Chemistry 236 -- Practice Quiz 2

September 10, 2003 — Kinetics: Inversion of Sucrose

1. (3) A solution is prepared by dissolving 13.71 g of smactose in water and bringing the volume to 0.100 L in a volumetric flask. The optical rotation observed at λ_D for this solution in a 0.500-m polarimetry cell is –34.7°. Calculate the specific rotation of smactose (units deg mL g^{-1} dm^{-1}) at this wavelength and *T*.

   a. –0.95 b. –23.8 c. –50.6 d. –126.5 e. none of these

2. 70.0 mL of 3.0 M Na_2SO_4 is mixed with 30.0 mL of 1.0 M NaCl. Assuming the volumes are additive, the resulting concentration of sodium ion is:

   a. 2.0 M b. 2.4 M c. 4.0 M d. 4.5 M e. none of these

3. If concentrations are expressed in molarity and the time is in seconds, what are the units of the rate constant for the following rate law: rate = $k\,\frac{[A]^3[B]}{[C]}$?

   a. $mol^3\ L^{-3}\ s^{-1}$ b. $L^3\ mol^3\ s$ c. $L^3\ mol^{-3}\ s^{-1}$ d. $mol\ L^{-1}\ s^{-1}$ e. none of these

4. The reaction, 2 A + 2 B → C + D, has a rate constant of 6.0×10^{-3} $L^2\ mol^{-2}\ s^{-1}$ at 0°C. The order of this reaction is

   a. 1 b. 2 c. 3
   d. indeterminate without additional information. e. none of these

5. For a certain reaction, a plot of ln [A] versus *t* gives a straight line with a slope of $-1.46\ s^{-1}$ and a *y*–intercept of 4.30. The rate constant for this reaction is

   a. 0.68 s b. $-1.46\ s^{-1}$ c. $1.46\ s^{-1}$ d. $4.30\ s^{-1}$
   e. This cannot be determined without additional information.

6. Of the expressions given below for $t_{1/2}$, which is correct for a reaction which follows the integrated rate law,

$$\frac{[B][B]_0^2}{2[B]_0 - [B]} = k\,t$$

   a. $t_{1/2} = \frac{[B][B]_0^2}{2[B]_0 - [B]}$ b. $t_{1/2} = \frac{[B][B]_0^2}{k\,(2[B]_0 - [B])}$ c. $t_{1/2} = \frac{[B]_0^2}{3\,k}$

   d. A half-life cannot be defined for a reaction having this integrated rate law.
   e. none of these

7. As a good rule of thumb, many reactions double in speed for a 10°C increase in *T* at room temperature. Taking the two temperatures to be 20°C and 30°C, the activation energy for such reactions would be

   a. $0.35\ kJ\ mol^{-1}$ b. $6.2\ kJ\ mol^{-1}$ c. $22\ kJ\ mol^{-1}$
   d. $51\ kJ\ mol^{-1}$ e. $148\ kJ\ mol^{-1}$

8. An acid-calalyzed reaction has a rate constant of 0.0434 L mol^{-1} min^{-1}. A reaction is initiated by mixing HCl with the other reactant to give an acid molarity of 1.3. What is the half-life of the reaction?

   a. 0.056 min b. 12.3 min c. 17.7 min
   d. This cannot be determined without additional information. e. none of these