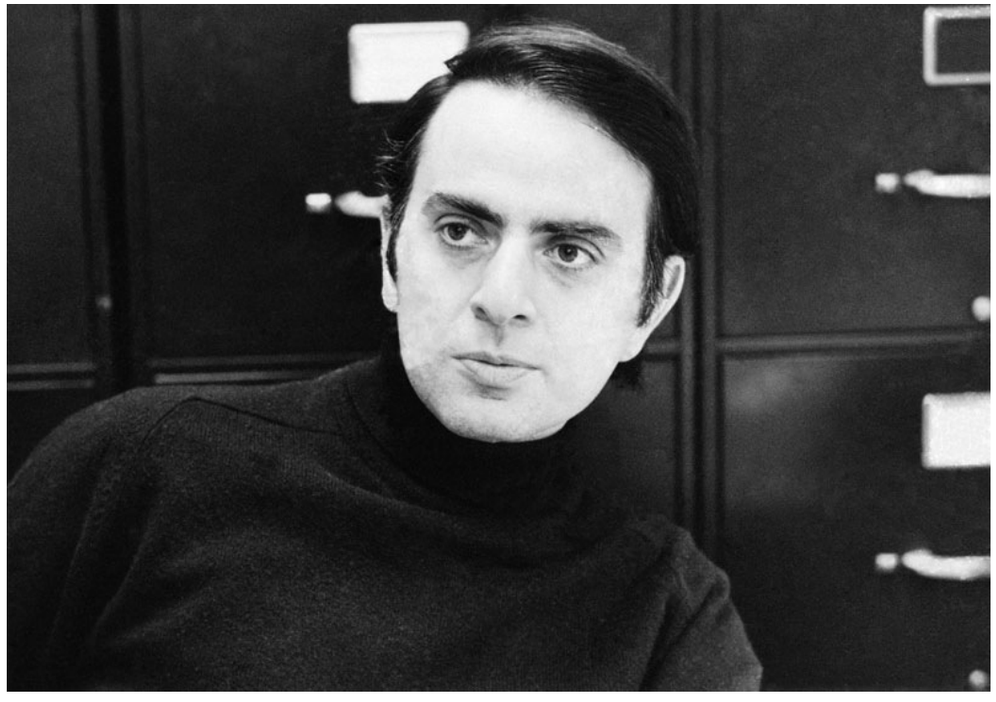
Every time you look up at the sky, every one of those points of light is a reminder that fusion energy is extractable from hydrogen and other light elements, and it is an everyday reality throughout the Milky Way Galaxy.

