

# Chapter 6

## (Electrochemistry)

### Self Assessment A (Chemistry by Raymond Chang)

*NOTE: A table of standard reduction potentials is required to work many of these problems.*

1. Complete and balance the following redox equation. When properly balanced using the smallest whole-number coefficients, the coefficient of S is



- A. 1            B. 2            C. 3            D. 5            E. 6

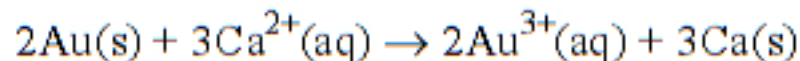
2. Given the following notation for an electrochemical cell



what is the balanced overall (net) cell reaction?

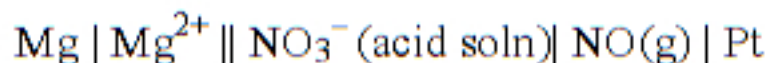
- A.  $2\text{H}^+(\text{aq}) + 2\text{Ag}^+(\text{aq}) \rightarrow \text{H}_2(\text{g}) + 2\text{Ag(s)}$   
B.  $\text{H}_2(\text{g}) + 2\text{Ag(s)} \rightarrow \text{H}^+(\text{aq}) + 2\text{Ag}^+(\text{aq})$   
C.  $2\text{H}^+(\text{aq}) + 2\text{Ag(s)} \rightarrow \text{H}_2(\text{g}) + 2\text{Ag}^+(\text{aq})$   
D.  $\text{H}_2(\text{g}) + \text{Ag}^+(\text{aq}) \rightarrow \text{H}^+(\text{aq}) + \text{Ag(s)}$   
E.  $\text{H}_2(\text{g}) + 2\text{Ag}^+(\text{aq}) \rightarrow 2\text{H}^+(\text{aq}) + 2\text{Ag(s)}$

3. Calculate the value of  $E^\circ_{\text{cell}}$  for the following reaction:



- A. -4.37 V    B. -1.37 V    C. -11.6 V    D. 1.37 V    E. 4.37 V

4. Calculate the standard cell emf for the following cell:



- A. 3.33 V    B. 1.41 V    C. -1.41 V    D. 8.46 V    E. -8.46 V

5. The overall reaction  $2\text{Co}^{3+}(\text{aq}) + 2\text{Cl}^{-}(\text{aq}) \rightarrow 2\text{Co}^{2+}(\text{aq}) + \text{Cl}_2(\text{g})$  has the standard cell voltage  $E^{\circ}_{\text{cell}} = 0.46 \text{ V}$ .

Given that  $\text{Cl}_2(\text{g}) + 2\text{e}^{-} \rightarrow 2\text{Cl}^{-}(\text{aq})$ ,  $E^{\circ} = 1.36 \text{ V}$ ,

calculate the standard reduction potential for the following the half reaction at  $25^{\circ}\text{C}$ :



- A. 1.82 V    B. -0.90 V    C. 0.90 V    D. -1.82 V    E. -1.36 V
6. In the following half equation, which is the oxidizing agent?
- $$\text{NO}_3^{-}(\text{aq}) + 4\text{H}^{+}(\text{aq}) + 3\text{e}^{-} \rightarrow \text{NO}(\text{g}) + 2\text{H}_2\text{O}$$
- A.  $\text{NO}_3^{-}$     B.  $\text{H}^{+}$     C.  $\text{e}^{-}$     D. NO    E.  $\text{H}_2\text{O}$
7. Which statement is *true* for a spontaneous redox reaction carried out at standard-state conditions?
- A.  $E^{\circ}_{\text{red}}$  is always negative.  
B.  $E^{\circ}_{\text{cell}}$  is always positive.  
C.  $E^{\circ}_{\text{ox}}$  is always positive.  
D.  $E^{\circ}_{\text{red}}$  is always positive.

8. Consider the following standard reduction potentials in acid solution:

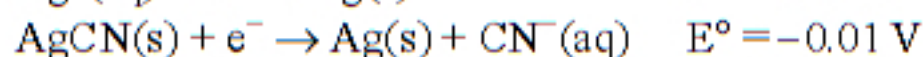
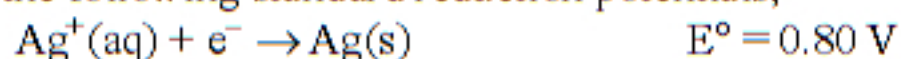
	$E^{\circ}(\text{V})$
$\text{Al}^{3+} + 3\text{e}^{-} \rightarrow \text{Al}(\text{s})$	-1.66
$\text{AgBr}(\text{s}) + \text{e}^{-} \rightarrow \text{Ag}(\text{s}) + \text{Br}^{-}$	+0.07
$\text{Sn}^{4+} + 2\text{e}^{-} \rightarrow \text{Sn}^{2+}$	+0.14
$\text{Fe}^{3+} + \text{e}^{-} \rightarrow \text{Fe}^{2+}$	+0.77

The strongest oxidizing agent among those shown above is

- A.  $\text{Fe}^{3+}$ .    B.  $\text{Fe}^{2+}$ .    C.  $\text{Br}^{-}$ .    D.  $\text{Al}^{3+}$ .    E. Al.
9. Determine the equilibrium constant,  $K_{\text{eq}}$ , at  $25^{\circ}\text{C}$  for the reaction
- $$2\text{Br}^{-}(\text{aq}) + \text{I}_2(\text{s}) \rightleftharpoons \text{Br}_2(\text{l}) + 2\text{I}^{-}(\text{aq})$$
- A.  $5.7 \times 10^{-19}$   
B. 18.30

- C.  $1.7 \times 10^{54}$   
D.  $1.9 \times 10^{18}$   
E.  $5.7 \times 10^{-55}$

10. Given the following standard reduction potentials,



calculate the solubility product of AgCN at 25°C.

- A.  $4.3 \times 10^{-14}$     B.  $2.3 \times 10^{13}$     C.  $2.1 \times 10^{-14}$     D.  $5.1 \times 10^{13}$     E. None of these
11. Calculate the cell emf for the following reaction at 25°C:  
 $2\text{Ag}^+(0.010 \text{ M}) + \text{H}_2(1 \text{ atm}) \rightarrow 2\text{Ag}(\text{s}) + 2\text{H}^+(\text{pH} = 10.0)$
- A. 1.04 V    B. 1.27 V    C. 0.92 V    D. 0.56 V    E. 0.80 V
12. How many coulombs of charge are required to cause reduction of 0.20 mole of  $\text{Cr}^{3+}$  to Cr?
- A. 0.60 C    B. 3.0 C    C.  $2.9 \times 10^4 \text{ C}$     D.  $5.8 \times 10^4 \text{ C}$     E.  $9.65 \times 10^4 \text{ C}$
13. A current of 0.80 A was applied to an electrolytic cell containing molten  $\text{CdCl}_2$  for 2.5 hours. Calculate the mass of cadmium metal deposited.
- A.  $3.2 \times 10^{-7} \text{ g}$     B.  $1.2 \times 10^{-3} \text{ g}$     C. 4.2 g    D. 8.4 g    E. 16.8 g
14. A current of 2.50 A was passed through an electrolytic cell containing molten  $\text{CaCl}_2$  for 4.50 hours. How many moles of calcium metal should be deposited?
- A.  $5.83 \times 10^{-5} \text{ mol}$     B. 0.210 mol    C. 0.420 mol    D. 0.840 mol  
E.  $1.95 \times 10^9 \text{ mol}$