



CHEMISTRY

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ELECTROCHEMISTRY

Examples

1. Salt bridge is used because it_____.



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2. The standard Hydrogen electrode potential is zero, because

A. It has been measured accurately.

B. it has been defined that way.

C. there Is no potential difference between electrode and solution.

D. none of these

Answer:



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3. It is Impossible to measure the actual voltage of any half cell by itself”.

State whether this statement Is true or false



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4. Corrosion Is basically

A. Qlycosidic interaction

B. Reaction with water

C. Presence of heavy metal

D. Electrochemical reactions

Answer:



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5. Which is not a primary cell?

- A. Leclanche cell
- B. Mercury cell
- C. Lead storage cell
- D. None of these

Answer:



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6. During the discharge In the case of lead storage batteries density of sulphuric acid _____.



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7. When 1 coulomb of charge is passed through electrolyte solution, then the mass deposited is equal to

- A. Electrochemical equivalent
- B. Chemical equivalent
- C. Atomic weight
- D. Equivalent weight

Answer:



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8. Electrolysis of aqueous HCl solution produces

- A. H_2 gas at the anode
- B. H_2 gas at the cathode
- C. Cl_2 gas at the anode

D. Cl_2 gas at the cathode

Answer:



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9. The conductivity of strong electrolyte is

- A. Decrease on dilution
- B. Does not change with dilution
- C. Increase on dilution
- D. None of these

Answer:



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10. Which of the following is the best reducing agent in aqueous solution ?

- A. Li
- B. Cs
- C. Rb
- D. K

Answer:



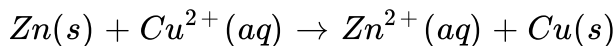
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11. Observe the relationship between the first two terms and fill in the blanks Strong electrolyte : NaOH, Weak electrolyte ____.



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12. Represent the galvanic cell in which the reaction is:



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13. _____ is the ratio of distance between electrodes and area of cross-section.



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14. Choose the correctly matched pair.

A. Nickel-cadmium cell secondary cell

B. Lead-storage cell : Primary cell

C. Daniel cell : Secondary cell

D.

Answer:



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15. _____ is the process in which metal is oxidised by loss of electrons



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16. Write the relationship between Gibb's free energy and EMF of cell is.



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17. Name the process of coating zinc over Iron so as to protect It from rusting



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18. What type of a battery is lead storage battery ?



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19. In lead storage battery_____as cathode.



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20. _____cells makes use of fuel but does not create pollution.



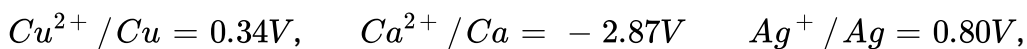
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21. Identify the anode and cathode In a dry cell.



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22. Some standard electrode potentials at 298K are given below.



$Na^{+} / Na = - 2.71$. Write the order of metals in the decreasing order of their reducing power with proper justification.

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23. NH_4OH is a weak electrolyte whose $\lambda^\circ m$ can be found using $\lambda^\circ m$ of NH_4Cl , $NaCl$ and $NaOH$ or by using $\lambda^\circ m$ of NH_4NO_3 , KNO_3 , and KOH . Similarly of weak electrolyte CH_3COOH can be found using strong electrolytes. Give two sets of electrolytes which can be used to find $\lambda^\circ m$ of CH_3COOH .

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24. NH_4OH is a weak electrolyte whose $\lambda^\circ m$ can be found using $\lambda^\circ m$ of NH_4Cl , $NaCl$ and $NaOH$ or by using $\lambda^\circ m$ of NH_4NO_3 , KNO_3 , and KOH . Similarly of weak electrolyte CH_3COOH can be found using strong electrolytes. Give two sets of electrolytes which can be used to find $\lambda^\circ m$ of CH_3COOH .

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25. Predict the product of electrolysis In each of the following: An aqueous solution of copper sulphate with platinum electrodes.



