



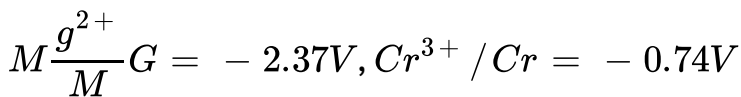
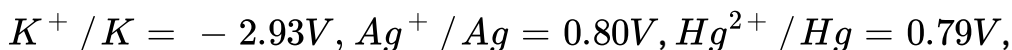
CHEMISTRY

BOOKS - R G PUBLICATION

ELECTROCHEMISTRY

Exercise

1. Given the standard electrode potential value of some metals



Arrange these metals in their increasing order of reducing power.



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2. State Kohlrausch law of independent migration of ions.

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3. What is a primary battery? Give one example.

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4. How much H_2 in grams will be liberated if 1F electricity is passed through acidic-fied water?

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5. Name one substance other than hydrogen that can be used for constructing fuel cells.

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6. Define standard electrode potential.

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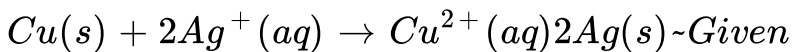
7. The measured emf of the cell-

$Pt(s) | H_2(g, 1\text{atm}) | H^+(aq, 1M) || Cu^{2+}(aq, 1M) | Cu(s)$ is $0.34V$.

What is the standard electrode potential of the half cell corresponding to the reaction?

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8. Calculate the equilibrium constant of the following reaction at 298K.



$$E_{\text{cell}}^{\Theta} = 0.46V$$



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



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10. A current of 1.50A was passed through an electrolytic cell containing $AgNO_3$ solution with inert electrodes. The mass of silver deposited to cathode was 1.50g. How long did the current flow? (atomic mass of Ag = 108u, $1F = 96500C$).



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11. Three electrolytic cells A, B and C containing electrolytes $ZnSO_4$, $AgNO_3$ and $CuSO_4$ respectively were connected in series. A steady current of 1.5A was passed through them. 1.45g Ag were deposited at the cathode of cell B. How long did the current flow?(Atomic mass of Cu = 63.5u, Zn = 65.3u, Ag = 108u.)



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12. Three electrolytic cells A, B and C containing electrolytes $ZnSO_4$, $AgNO_3$ and $CuSO_4$ respectively were connected in series. A steady current of 1.5A was passed through them. 1.45g Ag were deposited at the cathode of cell B. What mass of copper and zinc were deposited? (Atomic mass of Cu = 63.5u, Zn = 65.3u, Ag = 108u.)



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13. How do you explain with the help of graph, the increase in the value of molar conductivity with dilution in case of strong and weak electrolyte?



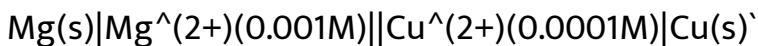
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14. Depict the Galvanic cell in which the reaction takes place as follows: $Zn(s) + 2Ag^+(aq) \rightarrow Zn^{2+} + 2Ag(s)$ Individual reaction at each electrode.



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15. Write the Nernst equation of the following cell



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16. Define molar conductivity of an electrolytic solution. How does molar conductivity vary with concentration for weak electrolyte?



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17. The limiting molar conductances of sodium chloride, hydrochloric acid and sodium acetate are 126.45, 426.16 and $91.0\text{Scm}^2\text{mol}^{-1}$ respectively at 298K. Calculate the limiting molar conductance of acetic acid at 298K.

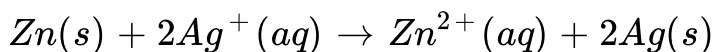


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18. What is corrosion? Give two measures for the prevention of corrosions of metals.

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19. Represent the cell with cell reaction-



Calculate the emf of the cell at 298K if the molar concentration of Ag^+ and Zn^{2+} ions in the half cells are 0.10 mol dm^{-3} and 0.01 mol dm^{-3} respectively. Given that $E^\circ \text{Ag}^+ / \text{Ag} = 0.80\text{V}$ and $E^\circ \text{Zn}^{2+} / \text{Zn} = -0.76\text{V}$,

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20. A current of 0.50 ampere is passed for 30 minutes through a voltameter containing copper sulphate solution. Calculate the mass of Cu deposited at the cathode. Given that atomic mass of Cu is 63.0amu.

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21. Define molar conductivity of an electrolytic solution

Show the variation of molar conductivity of a strong electrolyte with square root of concentration.

