6-11-2015

Molecular Collisions

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To understand inelastic and elastic collisions as well as temperature, concentration, surface area, and orientation as it pertains to collision theory.

**LEARNING STANDARDS**

**CHEMISTRY**

**PERFORMANCE**
**INDICATOR 3.4**
Use kinetic molecular theory (KMT) to explain rates of reactions and the relationships among temperature, pressure, and volume of a substance.

**Major Understandings:**
3.4c Kinetic molecular theory describes the relationships of pressure, volume, temperature, velocity, and frequency and force of collisions among gas molecules.
3.4d Collision theory states that a reaction is most likely to occur if reactant particles collide with the proper energy and orientation.
3.4f The rate of a chemical reaction depends on several factors: temperature, concentration, nature of the reactants, surface area, and the presence of a catalyst.

**PHYSICS**

4.1d Kinetic energy is the energy an object possesses by virtue of its motion.
5.1r Momentum is conserved in a closed system.

**MATH**

Definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the integral.

**LEARNING TARGETS**

Students will be able to:

- Manipulate the given model
- Explain how surface area, temperature, concentration, and orientation influence molecular collisions
- Explain how surface area, temperature, concentration, and orientation influence inelastic collisions
- Determine the distance traveled given the velocity of the particle

**OPTIONAL INSTRUCTIONAL TOOLS**

Netlogo Model

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<th>CONCEPT</th>
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<tbody>
<tr>
<td>Chemistry</td>
<td>Physics</td>
<td>Mathematics</td>
<td>Cross-Cutting</td>
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<td>How does surface area, temperature,</td>
<td>How does surface area, temperature,</td>
<td>Given the velocity of the particles, how far</td>
<td>What factors influence the inelastic</td>
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<tr>
<td>concentration, and orientation influence molecular collisions?</td>
<td>concentration, and orientation influence inelastic collisions?</td>
<td>have the particles traveled?</td>
<td>collisions needed to form a new molecule?</td>
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<tr>
<td>Collision Theory, Kinetic Energy, mass, concentration, surface area, temperature, orientation, Boltzmann’s Constant</td>
<td>Inelastic collisions, Elastic collisions, Momentum, Kinetic Energy, mass and velocity</td>
<td>Integral, derivative, function, ratio, velocity</td>
<td>Patterns, factors, relationships</td>
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**ADDITIONAL INFORMATION**

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