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26. Predict the product of electrolysis In each of the following: An aqueous solution of sodium chloride.



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27. Conductivity of ionic solutions are measured by using conductivity cell In Wheatstone bridge arrangement: What do you meant by cell constant?



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28. Conductivity of ionic solutions are measured by using conductivity cell In Wheatstone bridge arrangement:How is cell constant related to

conductivity?



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29. Conductance of an electrolyte depends upon temperature of electrolyte and concentration of the electrolytes. Classify the following into strong and weak electrolyte. KOH , CH_3COOH , NaCl , NH_4OH .



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30. Conductance of an electrolyte depends upon temperature of electrolyte and concentration of the electrolytes. What happens to the molar conductivity of an electrolyte solution when diluted with water? Justify your answer.



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31. Why does the voltage from mercury cell becomes constant?



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32. In Appollo space programme the fuel cells are used not only for electric power but also for prepare H_2O for drinking. What do-you understand by a fuel cell? What are the advantages of fuel cells over ordinary cells?



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33. A small Industry produces Al metal by the electrolysis of_____.



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34. Conductivity of 0.00241 M acetic acid Is $7.896 \times 10^{-5} \text{ Scm}^{-1}$. Calculate Its molar conductivity. If $\lambda^\circ m$ for acetic acid Is $390.5 \text{ Scm}^2 \text{ mol}^{-1}$, what Is Its dissociation constant?



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35. Why does the voltage from mercury cell becomes constant?



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36. Two metals P and Q have reduction potentials of -0.44 V and $+0.77\text{ V}$ respectively. Which metal can liberate hydrogen from dilute acids ?



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37. Scientists suggest the use of fuel cells as an alternative to conventional fossil fuels. Give the anodic and cathodic reactions of $H_2 - O_2$ fuel cell.



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38. Scientists suggest the use of fuel cells as an alternative to conventional fossil fuels. Draw and label the diagram of this cell.

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39. The cell reaction for a galvanic cell is $Ni_s + 2Ag_{aq}^+ \rightarrow Ni_{aq}^{2+} + 2Ag_s$. Represent that galvanic cell.

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40. Calculate the emf of the cell at 298K
 $E_{Ni^{2+}/Ni}^0 = -0.25V$ and $E_{Ag^+/Ag}^0 = +0.80V$.

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41. Ramu found that an iron sample in contact with sand is corroded. What is corrosion?

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42. Ramu found that an iron sample in contact with sand is corroded. It is found that alkaline medium inhibits the rusting of iron. Explain.

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43. Write two Important applications of electrochemical series.

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44. Write the anodic and cathodic reactions when SHE is used as a reference electrode.

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45. Iron Is galvanised for protecting It from rusting. Galvanised Iron is not used for making food containers. Why ?

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46. Iron can be protected by coating with copper or tin. But if the coating is broken, iron corrodes faster than it does in the absence of Cu or tin. Why?



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47. A student in a view to obtain sodium metal at the cathode, carried out the electrolysis of NaCl solution. He did not get sodium at the cathode, instead he got two gases at the electrodes. _____ gas produced at each electrode.



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48. A student in a view to obtain sodium metal at the cathode, carried out the electrolysis of NaCl solution. He did not get sodium at the cathode, instead he got two gases at the electrodes. Why he did not get Sodium?



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49. A car battery is made of lead plate dipping into sulphuric acid (Lead Accumulator). It can be recharged. Is there any change in the concentration of H_2SO_4 during discharging and recharging the cell?



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50. A car battery is made of lead plate dipping into sulphuric acid (Lead Accumulator). It can be recharged. When the battery is used a reaction takes place. Identify the change to this reaction when the battery is recharged and represent the reactions at the anode of the cell.



