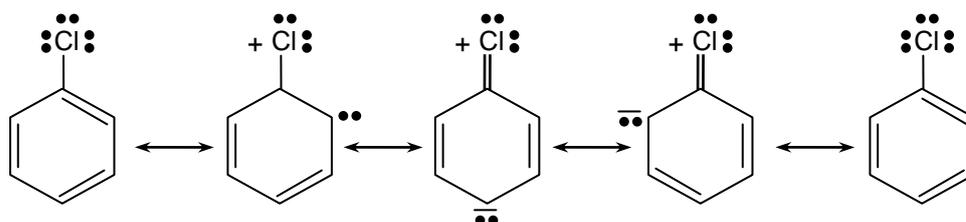
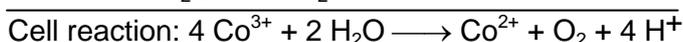
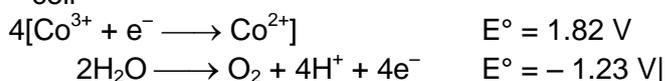


+2**Chemistry Board Examination Paper -1 (Test – 39) Answer Key**

- 4-Chloro-3, 5-dimethyl phenol, it is dettol
- It is a detergent.
- PHBVUC Polyhydroxy butyrate-CO-β-hydroxy valerated.
- Vitamin-C is helpful in healing wounds and cuts, its chemical name is Ascorbic acid.
- Tetraamminedibromocobalt (III) tetrachlorozincate (II)
- (i) Nitration is carried out with a mixture of Conc. NO_3 + Conc. H_2SO_4 (nitrating mix). In the presence of these acids, most of aniline gets protonated to form anilinium ion. Therefore, in the presence of acids, the reaction mixture consists of aniline and anilinium ion. Now $-\text{NH}_2$ gp in aniline is O, p-directing and activating while $-\text{N}^+\text{H}_3$ gp in anilinium ion is m-directing and deactivating hence a mixture of all three—ortho, para and meta derivatives is formed.
(ii) The lone pair of electrons of Chlorine in Chlorobenzene participates into resonance with the benzene ring due to +M effect. As a result C — Cl bond acquires a partial double bond character. Therefore, this C — Cl bond is stronger than C — Cl bond in ethyl chloride which is a pure single bond. As such the Chlorobenzene is difficult to hydrolyse than ethyl chloride.



- (i) SnO_2 is amphoteric in nature. It reacts with acid eg. HCl to form SnCl_4 in the solution. The common Sn^{4+} ions are adsorbed on the surface of SnO_2 particles giving them a positive charge. SnO_2 reacts with a base eg. NaOH to form Sodium Stannate in the solution. The stannate ions are adsorbed on the surface of SnO_2 particles giving them a negative charge.
(ii) Chemisorption takes place as a result of reaction between adsorbent and adsorbate. When the surface of the adsorbent is covered with one layer, no further reaction can take place. Physical adsorption is simply by Vander Waal's forces. So any number of layers may be formed one over the other on the surface of the adsorbent.
- The E°_{cell} can be calculated as:



$$E^\circ_{\text{cell}} = 1.82 \text{ V} - (-1.23 \text{ V}) = 3.05 \text{ V}$$

Since E°_{cell} is positive, the cell reaction is spontaneous. Co^{3+} ion will take part in the reaction and hence unstable in aqueous solution.

- (i) Formation of soluble complex KI_3 :
 $\text{I}_2 + \text{I}^- \longrightarrow \text{KI}_3$
(ii) Phosphorus can form $d\ell - d\ell$ bond and is pentavalent while Nitrogen cannot expand its octet due to absence of vacant 'd' orbital

- $K_b = 0.51 \text{ k kg/mol}$
 $\text{ClCH}_2 - \text{COOH} \rightleftharpoons \text{ClCH}_2\text{COO}^- + \text{H}^+$

$$K_a = \frac{C\alpha^2}{1-\alpha} \quad \text{or} \quad K_a = C\alpha^2$$

$$\alpha = \sqrt{\frac{K_a}{C}}$$

$$\alpha = \sqrt{K_a/C}$$

$$= \sqrt{1.36 \times 10^{-3} / 0.01}$$

$$\alpha = 0.3687$$

$$i = 1 + \alpha$$

$$= 1 + 0.3687 = 1.3687$$

$$\Delta T_b = i \times K_b m$$

$$= 1.36 \times 10^{-2} \times .51$$

$$= 0.0069 \text{ } ^\circ\text{C}$$

11. (i) The redox reaction is :



$$\Delta G^\circ = \Delta_f G^\circ(\text{Products}) - \Delta_f G^\circ(\text{reactant})$$

$$\text{At } 1273 \text{ K } \Delta G^\circ = -439 - (-941) = 502 \text{ KJ mol}^{-1}$$

