

You will need to use the Table of E° values given with the "Echem Cell" exam study questions to answer some of these questions.

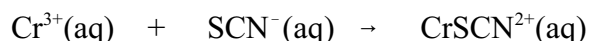
Consider the following electrochemical cell for the next two questions: [F 01, ex 3]



- Calculate E_{cell} .
(a) 0.02 V (b) -0.02 V (c) 0.05 V (d) -0.05 V (e) 0.03 V (ab) -0.03 V
- What will be the concentrations of FeCl_2 and CdCl_2 when the cell reaches equilibrium?
(a) $[\text{FeCl}_2] = 0.57 \text{ M}$; $[\text{CdCl}_2] = 0.03 \text{ M}$ (b) $[\text{FeCl}_2] = 0.43 \text{ M}$; $[\text{CdCl}_2] = 0.17 \text{ M}$
(c) $[\text{FeCl}_2] = 0.59 \text{ M}$; $[\text{CdCl}_2] = 0.01 \text{ M}$ (d) $[\text{FeCl}_2] = 0.30 \text{ M}$; $[\text{CdCl}_2] = 0.30 \text{ M}$
(e) $[\text{FeCl}_2] = 0.42 \text{ M}$; $[\text{CdCl}_2] = 0.18 \text{ M}$
- Which of the following compounds is the strongest reducing agent? (Hint: Consider E° values.) [F 00, ex 3]
(a) SO_4^{2-} (b) $\text{S}_2\text{O}_8^{2-}$ (c) H_2 (d) Mg (e) Mg^{2+}
- What is K_{sp} of $\text{Ni}(\text{OH})_2$? (Hint: Write out the reaction corresponding to K_{sp} and use the E° information provided to calculate K of this reaction.) [S 02, ex 3]
(a) 7×10^{-5} (b) 5×10^{-25} (c) 2×10^{-9} (d) 5×10^{-12} (e) 2×10^{-16}
- Calculate K_{sp} for Hg_2SO_4 using information provided with the exam. In other words, calculate K for the following reaction: [S 01, ex 3]
$$\text{Hg}_2\text{SO}_4(\text{s}) \rightleftharpoons \text{Hg}_2^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq})$$

(a) 8.1×10^{-7} (b) 1.8×10^{-5} (c) 3.2×10^{-11} (d) 7.4×10^{-9} (e) 1.5×10^{-8}

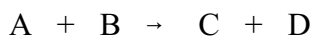
6. Consider the following reaction: [S 02, ex 3]



In the presence of 0.500 M SCN^{-} (a large excess), the reaction appears to be first order with a rate constant of $2.0 \times 10^{-6} \text{ s}^{-1}$ at a particular temperature. In order to determine the actual rate law and the true rate constant, the reaction was run again with $[\text{SCN}^{-}] = 0.700 \text{ M}$ and the $[\text{Cr}^{3+}]$ measured as a function of time. A plot of $\ln[\text{Cr}^{3+}]$ vs. time gives a straight line with a slope of $-2.8 \times 10^{-6} \text{ s}^{-1}$. What is the true rate law and rate constant for this reaction?

- (a) rate = $k[\text{Cr}^{3+}]$, $k = 2.8 \times 10^{-6} \text{ s}^{-1}$ (b) rate = $k[\text{Cr}^{3+}][\text{SCN}^{-}]$, $k = 5.6 \times 10^{-6} \text{ M}^{-1}\text{s}^{-1}$
 (c) rate = $k[\text{Cr}^{3+}][\text{SCN}^{-}]^2$, $k = 8.0 \times 10^{-6} \text{ M}^{-2}\text{s}^{-1}$ (d) rate = $k[\text{Cr}^{3+}][\text{SCN}^{-}]$, $k = 4.0 \times 10^{-6} \text{ M}^{-1}\text{s}^{-1}$
 (e) rate = $k[\text{SCN}^{-}]^2$, $k = 5.6 \times 10^{-6} \text{ M}^{-2}\text{s}^{-1}$

- Consider the following hypothetical reaction for the next two questions: [S 00, ex 3]



7. In order to determine the rate law for this reaction, experiments were run under "pseudo-order" conditions, similar to what you used in your kinetics laboratory experiment. To do this, concentration vs. time data were recorded for several different starting concentrations of A and B. In all cases the $[\text{A}] \gg [\text{B}]$ so that the $[\text{A}]$ did not change significantly during the course of the experiment. For the first data set, a plot of $\ln[\text{B}]$ vs. t gave a curved line, but a plot of $1/[\text{B}]$ vs. t gave a straight line.

What does this information tell about the kinetics of this reaction. Choose the **one** best answer.

- (a) The reaction is second order in B. (b) The reaction is first order in B.
 (c) The reaction is first order in A. (d) The reaction is second order in A.
 (e) The reaction is second order overall (ab) The reaction is fourth order overall.
8. Pseudo rate constants, k_{obs} 's, were determined from the slopes of the $1/[\text{B}]$ vs. t plots for two data sets. The results are shown below. What is the rate law for this reaction?

[A], M	[B], M	k_{obs} , $1/(\text{M}\cdot\text{s})$
0.10	1.0×10^{-3}	2.5×10^{-8}
0.20	1.0×10^{-3}	1.0×10^{-7}

- (a) rate = $k[\text{A}]^2[\text{B}]$ (b) rate = $k[\text{A}]^3[\text{B}]^2$ (c) rate = $k[\text{B}]^2$
 (d) rate = $k[\text{A}][\text{B}]$ (e) rate = $k[\text{A}]^2[\text{B}]^2$