PREVIOUS YEARS' QUESTIONS — EXERCISE-II

1. A gas X at 1 atm is bubbled through a solution containing a mixture of 1 M Y and 1 M Z at 25°C. If the reduction potential of Z > Y > X, then **[JEE 1999]**

(1) Y will oxidise X and not Z
(2) Y will oxidise Z and X
(3) Y will oxidise both X and Z
(4) Y will reduce both X and Z.

2. For the electrochemical cell, M | M^+ || X^- | X, $E^\circ(M^+|M) = 0.44$ V and $E^\circ(X|X^-) = 0.33$V. From this data, one can deduce that **[JEE 2000]**

(1) $M + X \longrightarrow M^+ + X^-$ is the spontaneous reaction
(2) $M^+ + X^- \longrightarrow M + X$ is the spontaneous reaction
(3) $E_{cell} = 0.77$ V
(4) $E_{cell} = -0.77$ V

3. Saturated solution of KNO_3 is used to make salt bridge because **[JEE 2001]**

(1) velocity of K^+ is greater than that of NO_3^-
(2) velocity of NO_3^- is greater than that of K^+
(3) velocities of both K^+ and NO_3^- are nearly the same
(4) KNO_3 is highly soluble in water

4. In the electrolytic cell, flow of electrons is from: **[JEE 2003]**

(1) Cathode to anode in solution
(2) Cathode to anode through external supply
(3) Cathode to anode through internal supply
(4) Anode to cathode through internal supply.

5. Find the equilibrium constant at 298 K for the reaction,

$$Cu^{2+}(aq) + In^{2+}(aq) \rightleftharpoons Cu^{+}(aq) + In^{3+}(aq)$$

Given that

$$E^\circ_{Cu^{2+}|Cu^+} = 0.15\text{V},\quad E^\circ_{In^{3+}|In^+} = -0.42\text{V},$$

$$E^\circ_{In^{2+}|In^+} = -0.40\text{V}$$ **[JEE 2004]**

(1) 10^4 (2) 10^6 (3) 10^8 (4) 10^{10}

6. Zn | Zn^{2+} (a = 0.1M) || Fe^{2+} (a = 0.01M) | Fe. The emf of the above cell is 0.2905 V. Equilibrium constant for the cell reaction is **[JEE 2004]**

(1) $10^{0.32/0.0591}$ (2) $10^{0.32/0.0295}$
(3) $10^{0.26/0.0295}$ (4) $e^{0.32/0.295}$

7. The half cell reactions for rusting of iron are:

$$2H^+ + \frac{1}{2}O_2 + 2e^- \longrightarrow H_2O;\ E^0 = +1.23\text{ V},$$

$$Fe^{2+} + 2e^- \longrightarrow Fe;\ E^0 = -0.44\text{ V}$$

ΔG^0 (in kJ) for the reaction is: **[JEE 2005]**

(1) –76 (2) –322 (3) –122 (4) –176

8. The molar conductivities, Λ^0_{NaOAc} and Λ^0_{HCl} at infinite dilution in water at 25°C are 91.0 and 426.2 S cm^2/mol respectively. To calculate Λ^0_{HOAc} the additional value required is : **[AIEEE 2006]**

(1) KCl (2) NaOH (3) NaCl (4) H_2O

9. Resistance of a conductivity cell filled with a solution of an electrolyte of concentration 0.1M is 100Ω. The conductivity of this solution is 1.29 Sm^{-1}. Resistance of the same cell when filled with 0.02M of the same solution is 520Ω. The molar conductivity of 0.02M solution of the electrolyte will be. **[AIEEE 2006]**

(1) 124×10^{-4} $Sm^2\ mol^{-1}$
(2) 1240×10^{-4} $Sm^2\ mol^{-1}$
(3) 1.24×10^{4} $Sm^2\ mol^{-1}$
(4) 12.4×10^{-4} $Sm^2\ mol^{-1}$

10. Given the data at 25°C,

$Ag_{(s)} + I^-_{(aq)} \rightarrow AgI_{(s)} + e^-$, $E^\circ = 0.152$V
$Ag_{(s)} \rightarrow Ag^+_{(aq)} + e^-$, $E^\circ = -0.800$ V

What is the value of log K_{sp} for AgI ?
(Where K_{sp}= solubility product)

$$\left(2.303\frac{RT}{F} = 0.059\text{V}\right)$$ **[AIEEE 2006]**

(1) –8.12 (2) +8.612 (3) –37.83 (4) –16.13

Paragraph for Questions 11 to 12

The concentration of potassium ions inside a biological cell is at least twenty times higher than the outside. The resulting potential difference across the cell is important in several processes such as transmission of nerve impulses and maintaining the ion balance. A simple model for such a concentration cell involving a metal M is :
M(s) | M^+(aq ; 0.05 molar) || M^+(aq ; 1 molar) | M(s)
For the above electrolytic cell the magnitude of the cell potential $|E_{cell}|$ = 70 mV. **[JEE 2010]**

