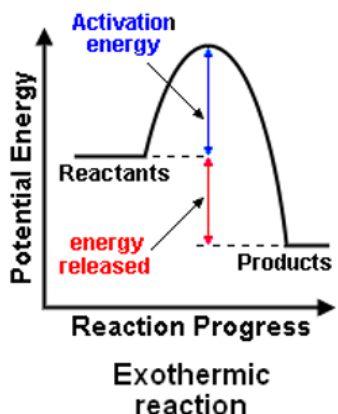


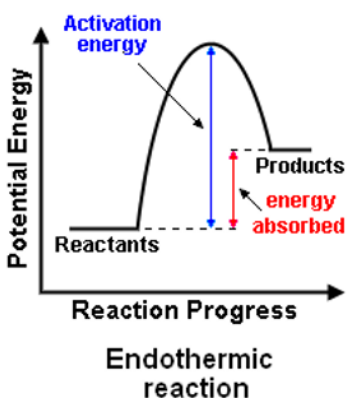
## CC15: Groups, rates and heat changes

### Lesson sequence

1. Exothermic and endothermic reactions
2. Explaining energy changes

#### 1. Endothermic and exothermic reactions

<b>*Exothermic reaction</b>	A reaction that transfers energy to the surroundings (gets hotter, temperature up).
<b>*Endothermic reaction</b>	A reaction that absorbs energy from the surroundings (gets colder, temperature down)
<b>**Exothermic reaction profile</b>	 <p>The diagram shows Potential Energy on the y-axis and Reaction Progress on the x-axis. A curve starts at a level for Reactants, rises to a peak, and then falls to a lower level for Products. A blue double-headed arrow between the reactant and product levels is labeled 'Activation energy'. A red arrow points from the reactant level down to the product level, labeled 'energy released'. The text 'Exothermic reaction' is written below the x-axis.</p>

<b>**Endothermic reaction profile</b>	 <p>The diagram shows Potential Energy on the y-axis and Reaction Progress on the x-axis. A curve starts at a level for Reactants, rises to a peak, and then falls to a higher level for Products. A blue double-headed arrow between the reactant and product levels is labeled 'Activation energy'. A red arrow points from the reactant level up to the product level, labeled 'energy absorbed'. The text 'Endothermic reaction' is written below the x-axis.</p>
<b>**Measuring energy changes</b>	<ul style="list-style-type: none"> <li>- Sit a polystyrene beaker inside a glass beaker (insulation)</li> <li>- Measure the starting temperature of the reactants.</li> <li>- Mix the reactants in the polystyrene beaker</li> <li>- Cover with lid fitted with a thermometer</li> <li>- Monitor and record the peak temperature change.</li> </ul>
<b>** Most common problem</b>	Heat escaping. Solution is more insulation.

#### 2. Explaining energy changes

<b>**Chemical bonds in reactions</b>	During chemical reactions, old chemical bonds are broken and new ones are formed.
<b>**Breaking bonds</b>	<b>Endothermic.</b> Breaking bonds absorbs energy, breaking stronger bonds absorbs more energy.
<b>**Making bonds</b>	<b>Exothermic.</b> Making bonds releases energy, making stronger bonds releases more energy.
<b>**Energy changes and bond formation</b>	The energy change in a reaction is the difference between the energy required to break the old bonds and the energy released by making the new ones.
<b>**Exothermic reactions and bonds</b>	Exothermic reactions break weaker bonds and make stronger ones.
<b>**Endothermic reactions and bonds</b>	Endothermic reactions break stronger bonds and make weaker ones.
<b>***Bond strength</b>	The energy required to break one mole of a particular covalent bond in kJ/mol.
<b>***Calculating energy changes from bond strengths</b>	Add up the total strength of old bonds broken and subtract the total strength of new bonds made. A negative answer is exothermic.