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51. Nernst equation describes the variation of electrode potential with concentration and temperature. Write cell reaction, overall reaction and calculate e.m.f at $25^\circ C$ for the cell. Also write Nernst equation for the cell

potential. $Mg / Mg^{2+}_{10^{-3}M} / Ag^{+}_{0.1M} / Ag$ Given $E^0_{Mg^{2+} / Mg} = 2.37V$

$$E^0_{Ag^{+} / Mg} = 0.8V.$$



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52. State the Faraday's laws of electrolysis



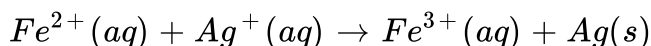
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53. Calculate the quantity of electricity required to deposit 0.09 g of Aluminium during the following electrode reaction. $Al^{3+} + 3e^{-} \rightarrow Al$.



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54. Calculate the standard cell potentials of galvanic cell. Also calculate ΔG^0 and equilibrium constant of the following cell, reaction.



$$E^0_{Ag^{+} / Ag} = 0.80V, E^0_{Fe^{3+} / Fe^{2+}} = 0.77V.$$



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55. Is the effect of dilution on the molar conductance of strong and weak electrolytes the same?



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56. Kohlrausch's law is useful for determining λ_m° of weak electrolytes. The molar conductance at infinite dilution for CH_3COONa , HCl and $NaCl$ are 91, 426.2 and $126.5 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$ respectively at 298K. Calculate the molar conductance of acetic acid at infinite dilution.



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57. Kohlrausch's law is useful for determining λ_m° of weak electrolytes. The molar conductance of 0.3 M acetic acid is $176.6 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$. Calculate its degree of dissociation if molar conductance at infinite dilution is $384 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$.



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58. Galvanic cells are classified into primary and secondary cell: Write any two differences between primary cell and secondary cell.



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59. Galvanic cells are classified into primary and secondary cell: What is a fuel cell?



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60. Daniell cell is a galvanic cell made of zinc and copper electrodes. Write the overall cell reaction in $H_2 - O_2$ fuel cell.



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61. Conductance (G), conductivity (K) and molar conductivity (Δ_m) are terms used in electrolytic conduction. Write any two factors on which conductivity depends on



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62. Conductance (G), conductivity (K) and molar conductivity Δ_m are terms used in electrolytic conduction.

How do conductivity and molar conductivity vary with concentration of electrolytic solution?



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63. Write any one difference between primary cell and secondary cell.



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64. Fuel cells are special types of galvanic cells. What are galvanic cells?



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65. Fuel cells are special type of galvanic cells. Write any two advantages of fuel cells



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66. Fuel cells are special type of galvanic cells. Write the electrode reactions in $H_2 - O_2$ fuel cell.



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67. The standard electrode potentials of some electrodes are given below:

$$E_{Zn^{2+}, Zn}^0 = -0.76V \quad E_{Cu^{2+}, Cu}^0 = +0.34V \quad E_{Ag^+, Ag}^0 = +0.80V$$

$E_{H^+, H}^0 = 0V$ What is the reaction taking place at SHE when it is connected to Ag/Ag^+ electrode to form a galvanic cell?



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68. The standard electrode potentials of some electrodes are given below:

$$E_{Zn^{2+}, Zn}^0 = -0.76V \quad E_{Cu^{2+}, Cu}^0 = +0.34V \quad E_{Ag^+, Ag}^0 = +0.80V$$

$\frac{E_{H^+, H}}{0} = 0V$. find the value of K_c (equilibrium constant) in the Daniel cell at 298K.



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69. Innumerable number of galvanic cells can be constructed on the pattern of Daniell cell by taking combination of different half cells. What is galvanic cells?



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70. Innumerable number of galvanic cells can be constructed on the pattern of Daniel cell by taking combination of different half-cells. Name the anode and cathode of the Daniel cell.



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71. Innumerable number of galvanic cells can be constructed on the pattern of Daneill cell by taking combination of different half cells. Write the name of the half represented by $\text{Pt(s)}/\text{H}_2(\text{g})/\text{H}^+(\text{aq})$



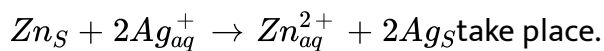
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72. Innumerable number of galvanic cells can be constructed on the pattern of Daneill cell by taking combination of different half cells. What is the potential of the above half cell at all temperatures?