11. For the above cell :-

(1) $E_{cell} < 0$; $\Delta G > 0$ (2) $E_{cell} > 0$; $\Delta G < 0$
(3) $E_{cell} < 0$; $\Delta G^0 > 0$ (4) $E_{cell} > 0$; $\Delta G^0 < 0$

12. If the 0.05 molar solution of M^+ is replaced by a 0.0025 molar M^+ solution, then the magnitude of the cell potential would be :-

(1) 35 mV (2) 70 mV
(3) 140 mV (4) 700 mV

13. Resistance of 0.2 M solution of an electrolyte is 50 Ω. The specific conductance of the solution is 1.3 S m^{-1}. If resistance of the 0.4M solution of the same electrolyte is 260 Ω, its molar conductivity is:- **[AIEEE 2011]**

(1) 6250 S m^2 mol^{-1}

(2) 6.25×10^{-4} S m^2 mol^{-1}

(3) 625×10^{-4} S m^2 mol^{-1}

(4) 62.5 S m^2 mol^{-1}

14. The reduction potential of hydrogen half-cell will be negative if :- **[AIEEE 2011]**

(1) $p(H_2)$ = 2 atm $[H^+]$ = 1.0 M

(2) $p(H_2)$ = 2 atm and $[H^+]$ = 2.0 M

(3) $p(H_2)$ = 1 atm and $[H^+]$ = 2.0 M

(4) $p(H_2)$ = 1 atm and $[H^+]$ = 1.0 M

15. Consider the following cell reaction :

$$2Fe_{(s)} + O_{2(g)} + 4H^+_{(aq)} \rightarrow 2Fe^{2+}_{(a)} + 2H_2O(\ell) \quad E° = 1.67\ V$$

At $[Fe^{2+}] = 10^{-3}$ M, $P(O_2)$ = 0.1 atm and pH = 3, the cell potential at 25°C is - **[JEE 2011]**

(1) 1.47 V (2) 1.77 V

(3) 1.87 V (4) 1.57 V

16. The standard reduction potentials for Zn^{2+} | Zn, Ni^{2+} | Ni and Fe^{2+} | Fe are – 0.76, – 0.23 and – 0.44 V respectively. The reaction $X + Y^{+2} \rightarrow X^{2+} + Y$ will be spontaneous when **[AIEEE 2012]**

(1) X = Zn, Y = Ni (2) X = Ni, Y = Fe

(3) X = Ni, Y = Zn (4) X = Fe, Y = Zn

17. Given : **[JEE-MAINS 2013]**

$$E^0_{Cr^{3+}/Cr} = -0.74\ V \quad ; \quad E^0_{MnO_4^-/Mn^{2+}} = 1.51\ V$$

$$E^0_{Cr_2O_7^{2-}/Cr^{3+}} = 1.33\ V \quad ; \quad E^0_{Cl/Cl^-} = 1.36\ V$$

Based on the data given above, strongest oxidising agent will be :

(1) Cl^- (2) Cr^{3+} (3) Mn^{2+} (4) MnO_4^-

18. Resistance of 0.2 M solution of an electrolyte is 50 Ω. The specific conductance of the solution is 1.4 S m^{-1}. The resistance of 0.5 M solution of the same electrolyte is 280 Ω. The molar conductivity of 0.5 M solution of the electrolyte in S m^2 mol^{-1} is : **[JEE-MAINS 2014]**

(1) 5×10^3 (2) 5×10^2

(3) 5×10^{-4} (4) 5×10^{-3}

19. At 298 K, the standard reduction potentials are 1.51 V for MnO_4^- | Mn^{2+}, 1.36 V for Cl_2 | Cl^-, 1.07 V for Br_2 | Br^-, and 0.54 V for I_2 | I^-. At pH = 3, permanganate is expected to oxidize $\left(\frac{RT}{F} = 0.059\ V\right)$:- **[JEE-MAINS (ONLINE) 2015]**

(1) Cl^- and Br^- (2) Cl^-, Br^- and I^-

(3) Br^- and I^- (4) I^- only

20. A variable, opposite external potential (E_{ext}) is applied to the cell Zn | Zn^{2+} (1 M) || Cu^{2+} (1 M) | Cu, of potential 1.1 V. When E_{ext} < 1.1 V and E_{ext} > 1.1 V, respectively electrons flow from : **[JEE-MAINS (ONLINE) 2015]**

(1) anode to cathode in both cases

(2) anode to cathode and cathode to anode

(3) cathode to anode in both cases

(4) cathode to anode and anode to cathode

21. What will occur if a block of copper metal is dropped into a beaker containing a solution of 1M $ZnSO_4$ **[JEE-MAINS (ONLINE) 2016]**

