

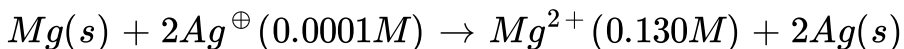
CHEMISTRY

NCERT - NCERT CHEMISTRY(ENGLISH)

ELECTROCHEMISTRY

Solved Examples

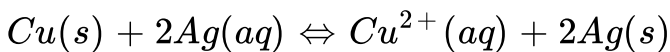
1. Represent the cell in which following reaction takes place :



calculate its E_{cell} if $E^{\ominus}_{.cell} = 3.17V$.

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2. Calculate the equilibrium constant of the reaction :



$$E^{c-}_{cell} = 0.46V$$



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3. The standard electrode potential for Daniell cell is 1.1V.

Calculate the standard Gibbs energy for the reaction.



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4. The resistance of a conductivity cell filled with 0.1M KCl solution is 100Ω. If R of the same cell when filled with 0.02M KCl solution is 520Ω, calculate the conductivity and molar

conductivity of $0.02M KCl$ solution. The conductivity of $0.1M KCl$ solution is $1.29 S m^{-1}$.



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5. The electrical resistance of a column of $0.05M NaOH$ solution of diameter $1cm$ and length $50cm$ is $5.55 \times 10^3 ohm$. Calculate its resistivity, conductivity, and molar conductivity.



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6. The molar conductivity of KCl solutions at different concentration at $298K$ are given below :

$C / mol L^{-1}$	$\Lambda_m / S cm^2 mol^{-1}$
0.000198	148.61
0.000309	148.29
0.000521	147.81
0.000987	143.09

Show that a plot between Λ_m and $C^{1/2}$ is a straight line.

Determine the values of Λ_m^0 and Λ for KCl.



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7. Λ_m° for $CaCl_2$ and $MgSO_4$ from the given data.

$$\lambda_{Ca^{2+}}^\circ = 119.0 \text{ Scm}^2 \text{ mol}^{-1} \text{ ltr. } \lambda_{Cl^-}^\circ = 76.3 \text{ Scm}^2 \text{ mol}^{-1}$$

$$\lambda_{Mg^{2+}}^\circ = 106.0 \text{ Scm}^2 \text{ mol}^{-1}$$

$$\lambda_{SO_4^{2-}}^\circ = 160.0 \text{ cm}^2 \text{ mol}^{-1}$$



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8. Λ_m° for $NaCl$, HCl , and $NaAc$ are 126.4, 425.9, and $91.0 \text{ Scm}^2 \text{ mol}^{-1}$, respectively. Calculate Λ° for HAc .



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9. The conductivity of $0.001028M$ acetic acid is $4.95 \times 10^{-5} S cm^{-1}$. Calculate dissociation constant if Λ_m° for acetic acid is $390.5 S cm^2 mol^{-1}$.

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10. A solution of $CuSO_4$ is electrolyzed for 10 min with a current of $1.5A$. What is the mass of Cu deposited at the cathode? [Atomic mass of $Cu = 63g$]

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Exercise

1. How would you determine the standard reduction potential of the system $Mg^{2+} | Mg$?



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2. Can you store $CuSO_4$ solution in Zn pot ?



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3. Consult the table of standard electrode potential and suggest three substances that can oxidize Fe^{2+} ions under suitable conditions.



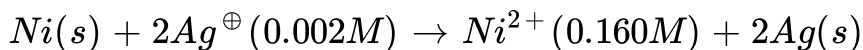
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4. Calculate the potential of hydrogen electrode in contact with a solution whose $pH = 10$.



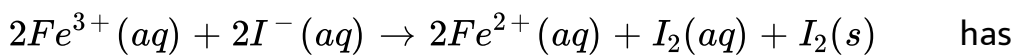
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5. Calculate the EMF of the cell in which the following reaction takes place :



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6. The cell in which the following reaction occurs



$$E_{cell}^0 = 0.236V \text{ at } 298 \text{ K.}$$

Calculate the standard gibbs energy and the equilibrium constant of the cell reaction.



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7. Why does the conductivity of a solution decreases with dilution ?



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8. Suggest a way to determine Λ_m° value of water.



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9. The molar conductivity of 0.25 mol L^{-1} methanoic acid is $46.1 \text{ Scm}^2 \text{ mol}^{-1}$. Calculate the degree of dissociation constant.

Given : $\lambda_{(H^\oplus)}^\circ = 349.6 \text{ Scm}^2 \text{ mol}^{-1}$ and

$\lambda_{HCOO^-}^\circ = 54.6 \text{ Scm}^2 \text{ mol}^{-1}$



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10. If a current of 0.5 A flows through a metallic wire for 2 hours, then how many electrons would flow through the wire ?



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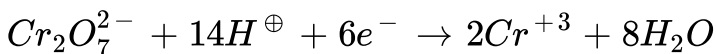
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11. Suggest a list of metals that are extracted electrolytically.



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12. Consider the reaction :



What is the quantity of electricity in coulombs needed to reduce
1mole of $Cr_2O_7^{2-}$?



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13. Write the Chemistry of recharging of lead storage battery highlighting all the materials that are involved during recharging.



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14. Suggest two materials other than hydrogen that can be used as fuels in fuel cells.