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22. Three electrolytic cells A, B and C containing electrolytes $ZnSO_4$, $AgNO_3$ and $CuSO_4$ respectively were connected in

series. A steady current of 1.5A was passed through them. 1.45g Ag were deposited at the cathode of cell B. How long did the current flow?(Atomic mass of Cu = 63.5u, Zn = 65.3u, Ag = 108u.)

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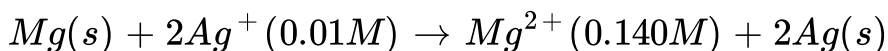
23. Three electrolytic cells A, B and C containing electrolytes $ZnSO_4$, $AgNO_3$ and $CuSO_4$ respectively were connected in series. A steady current of 1.5A was passed through them. 1.45g Ag were deposited at the cathode of cell B. What mass of copper and zinc were deposited? (Atomic mass of Cu = 63.5u, Zn = 65.3u, Ag = 108u.)

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24. The limiting molar conductances of sodium chloride, hydrochloric acid and sodium acetate are 126.45, 426.16 and $91.0 \text{ S cm}^2 \text{ mol}^{-1}$ respectively at 298K. Calculate the limiting molar conductance of acetic acid at 298K.

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25. Represent the cell in which the following reaction takes place.



Write the Nernst equation and calculate the emf of the cell at 298K. Given $E_{cell}^{\ominus} = 3.17V$

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26. What is battery? Give one example each of primary battery and secondary battery.



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27. Which is true for a galvanic cell?

- A. Total electric potential is equal to 1.0 volt.
- B. Cathode is Zn rod & anode is Cu rod.
- C. The cell reaction takes place in the same container
- D. The current flows from positive terminal to negative terminal

Answer:



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28. An electrolyte.

- A. Forms complex ions in solution
- B. Gives ions only when electricity is passed.
- C. Possesses ions even in solid state.
- D. Gives ions when dissolved in water.

Answer:



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29. If a salt bridge is removed between the two half cells, the voltage

- A. Drops to zero.

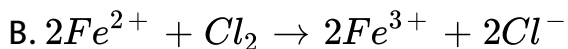
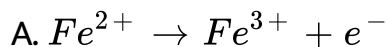
- B. Does not change
- C. Increased gradually
- D. Increases rapidly

Answer:



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30. Which of the following is a redox reaction?



Answer:



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31. When a metal rod C is dipped in an aqueous solution of a metal D (having concentration 1M for D^{2+} ion) at $25^\circ C$ the standard electrode potentials are $C^{2+}/C = -0.76$ volts. $D^{2+}/D = +0.34$ volts.

- A. C will not dissolve
- B. D will deposit on C
- C. NO reaction is possible
- D. Water will decompose into H_2 & O_2 .

Answer:



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32. The standard hydrogen electrode has zero electrode potential because.

- A. Hydrogen is easily oxidised.
- B. Its electrode potential is assumed to be zero
- C. Hydrogen atoms has only one electron
- D. Hydrogen is the lightest element

Answer:



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33. The potential developed at the electrode electrolyte interface is due to.

- A. Irreversible reaction taking place at the metal surface and the electrolyte.
- B. Separation of charges across the metal solution interface.
- C. The electrode surface acquires positive charge due to liberation of electrons towards solution
- D. None of the above.

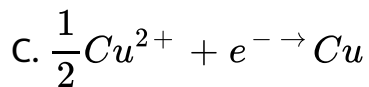
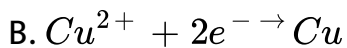
Answer:



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34. The standard potential of Cu/Cu^{2+} electrode = -3.34V. It corresponds to the reaction





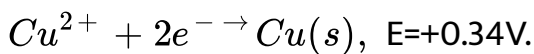
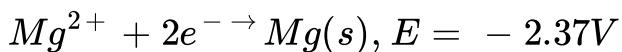
D. None of the above.

Answer:



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35. The electrode potentials for the two half cell reaction is given below. Determine emf



A. $- 2.03V$

B. $1.36V$

C. $2.7 V$

D. 2.03 V

Answer:



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36. The hydrogen electrode is dipped in a solution of $\text{pH} = 3$ at 25°C . The potential of the cell is given by.

A. 0.177V

B. -0.177V

C. 0.087V

D. 0.059V

Answer:



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37. Strong electrolytes are those which.

- A. Dissolve readily in water.
- B. Conduct electricity,
- C. Dissociate into ions at high dilution.
- D. Completely dissociate into ions at all dilution.

Answer:



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38. The molar conductivity of a strong electrolyte.

