Kinetics: Multiple Choice Practice I

1. Consider the reaction:

$$2\,C_3H_6 + 9\,O_2 \longrightarrow 6\,CO_2 + 6\,H_2O$$

If the rate of appearance of CO_2 is 0.40 mol/L/s, the rate of disappearance of O_2 is*:*

a) 0.10 mol/L/s b) 0.90 mol/L/s c) 0.60 mol/L/s
d) 0.30 mol/L/s e) 1.2 mol/L/s

2. Which statement best explains why increasing concentration increases reaction rate?

a) The collisions become more effective. b) The collision frequency increases.
c) The average kinetic energy increases. d) The activation energy increases.
e) The activation energy decreases.

3. 1.5 g samples of magnesium ribbon are each added to 1 L of acetic acid (2 mol/L) and 1 L of hydrochloric acid (2 mol/L). Which of the following best describes the reactions that occur in the acid solutions?

a) both the rate of reaction and the mass of Mg consumed are the same
b) both the rate of reaction and the mass of Mg consumed are different
c) the rate of reaction is different but the mass of Mg consumed is the same
d) the rate of reaction is the same but the mass of Mg consumed is different

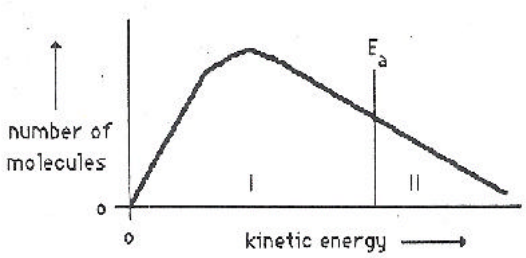
4. When lycopodium powder is heated in a spoon, it burns slowly with a yellow, sooty flame yet when it is blown through a candle flame, it burns explosively. An explanation of this observation is that:

a) the candle flame acts as a catalyst to the reaction
b) the concentration of oxygen in the flame is higher than in the air above the spoon
c) the lycopodium powder reacts with something in the candle flame
d) the exposed surface area of the powder is much larger in the flame than on the spoon
e) the heat from the flame is more concentrated, causing the lycopodium powder to reach its ignition temperature easier

5. The rate of reaction increases with increasing temperature primarily because:

(a) the activation energy is lowered as the temperature is increased
(b) changing the temperature usually alters the mechanism
(c) the heat of reaction is increased
(d) an endothermic process is "helped along" by increasing the temperature
(e) a greater fraction of the molecules possess the activation energy

Consider the following graph of the kinetic energy distribution among molecules at temperature T.



The next four questions, 6 – 9 refer to the above graph:

6. If the temperature were increased, how would the resulting graph differ from the one above?

(a) both areas I and II would increase
(b) both areas I and II would decrease
(c) area I would increase and area II would decrease
(d) area I would decrease and area II would increase
(e) both areas I and II would remain the same

7. If a catalyst is added:

a) E_a moves left
b) E_a does not move
c) E_a moves right
d) no prediction can be made

8. If the temperature is raised:

a) E_a moves left
b) E_a does not move
c) E_a moves right
d) no prediction can be made

9. If the temperature of the system were increased from 20 ^{O}C to 30 ^{O}C, the % of molecules with $E_k > E_A$ would:

a) decrease by a factor of 10
b) increase by a factor of 10
c) decrease by a factor of 2
d) increase by a factor of 2

10. For a given reaction, the overall enthalpy change is + 100 kJ/mol and the activation energy for the reverse reaction is + 200 kJ/mol. The activation energy for the forward reaction would be:

a) + 300 kJ/mol
b) + 200 kJ/mol
c) + 100 kJ/mol
d) - 100 kJ/mol
e) - 200 kJ/mol

11. A rise of 10 ^{O}C can cause the rate of some reactions to double. This is best explained by:
   a) the average velocity of the molecules has doubled
   b) the number of molecules with more than enough energy to overcome the activation energy barrier has doubled
   c) the average kinetic energy of the particles doubles
   d) the activation energy has lowered
   e) the concentration of the reactants has doubled

12. A catalyst speeds up a reaction by:
   a) lowering the ? H for the reaction
   b) lowering the activation energy for the reaction
   c) raising the kinetic energy of the particles
   d) raising the enthalpy of the reactants
   e) lowering the enthalpy of the reactants

13. In a chemical reaction at constant temperature, the addition of a catalyst:
   a) increases the concentration of products at equilibrium
   b) increases the fraction of molecules with more than a given kinetic energy
   c) lowers the value of ? H of the reaction
   d) does not affect the value of E_a for the reverse reaction
   e) provides an alternative reaction mechanism

14. The rate-determining step of a reaction is:
   a) always the slowest step
   b) always the fastest step
   c) always the first step in a reaction mechanism
   d) always the step with the lowest activation energy
   e) always the step with the least number of molecules

Problem

For the following reaction $2\ HI_{(g)} \longrightarrow H_{2\ (g)} + I_{2\ (s)}$

Given that the activation energy for the forward reaction is + 145 kJ/mol and the activation energy for the reverse reaction is + 186 kJ/mol:

a) sketch a potential energy graph for this reaction, label each axis appropriately
b) label the graph to indicate the following: activated complex, activation energies, heat of reaction, reactants, products
c) on the graph, show what would happen if a catalyst were used
d) Is this reaction endothermic or exothermic?