

Electrochemistry

Question1

The correct statement/s about Galvanic cell is/are

- (a) Current flows from cathode to anode
- (b) Anode is positive terminal
- (c) If $E_{\text{cell}} < 0$, then it is spontaneous reaction
- (d) Cathode is positive terminal

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Options:

- A. a and b only
- B. a, b and c
- C. a and d only
- D. b only

Answer: C

Solution:

The correct choice is **C: (a) and (d) only**. Here's why:

In a galvanic (voltaic) cell

The anode is where oxidation occurs and is the **negative** terminal.

The cathode is where reduction occurs and is the **positive** terminal.

⇒ (b) "Anode is positive" is false, (d) "Cathode is positive" is true.



Conventional current (flow of positive charge) goes **from cathode to anode** through the external circuit.

⇒ (a) is true.

A negative cell potential means the reaction is non-spontaneous:

$$E_{\text{cell}} < 0 \implies \text{non-spontaneous}$$

⇒ (c) is false.

Question2

The electronic conductance depends on

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Options:

- A. Nature of electrolyte added
- B. The number of valence electrons per atom
- C. Concentration of the electrolyte
- D. Size of the ions

Answer: B

Solution:

The electronic conductance is influenced by the number of valence electrons per atom, and this relationship is inversely proportional to temperature. The formula representing this relationship is:

$$\text{Electronic conductance} \propto \frac{\text{number of electrons per atom}}{\text{Temperature}}$$

This indicates that as the number of valence electrons increases, electronic conductance increases, but it decreases with rising temperature.

Question3

For a given half cell, $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$ on increasing of aluminium ion, the electrode potential will



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Options:

- A. Decrease
- B. No change
- C. First increase then decrease
- D. Increase

Answer: D

Solution:

For the half-cell reaction $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al(s)}$, consider the Nernst equation:

$$E_{\text{Red}} = E_{\text{Red}}^{\circ} - \frac{0.0591}{3} \log \frac{[\text{Al(s)}]}{[\text{Al}^{3+}]}$$

Since the active mass of a solid is constant and equal to 1, the equation simplifies to:

$$E_{\text{Red}} = E_{\text{Red}}^{\circ} - \frac{0.0591}{3} \log \frac{1}{[\text{Al}^{3+}]}$$

This further simplifies to:

$$E_{\text{Red}} = E_{\text{Red}}^{\circ} + \frac{0.0591}{3} \log [\text{Al}^{3+}]$$

From this equation, it's clear that E_{Red} is directly proportional to $[\text{Al}^{3+}]$. Thus, as the concentration of Al^{3+} increases, the electrode potential increases.

Question4

Match the following select the correct option for the quantity of electricity, in Cmol^{-1} required to deposit various metals at cathode



	List - I		List- II
a	Ag^+	i	386000Cmol^{-1}
b	Mg^{2+}	ii	289500Cmol^{-1}
c	Al^{3+}	iii	96500Cmol^{-1}
d	Ti^{4+}	iv	193000Cmol^{-1}

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Options:

A. a-ii,b-i,c-iv,d-iii

B. a – iii, b – iv, c – ii, d – i

C. a – iv, b – iii, c – i, d – ii

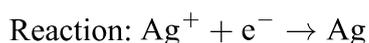
D. a-i,b-ii,c-iii,d-iv

Answer: B

Solution:

To determine the quantity of electricity required to deposit various metals at the cathode, we use Faraday's laws of electrolysis, where 1 Faraday (F) is equivalent to 96500 coulombs (C) per mole of electrons. Let's analyze each metal ion:

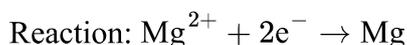
Silver (Ag^+):



$$\text{Calculation: } 1 \times 96500 \text{ C} = 96500 \text{ Cmol}^{-1}$$

Requires 1 Faraday per mole.

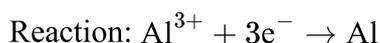
Magnesium (Mg^{2+}):



$$\text{Calculation: } 2 \times 96500 \text{ C} = 193000 \text{ Cmol}^{-1}$$

Requires 2 Faradays per mole.

