Practice Quiz - Electrochemistry

Name

1. A voltaic cell prepared using aluminum and nickel has the following cell notation: $Al(s) | Al^{3+}(aq) | Ni^{2+}(aq) | Ni(s)$ Which of the following reactions occurs at the anode?

A. Al(s)
$$\rightarrow$$
 Al³⁺(aq) + 3e⁻

B.
$$Al^{3+}(aq) + 3e \rightarrow Al(s)$$

C. Ni(s)
$$\to$$
 Ni²⁺(aq) + 2e⁻

D.
$$Ni^{2+}(aq) + 2e^{-} \rightarrow Ni(s)$$

2. Which of the following solids is commonly used as an inactive electrode in electrochemical cells?

3. Calculate E°_{cell} and indicate whether the overall reaction shown is spontaneous or nonspontaneous.

$$O_2(g) + 4H^+(aq) + 4e^- \implies 2H_2O(I)$$
 $E^\circ = 1.229 \text{ V}$
 $AI^{3+}(aq) + 3e^- \implies AI(s)$ $E^\circ = -1.662 \text{ V}$

$$Al^{3+}(aq) + 3e^{-} \implies Al(s)$$

$$E^{\circ} = 1.229 \text{ V}$$

 $E^{\circ} = -1.662 \text{ V}$

Overall reaction:

$$4Al(s) + 3O_2(g) + 12H^+(aq) \rightarrow 4Al^{3+}(aq) + 6H_2O(l)$$

A.
$$E^{\circ}_{\text{cell}} = -2.891 \text{ V}$$
, nonspontaneous

B.
$$E^{\circ}_{\text{cell}} = -2.891 \text{ V}$$
, spontaneous

C.
$$E^{\circ}_{\text{cell}} = 2.891 \text{ V}$$
, nonspontaneous

D.
$$E^{\circ}_{\text{cell}} = 2.891 \text{ V}$$
, spontaneous

E. Spontaneous, but none of the values of
$$E^{\circ}_{cell}$$
 is correct.

4. What is the value of the equilibrium constant for the cell reaction below at 25°C? $E_{\text{cell}}^{\circ} = 0.30 \text{ V}$

$$\operatorname{Sn}^{2+}(aq) + \operatorname{Fe}(s) \implies \operatorname{Sn}(s) + \operatorname{Fe}^{2+}(aq)$$

A.
$$1.2 \times 10^5$$

B.
$$1.4 \times 10^{10}$$

C.
$$8.6 \times 10^{-6}$$

D.
$$7.1 \times 10^{-11}$$

E.
$$2.3 \times 10^{23}$$

5. Calculate ΔG° for the oxidation of 3 moles of copper by nitric acid.

$$Cu^{2+}(aq) + 2e^{-} \implies Cu(s)$$

$$E^{\circ} = 0.34 \text{ V}$$

$$NO_3$$
 (aq) + $4H^+(aq)$ + $3e^ \Rightarrow$ $NO(g)$ + $2H_2O(l)$ E° = 0.957 V
A. -120 kJ B. -180 kJ C. -240 kJ

6. What mass of copper will be deposited when 18.2 A are passed through a CuSO₄ solution for 45.0 minutes?

7. Consider the reaction of iodine with manganese dioxide:

$$3I_2(s) + 2MnO_2(s) + 8OH^-(aq) \implies 6I^-(aq) + 2MnO_4^-(aq) + 4H_2O(l)$$

The equilibrium constant for the overall reaction is 8.30×10^{-7} . Calculate ΔG° for the reaction at 25°C.

E. None of these choices is correct.

Use the following diagram of a voltaic cell for questions 8, 9 and 10.

- 8. Label the anode and the cathode.
- 9. Write the half-reactions.
- 10. Write the overall cell reaction.

