



## HW10 - Electrochemical Stoichiometry

### Question 1 1.5 pts

What is the standard cell potential of a battery made from the half reactions below?



- a. -2.46
- b. -1.23
- c. 2.46
- d. 1.23

### Question 2 1.5 pts

In an electrolytic cell, the negative terminal is the (cathode/anode) and is the site of the (oxidation/reduction) half-reaction.

- a. anode, reduction
- b. cathode, oxidation
- c. cathode, reduction
- d. anode, oxidation

### Question 3 1.5 pts

Consider the galvanic cell:



What is the smallest possible integer coefficient of Ag(s) in the combined balanced equation?

- a. 3
- b. 4
- c. 1
- d. 2

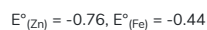
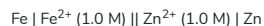
### Question 4 1.5 pts

Silver is plated on copper by immersing a piece of copper into a solution containing silver (I) ions. In the plating reaction, copper...

- a. is oxidized and is the reducing agent.
- b. is reduced and is the oxidizing agent.
- c. is oxidized and is the oxidizing agent.
- d. is reduced and is the reducing agent.

### Question 5 1.5 pts

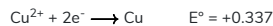
What is the  $E^\circ$  for the following electrochemical cell where Zn is the cathode?



- a. +0.32
- b. -1.20
- c. +1.20
- d. -0.32

### Question 6 1.5 pts

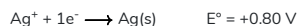
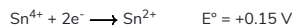
Which of the metals in the list below will react with 1M  $\text{H}_2\text{SO}_4$  to produce hydrogen gas?



- a. Na, Cd, Pb, and Cu
- b. Na, Cd, and Pb only
- c. Na and Cd only
- d. Cu only

### Question 7 1.5 pts

Consider the voltaic cell:



The electrons flow in the external circuit from...

- a. Sn to Ag
- b. Ag to Pt
- c.  $\text{Sn}^{2+}$  to  $\text{Ag}^+$
- d. Pt to Ag

### Question 8 1.5 pts

Using the standard potential tables, what is the largest approximate  $E^\circ$  value that can be achieved when two half-cell reactions are combined to form a battery?

- a. 3 V
- b. -6 V
- c. 6 V
- d. -3 V

### Question 9 1.5 pts

Consider the cell:



Calculate  $E^\circ$ .

- a. -1.20 V
- b. +0.98 V
- c. +1.20 V
- d. +0.54 V

### Question 10 2.0 pts

Which species will oxidize  $\text{Cr}^{2+}$  ( $E^\circ_{\text{red}} = -0.407$ ) but not  $\text{Mn}^{2+}$  ( $E^\circ_{\text{red}} = +1.224$ )?

- a.  $\text{Pb}^{4+}$  ( $E^\circ_{\text{red}} = +1.68$ )
- b.  $\text{O}_3$  in acid ( $E^\circ_{\text{red}} = +2.076$ )
- c.  $\text{Zn}^{2+}$  ( $E^\circ_{\text{red}} = -0.762$ )
- d.  $\text{Fe}^{2+}$  ( $E^\circ_{\text{red}} = -0.771$ )
- e.  $\text{V}^{3+}$  ( $E^\circ_{\text{red}} = -0.255$ )

## Question 11

1.5 pts

If the standard potentials for the couples  $\text{Cu}^{2+}|\text{Cu}$ ,  $\text{Ag}^+|\text{Ag}$ , and  $\text{Fe}^{2+}|\text{Fe}$  are +0.34, +0.80, and -0.44 V respectively, which is the strongest reducing agent?

- $\text{Cu}^{2+}$
- $\text{Fe}^{2+}$
- Cu
- Ag
- Fe
- $\text{Ag}^+$

## Question 12

1.5 pts

For the cell diagram below:



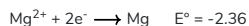
What reaction occurs at the cathode?

- $2\text{Cd(l)} + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{CdSO}_4(\text{s}) + 2\text{e}^-$
- $2\text{Hg(l)} + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{Hg}_2\text{SO}_4(\text{s}) + 2\text{e}^-$
- $\text{Hg}_2\text{SO}_4(\text{s}) + 2\text{e}^- \rightarrow 2\text{Hg(l)} + \text{SO}_4^{2-}(\text{aq})$
- $\text{CdSO}_4(\text{s}) + 2\text{e}^- \rightarrow 2\text{Cd(l)} + \text{SO}_4^{2-}(\text{aq})$

## Question 13

2.0 pts

Consider the cell diagram below:



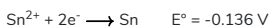
What is the cathode and what is the cell type?

- Mg(s); a voltaic cell
- Au(s); an electrolytic cell
- Mg(s); an electrolytic cell
- Au(s); a voltaic cell

## Question 14

1.5 pts

Consider the half-reactions:



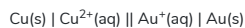
Using the redox couples to establish a voltaic cell, which reaction would be non-spontaneous?

- $2\text{Ga} + 3\text{Sn}^{2+} \rightarrow 2\text{Ga}^{3+} + 3\text{Sn}$
- $\text{Sn}^{2+} + \text{Mn} \rightarrow \text{Sn} + \text{Mn}^{2+}$
- $\text{Sn}^{2+} + \text{Fe} \rightarrow \text{Sn} + \text{Fe}^{2+}$
- $2\text{Ga}^{3+} + 3\text{Fe} \rightarrow 2\text{Ga} + 3\text{Fe}^{2+}$
- $\text{Fe}^{2+} + \text{Mn} \rightarrow \text{Mn}^{2+} + \text{Fe}$

## Question 15

1.5 pts

Find the standard emf of the given cell diagram:



- +2.03 V
- 1.35 V
- 2.03 V
- +1.35 V

## Question 16

2.0 pts

Which species will REDUCE  $\text{Ag}^+$  but not  $\text{Fe}^{2+}$ ?

- Cr
- K
- $\text{Co}^{2+}$
- $\text{H}_2$

## Question 17

1.5 pts

If the table of standard reduction potentials is ordered with the strongest reducing agents at the top, how are the reduction potentials ordered (from top to bottom)?

- from most spontaneous to least spontaneous
- from most common to least common
- from most negative to most positive
- from most positive to most negative

## Question 18

1.5 pts

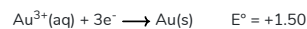
Which species is the weakest reducing agent in the table of half-reactions?

- $\text{F}^-$
- $\text{F}_2$
- $\text{Li}^+$
- Li

## Question 19

1.5 pts

If the two half-reactions below were used to make an electrolytic cell, what species would be consumed at the anode?



- $\text{I}^-(\text{aq})$
- $\text{Au}^{3+}(\text{aq})$
- $\text{I}_2(\text{s})$
- $\text{Au(s)}$