CONCEPT: COLLISION THEORY

- According to **Collision Theory**, a chemical reaction is successful when two _____ reactants successfully collide.
  - □ *Successful collision*: reacting molecules must collide with enough _____ and with proper _____.

Factors Influencing Collisions

1. Temperature: ___Temp, ___ energetic collisions
2. Activation Energy: ___ Ea, _____ reaction rate.
3. [Reactants]: ___ [reactants], ___ frequency of collisions
4. Orientation: molecules must collide with proper _____ = successful collision.
   - determined by _____ of molecules

- □ The *rate of a reaction* is influenced by molecular collisions: ____ collisions, _____ rate of reaction.

EXAMPLE: For a chemical reaction to occur, all of the following must happen *except*.

a) A large enough number of collisions must occur

b) Chemical bonds in the reactants must break

c) Reactant molecules must collide with correct orientation

d) Reactant molecules must collide with enough energy

e) None of the above

Intro to Arrhenius Equation

- Illustrates how the *rate of reaction* is affected by different variables.
  - □ Faster reaction rate = ___ k, ___ A, ___ Ea, ___ Temp.

Arrhenius Equation

$$k = \_\_ \cdot e^{\frac{\_\_}{\_\_}}$$

___ the k, ___ the rate of reaction

- □ ____ = Rate Constant
- □ ____ = Frequency Factor
- □ ____ = Activation Energy
- □ ____ = Gas Constant as _____ $\frac{J}{mole\ K}$
- □ ____ = Temperature in _____

□ Frequency Factor (A) can be split into 2 variables: *orientation factor* (p) and *collision frequency* (z).

1. **Orientation factor (p):** a number that represents the fraction of collisions with correct orientation.
   - _____ the reactant, _____ the orientation factor, _____ successful collisions.
2. **Collision Frequency (z):** frequency of molecule collisions.

EXAMPLE: Determine which of the following reactions has the smallest orientation factor (p).

a) $I + HI \longrightarrow I_2 + H$

b) $H + H \longrightarrow H_2$

c) $Br_2 + H_2C{=}CH_2 \longrightarrow H_2BrC\text{-}CBrH_2$

d) All of these reactions should have same orientation factors.