Chapter 6: Quantities in Chemical Reactions

October 10, 2022

Chemistry Department, Cypress College

Class Annoucements

Lab

- Experiment 12 - Single Displacement Reactions
- Recall indications for chemical reaction (color, solids, temp, etc.)
- Week 5 Lab assignments graded
- Reminder - Need 70% of laborator points to pass the course

Lecture

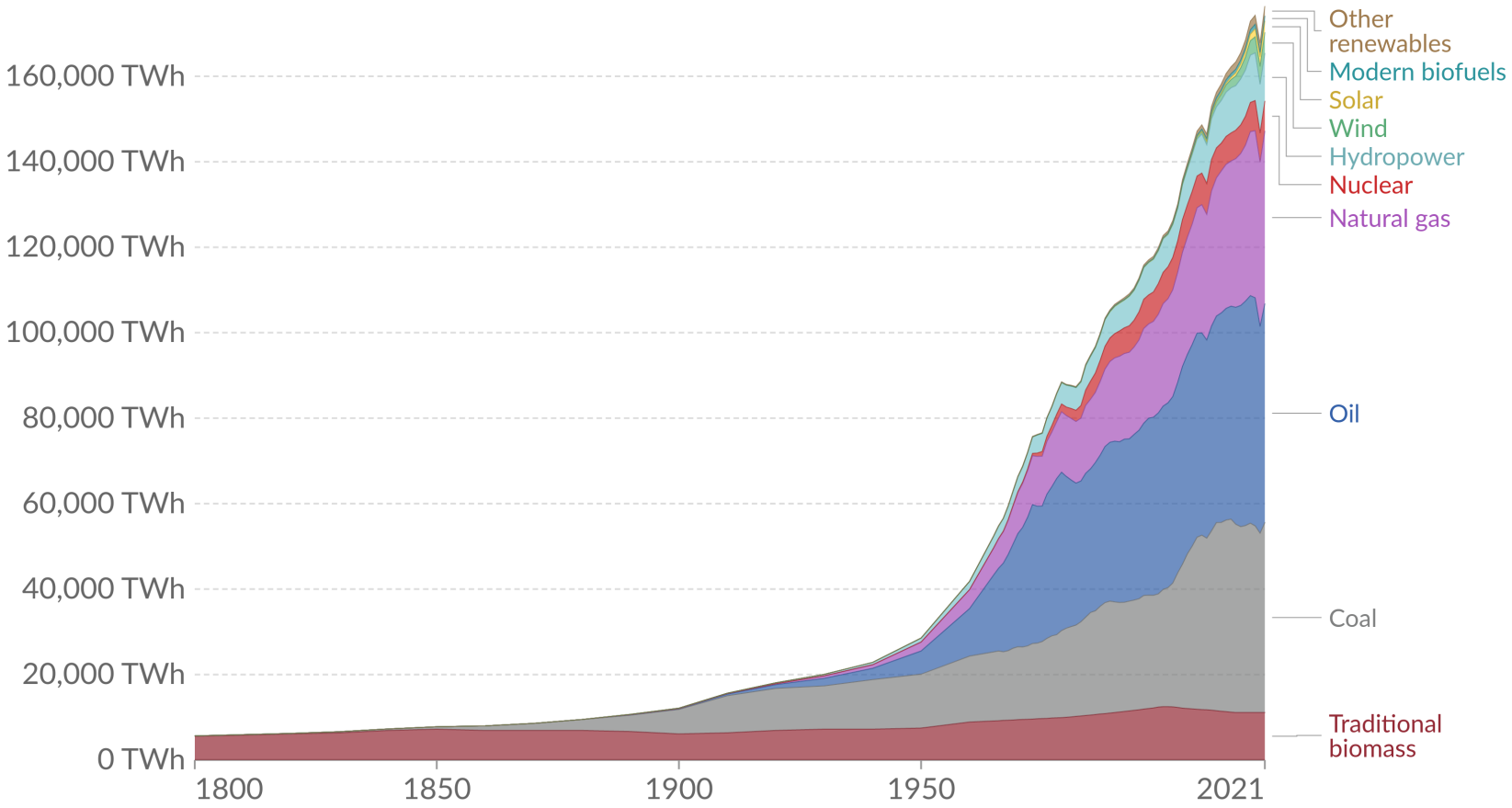
- Finally graded homework 3 and go over homework 4 (EC for students who present)
- Finish up Ch 6 and worksheet 7; begin discussion on Ch 7 - Electronic Structure of the Atom
- Quiz and Homework assignment released Fri, Oct 14th at 3pm

