

Chem 12 Electrochemistry : Quiz 2 - 120

Part 1

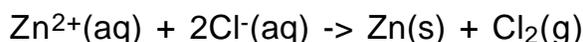
1) A particular reaction has a predicted E° of -2.25 V. This indicates that the reaction would :

- a) occur rapidly b) produce energy c) go to completion
d) be non-spontaneous

2) Corrosion of a metal means that the metal :

- a) acts as a cathode b) undergoes oxidation
c) undergoes reduction d) acts as an oxidizing agent

3) Zinc metal is prepared by electrolysis as follows:



What is the minimum voltage necessary for the electrolysis reaction to proceed ?

- a) 2.12 b) 1.58 c) 1.96 d) 3.48

4) Which metal would provide the best cathodic protection for iron pipes ?

- a) Ag b) Sn c) Mg d) Cu

5) Which half-reaction best describes what is taking place at the anode during the electrolysis of a 1.0 M NaCl solution ?

- a) $\text{Na}^{+} + \text{e}^{-} \rightarrow \text{Na}$ b) $2\text{Cl}^{-} \rightarrow \text{Cl}_2(\text{g}) + 2\text{e}^{-}$
c) $2\text{H}^{+}(10^{-7}\text{M}) + 2\text{e}^{-} \rightarrow \text{H}_2(\text{g})$ d) $\text{H}_2\text{O} \rightarrow 1/2 \text{O}_2(\text{g}) + 2\text{H}^{+}(10^{-7}\text{M}) + 2\text{e}^{-}$

6) Which one of the following converts chemical energy to electrical energy ?

- a) Industrial production of aluminum b) Nickel plating
c) Discharging a "dry" cell d) Production of Na(s)

7) Which is the unit for the energy per coulomb of electrons ?

a) Ohm b) Joule c) Ampere d) Volt

8) Which of the following energy sources has a zinc electrode ?

a) Alkaline cell b) Fuel cell c) Nickel-Cadmium battery
d) Automobile battery

9) Which one of the following half-reactions is involved in an electrolytic process to plate an iron chair with chromium ?

a) $\text{Cr(s)} + 3\text{e}^- \rightarrow \text{Cr}^{3+}(\text{aq})$ b) $\text{Cr}^{3+}(\text{aq}) + 3\text{e}^- \rightarrow \text{Cr(s)}$
c) $\text{Cr}^{3+}(\text{aq}) \rightarrow 3\text{e}^- + \text{Cr(s)}$ d) $\text{Cr(s)} \rightarrow \text{Cr}^{3+}(\text{aq}) + 3\text{e}^-$

10) An important feature of the fuel cell is the :

a) absence of electrodes b) rechargeability
c) efficient production of fuel
d) efficient production of electrical energy

11) Zinc can be used for the cathodic protection of :

a) lead b) calcium c) aluminum d) magnesium

12) What is produced at the cathode during the electrolysis of aqueous CaI_2 ?

a) Ca(s) b) $\text{I}_2(\text{s})$ c) $\text{H}_2(\text{g})$ d) $\text{O}_2(\text{g})$

13) During the industrial production of aluminum from Al_2O_3 , the mineral cryolite, Na_3AlF_6 , is used as the :

a) anode in releasing electrons
b) cathode where the Al(s) forms
c) solvent, allowing Al_2O_3 to dissociate
d) salt bridge in the electrolytic cell

14) Which of the following reagents is the **Best** choice for use in a redox titration which converts Cl^- to Cl_2 ?

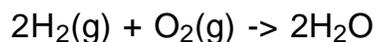
a) Br_2 b) HNO_3 c) MnO_4^- in acid d) $\text{Cr}_2\text{O}_7^{2-}$ in acid

Part 2

1) Give an advantage of the Lead-acid storage battery.

2) The Leclanche cell is inexpensive. Give another advantage.

3) The overall reaction for the hydrogen-oxygen fuel cell is :



The anode reaction is : _____

The cathode reaction is : _____

Part 3

1) Define electrolysis :

2) Give an advantage of a Type 1 (molten) electrolytic cell.

3) Give an advantage of a Type 2 (aqueous) electrolytic cell.

4) For each of the following solutions in an electrolytic cell, tell what forms at the anode and the cathode. (Assume aqueous solutions are 1.0 M)

a) KBr(aq) anode _____ , cathode _____

b) KI(aq) anode _____ , cathode _____

c) SnI₂(aq) anode _____ , cathode _____

d) NaF(molten) anode _____ , cathode _____

e) NaF(aq) anode _____ , cathode _____

f) NiCl₂(aq) anode _____ , cathode _____

5) Name any salt that could be used in an electrolytic cell to decompose neutral water into hydrogen and oxygen.

6) Draw a picture of an electrolytic cell that will plate nickel onto iron. Show the battery connections. Give a suitable electrolyte. Label the cathode and anode. Give the anode and cathode half-reactions. (4 marks)

Part 4

1) Define : Electrorefining

2) Write down the formula for bauxite. (Aluminum ore) _____

3) What is the **best** way to prevent corrosion of metal ?

4) Aluminum has a high oxidation potential. However, aluminum does not need any corrosion protection. Explain why.

5) Iron is coated with zinc. This is called galvanizing. If the zinc coat is broken, exposing the iron, what happens to the iron ?

Answers : Part 1; 1) d, 2) b, 3) a, 4) c, 5) b, 6) c, 7) d, 8) a, 9) b, 10) d, 11) a, 12) c, 13) c, 14) c, Part 2; 1) It's rechargeable, it also produces a large current, 2) It's small, "dry", portable, 3) anode reaction : $2\text{H}_2 + 4\text{OH}^- \rightarrow 4\text{H}_2\text{O} + 4\text{e}^-$, cathode reaction : $\text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^- \rightarrow 4\text{OH}^-$, (conditions are basic) , Part 3; 1) The process of supplying energy to a system in order to produce a chemical change, 2) There are fewer species that will react, 3) It operates at a much lower temperature than a type 1 cell, 4) a) Br_2, H_2 , b) I_2, H_2 , c) I_2, Sn , d) F_2, Na , e) O_2, H_2 , f) Cl_2, Ni , 5) Na_2SO_4 (and others), 6) anode reaction is $\text{Ni} \rightarrow \text{Ni}^{2+} + 2\text{e}^-$, cathode reaction is $\text{Ni}^{2+} + 2\text{e}^- \rightarrow \text{Ni}$, attach the negative terminal of a battery to an iron electrode and the positive terminal to the nickel electrode. Immerse both electrodes in a $\text{NiSO}_4(\text{aq})$ solution. Nickel will plate onto the iron., Part 4; 1) It is the process of purifying a metal by electrolysis., 2) $\text{Al}_2\text{O}_3 \cdot n \text{H}_2\text{O}$, (hydrated aluminum oxide), 3) cathodic protection, 4) a thin oxide coat protects the metal, 5) Nothing. The zinc is cathodic protection.