केन्द्रीय माध्यमिक शिक्षा बोर्ड, दिल्ली
सीनियर स्कूल सर्टिफिकेट परीक्षा (कक्षा बारहवीं)
परीक्षार्थी प्रवेश–पत्र के अनुसार भरें

विषय Subject : CHEMISTRY (043)

परीक्षा का दिन एवं तिथि
Day & Date of the Examination : TUESDAY, 13/03/2012

उत्तर देने का माध्यम
Medium of answering the paper : ENGLISH

प्रश्न पत्र के ऊपर लिखे कोड को दर्शाए
Write Code No. as written on the top of Question Paper : 56/2

अतिरिक्त उत्तर-पुस्तिका (ओं) की संख्या
No. of Supplementary answer-book(s) used : Nil

किसी शारीरिक अक्षमता के प्रभावित हो तो संबंधित वर्ग में ✓ का निशान लगाएं।
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B	D	H	S	C

B = दृष्टिहीन, D = मूक एवं बधिर, H = शारीरिक रुप से विकलांग, S = स्पस्टिक, C = डिस्लेक्सिक
B = Blind, D = Deaf & Dumb, H = Physically Handicapped, S = Spastic, C = Dyslexic

क्या लेखन - लिपिक उपलब्ध करवाया गया : हाँ / नहीं
Whether writer provided : Yes / No — No.

*एक खाने में एक अक्षर लिखें। नाम के प्रत्येक भाग के बीच एक खाना रिक्त छोड दें। यदि परीक्षार्थी का नाम 24 अक्षरों से अधिक है, तो केवल नाम के प्रथम 24 अक्षर ही लिखें।
*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.

कार्यालय उपयोग के लिए
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(1) Interstiatial defect.

Shape selective catalysis' is the catalytic process that depends upon the pore size of catalyst, and size of reactant and product molecules. Eg:- ZSM 5.

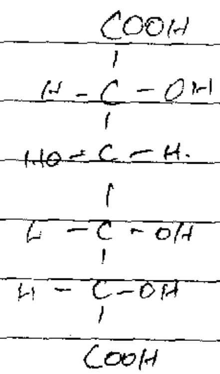
Collectors enhances the non wettability of ore particles and helps them to come with froth.

BiH_3 is stronger reducing agent than SbH_3 because of low bond dissociation enthalpy of Bi-H bond than Sb-H bond.

5 Bromine gets added across C=C bond forming vicinal dibromide ie,

$$CH_2=CH-CH_2-C\equiv CH + Br_2 \rightarrow CH_2Br-CH(Br)-CH_2-C\equiv CH.$$

7 Disinfectants have high concentration of chemical substance and is applied on non-living things whereas antiseptics have low concentration of chemicals and they are applied on human tissues and animal bodies

8. 

Gluconic acid.

9. If G^*, R and K represents cell constant, resistance and conductivity of a solution, then their relation is

$$G^* = RK$$

Molar conductivity is the conductivity offered by a solution of unit concentration, i.e., in other words, volume of solution having one mole of electrolyte ~~bet~~ kept between two platinum electrodes which are at unit distance apart and have enough area of cross section of accomodate the solution.

If Λ_m, K and C represents molar conductivity, conductivity and concentration of solution, then

$$\Lambda_m = \frac{K}{C}$$

10 (i) Nickel is purified by Mond's process which uses the principle of vapour phase refining. That is, impure nickel is made to react with a stream of CO and forming a volatile complex, nickel tetracarbonyl, which is then decomposed at high temperature to give back pure nickel.

$$\underset{impure}{Ni} + 4CO \xrightarrow{353K} [Ni(CO)_4]$$

$$[Ni(CO)_4] \xrightarrow{473K} \underset{pure}{Ni} + CO.$$

(ii) Germanium is purified by zone refining which uses the principle that impurities are more soluble in the melt that in the solid state of metal. A circular heater is fixed on the Ge rod (impure) which is made to move in a particular direction many times. Impurities gets concentrated at one end and this end is then cut off to get back pure germanium.

11. (i) NF_3 is an exothermic compound because the bond formed between N and F is very strong and hence releasing energy, whereas, bond formed between N and Cl in NCl_3 is weak and requires energy for bond formation.