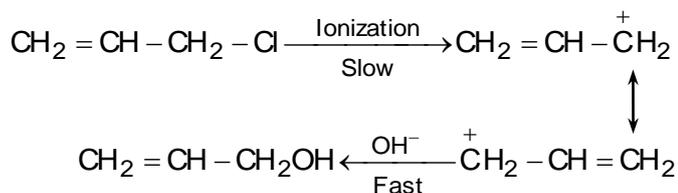
$$\text{At } 2273 \text{ K } \Delta G^\circ = -628 - (-314) = -314 \text{ KJ mol}^{-1}$$

The reaction is feasible at 2273 K.

(ii) $[X] = [\text{Au}(\text{CN})_2]^-$, $[Y] = [\text{Zn}(\text{CN})_4]^{2-}$

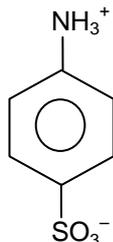
12. (a) The reactivity in S_N^2 reaction depends upon the extent of steric hindrance. i-bromobutane is a 1° alkyl halide and 2-bromobutane is a 2° alkyl halide. Since there will be some steric hindrance in 2° alkyl halide than in 1° alkylhalide, therefore 1° -bromobutane will react faster than 2-bromobutane in S_N^2 reaction.

(b) Allyl Chloride readily undergoes ionization to produce resonance stabilized allyl carbocation. Since carbocations are reactive species they readily combine with OH^- ions to form allyl alcohol.



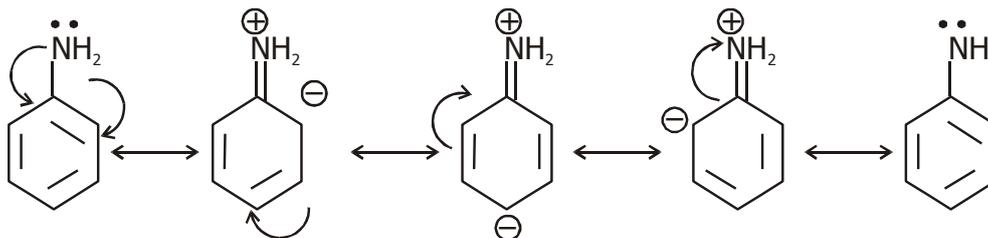
In contrast, n-propyl chloride does not undergo ionization to produce n-propyl carbocation (less stable) and hence allyl chloride is hydrolysed more readily than n-propyl chloride.

(c) Sulphanilic acid exists as Zwitter ion as :



In the presence of dil. NaOH the weakly acidic $-\text{NH}_3^+$ group transfers its H^+ to OH^- to form soluble salt $[\text{P} - \text{NH}_2\text{C}_6\text{H}_4\text{SO}_3^- \text{Na}^+]$. On the other hand, $-\text{SO}_3^-$ group is a very weak base and does not accept H^+ from dil HCl to form $\text{NH}_3\text{C}_6\text{H}_4\text{SO}_3\text{H}$ and therefore, it does not dissolve in dil HCl.

13. (i) In Aromatic amines, due to resonance, N-atom acquires +ve charge and \therefore lone pair of N-atom is less available.



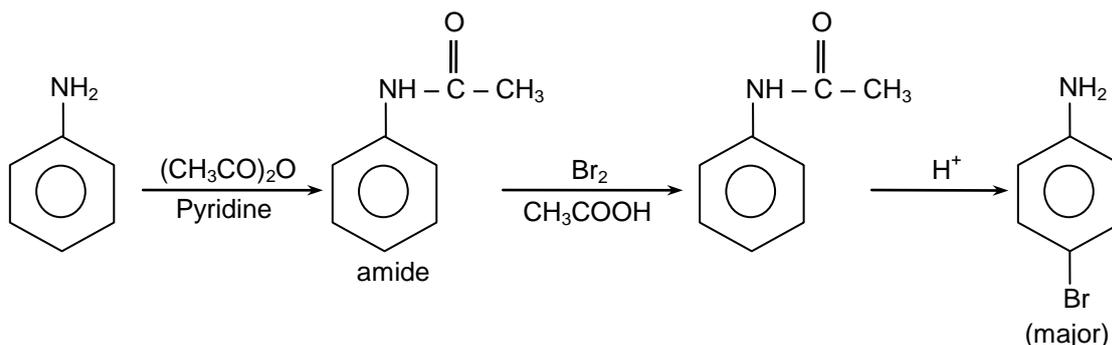
In aliphatic amines, due to e^- releasing nature of alkyl groups lone pair of e^- on N-atom is more available.