(1) The copper metal will dissolve and zinc metal will be deposited

(2) No reaction will occur

(3) The copper metal will dissolve with evolution of oxygen gas

(4) The copper metal will dissolve with evolution of hydrogen gas

22. Oxidation of succinate ion produces ethylene and carbon dioxide gases. On passing 0.2 Faraday electricity through on aqueous solution of potassium succinate, the total volume of gases (at both cathode and anode) at STP (1 atm and 273 K) is : **[JEE-MAINS (ONLINE) 2016]**

(1) 8.96 L (2) 2.24 L

(3) 4.48 L (4) 6.72 L

23. For the following electrochemical cell at 298K,

Pt(s) | H_2(g, 1bar) | H^+ (aq, 1M) || M^{4+}(a), M^{2+}(a) | Pt(s)

$$E_{cell} = 0.092\ V \text{ when } \frac{[M^{2+}(aq.)]}{[M^{4+}(aq.)]} = 10^x$$

$$\text{Given : } E^0_{M^{4+}/M^{2+}} = 0.151V ; 2.303\frac{RT}{F} = 0.059\ V$$

The value of x is - **[JEE-Adv. 2016]**

(1) –2 (2) –1 (3) 1 (4) 2

24. Given [JEE-MAINS - 2017]

$E^o_{Cl_2/Cl^-} = 1.36\,V, E^o_{Cr^{3+}/Cr} = -0.74\,V$

$E^o_{Cr_2O_7^{2-}/Cr^{3+}} = 1.33\,V, E^o_{MnO_4^-/Mn^{2+}} = 1.51\,V$.

Among the following, the strongest reducing agent is

(1) Cr (2) Mn^{2+} (3) Cr^{3+} (4) Cl^-

25. What is the standard reduction potential (E°) for $Fe^{3+} \rightarrow Fe$? [JEE-MAINS (ONLINE) 2017]

Given that :

$Fe^{2+} + 2e^- \rightarrow Fe$; $E^o_{Fe^{2+}/Fe} = -0.47\,V$

$Fe^{3+} + e^- \rightarrow Fe^{2+}$; $E^o_{Fe^{3+}/Fe^{2+}} = +0.77\,V$

(1) +0.30 V (2) +0.057 V
(3) –0.057 V (4) –0.30 V

26. To find the standard potential of M^{3+} | M electrode, the following cell is constituted:

Pt | M | M^{3+}(0.001 mol L^{-1}) | Ag^+(0.01 mol L^{-1}) | Ag

The emf of the cell is found to be 0.421 volt at 298 K. The standard potential of half reaction $M^{3+} + 3e^- \rightarrow M$ at 298 K will be:

[JEE-MAINS (ONLINE) 2017]

(Given $E^{\ominus}_{Ag^+/Ag}$ at 298 K = 0.80 Volt)

(1) +0.30 V (2) +0.057 V
(3) –0.057 V (4) –0.30 V

27. How long (approximate) should water be electrolysed by passing through 100 amperes current so that the oxygen released can completely burn 27.66 g of diborane ?

[JEE-MAINS (OFFLINE) 2017]

(Atomic weight of B = 10.8 u)

(1) 0.8 hours (2) 3.2 hours
(3) 1.6 hours (4) 6.4 hours

28. For the following cell : [JEE-Adv. 2017]

Zn(s) | $ZnSO_4$ (aq.) | | $CuSO_4$ (aq.) | Cu(s)

when the concentration of Zn^{2+} is 10 times the concentration of Cu^{2+} , the expression for ΔG (in J mol^{-1}) is

[F is Faraday constant , R is gas constant, T is temperature , E°(cell) = 1.1V]

(1) 2.303 RT + 1.1F (2) 2.303 RT – 2.2F
(3) 1.1 F (4) –2.2 F

29 When an electric current is passed through acidified water, 112 mL of hydrogen gas at N.T.P. was collected at the catode in 965 seconds. The current passed, in ampere, is : [JEE-MAINS (ONLINE) 2018]

(1) 2.0 (2) 1.0
(3) 0.1 (4) 0.5

30. When 9.65 ampere current was passed for 1.0 hour into nitrobenzene in acidic medium, the amount of p-aminophenol produced is :-

[JEE-MAINS (ONLINE) 2018]

(1) 10.9 g (2) 98.1 g
(3) 109.0 g (4) 9.81 g

PREVIOUS YEARS QUESTIONS				ANSWER KEY					Exercise-II
Que.	1	2	3	4	5	6	7	8	9	10
Ans.	1	2	3	3	4	2	2	3	1	4
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	2	3	2	1	4	1	4	4	3	2
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	2	1	4	1	3	2	2	2	2	4