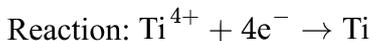
Aluminum (Al^{3+}):



$$\text{Calculation: } 3 \times 96500 \text{ C} = 289500 \text{ Cmol}^{-1}$$

Requires 3 Faradays per mole.

Titanium (Ti⁴⁺):



$$\text{Calculation: } 4 \times 96500 \text{ C} = 386000 \text{ Cmol}^{-1}$$

Requires 4 Faradays per mole.

The correct matches for the amounts of electricity required to deposit each metal are as follows:

Ag⁺ matches with 96500 Cmol⁻¹

Mg²⁺ matches with 193000 Cmol⁻¹

Al³⁺ matches with 289500 Cmol⁻¹

Ti⁴⁺ matches with 386000 Cmol⁻¹

Question5

How many coulombs are required to oxidise 0.1 mole of H₂O to oxygen?

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Options:

A. $1.93 \times 10^5 \text{ C}$

B. $1.93 \times 10^4 \text{ C}$

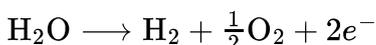
C. $3.86 \times 10^4 \text{ C}$

D. $9.65 \times 10^3 \text{ C}$

Answer: B

Solution:

The reaction involved is as follows



So, from the equation it is clear that 1 mole of H₂O required 2 Faradays = $2 \times 96500 \text{ C}$

So, 0.1 mole of H_2O will require

$$\begin{aligned} &= \frac{2 \times 96500 \times 0.1}{1} \\ &= 19300\text{C} \\ &= 1.93 \times 10^4\text{C}. \end{aligned}$$

Question6

A current of 3 A is passed through a molten calcium salt for 1 hr 47 min 13 s . The mass of calcium deposited is(Molar mass of $\text{Ca} = 40 \text{ g mol}^{-1}$)

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Options:

- A. 6.0 g
- B. 2.0 g
- C. 8.0 g
- D. 4.0 g

Answer: D

Solution:

Given,

$$t = 1 \text{ hr} 47 \text{ min} 13 \text{ sec} = 6433 \text{ seconds}$$

$$\text{Molar mass of Ca} = 40 \text{ g/mol}$$

$$\text{Current } (i) = 3A$$

$$\text{Mass of calcium deposited } (w) = ?$$

Using Faraday's 2nd law

$$w = zit \quad \dots (i)$$

$$\text{where, } z = \frac{M}{n \times 96500} = \frac{40}{2 \times 96500}$$

Substitute the value of Z and given values in equation (i)

$$W = \frac{40 \times 3 \times 6433}{2 \times 96500} = 3.99 \text{ g} \approx 4 \text{ g}$$

Question7

The value of ' A ' in the equation $\lambda_m = \lambda_m^\circ - A\sqrt{C}$ is same for the pair

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Options:

- A. NaCl and CaCl₂
- B. CaCl₂ and MgSO₄
- C. NaCl and KBr
- D. MgCl₂ and NaCl

Answer: C

Solution:

Among the given options, option containing NaCl and KBr will have same value of ' A '. It is because all electrolytes of a particular type i.e. here 1 – 1 electrolytes, have the same value of ' A '.

Question8

The resistance of 0.1 M weak acid HA in a conductivity cell is 2×10^3 Ohm. The cell constant of the cell is 0.78 C m^{-1} and λ_m° of acid HA is $390 \text{ S cm}^2 \text{ mol}^{-1}$. The pH of the solution is

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Options:



A. 3.3

B. 4.2

C. 5

D. 3

Answer: D

Solution:

Given, $C = 0.1 \text{ M}$

$$\Lambda_m^\circ = 390 \text{ S cm}^2 \text{ mol}^{-1}$$

$$R = 2 \times 10^3 \text{ ohm}$$

$$G^* = 0.78 \text{ cm}^{-1}$$

Now,

$$K = \frac{R}{G^*} = \frac{0.78}{2 \times 10^3} = 3.9 \times 10^{-4}$$

$$\Lambda_m^\circ = \frac{K \times 1000}{C} = \frac{3.9 \times 10^{-4} \times 1000}{0.1} = 3.9$$

$$\alpha = \frac{\Lambda_m}{\Lambda_m^\circ} = \frac{3.9}{390} = 10^{-2}$$

$$[\text{H}^+] = C \cdot \alpha = 0.1 \times 10^{-2} = 10^{-3}$$

$$\text{So, } \text{pH} = -\log 10^{-3} = 3$$

Question9

During the electrolysis of brine, by using inert electrodes,

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Options:

