Answers to Problems: Kinetics Assignment #1

1. average rate for NO = $\frac{0.000115914 \text{ mol / L} - 0.000514 \text{ mol / L}}{71 \text{ min} - 0 \text{ min}}$

$= 5.61 \times 10^{-6}$ mol / L·min

average rate for O_2 = $\frac{0.000144 \text{ mol / L} - 0.000343 \text{ mol / L}}{71 \text{ min} - 0 \text{ min}}$

$= 2.80 \times 10^{-6}$ mol / L·min

average rate for NO_2 = $\frac{0.000398086 \text{ mol / L} - 0 \text{ mol / L}}{71 \text{ min} - 0 \text{ min}}$

$= 5.61 \times 10^{-6}$ mol / L·min

2. Over the first 10 minutes

average rate for NO = $\frac{0.00031192 \text{ mol / L} - 0.000514 \text{ mol / L}}{10 \text{ min} - 0 \text{ min}}$

$= 2.02 \times 10^{-5}$ mol / L·min

average rate for O_2 = $\frac{0.000242 \text{ mol / L} - 0.000343 \text{ mol / L}}{10 \text{ min} - 0 \text{ min}}$

$= 1.01 \times 10^{-5}$ mol / L·min

average rate for NO_2 = $\frac{0.00020208 \text{ mol / L} - 0 \text{ mol / L}}{10 \text{ min} - 0 \text{ min}}$

$= 2.02 \times 10^{-5}$ mol / L·min

Over the last 10 minutes

average rate for NO = $\frac{0.000115914 \text{ mol / L} - 0.000127914 \text{ mol / L}}{71 \text{ min} - 61 \text{ min}}$

$= 1.20 \times 10^{-6}$ mol / L·min

average rate for O_2 = $\frac{0.000144 \text{ mol / L} - 0.000150 \text{ mol / L}}{71 \text{ min} - 61 \text{ min}}$

$= 6.00 \times 10^{-7}$ mol / L·min

average rate for NO_2 = $\frac{0.000398086 \text{ mol / L} - 0.000386086 \text{ mol / L}}{71 \text{ min} - 61 \text{ min}}$

$= 1.20 \times 10^{-6}$ mol / L·min

3. Answers will vary slightly due to the drawing of the tangent line to the point at 4 min.

Instantaneous rate, NO = $\frac{0.00028 \text{ mol / L} - 0.000485 \text{ mol / L}}{10 \text{ min} - 0 \text{ min}}$

$= 2.05 \times 10^{-5}$ mol / L·min

Instantaneous rate, O_2 = $\frac{0.00022 \text{ mol / L} - 0.00033 \text{ mol / L}}{10 \text{ min} - 0 \text{ min}}$

$= 1.10 \times 10^{-5}$ mol / L·min

Instantaneous rate, NO_2 = $\frac{0.000242 \text{ mol / L} - 0.00003 \text{ mol / L}}{10 \text{ min} - 0 \text{ min}}$

$= 2.12 \times 10^{-5}$ mol / L·min

Answers will vary slightly due to the drawing of the tangent line to the point at 41 min.

Instantaneous rate, NO = $\frac{0.000125 \text{ mol / L} - 0.00018 \text{ mol / L}}{60 \text{ min} - 30 \text{ min}}$

$= 1.83 \times 10^{-6}$ mol / L·min

Instantaneous rate, O_2 = $\frac{0.00014 \text{ mol / L} - 0.00019 \text{ mol / L}}{70 \text{ min} - 20 \text{ min}}$

$= 1.00 \times 10^{-6}$ mol / L·min

Instantaneous rate, NO_2 = $\frac{0.000365 \text{ mol / L} - 0.000325 \text{ mol / L}}{50 \text{ min} - 30 \text{ min}}$

$= 2.00 \times 10^{-6}$ mol / L·min

4. The ratio between O_2 and NO_2 is 1:2. The rate consumption of O_2 is one-half the rate of formation of NO_2.

The ratio between NO and NO_2 is 2:2, or 1:1. The rate consumption of NO is equal to the rate of formation of NO_2.