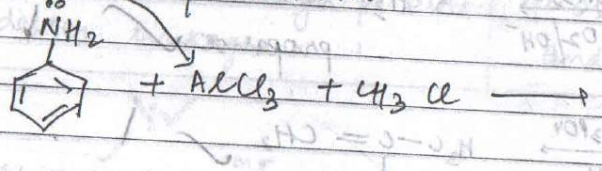
propanol

(ii) $CH_3-\underset{CH_3}{\overset{CH_3}{C}}-OH \xrightarrow[358K]{20\%\ H_3PO_4} H_3C-\underset{CH_3}{C}=CH_2$

(iii) 

Ans 33: (i) Aniline consists of amine attached to benzene ring. ~~Amin~~ Nitrogen in amine consists lone pair which ~~it delocalises in the ring by resonance.~~ due to this resonance, through which it can act as a strong lewis base.

In friedal craft, $AlCl_3$ is used as a catalyst which is a strong lewis acid. The lone pair of nitrogen easily attacks vacant orbital of $AlCl_3$ and forms salt and doesn't undergo friedal crafts reaction.



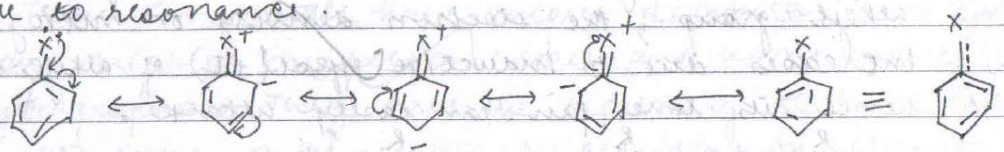
NO friedal craft product formed.

(ii) In gabriels pthalimide synthesis, nucleophilic addition on the alkyl halide of which amine is to be made is carried out.

In case of aromatic halides, nucleophilic substitution

is very difficult as:

#1 There is a partial double bond character between C and X due to resonance.

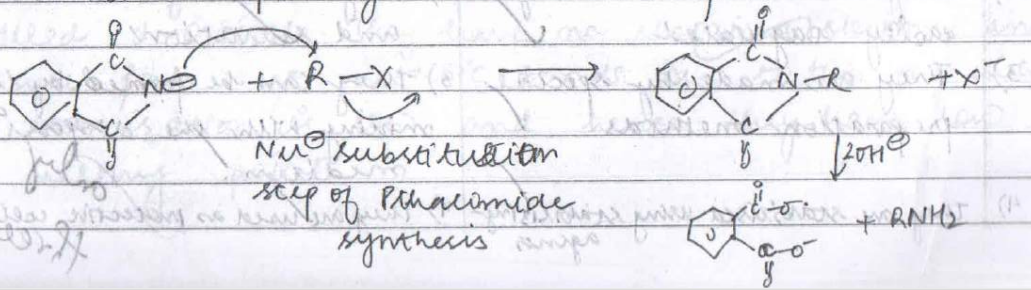


also electronegativity of sp^2 carbon is higher and hence bond length is shorter.

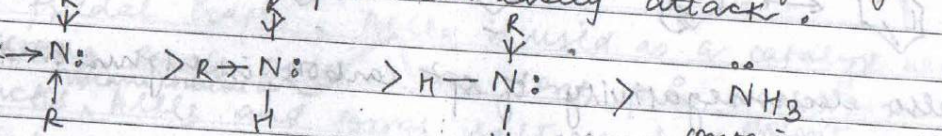
Due to these breaking of C–X bond is difficult

#2 The ring itself is electron rich and thus the incoming nucleophile faces repulsion.

Due to all the the nucleophilic attack is not possible and hence aromatic primary amines is not formed.



iii) Amines are basic (lewis) in nature due to presence of lone pair on nitrogen. Due to introduction of an alkyl group, the electron density on nitrogen increases due to inductive (effect (+I) of alkyl and hence its lone pair can easily attack.



contains no alkyl group
∴ least basic.

