

Chemistry-4311
November 11, 2016

Quiz #8

Name Key

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

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.

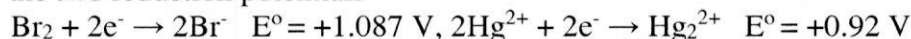
The membrane potential arising from different inner and outer concentrations of K^+ is c.

ΔG° for an electrochemical cell is i.

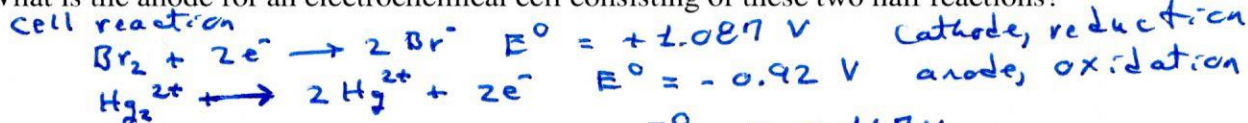
The emf E of an electrochemical cell is g.

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

+3 2. Consider the two reduction potentials



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



b. Calculate E° and ΔG° for the cell

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

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$$\Delta G^\circ = -vFE^\circ = -2 \text{ moles} \times \frac{96,500 \text{ C}}{\text{mole}} \times 0.167 \text{ V} = -32,231 \text{ V}\cdot\text{C} = -32,231 \text{ J} = -32.23 \text{ kJ}$$

+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