PHYSICAL / INORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 31

Total Marks : 33

Max. Time : 33 min.

Topic : Electro Chemistry

Type of Questions **M.M., Min.**

Single choice Objective ('–1' negative marking) Q.1 to Q.11 **(3 marks, 3 min.)** **[33, 33]**

1. **(a)** Which process occurs in the electrolysis of an aqueous tin(II) chloride solution at a tin anode?

(A) $Sn = Sn^{2+} + 2e^-$ (B) $2Cl^- = Cl_2 + 2e^-$

(C) $2H_2O = O_2 + 4H^+ + 4e^-$ (D) none of these

(b) In the electrolysis of an aqueous nickel(II) sulphate solution, the process $2H_2O = O_2 + 4H^+ + 4e^-$ occurs at the anode. The material of construction of the anode is

(A) nickel (B) gold (C) copper (D) none of these

2. **(a)** In the electrolysis of an aqueous potassium sulphate solution, the pH of the solution in the space near an electrode increased. Which pole of the current source is the electrode connected to?

(A) The positive pole (B) Could be either pole

(C) The negative pole (D) Cannot be determined

(b) In the electrolysis of an aqueous solution of a salt, the pH in the space near one of the electrodes increased. A solution of which salt is being electrolyzed?

(A) none of the following (B) $CuCl_2$

(C) $Cu(NO_3)_2$ (D) KCl

3. Number of electrons lost during electrolysis of 0.355 g of Cl^- is -

(A) 0.01 (B) 0.01 N_0 (C) 0.02 N_0 (D) $\frac{0.01}{2N_0}$

4. In the electrolysis of a copper(II) chloride solution, the mass of the cathode increased by 3.2 g. What occurred at the copper anode?

(A) 0.05 mol of Cu^{2+} passed into the solution (B) 0.56 L of O_2 was liberated

(C) 0.1 mol of Cu^{2+} passed into the solution (D) 0.112 L of Cl_2 was liberated

5. The passage of a constant current through a solution of dilute H_2SO_4 with 'Pt' electrodes liberated 336 cm^3 of a mixture of H_2 and O_2 at S.T.P. The quantity of electricity that was passed is

(A) 96500 C (B) 965 C (C) 1930 C (D) $\frac{1}{100}$ faraday

6. A very thin copper plate is electro-plated with gold using gold chloride in HCl. The current was passed for 20 min. and the increase in the weight of the plate was found to be 2g. [Au = 197]. The current passed was -

(A) 0.816 amp (B) 1.632 amp (C) 2.448 amp (D) 3.264 amp

7. In the electrolysis of an aqueous $SnCl_2$ solution, 4.48 L of chlorine at STP were liberated at the anode. The mass of tin deposited at the cathode was (M of Sn = 118.5)

(A) 119 g (B) 79.3 g (C) 47.4 g (D) 23.7 g

8. What must be the concentration of Ag^+ in an aqueous solution containing Cu^{2+} = 1.0 M so that both the metals can be deposited on the cathode simultaneously. Given that $E^0_{Cu/Cu^{2+}} = -0.34$ V and $E^0_{Ag^+/Ag}$ = 0.812 V, T = 298 K

(A) nearly 10^{-19} M (B) 10^{-12} M (C) 10^{-8} M (D) nearly 10^{-16} M

9. Electrolytic reduction of 6.15 g of nitrobenzene using a current effeciency of 40% will require which of the following quantity of electricity. [C = 12, H = 1, N = 14, O = 16]

(A) 0.75 F (B) 0.15 F (C) 0.75 C (D) 0.125 C

10. Electrolysis of a solution of HSO_4^- ions produces $S_2O_8^{--}$. Assuming 75% current efficiency, what current should be employed to achieve a production rate of 1 mole of $S_2O_8^{--}$ per hour ?

