First, there is the power of the Wind, constantly exerted over the globe.... Here is an almost incalculable energy at our disposal, yet how trifling the use we make of it! It only serves to turn a few mills, blow a few vessels across the ocean, and a few trivial ends besides. What a poor compliment do we pay to our indefatigable and energetic servant!

Henry Thoreau

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SES 194

Energy in Everyday Life

Catalysts and Inhibitors

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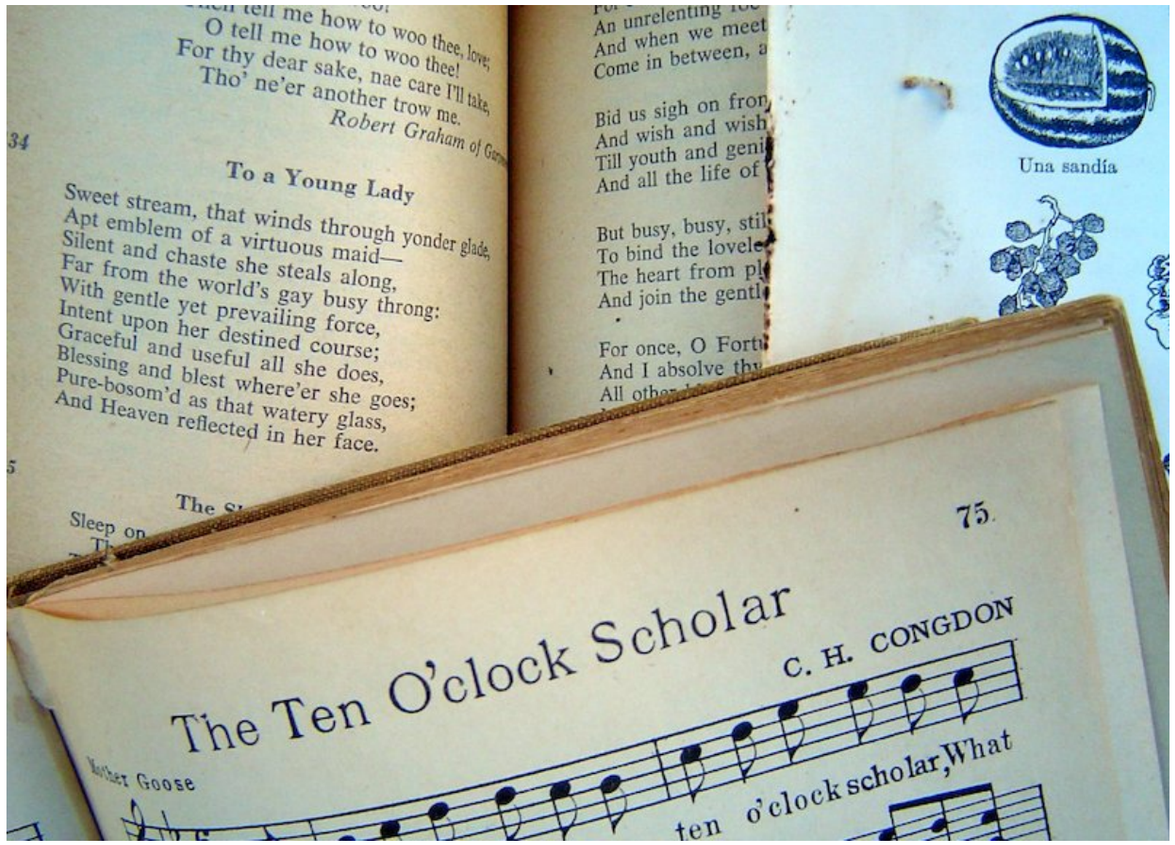
Many chemical reactions occur quite slowly.

Iron rusts (combines with oxygen) very slowly at normal temperatures. In the presence of water, especially salt water, the reaction occurs more rapidly.

People who live where salt is spread on roadways for ice control can see their cars corroding after only a few years.

Paper is made from wood; it is slowly burning (oxidizing) just by existing.

You may have seen old books with their brittle, yellow, half burnt paper.