\therefore More basic.

(ii) First convert phenol to benzene by heating with Zn dust.

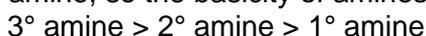
Nitration of benzene with conc. nitric acid in presence of conc. sulphuric acid.

16. (i) Because of high reactivity of aromatic amines substitution tends to occur at o- and p- positions. Monosubstituted aniline can be prepared by protecting — NH₂ group by acetylation with acetic anhydride, then carrying out substitution followed by hydrolysis of substituted amide.



- (ii). Due to + I effect of alkyl gps, the electron density on the N-atom of 1°, 2° and 3° amines is higher than that on the N-atom in NH₃. Therefore, all amines are more basic than NH₃

- (a) In gaseous phase, solvation effects are absent and hence the relative basicity of amines depends only on + I effect of the alkyl gps. Now since + I effect increases in going from 1° to 2° to 3° amine, so the basicity of amines decreases in the order :

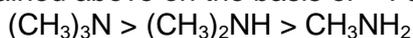


- (b) In aq. soln, the basicity depends upon two factors :

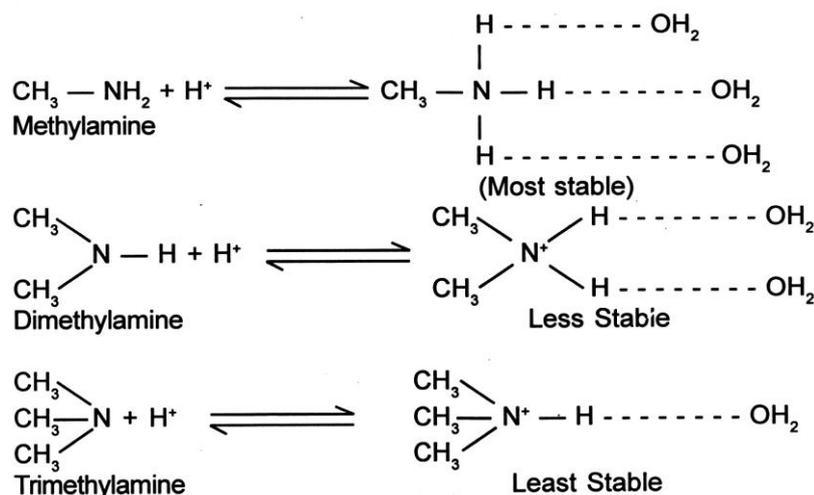
- (a) + I effect of CH₃ gp and

- (b) Solvation effect.

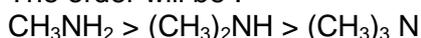
Stabilization of the conjugate acid (formed addition of a proton to amine) by H-bonding explained above on the basis of + I effect, the order will be :



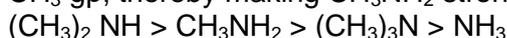
On the basis of Stabilisation of conjugate acids by H-bonding alone as explained below :



The order will be :



The combined effect of these two opposing factors is that (CH₃)₂NH is the strongest base. In case of CH₃NH₂ and (CH₃)₃NH, the stability due to H-bonding predominates over stability due to + I effect of CH₃ gp, thereby making CH₃NH₂ stronger than (CH₃)₃NH. So the overall order in aq. soln will be :



17. (i) It is because of 2 reasons :

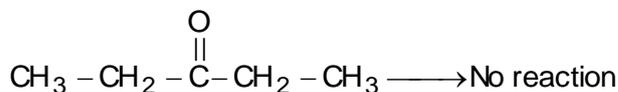
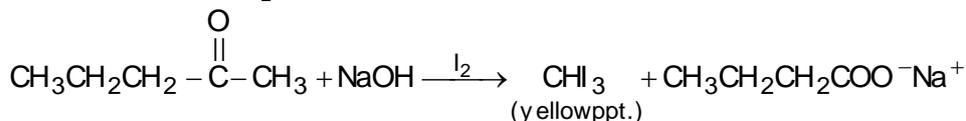
The carboxyl compounds (both aldehydes & ketones) undergo nucleophilic addition reaction.

