Molarity

-- measures concentration
-- solute is measured in moles
-- solution is measured in liters
-- abbreviated with a CAPITAL M

$$M = \frac{\text{moles}}{\text{liters}}$$

Mar 17-7:56 AM

Practice:

$$M = \frac{\text{moles}}{\text{liters}}$$

What is the molarity of a solution that has 10 grams of sodium sulfate in 100 mL of solution

$\frac{10\ mol}{142\ g} = .1818$

$\frac{.1818}{.1} = 1.818\ M$

Na_2SO_4

$Na = 2 \times 23 = 46$

$S = 1 \times 32 = 32$

$O = 4 \times 16 = 64$

$142\ g/mol$

$10\ g \times \frac{1\ mol}{142\ g} = \frac{.07}{.1} = .7\ M$

Mar 17-7:56 AM

Rate Laws:

-- Increased concentration of a reactant usually increases the rate of reaction.

-- However, increased concentration might actually have little effect on the rate of reacti

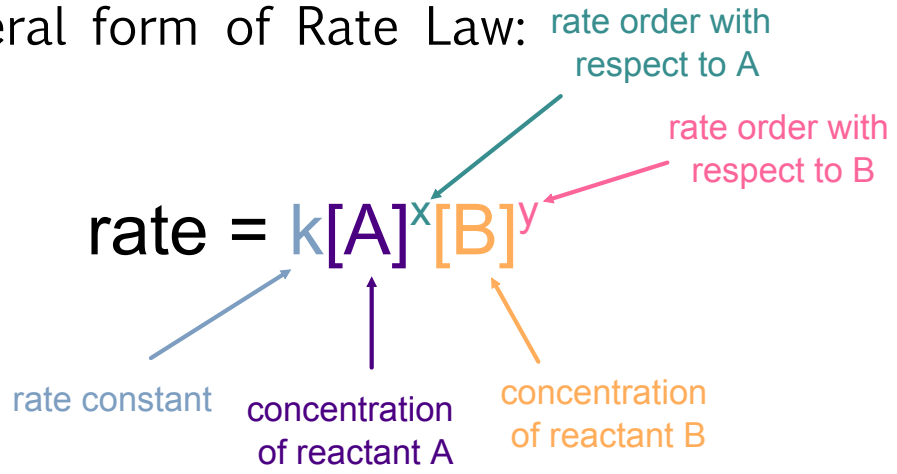
-- How can we tell?

Mar 17-7:56 AM

Rate Order and Rate Laws:

A + B --> C + D [ ] = M

-- General form of Rate Law:



Mar 17-7:56 AM

Rate Order and Rate Laws:

- Rate Laws are found experimentally
  - change the concentration of one reactant at a time to see how the rates are affected

- Rate units: M/s (change in molarity per second)

Mar 17-7:56 AM

Rate Law Example #1:

Reaction: A + B ⟶ C

$[A]^x = rate$

Trial	[A] - M	[B]	Rate (M/sec)
1	1.0	2.0	0.50
2	2.0	2.0	1.00
3	2.0	6.0	3.00

1. What happens to the rate when [A] doubles? $[A]\times 2$ rate x2
2. What is the rate order of reactant A? $2^x = 2$, $x = 1$
3. What happens to the rate when [B] triples? $[B]\times 3$ rate $\times 3$
4. What is the rate order of reactant B? $3^y = 3$, $y = 1$
5. What is the rate law for this reaction? $rate = k[A][B]$

Mar 17-7:56 AM

Rate Law Example #2:

Reaction: A ⟶ B + C

Trial	[A]	Rate (M/sec)
1	2.5	1.00
2	5.0	4.00
3	7.5	16.00

1. What happens to the rate when [A] doubles? ×4
2. What is the rate order of reactant A? [A]×2 rate×4 $2^x = 4$ $x = 2$
3. What is the rate law for this reaction? $rate = k[A]^2$

Mar 17-7:56 AM

Rate Law Example #3:

Reaction: A + B ⟶ C

Trial	[A]	[B]	Rate (M/sec)
1	2.0	4.0	3.00
2	6.0	2.0	1.50
3	6.0	4.0	3.00

1. What happens to the rate when [A] triples? [A]×3 rate×1 $3^x = 1$ $x = 0$
2. What is the rate order of reactant A?
3. What happens to the rate when [B] doubles? [B]×2 rate×2 $2^y = 2$ $y = 1$
4. What is the rate order of reactant B?
5. What is the rate law for this reaction? $rate = k[B]$

Mar 17-7:56 AM