A. O_2 liberates at anode

B. H_2 liberates at anode

C. Na deposits on cathode

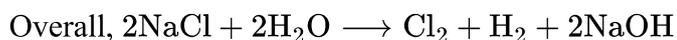
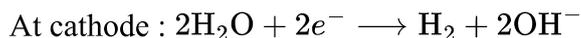
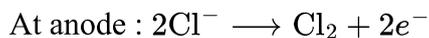


D. Cl_2 liberates at anode

Answer: D

Solution:

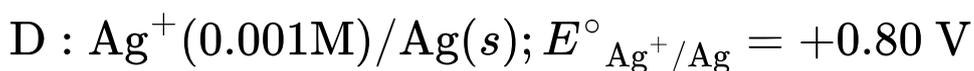
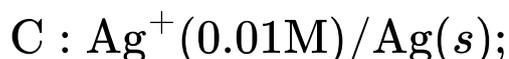
During electrolysis of brine using inert electrodes.



i.e. Cl_2 is produced at anode while H_2 is produced at cathode.

Question10

Consider the following 4 electrodes



Then reduction potential in volts of the electrodes in the order.

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Options:

A. $B > C > D > A$

B. $C > D > A > B$

C. $A > D > C > B$

D. $A > B > C > D$

Answer: A



Solution:

$$E_{\text{Ag}^+/\text{Ag}} = E_{\text{Ag}^+/\text{Ag}}^\circ + \frac{0.059}{n} \log [\text{Ag}^+]$$

According to this equation, as concentration of metal ion increases, reduction potential of metal electrode also increases i.e $E \propto$ concentration.

$\therefore B > C > D > A$

Question11

In fuel cells _____ are used as catalysts.

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Options:

- A. nickel-cadmium
- B. lead-manganese
- C. zinc-mercury
- D. platinum-palladium

Answer: D

Solution:

In fuel cells platinum-palladium are used as catalysts.

Question12

The molar conductivity is maximum for the solution of concentration

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Options:

- A. 0.002 M
- B. 0.005 M
- C. 0.001 M
- D. 0.004 M

Answer: C

Solution:

We know that,

$$\text{molar conductivity, } \Lambda_m = \frac{\kappa \times 1000}{M}$$

That means Λ_m is inversely proportional to the molarity. The solution which is less concentrated have maximum molar conductivity: Thus, among the given option 0.001 M has the maximum molar conductivity.

Question13

For spontaneity of a cell, which is correct?

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Options:

- A. $\Delta G = -ve, \Delta E = 0$
- B. $\Delta G = +ve, \Delta E = +ve$
- C. $\Delta G = -ve$
- D. $\Delta G = 0, \Delta E = 0$

Answer: C

Solution:

For spontaneity of a cell, the value of ΔG should be negative.



Question14

Specific conductance of 0.1 M HNO_3 is $6.3 \times 10^{-2} \text{ ohm}^{-1} \text{ cm}^{-1}$. The molar conductance of the solution is

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Options:

- A. $315 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$
- B. $6.300 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$
- C. $63.0 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$
- D. $630 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$

Answer: D

Solution:

Given, specific conductance,

$$k = 6.3 \times 10^{-2} \text{ ohm}^{-1} \text{ cm}^{-1}$$

HNO_3 concentration, $c = 0.1\text{M}$

$$\text{Molar conductance } \Lambda_m = \frac{\kappa \times 1000}{c}$$

$$= 6.3 \times 10^{-2} \times \frac{1000}{0.1} = 630 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$$

Question15

Consider the following electrodes



$E^\circ(\text{Zn}/\text{Zn}^{2+}) = -0.76 \text{ V}$ electrode potentials of the above electrodes in volts are in the order