- (i) + I effect : The alkyl group in ketones due to their e⁻ releasing character decrease the electrophilicity [+ ve charge on c-atom] and thus reduce its reactivity.

- (ii) Steric hindrance : Due to steric hindrance in ketones, they are less reactive.

- (ii) Fehling A = aq. CuSO_4
Fehling B = alkaline sodium potassium tartarate
(Rochelle Salt)

- (iii) 2-pentanone has a CH_3CO -group, hence gives positive iodoform test.
3-pentanone does not have a CH_3CO -group, hence does not give positive iodoform test.
Iodoform test $\longrightarrow \text{I}_2 / \text{NaOH}$



18. (i) H_2SO_4 cannot be used along with KI in conversion of an alcohol to alkyl iodide as it converts KI to corresponding HI and then oxidises it to I_2
(ii) B.P. decreases with increase in branching due to decrease in Van der Waals forces of attraction.
 $(\text{CH}_3)_3\text{CBr} < (\text{CH}_3)_2\text{CHCH}_2\text{Br} < \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$
(iii) Reactivity increases as C — X bond dissociation energy decreases.
 $\text{CH}_3\text{F} < \text{CH}_3\text{Cl} < \text{CH}_3\text{Br} < \text{CH}_3\text{I}$

19. (i) The stability of the compounds depend upon sum of ionization enthalpies :

$$\text{IE}_1 + \text{IE}_2 < \text{IE}_1 + \text{IE}_2$$

in Ni in Pt

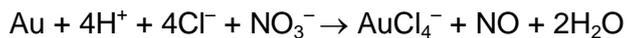
$\therefore \text{Ni}^{2+}$ is stable than Pt^{+2} .

$$\text{IE}_1 + \text{IE}_2 + \text{IE}_3 + \text{IE}_4 < \text{IE}_1 + \text{IE}_2 + \text{IE}_3 + \text{IE}_4$$

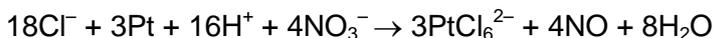
in Pt^{4+} in Ni^{4+}

$\therefore \text{Pt}^{4+}$ is stable, $\therefore \text{K}_2\text{PtCl}_6$ is well known compound.

- (ii) (a) $\text{Au} + 4\text{Cl}^- \rightarrow \text{AuCl}_4^- + 3\text{e}^-$ (oxidation)
 $3\text{e}^- + 4\text{H}^+ + \text{NO}_3^- \rightarrow \text{NO} + 2\text{H}_2\text{O}$ (reduction)

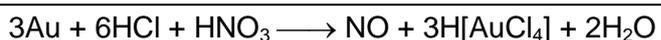
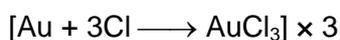
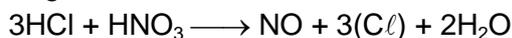


- (b) $[\text{Pt} + 6\text{Cl}^- \rightarrow \text{PtCl}_6^{2-} + 4\text{e}^-] \times 3$ (oxidation)
 $[4\text{e}^- + 4\text{H}^+ + \text{NO}_3^- \rightarrow \text{NO} + 2\text{H}_2\text{O}] \times 4$ (reduction)



Or

Aqua regia



20. (i) $\text{time}^{-1} (\text{s}^{-1})$ (It is a first order reactions]

(ii) $K = \frac{0.693}{t_{1/2}}$

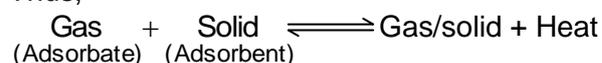
- (iii) rate constant K of the reaction.

21. (i) Physisorption is:

• Reversible & • Exothermic

• Characterised by weak vander Waals' forces of attraction between adsorbate and adsorbent.

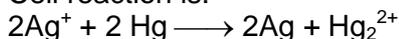
Thus,



In accordance with Le-Chateliers principle, increase in temperature will shift the equilibrium in backward direction i.e., adsorption will decrease.

- (ii) Alum gives positive ions, Al^{3+} . Colloidal mud particles are negatively charged. So, addition of alum to impure water results in coagulation of mud particles by Al^{3+} ions which settle down at the bottom of vessels and purifies the water.
- (iii) Molecules of dispersion medium hit the colloidal particles with different forces from different directions which results in the zig-zag movement of colloidal particles (Brownian movement). Therefore, particles do not settle and provides stability to the colloidal solution.