(ii) SF_4 contains 1 lone pair and 4 bond pairs, thus it have see-saw shape. Axial S-F bonds suffer more repulsion from 1 lone pair and 2 bond pairs, than equatorial bonds, so they are longer and weaker. So all bonds in SF_4 are not equivalent.

12. For a second order reaction

$$Rate = k[R]^2$$

(i) When concentration of reactant is doubled, new rate becomes

$$Rate' = k[R']^2 = k[2R]^2 = 4k[R]^2 = 4 rate,$$

4 times the old rate.

(ii) When concentration is halfed; new rate becomes

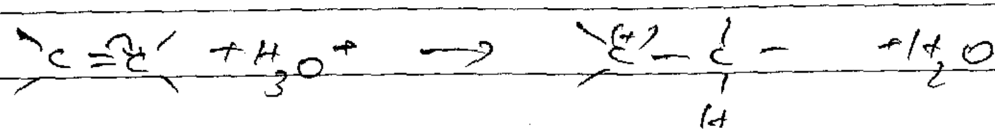
$$Rate' = k[\frac{R}{2}]^2 = \frac{1}{4} k[R]^2 = \frac{1}{4} rate$$

one-fourth the old rate.

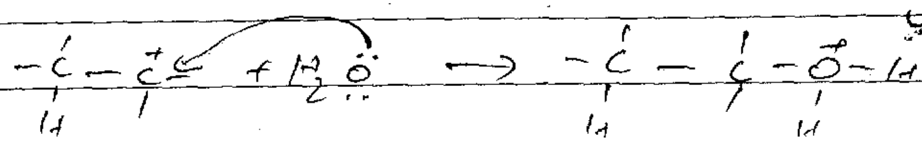
13. Acid catalysed hydration of alkene takes place in three steps:

1) Formation of carbocation by electrophilic attack of H_3O^+

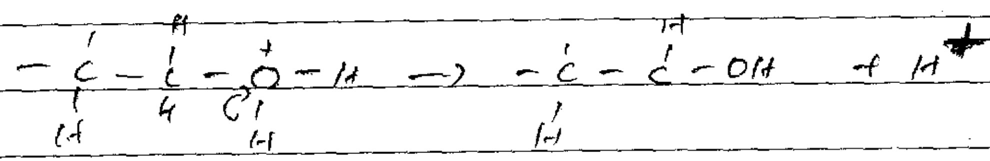
$$H_2O + H^+ \rightarrow H_3O^+$$



2) Nucleophilic attack of H_2O on carbocation



3) Deprotonation to give ~~[illegible]~~ alcohol



Net reaction is the addition of H_2O molecule across C=C bond following Markovnikov's rule.

14. (i) $Cr_2O_7^{2-} + 6I^- + 14H^+ \rightarrow 2Cr^{3+} + 3I_2 + 7H_2O$

(ii) $2MnO_4^- + 5NO_2^- + 6H^+ \rightarrow 2Mn^{2+} + 5NO_3^- + 3H_2O$

15. (i) When aliphatic or aromatic primary amine is treated with chloroform in the presence of potassium chloride, a foul smelling gas i.e, isocyanide, is evolved. This reaction is used for identification of primary amines, and this reaction is known as carbylamine reaction.

$$R-NH_2 + CHCl_3 + 3KOH \xrightarrow{warming} R-NC + 3KCl + 3H_2O$$

isocyanide
foul smelling

(ii) When an amide is treated with bromine in the presence of sodium hydroxide, alkyl group shifts from carbonyl carbon, to nitrogen atom to form an amine, which contain one carbon atom less than starting amide. This reaction is known as Hoffmann Bromamide reaction.

$$R-\overset{O}{\overset{\|}{C}}-NH_2 + Br_2 + 4NaOH \longrightarrow R-NH_2 + 2NaBr + Na_2CO_3 + 2H_2O$$

Amide — Amine (1 C atom loss)

16. (i) Alcohols are more soluble than hydrocarbons of comparable molecular masses due to its ability to form hydrogen bond with water.