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Options:

A. $P > S > R > Q$

B. $S > R > Q < P$

C. $Q > R > S > P$

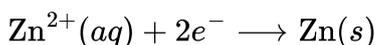
D. $P > Q > R > S$

Answer: C

Solution:

The standard potential of $\text{Zn} | \text{Zn}^{2+}$ half-cell = -0.76 V

Half-cell reaction,



$$E_{\text{red}} = E_{\text{red}}^0 - \frac{0.059}{n} \log \left[\frac{1}{\text{Zn}^{2+}} \right]$$

$$= -0.76 + \frac{0.059}{n} \log [\text{Zn}^{2+}]$$

Lower the concentration of Zn^{2+} , lower is the E_{red} or vice-versa.

Hence, the correct order is $Q > R > S > P$.

Question 16

The resistance of 0.01 m KCl solution at 298 K is 1500Ω . If the conductivity of 0.01 m KCl solution at 298 K is $0.1466 \times 10^{-3} \text{ S cm}^{-1}$. The cell constant of the conductivity cell in cm^{-1} is



KCET 2021

Options:

A. 0.219

B. 0.291

C. 0.301

D. 0.194

Answer: A

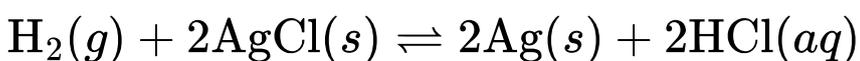
Solution:

Given, concentration of KCl solution = 0.01 m Resistance (R) of KCl solution = 1500Ω

Conductivity (K) of 0.01 mKCl solution at 298 K = $0.1466 \times 10^{-3} \text{ S cm}^{-1}$

$$\begin{aligned}\therefore \text{Cell constant } (G^*) &= KR \\ &= 0.1466 \times 10^{-3} \times 1500 \\ &= 0.219\end{aligned}$$

Question17



E_{cell}° at 25°C for the cell is 0.22 V. The equilibrium constant at 25°C is

KCET 2021

Options:

A. 2.8×10^7

B. 5.2×10^8

C. 2.8×10^5

D. 5.2×10^4



Answer: A

Solution:

For given reaction, E_{cell}° at $25^{\circ}\text{C} = 0.22\text{ V}$

At equilibrium,

$$E_{\text{cell}}^{\circ} = \frac{0.059}{n} \log K_C$$
$$\Rightarrow \log K_C = \frac{E_{\text{cell}}^{\circ} \times n}{0.059} = \frac{0.22 \times 2}{0.059} = 7.45$$
$$K_C = \text{antilog } 7.45$$
$$= 2.8 \times 10^7$$

Question18

The pair of electrolytes that possess same value for the constant (A) in the Debye-Huckel-Onsager equation, $\Lambda_m = \Lambda_m^{\circ} - A\sqrt{C}$ is

KCET 2020

Options:

- A. $\text{MgSO}_4, \text{NaSO}_4$
- B. $\text{NH}_4\text{Cl}, \text{NaBr}$
- C. $\text{NaBr}, \text{MgSO}_4$
- D. $\text{NaCl}, \text{CaCl}_2$

Answer: B

Solution:

$$\Lambda_m = \Lambda_m^{\circ} - A\sqrt{C}$$

Out of all the given pairs, the pair having same (similar) charges will possess the same value of A . Here, MgSO_4 and $\text{Na}_2\text{SO}_4 \rightarrow \text{Mg}^{2+}$ and Na^+

NH_4Cl and $\text{NaBr} \rightarrow \text{NH}_4^+$ and Na^+

NaBr and $\text{MgSO}_4 \rightarrow \text{Na}^+$ and Mg^{2+}

NaCl and $\text{CaCl}_2 \rightarrow \text{Na}^+$ and Ca^{2+}

So, only in NH_4Cl and NaBr , the charge is same on both the cations and hence, there will have same value of A .