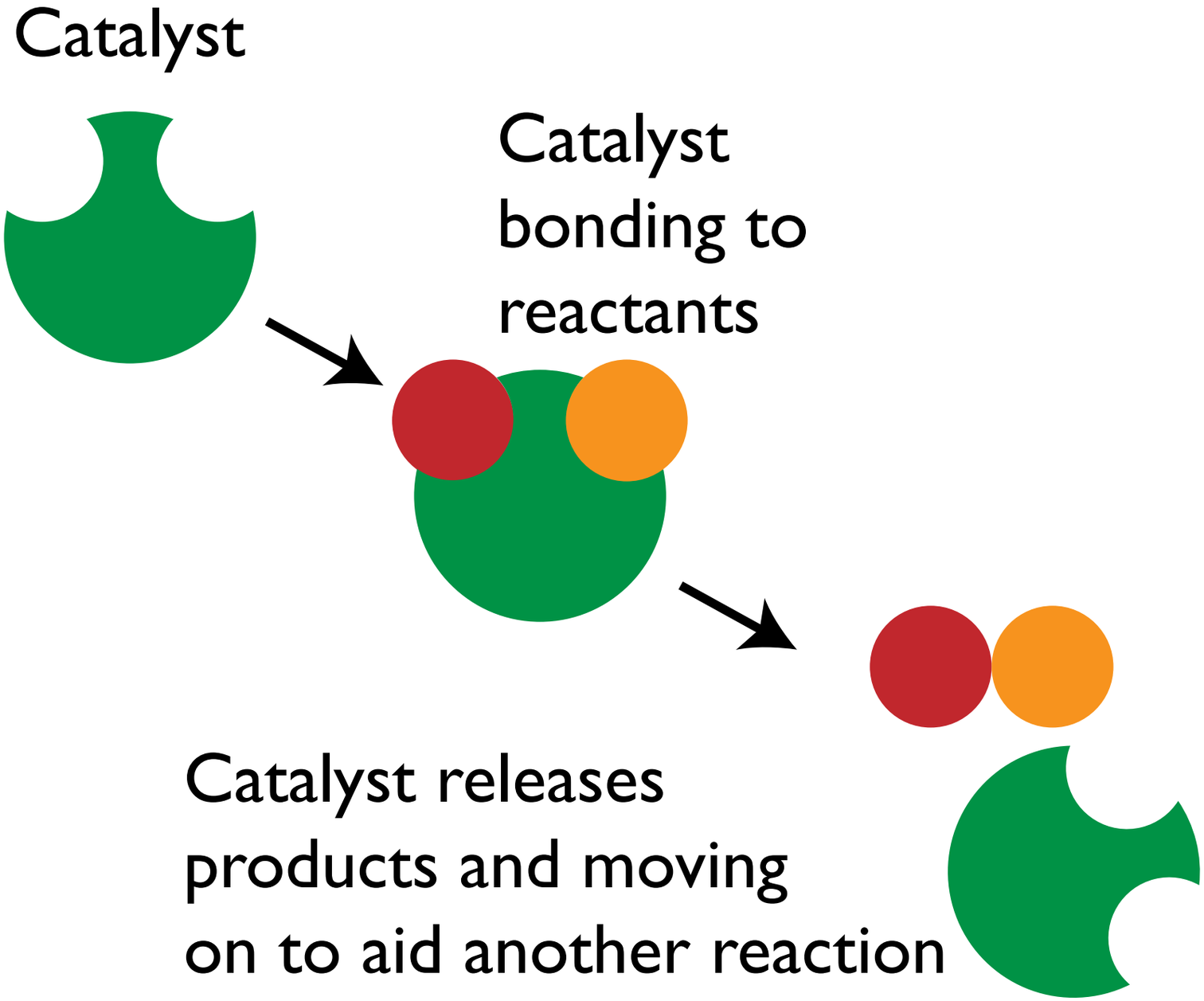
We can hasten the process by supplying the activation energy for a chain reaction and burn the book in minutes.

It is possible to change the rate at which reactions occur.

