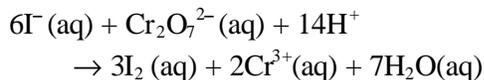


21 • Electrochemistry

NChO Practice Problems

1998

40. For this reaction, $E^\circ_{\text{cell}} = 0.79 \text{ V}$.

Given that the standard reduction potential for $\text{Cr}_2\text{O}_7^{2-} (\text{aq}) \rightarrow 2\text{Cr}^{3+} (\text{aq})$ is 1.33 V, what is E°_{red} for $\text{I}_2 (\text{aq})$?

- a) +0.54 V b) -0.54 V
c) +0.18 V d) -0.18 V

41. What is the product formed at the anode in the electrolysis of 1.0 M $\text{NaNO}_3 (\text{aq})$?

- a) $\text{H}_2 (\text{g})$ b) $\text{NO}_2 (\text{g})$
c) $\text{O}_2 (\text{g})$ d) $\text{Na} (\text{s})$

42. Which of these ions is the best reducing agent?

Standard Reduction Potentials, E°	
$\text{Fe}^{3+} (\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+} (\text{aq})$	+0.77 V
$\text{Cu}^{2+} (\text{aq}) + \text{e}^- \rightarrow \text{Cu}^+ (\text{aq})$	+0.15 V

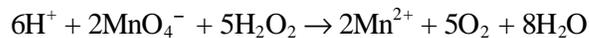
- a) Fe^{3+} b) Fe^{2+}
c) Cu^{2+} d) Cu^+

43. $\text{Zn} (\text{s}) + \text{Cl}_2 (\text{g}, 1 \text{ atm}) \\ \rightleftharpoons \text{Zn}^{2+} (\text{aq}, 1 \text{ M}) + 2\text{Cl}^- (\text{aq}, 1 \text{ M})$

An electrochemical cell based on this reaction has a cell voltage, E° , of 2.12 V. Which change could make the cell voltage greater than 2.12 V?

- a) add more $\text{Zn} (\text{s})$
b) add more $\text{Cl}^- (\text{aq})$ ions
c) decrease the concentration of $\text{Zn}^{2+} (\text{aq})$ ions
d) decrease the partial pressure of Cl_2

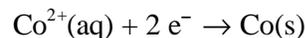
1997

43. What is the function of H_2O_2 in this reaction?

- a) catalyst b) reducing agent
c) oxidizing agent d) inhibitor

44. How much hydrogen is produced from the electrolysis of water in the same time that 2.2 L of oxygen is formed?

- a) 0.14 L b) 1.1 L
c) 2.2 L d) 4.4 L

45. Which of these changes will cause the value of the potential for this half-reaction to be less negative? ($E^\circ = -0.28 \text{ V}$ for the reaction.)

- a) increasing the amount of solid Co
b) decreasing the amount of solid Co
c) increasing the concentration of $\text{Co}^{2+} (\text{aq})$
d) decreasing the concentration of $\text{Co}^{2+} (\text{aq})$

1996

43. Use these reduction potentials to determine which one of the reactions below is spontaneous.

Reaction	Reduction Potentials, E°
$\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag}$	0.800 V
$\text{Pb}^{2+} + 2\text{e}^- \rightarrow \text{Pb}$	- 0.126 V
$\text{V}^{2+} + 2\text{e}^- \rightarrow \text{V}$	- 1.18 V

- a) $\text{V}^{2+} + 2 \text{Ag} \rightarrow \text{V} + 2 \text{Ag}^+$
b) $\text{V}^{2+} + \text{Pb} \rightarrow \text{V} + \text{Pb}^{2+}$
c) $2 \text{Ag}^+ + \text{Pb}^{2+} \rightarrow 2 \text{Ag} + \text{Pb}$
d) $2 \text{Ag}^+ + \text{Pb} \rightarrow 2 \text{Ag} + \text{Pb}^{2+}$

44. It is possible to produce chlorine gas by electrolyzing any of these chlorine-containing compounds under the proper conditions. Which compound will require the smallest number of coulombs to produce one mole of chlorine?
- a) $\text{Ca}(\text{OCl})_2$ b) NaClO_2
 c) KClO_3 d) $\text{Mg}(\text{ClO}_4)_2$

1994

46. If solid nickel metal were added to separate aqueous solutions each containing 1M concentrations of Ag^+ , Cd^{2+} , and Sn^{2+} ions, how many metals would plate out, based on the given standard reaction potentials?

Standard Reduction Potentials

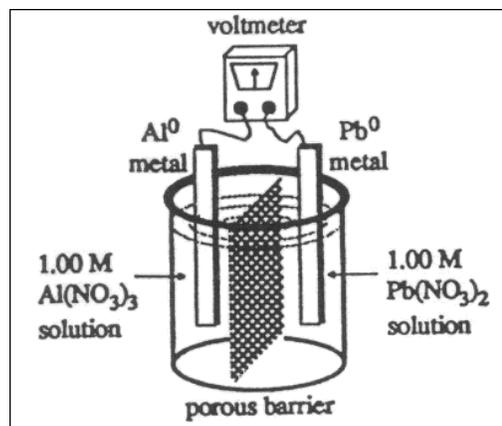
Ag^+/Ag	0.799 V
Sn^{2+}/Sn	-0.141 V
Ni^{2+}/Ni	-0.236 V
Cd^{2+}/Cd	-0.400 V

- a) zero b) one
 c) two d) three
48. Solutions of Ag^+ , Cu^{2+} , Fe^{3+} and Ti^{4+} are electrolyzed with a constant current until 0.10 mol of metal is deposited. Which will require the greatest length of time?
- a) Ag^+ b) Cu^{2+}
 c) Fe^{3+} d) Ti^{4+}

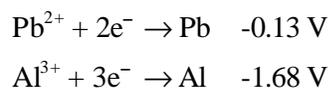
1993

67. How many grams of cobalt metal will be deposited when a solution of cobalt(II) chloride is electrolyzed with a current of 10. amperes for 109 minutes?
- a) 0.66 b) 4.0
 c) 20 d) 40

66. What voltage will be produced by the electrochemical cell?



Reduction Potentials

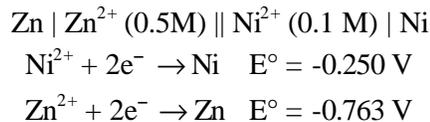


- a) 2.97V b) 1.55V
 c) -1.81V d) -2.97V

1992

59. A spoon is made the cathode in an electroplating apparatus containing a AgNO_3 solution. How many grams of Ag will be plated on the spoon if a current of 2.00 A is passed through the apparatus for 1.90 min.?
- a) 0.255 g b) 0.150 g
 c) 0.128 g d) 0.0638 g

60. A cell is set up using the following reactions:



What is the voltage of the cell?

- a) -0.513 V b) -1.013 V
 c) 0.492 V d) 0.513 V

Answers:

1998	40 a, 41 c, 42 d, 43 c
1997	43 b, 44 d, 45 c
1996	43 d, 44 a
1994	46 c, 48 d
1993	67 c, 66 b
1992	59 a, 60 c