(ii) Ortho-nitrophenol is more acidic than ortho-methoxyphenol, due to electron withdrawing nature of $-NO_2$ group, which stabilises the phenoxide ion formed after release of H^+, by effective delocalisation of negative charge. Methoxy group is electron donating group, which destabilises the phenolic ion formed by increasing e^- density over oxygen.

17. Soap is actually sodium or potassium salt of long chain carboxylic acid of general formula ($RCOO^-Na^+$ or $RCOO^-K^+$). When it is dissolved in water it forms $RCOO^-$ ions, which have two parts. Hydrophilic polar head part i.e COO^- and hydrophobic long hydrocarbon chain part i.e R. So they exist as COO^- towards water and R away from water.

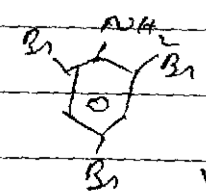
At critical micelle concentration (CMC) they are pulled into the bulk, and they form micelles around oil or grease droplets, which hydrocarbon part towards oil and COO^- part towards outward surface of sphere. Since polar group can interact with water, these micelles along with oil droplet are pulled away from fabric thus cleaning the cloth. The priciple of soap is emulsification. Example for soap is sodium stearate $C_{17}H_{35}COO^- Na^+$.

Soaps do not work in hard water because hard water contains Mg^{2+} and Ca^{2+} ions which forms insoluble Mg soap and Ca soap respectively and forms scum.

$$2C_{17}H_{35}COONa + M \rightarrow (C_{17}H_{35}COO)_2M + 2Na^+ \quad [M = Ca, Mg]$$

Insoluble.

18 (i) $C_6H_5N_2Cl + H_3PO_2 + H_2O \rightarrow C_6H_6 + H_3PO_3 + N_2 + HCl$

(ii) $C_6H_5NH_2 + 3Br_2(aq) \longrightarrow$  $+ 3HBr$

19. We know the eq.

$$d = \frac{zM}{N_A a^3} \Rightarrow N_A = \frac{zM}{d a^3}$$

Given $z = 2$ [∵ bcc unit cell contain 2 atom]

$M = 56.0u = 56 \, g \, mol^{-1}$

$d = 7.87 \, g \, cm^{-3}$

$a = 286.65 \, pm = 286.65 \times 10^{-10} \, cm$

$$N_A = \frac{2 \times 56 \, g \, mol^{-1}}{7.87 \, g \, cm^{-3} \times (286.65 \times 10^{-10})^3 \, cm^3}$$

$$= \frac{2 \times 56 \, mol^{-1}}{7.87 \times (286.65)^3 \times 10^{-30}} = \frac{2 \times 56 \times 10^{23} \, mol^{-1}}{7.87 \times 2.355}$$

$$= 6.042 \times 10^{23} \, mol^{-1}$$

20. At anode $Al \rightarrow Al^{3+} + 3e^-$ ×2 → 1

At cathode $Ni^{2+} + 2e^- \rightarrow Ni$ ×3 → 2

Here Al^{3+}/Al is taken as anode as it have lower reduction potential than Ni^{2+}/Ni.

Overall reaction when current generates is
By adding 1 and 2, we get

$$2Al + 3Ni^{2+} \rightarrow 2Al^{3+} + 3Ni$$

$$E_{cell} = E^{o}_{cell} - \frac{RT}{nF} \ln \frac{[Al^{3+}]^2}{[Ni^{2+}]^3}$$ [by Nernst equation]

$$E^{o}_{cell} = E^{o}_{cathode} - E^{o}_{anode}$$
$$= -0.25V - -1.66$$
$$= 1.41V.$$

$[Al^{3+}] = 0.001M$ $[Ni^{2+}] = 0.50$ M.
$n = 3\times2$

$$\therefore E_{cell} = 1.41 - \frac{0.059}{3\times2} \log \frac{[0.001]^2}{[0.50]^3}$$ V

$= 1.41 - \frac{0.059}{3\times2} \log 8\times10^{-6}$ V

$= 1.41 - \frac{0.059}{3\times2} \times -0.54$ V

$= 1.41 + 0.0162$ V $= \underline{1.426 \text{ V}}$

21\. (i) Aerosol is a colloidal system formed by solid in gas or liquid in gas, i.e., solid/liquid as dispersed phase and gas as dispersion medium. eg:- fog, mist, cloud, ~~Sp~~ dust etc.

