REVIEW QUESTIONS
Final Exam

1. Which oxidizing agent shown below will oxidize Br^- but not Cl^-?

   a) HNO_3

   b) $K_2Cr_2O_7$ (in acid)

   c) $KMnO_4$ (in acid)

2. The equilibrium constant (K_c) for the reaction shown below is 9.1 X 10^{-6} at 25°C. What is ΔG^o for this reaction at this temperature?

$$2Fe^{3+}\,(aq) + Hg_2^{2+}\,(aq) \rightarrow 2Fe^{2+}\,(aq) + 2\,Hg^{2+}\,(aq)$$

3. Write half reactions and cell notation for a cell that has the following overall reaction:

$$Zn\,(s) + 2HCl\,(aq) \rightarrow ZnCl_2\,(aq) + H_2\,(g)$$

4. Calculate the equilibrium constant K for the following reaction at 25°C from standard electrode potentials.

$$2\,Fe\,(s) + 6\,H^+\,(aq) \rightarrow 2\,Fe^{3+}\,(aq) + 3\,H_2\,(g)$$

5. The free energy change (ΔG) for the reaction A (g) $\rightarrow$ B (g) is zero under certain conditions. The standard free energy change ($\Delta G°$) for this reaction is –42.5 kJ. Which of the statements below must be true about this reaction?

   a) The concentration of the product is greater than the concentration of the reactant.

   b) The reaction is at equilibrium.

   c) The concentration of the reactant is greater than the concentration of the product.

6. Calculate the cell potential of a cell of a cell operating with the following reaction at $25^{o}C$, in which $[VO_2^+] = 0.010M$, $[H^+] = 1.0M$, $[Ni^{2+}] = 2.0$ M, and $[VO^{2+}] = 2.0$ M.

$$Ni\ (s) + 2\ VO_2^+\ (aq) + 4\ H^+\ (aq) \rightarrow Ni^{2+}\ (aq) + 2\ VO^{2+}\ (aq) + 2\ H_2O\ (l)$$

7. Which process is spontaneous at 298 K? (Hint: Use data in appendix II in your text to calculate $\Delta G°$, and then calculate ΔG for non-standard non-standard conditions)

   a) $H_2O\ (l) \rightarrow H_2O\ (g, 1\ atm)$

   b) $H_2O\ (l) \rightarrow H_2O\ (g, 0.10\ atm)$

   c) $H_2O\ (l) \rightarrow H_2O\ (g, 0.010\ atm)$

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ANSWERS:

1) $K_2Cr_2O_7$ (in acid)
2) 29 kJ
3) Zn (s) | Zn^{2+} (aq) || H^+ (aq) | H_2 (g) | Pt
4) $K=4.5x10^3$
5) a
6) 1.08 V
7) c