- A. Increases on dilution.
- B. Does not change considerable on dilution.

C. Decrease on dilution.

D. Depends on density

Answer:



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39. On which of the following factors the conductivity of electronic conductor does not depend,

A. Nature of the material

B. Surrounding pressure.

C. Number of valence electrons per atoms.

D. Temperature,

Answer:

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40. In the measurement of the conductivity of electrolyte DC is not used because.

- A. Dc current cannot initiate the reaction
- B. DC current cannot be controlled.
- C. It changes the composition of solution.
- D. None of the above.

Answer:

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41. The SI unit of specific conductivity is.

A. m^{-1}

B. S.m.

C. mS^{-1}

D. Sm^{-1}

Answer:



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42. The molar conductivity of weak electrolyte at infinite dilution can be determined by

A. Increasing the volume of solution only

B. Decreasing the temperature

C. Kohlrausch law of independent migration of ions

D. Calculating degree of dissociation only

Answer:



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43. The amount of ion discharged during electrolysis is not directly proportional to.

A. Resistance

B. Time

C. Current

D. Chemical equivalent of the ion,

Answer:



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44. On the electrolysis of aqueous solution of Na_2SO_4 on cathode, we get

A. Na

B. H_2

C. SO_2

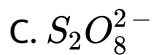
D. SO_3

Answer:



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45. When concentrated sulphuric acid is electrolysed the main product at the anode

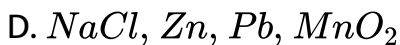
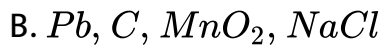
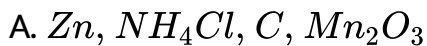


Answer:



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46. The main components of Leclanche cell are



Answer:



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47. As a lead storage battery is charged.

- A. Lead dioxide dissolves.
- B. Sulphuric acid is regenerated
- C. The lead electrode become coated with lead sulphate
- D. The amount of sulphuric acid decreases.

Answer:



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48. Hydrogen oxygen fuel cells are used in space craft to supply.

A. Power for heat & light

B. Power for pressure

C. Oxygen

D. Water

Answer:



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49. Fill in the blanks

Maximum electric work done by electro chemical cell is given by the expression -



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50. Fill in the blanks

Cell constant of a conductivity cell = $_ _ \times _ _$



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51. What is galvanic cell?



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52. What is the function of salt bridge?



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53. Define standard electrode potential.



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54. Write the half cell reactions of Daniel cell.

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55. A cell is formed by two electrodes Cu & Ag. Write the cell representation.

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56. What is hydrogen electrode?

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57. Why Cu does not dissolve in HCl.



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58. What is inert electrode? Give one example.



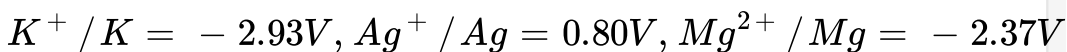
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59. Standard reduction potential of Li atom is -3.05 volt. What do you mean,



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60. Given the standard electrode potentials.



. Arrange these metals in their decreasing order of oxidising power.

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61. Write the relationship between standard electrode potential and equilibrium constant (K_c).

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62. Given

$$Fe^{2+} / Fe(s) = -0.44V, Ag^+ / Ag(s) = +0.80V.$$

Calculate total emf of the cell.

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63. The $E_{M^{2+}/M}^\ominus$ for copper positive (+0.34V) It is only metal in the first series of transition elements showing this type of

behaviour. Explain.



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64. Define resistivity and conductivity.



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65. Write the SI unit of conductance and conductivity.



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66. Give one example of semiconductor.



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67. Define molar conductivity of an electrolytic solution. How does molar conductivity vary with concentration for weak electrolyte?



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68. Can you store copper sulphate solutions in a zinc pot?



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69. Amount of charge carried by one mole electron is equal to



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70. Two boxes of volume $1m^3$ & $2m^3$ respectively are filled with electrolytic solution containing 1 mole electrolyte in each box. What do you say about specific conductance and molar conductance in each box?

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71. Give one example each from 2-1,2-2 type electrolytes.

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72. State Kohlrausch law of independent migration of ions.

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73. Calculate the amount of electricity required to deposit 1 mol Cu atom at the cathode.



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74. Give two examples of metal which are extracted electrolytically.



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75. What is a primary battery? Give one example.



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76. What type of battery is used in invertors? Gived one example.



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77. Write the overall reaction of a fuel cell.



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78. Write the formula of rust.



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79. Give one example each of the surface coating agent and sacrificial metal.



