

## INDIAN SCHOOL DARSAIT DEPARTMENT OF CHEMISTRY



Subje	ect: Chemistry	Topic : Electrochemistry	Date of Worksheet: 29.10.20	018
Reso	urce Person: SREEKALA	М	Date of Submission:	
Name	e of the Student:	Class &Division: XII	Roll Number:	
1	Write the product obtaine platinum electrodes.	d at anode on electrolysis of concentra	ated sulphuric acid using	1
2		sed to stir a copper sulphate solution? (25 V, $E^{o} Cu^{2+} / Cu = 0.34 V$	Give reason.	1
3	Write the function of plat	inised platinum in standard hydrogen e	electrode.	1
4	How many faradays of ele electrolysis of a solution?	ectricity are required to liberate two m	oles of hydrogen gas in	1
5	How does concentration of it?	of $H_2SO_4$ changes in lead storage batte	ery when current is drawn from	1
6	Why does a mercury cell	give a constant voltage throughout its	life?	1
7	Two metals A and B have of these will liberate $H_2$ fr	e reduction potential values -0.76 V ar com dilute $H_2SO_4$ ?	nd +0.34 V respectively. Which	1
8	Explain Kohlrausch law o	of independent migration of ions. Ment	tion its applications.	2
9	Write the reactions at cath a) Molten NaCl b)A	node and anode when the following sur queous NaCl	bstances are electrolysed:	2
10	State Faradays laws of ele	ectrolysis.		2
11		activity of 0.02 M KCl solution if its c K. (Ans: 138.5Scm <sup>2</sup> mol <sup>-1</sup> )	onductivity is	
12	Define the terms given be a) Conductivity	low: b) Molar Conducti	vity	2
13		of a H <sub>2</sub> -O <sub>2</sub> fuel cell and the reactions		2
14	Write overall cell reaction	n for lead storage battery when the batt	tery is being charged.	2

15	Determine the values of equilibrium constant (Kc) and $\Delta G^0$ for the following reaction: Ni(s) + 2Ag <sup>+</sup> (aq) $\rightarrow$ Ni <sup>2+</sup> (aq) + 2 Ag(s), $E^0_{cell} = 1.05V$ , (F= 96500C) (Ans: $\Delta G^0_{cell} = -202,650J$ , K <sub>c</sub> = 3.917x 10 <sup>35</sup> .)	
16	Write the reaction taking place at cathode anode when the lead –acid storage battery is in use.	
17	What is the difference between an electro-chemical cell and an electrolytic cell?	
18	$ \begin{array}{l} \hline Calculate \ the \ standard \ cell \ potential \ of \ the \ galvanic \ cell \ in \ which \ the \ following \ reaction \ takes \ place: \\ 2Cr \ (s) + 3Cd^{2+}(aq) \rightarrow 2Cr^{3+}(aq) \ + 3Cd(s) \\ Given \ E^{o} \ Cr^{3+}/Cr = -0.74V, \ E^{o} \ Cd^{2+}/Cd = -0.40V, \ F = 96500C \ mol^{-1} \\ Also \ calculate \ the \ \Delta_{r}G^{0} \ value \ of \ the \ reaction. \ (Ans: \ E^{0}cell = 0.34V, \ \Delta_{r}G^{0} = -196.86 \ kJ \ mol^{-1}) \end{array} $	
19	For what concentration of $Ag^+$ (aq) will the emf of the given cell be zero at 298 K, if concentration of $Cu^{2+}$ (aq) is 0.01M? $Cu(s)/Cu^{2+}(0.1M)//Ag^+$ (aq) / Ag(s). Given $E^{o}Ag^+/Ag = +0.80V$ , $E^{o}Cu^{2+}/Cu = +0.34 V$ . (Ans: $[Ag^+] = 1.48 \times 10^{-9} M$ )	2
20	The chemistry of corrosion is essentially an electrochemical phenomenon. Explain the reactions occurring during the corrosion of iron in the atmosphere.	2
21	Write the anode and cathode reactions occurring in a commonly used mercury cell. How is the overall reaction represented?	2
22	Give reasons:	
i)	On the bais of $E^0$ values, $O_2$ gas should be liberated at anode but it is $Cl_2$ gas which is liberated in the electrolysis of aqueous NaCl	
ii)	Conductivity of CH <sub>3</sub> COOH decreases on dilution.	
23	Define the molar conductivity and Explain the variation in molar conductivity with change in concentration of a weak electrolyte and a strong electrolyte in its solution.	
24	For the reaction $2AgCl (s) + H_2 (g) (1 \text{ atm}) \longrightarrow 2Ag (s) + 2H^+ (0.1 \text{ M}) + 2Cl^- (0.1 \text{ M}),$ $\Delta G^0 = -43600 \text{ J at } 25^{\circ}\text{C}.$ Calculate the e.m.f. of the cell. $[\log 10^{-n} = -n]$ Ans: $E_{cell} = 0.344V$	
25	A copper-silver cell is set up. The copper ion concentration is 0.10M. The concentration of silver ions is not known. The cell potential was found to be 0.422V. Determine the concentration of silver ions in the cell. (Given: $E^{0}_{Cu2+/Cu} = +0.34V$ , $E^{0}_{Ag+/Ag} = +0.80V$ ) (Ans: 7.1 x10 <sup>-2</sup> M)	3