Carl Sagan



Arizona State University
SES 194

Energy in Everyday Life

Kickstarting a Reaction

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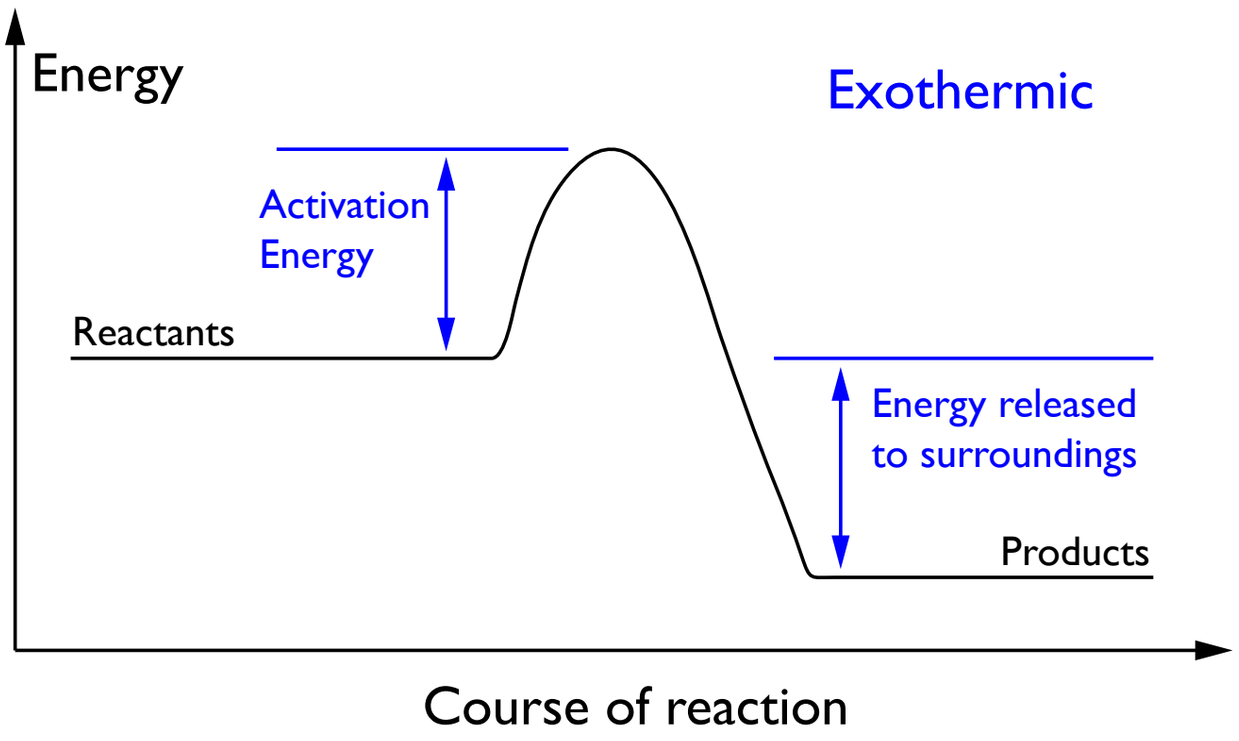
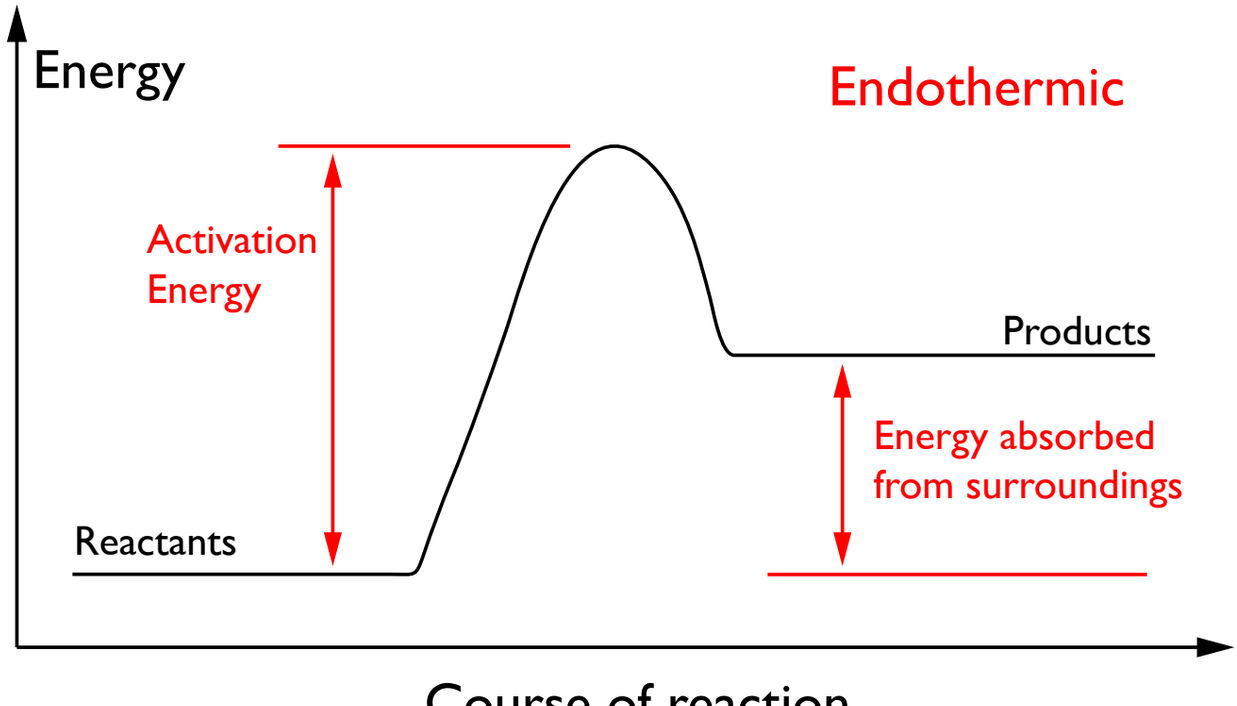
In most cases, some energy input is needed to get the atoms to start sharing their electrons.