(ii) Emulsion is a liquid in liquid colloid i.e., ~~pa~~ particle of a liquid dispersed as ~~bag~~ colloidal particles in a ~~disc~~ liquid dispersion medium. eg:- milk

(iii) Micelle is also known as associated colloids, which are formed by aggregation of 100-100 molecules above a particular concentration and temperature known as critical micelle concentration (cmc) and Kraft temperature ~~(T)~~ respectively.

Below these concentration and temperature they behave as normal strong electrolytes.

22. Equilibrium constant K for given reaction can be written as.

$$K = \frac{[NO]^2}{[N_2][O_2]}$$

At 1800K, $K = 1.0 \times 10^{-5}$.
Given case $[N_2] = 0.80$ $[O_2] = 0.20$.

$$1.0 \times 10^{-5} = \frac{[NO]^2}{[0.80][0.20]}$$

$$[NO]^2 = 10^{-5} \times 8 \times 2 \times 10^{-2} \ mol^2 L^{-2}$$
$$= 16 \times 10^{-7} \ mol^2 L^{-2}$$

$$\therefore [NO] = \sqrt{16 \times 10^{-7} \ mol^2 L^{-2}}$$
$$= 1.26 \times 10^{-3} \ mol L^{-1}$$

So equilibrium concentration of $NO = 1.26 \times 10^{-3}\ mol\,l^{-1}$

Now $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

	$N_2(g)$	$O_2(g)$	$2NO(g)$
Initial	0.8	0.20	0
Equilibrium	$0.8-\alpha$	$0.2-\alpha$	2α.

We have $2\alpha = 1.26 \times 10^{-3}\ mol\,l^{-1}$

$\therefore \alpha = 0.63 \times 10^{-3}\ mol\,l^{-1}$

$\therefore$ Equilibrium concentration of $N_2 = 0.8 - \alpha$

$= 0.8 - 0.63 \times 10^{-3}$

$= 0.8 - 0.00063$

$= 0.79937\ mol\,l^{-1}$

Equilibrium concentration of $O_2 = 0.2 - \alpha$

$= 0.2 - 0.63 \times 10^{-3}$

$= 0.19937\ mol\,l^{-1}$

23 (i) Many transition metals forms interstitial compounds due to the presence of voids which can accomodate small atoms like Hydrogen.

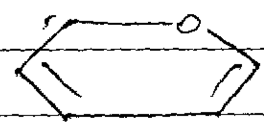
(ii) General increase in density from titanium to copper is due to:
- decrease in atomic size due increasing effective nuclear charge.
- increase in atomic mass as we move from titanium to copper.

(iii) Members of actinoid series exhibit greater range of oxidation states, due to comparable energies of 5f, 6d, 7s orbitals whereas, in case of lanthanoid energies of 4f, 5d, 6s orbitals have large difference, hence show limited range of oxidation states

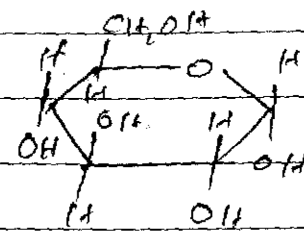
24. The difference between α glucose and β-glucose is in the configuration of C-1 carbon atom i.e, configuration of anomeric carbon.
In α-glucose -OH group is on right hand side of anomeric carbon whereas in β-glucose -OH is on left hand side.

The cyclic 6-membered hemiacetal structure of glucose ~~is similar to~~ can be drawn in a ring type structure which has similarity to

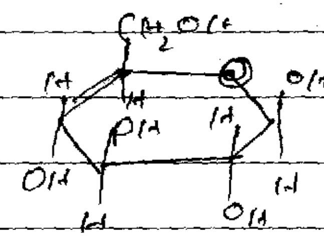
the organic compound pyran which is a heterocyclic compound containing 5 carbon atoms and 1 O atom in the ring.
Pyranose structure of glucose is given below along with structure of pyran



pyran



α - glucopyranose



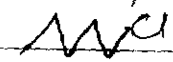
B - glucopyranose.

