Q1 - 2024 (01 Feb Shift 1)

The potential for the given half cell at 298 K is

$(-) \ldots\ldots\ldots\ldots \times 10^{-2}$ V.

$2H^{+}_{(aq)} + 2e^{-} \rightarrow H_2(g)$

$\left[H^{+}\right] = 1M, P_{H_2} = 2$ atm

(Given: $2.303RT/F = 0.06$ V, $\log 2 = 0.3$)

Q2 - 2024 (01 Feb Shift 2)

The amount of electricity in Coulomb required for the oxidation of 1 mol of H_2O to O_2 is _____ $\times 10^5$C.

Q3 - 2024 (01 Feb Shift 2)

Consider the following redox reaction :

$MnO_4^- + H^+ + H_2C_2O_4 \rightleftharpoons Mn^{2+} + H_2O + CO_2$

The standard reduction potentials are given as below (E°_{red})

$E^{\circ}_{MnO_4^-/Mn^{2+}} = +1.51$ V

$E^{\circ}_{CO_2/H_2C_2O_4} = -0.49$ V

If the equilibrium constant of the above reaction is given as $K_{eq} = 10^x$, then the value of $x =$ _____ (nearest integer)

Q4 - 2024 (27 Jan Shift 1)

The mass of silver (Molar mass of Ag : $108 g mol^{-1}$) displaced by a quantity of electricity which displaces 5600 mL of O_2 at S.T.P. will be _____ g.

Q5 - 2024 (27 Jan Shift 2)

Which of the following statements is not correct about rusting of iron?

(1) Coating of iron surface by tin prevents rusting, even if the tin coating is peeling off.

(2) When pH lies above 9 or 10 , rusting of iron does not take place.

(3) Dissolved acidic oxides SO_2, NO_2 in water act as catalyst in the process of rusting.

(4) Rusting of iron is envisaged as setting up of electrochemical cell on the surface of iron object.

Q6 - 2024 (27 Jan Shift 2)

The hydrogen electrode is dipped in a solution of $\mathrm{pH}=3$ at $25^{\circ} \mathrm{C}$. The potential of the electrode will be - $\_\_\_\_\_ \times 10^{-2}$ V.

$\left(\frac{2.303 \mathrm{RT}}{\mathrm{F}}=0.059 \mathrm{~V}\right)$

Q7 - 2024 (29 Jan Shift 1)

The mass of zinc produced by the electrolysis of zinc sulphate solution with a steady current of 0.015 A for 15 minutes is $\_\_\_\_\_ \times 10^{-4}$ g.

(Atomic mass of zinc $=65.4 \mathrm{amu}$)

Q8 - 2024 (29 Jan Shift 2)

A constant current was passed through a solution of AuCl_4^- ion between gold electrodes. After a period of 10.0 minutes, the increase in mass of cathode was 1.314 g. The total charge passed through the solution is $\_\_\_\_\_ \times 10^{-2}$ F.

(Given atomic mass of $\overline{\mathrm{Au}}=197$)

Q9 - 2024 (30 Jan Shift 2)

Reduction potential of ions are given below:

ClO_4^-	IO_4^-	BrO_4^-
$\mathrm{E}^{\circ}=1.19 \mathrm{~V}$	$\mathrm{E}^{\circ}=1.65 \mathrm{~V}$	$\mathrm{E}^{\circ}=1.74 \mathrm{~V}$

The correct order of their oxidising power is:

(1) $\mathrm{ClO}_4^- > \mathrm{IO}_4^- > \mathrm{BrO}_4^-$

(2) $\mathrm{BrO}_4^- > \mathrm{IO}_4^- > \mathrm{ClO}_4^-$

(3) $\mathrm{BrO}_4^- > \mathrm{ClO}_4^- > \mathrm{IO}_4^-$

(4) $\mathrm{IO}_4^- > \mathrm{BrO}_4^- > \mathrm{ClO}_4^-$

Q10 - 2024 (31 Jan Shift 1)

The metals that are employed in the battery industries are

A. Fe

B. Mn

C. Ni

D. Cr

E. Cd

Choose the correct answer from the options given below:

(1) B, C and E only

(2) A, B, C, D and E

(3) A, B, C and D only

(4) B, D and E only

Q11 - 2024 (31 Jan Shift 1)

Identify the factor from the following that does not affect electrolytic conductance of a solution.

(1) The nature of the electrolyte added.

(2) The nature of the electrode used.

(3) Concentration of the electrolyte.

(4) The nature of solvent used.

