During Class Invention

Name_____

Rates of Reaction

TA Name _____

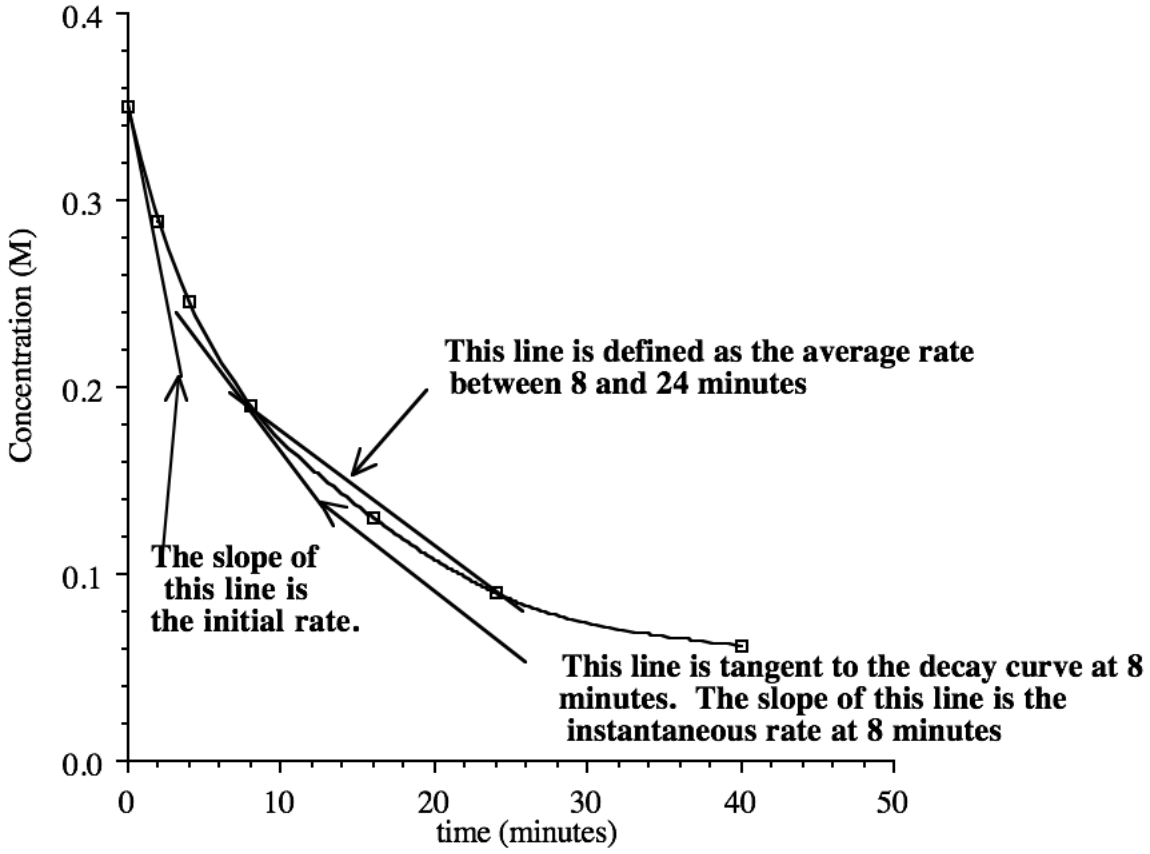
Lab Section #_____

1a. Given the following data

Time (min)	Exp. #1 $[NO_2]$ (M)	Exp. #2 $[NO_2]$ (M)
0	0.350	0.700
2	0.289	0.492
4	0.245	0.379
8	0.190	0.258
16	0.130	0.158
24	0.090	0.115
40	0.062	0.074

for the reaction $2NO_{2(g)} \rightarrow 2NO_{(g)} + O_{2(g)}$

Plot the data for Exp. #1 and determine the average rate of the reaction between 8 and 24 min., the instantaneous rate of the reaction at 8 minutes and the initial rate of the reaction.