Question 19

Given $E_{\text{Fe}^{3+}/\text{Fe}^{2+}}^{\circ} = +0.76 \text{ V}$ and $E_{\text{I}_2/\text{I}^-}^{\circ} = +0.55 \text{ V}$. The equilibrium constant for the reaction taking place in galvanic cell consisting of above two electrodes is $\left[\frac{2303RT}{F} = 0.06 \right]$

KCET 2020

Options:

A. 1×10^7

B. 1×10^9

C. 3×10^8

D. 5×10^{12}

Answer: A

Solution:

$$E_{\text{Fe}^{3+}/\text{Fe}^{2+}}^{\circ} = 0.76 \text{ V} \text{ and } E_{\text{I}_2/\text{I}^-}^{\circ} = 0.55 \text{ V}$$

$$K = ?$$

$$\text{Also } \frac{2.303RT}{F} = 0.06$$

Here, I_2/I^- will act as anode and $\text{Fe}^{3+}/\text{Fe}^{2+}$ will act as cathode.



Here, $n = 2$

$$E_{\text{cell}}^{\circ} = E_{\text{cathode}} - E_{\text{anode}} = 0.76 - 0.55 = +0.21$$

$$\begin{aligned} \Delta G^{\circ} &= -nFE_{\text{cell}}^{\circ} = -2(96500) \times 0.21 \\ &= -40530 \text{ J} \end{aligned}$$

Also, $\Delta G = -2.303RT \log K_c$

$$\begin{aligned}\text{So, } \log K_c &= \frac{\Delta G}{-\left(\frac{2303RT}{F}\right) \times F} \\ &= \frac{+40530}{-(0.06) \times 96500} = \frac{40530}{5790} \\ \log K_c &= 7 \\ K_c &= 1 \times 10^7\end{aligned}$$

Question20

If an aqueous solution of NaF is electrolysed between inert electrodes, the product obtained at anode is

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Options:

A. F₂

B. H₂

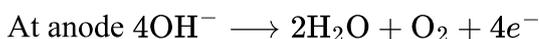
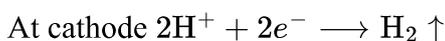
C. Na

D. O₂

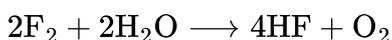
Answer: D

Solution:

Aqueous NaF, when electrolysed between inert electrodes we always get O₂ at anode, as:



Also, if any fluorine is liberated, that too reacts with H₂O.



So, ultimate product is oxygen.



Question21

One litre solution of MgCl_2 is electrolysed completely by passing a current of 1 A for 16 min 5 sec. The original concentration of MgCl_2 solution was (Atomic mass of Mg = 24)

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Options:

A. $5 \times 10^{-3}\text{M}$

B. $5 \times 10^{-2}\text{M}$

C. $0.5 \times 10^{-3}\text{M}$

D. $1.0 \times 10^{-2}\text{M}$

Answer: A

Solution:

Given, current = 1 A

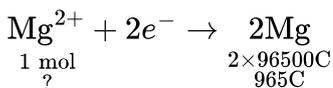
Time, $t = 16 \text{ min } 5 \text{ s}$

$$= 16 \times 60 + 5 = 965 \text{ sec}$$

Quantity of charge passed = current \times time

$$= 1 \times 965\text{C} = 965\text{C}$$

Chemical reaction involved during the electrolysis of MgCl_2 is



$2 \times 96500\text{C}$ generated from 1 mole of Mg^{2+}

$$\begin{aligned} \therefore 965\text{C generate} &= \frac{965}{2 \times 96500} = \frac{1}{200} \\ &= 5 \times 10^{-3}\text{M} \end{aligned}$$



Question22

An aqueous solution of CuSO_4 is subjected to electrolysis using inert electrodes. The pH of the solution will

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Options:

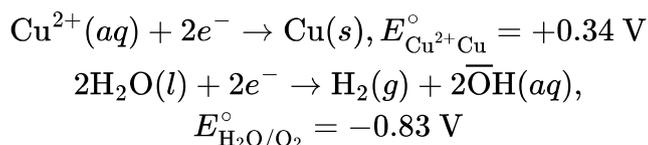
- A. increase
- B. remains unchanged
- C. decrease
- D. increase or decrease depending on the strength of the current