Ans 34)

	Hydrophobic	Hydrophilic
1)	They are liquid hating colloids i.e. don't interact with solvent much	1) They are liquid loving colloids as they interact with solvent
2)	They are unstable and get easily coagulated	2) They are stable due to charge and solvation
3)	They are made by special preparation methods	3) They can be formed by just mixing with the dispersion medium.
4)	They are stabilised using stabilizing agents	4) They are used as protective colloids.

SECTION-D

Ans 35: (a) (i) Transition metals have empty d-orbitals and can show variable oxidation state and hence shows catalytic properties. They have the capability to lower the activation energy of the reaction by providing an alternate path to the reaction. They also provide large surface area for adsorption during heterogeneous catalysis.

Eg: $2SO_2 + O_2 \xrightarrow{V_2O_5} 2SO_3$ V_2O_5 : catalyst

(ii) Separation of a mixture of Lanthanoids is difficult because they have similar atomic radii due to lanthanoid contraction and similar chemical properties.

(iii) Zn, Cd, Hg are non-transition metals i.e they have fully filled d-orbitals. They have no unpaired electrons and hence form weak metallic bonds. Due to this the enthalpy of atomisation is low and hence they have low melting point

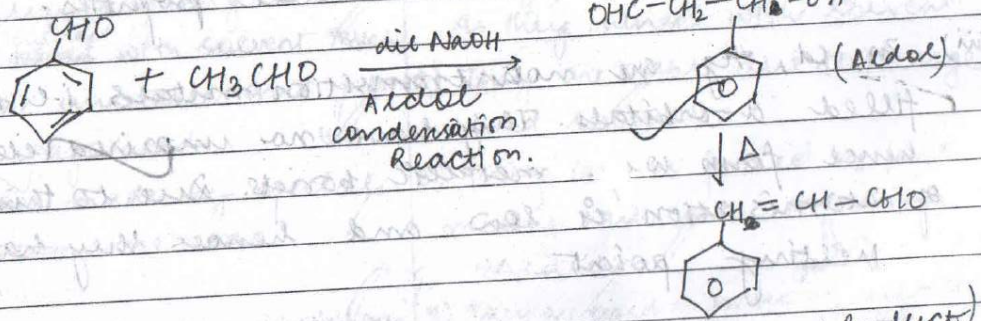
(b) (i) (Sodium chromate) Na_2CrO_4 is converted to sodium dichromate $Na_2Cr_2O_7$ by reacting it with an acidic medium like in dil H_2SO_4

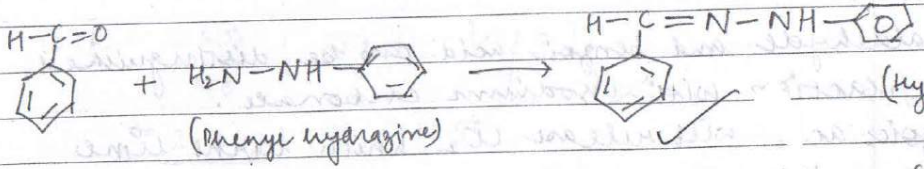
$$2Na_2CrO_4 + 2H^+ \longrightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$$

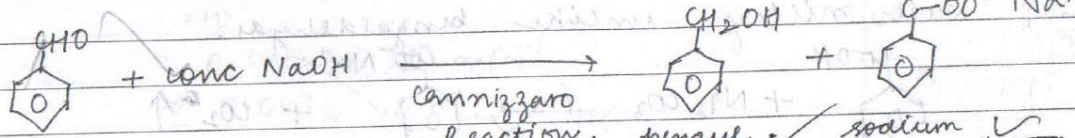
(ii) Potassium (K_2MnO_4) manganate is prepared by pyrolusite ore (MnO_2) by fusing it with KOH followed by oxidation by atmospheric oxygen or HNO_3.