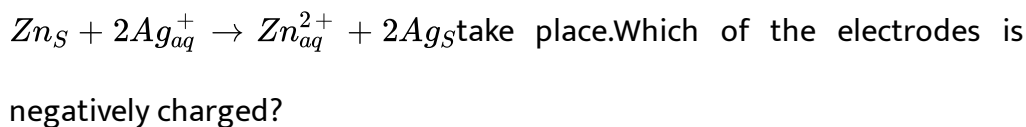
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73. Depict the galvanic cell in which the reaction,



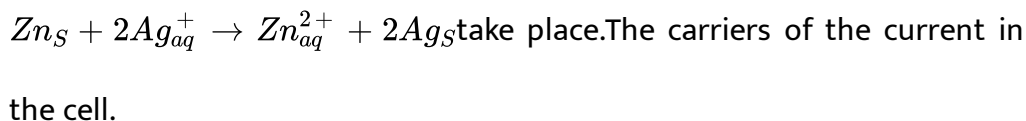
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74. Depict the galvanic cell in which the reaction,



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75. Depict the galvanic cell in which the reaction,



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76. Depict the galvanic cell in which the reaction,
 $Zn_{(s)} + 2Ag_{(aq)}^+ \rightarrow Zn_{(aq)}^{2+} + 2Ag_{(s)}$ takes place. Individual reaction at each electrode.



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77. How much charge is required for the following reductions: i. 1 mol of Al^{3+} to Al ? ii. 1 mol of Cu^{2+} to Cu ? 1 mol of MnO_4^- to Mn^{2+}



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78. How much electricity is required in coulomb for the oxidation of i. 1 mol of H_2O to O_2 ii. 1 mol of FeO to Fe_2O_3



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79. Three electrolytic cells A, B, C containing solutions of $ZnSO_4$, $AgNO_3$ and $CuSO_4$, respectively are connected in series. A steady current of 1.5 amperes 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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80. Predict the products of electrolysis In each of the following: An aqueous solution of $AgNO_3$ with silver.



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81. Predict the products of electrolysis In each of the following: An aqueous solution of $AgNO_3$ with platinum electrodes



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82. Predict the products of electrolysis In each of the following: A dilute solution of H_2SO_4 with platinum electrodes.



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83. Predict the products of electrolysis In each of the following: An aqueous solution of $CuCl_2$ with platinum electrodes.



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84. Given the standard electrode potentials

$$K^+ / K = -2.93V, Ag^+ / Ag = +0.8V, Hg^{2+} / Hg = 0.79V, Mg^{2+} / Mg = -2.37V$$

Arrange them in increasing order of reducing power.



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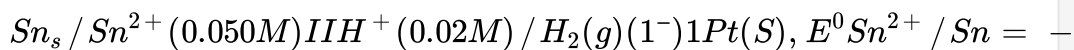
85. Write the Nernst equation and emf of the following cells at 298 K.

$$Mg_s / Mg^{2+}(0.001M) || Cu^{2+}(0.001M) / Cu_s, E^0_{cell} = 2.71V.$$



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86. Write the Nernst equation and emf of the following cells at 298 K.



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



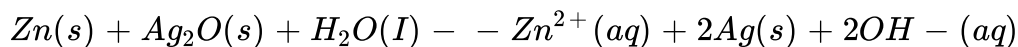
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88. The resistance of a conductivity cell containing $0.001M^\circ KCl$ solution at 298-K is 1500Ω . What is the cell constant if conductivity of $0.001M KCl$ solution at 298K is $0.146 \times 10^{-3} S cm^{-1}$



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



Determine $\Delta_r G^0$ and E^0 for the reaction.



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90. The limiting molar conductivity of weak electrolyte can be calculated by using the law.

