CH 302 Spring 2007 Worksheet 11

Half-reaction	ΔE_r^0 (V)
$Li^+(aq) + e^- \rightarrow Li(s)$	-3.05
$Al^{3+}(aq) + 3e^- \rightarrow Al(s)$	-1.68
$TiO(s) + 2H^+ + 2e^- \rightarrow Ti(s) + H_2O$	-1.31
$Ti^{3+}(aq) + 3e^- \rightarrow Ti(s)$	-1.21
$Ni^{2+}(aq) + 2e^- \rightarrow Ni(s)$	-0.25
$CO_2(g) + 2H^+ + 2e^- \rightarrow HCOOH(aq)$	-0.11
$2H^+(aq) + 2e^- \rightarrow H_2(g)$	0
$SO_4^{2-}(aq) + 4H^+ + 2e^- \rightarrow 2H_2O(l) + SO_2(aq)$	+0.17
$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$	+0.34
$Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq)$	+0.77
$NO_3^-(aq) + 2H^+(aq) + e^- \rightarrow NO_2(g) + H_2O(l)$	+0.80
$Au^{3+}(aq) + 3e^- \rightarrow Au(s)$	+1.52
$Ag_2O_3(s) + 6H^+ + 4e^- \rightarrow 2Ag^+(aq) + 3H_2O$	+1.67
$F_2(g) + 2e^- \rightarrow 2F^-(aq)$	+2.87

For problems 1-5, calculate ΔE for the given electrochemical cell.

1. Pt | F^-(1.3 M) | F_2(0.75 atm) || Cu^{2+}(0.25 M) | Cu

2. Au | Au^{3+}(0.1 M) || Ni^{2+}(0.05 M) | Ni

3. Pt | Cu | Cu^{2+}(0.025 M) || Fe^{3+}(0.9 M) | Fe^{2+}(2.05 M) | Ag

4. Ti | Ti^{3+}(1.3 M) || Au^{3+} (0.05 M) | Au

5. Pt | F^-(0.5 M) | F_2 (0.8 atm) || H^+ (10^{-7} M) | H_2(0.25 atm) | Pt

For problems 6-10, calculate the current generated by the reaction when the given amount of reactant is used up in one hour.

6. $Ag_2O_3(s) + Ni(s) \rightarrow Ag^+(aq) + Ni^{2+}(aq)$ 5 g Ni

7. $Au^{3+}(aq) + Li(s) \rightarrow Au(s) + Li^+(aq)$ 0.01 M Au^{3+}

8. $Fe^{3+}(aq) + Ti(s) \rightarrow Fe^{2+}(aq) + Ti^{3+}(aq)$ 10 g Ti

9. $NO_3^-(aq) + Al(s) \rightarrow NO_2(g) + Al^{3+}(aq)$ 0.25 M NO_3^-

10. $Au^{3+}(aq) + Fe^{2+}(aq) \rightarrow Au(s) + Fe^{3+}(aq)$ 0.03 M Fe^{2+}

11. If the rate of the following reaction is 1.3×10^{-5} M/s, what is $\Delta[O_2]/\Delta t$?

$$2\ C_6H_6OH + {}^{29}/_2 O_2 \rightarrow 12\ CO_2 + 7\ H_2O$$

12. If $\Delta[CO_2]/\Delta t = 10^{-4}$ M/s for the same reaction as in problem 11, what is the rate of the reaction?

13. Predict whether the rate of the reaction in problem 11 will increase, decrease, or stay the same if the following changes are made to the system.
    a. Add C_6H_6OH
    b. Remove O_2
    c. Increase the temperature
    d. Keep the same amount of everything, but double the size of the reaction vessel.
    e. Add a catalyst

For the reactions in problems 14-20, calculate either the rate or the $\Delta[\ ]/\Delta t$ using the information given.

14. $2\ CH_4 + 3\ Cl_2 \rightarrow 2\ CHCl_3 + 3\ H_2$ $\quad \Delta[H_2]/\Delta t = 5.3 \times 10^{-5}$ M/s $\quad$ rate = _____

15. $3\ H_2 + N_2 \rightarrow 3\ NH_3$ $\quad$ rate $= 2.7 \times 10^{-3}$ M/s $\quad \Delta[H_2]/\Delta t =$ ___

16. $H_2 + I_2 \rightarrow 2HI$ $\quad$ rate $= 4.2 \times 10^{-4}$ M/s $\quad \Delta[HI]/\Delta t =$ ___

17. $4\ Al + 3\ O_2 \rightarrow 2\ Al_2O_3$ $\quad \Delta[Al]/\Delta t = -9.4 \times 10^{-3}$ M/s $\quad$ rate = _____

18. $C_8H_{18} + {}^{25}/_2\ O_2 \rightarrow 8\ CO_2 + 9\ H_2O$ $\quad \Delta[O_2] = -3.6 \times 10^{-5}$ M/s $\quad \Delta[H_2O]/\Delta t =$ _

19. $CH_2S + 6\ F_2 \rightarrow CF_4 + 2\ HF + SF_6$ $\quad$ rate $= 1.5 \times 10^{-2}$ M/s $\quad \Delta[F_2]/\Delta t =$ ___

20. $Fe_2O_3 + 2\ Al \rightarrow Al_2O_3 + 2\ Fe$ $\quad \Delta[Fe]/\Delta t = 1.1 \times 10^{-4}$ M/s $\quad$ rate = _____