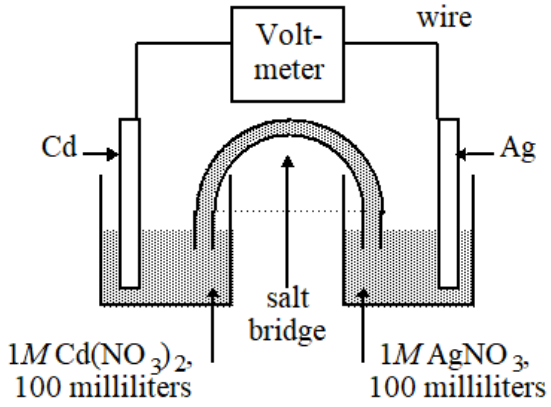
Redox Review

1. An electric current of 1.00 ampere is passed through an aqueous solution of $Ni(NO_3)_2$. How long will it take to plate out exactly 1.00 mol of nickel metal, assuming 100 percent current efficiency?

(1 faraday = 96,500 coulombs = 6.02 X 10^{23} electrons)

(A) 386,000 sec
(B) 193,000 sec
(C) 96,500 sec
(D) 48,200 sec
(E) 24,100 sec

2.



The spontaneous reaction that occurs when the cell above operates is $2\ Ag^+ + Cd(s) \rightarrow 2\ Ag(s) + Cd^{2+}$

Which of the above occurs for the following circumstance?

A 50–milliliter sample of a 2-molar $Cd(NO_3)_2$ solution is added to the left beaker.

(A) Voltage increases.
(B) Voltage decreases but remains above zero
(C) Voltage becomes zero and remains at zero
(D) No change in voltage occurs
(E) Direction of voltage change cannot be predicted without additional information

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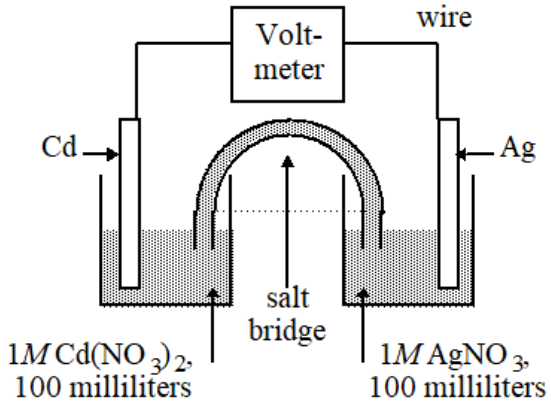
3.



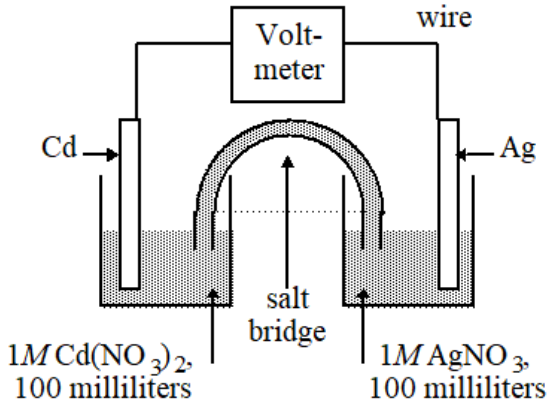
The spontaneous reaction that occurs when the cell above operates is $2\ Ag^{+} + Cd(s) \rightarrow 2\ Ag(s) + Cd^{2+}$

Which of the above occurs for the following circumstance?

The silver electrode is made larger.

(A) Voltage increases.
(B) Voltage decreases but remains above zero
(C) Voltage becomes zero and remains at zero
(D) No change in voltage occurs
(E) Direction of voltage change cannot be predicted without additional information

4.



The spontaneous reaction that occurs when the cell above operates is $2\ Ag^{+} + Cd(s) \rightarrow 2\ Ag(s) + Cd^{2+}$

Which of the above occurs for the following circumstance?

The salt bridge is replaced by a platinum wire.