Answer: C

Solution:

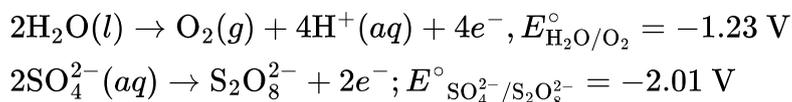
In aqueous solution of CuSO_4 , the ions present in solution are Cu^{2+} , SO_4^{2-} , H^+ and OH^\ominus . Possible reaction that can occur are as follows

At Cathode



Due to high value of $E_{\text{Cu}^{2+}/\text{Cu}}^\circ$, Cu is released at cathode.

At anode



Due to high value of $E_{\text{H}_2\text{O}/\text{O}_2}^\circ$, O_2 is liberated at anode. The aqueous solution of CuSO_4 will become acidic (due to the presence of H^+ ions) after electrolysis. As a result, pH of the solution will decrease.

Question23

Give $E_{\text{Mn}^{+7}|\text{Mn}^{+2}}^0 = 1.5 \text{ V}$ and $E_{\text{Mn}^{+4}|\text{Mn}^{+2}}^0 = 1.2 \text{ V}$, then $E_{\text{Mn}^{+7}|\text{Mn}^{+4}}^0$ is

KCET 2019

Options:

A. 0.3 V

B. 0.1 V

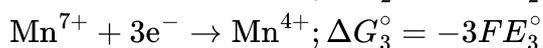
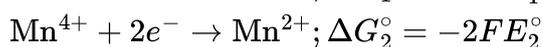
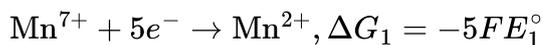
C. 1.7 V

D. 2.1 V

Answer: C

Solution:

Key Idea E° cannot be found out by direct additive process. To find the value of unknown E° , we use the formula, $\Delta G = -nFE^\circ$



$$\Delta G_3^\circ = \Delta G_1^\circ - \Delta G_2^\circ - 3FE_3^\circ = -5FE_1^\circ + 2FE_2^\circ$$

$$\begin{aligned} E_3^\circ &= \frac{5E_1^\circ - 2E_2^\circ}{3} = \frac{5 \times 1.5 - 2 \times 1.2}{3} \\ &= \frac{7.5 - 2.4}{3} \text{ V} = 1.7 \text{ V} \end{aligned}$$

Question24

Addition of excess of AgNO_3 to an aqueous solution of 1 mole of $\text{PdCl}_2 \cdot 4\text{NH}_3$ gives 2 moles of AgCl . The conductivity of this solution corresponds to

KCET 2019

Options:

A. 1 : 1 electrolyte



B. 1 : 3 electrolyte

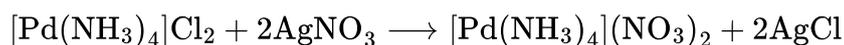
C. 1 : 2 electrolyte

D. 1 : 4 electrolyte

Answer: C

Solution:

Formation of two moles of AgCl with excess of AgNO₃ shows that at least two Cl⁻ ions are present outside the coordination sphere. Thus, the formula of the complex is [Pd(NH₃)₄]Cl₂. The two Cl⁻ ions present outside the coordination sphere is precipitated by 2 moles of AgNO₃. The reaction involved is as follows:



So, the conductivity of this solution corresponds to 1 : 2 electrolyte.

Question25

The charge required for the reduction of 1 mol of MnO₄⁻ to MnO₂ is

KCET 2018

Options:

A. 1 F

B. 3F

C. 5 F

D. 7F

Answer: B

Solution:

To determine the charge required, we need to find how many electrons are involved in the reduction process.

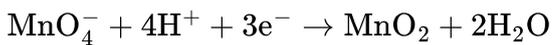
In the permanganate ion (MnO₄⁻), manganese is in the oxidation state +7.

In manganese dioxide (MnO₂), manganese is in the oxidation state +4.

The change in oxidation state per manganese atom is from +7 to +4, which means a reduction by 3 electrons.

