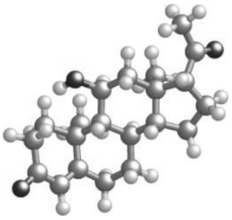

Chem!stry

Name: …………………… (   )

Class: ………………

Date: …… / …… / ……

Electrolysis of Aqueous Electrolytes with Reference to Standard Electrode Potentials

Concept of Systems

• **Standard Electrode Potentials:**

At the Cathode	Half-equations	$E^{\ominus}$ / V
K^+	$K^+ + e^- \rightleftharpoons K$	–2.92
Na^+	$Na^+ + e^- \rightleftharpoons Na$	–2.71
Mg^{2+}	$Mg^{2+} + 2e^- \rightleftharpoons Mg$	–2.36
Al^{3+}	$Al^{+} + 3e^- \rightleftharpoons Al$	–1.68
H_2O	$2H_2O + 2e^- \rightleftharpoons H_2 + 2OH^-$	–0.83
Zn^{2+}	$Zn^{2+} + 2e^- \rightleftharpoons Zn$	–0.76
Fe^{2+}	$Fe^{2+} + 2e^- \rightleftharpoons Fe$	–0.44
Pb^{2+}	$Pb^{2+} + 2e^- \rightleftharpoons Pb$	–0.13
H^+	$2H^+ + 2e^- \rightleftharpoons H_2$	0.00
Cu^{2+}	$Cu^{2+} + 2e^- \rightleftharpoons Cu$	+0.34
Ag^+	$Ag^+ + e^- \rightleftharpoons Ag$	+0.80

At the Anode	Half-equations	$E^{\ominus}$ / V
F^-	$F_2 + 2e^- \rightleftharpoons 2F^-$	+2.87
SO_4^{2-}	$S_2O_8^{2-} + 2e^- \rightleftharpoons 2SO_4^{2-}$	+2.01
Cl^-	$Cl_2 + 2e^- \rightleftharpoons 2Cl^-$	+1.36
H_2O	$O_2 + 4H^+ + 4e^- \rightleftharpoons 2H_2O$	+1.23
Br^-	$Br_2 + 2e^- \rightleftharpoons 2Br^-$	+1.07
I^-	$I_2 + 2e^- \rightleftharpoons 2I^-$	+0.54
OH^-	$O_2 + 2H_2O + 4e^- \rightleftharpoons 4OH^-$	+0.40

• **General Rules:**

→ **Systems:** Systems are composed of parts that interact with each other to fulfil a specific function. Systems follow rules. When studied as a whole, the system should be logical and should 'make sense' without errors or contradictions. Electrochemistry is a redox system involving oxidation at the anode and reduction at the cathode. Mobile ions move through the electrolyte and electrons move through the wires.

→ **At the Anode:** Water molecules and anions are attracted to the anode. The less positive / more negative an electrode potential, the more likely it is for that chemical species to be preferentially oxidised at the anode.

→ **At the Cathode:** Water molecules and cations are attracted to the cathode. The more positive / less negative an electrode potential, the more likely it is for that chemical species to be preferentially reduced at the cathode.

- Consider the electrolysis of the following aqueous systems using inert electrodes.

  Write half-equations to describe the process of oxidation at the anode and the process of reduction at the cathode.

  For each system, briefly explain your choice of the species that is preferentially oxidised and preferentially reduced.

(a) Dilute aqueous potassium iodide.

- Anode: ……………………………………………………………………………………..
- Explanation: ……………………………………………………………………………………..

  ……………………………………………………………………………………..
- Cathode: ……………………………………………………………………………………..
- Explanation: ……………………………………………………………………………………..

  ……………………………………………………………………………………..

(b) Concentrated aqueous sodium chloride.

- Anode: ……………………………………………………………………………………..
- Explanation: ……………………………………………………………………………………..

  ……………………………………………………………………………………..
- Cathode: ……………………………………………………………………………………..
- Explanation: ……………………………………………………………………………………..

  ……………………………………………………………………………………..

(c) Dilute aqueous copper(II) sulfate.

- Anode: ……………………………………………………………………………………..
- Explanation: ……………………………………………………………………………………..

  ……………………………………………………………………………………..
- Cathode: ……………………………………………………………………………………..
- Explanation: ……………………………………………………………………………………..

  ……………………………………………………………………………………..

(d) Concentrated aqueous silver nitrate.

- Anode: ……………………………………………………………………………………..
- Explanation: ……………………………………………………………………………………..

  ……………………………………………………………………………………..
- Cathode: ……………………………………………………………………………………..
- Explanation: ……………………………………………………………………………………..

  ……………………………………………………………………………………..

(e) Dilute aqueous sodium hydroxide.

- Anode: ....
- Explanation: ....

....

- Cathode: ....
- Explanation: ....

....

(f) Concentrated hydrochloric acid.

- Anode: ....
- Explanation: ....

....

- Cathode: ....
- Explanation: ....

....

(g) Concentrated aqueous zinc sulfate.

- Anode: ....
- Explanation: ....

....

- Cathode: ....
- Explanation: ....

....

- Scan the QR code for the answers to this assignment.

https://www.chemist.sg/electro_chem/standard_electrode_potentials/standard_electrode_potentials_ans.pdf