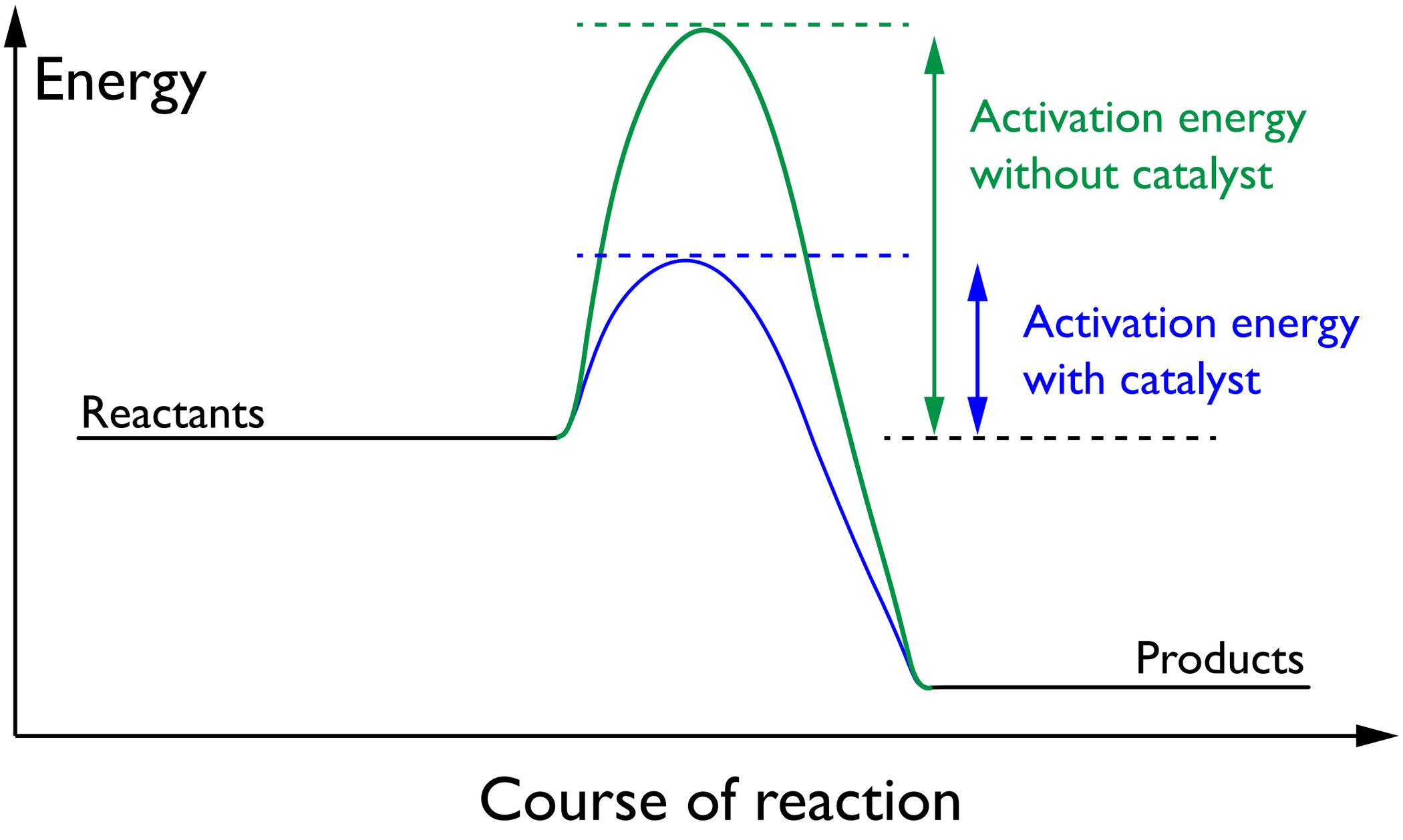
Electron exchanges can only occur when electron shells are in the vicinity of one another.

Suppose we add to a reaction materials which allow the appropriate surfaces in the constituents to come into closer contact with one another.