25. (i) Chirality of a compound is the ability to form optical isomers. Essential condition for chirality is that compound should contain atleast one unsymmetric or chiral C atom. eg:-

$$CH_3-\overset{OH}{\underset{H}{|}}\!C^*-COOH$$ 2-Hydroxypropanoic acid.

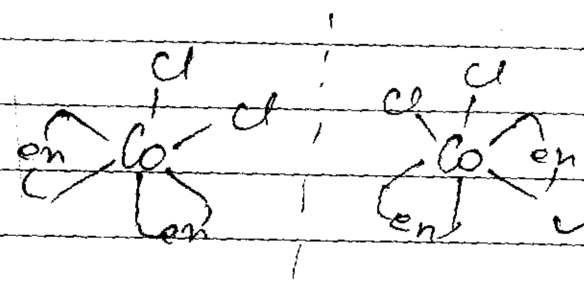
* indicates C atom is asymmetric.

(ii). As hydrolysis of ROH involves, formation of carbocation, greater the stability of carbocation formed, more easily it can be hydrolysed. Since stability of $CH_3-\overset{+}{C}H-CH_2-CH_3$ (2°) is greater than $CH_3CH_2\overset{+}{C}H_2$ (1°), $CH_3-CHCl-CH_2-CH_3$ will be more easily hydrolysed.

(iii) Compound  will undergo S_N2 reaction faster than  because I^- is a better leaving group than Cl^-.

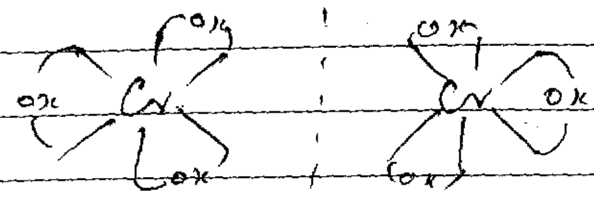
26. (i) bis-(ethane-1,2-diamine)dichloridocobalt (III).

Structures of stereoisomer is given below



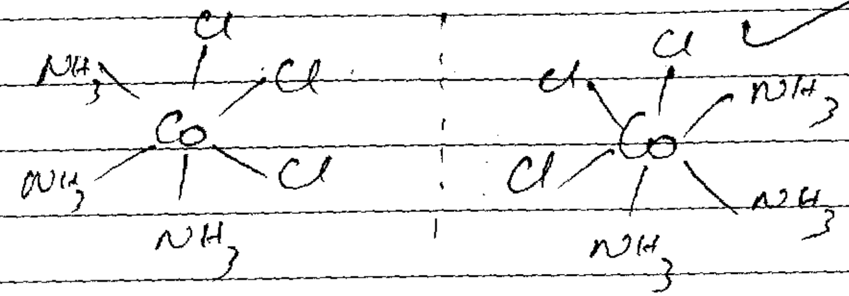
(ii) trioxalatochromate (III)

Structure of stereoisomers is given below



where $ox = C_2O_4^{2-}$ (oxalato group).

(iii) Triamminetrichlorido Cobalt (III).



22. (i) Elastomers are polymers that have weak Van Der Waal's forces of intermolecular attractions and hence can be stretched. They are provided with a few cross-links so that they can retain shape ~~and~~ after mechanical force is removed. eg:- natural rubber, Vulcanised rubber, synthetic rubbers like Buna-S, Buna-N etc.

(ii) Condensation polymers are formed by polymerisation of monomers having two or active functional groups and during polymerisation,

there is elimination of small molecules like H_2O, HCl etc.
They are also called step-growth polymers. eg: Nylon 6,6, Nylon 2,6, dacron or terylene etc.

(iii) Addition polymers are formed by the repeated addition of monomers. Here there is no elimination of molecules while polymerization. eg: polythene, PVC, polystyrene etc. They undergo polymerisation in presence of free radical generator (generally).

28 (a) (i) Mole fraction: Mole fraction of a component in a solution is defined as the ratio of number of moles of the component to the total number of moles of all the components. In a binary solution if A and B are the components, then

$$x_A \text{ (Molefraction of A)} = \frac{n_A}{n_A + n_B}$$

Sum of Mole fraction of all the components in a solution is unity ie

$$\Sigma x_i = 1$$

(ii) Ideal solutions: Solutions that obey Raoult's law for entire range of concentration is known as ideal solution. Their two important properties are, $\Delta_{mix}H = 0$, $\Delta_{mix}V = 0$. Ideal solutions are rare, however there are solutions having nearly ideal behaviour eg: solution of benzene and toluene, solution of n-heptane and n-hexane, solution of chloroethane and bromoethane etc.