22. Cell reaction is:



$$E_{cell} = E_{cell}^{\circ} - \frac{0.0591}{2} \log \frac{[Hg_2^{2+}]}{[Ag^+]^2}$$

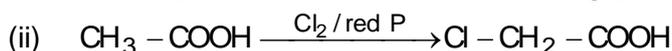
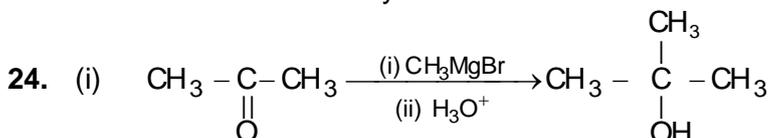
$$= (0.80 V - 0.79 V) - \frac{0.0591}{2} \log \frac{10^{-3}}{(10^{-1})^2}$$

$$= 0.01 V - \frac{0.0591}{2} (-1) = 0.01 + 0.0295$$

$$= 0.0395 V$$

Since E_{cell} is positive, the reaction will be spontaneous in the forward direction.

23. (a) Due to annealing over a number of years glass acquires some crystalline character.
 (b) Glass is not a true solid. But a super-cooled liquid of high viscosity. It has the property to flow, so the bottom of window turn thick.
 (c) 2 Ag^+ will be replaced by 1 Ca^{2+} ions to maintain electrical neutrality. Thus a hole is created in lattice site for every Ca^{2+} ion introduced.



(iii) $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$

$$\text{Mass of one atom in unit cell} = \frac{\text{Molar / atomic mass (M)}}{\text{Avogadro's no. (N}_0\text{)}}$$

$$\text{Mass of Z atoms in unit cell} = \frac{M \times Z}{N_0}$$

$$\text{Volume of unit cell} = (\text{edge length})^3 = a^3$$

$$\Rightarrow \rho = \frac{M \times Z}{N_0 \times a^3}$$

$$10 = \frac{81 \times Z}{6.023 \times 10^{23} \times (3 \times 10^{-8})^3}$$

$$\Rightarrow Z = \frac{10 \times 6.023 \times 10^{23} \times (3 \times 10^{-8})^3}{81}$$

$$= \frac{10 \times 6.023 \times 27 \times 10^{-1}}{81}$$

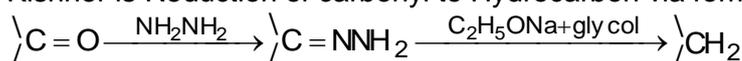
$$= \frac{27 \times 6.023}{81} = 2$$

Hence, number of atoms in unit cell = 2

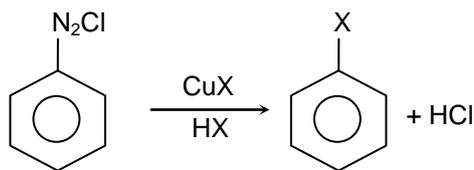
\Rightarrow Nature of cubic unit cell is body centered cubic (bcc) unit cell.

Or

- (i) Wolf Kishner is Reduction of carbonyl to Hydrocarbon via formation of Hydrazone

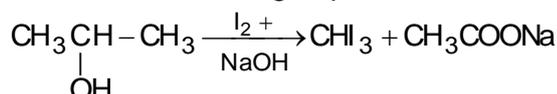


- (ii) Sandmeyer Reaction:
Conversion of benzene diazonium salt to halo benzene using HX/CuX.



- (iii) Cannizzaro Reaction is Auto Redox of carbonyl having no α - H to carboxylic acid & alcohol
 $2\text{HCHO} + \text{NaOH} \longrightarrow \text{HCOONa} + \text{CH}_3\text{OH}$

- (iv) Formation of iodoform from compound having $\text{CH}_3 - \overset{\text{OH}}{\underset{|}{\text{C}}}\text{H} - / \text{CH}_3 - \overset{\text{O}}{\parallel}{\text{C}} -$ gp using $\text{I}_2 + \text{NaOH}$ is used for identification of these groups under the name iodoform test. e.g.



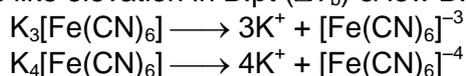
$\text{CH}_3\text{CH}_2\text{OH}$ is the only pri. alcohol and ethanal is the only aldehyde that give iodoform test.