$$2MnO_2 + 4KOH + O_2 \longrightarrow 2K_2MnO_4 + 2H_2O$$

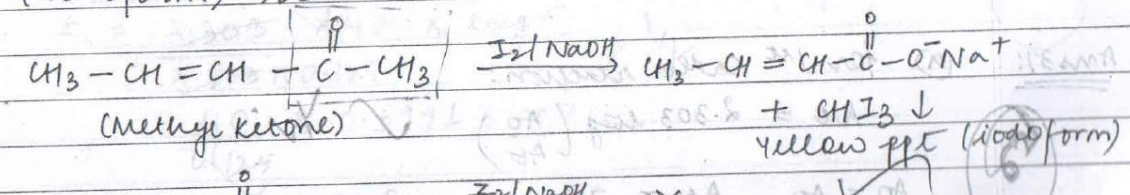
Ans 26: (A) (i)



(ii) 

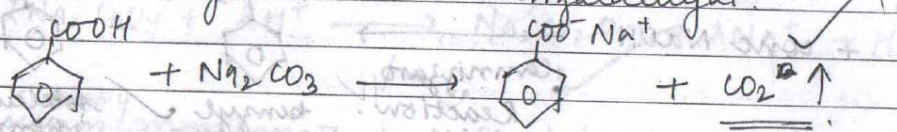
(iii) 

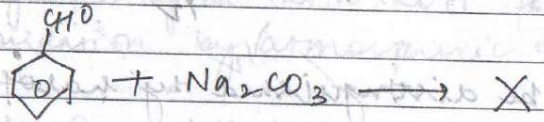
(b) (i) The compounds can be distinguished by haloform (iodoform) reaction.



pent-3-en-2-one will give yellow precipitate of iodoform on reaction with sodium iodonacite as it contains methyl ketone group.

(iii) Benzaldehyde and benzoic acid can be distinguished by reaction with sodium carbonate.
Benzoic acid will release CO_2 which turns lime water milky unlike benzaldehyde.





Ans 37: (a) for 1st order reaction:

$$Kt = 2.303 \log\left(\frac{A_0}{A_t}\right)$$

$A_0 = A_0 \quad A_t = \frac{75}{100} A_0 = \frac{3}{4} A_0$

$$\Rightarrow K \times 40 = 2.303 \log\left(\frac{A_0}{3A_0} \times 4\right)$$

$\Rightarrow k = \frac{2.303}{40}(\log 4 - \log 3)$

$= \frac{2.303}{40} \times 0.1250$

$= 0.007196875 \text{ min}^{-1}$

$\approx 0.0072 \text{ min}^{-1}$ ✓

Now, 80% complete $\quad A_t = \frac{20}{100} A_0$

$kt = 2.303 \log\left(\frac{A_0}{20A_0} \times \frac{5}{100}\right)$ ✓

$t = \frac{2.303}{2.303 \times 0.125} \times 40 \times \log 5$

$= \frac{40}{0.125} \times 0.6991 \times \frac{8}{1000}$

$= 223.712 \text{ minutes.}$ ✓

0.6021
0.4771
0.1250

$2.303 \times 125 = 287875$

$4 \overline{)0.287875}$

28
07
4
38
36
27
24
35
32

$125 \times 8 = 1000$

6991
32
13982
209730
223.712

(b) Order of the reaction is the sum of powers of the concentrations in molarity (or atm) of one reactant in the rate law expression.

They may not be equal to sum of ~~balanced~~ stoichiometric coefficient in balanced chemical reaction.

$R = K[A]^x[B]^y$ ∴ Rate law expression

Order $= x + y$

A bimolecular reaction can be made to follow first order kinetics if one of the reactant is taken in large excess, by which there will be no effect in the rate of reaction by changing the concentration of this excess reactant.

For eg: Hydrolysis of ester.

$$CH_3COOCH_3 + H_2O \xrightleftharpoons{H^+} CH_3COOH + CH_3-OH$$

water is taken in huge amount and hence have no effect on rate of reaction.

$R = K[CH_3COOCH_3][H_2O]$

$R = K'[CH_3COOCH_3]$ $[H_2O]$ is constant

where $K' = K[H_2O]$

and hence it is converted to 1st order reaction.

These types of reactions are called Pseudo first order reaction.