

## HW03 - Electrochemistry

1 4 points

Match the term with the best pair:

reduction

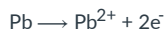
reducing agent

oxidization

oxidizing agent

2 4 points

What is the coefficient of lead (Pb) in the redox reaction after the following half-reactions are balanced?



Type your answer...

3 4 points

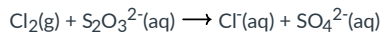
What is the sum of coefficients in the redox reaction after the following half-reactions are balanced?



Type your answer...

4 4 points

In the reaction of thiosulfate ion with chlorine gas in an acidic solution, what is the reducing agent?



- Cl
- Cl<sub>2</sub>
- S<sub>2</sub>O<sub>3</sub><sup>2-</sup>
- S<sup>2+</sup>

5 4 points

What is the coefficient on H<sup>+</sup> when you balance the following redox reaction in acid? Is H<sup>+</sup> a product or reactant?



- 3, product
- 2, product
- 4, reactant
- 6, product
- 3, reactant
- 0, neither
- 4, product
- 2, reactant
- 6, reactant

6 4 points

Based on the push and pull of electrons in a redox reaction, it can be inferred that the species being oxidized is also the...

- strong acid
- oxidizer
- oxidizing agent
- reducing agent

7 4 points

What is the change in oxidation number of sulfur when SO<sub>3</sub> reacts to form SO<sup>-</sup> in a redox reaction?

Type your answer...

8 4 points

When Na<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> reacts to form Cr(OH)<sub>3</sub>, the Cr atom gets \_\_\_\_\_ and the change in oxidation number is equal to \_\_\_\_.

- reduced, -6
- reduced, -3
- oxidized, -6
- reduced, +3
- oxidized, +3

9 4 points

What is the oxidation number of chlorine in ClO<sub>4</sub><sup>-</sup>?

Type your answer...

10 4 points

What is the oxidation number of sulfur in SO<sub>4</sub><sup>2-</sup>?

Type your answer...

11 4 points

What is the oxidation number of an individual sulfur in thiosulfate, S<sub>2</sub>O<sub>3</sub><sup>2-</sup>?

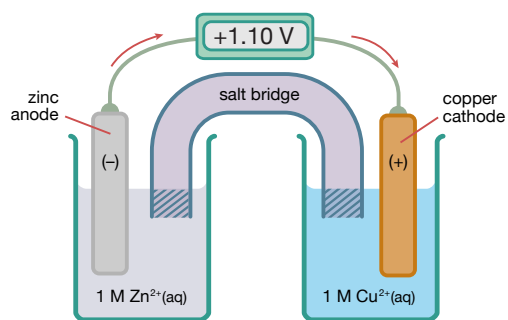
Type your answer...

12 4 points

What is the oxidation number of phosphorus in hydrogen phosphate, HPO<sub>4</sub><sup>2-</sup>?

Type your answer...

13 4 points



In this electrochemical cell, what is the reduction half reaction?

- $\text{Cu(s)} \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{e}^-$
- $\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Zn(s)}$
- $\text{Zn(s)} \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^-$
- $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu(s)}$

14 4 points

Consider the cell reaction represented by the skeletal equation:  
 $\text{Mn(s)} + \text{Ti}^{2+}(\text{aq}) \rightarrow \text{Mn}^{2+}(\text{aq}) + \text{Ti(s)}$   
 What is the proper cell diagram for this reaction?

- $\text{Mn(s)} \mid \text{Mn}^{2+}(\text{aq}) \parallel \text{Ti}^{2+}(\text{aq}) \mid \text{Ti(s)}$
- $\text{Ti(s)} \mid \text{Ti}^{2+}(\text{aq}) \parallel \text{Mn}^{2+}(\text{aq}) \mid \text{Mn(s)}$
- $\text{Ti}^{2+}(\text{aq}) \mid \text{Ti(s)} \parallel \text{Mn(s)} \mid \text{Mn}^{2+}(\text{aq})$
- $\text{Mn}^{2+}(\text{aq}) \mid \text{Mn(s)} \parallel \text{Ti(s)} \mid \text{Ti}^{2+}(\text{aq})$

15 4 points

Consider the cell:  
 $\text{Zn(s)} \mid \text{Zn}^{2+}(\text{aq}) \parallel \text{Cl}^-(\text{aq}) \mid \text{AgCl(s)} \mid \text{Ag(s)}$   
 Calculate  $E^\circ$ .

- 1.20 V
- +0.54 V
- +0.98 V
- +1.20 V

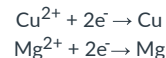
16 4 points

In a working electrochemical cell (a voltaic or a battery), the cations in the salt bridge move toward the cathode.

- It is impossible to tell unless we know if the cathode is "+" or "-".
- True
- False
- It depends on the charge of the cation.

17 4 points

What is the voltage of a standard voltaic cell made from the following half-reactions?



- 2.70 V
- 2.70 V
- 2.02 V
- 2.02 V

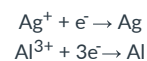
18 4 points

For the cell in the previous question, identify the solid anode and cathode.

- Cu: anode  
Mg: cathode
- Cu: cathode  
Mg: anode

19 4 points

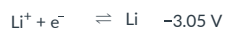
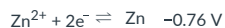
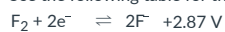
What is the voltage of a standard electrolytic cell made from the following half-reactions?



- 2.46 V
- 2.46 V
- 1.66 V
- 0.86 V
- 0.86 V

20 4 points

Use the following table for the next three questions:



Which out of the following is the strongest reducing agent?

- Li
- Zn
- Mg
- Ag<sup>+</sup>
- Li<sup>+</sup>
- Ag

21 4 points

What is the standard cell potential for the strongest battery possible using the table?

Note: for this question, only compare standard cell potential to assess the strength of the battery.

- 0.00 V
- 2.87 V
- 5.92 V
- 3.05 V

22 4 points

If you wanted to spontaneously reduce Al<sup>3+</sup> to form Al, you should pair it with...

- the oxidation of Mg
- the S.H.E reaction
- the oxidation of Pb
- the reduction of Mg

23 4 points

In a voltaic cell...

- oxidation takes place at the cathode
- electrolytes are added to carry electrons between electrodes
- oxidation and reduction take place at the same time, but at different electrodes
- electrical energy is used to reverse spontaneous chemical reactions

24 4 points

A discharging battery is a voltaic cell, meaning it is...

- non-spontaneous with a negative cell potential
- spontaneous with a positive cell potential
- spontaneous with a negative cell potential
- non-spontaneous with a positive cell potential

25 4 points

Suppose you set up an electrochemical cell. In one beaker, you have a 1 M copper(II) ion solution with a copper metal electrode. You use an external wire to connect the copper electrode to an aluminum electrode in another beaker with a 1 M aluminum ion solution. Then you add a salt bridge with sodium sulfate ions. All things are in place to have a functional cell. Which of the following statements is FALSE?

- You can run this as a voltaic cell and get out a maximum of 2.00 V
- Without a power source, electrons will travel from the aluminum beaker to the copper beaker
- You can run this as an electrolytic cell only if you input a minimum of 2.00 V
- Nothing will happen until you add an external power source.