**New Stuff**

1. Determine the cell reaction and standard cell potential at 25 °C for a cell made from an anode half-cell containing a cadmium electrode in 1 $M$ cadmium nitrate and a cathode half-cell consisting of an aluminum electrode in 1 $M$ aluminum nitrate solution. Is the reaction spontaneous at standard conditions? What is the $\Delta G°$ for this reaction?

2. Determine the non-standard cell potential for the following reaction and if the redox reaction is spontaneous as written.

   $Hg(l)+S^{2-}(aq, 0.10M)+2Ag^+(aq, 0.25M)\longrightarrow 2Ag(s)+HgS(s)$
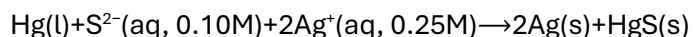
3. Write a nuclear reaction for each step in the formation of Po-218 from U-238, which proceeds by a series of decay reactions involving the step-wise emission of α, β, β, α, α, α particles, in that order.

4. $^{239}$Pu is a nuclear waste byproduct with a half-life of 24,000 y. What fraction of the $^{239}$Pu present today will be present in 1000 y? Radioisotopes follow first order kinetics.

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5.  A reaction has a rate constant, $k = 2.1 \times 10^{-11}$ s$^{-1}$ at 27 °C and $8.5 \times 10^{-11}$ s$^{-1}$ at 37 °C.  What is the activation energy for the reaction?

6.  Calculate the equilibrium concentration of both species in 1.00 L of a solution prepared from 0.129 mol of $N_2O_4$ with chloroform as the solvent.

$$N_2O_4(g) \rightleftharpoons 2NO_2(g) \quad K_c = 1.07 \times 10^{-5}$$
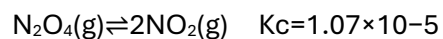
7.  What is the pH of a 0.100 M solution of sodium fluoride?

8.  A buffer is made by mixing 10.0 mL of 0.100 M sodium acetate and 10.0 mL of 0.200 M acetic acid.  What is the pH after 5.00 mL of 0.100 M HCl is added?