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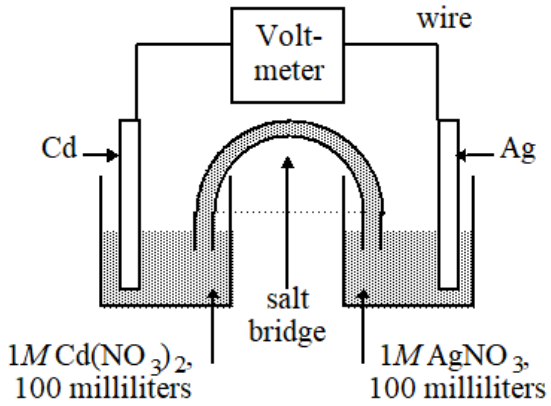
(A) Voltage increases.
(B) Voltage decreases but remains above zero
(C) Voltage becomes zero and remains at zero
(D) No change in voltage occurs
(E) Direction of voltage change cannot be predicted without additional information

5.



The spontaneous reaction that occurs when the cell above operates is $2\ Ag^{+} + Cd(s) \rightarrow 2\ Ag(s) + Cd^{2+}$

Which of the above occurs for the following circumstance?

Current is allowed to flow for 5 minutes

(A) Voltage increases.
(B) Voltage decreases but remains above zero
(C) Voltage becomes zero and remains at zero
(D) No change in voltage occurs
(E) Direction of voltage change cannot be predicted without additional information

6. $Cu(s) + 2\ Ag^{+} \rightarrow Cu^{2+} + 2\ Ag(s)$

If the equilibrium constant for the reaction above is 3.7×10^{15}, which of the following correctly describes the standard voltage, E°, and the standard free energy change, ΔG°, for this reaction?

(A) E° is positive and ΔG° is negative.
(B) E° is negative and ΔG° is positive.
(C) E° and ΔG° are both positive.
(D) E° and ΔG° are both negative.
(E) E° and ΔG° are both zero.

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7. $Zn(s) + Cu^{2+} \rightleftharpoons Zn^{2+} + Cu(s)$

An electrolytic cell based on the reaction represented above was constructed from zinc and copper half-cells. The observed voltage was found to be 1.00 volt instead of the standard cell potential, E^0, of 1.10 volts. Which of the following could correctly account for this observation?

(A) The copper electrode was larger than the zinc electrode.

(B) The Zn^{2+} electrolyte was $Zn(NO_3)_2$, while the Cu^{2+} electrolyte was $CuSO_4$.

(C) The Zn^{2+} solution was more concentrated than the Cu^{2+} solution.

(D) The solutions in the half-cells had different volumes.

(E) The salt bridge contained KCl as the electrolyte.

8. In the electroplating of nickel, 0.200 faraday of electrical charge is passed through a solution of $NiSO_4$. What mass of nickel is deposited?

(A) 2.94 g

(B) 5.87 g

(C) 11.7 g

(D) 58.7 g

(E) 294 g

9.

$$M(s) + 3\ Ag^+(aq) \rightarrow 3\ Ag(s) + M^{3+}(aq) \qquad E° = +2.46\ V$$

$$Ag^+(aq) + e^- \rightarrow Ag(s) \qquad E° = +0.80\ V$$

According to the information above, what is the standard reduction potential for the half-reaction $M^{3+}(aq) + 3\ e^- \rightarrow M(s)$?

(A) -1.66 V

(B) -0.06 V

(C) 0.06 V

(D) 1.66 V

(E) 3.26 V

10.

Half-Reaction	E° (V)
$Ag^+(aq) + e^- \rightarrow Ag(s)$	0.80
$Cr^{3+}(aq) + 3\ e^- \rightarrow Cr(s)$	−0.41

Based on the standard reduction potentials in the table above, what is the value of E° for a standard galvanic cell made with Ag/Ag^+ and Cr/Cr^{3+} half-cells?

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(A) 0.39 V
(B) 1.21 V
(C) 1.99 V
(D) 2.81 V