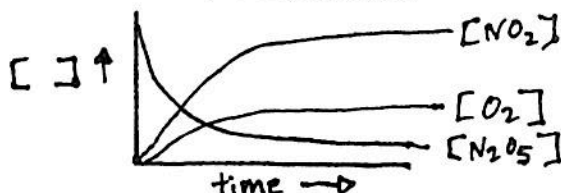


B. Reaction rates and STOICHIOMETRY:

1. In our $2\text{N}_2\text{O}_5 \longrightarrow 4\text{NO}_2 + \text{O}_2$ example, we expressed the rate in terms of $[\text{N}_2\text{O}_5]$. Can we express the rate in terms of other reactants and products? YES!!

a. Graphical representation.

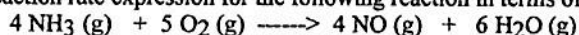


- * NO_2 is being produced _____ as fast as O_2 .
- * NO_2 is being produced _____ as fast as N_2O_5 is used.

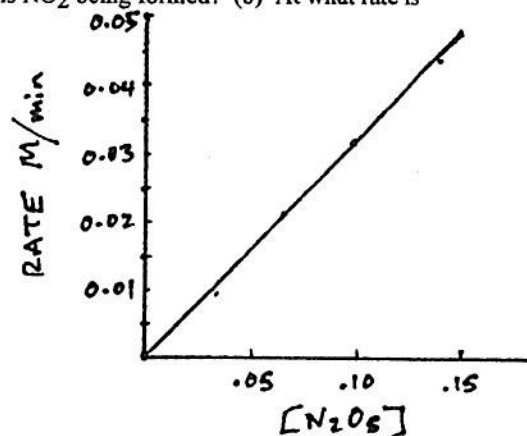
b. Rate expressions. rate =

- ** Make rates equal to each other and to simplest rate!!
- ** Be careful with signs.

EX: Write the reaction rate expression for the following reaction in terms of all products and all reactants:



EX: Consider the following reaction: $2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{NO}_2(\text{g})$. Suppose that a particular moment during the reaction, nitric oxide (NO) is reacting at the rate of 0.0666 M/s. a) At what rate is NO_2 being formed? (b) At what rate is molecular oxygen reacting?

C. THE RATE CONSTANT, kgoing back to rate and $[\text{N}_2\text{O}_5]$

1. rate $\propto [\text{N}_2\text{O}_5]$what is the relationship between rate and $[\text{N}_2\text{O}_5]$?

* Plot rate vs $[\text{N}_2\text{O}_5]$ to find out....

2. Notice that the ratio of rate : $[\text{N}_2\text{O}_5]$ is _____.

3. rate = $k [\text{N}_2\text{O}_5]$ k = rate constant....every reaction has it's own rate constant at a particular temperature.

- Calculate the units for k in this reaction?

** You will notice that the units for k are different depending on the reaction whereas the units for rate is ALWAYS M/s.

4. Go back to the $2\text{N}_2\text{O}_5 \longrightarrow 4\text{NO}_2 + \text{O}_2$ data and calculate k at each minute. How does k compare?

D. RATE LAWS - express the relationship of the rate of a reaction to the rate constant and the concentrations of the reactants raised to some power.

1. example reaction: $a\text{A} + b\text{B} \longrightarrow c\text{C} + d\text{D}$ rate = _____

- x and y are determined EXPERIMENTALLY. These #'s have nothing to do with the coefficients in the balanced equation!!!

Notes #43

- Notice that the rate is just dependent on the concentration of the reactants, never the products. That's because in kinetics, we only consider the _____ rates of reaction because as the reaction continues, equilibrium will be established as the _____ reaction will become an issue.

EX 1:

2. Let's take a look at some experimental data.

	[F ₂]	[ClO ₂]	Initial Rate
F ₂ (g) + 2 ClO ₂ (g) -----> 2 FClO ₂ (g)	0.10	0.010	1.2x10 ⁻³

a. Determine the rate law:

	0.10	0.040	4.8x10 ⁻³
* When you double [F ₂], holding [ClO ₂] constant,	0.20	0.010	2.4x10 ⁻³

the rate _____. This means that the reaction is _____ in terms of [F₂].

* When you quadruple [ClO₂], holding [F₂] constant, the rate of the reaction is _____. This means that the reaction is also _____ in terms of [ClO₂].

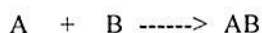
- The rate law for this equation is: _____. The reaction is _____ order overall.

- The OVERALL order of a reaction is just the _____.

b. Determine the rate constant for this reaction. Determine units for k.

c. Using your k value and rate law expression, what would be the rate of reaction if [F₂] = 0.20 and [ClO₂] = 0.40.

EX 2: Let's take a look at some more experimental data:



- Determine the rate law, find the rate constant, and determine the overall order of the reaction.

[A]	[B]	Initial rate
0.100	0.100	1.53x10 ⁻⁴
0.100	0.300	4.59x10 ⁻⁴
0.200	0.100	6.12x10 ⁻⁴
0.100	?	3.06x10 ⁻⁴
0.300	?	8.26x10 ⁻³

** The key - Determine how the rate varies with varying concentration of one component while the concentration of the other is held constant.

-As [B] triples and [A] is constant, the rate triples (1st Order)

-As [A] doubles and [B] is constant, the rate quadruples (2nd Order)

EX 3: Consider the following reaction:



- Determine the rate law.

[A]	[B]	initial rate
1.50	1.50	3.20x10 ⁻¹
1.50	2.50	3.20x10 ⁻¹
3.00	1.50	6.40x10 ⁻¹

* As [B] increases ([A] is constant) rate _____. Rxn is _____ order with respect to [B].

* As [A] is doubled, (doesn't matter what [B] does), rate _____. Rxn is _____ order with respect to [A].