

Previous HSE Questions from the chapter "ELECTROCHEMISTRY"

1. A solution of CuSO_4 , is electrolysed for 20 minutes with a current of 1.5 amperes. What is the mass of copper deposited at cathode? (Atomic mass of copper = 63) (3)
2. Predict the products of electrolysis of the following substances at anode and cathode using suitable chemical equations.
(a) Aqueous NaCl (b) H_2SO_4 solution (4)
3. a) Symbolically represent standard hydrogen electrode, when it acts as an anode and as cathode.
(b) Write Nernst equation for a Daniel cell. (Assume activity of metals is unity). (4) [SAY 2018]
4. Write the anode and cathode reactions occur in the operation of a lead storage battery. Mention the electrolyte used in the battery. (2)
5. a) What are primary batteries? (1)
b) The cell potential of a mercury cell is 1.35 V, and remains constant during its life. Give reason. (1)
c) Write the equations of the reactions involved at each electrode in a $\text{H}_2 - \text{O}_2$ fuel cell. (2) [March 2018]
6. a) Identify the weak electrolyte from the following:
i) KCl ii) NaCl iii) KBr iv) CH_3COOH
b) Kohlrausch's law helps to determine the degree of dissociation of weak electrolyte at a given concentration.
i) State Kohlrausch's law. (1)
ii) The molar conductivity (λ_m) of 0.001 M acetic acid is $4.95 \times 10^{-5} \text{ S cm}^2 \text{ mol}^{-1}$. Calculate the degree of dissociation (α) at this concentration if the limiting molar conductivity (λ_m^0) for H^+ is $340 \times 10^{-5} \text{ S cm}^2 \text{ mol}^{-1}$ and for CH_3COO^- is $50.5 \times 10^{-5} \text{ S cm}^2 \text{ mol}^{-1}$. (2) [SAY 2017]
7. a) Represent the galvanic cell based on the cell reaction given below:
$$\text{Cu(s)} + 2 \text{Ag}^+(\text{aq}) \longrightarrow \text{Cu}^{2+}(\text{aq}) + 2 \text{Ag(s)} \quad (1)$$

b) Write the half cell reactions of the above cell. (1)
c) λ_m^0 for NaCl , HCl and NaAc are 126.4, 425.9 and $91.0 \text{ S cm}^2 \text{ mol}^{-1}$ respectively. Calculate λ_m^0 for HAc . (2) [March 2017]
8. Galvanic cells are classified into primary and secondary cells.
a) Write any two differences between primary and secondary cells. (2)
b) (i) What is a fuel cell? (1)
(ii) Write the overall cell reaction in $\text{H}_2 - \text{O}_2$ fuel cell? (1) [SAY 2016]
9. a) Which of the following is a secondary cell ?
(a) Dry cell (b) Leclanche cell (c) Mercury cell (d) None of these (1)
(b) What is the relationship between resistance and conductance? (1)
(c) One of the fuel cells uses the reaction of hydrogen and oxygen to form water. Write down the cell reaction taking place in the anode and cathode of that fuel cell. (2) [March 2016]
10. a) Conductance (G), conductivity (K) and molar conductivity (m) are terms used in electrolytic conduction.
i) Write any two factors on which conductivity depends on. (1)
ii) How do conductivity and molar conductivity vary with concentration of electrolytic solution? (2)
b) Write any one difference between primary cell and secondary cell. (1) [SAY 2015]