They then can give up a great deal more energy as they form the bonds of the compound.

The smaller amount of energy necessary to get the process started is called the activation energy.

Activation energy is supplied for macroscopic amounts of chemicals by rubbing them together with pestle & mortar, pressurizing them, heating them perhaps with a spark, or exposing them to light.



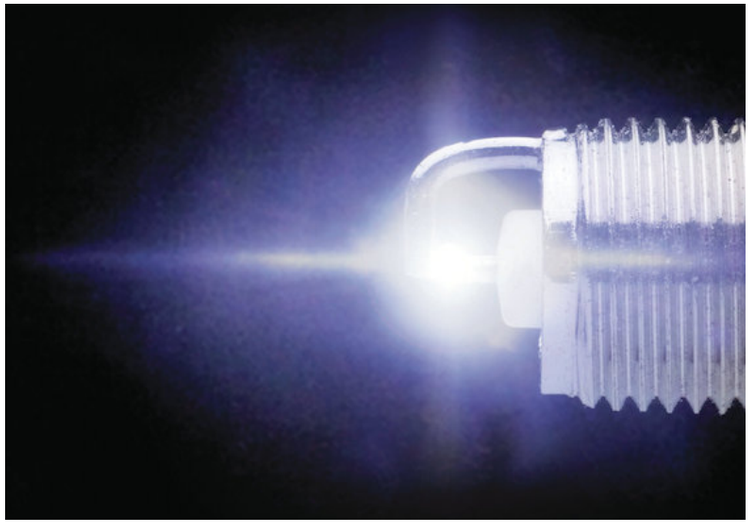


Even something as simple as the atoms bumping into one another can supply the activation energy to start a reaction.

Marshburg, PA, September 19, 1941

If we put hydrogen and oxygen in a container and waited there would be a very slow reaction. After thousands of years, some molecules of H and O would break into atoms, which would occasionally collide as they jostle about with their thermal energy, and water would form.

For water, supplying a small amount of activation energy, with a spark say, starts off the reaction of H and O.



Molecules break into atoms near the spark. The atoms combine to form water, which liberates an amount of energy.

The kinetic energy of the products is a new supply of activation energy, so molecules next to the first molecules break apart, leading to more water production, adding more energy, and so forth.

When the energy liberated is much greater than the activation energy, the reaction could take place so rapidly that an explosion may occur.

Water formation is exothermic and the reaction rate is large because the energy produced in forming the bond between H and O to make water far exceeds the activation energy.

Much of the time, chemicals in exothermic reactions give off their energy in just this way - by increasing their kinetic energy (and thereby their speed).

When molecules speed up, the temperature of the compound increases. But energy from an exothermic reaction need not necessarily cause a temperature increase.

The energy may be drawn off as electrical, as in a battery, where chemical energy changes to electromagnetic energy.

Or, the energy may be released as light energy. The light sticks you have have seen at public events produce light, but do not heat up in doing so from the chemical reaction taking place between two liquids inside the tube.