

Electrochemistry Practice  
Palmer Graves, Instructor

MULTIPLE CHOICE

Section 4.10 Balancing Redox Reactions: The Half-Reaction Method

- What are the coefficients in front of  $\text{NO}_3^-(\text{aq})$  and  $\text{Cu}(\text{s})$  when the following redox equation is balanced in an acidic solution:  

$$\underline{\hspace{1cm}} \text{NO}_3^-(\text{aq}) + \underline{\hspace{1cm}} \text{Cu}(\text{s}) \longrightarrow \underline{\hspace{1cm}} \text{NO}(\text{g}) + \underline{\hspace{1cm}} \text{Cu}^{2+}(\text{aq})?$$
  - 2, 3
  - 2, 6
  - 3, 4
  - 3, 6
- What are the coefficients in front of  $\text{BrO}_3^-(\text{aq})$  and  $\text{Br}^-(\text{aq})$  when the following equation is balanced in an acidic solution:  

$$\underline{\hspace{1cm}} \text{BrO}_3^-(\text{aq}) + \underline{\hspace{1cm}} \text{Br}^-(\text{aq}) \longrightarrow \underline{\hspace{1cm}} \text{Br}_2(\text{aq})?$$
  - 1, 3
  - 1, 5
  - 2, 3
  - 2, 5
- Determine the number of water molecules necessary to balance the reduction half reaction of  $\underline{\hspace{1cm}} \text{MnO}_4^-(\text{aq}) \longrightarrow \underline{\hspace{1cm}} \text{MnO}_2(\text{s})$  that occurs in a basic solution.
  - 2
  - 3
  - 4
  - 5

Section 18.1 Galvanic Cell

- The half-reaction  $\text{MnO}_4^-(\text{aq}) + 8 \text{H}^+(\text{aq}) + 5 \text{e}^- \rightarrow \text{Mn}^{2+}(\text{aq}) + 4 \text{H}_2\text{O}(\text{l})$ 
  - is an oxidation half-reaction and occurs at the anode.
  - is an oxidation half-reaction and occurs at the cathode.
  - is a reduction half-reaction and occurs at the anode.
  - is a reduction half-reaction and occurs at the cathode.
- What species is oxidized in the reaction,  $\text{CuSO}_4(\text{aq}) + \text{Fe}(\text{s}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Cu}(\text{s})$ ?
  - $\text{CuSO}_4$
  - Fe
  - $\text{FeSO}_4$
  - Cu
- Given that  $\text{Cl}_2(\text{g}) + 2 \text{e}^- \rightarrow 2 \text{Cl}^-(\text{aq})$  is the reduction half-reaction for the overall reaction  

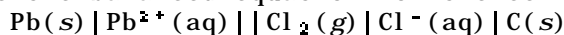
$$2 \text{Ag}(\text{s}) + \text{Cl}_2(\text{g}) \rightarrow 2 \text{AgCl}(\text{s}),$$
what is the oxidation half reaction?
  - $\text{Ag}(\text{s}) \rightarrow \text{Ag}^+(\text{aq}) + \text{e}^-$
  - $\text{Ag}(\text{s}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{e}^-$
  - $\text{Ag}(\text{s}) + \text{Cl}_2(\text{g}) + \text{e}^- \rightarrow \text{AgCl}(\text{s}) + \text{Cl}^-(\text{aq})$
  - $2 \text{Cl}^-(\text{aq}) \rightarrow \text{Cl}_2(\text{g}) + 2 \text{e}^-$

### Section 18.2 Shorthand Notation for Galvanic Cells

7. What is an appropriate shorthand notation for the galvanic cell based on the reaction below?



- a)  $\text{Fe}(s) \mid \text{Fe}^{2+}(aq) \parallel \text{Cu}^{2+}(aq) \mid \text{Cu}(s)$   
 b)  $\text{Cu}(s) \mid \text{Cu}^{2+}(aq) \parallel \text{Fe}^{2+}(aq) \mid \text{Fe}(s)$   
 c)  $\text{Fe}(s) \mid \text{NO}_3^-(aq) \parallel \text{NO}_3^-(aq) \mid \text{Cu}(s)$   
 d)  $\text{Cu}(s) \mid \text{Cu}(\text{NO}_3)_2(aq) \parallel \text{Fe}(\text{NO}_3)_2(aq) \mid \text{Fe}(s)$
8. Write the balanced equation for the cell reaction of the following galvanic cell.