- A. Faraday's law
- B. Kohlrausch law
- C. Henry's law
- D. Raoult's law

Answer:



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91. Daniell cell converts the chemical energy liberated during the redox reaction to electrical energy. $Zn_s + Cu_{aq}^{2+} \rightarrow Zn_{aq}^{2+} + Cu_s$, $E_{cell}^0 = 1.1V$. Identify the anode and cathode in Daniell cell.



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92. Daniell cell converts the chemical energy liberated during the redox reaction to electrical energy. $Zn_s + Cu_{aq}^{2+} \rightarrow Zn_{aq}^{2+} + Cu_s$, $E_{cell}^0 = 1.1V$. Calculate the standard Gibbs energy ($\Delta_r G^0$) for the reaction.



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93. Daniell cell converts the chemical energy liberated during the redox reaction to electrical energy. $Zn_s + Cu_{aq}^{2+} \rightarrow Zn_{aq}^{2+} + Cu_s$, $E_{cell}^0 = 1.1V$. Give the Nernst equation of above cell reaction.



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94. Diagrammatically represent $H_2 - O_2$ fuel cell and write the half cell reactions taking place in this cell.



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95. Define minimum boiling azeotropes with example.



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96. Write the anode and cathode reactions occurring in the operation of lead storage battery. Mention the electrolyte used in the battery.



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97. What are primary batteries?



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98. The cell potential of mercury cell is 1.35 V, and remains constant during its life. Give reason.



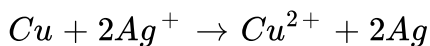
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99. Fuel cells are a special type of galvanic cells. Write the electrode reactions in $H_2 - O_2$ fuel cell.



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100. Represent the galvanic cell based on the cell reaction given below:



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101. λ_m^0 for NaCl, HCl and NaAc are 126.4, 425.9 and 91.0 $S\,cm^2\,mol^{-1}$ respectively. Calculate Λ_m^0 for HAc.





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102. Which of the following is a secondary cell?

- A. Dry cell
- B. Leclanche cell
- C. Mercury cell
- D. None of these

Answer:



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103. What Is the relationship between resistance and conductance?



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104. One of the fuel cell uses the reaction of hydrogen and oxygen to form water. Write down the cell reaction taking place in the anode and cathode of the fuel cell.



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105. You are supplied with the following substances:

copper rod, Zinc rod, Salt bridge, two glass beakers, a piece of wire,
 $1M, CuSO_4$ solution, $1M ZnSO_4$ solution

Represent the cell made using the above materials.



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106. You are supplied with the following substances:

copper rod, Zinc rod, Salt bridge, two glass beakers, a piece of wire,
 $1M, CuSO_4$ solution, $1M ZnSO_4$ solution

Write Nernst equation for the above cell.



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107. You are supplied with the following substances:

copper rod, Zinc rod, Salt bridge, two glass beakers, a piece of wire,
 $1M, CuSO_4$ solution, $1M ZnSO_4$ solution

Calculate the standard EMF of the cell if

E°



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108. The cell reaction in Daniell cell is

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$ and Nernst equation for single electrode potential for general electrode reaction

$$M^{n+}(aq) + ne^{-} \rightarrow M(s) \quad \text{is} \quad E_{M^{n+}/M} = E_{M^{n+}/M}^{\circ} - \frac{2.303RT}{nF} \log \frac{[M]}{[M^{n+}]}$$

Derive Nernst equation for Daniell cell



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109. Write any one difference between primary cell and secondary cell.



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110. Galvanic cell Is a device which converts chemical energy to electrical energy. Give the diagrammatic representation of the cell $Mg/MgSO_4 || CuSO_4/Cu$. Write the half-cell reactions take place in this cell.



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111. Galvanic cell Is a device which converts chemical energy to electrical energy. Explain the mechanism of corrosion using electro chemical theory.