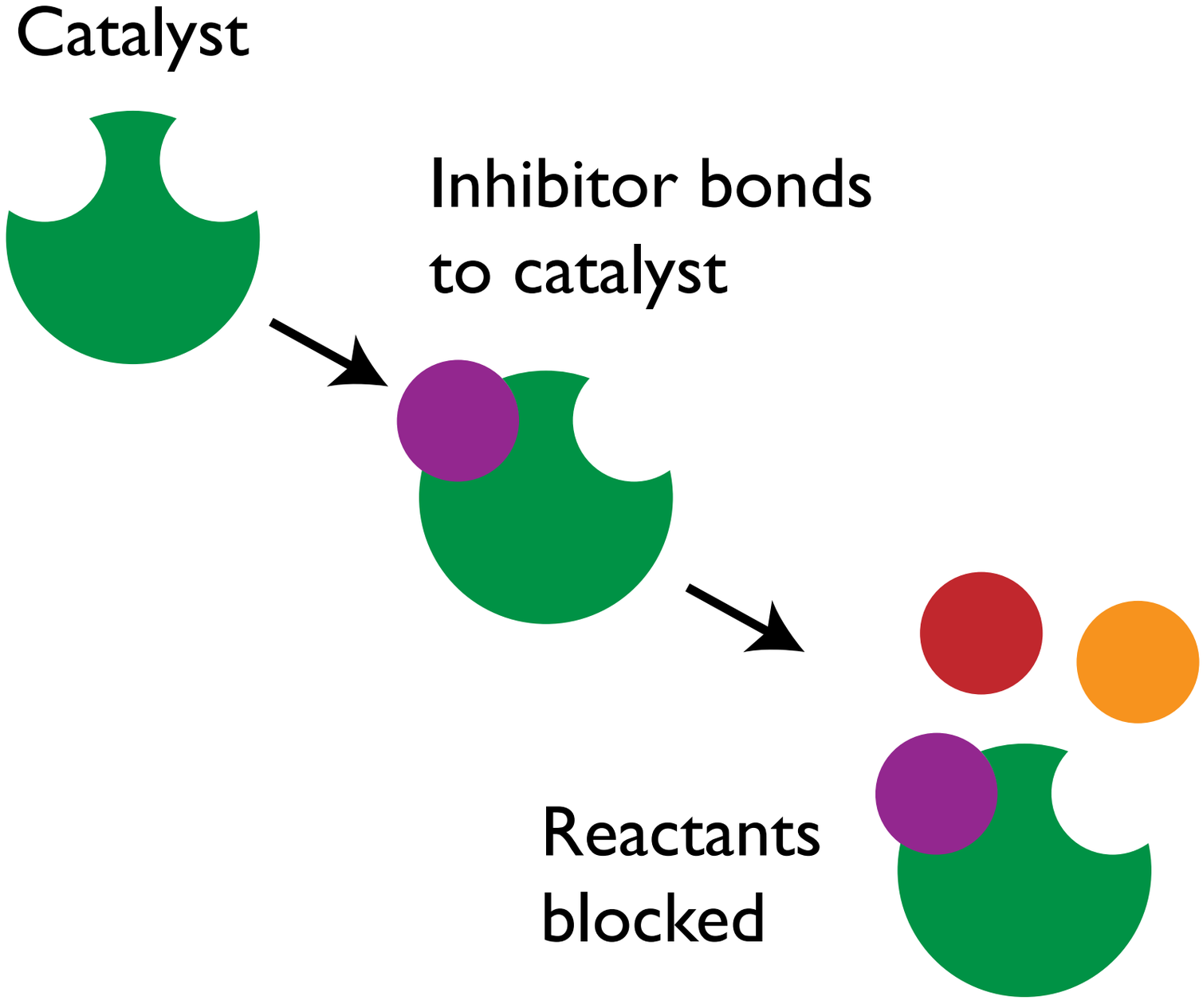
These materials would enhance the speed with which the chemical reaction occurs, but the added materials would not be used or even affected in the process.



A catalyst increases the rate of reaction but is not consumed by the reaction. Catalysts lower the activation energy.



The opposite of a catalyst, a substance that reduces the rate of a reaction, increasing the activation energy,is an inhibitor.