(A) +71.5 amp (B) 35.7 amp (C) 142.96 amp (D) 285.93 amp

11. A current is passed through 2 voltameters connected in series. The first voltameter contains XSO_4 (aq.) and second has Y_2SO_4 the relative atomic masses of X and Y are in the ratio of 2 : 1. The ratio of the mass of X liberated to the mass of Y liberated is

(A) 1 : 1 (B) 1 : 2 (C) 2 : 1 (D) None of the above

Answer Key

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1.	**(a)** (A) **(b)** (B)	**2.**	**(a)** (C) **(b)** (D)	**3.**	(B)	**4.**	(A)	**5.**	(C)
6.	(C)	**7.**	(D)	**8.**	(C)	**9.**	(A)	**10.**	(A)
11.	(A)								

Hints & Solutions

PHYSICAL / INORGANIC CHEMISTRY

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1. **(a)** Solution contains Sn^{2+}, Cl^-, H_2O.
Anode is tin anode.

$E^\circ_{Sn^{2+}/Sn} = -0.14V$; $E^\circ_{O_2/H_2O} = 1.23V$; $E^\circ_{Cl_2/Cl^-} = 1.36V$.

From the SRP values, it is clear that the reaction for which SRP is least will take place at anode $E^\circ_{Sn^{2+}/Sn}$ is least.

So, $Sn \longrightarrow Sn^{2+} + 2e^-$ **Ans.**

(b) The solution contains Ni^{2+}, SO_4^{2-}, H_2O

$E^\circ_{Ni^{2+}/Ni} = 0.23V$ $\quad$ $E^\circ_{S_2O_8^{2-}/SO_4^{2-}} = 2.05V$

$E^\circ_{O_2/H_2O} = 1.23V$ $\quad$ $E^\circ_{Au^{3+}/Au} = 1.4V$ $\quad$ $E^\circ_{Cu^{2+}/Cu} = 0.34V$

If Nickel electrode is used, then Nickel will get oxidised as its SRP is least. So Nickel is not anode. If gold electrode is used, then water will get oxidised as SRP of gold is more than SRP of water. So gold is the anode.
If copper electrode is used, then copper will get oxidised as SRP of Cu is less than that of water.

2. **(a)** K_2SO_4(aq.) contains K^+, SO_4^{2-}, H_2O
At anode ; water gets oxidized
At anode ; water gets oxidized

$$2H_2O \longrightarrow O_2 + 4n^+ + 4e^-$$

as H^+ are produced, region around anode has lesser pH.
At cathode, water get reduced.

$$2H_2O + 2e^- \longrightarrow H_2 + 2OH^-$$

as OH^- are produced, region around cathode has higher pH.
Cathode is negatively charged.
(b) In $CuCl_2$ solution,
At anode

$$\text{Either } 2Cl^- \longrightarrow Cl_2 + 2e^-$$

5. $H_2O \xrightarrow{2e^-} H_2 + \frac{1}{2}O_2$

$2 \times 96500\ C \rightarrow 22.4 \times 1000\ cm^3\ H_2$

$\frac{2 \times 96500 \times 224}{22.4 \times 1000}\ C \leftarrow \quad \therefore\ 224\ cm^3\ H_2$

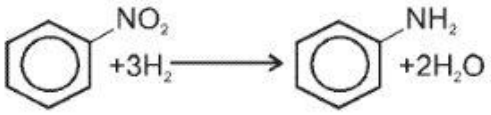
$= 1930\ C.$

6. Gold chloride $AuCl_3$

$$m = \frac{M}{96500 \times n} \times I \times t$$

$$I = \frac{2 \times 96500 \times 3}{197 \times 20 \times 60} = 2.448A.$$

9.



$\frac{6.15}{123}$ = 0.05 mole of mitro benzene

V.F = 6

electricity of charge required if efficiency is 100%

= 0.05 × 6 = 0.3 F

But efficiency is 40%

charge required = $\frac{0.3}{0.4}$ = 0.75.

11. XSO_4 (aq.)

Y_2SO_4 (aq.)

$$\frac{\text{Mol.mass X}}{\text{Mol.massY}} = \frac{2}{1} \quad \Rightarrow \quad \text{eq. wt. of X} = \frac{\text{mol. mass X}}{2} \quad \Rightarrow \quad \text{eq. wt. of Y} = \frac{\text{mol. mass Y}}{2}$$

$$\frac{\text{mass of Y}}{\text{mass of X}} = \frac{\text{eq.wt. of Y}}{\text{eq.wt. of X}} = \frac{\text{mol.mass Y}}{\text{mol.mass X}} \times \frac{2}{1} = 1:1.$$