27	i)A current of 1.5 ampere was passed through an electrolytic cell containing AgNO <sub>3</sub> solution with inert electrodes. The weight of Ag deposited was 1.50g. How long did the current flow? (Ans: 893.51 sec)	3
	ii)Write the reactions taking place at the anode and cathode in the above cell? iii)Give reactions taking place at the two electrodes if these are made up of Ag.	
28	A voltaic cell is set up at 25 <sup>°</sup> C with the following half cells, $Al^{3+}$ (0.001M) and Ni <sup>2+</sup> (0.50M). Write the cell reaction when the cell generates an electric current and determine the cell potential. (Given $E^{0}_{Ni2+/Ni} = -0.25V$ , $E^{0}_{Al3+/Al} = -1.66V$ ) (Ans: $E_{cell} = 1.46V$ )	3
29	The molar conductivity at infinite dilution for NH <sub>4</sub> Cl, NaOH and NaCl are 129.8, 217.4, and 108 Scm <sup>2</sup> mol <sup>-1</sup> respectively. If the molar conductivity of 0.01M solution of NH <sub>4</sub> OH is $9.33$ Scm <sup>2</sup> mol <sup>-1</sup> . Calculate the dissociation constant of NH <sub>4</sub> OH (Ans: 1.60 x 10 <sup>-5-</sup> )	3
30	One half cell in a voltaic cell is constructed from a silver wire dipped in silver nitrate solution of unknown concentration. The other half cell consists of a zinc electrode in a 0.10M solution of $Zn(NO_3)_2$ . A voltage of 1.48V is measured for this cell. Use this information to calculate the concentration of silver nitrate solution. (Given: $E^0_{Zn2+/Zn} = -0.763V$ , $E^0_{Ag+/Ag} = +0.80V$ ) (Ans: $[Ag^+] = 1.247 \times 10^{-2}$ M)	3
31	$ \begin{array}{l} \hline Calculate \ the \ equilibrium \ constant \ for \ the \ reaction \ equilibrium \ Fe(s) \ + \ Cd^{2+}(aq) \ \rightarrow \ Fe^{2+}(aq) \ + \ Cd(s) \ (Given: \ E^0_{\ Cd2+/Cd} = -0.40V, \ \ E^0_{\ Fe2+/Fe} = -0.44V) \ (Ans: \ K_c = 22.57) \end{array} $	3
32	a)Calculate the charge in coulombs required for oxidation of 2 moles of water to oxygen?[Given 1F= 96,500Cmol <sup>-1</sup> ] b)Zinc/silver oxide cell is used in hearing aids and electric watches. The following reaction occur: $Zn(s) \rightarrow Zn^{2+} (aq) + 2e^{-} \qquad E^{0}_{Zn2+/Zn} = -0.76V$ $Ag_{2}O + H_{2}O + 2e^{-} \rightarrow 2Ag + 2OH^{-} \qquad E^{0}_{Ag+/Ag} = +0.344V$ Calculate i) standard potential of the cell ii) Standard Gibbs energy (Ans: E <sup>0</sup> cell = 1.104V, $\Delta G^{0} = -213072J$ )	3
33	Give reason: a)Why does an alkaline medium inhibit the rusting of iron? b)Why is zinc better than Tin in protecting iron from corrosion? c)What are antirust solutions? Give one example.	3