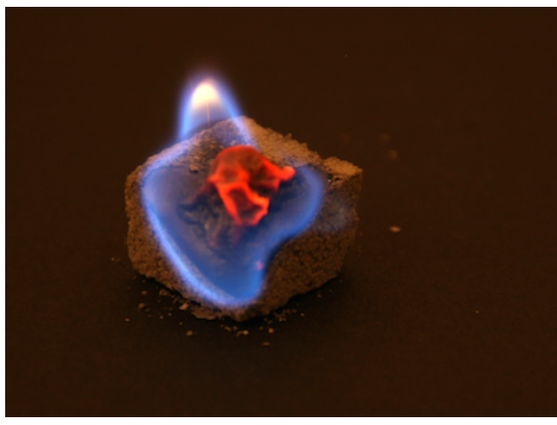


Examples of catalysts in daily use include

salt in water (boils faster), bread, beer

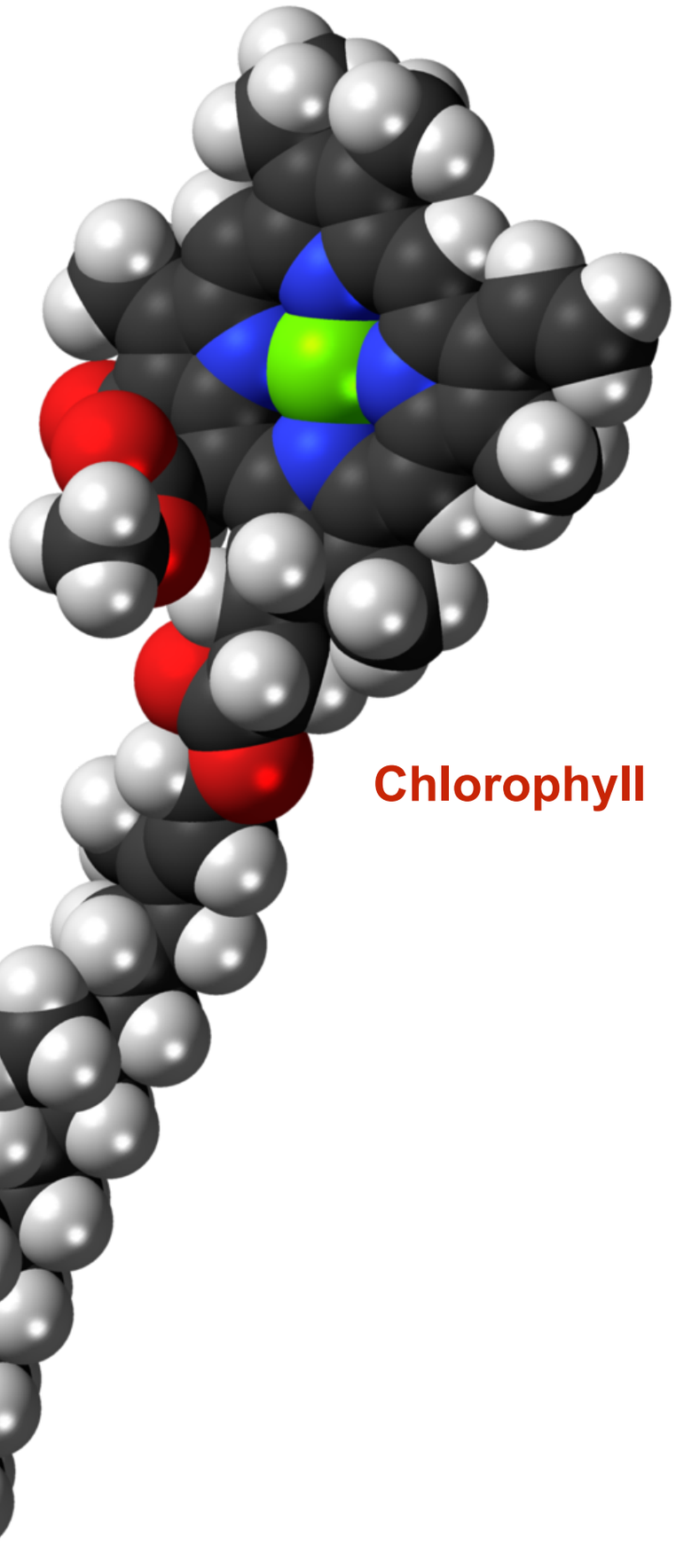
chlorine in ozone depletion (net is 2 $O_3 \rightarrow 3\ O_2$)

finely ground ashes to allow sugar to burn



platinum powder to increase the rate of combustion of hydrogen and oxygen to form water

And more important, the catalyst chlorophyll is used by plants to enhance the rate at which carbon dioxide and water (reactants) are converted to sugars and oxygen (products).



Chlorophyll

Catalysts are essential to life.
In living systems, catalysts called enzymes make life possible.