SHIKSHA CLASSES

BOARD ANSWER PAPER

Subject : Chemistry **Topic : 5. Electrochemistry** **Total Marks : 20**

Class : XII

Section (A)

Q.1 : a) Select and write the most appropriate answer from the following alternatives of each sub question. (05)

i) The SI unit of molar conductivity is

Ans : d) $S\ m^2 mol^{-1}$

ii) The number of electrons that have a total charge of 965 coulomb is

Ans : c) 6.022×10^{21}

iii) For Daniell Cell which is correct.

Ans : a) Zn is anode

iv) Kohlrausch law used to determine molar conductivity at zero concentration of following electrolyte.

Ans : d) CH_3COOH

v) On diluting the solution of an electrolyte

Ans : b) Both ^ and k decrease

Q.1 : (b) Very short answer type Question [2]

i) What is sign of cathode and anode in galvanic cell?

Ans : In galvanic cell anode is negative and cathode is positive electrode.

ii) What is relation of molar conductivity with concentration?

Ans : Molar conductivity decreases with concentration.

$$\Lambda = \frac{1000k}{C}$$

Section (B)

Q.2 : Answer the following question (Any three). (06)

i) The molar conducivity of 0.05 M $BaCl_2$ Solution at 25° C is 223 Ω^{-1} cm² mol⁻¹. What is it's conductivity?

Ans. : $\wedge = 223\Omega^{-1}cm^2mol^{-1}$, $C = 0.05\ mol\ L^{-1}$

We know that

$$\wedge = \frac{1000k}{C}$$

$$k = \frac{223 \times 0.05}{1000}$$

$$\boxed{k = 0.01115\Omega^{-1}cm^{-1}}$$

ii) How many faradays would be required to plate out 1.00 mole of free metal from following cations?

(i) Mg^{2+} (ii) Cu^+

Ans : For 1) Mg Metal : $Mg^{2+} + 2e^{\ominus} \rightarrow Mg(s)$.

Hence 2F of electricity require to produce 1 mole Mg.

For (2) Cu Metal : $Cu^+ + 1e^{\ominus} \rightarrow Cu(s)$.

Hence 1F of electricity require to produce 1 mole of Cu.

iii) What is cell constant? What is its unit? Write its relation with resistance and conductivity.

Ans. : Cell constant : It is defined as the ratio of distance between the electrodes and area of cross section of electrode.

If b is cell constant, l = distance between electrodes and a is area of cross section.

$$\therefore b = \frac{l}{a}$$

resistance and conductivity related as

$$k = \frac{b}{R}$$

iv)Differentiate between electrolytic Cell and Voltaic Cell.

Ans :

Electrolytic Cell	**Voltalic Cell**
1) An electric current drives a non-spontanous reaction.	1) A spantaneous chemical reaction generates electric current.
2) Electrical energy is converted to chemical energy.	2) Chemical energy is converted to electrical energy.
3) Anode is positive and cathode is negative.	3) Anode is negative and Cathode is positive.
4) Oxidation occurs at positive electrode.	4) Oxidation occurs at negative electrode.
5) Reduction occurs at negative electrode.	5) Reduction occurs at positive electrode.
6) They are used for electro-plating, electro-refining.	6) They are used as a source of electric current.

Section (C)

Q.3 : Answer the following question (any one). (03)

i) Calculate mass of copper produced during passage of 2.5 A of current through a solution of $CuSO_4$ for 40 minutes molar mass of Cu is 63.5g mol^{-1} ?

Ans : Given

$I = 2.5$ A

$t = 40$ min $= 40 \times 60$ s $= 2400$ s

$M = 63.5$ g mol^{-1}

Mass of copper produced = ?

Reduction half reaction is

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

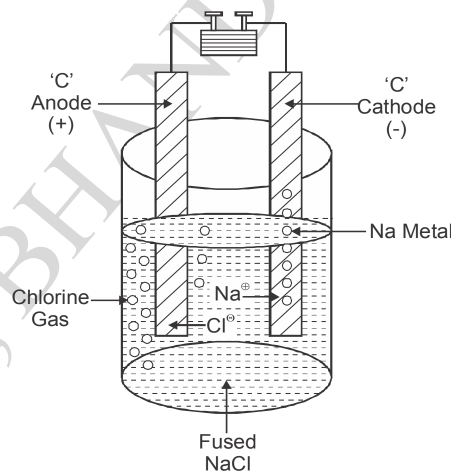
$$\text{Hence mole ratio} = \frac{1 \text{ mole } Cu}{2 \text{ mole } e^{-}} = \frac{1}{2}$$

$$\therefore \text{ Mass copper produced} = \frac{I \times t}{96500} \times \text{mole ratio} \times \text{molar mass}$$

$$= \frac{2.5 \times 2400}{96500} \times \frac{1}{2} \times 63.5 = 1.97g$$

ii) Explain the elctrolysis of molten NaCl

Ans :



Construction :- The cell consist of graphite cathode and anode immersed in molten NaCl. Externally connected to battery.

