Quiz: 13.1 –13.3 Kinetics Rate Laws

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Given the following balanced equation, determine the rate of reaction with respect to [SO_2].

$$2\,SO_2(g) + O_2(g) \rightarrow 2\,SO_3(g)$$

A) Rate $= +\dfrac{2\,\Delta[SO_2]}{\Delta t}$

B) Rate $= -\dfrac{1}{2}\dfrac{\Delta[SO_2]}{\Delta t}$

C) Rate $= -\dfrac{\Delta[SO_2]}{\Delta t}$

D) Rate $= +\dfrac{1}{2}\dfrac{\Delta[SO_2]}{\Delta t}$

E) It is not possible to determine without more information.

2) Given the following rate law, how does the rate of reaction change if the concentration of Y is doubled?

Rate = k [X][Y]^2

A) The rate of reaction will decrease by a factor of 2.
B) The rate of reaction will increase by a factor of 2.
C) The rate of reaction will increase by a factor of 5.
D) The rate of reaction will increase by a factor of 4.
E) The rate of reaction will remain unchanged.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

3) Write a balanced reaction for which the following rate relationships are true.

$$\text{Rate} = -\frac{1}{2}\frac{\Delta[N_2O_5]}{\Delta t} = \frac{1}{4}\frac{\Delta[NO_2]}{\Delta t} = \frac{\Delta[O_2]}{\Delta t}$$

4) Determine the rate law **and** the value of k for the following reaction using the data provided.

$2\ N_2O_5(g) \rightarrow 4\ NO_2(g) + O_2(g)$

$[N_2O_5]_i$ (M)	Initial Rate (M/s)
0.093	4.84×10^{-4}
0.084	4.37×10^{-4}
0.224	1.16×10^{-3}

5) Determine the rate law **and** the value of k for the following reaction using the data provided.

$2\ NO(g) + O_2(g) \rightarrow 2\ NO_2(g)$

$[NO]_i$ (M)	$[O_2]_i$ (M)	Initial Rate (M/s)
0.030	0.0055	8.55×10^{-3}
0.030	0.0110	1.71×10^{-2}
0.060	0.0055	3.42×10^{-2}

6) What are the units of k in a zero order reaction?

7) What are the units of k in a second order reaction?

8) What is the **overall <u>order</u>** of the following reaction, given the rate law?

$2\ X + 3\ Y \rightarrow 2\ Z$ Rate = $k[X]^1[Y]^2$

9) The decomposition of dinitrogen pentoxide is described by the chemical equation

$2\ N_2O_5(g) \rightarrow 4\ NO_2(g) + O_2(g)$

If the rate of appearance of NO_2 is equal to 0.560 mol/min at a particular moment, what is the rate of appearance of O_2 at that moment? (Conceptualize this)

10) What happens in the concentration of reactants and products during a chemical reaction?

11) What is the difference between average reaction rate and instantaneous reaction rate?

12) Explain how the order of a reaction can be determined.

1) B
2) D
3) $2\ N_2O_5 \rightarrow 4\ NO_2 + O_2$
4) Rate = $5.2 \times 10^{-3}\ s^{-1}[N_2O_5]$
5) Rate = $1.7 \times 10^{3}\ M^{-2}s^{-1}[NO]^2[O_2]$
6) $\frac{M}{s}$
7) $M^{-1}s^{-1}$
8) 3rd order
9) 0.140 mol/min
10) The concentration of reactants decrease and the concentration of products increase during a chemical reaction.
11) An average reaction rate is determined using long periods of time during the reaction. An instantaneous rate is found at a particular moment during reaction. Instantaneous rates usually decrease during the course of a reaction.
12) The order of a reaction can only be determined experimentally.