34	a)Why does a dry cell become dead after a long time even if it has not been used? b)What is the role of ZnCl <sub>2</sub> in a dry cell?	3
35	Two electrolytic cells containing electrolyte AgNO <sub>3</sub> and CuSO <sub>4</sub> are connected in series. A steady current of 2.5 Amperes were passed through them until 1.078g of Ag were deposited. How long did the current flow? What mass of copper was deposited? (Ans; 386sec, 0.3175g)	3
36	<ul> <li>a)Two electrolytic cells containing silver nitrate solution and dilute sulphuric acid solution were connected in series. A steady current of 2.5 amp was passed through them till 1.078g of silver was deposited. [Ag = 107.8gmol<sup>-1</sup>, 1F = 96,500C] <ul> <li>i) How much electricity was consumed?</li> <li>(Ans: 0.01 F or 965C)</li> <li>ii) What was the weight of oxygen gas liberated? (Ans: 0.16g)</li> </ul> </li> <li>b)Give reason: <ul> <li>i) Rusting of iron pipe can be prevented by joining it with a piece of magnesium.</li> <li>ii) Conductivity of an electrolyte solution decreases with the decrease in concentration.</li> </ul> </li> </ul>	5
37	Write the cell reaction and calculate the emf of the following cell at 298K Sn (s) $  Sn^{2+} (0.004 \text{ M})    H^{+} (0.020 \text{ M})   H_2 (g) (1 \text{ bar})   Pt (s)$ (Given : $E_{Sn^{2+}/Sn}^0 = -0.14 \text{ V}$ ) Ans: $E_{cell} = 0.1105 \text{ V}$	
38.	a)What is a fuel cell? What is its main advantage? b)What are the reactions occurring at the cathode and anode of a Lechlanche cell? c)In the button cell widely used for watches and other devices, the following reaction takes place:Zn(s) + Ag <sub>2</sub> O(s) + H <sub>2</sub> O(l) $\rightarrow$ Zn <sup>2+</sup> (aq) + 2Ag(s) + 2OH <sup>-</sup> (aq) Give the cell representation and determine the value of Kc for the above reaction using the following data: Ag <sub>2</sub> O(s) + H <sub>2</sub> O(l) + 2e <sup>-</sup> $\rightarrow$ 2Ag(s) + 2OH <sup>-</sup> (aq) (E <sup>0</sup> = 0.344V) Zn <sup>2+</sup> (aq) + 2e <sup>-</sup> $\rightarrow$ Zn (s) (E <sup>0</sup> = -0.76V) (Ans: $\Delta G^0$ = -213072J, K <sub>c</sub> = 2.649x10 <sup>37</sup> )	5
39.	$ \begin{array}{l} \hline \label{eq:constraint} \hline \mbox{The following chemical reaction is occurring in an electrochemical cell} \\ \hline \mbox{Mg (s) } + 2 \mbox{Ag}^+(0.0001 \mbox{M}) \rightarrow \mbox{Mg}^{2+} \ (0.10 \mbox{M}) + 2 \mbox{Ag(s)} \\ \hline \mbox{Given } E^0 \mbox{Mg}^{2+} \mbox{Mg } = -2.36 \mbox{V and } \mbox{Ag}^+ \mbox{Ag } = 0.81 \mbox{V} \\ \hline \mbox{For this cell calculate/write} \\ \hline \mbox{i) a) } E^0 \mbox{ value for the electrode } 2 \mbox{Ag}^+ \mbox{/2} \mbox{Ag}. \mbox{ b)} \mbox{Standard cell potential } E^0_{\mbox{ cell}}. \\ \hline \mbox{ii) Cell potential } (E_{cell}) \\ \hline \mbox{iii) a) } \mbox{Symbolic representation of the above cell.} \\ \hline \mbox{b) Will the above cell reaction be spontaneous.} \\ \hline \mbox{(Ans: i) a)} 0.81 \mbox{V b) } 3.17 \mbox{V} \ \mbox{(ii) } 2.96 \mbox{V}, \ \mbox{iii) b) yes.} \end{array}$	5