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112. Galvanic cell Is a device which converts chemical energy to electrical energy. How many coulombs of electricity are required for the reduction

of 1mol of MnO_4^- to Mn^{2+} ?



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113. With decrease in concentration of an electrolytic solution, conductivity (K) decreases and molar conductivity (Δ_m) increases. Write the equation showing the relationship between conductivity and molar conductivity.



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114. With decrease in concentration of an electrolytic solution, conductivity (K) decreases and molar conductivity (Δ_m) increases. How will you account for the Increase In molar conductivity with decrease in concentration?



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115. With decreases in concentration of an electrolytic solution , Conductivity (K) decreases and molar conductivity(Λ_m) increases.

Limiting molar conductivity(Λ_m°) of a strong electrolyte can be determined by graphical extrapolation method, Suggest a method for the determination of limiting molar conductivity of a weak electrolyte, taking acetic acid (CH_3COOH) as example .

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116. Daniell cell is a galvanic cell made of zinc and copper electrodes.

Write anode and cathode reactions in Daniel cell

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117. The cell reaction in Daniell cell is

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$ and Nernst equation for single electrode potential for general electrode reaction

$M^+(aq) + ne^- \rightarrow M(s)$ is $E_{M^{n+}/M} = E_{M^{n+}/M}^\circ - \frac{2.303RT}{nF} \log$

$$\frac{[M]}{[M^{n+}]}$$

Derive Nernst equation for Daniell cell



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118. Write any one difference between primary cell and secondary cell.



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119. Galvanic cells are classified into primary and secondary cell: What is a fuel cell?



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120. Daniell cell is a galvanic cell made of zinc and copper electrodes. write the overall cell reaction in $H_2 - O_2$ fuel cell.



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121. Innumerable number of galvanic cells can be constructed on the pattern of Daneill cell by taking combination of different half cells. What is galvanic cells?



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122. Innumerable number of galvanic cells can be constructed on the pattern of Daniel cell by taking combination of different half-cells. Name the anode and cathode of the Daniel cell.



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123. Innumerable number of galvanic cells can be constructed on the pattern of Daneill cell by taking combination of different half cells. Write the name of the half represented by $\text{Pt(s)}/\text{H}_2(\text{g})/\text{H}^+(\text{aq})$



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124. For the given cell , $\text{Mg} \mid \text{Mg}^{2+} \parallel \text{Cu}^{(2+)} \mid \text{Cu}$ identify the correct statement given below.

A. Mg act as cathode

B. Cu act as cathode

C. The cell reaction is $\text{Cu} + \text{Mg}^{2+} \rightarrow \text{Cu}^{2+} + \text{Mg}$

D. Cu is the oxidising agent

Answer:



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125. The device in which chemical energy is converted into electrical energy is called ____.



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126. Two electrode A and B have standard electrode potential of -0.76V and 0.34V respectively. Identify the oxidation and reduction electrodes, IF they are coupled to form a cell.



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127. Two electrode A and B have standard electrode potential of -0.76V and 0.34V respectively. Find the standard cell potential of the cell formed.



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128. Commercial cells can be classified into primary cells and secondary cells. Explain them by giving one example each.



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129. Fill in the blanks: λ_m _____ with increase in temperature.



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130. Fill in the blanks: Conductance of electrolyte_____ with increase in temperature.



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131. Rusting of iron is quicker in saline water than in ordinary water . Give reasons



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132. Corrosion of iron occurs in the presence of moisture and oxygen and presence of H^+ ions._____ and saline water increases rate of corrosion of iron.



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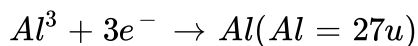
133. In class room , the teacher has explained the quantitative aspects of electrolysis by stating the Faraday's laws of electrolysis. Explain the term electrochemical equivalent.



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134. In a classroom, the teacher has explained the quantitative aspects of electrolysis by stating the Faraday's laws of electrolysis.

Calculate the quantity of electricity required to deposit 0.09 g of aluminium during the following electrode reaction:



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