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80. Suggest a method to determine the conductance of water at infinite dilution.



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81. Why is a salt bridge not needed in a lead storage battery?



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82. In Daniell cell, what will be the observation if the externally applied cell potential is more than 1.1V?



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83. Why it is not possible to determine the absolute value of potential of a single electrode?

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84. Why does an alkaline medium inhibit the rusting of iron?

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85. Why does a dry cell become dead after a long time even if it has not been used?

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86. Ag_2O is reduced to Ag by means of H_2 but MgO is not.

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87. Calculate the potential of hydrogen electrode in contact with a solution whose P^H is 10.

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88. Why is equilibrium constant K related to only E_{cell}° and not E_{cell} ?

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89. What is the effect of an increase in concentration of zinc ions on the electrode potential of zinc electrode for which E° equals to $-0.76V$.

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90. Why a mercury cell gives a constant voltage throughout its life?

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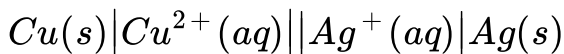
91. Draw the level diagram of a Daniell cell.

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92. What is salt bridge? Why is it used in electrochemical cell?

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93. A cell is represented in the following way.

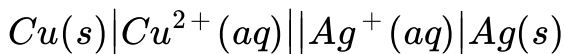


Write the half cell reactions.



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94. A cell is represented in the following way.

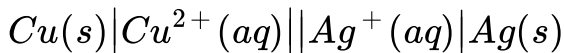


Which electrode acts as anode?



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95. A cell is represented in the following way.



name the electrolytes required for the above cell.

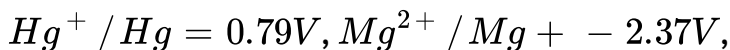
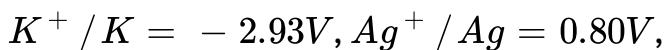


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96. How would you determine the standard electrode potential of the system Mg^{2+} / Mg ?

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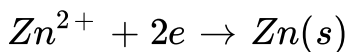
97. Given the standard electrode potential value of some metals.



$Cr^{3+} / Cr = -0.74V$. Arrange these metals in their increasing order of reducing power.

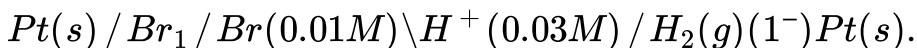
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98. Write the Nernst equation for the following cell.



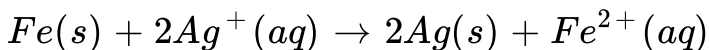
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99. Determine the e.m.f of the following cell at 298 K.



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100. Calculate the equilibrium constant for the following reaction.



$$E_{\text{Fe}^{2+}/\text{Fe}}^\circ = -0.44V, E_{\text{Ag}^+/\text{Ag}}^\circ = +0.80V.$$

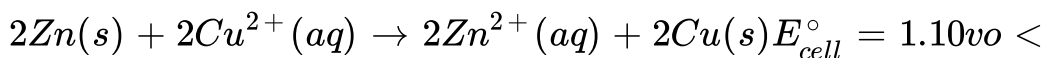


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101. How will you calculate pH using Hydrogen electrode?

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102. The cell in which the following reaction occur.



at 298K. Calculate the standard Gibbs energy and the equilibrium constant.

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103. What is conductivity. Write its SI unit.

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104. Write four factors on which conductivity of electrolytic solution depends.

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105. What is cell constant? How is it determined?

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106. What is molar conductivity? How it is differ from specific conductivity?

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107. The conductivity of 0.20M solution of KCL at 298K is 0.0248 S cm^{-1} , Calculate its molar conductivity.



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108. What is limiting molar conductivity? Discuss the variation of molar conductivity of a strong electrolyte with concentration.



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109. State Kohlrausch law of independent migration of ions.



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110. On which factors the variation of the molar conductivity of weak electrolyte with dilution depend? How Kohlrausch law is useful in determining the limiting molar conductivity of a weak electrolyte?

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111. Show that $K_a = \frac{C \Lambda_m^2}{\Lambda_m^0 (\Lambda_m^0 - \Lambda_m)}$

Where $K_a \rightarrow$ dissociation constant of weak acid $C \rightarrow$
Concentration

$\Lambda_m \rightarrow$ molar conductivity at any concentration

$\Lambda_m^0 \rightarrow$ molar conductivity at infinite dilution

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112. The limiting molar conductances of sodium chloride, hydrochloric acid and sodium acetate are 126.45, 426.16 and $91.0 \text{ Scm}^2 \text{ mol}^{-1}$ respectively at 298K. Calculate the limiting molar conductance of acetic acid at 298K.