Q12 - 2024 (31 Jan Shift 1)

One Faraday of electricity liberates $\mathrm{x} \times 10^{-1}$ gram atom of copper from copper sulphate, x is _____

Q13 - 2024 (31 Jan Shift 2)

The values of conductivity of some materials at $298.15\ \mathrm{K}$ in Sm^{-1} are 2.1×10^{3}, $1.0 \times 10^{-16}, 1.2 \times 10, 3.91, 1.5 \times 10^{-2}$, $1 \times 10^{-7}, 1.0 \times 10^{3}$. The number of conductors among the materials is _____

Answer Key

Q1 (1)	**Q2** (2)	**Q3** (339)	**Q4** (108)
Q5 (1)	**Q6** (18)	**Q7** (46)	**Q8** (2)
Q9 (2)	**Q10** (1)	**Q11** (2)	**Q12** (5)
Q13 (4)			

Q1

$$E = E^{\circ}_{H^+/H_2} - \frac{0.06}{2}\log\frac{P_{H_2}}{[H^+]^2}$$

$$E = 0.00 - \frac{0.06}{2}\log\frac{2}{[1]^2}$$

$$E = -0.03 \times 0.3 = -0.9 \times 10^{-2}\ V$$

Q2

$$2H_2O \rightarrow O_2 + 4H^+ + 4e^-$$

$$\frac{W}{E} = \frac{Q}{96500}$$

$$\text{mole} \times \text{n-factor} = \frac{Q}{96500}$$

$$1 \times 2 = \frac{Q}{96500}$$

$$Q = 2 \times 96500C$$

$$= 1.93 \times 10^5 C$$

Q3

$$\text{CellRx}^n; MnO_4^- + H_2C_2O_4 \rightarrow Mn^{2+} + CO_2$$

$$E^{\circ}_{cell} = E^{\circ}_{op} \text{ of anode } + E^{\circ}_{RP \text{ of cathode}}$$

$$= 0.49 + 1.51 = 2.00\ V$$

At equilibrium

$$E_{cell} = 0,$$

$$E^{\circ}_{cell} = \frac{0.059}{n}\log K$$

(As per NCERT $\frac{RT}{F} = 0.059$ But $\frac{RT}{F} = 0.0591$ can also be taken.)

$$2 = \frac{0.059}{10}\log K$$

$$\log K = 338.98$$

Q4

Eq. of Ag = Eq. of O_2

Let x gm silver displaced, $\frac{x \times 1}{108} = \frac{5.6}{22.7} \times 4$

(Molar volume of gas at STP = 22.7 lit) x = 106.57gm

Ans. 107

OR, as per old STP data, molar volume $= 22.4$ lit

$\frac{x \times 1}{108} = \frac{5.6}{22.4} \times 4, x = 108 gm.$

Ans. 108

Q5

As tin coating is peeled off, then iron is exposed to atmosphere.

Q6

$2H^{+}_{(aq.)} + 2e^{-} \rightarrow H_2(g)$

$E_{cell} = E^0_{cell} - \frac{0.059}{2} \log \frac{P_{H_2}}{[H^+]^2}$

$= 0 - 0.059 \times 3 = -0.177$ volts. $= -17.7 \times 10^{-2}$ V.

Q7

$Zn^{+2} + 2e^{-} \longrightarrow Zn$

$W = Z \times i \times t$

$= \frac{65.4}{2 \times 96500} \times 0.015 \times 15 \times 60$

$= 45.75 \times 10^{-4} gm$

Q8

$\frac{W}{E} = \frac{\text{charge}}{1\ F}$

$\frac{1.314}{\frac{197}{3}} = \frac{Q}{1\ F}$

$Q = 2 \times 10^{-2}\ F$

Q9

Higher the value of $\oplus$ve SRP (Std. reduction potential) more is tendency to undergo reduction, so better is oxidising power of reactant.

Hence, ox. Power:- $BrO_4^- > IO_4^- > ClO_4^-$

Q10

Mn, Ni and Cd metals used in battery industries.

Q11

Conductivity of electrolytic cell is affected by concentration of electrolyte, nature of electrolyte and nature of solvent.

Q12

$Cu^{2+} + 2e^- \rightarrow Cu$

2 Faraday $\rightarrow$ 1 molCu

1 Faraday $\rightarrow$ 0.5 molCu deposit

$0.5 \text{ mol} = 0.5 \text{ g atom} = 5 \times 10^{-1}$

$x = 5$

Q13

Conductivity $\left(Sm^{-1}\right)$

$\left.\begin{matrix} 2.1 \times 10^3 \\ 1.2 \times 10 \\ 3.91 \\ 1 \times 10^3 \end{matrix}\right\}$ conductors at 298.15 K

1×10^{-16} Insulator at 298.15 K

$\left.\begin{matrix} 1.5 \times 10^{-2} \\ 1 \times 10^{-7} \end{matrix}\right\}$ Semiconductor at 298.15 K

Therefore number of conductors is 4.