Chemistry-4311
November 11, 2016

Quiz #8 **Name** Key

$R = 1.987$ cal K^{-1} mol^{-1} $= 8.314$ J K^{-1} mol^{-1} $= 0.08206$ L atm K^{-1} mol^{-1}
$K = {}^{o}C + 273.15$, $F = 96{,}500$ C/mole

1. Matching (Use a letter only once)

For an electrochemical cell operating spontaneously, the sign of the emf potential E is e.

The equilibrium constant for an electrochemical cell is found from a.

The membrane potential arising from different inner and outer concentrations of K^+ is c.

ΔG^o for an electrochemical cell is i

The emf E of an electrochemical cell is g.

a. $\ln K = \nu F E^o/RT$
b. $-\nu F \ln Q$
c. $0.0257\ V \ln\{[K^+]_{outer}/[K^+]_{inner}\}$
d. ΔG_r
e. positive
f. $\ln K = RTE^o/\nu F$
g. $E^o - (RT/\nu F)\ln Q$
h. negative.
i. $-\nu F E^o$
j. $\nu F E^o \ln\{[K^+]_{outer}/[K^+]_{inner}\}$

+3 2. Consider the two reduction potentials

$Br_2 + 2e^- \rightarrow 2Br^-$ $E^o = +1.087$ V, $2Hg^{2+} + 2e^- \rightarrow Hg_2^{2+}$ $E^o = +0.92$ V

a. What is the anode for an electrochemical cell consisting of these two half reactions?

cell reaction
$Br_2 + 2e^- \rightarrow 2Br^-$ $E^o = +1.087$ V cathode, reduction
$Hg_2^{2+} \rightarrow 2Hg^{2+} + 2e^-$ $E^o = -0.92$ V anode, oxidation

b. Calculate E^o and ΔG^o for the cell

$E^o_{cell} = 0.167$ V

$E^o_{cell} = 1.087\ V - 0.92\ V$
$= 0.167$ V

$\Delta G^o = -\nu F E^o = -2\ moles \times \frac{96{,}500\ C}{mole} \times 0.167\ V = -32{,}231$ V-C
$= -32{,}231$ J
$= -32.23$ kJ

+2 3. Give the reasons why ΔG_r has a large negative value for ATP hydrolysis

1. ATP has considerable electron repulsion. Reduced when ATP is hydrolyzed to ADP and HPO_4^{2-}.

2. ADP and HPO_4^{2-} possess more resonance structures than ATP.

3. Release of the steric crowding among oxygen atoms on adjacent phosphate groups upon hydrolysis.

List two for full credit