(3). We know
$\Delta T_f = K_f \times m$.

Here $\Delta T_f = 0.34°C$, $K_f = 1.86\ K\,kg\,mol^{-1}$

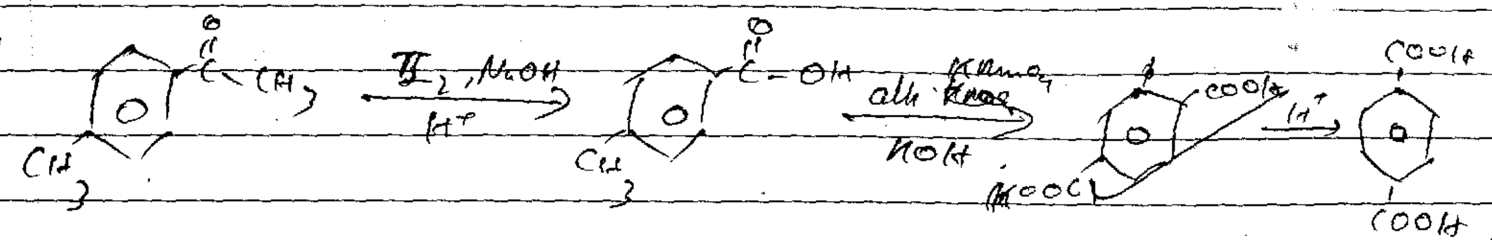
$m = \frac{w_2}{M_2} \times \frac{1000}{w_1}$, where $w_2 = 15g$, $w_1 = 450g$.

$\therefore 0.34 = 1.86 \times \frac{15}{M_2} \times \frac{1000}{450}$

$M_2 = \frac{1.86 \times 100}{3 \times 0.34} = 182.35\ g\,mol^{-1}$

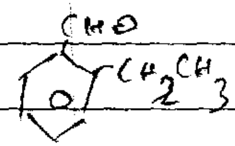
24. (a)(i) $CH_3CH_2CH_2CH_2OH \xrightarrow{\text{alkaline KMnO}_4} CH_3CH_2CH_2COOH$

