

8.2 EFFECT OF TEMPERATURE ON THE RATES OF REACTION

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Learning outcomes

After the completion of the lesson, candidates should be able to:

1. define activation energy, E_A , as the minimum energy required for a collision to be effective
2. sketch and use the Boltzmann distribution to explain the significance of activation energy
3. explain qualitatively, in terms both of the Boltzmann distribution and of frequency of effective collisions, the effect of temperature change on the rate of a reaction

Introduction

At higher temperatures, molecules have more kinetic energy, so a **higher percentage of successful collisions** occur between reactant molecules.

Remember that increasing temperature increases the rate of reaction because of two factors:

1. The frequency of effective collisions is greater because of the greater kinetic energy of the molecules
 2. A greater proportion of the molecules have kinetic energy greater than the activation energy.
- The second reason has a far greater effect.

Boltzmann distribution: a graph showing the number of molecules with a particular kinetic energy plotted against the kinetic energy. The shape of the curve varies with temperature. The curve shows that only a very small proportion of the molecules have very high energies.

Video explanation:

<https://www.youtube.com/watch?v=YacsIU97OFc>

The Boltzmann distribution represents the number of molecules in a sample with particular energies. The change in the Boltzmann distribution as the temperature is increased shows that more molecules have energy greater than the activation energy. This, in turn, leads to an increase in reaction rate.

Problems involving activation energy

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