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113. Why does the conductivity of a solution decrease with dilution?

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114. Conductivity of 0.00241 M acetic acid is $7.896 \times 10^{-5} \text{ Scm}^{-1}$. Calculate its molar conductivity and what is its dissociation constant?



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115. Predict the products of electrolysis in each of the following.

An aqueous solution of $AgNO_3$ with silver electrode.

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116. Predict the products of electrolysis in each of the following.

A dilute solution of H_2SO_4 with platinum electrode.

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117. Predict the products of electrolysis in each of the following.

A dilute solution of $NaCl$ with platinum electrode.

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118. What is Faraday? Show that 1 Faraday=96487C.

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119. Consider the reaction:

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$ what is the quantity of electricity in coulombs needed to reduce 1 mol of $Cr_2O_7^{2-}$?

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120. How much electricity in terms of Faraday is required to produce 20g of Ca from molten $CaCl_2$?

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121. Write the full cell reaction taking place in Laclanche cell.

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122. Write short note on lead storage battery.

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123. What is corrosion? Write the electrode reactions of rusting.

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124. One half-cell in a voltaic cell is constructed from a silver wire dipped in silver nitrate solution of unknoww concentration.

It other half cell consists of a zinc electrode dipping in 1.0M

solution of $Zn(NO_3)_2$. A voltage of 1.48V is measure for this cell. Use this information to calculate the concentration of silver nitrate solution used

$$\left(E_{Zn^{2+}/Zn}^0 = -0.76V, E_{Ag^+/Ag}^0 = +0.80V \right)$$

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125. Conductivity of $2.5 \times 10^{-4}M$ methanoic acid is $5.25 \times 10^{-5}Scm^{-1}$. Calculate its molar conductivity and degree of dissociation (Given $\lambda^\circ(H^+) = 349.5Scm^2mol^{-1}$ and $\lambda^\circ(HCOO) = 50.5Scm^2mol^{-1}$)

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126. A zinc rod is dipped in 0.1M *sol* of $ZnSO_4$. The sald is 95% dissociated at this dilution at 298K. Calculate the electrode

potential.

$$\left(E_{Zn^{2+} / Zn}^{\circ} = -0.76V \right)$$

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127. How many moles of mercury will be produced by electrolysing 1.0M $Hg(NO_3)_2$. Solution with a current of 2.00A for 3 hours? (molar mass of $Hg(NO_3)_2 = 200.6 \text{ g mol}^{-1}$).

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128. Which of the following pairs will have greater conduction ?

0,1M acetic acid solution or 1m acetic acid solution.

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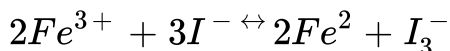
129. Which of the following pairs will have greater conduction ?

0.1M NaCl solution at $25^{\circ}C$ and 0.1M NaCl solution at $50^{\circ}C$.



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130. Calculate the equilibrium constant for the reaction.



The standard reduction potentials in acidic conditions are 0.77V and 0.54V respectively for Fe^{3+} / Fe^{2+} and I_3^{-} / I^{-} couples.



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131. Calculate the electrode potential of a copper electrode dipped in 0.1M solution of copper sulphate at $25^{\circ}C$. (Given E° for Cu is +0.34V at 298K)

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132. Write Debye-Huckel-Onsagar equation what do different symbols signify?

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133. Consider the reaction:
$$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$$
 what is the quantity of electricity in coulombs needed to reduce 1 mol of $Cr_2O_7^{2-}$?

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134. The conductivity of 0.001M acetic acid is $4 \times 10^{-2} S/m$. Calculate the dissociation constant of acetic acid if λ_m° for acetic

acid is $390\text{Scm}^2\text{mol}^{-1}$.

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135. What is a Nickel-Cadmium cell? State its one merit and one demerit over lead storage cell. Write the over all reactions that occurs during discharging of this cell.

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136. A copper silver cell is set up. The copper ion concentration is 0.10M . The concentration of silver ion is not known. The cell potential when measured was 0.422V . Determine the concentration of silver ions in the cell. (Given)

$$E_{\text{Ag}^{2+}/\text{Ag}}^{\circ} = +0.80\text{V}, E_{\text{Cu}^{2+}/\text{Cu}}^{\circ} = +0.34\text{V}$$

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137. Corrosion is essentially an electro chemical phenomenon.

Explain the reactions occurring during corrosion of iron kept in an open atmosphere.



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