Name _____ Date _____ Period _____

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5.2 Introduction to Rate Law

AP Chemistry

Rate = $k[A]^m[B]^n$, with rate in M/s. Show all work, including the units of k.

1. The rate law for a reaction is rate = $k[NO]^2[O_2]$.

(a) What is the order in NO? In O_2?

(b) What is the overall order?

(c) What are the units of k?

2. A reaction between A and B is zero order in A and first order in B.

(a) Write the rate law.

(b) What are the units of k?

(c) What happens to the rate if [A] is doubled?

3. The rate law is rate = $k[A][B]^2$. By what factor does the rate change when:

(a) [A] is tripled?

(b) [B] is cut in half?

(c) [A] and [B] are both doubled?

(d) The temperature is raised. Does k change? Explain.

4. For $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$, a student writes rate = $k[NO]^2[O_2]$ "because the coefficients are 2 and 1." Explain what is wrong with the student's reasoning.

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5. Use the data for A + B → C.

Trial	[A] (M)	[B] (M)	Initial rate (M/s)
1	0.15	0.10	3.0×10^{-4}
2	0.30	0.10	6.0×10^{-4}
3	0.15	0.30	2.7×10^{-3}

(a) Find the order in A and the order in B. Show which trials you used.

(b) Write the rate law.

(c) Calculate k with units.

(d) Find the rate when [A] = 0.20 M and [B] = 0.20 M.

6. Use the data for 2X + Y → Z.

Trial	[X] (M)	[Y] (M)	Initial rate (M/s)
1	0.020	0.050	4.8×10^{-5}
2	0.040	0.050	1.9×10^{-4}
3	0.020	0.100	4.8×10^{-5}

(a) Write the rate law. Justify each order with the data.

(b) Calculate k with units.

(c) The coefficient of Y is 1, but its order is not 1. Explain how this is possible.

7. Name a property you could measure over time to follow each reaction. Explain your choice.

(a) Purple $MnO_4^-(aq)$ fades to a colorless product.

(b) $2NO_2(g) \rightarrow 2NO(g) + O_2(g)$ in a sealed, rigid container.

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