- (v) Conversion of Pri amine to Isocyanide using CHCl_3 & alc. KOH is carbylamine Reaction.
 $\text{RNH}_2 + \text{CHCl}_3 + 3\text{KOH} \rightarrow \text{RNC} + 3\text{KCl} + 3\text{H}_2\text{O}$
25. (i) $\text{K}_2\text{Cr}_2\text{O}_7 + 4 \text{NH}_4\text{Cl} + 3 \text{H}_2\text{SO}_4 \longrightarrow \text{K}_2\text{SO}_4 + 2 \text{Cr}_2\text{O}_2\text{Cl}_2 + 2 (\text{NH}_4)_2\text{SO}_4 + 3 \text{H}_2\text{O}$
 (A) Sublime (B) Chromyl Chloride red gas (C)
- (ii) $\text{CrO}_2\text{Cl}_2 + 4 \text{NaOH} \longrightarrow \text{Na}_2\text{CrO}_4 + 2 \text{NaCl} + 2 \text{H}_2\text{O}$
 (C) Yellow Soln. (D)
- (iii) $\text{Na}_2\text{CrO}_4 + (\text{CH}_3\text{COO})_2\text{Pb} \longrightarrow \text{PbCrO}_4 + 2 \text{CH}_3\text{COONa}$
 (D) Yellow ppt. (E)
26. (a) Due to non-stoichiometric defect it turn yellow. On heating some of the oxide ion leave the crystal as O_2 & Zn^{2+} ion are occupied in tetrahedral voids of remaining lattice along with e^- , which are responsible for color.
- (b) Henry's law: Solubility of a gas in solution at low temperature increases with increase in partial pressure of the gas above solution.
 Mass of gas dissolved \propto Pressure of gas
 This law is applicable if gas does not react in solution

(c)

Schottky defect		Frenkel defect
(i)	Cation vacancy is followed by anion vanancy	Small cation is displaced in neighbouring vacant interstitial site.
(ii)	Density of crystal decreases	Density remain same
(iii)	Compound with High coordination number & high ionic character have this defect eg. CsCl	Compound with low coordination number & less ionic nature have this defect e.g. ZnS

- (d) Due to weak attractive interaction between solution & medium, lyophobic solution are less stable than lyophobic.
- (e) $\text{K}_3[\text{Fe}(\text{CN})_6]$ solution have less number of particle than $\text{K}_4[\text{Fe}(\text{CN})_6]$ so will have less colligative properties like elevation in B.pt (ΔT_b) & low B.pt.



Or

- (a) At Anode: $[\text{Cr} \longrightarrow \text{Cr}^{3+} + 3e^-] \times 2$
 At Cathode: $[\text{Fe}^{2+} + 2e^- \longrightarrow \text{Fe}] \times 3$
 Net reaction: $[2\text{Cr} + 3\text{Fe}^{2+} \longrightarrow 2 \text{Cr}^{3+} + 3\text{Fe}]$
 $n = 6$

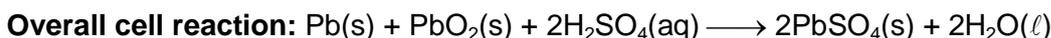
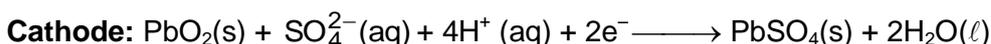
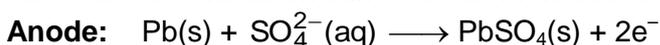
Nernst equation for this cell is

$$E_{\text{cell}} = E_{\text{cell}}^\ominus - \frac{0.0592}{n} \log \frac{[\text{Cr}^{3+}]^2}{[\text{Fe}^{2+}]^3}$$

$$\begin{aligned} &= (E_{\text{cathode}}^{\ominus} - E_{\text{anode}}^{\ominus}) - \frac{0.059}{6} \log \frac{[0.1]^2}{[0.01]^3} \\ &= [-0.44 - (-0.74)] - \frac{0.059}{6} \log \frac{10^{-2}}{10^{-6}} \\ &= +0.30 - \frac{0.059}{6} \log 10^4 \\ &= 0.30 - \frac{0.059 \times 4}{6} \\ &= 0.30 - 0.039 = 0.261 \text{ V} \end{aligned}$$

- (b) Lead storage battery is a secondary battery that can be recharged by passing direct current through it.

The cell reactions when current is drawn from it are given below:



- (c) Fuel cells are the galvanic cells that are designed to convert the energy of combustion of fuel like hydrogen, methane, methanol directly into electrical energy. e.g., hydrogen-oxygen fuel cell in which hydrogen and oxygen are bubbled through porous carbon electrodes into conc. KOH solution. Finely divided Pt or Pd metals are incorporated into the electrodes for increasing the rate of electrode reactions.

