CHAPTER 6 BLM ANSWER KEY

BLM 6-1: Average and Instantaneous Rates

Answers

1. **(a)** Student graphs should show concentration (the dependent variable) on the *y*-axis and time (the independent variable) on the *x*-axis. The axis labels should include units. The curve for [A] has a negative slope that becomes less negative as the reaction progresses.

   (b) The graph has a negative slope, because the concentration of A is decreasing. The slope becomes less negative as the reaction progresses, because as [A] decreases, the reaction rate decreases. Therefore, [A] decreases at a lesser rate.

   (c) $\text{slope} = \frac{(2.42 - 3.20)}{(3.00 - 0.00)}$
   $= -0.260$

   (d) 0.260 mol/(L • s)

   (e) 0.157 mol/(L • s)

   (f) The rate decreases as the reaction progresses because the reactant concentration decreases.

   (g) The tangent should have a slope of approximately –0.12.

   (h) The instantaneous rate in terms of [A] is 0.12 mol/(L • s).

2. **(a)** Students should draw their curve for [C] on the same set of axes they used for [A]. A good graph will have a legend that identifies the two curves (e.g., by colour).

   (b) The graph has a positive, but decreasing, slope. The slope is positive because the concentration of C is increasing. The slope is decreasing, because as the concentration of A decreases, C is produced at a progressively slower rate.

   (c) $\text{slope} = \frac{(1.58 - 0.00)}{(3.00 - 0.00)}$
   $= 0.527$

   (d) 0.527 mol/(L • s)

   (e) 0.307 mol/(L • s)

   (f) The concentration of A is decreasing as the reaction progresses; therefore, the rate at which B is being produced is also decreasing.

   (g) The tangent should have a slope of approximately 0.24.

   (h) The instantaneous rate in terms of [C] is 0.24 mol/(L • s).

3. **(a)** $\text{rate} = -\frac{\Delta[\text{A}]}{\Delta t} = \frac{1}{2}\frac{\Delta[\text{C}]}{\Delta t}$

   (b) The curves for [A] and [C] support the expression: the slope for the [A] vs time curve is negative, while the slope for the [C] vs time curve is positive. At any given point, the absolute value of the slope of the curve for [C] is about twice the slope of the curve for [A].

BLM 6-2: Rate Law Equations

Answers

1. **(a)** Consider experiments 1 and 3. $[O_2]$ remains the same, while $[NO_2]$ doubles. The rate also doubles. Therefore, the reaction is first order in NO_2.

   Consider experiments 1 and 2. $[NO_2]$ remains the same, while $[O_2]$ doubles. The rate also doubles. Therefore, the reaction is first order in O_2.

   The rate law expression is: rate = $k[O_2][NO_2]$

   (b) 1.1 L/(mol • s)

   (c) 5.6×10^{-4} mol/(L • s)

2. **(a)** multiplied by a factor of 12

   (b) multiplied by a factor of 0.25

   (c) no change

   (d) multiplied by a factor of 0.125

3. **(a)** first order in bromate and bromide ions, second order in hydrogen ions

   (b) fourth order

   (c) monitor changing pH, monitor changing conductivity

4. **(a)** 1.12×10^{3} s

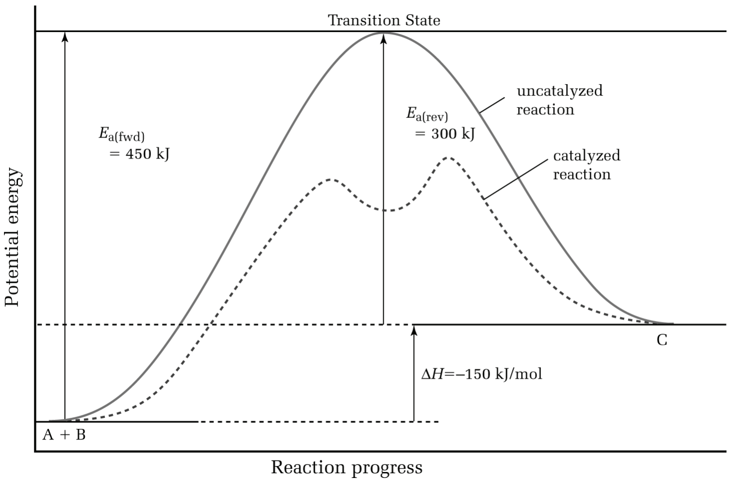
   (b) 37.3 min

CHAPTER 6 BLM ANSWER KEY

BLM 6-3: Potential Energy Diagrams

Answers

1.



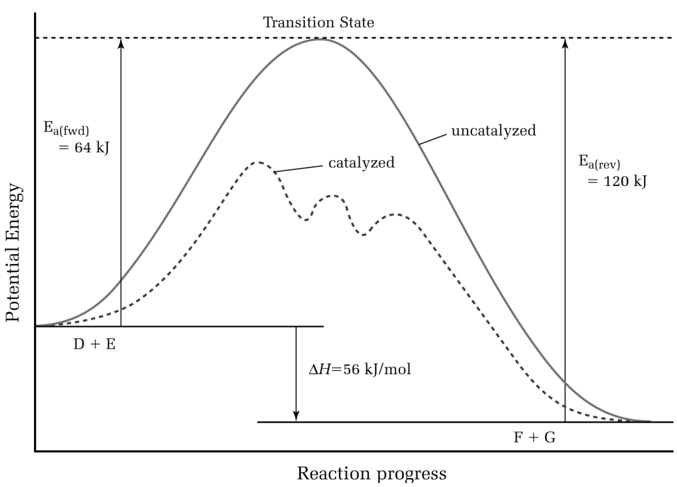
(a) endothermic

(b) 300 kJ

(c) The curve representing reaction progress would have had two "hills." In other words, the diagram would need to show two activation energies—one for each step.

(d) see dotted curve on diagram above

2.



(a) exothermic

(b) 64 kJ

(c) see dotted curve on diagram above

BLM 6-5: Chapter 6 Test

Mulitple Choice

1. (d)

2. (c)

3. (c)

4. (d)

Short Answer

5. (a) Activation energy is the minimum quantity of energy required for a collision to be successful (i.e., to result in a reaction). An activated complex is a highly unstable, short-lived chemical species that forms at the transition state—just as a collision takes place between reactants. The activated complex can break down to form either reactants or products.

(b) Both homogeneous and heterogeneous catalysts change the rate of a chemical reaction. Both are regenerated unchanged at the end of a reaction. However, homogeneous catalysts exist in the same phase as the reactants, while heterogeneous catalysts exist in a different phase from the catalysts.

6. (a) rate = $k[NO]^2[H_2]$

(b) 1.7×10^6 $L^2/(mol^2 \bullet s)$

(c) homogeneous

(d) 3.1 mol/(L • s)

(e) The rate constant is constant only at a constant temperature.

(f) The amount of gas decreases as the reaction progresses. For every 2 mol reactants, 1.5 mol products form.

7. (a) 3

(b) 2

(c) 1

(d) 6

(e) 7