11. You are supplied with the following substances: Copper rod, zinc rod, salt bridge, two glass beakers, a piece of wire, 1 M CuSO_4 solution, 1 M ZnSO_4 solution.
- Represent the cell made using the above materials. (1)
 - Write the Nernst equation for the above cell. (2)
 - Calculate the standard emf of the cell if $E^0(\text{Zn}^{2+}/\text{Zn}) = -0.76 \text{ V}$ and $E^0(\text{Cu}^{2+}/\text{Cu}) = +0.34 \text{ V}$ (1)
- [March 2015]
12. a) The cell reaction in Daniel cell is $\text{Zn(s)} + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu(s)}$ and Nernst equation for single electrode potential for general electrode reaction $\text{M}^{n+}(\text{aq}) + n\text{e}^- \rightarrow \text{M(s)}$ is
- $$E_{\text{M}^{n+}/\text{M}} = E_{\text{M}^{n+}/\text{M}}^0 - \frac{2.303RT}{nF} \log [\text{M}^{n+}]$$
- Derive Nernst equation for Daniel cell. (3)
- b) Daniel cell is a primary cell while lead storage cell is a secondary cell. Write any one difference between primary and secondary cell. (1) [March 2014]
13. Fuel cells are special types of Galvanic cells.
- What are galvanic cells? (1)
 - Write any two advantages of fuel cells. (1)
 - Write the electrode reactions in $\text{H}_2 - \text{O}_2$ fuel cell. (2) [SAY 2014]
14. We can construct innumerable number of Galvanic cells on the pattern of Daniel cell by taking combination of different half cells.
- What is a Galvanic cell? (1)
 - Name the anode and cathode used in the Daniel cell? (1)
 - Name the cell represented by $\text{Pt(s)}/\text{H}_{2(\text{g})}/\text{H}^{+}_{(\text{aq})}$. (½)
 - According to the convention, what is the potential of the above cell at all temperatures? (1)
 - Write the use of the above cell? (½) [SAY 2013 & 2012]
15. With decrease in concentration of an electrolytic solution, conductivity (k) decreases and molar conductivity (λ_m) increases.
- Write the equation showing the relationship between conductivity and molar conductivity. (1)
 - How will you account for the increase in molar conductivity with decrease in concentration? (1½)
 - Limiting molar conductivity (λ_m^0) 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. (1½) [March 2013]
16. Daniel cell is a galvanic cell made of Zn and Cu electrodes.
- Write anode and cathode reactions in Daniel cell? (1)
 - Nernst equation for the electrode reaction $\text{M}^{n+} + n\text{e}^- \rightarrow \text{M}$ is:
 $E_{\text{M}^{n+}/\text{M}} = E_{\text{M}^{n+}/\text{M}}^0 - (2.303RT/nF) \log 1/[\text{M}^{n+}]$. Derive Nernst equation for Daniel cell. (3) [March 2012]
17. Leclanche cell, Lead storage cell and Fuel cell are galvanic cells having different uses.
- Among these, Leclanche cell is a primary cell and lead storage cell is a secondary cell. Write any 2 differences between primary cell and secondary cell. (2)
 - What is a fuel cell? (1)
 - Write the overall cell reaction in $\text{H}_2 - \text{O}_2$ fuel cell? (1) [March 2012]



18. The limiting molar conductivity of an electrolyte is obtained by adding the limiting molar conductivities of cation and anion of the electrolyte.
- Name the above law. (½)
 - What is meant by limiting molar conductivity? (½)
 - Explain how conductivity measurements help to determine the ionisation constant of a weak electrolyte like acetic acid. (1)
 - Explain the change of conductivity and molar conductivity of a solution with dilution? (2) [March11]
19. The standard electrode potentials of some electrodes are given below:
 $E^0(\text{Zn}^{2+}/\text{Zn}) = -0.76\text{V}$, $E^0(\text{Cu}^{2+}/\text{Cu}) = 0.34\text{V}$, $E^0(\text{Ag}^+/\text{Ag}) = 0.8\text{V}$, $E^0(\text{H}^+/\text{H}_2) = 0\text{V}$.
- Can CuSO_4 solution be kept in silver vessel? (½)
 - Zn or Cu, which can displace hydrogen from dil. H_2SO_4 ? (½)
 - What is the reaction taking place at SHE when it is connected with Ag^+/Ag electrode to form a galvanic cell? (1)
 - Find the value of K_c (equilibrium constant) in the Daniel cell at 298K. (2) [SAY 2011]
20. From the position of elements in the electrochemical series, Cu can displace Ag from AgNO_3 solution.
- Represent the cell constructed with Cu and Ag electrodes. (1)
 - Write down the cell reaction taking place at the anode and the cathode. (2)
 - Write the Nernst equation for the above cell reaction. (1) [March 2010]
21. Lead storage cell is the commonly used secondary cell in automobiles.
- What is a secondary cell? (1)
 - What are the anode and cathode of the cell? (1)
 - Write down the reactions at anode and cathode during discharging of the cell? (2) [March 2010]
22. Certain Galvanic cells are designed to convert the energy of combustion of fuels directly into electrical energy.
- Name the above type of Galvanic cells. (½)
 - Give an example for the above cell. (½)
 - Represent the reactions taking place at anode and cathode of the above cell. (2)
 - Mention any two advantages of the above cell. (1) [March 2009]
23. The graphs showing the variation of molar conductance with concentration for weak and strong acids are given.
- Explain the Debye-Huckel-Onsager equation? (1)
 - What is molar conductance? (1)
 - Calculate the molar conductance at infinite dilution of NH_4OH .
 Given that λ_m^0 for NaCl, NaOH and NH_4Cl are 126.4, 248.1 and 129.8 $\text{ohm}^{-1}\text{cm}^2\text{mol}^{-1}$. (2)
 [March 2008]
- @@