The balanced half-reaction in acidic medium is:





Since each mole of electrons carries a charge of 1 Faraday (F), reducing 1 mole of MnO_4^- requires 3 moles of electrons, or 3 F.

Thus, the correct answer is:

Option B: 3 F

Question 26

At a particular temperature, the ratio of molar conductance of specific conductance of 0.01 M NaCl solution is

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Options:

A. $10^5 \text{ cm}^3 \text{ mol}^{-1}$

B. $10^3 \text{ cm}^3 \text{ mol}^{-1}$

C. $10 \text{ cm}^3 \text{ mol}^{-1}$

D. $10^5 \text{ cm}^3 \text{ mol}^{-1}$

Answer: A

Solution:

To solve this, let's start by recalling the relationship between molar conductance (Λ_m) and specific conductance (κ) for a solution.

Molar conductance is defined as the conductivity of the solution multiplied by the volume (in cm^3) that contains one mole of the electrolyte. Mathematically, when the concentration (C) is given in moles per liter (M), we have:

$$\Lambda_m = \frac{\kappa \times 1000}{C}$$

For a 0.01 M NaCl solution, substitute $C = 0.01$ into the formula:

$$\Lambda_m = \frac{\kappa \times 1000}{0.01} = \kappa \times 10^5$$

This shows that the ratio of molar conductance to specific conductance is:

$$\frac{\Lambda_m}{\kappa} = 10^5 \text{ cm}^3 \text{ mol}^{-1}$$

Thus, the correct option is:

Option A: $10^5 \text{ cm}^3 \text{ mol}^{-1}$

Question27

Which of the following is not a conductor of electricity?

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Options:

A. Solid NaCl

B. Cu

C. Fused NaCl

D. Brine solution

Answer: A

Solution:

The correct answer is Option A: Solid NaCl.

Here's why:

Solid NaCl:

In its solid form, NaCl is arranged in a crystal lattice where the sodium (Na^+) and chloride (Cl^-) ions are fixed in place.

Because the ions cannot move freely, solid NaCl does not conduct electricity.

Copper (Cu):

Copper is a metal with free electrons, making it an excellent conductor of electricity.

Fused (molten) NaCl:

When NaCl is melted, the ions are free to move.

The mobility of these ions allows the molten salt to conduct electricity.

Brine Solution:

A brine solution is salt dissolved in water.

In solution, the ions dissociate and move freely, which enables the solution to conduct electricity.

Therefore, among the given options, only solid NaCl does not conduct electricity.



Question28

For a cell involving two electron changes, $E_{\text{cell}}^{\circ} = 0.3 \text{ V}$ at 25°C .
The equilibrium constant of the reaction is

KCET 2018

Options:

- A. 10^{-10}
- B. 3×10^{-2}
- C. 10
- D. 10^{10}

Answer: D

Solution:

At 25°C (which is 298 K):

$$E^{\circ} = \frac{0.0591}{n} \log K$$

Given that:

$n = 2$ (number of electrons exchanged)

$$E_{\text{cell}}^{\circ} = 0.3 \text{ V}$$

We calculate $\log K$ as follows:

$$\log K = E^{\circ} \times \frac{n}{0.0591} = 0.3 \times \frac{2}{0.0591}$$

$$\log K = 10.1 \approx 10$$

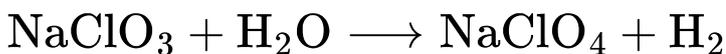
Thus, the equilibrium constant K is:

$$K = 10^{10}$$

Therefore, the equilibrium constant for the reaction is 10^{10} .

Question29

By passing electric current, NaClO_3 is converted in to NaClO_4 according to the following equation



How many moles of NaClO_4 will be formed when three Faradays of charges is passed through NaClO_3 ?

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Options:

A. 3.0

B. 1.5

C. 0.75

D. 1.0

Answer: B

Solution:

To convert NaClO_3 to NaClO_4 using electric current, the reaction is given by:



Here, the oxidation states change from:

NaClO_3 with chlorine at (+5 oxidation state)

to NaClO_4 with chlorine at (+7 oxidation state).

