A First Course on Kinetics and Reaction Engineering

Unit 5 Additional Quiz Questions

1. Which of the following is the Monod equation.

   a. $r_j = k_j \prod_{\substack{i=\text{all} \\ \text{species}}} [i]^{m_i}$

   b. $r_j = k_{j,0} \exp\left(\frac{-E_j}{RT}\right) \prod_{\substack{i=\text{all} \\ \text{species}}} [i]^{m_i} \left\{1 - \frac{\prod_{\substack{i=\text{all} \\ \text{species}}} [i]^{\nu_{i,j}}}{K_{eq,j}(T)}\right\}^a$

   c. $\mu = \frac{\mu_{\max} C_S}{K_s + C_S}$

   d. $\mu = \frac{K_s + C_S}{\mu_{\max} + C_S}$

   e. None of the equations (a) through (d) is the Monod equation.

2. The Monod equation is used to describe
   a. substrate-inhibited enzymatic hydrolysis
   b. living cell growth kinetics
   c. empirical reaction rates
   d. theoretical reaction rates
   e. last night's dinner
3. True or False? Empirical rate expressions cannot be derived theoretically.
4. Which of the following defines an elementary reaction?
   a. A reaction where at least one reactant is an element.
   b. A reaction where at least one product is an element.
   c. A reaction where at least one reactant and one product is an element.
   d. A reaction which, as written, is an exact description of a single molecular event.
   e. A relatively simple reaction involving a few small molecules.
5. True or False? Elementary reactions are always irreversible.
6. The principle of microscopic reversibility states that
   a. Within a microscopically sized volume, a reaction is always at equilibrium.
   b. Within a microscopically sized volume, a reaction can oscillate, going backwards and forward.
   c. An elementary reaction is always reversible.
   d. If you look backwards into a microscope, things will look smaller.
   e. If a reaction is reversible, then it must be elementary.

7. True or False? Theories about reaction rates generally attempt to explain the rates of elementary reactions.
8. Which of the following is an advantage of collision theory?
    a. It is highly accurate.
    b. It provides a means for approximating the value of rate coefficients.
    c. It provides a means for approximating the value of pre-exponential factors.
    d. It provides a means for approximating activation energies.
    e. It helps insurance companies set the premiums for their policies.
9. Which of the following is NOT a disadvantage of collision theory?
    a. It provides no prediction for the value of the activation energy.
    b. It provides no prediction for the value of the steric factor.
    c. It provides no prediction for the value of the pre-exponential factor.
    d. It only applies to gases.
    e. It assumes molecules are hard spheres.
10. True or False? Collision theory assumes that a collision must involve some minimum relative kinetic energy in order for reaction to occur.
11. True or False? An inelastic collision is one where the total translational energy of the bodies before the collision equals that of the bodies after the collision.
12. True or False? “Activated complex” is the special name given to a species that corresponds to one of the deep valleys on a potential energy surface.
13. True or False? According to transition state theory, the reacting species will cross the highest available barrier separating them from the products.
14. True or False? The transition state rate expression assumes that all species are in their electronic ground state.
15. The term “transition state” refers to
    a. a species geometry that is more like a reactant than a product.
    b. the thermodynamic state of an activated complex.
    c. the geometry of an activated complex.
    d. a species geometry that is more like a product than a reactant.
    e. a country or province where the government has been overthrown.