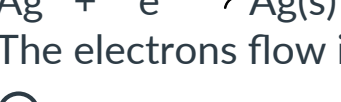
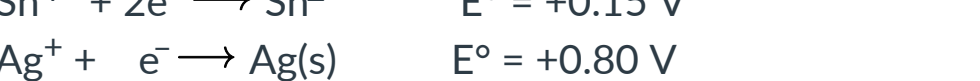


# HW08 - Electrochemical Cells & Applications

1 1 point

Consider the voltaic cell:

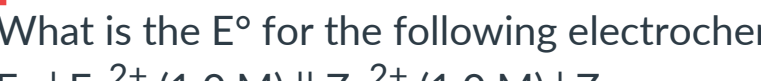


The electrons flow in the external circuit from...

- Ag to Pt
- Pt to Ag
- $\text{Sn}^{2+}$  to  $\text{Ag}^+$
- Sn to Ag

2 1 point

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



- 1.23
- 2.46
- 1.23
- 2.46

3 1 point

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



- 1.20
- +1.20
- 0.32
- +0.32

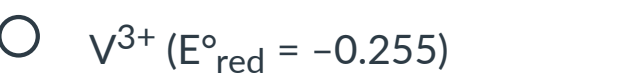
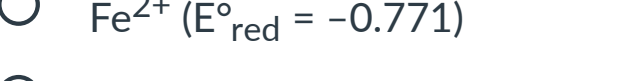
4 1 point

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

- 3 V
- 6 V
- 6 V
- 3 V

5 1 point

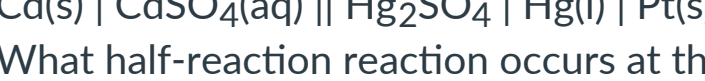
Which of the metals in the list below will react with 1M  $\text{H}_2\text{SO}_4$  to produce hydrogen gas? For reference, [here](#) is the standard reductions potentials list.



- Cu only
- Na and Cd only
- Na, Cd, Pb, and Cu
- Na, Cd, and Pb only

6 1 point

Consider the cell:



Calculate  $E^\circ$ . For reference, [here](#) is the standard reduction potentials list.

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

7 1 point

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

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

8 1 point

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?

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

9 1 point

For the cell diagram below:

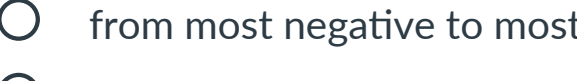


What half-reaction reaction occurs at the cathode?

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

10 1 point

Consider the cell diagram below:

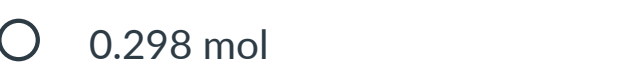


What is the cathode and what is the cell type?

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

11 1 point

Consider the half-reactions:

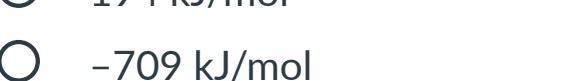


Which of these redox couples could not be used to make a voltaic cell?

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

12 1 point

Find the standard emf of the given cell diagram:



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

13 1 point

Using [this list](#) from gchem, which species will reduce  $\text{Ag}^+$  but not  $\text{Fe}^{2+}$ ?

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

14 1 point

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

15 1 point

Which species is the weakest reducing agent in [this table](#) of half-reactions?

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

16 1 point

How many moles of  $\text{Cl}_2(\text{g})$  are produced by the electrolysis of a concentrated sodium chloride if 2.00 A are passed through the solution for 4.00 hours? The equation for this process (the "chloralkali" process) is given below.



- 0.149 mol
- 0.0745 mol
- 0.298 mol
- 0.00248 mol

17 1 point

A steel surface has been electroplated with 5.10 g of vanadium (V, molar mass = 51 g/mol). If  $2.90 \times 10^4 \text{ C}$  of charge were used, what was the original oxidation number of V?

- +4
- +2
- +3
- +1

18 1 point

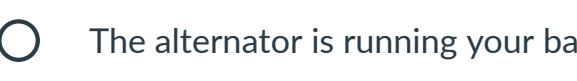
What is  $\Delta G^\circ$  for the half-reaction below?



- 709,000 kJ/mol
- 194,000 kJ/mol
- 194 kJ/mol
- 709 kJ/mol

19 1 point

Consider the cell:



If run at standard conditions, calculate the value of  $\Delta G^\circ_{\text{Zn}}$  for the reaction that occurs when current is drawn from this cell.