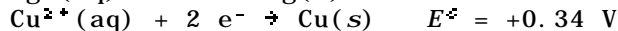
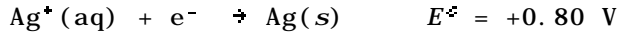
- a)  $\text{Pb}(s) + 2 \text{Cl}^-(aq) \rightarrow \text{Pb}^{2+}(aq) + \text{Cl}_2(g)$   
 b)  $\text{Pb}(s) + \text{Cl}_2(g) \rightarrow \text{Pb}^{2+}(aq) + 2 \text{Cl}^-(aq)$   
 c)  $\text{Pb}^{2+}(aq) + 2 \text{Cl}^-(aq) \rightarrow \text{Pb}(s) + \text{Cl}_2(g)$   
 d)  $\text{Pb}^{2+}(aq) + 2 \text{Cl}^-(aq) \rightarrow \text{PbCl}_2(s)$

### Section 18.3 Cell Potentials and Free Energy Changes for Cell Reactions

9. For the reaction  $2 \text{Al}(s) + 3 \text{Co}^{2+}(aq) \rightarrow 2 \text{Al}^{3+}(aq) + 3 \text{Co}(s)$ ,  $\Delta G^\circ$  is -799 kJ. What is  $E^\circ$  for a standard cell based on this reaction?
- a) +1.38 V  
 b) +2.76 V  
 c) +4.14 V  
 d) +8.28 V

### Section 18.5 Using Standard Reduction Potentials

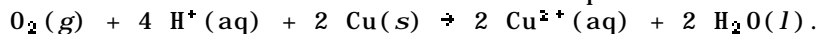
10. A galvanic cell is formed from one half-cell containing  $\text{Ag}(s)$  and  $\text{Ag}^+(aq)$ , and another half-cell containing  $\text{Cu}(s)$  and  $\text{Cu}^{2+}(aq)$ . What species are produced at the electrodes under standard conditions?



- a) Ag at the cathode and Cu at the anode.  
 b) Ag at the cathode and  $\text{Cu}^{2+}$  at the anode.  
 c) Cu at the cathode and  $\text{Ag}^+$  at the anode.  
 d)  $\text{Cu}^{2+}$  at the cathode and Ag at the anode.

The following five questions require access to Table 18.1

11. Use Table 18.1 to calculate the standard potential for the reaction



- a) -1.57 V  
 b) -0.89 V  
 c) +0.89 V  
 d) +1.57 V

**Section 18.13 Quantitative Aspects of Electrolysis**

12. How many grams of chromium can be plated out by passing a current of 8.00 A through an aqueous solution containing  $\text{Cr}^{3+}$  ions for 40.0 minutes?
- a) 3.45 g
  - b) 6.15 g
  - c) 10.3 g
  - d) 31.0 g
13. Chromium can be electroplated from an aqueous solution containing sulfuric acid and chromic acid,  $\text{H}_2\text{CrO}_4$ . What current is required to deposit chromium at a rate of 1.25 g/min?
- a) 38.1 A
  - b) 38.7 A
  - c) 116 A
  - d) 232 A

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1. a)	Chapter: 4	QUESTION: 66
2. b)	Chapter: 4	QUESTION: 69
3. a)	Chapter: 4	QUESTION: 71
4. d)	Chapter: 18	QUESTION: 2
5. b)	Chapter: 18	QUESTION: 6
6. b)	Chapter: 18	QUESTION: 8
7. a)	Chapter: 18	QUESTION: 16
8. b)	Chapter: 18	QUESTION: 19
9. a)	Chapter: 18	QUESTION: 26
10. b)	Chapter: 18	QUESTION: 33
11. c)	Chapter: 18	QUESTION: 42
12. a)	Chapter: 18	QUESTION: 87
13. d)	Chapter: 18	QUESTION: 90