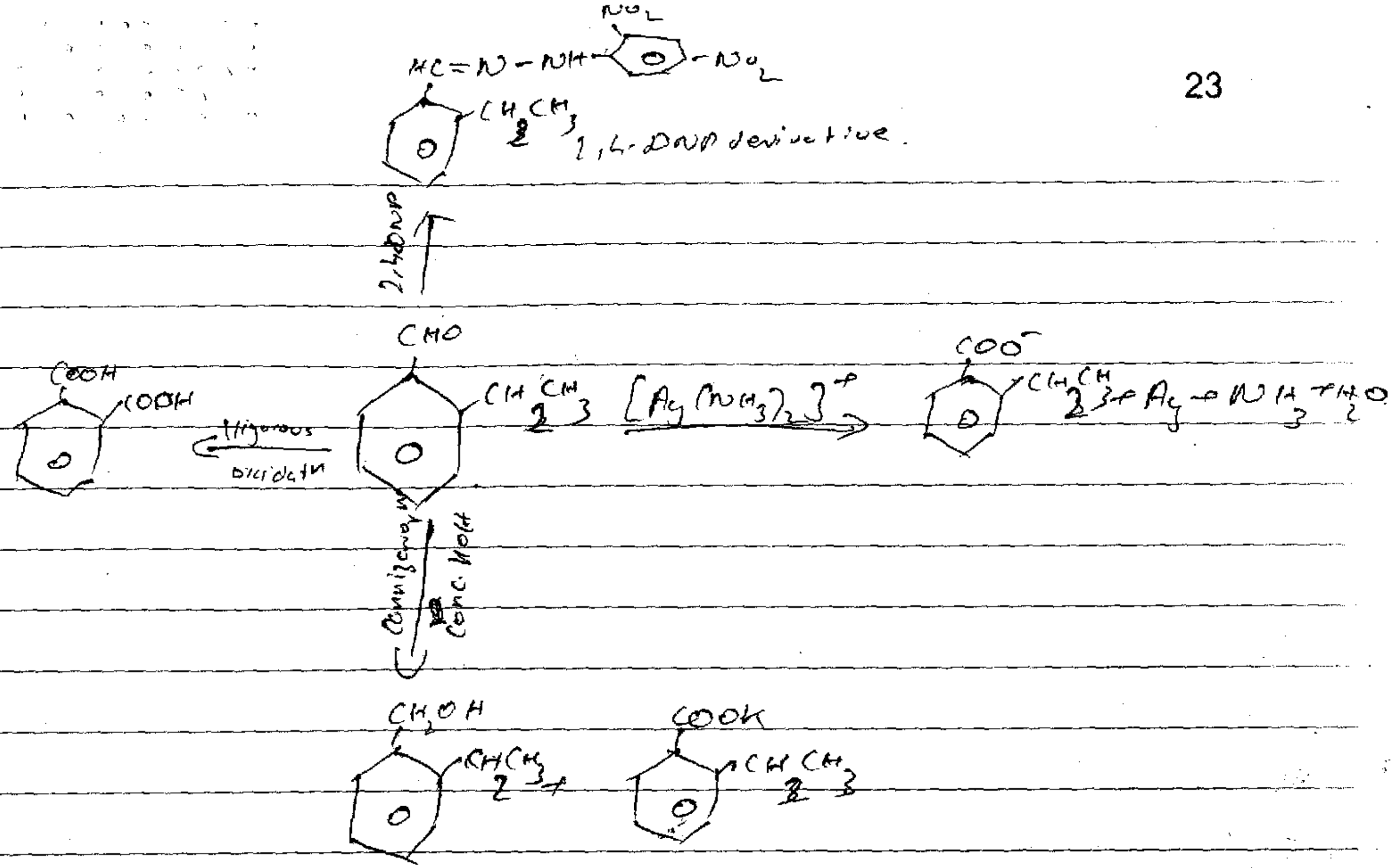
(ii)



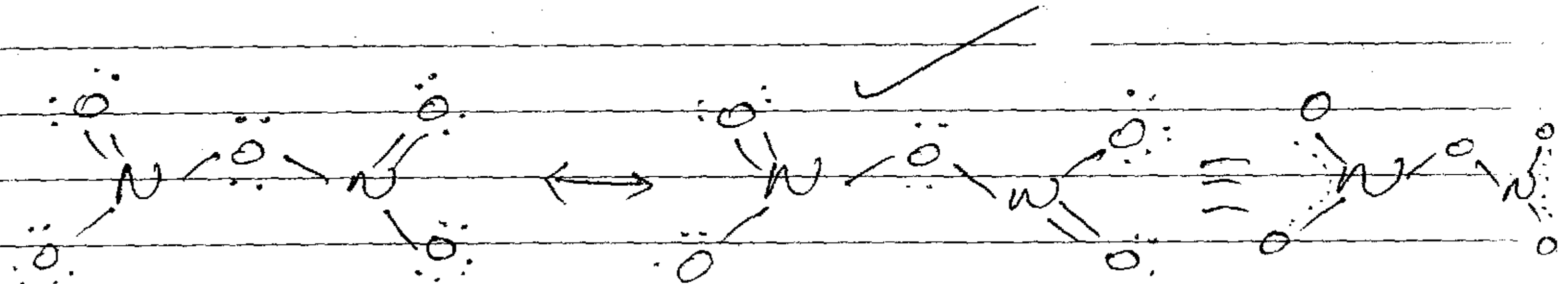
(b). Compound forms 2,4-DNP derivative. So it must contain carbonyl group. Reduces Tollen's reagent: indicates that it is aldehyde.
Since it undergo Cannizzaro's reaction it won't contain α-hydrogen.
Vigorous oxidation yields benzene-1,2-dicarboxylic acid, indicating an alkyl group is present in 2nd position.

Molecular formula indicate it is 2-ethylbenzaldehyde ie.



