LECTURE 26

1. You are given two half-cells, one a standard Cu *(s)* | Cu^{+2} *(aq)*, and the other an unknown metal, described as M *(s)* | M^{+n} *(aq)*. When you connect the half cells at 25 °C, you make a galvanic cell with $E = 0.57$ V. You also notice that copper is being deposited on the electrode.
(a) Calculate the standard potential of the unknown half-cell using the table at the end of this PSet.
(b) Using the table at the end of this PSet, determine what the metal is.

(a) $E^\circ = -0.23$ V
(b) Nickel

2. Oxidative damage of DNA leads to mutation, which can in turn lead to cancer or genetic defects. The redox potentials of the four nucleotides of DNA are listed below. Which nucleotide (A, G, T, C) is the most likely to undergo oxidation?

Nucleotide	*E* (V)
G	1.33
A	1.42
C	1.60
T	1.70

G is most likely to undergo oxidation.

3. Using Standard Reduction Potentials listed below, answer the following.

(a) Which is the best reducing agent: Cu, Cu^{2+}, or **Fe**?

(b) Which is the best oxidizing agent: Au, **Au^{+}**, Ag^{+}, or Ag?

(c) Which of the following will spontaneously oxidize Pb: **Cu^{2+}**, Zn^{2+}, or Fe^{2+}?

4. You construct a galvanic cell using the two half cells below:

$$Au^{+}\ (aq) + e^{-} \rightarrow Au\ (s)$$
$$Cl_2\ (g) + 2e^{-} \rightarrow 2Cl^{-}\ (aq)$$

The initial concentration of Au^{+} is 0.10 M and Cl^{-} is 0.50 M. The initial pressure of Cl_2 is 1.50 atm at 25 °C. Using the table below, calculate the initial voltage of the galvanic cell.

0.25 V

5. Using the table below, determine the unknown quantity for the following galvanic cell:
$Pt(s)|H_2(g, 1.0\ bar)|H^{+}(pH = ?)||Cl^{-}(aq, 1.0M)|AgCl(s)|Ag(s)$, $E = +0.30V$

pH = 1

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Selected Standard Reduction Potentials at 25°C

Half-Reactions	E° (volts)
Au^{+} (*aq*) + e^{-} → Au (*s*)	1.69
$HClO_2$ (*aq*) + $2H_3O^{+}$ (*aq*) + $2e^{-}$ → HClO (*aq*) + $3H_2O$ (λ)	1.640
HClO (*aq*) + H_3O^{+}(*aq*) + e- → ½ Cl_2 (*g*) + $2H_2O$ (λ)	1.63
Cl_2 (*g*) + $2e^{-}$ → $2Cl^{-}$ (*aq*)	1.3583
$Cr_2O_7^{2-}$ (*aq*) + $14H_3O^{+}$ (*aq*) + $6e^{-}$ → $2Cr^{3+}$ (*aq*) + $21H_2O$ (λ)	1.330
Ag^{+} (*aq*) + e^{-} → Ag (*s*)	0.7996
Cu^{2+} (*aq*) + $2e^{-}$ → Cu (*s*)	0.3402
AgCl (*s*) + e^{-} → Ag (*s*) + Cl^{-} *(aq)*	0.22
Cu^{2+} (*aq*) + e^{-} → Cu^{+} (*aq*)	0.15
$2H^{+}$ (*aq*) + $2e^{-}$ → H_2 (g)	0.000
Pb^{2+} (*aq*) + $2e^{-}$ → Pb (*s*)	-0.13
Sn^{2+} (*aq*) + $2e^{-}$ → Sn (*s*)	-0.14
Ni^{2+} (*aq*) + $2e^{-}$→ Ni (*s*)	-0.23
Fe^{2+} (*aq*) + $2e^{-}$ → Fe (*s*)	-0.44
Zn^{2+} (*aq*) + $2e^{-}$→ Zn (*s*)	-0.7628
Mg^{2+} (*aq*) + $2e^{-}$ → Mg (*s*)	-2.36

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