

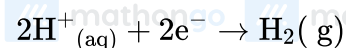
Questions with Answer Keys

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Q1 - 2024 (01 Feb Shift 1)

The potential for the given half cell at 298 K is

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



$[\text{H}^+] = 1\text{M}, P_{\text{H}_2} = 2\text{ atm}$

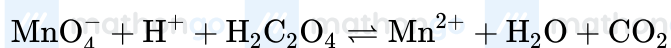
(Given: $2.303RT/F = 0.06\text{ V}, \log 2 = 0.3$)

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 _____ $\times 10^5\text{C}$.

Q3 - 2024 (01 Feb Shift 2)

Consider the following redox reaction :



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

$$E^\circ_{\text{MnO}_4^-/\text{Mn}^{2+}} = +1.51\text{ V}$$

$$E^\circ_{\text{CO}_2/\text{H}_2\text{C}_2\text{O}_4} = -0.49\text{ V}$$

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

Q4 - 2024 (27 Jan Shift 1)

The mass of silver (Molar mass of $\text{Ag} : 108\text{g mol}^{-1}$) 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.

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(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 $\text{pH} = 3$ at 25°C . The potential of the electrode will be -

$$\frac{\quad}{\quad} \times 10^{-2} \text{ V.}$$

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

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 $\quad \times 10^{-4} \text{ g}$.

(Atomic mass of zinc = 65.4 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 $\quad \times 10^{-2} \text{ F}$.

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

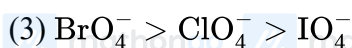
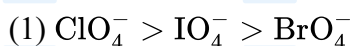
Q9 - 2024 (30 Jan Shift 2)

Reduction potential of ions are given below:

$$\text{ClO}_4^- \quad \text{IO}_4^- \quad \text{BrO}_4^-$$

$$E^\circ = 1.19 \text{ V} \quad E^\circ = 1.65 \text{ V} \quad E^\circ = 1.74 \text{ V}$$

The correct order of their oxidising power is:



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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 $x \times 10^{-1}$ 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 K in Sm^{-1} are 2.1×10^3 ,

1.0×10^{-16} , 1.2×10 , 3.91 , 1.5×10^{-2} ,

1×10^{-7} , 1.0×10^3 . The number of conductors among the materials is _____

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Questions with Answer Keys

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Answer Key

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Q1 (1) athongo /// ma **Q2** (2) o /// mathongo **Q3** (339) athongo /// ma **Q4** (108) /// mathongo

Q5 (1) athongo /// ma **Q6** (18) /// mathongo **Q7** (46) athongo /// ma **Q8** (2) o /// mathongo

Q9 (2) athongo /// ma **Q10** (1) /// mathongo **Q11** (2) athongo /// ma **Q12** (5) /// mathongo

Q13 (4) thongo /// mathongo /// mathongo /// mathongo /// mathongo /// mathongo

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Solutions

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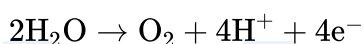
Q1

$$E = E_{\text{H}^+/\text{H}_2}^\circ - \frac{0.06}{2} \log \frac{P_{\text{H}_2}}{[\text{H}^+]^2}$$

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

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

Q2



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

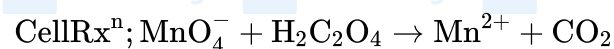
$$\text{mole} \times \text{n-factor} = \frac{Q}{96500}$$

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

$$Q = 2 \times 96500 \text{ C}$$

$$= 1.93 \times 10^5 \text{ C}$$

Q3



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

$$= 0.49 + 1.51 = 2.00 \text{ V}$$

At equilibrium

$$E_{\text{cell}} = 0,$$

$$E_{\text{cell}}^\circ = \frac{0.059}{n} \log K$$

(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 O₂

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

(Molar volume of gas at STP = 22.7 lit) $x = 106.57 \text{ gm}$

Ans. 107

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

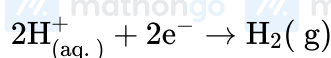
$$\frac{x \times 1}{108} = \frac{5.6}{22.4} \times 4, x = 108 \text{ gm.}$$

Ans. 108

Q5

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

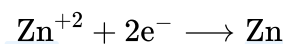
Q6



$$E_{\text{cell}} = E_{\text{cell}}^0 - \frac{0.059}{2} \log \frac{P_{\text{H}_2}}{[\text{H}^+]^2}$$

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

Q7



$$W = Z \times i \times t$$

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

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

Q8

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

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

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

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:- $\text{BrO}_4^- > \text{IO}_4^- > \text{ClO}_4^-$

Q10

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Solutions

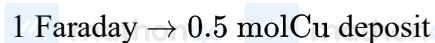
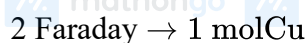
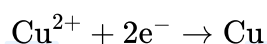
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Mn, Ni and Cd metals used in battery industries.

Q11

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

Q12



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

$$x = 5$$

Q13

Conductivity (Sm^{-1})

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

1×10^{-16} Insulator at 298.15 K

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

Therefore number of conductors is 4.

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