The initial rate can be obtained by determining the slope of the line

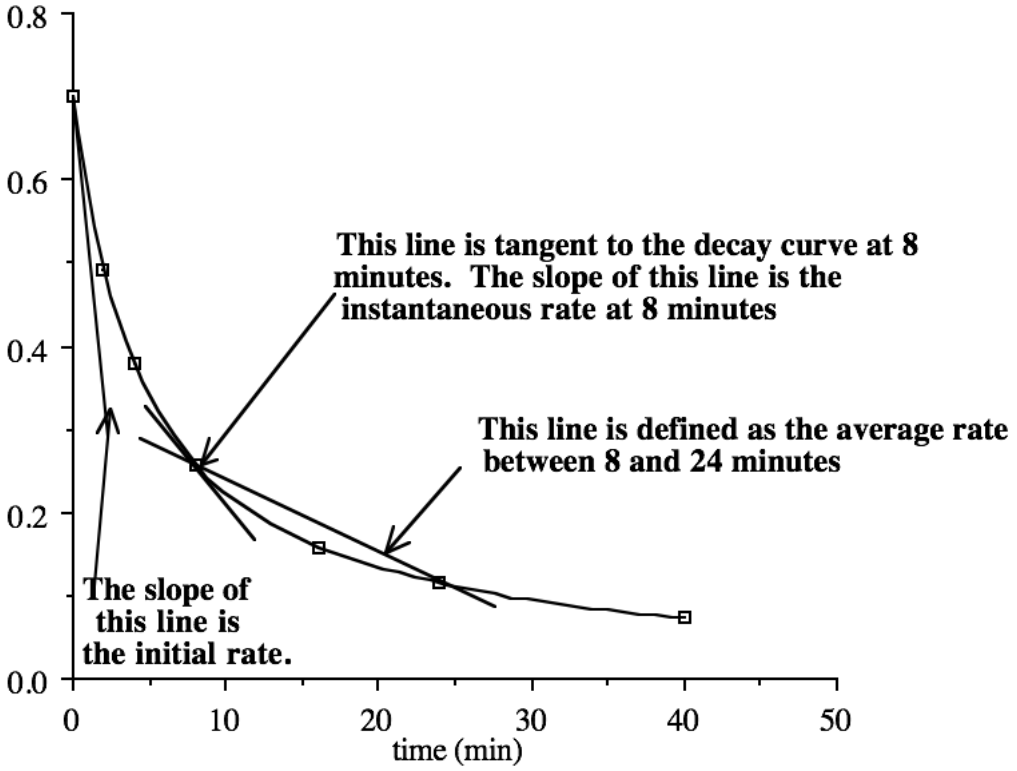
tangent to the point at t = 0. For this set of data, the initial rate will have a range of values around 0.037 $\frac{M}{min}$.

The instantaneous rate at 8 min = 0.010 $\frac{M}{min}$.

The average rate between 8 and 24 min can be obtained as shown,

$$\text{rate} = -\frac{(0.190\ M - 0.090\ M)}{(8\ min - 24\ min)} = 6.25 \times 10^{-3}\ \frac{M}{min}$$

b. Plot the data for Exp. #2 and determine the average rate of the reaction between 8 and 24 minutes, the instantaneous rate of the reaction at 8 minutes and the initial rate of the reaction.



The initial rate can be obtained determining the slope of the line tangent to the point at t = 0. For this set of data the initial rate will have a range of values around 0.15 $\frac{M}{min}$.

The instantaneous rate at 8 min = 0.0204 $\frac{M}{min}$.

The average rate between 8 and 24 min can be obtained as shown,

$$\text{rate} = -\frac{(0.258\ M - 0.115\ M)}{(8\ min - 24\ min)} = 8.9 \times 10^{-3}\ \frac{M}{min}$$

c. By what factor did the initial concentration change in going from Exp #1 to Exp #2?

$$\frac{\mathbf{0.700\ M}}{\mathbf{0.350\ M}} = \mathbf{2}$$ **The initial concentration increased by a factor of 2.**

d. By what factor did the initial rate change in going from Exp #1 to Exp #2?

$$\frac{\mathbf{0.15\ \frac{M}{min}}}{\mathbf{0.037\ \frac{M}{min}}} = \mathbf{4.1}$$ **The initial rate increased by a factor of 4.**

e. Write an equation which describes how the initial rate of the reaction depends on the initial concentration.

rate α $[NO_2]^2$ therefore rate = $k[NO_2]^2$