This means that for every NaClO_3 molecule converted to NaClO_4 , 2 moles of electrons are involved (as two electrons are required to change the oxidation state from +5 to +7).

According to the reaction stoichiometry:

2 Faradays of charge are needed to provide 2 moles of electrons.

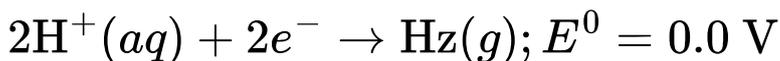
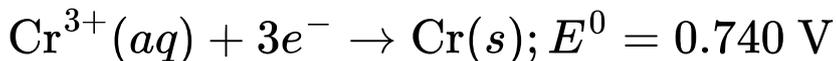
Therefore, when 3 Faradays of charge are passed, the moles of electrons supplied will be:

$$\text{Moles of electrons} = \frac{3}{2} = 1.5$$

Hence, 1.5 moles of NaClO_4 will be formed.

Question30

The standard reduction potential at 298 K for the following half cell reaction



Which of the following is strongest reducing agent?

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Options:

A. Zn(s)

B. Cr(s)

C. H₂(g)

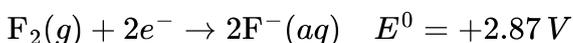
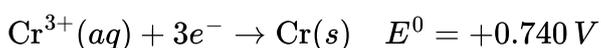
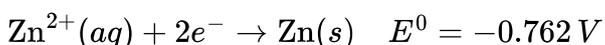
D. F₂(g)

Answer: A

Solution:

To determine the strongest reducing agent, we need to consider which species can most easily donate electrons (i.e., be oxidized). The given standard reduction potentials are for the reactions written as reductions. A lower (more negative) standard reduction potential indicates that the reaction is less favorable in the reduction direction, which means the reverse (oxidation) reaction is more favorable. In other words, such a substance is more willing to lose electrons, making it a stronger reducing agent.

Let's look at the available half-reactions and their standard reduction potentials:



Now, analyze each option:

Zn(s):

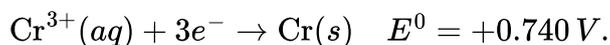
The reduction potential of $\text{Zn}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Zn}(\text{s})$ is -0.762 V .

When reversed to oxidation (i.e., $\text{Zn}(\text{s}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^{-}$), the potential becomes $+0.762 \text{ V}$.

A more negative reduction potential (or a higher oxidation potential) means Zn(s) is more willing to lose electrons and is therefore a strong reducing agent.

Cr(s):

The reduction reaction for chromium is:



Reversing this would yield an oxidation potential of -0.740 V , indicating that Cr(s) is less readily oxidized than Zn(s).

H₂(g):

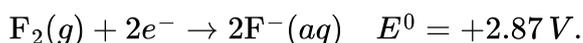
The reduction reaction for hydrogen is:



Its oxidation potential (reversing the reaction) is 0.0 V , which is higher than Cr(s) but still less favorable compared to Zn(s).

F₂(g):

The reduction reaction for fluorine is:



Reversing this reaction gives an oxidation potential of -2.87 V .

However, a very high reduction potential indicates that F₂(g) is a strong oxidizing agent, not a reducing agent.

Given these comparisons, Zn(s) has the most negative standard reduction potential, meaning that it is the easiest to oxidize. Hence, Zn(s) is the strongest reducing agent among the options provided.

The answer is:

Option A: Zn(s).

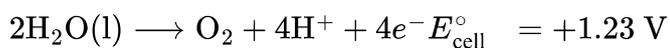
Question31

In the electrolysis of aqueous sodium chloride solution, which of the half cell reaction will occur at anode?

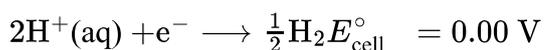
KCET 2017

Options:

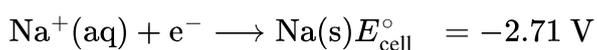
A.



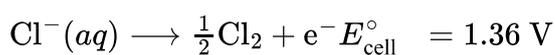
B.



C.



D.



Answer: D

Solution:

During electrolysis of aqueous