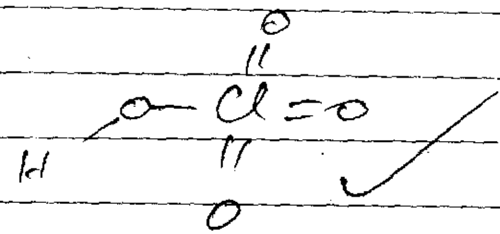


30. (a) (i)



Structure of N_2O_5

(ii)



Structure of $HClO_4$.

(b)(i) H_2S is more acidic than H_2O because of low bond dissociation enthalpy of H – S bond than H – O bond, thereby facilitating easy release of H^+ (compared to H_2O).

(ii) Fluorine does not exhibit any positive oxidation state because:

- It is the highest electronegative element
- Non-availability of vacant d-orbitals.

(iii) Helium does not form any real compounds because:

- fully filled s configuration i.e, $1s^2$.
- Non availability of p, d orbitals.

so He cannot form bonds with other elements and hence no real compounds of He is known.

22. Equation is

$$N_2(g) + O_2(g) \rightleftharpoons 2NO(g).$$

Initial $0.80\,mol\,l^{-1}$ $0.20\,mol\,l^{-1}$ 0

At equilibrium $0.80-\alpha$ $0.20-\alpha$ 2α.

At equilibrium $K = \dfrac{[NO]^2}{[N_2][O_2]} = \dfrac{[2\alpha]^2}{[0.8-\alpha][0.2-\alpha]}$

$\therefore$ $1\times10^{-5} = \dfrac{4\alpha^2}{0.16-\alpha+\alpha^2} \Rightarrow 16\times10^{-7} - \alpha\times10^{-5} + \alpha^2\times10^{-5} = 4\alpha^2$

$\Rightarrow \alpha^2(4-10^{-5}) + \alpha\times10^{-5} - 16\times10^{-7} = 0$

$\Rightarrow \alpha^2(4\times10^{5}-1) + \alpha - 16\times10^{-2} = 0.$

Since $4\times10^5 >> 1$ $\quad 4\times10^5 - 1 \simeq 4\times10^5$

$\therefore \alpha^2(4\times10^5) + \alpha - .16 = 0$

Solving quadratic eq. we get

$$\alpha = \frac{-1 \pm \sqrt{16^2\times10^3}}{2\times4\times10^5}$$ where $1+16^2\times10^3 \simeq 16^2\times10^3$

Since negative value is not possible we neglect it.

Therefore $$\alpha = \frac{-1+\sqrt{16^2\times10^3}}{8\times10^5}$$

$$= \frac{-1+16\times10\times3.148}{8\times10^5}$$

$$= \frac{124.92\times10}{8\times10^5} = 15.74\times10^{-5}\ \text{mol}\,l^{-1}$$

So equilibrium concentration of $N_2 = 0.8 - \alpha$ mol l^{-1}

$= 0.8 - 0.01574$ mol l^{-1}

$= 0.78426$ mol l^{-1}

Equilibrium concentration of $O_2 = 0.2 - \alpha$ mol l^{-1}

$= 0.18426$ mol l^{-1}

Equilibrium concentration of $NO = 2\alpha$

$= 2 \times 15.74 \times 10^{-5}$

$= 0.03148$ mol l^{-1}

Therefore $\alpha = \dfrac{-1 + 160 \times 3.148}{8 \times 10^5}$

$= \dfrac{502.68}{8 \times 10^5} = \dfrac{502.68 \times 10^{-5}}{8} = 62.845 \times 10^{-5}$ mol l^{-1}

Equilibrium Concentration of $NO = 2\alpha$

$= 2 \times 62.845 \times 10^{-5}$

$= 1.2569 \times 10^{-3} mol\,l^{-1}$

Equilibrium Concentration of $N_2 = 0.8 - \alpha$

$= 0.8 - 0.00062845$

$= ~~0.737155 \times 10^{-2} mol\,l^{-1}~~$

$= 0.79937155 mol\,l^{-1}$

Equilibrium concentration of $O_2 = 0.2 - \alpha$

$= 0.2 - 0.00062845$

$= ~~0.137155 \times 10^{-2} mol\,l^{-1}~~$

$= 0.19937155 mol\,l^{-1}$