# Kinetics Worksheet 3

For problems 1-5 find the rate law for the reaction using the concentration/rate data. Determine the value of the rate constant along with the units.

1. $H_2O_2 + 2HI \rightarrow 2H_2O + I_2$

| **Trial** | **$[H_2O_2]$ (M)** | **[HI] (M)** | **Rate (mol/L/s)** |
|---|---|---|---|
| 1 | 0.10 M | 0.10 M | 0.0076 |
| 2 | 0.10 M | 0.20 M | 0.0152 |
| 3 | 0.20 M | 0.10 M | 0.0152 |

2. $H_2 + I_2 \rightarrow 2HI$

| **Trial** | **$[H_2]$ (mol/L)** | **$[I_2]$ (mol/L)** | **Rate (mol/L/s)** |
|---|---|---|---|
| 1 | 1.0 | 1.0 | 0.20 |
| 2 | 1.0 | 2.0 | 0.40 |
| 3 | 2.0 | 2.0 | 0.80 |

3. $2NO_2 + F_2 \rightarrow 2NO_2F$

| **Trial** | **$[NO_2]$ (mol/L)** | **$[F_2]$ (mol/L)** | **Rate (mol/L/min)** |
|---|---|---|---|
| 1 | 1.0 | 1.0 | $1.0 \times 10^{-4}$ |
| 2 | 2.0 | 1.0 | $2.0 \times 10^{-4}$ |
| 3 | 1.0 | 2.0 | $2.0 \times 10^{-4}$ |

4. $2NO + Br_2 \rightarrow 2NOBr$

| **Trial** | **[NO] (mol/L)** | **$[Br_2]$ (mol/L)** | **Rate (mol/L/hr)** |
|---|---|---|---|
| 1 | 1.0 | 1.0 | $1.30 \times 10^{-3}$ |
| 2 | 2.0 | 1.0 | $5.20 \times 10^{-3}$ |
| 3 | 1.0 | 2.0 | $4.16 \times 10^{-2}$ |

5. $ClO^{3-} + 9I^- + 6H^+ \rightarrow 3I^{3-} + Cl^- + 2H_2O$

| **Trial** | **$[ClO^{3-}]$ (mol/L)** | **$[I^-]$ (mol/L)** | **$[H^+]$ (mol/L)** | **Rate (mol/L/s)** |
|---|---|---|---|---|
| 1 | 0.10 | 0.10 | 0.10 | X |
| 2 | 0.10 | 0.20 | 0.10 | 2X |
| 3 | 0.20 | 0.20 | 0.10 | 4X |
| 4 | 0.20 | 0.20 | 0.20 | 16X |

Given the rate law provided, predict the effect on the initial rate of the following changes in the conditions (temperature, concentration, volume)

6. Nitrogen monoxide gas and hydrogen gas react according to the rate law:

$$\text{Rate} = k[NO]^2[H_2]$$

How does the rate change if:

(a) the concentration of hydrogen is doubled.
(b) the concentration of nitrogen monoxide is doubled.
(c) the concentration of hydrogen is cut in half.
(d) the volume of the container is cut in half.
(e) the volume of the container is doubled.
(f) the temperature is increased.
(g) the concentration of nitrogen monoxide is doubled while the concentration of hydrogen is cut in half.
(h) the concentration of hydrogen is doubled while the concentration of nitrogen monoxide is cut in half.

7. The rate law of a particular reaction between gases X, Y and Z is found to be

$$\text{Rate} = k\,[Y]^2[Z]$$

How does the initial rate change if:

(a) the concentration of X is doubled.
(b) the concentration of Y is tripled.
(c) the concentration of Z is quadrupled.
(d) the volume of the container is cut in half.
(e) the volume of the container is doubled.
(f) the temperature is increased.
(g) the concentration of X is quadrupled while the concentration of Y and Z are doubled.
(h) the concentration of Z is cut in half while the concentration of Y is doubled.
(i) the concentration of Y and Z are tripled while the concentration of X is cut in thirds.