- 31 kJ/mol
- +62 kJ/mol
- 62 kJ/mol
- 230 kJ/mol

20 1 point

Consider the cell:



If  $E^\circ$  for the cell is 0.36 V at 25°C, write the Nernst equation for the cell at this temperature.

[NOTE: These answer choices are written using natural log instead of  $\log_{10}$ , so the familiar factor of (0.0591/n) does not appear in these equations. What should that factor be when you are using natural log instead of  $\log_{10}$ ?

- $E = 0.36 - 0.01285 \cdot \ln \frac{192.5}{(0.70)^2(0.60)}$
- $E = 0.36 - 0.01285 \cdot \ln \frac{1.90}{(0.70)^2(0.60)}$
- $E = 0.36 - 0.02569 \cdot \ln \frac{192.5}{(0.70)^2(0.60)}$
- $E = 0.36 - 0.01285 \cdot \ln \frac{1.90}{(0.70)(0.60)}$

21 1 point

A concentration cell consists of the same redox couples at the anode and the cathode and different concentrations of the ions in the respective compartments. Find the unknown concentration for the following cell:



- $7.97 \times 10^{-3} \text{ M}$
- 1.26 M
- $6.35 \times 10^{-4} \text{ M}$
- 15.8 M

22 1 point

The standard potential of the cell:



is +0.23 V at 25°C. Calculate the equilibrium constant for the reaction of 1 M  $\text{Pb}^{2+}(\text{aq})$  with 1 M  $\text{SO}_4^{2-}(\text{aq})$ .

- $8.0 \times 10^{17}$
- $6.0 \times 10^7$
- $1.7 \times 10^{-8}$
- $7.7 \times 10^3$

23 1 point

The equilibrium constant for the reaction below:



is  $5.6 \times 10^{-20}$  at 25°C. Calculate the value of  $E^\circ_{\text{cell}}$  for this reaction.

- 0.57 V
- +0.57 V
- +1.14 V
- 1.14 V

24 1 point

How long will it take to deposit 0.00235 moles of solid gold by the electrolysis of  $\text{KAuCl}_4(\text{aq})$  using a current of 0.214 amperes?

- 26.5 min
- 53.0 min
- 70.7 min
- 106 min

25 1 point

You turn on a flashlight containing brand new NiCad batteries and keep it lit for a minute or two. Which of the following can be considered TRUE regarding the chemical state of these batteries?

- I. The chemical reaction is spontaneous
- II.  $E_{\text{cell}} > 0$
- III. The overall redox reaction in the battery is at equilibrium
- IV.  $E_{\text{cell}}$  is substantially decreasing during this time
- All are true.
- All but III
- I and II only
- III only
- All but IV

26 1 point

Consider the following three species involving lead in various oxidation states:



What are the oxidation states of lead in the order that the species are written?

- +2, +4, +2
- 0, -2, -4
- 0, -2, +4
- +2, 0, -4
- 0, +2, +4

27 1 point

The common alkaline cell batteries (D, AA, AAA, etc.) share the same voltage but differ on the basis that...

- The maximum current that can be delivered is inversely proportional to the radius of the battery - so the smaller battery (AAA) is more concentrated and therefore able to deliver more current.
- The maximum current that can be delivered is proportional to the surface area of the electrodes - so the bigger battery sizes are able to deliver more current.

28 1 point

You start your car and begin driving. After about 10 to 15 minutes of driving your car just dies and will not restart. Which of the following reasons is the most logical explanation why your car died?

- The alternator is not properly recharging the battery as you are driving
- The battery is damaged and you need to buy a new one
- The battery was completely dead when you started your car
- The alternator is running your battery as an electrolytic cell

29 1 point

The overall reaction for an alkaline battery is:



Which species is oxidized as the battery is used?

- $\text{MnO}_2(\text{s})$
- Zn(s)
- $\text{Mn}_2\text{O}_3(\text{s})$
- ZnO(s)

30 1 point

Which of the following batteries are rechargeable?

- I. alkaline battery
- II. NiMH battery
- III. lithium battery
- IV. Li-ion battery
- V. Pb-acid battery
- All except I
- I and III only
- II, IV, and V only
- II and V only