Working of Cell :- As current flows Na^{+} moves towards cathode. $Cl^{\ominus}$ moves towards anode.

Cell reaction :

anode $2Cl^{\ominus} \longrightarrow Cl_2(g) + 2e^{\ominus}$

cathode $2Na^{\oplus} + 2e^{\ominus} \longrightarrow 2Na(s)$

Overall reaction

$2Na^{\oplus} + 2Cl^{\ominus} \longrightarrow 2Na(s) + Cl_2(g)$

Result :-

1) A pale yellow green Cl_2 gas produced at anode.
2) A Na metal deposited at cathode.

Section (D)

Q.4 : Answer the following question. (Any one) (04)

1) a) Write Nernst equation for the following reactions

i) $Cr(s) + 3Fe^{3+}(aq) \rightarrow Cr^{3+}(aq) + 3Fe^{2+}(aq)$

Ans : $E_{cell} = E^{0}_{cell} - \frac{2.303RT}{3F} \log \frac{[Cr^{3+}][Fe^{2+}]^3}{[Fe^{3+}]^3}$

$E_{cell} = E^{0}_{cell} - \frac{0.0592}{3} \log \frac{[Cr^{3+}][Fe^{2+}]^3}{[Fe^{3+}]^3}$

ii) $Al^{3+}(aq) + 3e^{(-)} \rightarrow Al(s)$

Ans : $E_{red} = E^{0}_{red} - \frac{2.303RT}{3F} \log \frac{1}{[Al^{3+}]}$

at 25^0C

$E_{red} = E^{0}_{red} - \frac{0.0592}{3} \log \frac{1}{[Al^{3+}]}$

b) Calculate potential of following cell at 25^0C Zn/Zn^{2+} (0.6M)// H^+ (1.2M) / H_2(g, 1atm) / Pt $E^0Zn = -0.763V$.

Ans : $[Zn^{2+}] = 0.6$ M

$[H^+] = 1.2$ M

$H_2 = 1$ atm

$E^o_{Zn} = -0.763$ V

$\therefore E^0 = E^0_{H_2} - E^0zn$

$= 0 - (-0.763)$

$= +0.763V$

The overall reaction is

$Zn_{(s)} + 2H^+_{(aq)} \rightarrow Zn^{2+}_{(aq)} + H_2 \uparrow$

$\therefore$ n=2 no. of moles of e^-

The Nernest equation is

$E_{cell} = E^0_{cell} - \frac{0.592}{n} \log_{10} \frac{[Zn^{2+}][P_{H2}]}{[Zn][H^+]^2}$

$= (0.763) - \frac{0.592}{2} \times \log_{10} \frac{0.6 \times 1}{1 \times (1.2)^2}$

$= 0.763 - 0.0296 \times \log_{10} \frac{0.6}{1.44}$

$= 0.763 - 0.0296 \times \log_{10} 0.41$

$= 0.763 - 0.0296 \times (-0.38)$

$= 0.763 + 0.01125$

$E_{cell} = 0.774V$

2) a) Formulate a cell for each of the following reaction

i) $Sn^{2+}(aq) + 2\ AgCl_{(s)} \rightarrow Sn^{+4}(aq) + 2Ag(s) + 2\ Cl^-(aq)$

Ans : $Pt / Sn^{+2}_{(aq)}, Sn^{+4} // Cl^-_{(aq)} / AgCl_{(s)} / Ag$

ii) $Zn_{(s)} + 2Fe^{+3}_{(aq)} \rightarrow 2Fe^{+2}_{(aq)} + Zn^{+2}_{(aq)}$

Ans : $Zn_{(s)} / Zn^{+2}_{(aq)} // Fe^{+2}, Fe^{+3}_{(aq)} / Pt$

b) From the following pair predict which is better reducing agent, their standard potentials given in bracket. Give reason.

i) $Co^{+3}(aq)$ (1.81V) & I_2 (0.54V)

Ans : I_2 is stronger reducing agent having less potential than Co^{+3}.

ii) $Ce^{3+}(aq)$ (–2.48V) & Ni^{+2} (–0.25V)

Ans : Ce^{+3} is better reducing agent than Ni^{+2}.

* * *


BECOME AN ACE IN JEE & NEET
SHIKSHA CLASSES
Believe & Achieve
JEE | NEET | Previse (8-10)
8625055707 | 8623085707
shikshaclasses.co.in
M-19, MHADA Colony, Khat Road, Bhandara
Learn with Jaiswal sir