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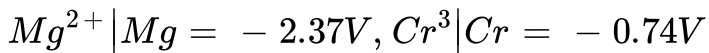
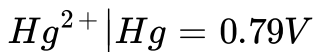
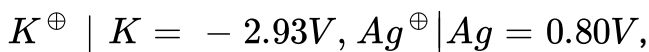
15. Explain how rusting of iron is envisaged as setting up of an electrochemical cell.

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16. Arrange the following metals in the order in which they displace each other from the solution of their salts.
Al, Cu, Fe, Mg, and Zn.

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17. Given standard electrode potentials

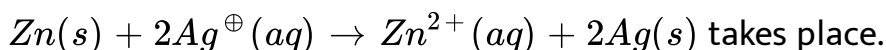


Arrange these metals in their increasing order of reducing power.



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18. Depict the galvanic cell in which the reaction :



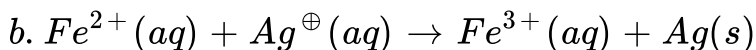
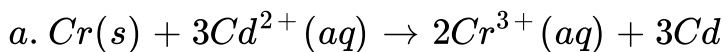
Further show :

- Which of the electrode is negatively charged ?
- The carriers of the current in the cell.
- Individual reaction at each electrode.



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19. Calculate the standard cell potentials of galvanic cell in which the following reactions take place :

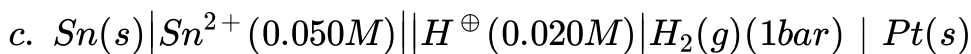
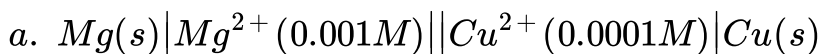


Calculate the $\Delta_r G^{\circ}$ and equilibrium constant of the reactions .

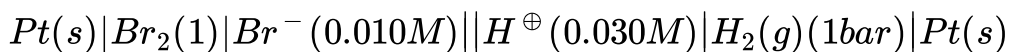


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20. Write the Nernst equation and EMF of the following cells at $298K$:

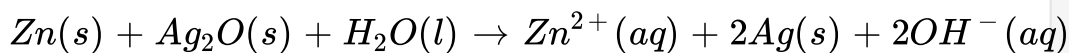


d.



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21. In the button cells widely used in watches and other devices the following reaction takes place :



Determine $\Delta_r G^\circ$ and E° for the reaction.



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22. Define conductivity and molar conductivity for the solution of an electrolyte. Discuss their variation with concentration.



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23. The conductivity of $0.20M$ solution of KCl at $298K$ is $0.0248 S cm^{-1}$. Calculate its molar conductivity.



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24. The resistance of a conductivity cell containing $0.001M KCl$ solution at $298K$ is 1500Ω . What is the cell constant if conductivity of $0.001M KCl$ solution at $298K$ is $0.146 \times 10^{-3} S cm^{-1}$.

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25. The conductivity of sodium Chloride at $298K$ has been determined at different concentrations and the results are given below :

<i>Concentration(M)</i> :	0.001	0.010	0.020	0.050	0.100
$10^2 \times k(Sm^{-1})$:	1.237	11.85	23.15	55.53	106.74

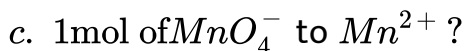
Calculate Λ_m for all concentrations and draw a plot between Λ_m and $c^{1/2}$. Find the value of Λ_m° .

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26. The conductivity of $0.00241M$ acetic acid is $7.896 \times 10^{-5} S cm^{-1}$. Calculate its molar conductivity. If Λ_m° for acetic acid is $390.5 S cm^2 mol^{-1}$, what is its dissociation constant ?

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27. How much Charge is required for the following reductions :



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28. How much electricity in terms of Faraday is required to produce.

a. 20.0g of Ca from molten $CaCl_2$

b. 40g of Al from molten Al_2O_3

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29. How much electricity is required in coulomb for the oxidation of :

(a) 1 mol of H_2O to O_2 ,

(b) 1 mole of FeO to Fe_2O_3 ?

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30. A solution of $Ni(NO_3)_2$ is electrolyzed between platinum electrodes using a current of 5A for 20min. What mass of Ni is

deposited at the cathode ?



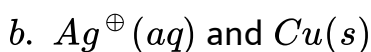
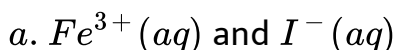
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31. Three electrolytic cell A , B , and C containing solutions of $ZnSO_4$, $AgNO_3$, and $CuSO_4$, respectively, are connected in series. A steady current of $1.5A$ was passed through them until $1.45g$ of silver deposited at the cathode of cell B . How long did the current flow ? What mass of copper and zinc were deposited ?



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32. Using the standard electrode potentials given in the electrode potential series, predict if the reaction between the following is feasible:



c. $Fe^{3+}(aq)$ and $Br^{-}(aq)$

d. $Ag(s)$ and $Fe^{3+}(aq)$

e. $Br_2(aq)$ and $Fe^{2+}(aq)$.



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33. Predict the products of electrolysis in each of the following :

a. An aqueous solution of $AgNO_3$ with silver electrodes.

b. An aqueous solution of $AgNO_3$ with platinum electrodes,

c. A dilute solution of H_2SO_4 with platinum electrodes.

d. An aqueous solution of $CuCl_2$ with platinum electrodes.



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