Outline

Global Energy Consumption

Global primary energy consumption by source

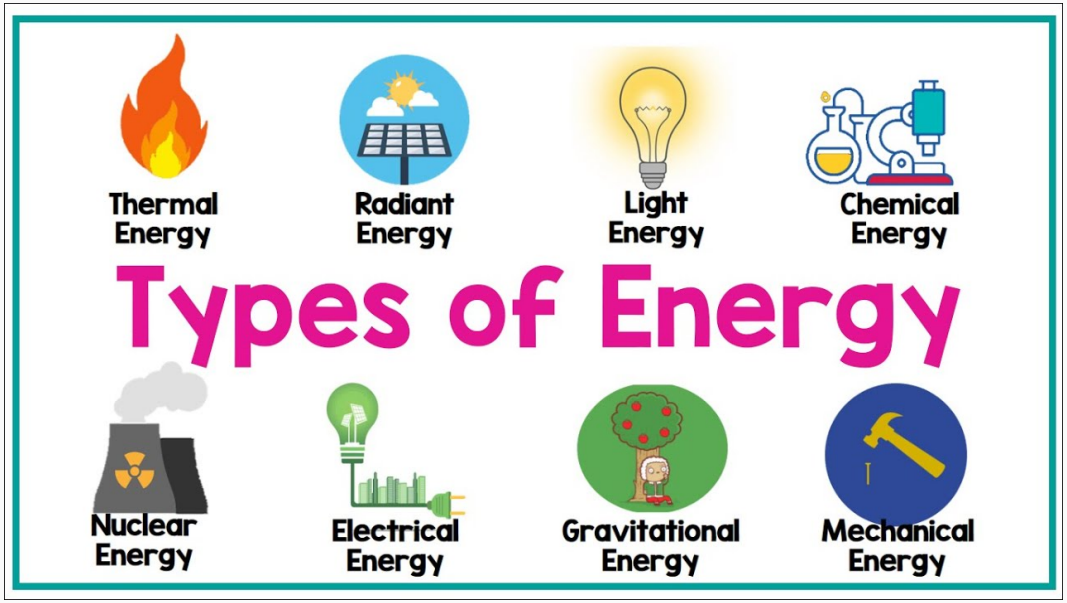
Primary energy is calculated based on the 'substitution method' which takes account of the inefficiencies in fossil fuel production by converting non-fossil energy into the energy inputs required if they had the same conversion losses as fossil fuels.



Source: Our World in Data based on Vaclav Smil (2017) and BP Statistical Review of World Energy

OurWorldInData.org/energy • CC BY

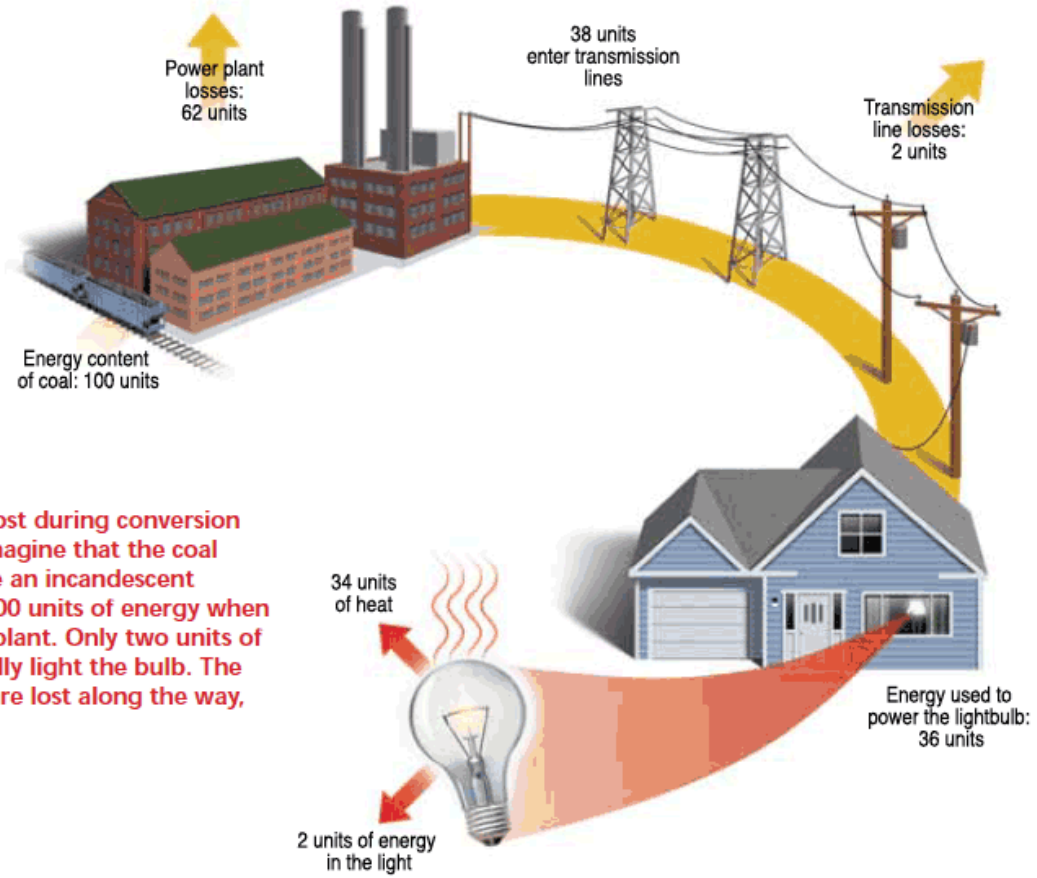
Law of Conservation of Energy



Energy is neither created nor destroyed

- Energy can be converted from form to another e.g. mechanical, chemical, thermal, nuclear, electrical and vibrational energy
- Converting from one energy form to another is never 100% efficient; there is always a loss of energy

Context: Energy Loss



Example of energy lost during conversion and transmission. Imagine that the coal needed to illuminate an incandescent lightbulb contains 100 units of energy when it enters the power plant. Only two units of that energy eventually light the bulb. The remaining 98 units are lost along the way, primarily as heat.

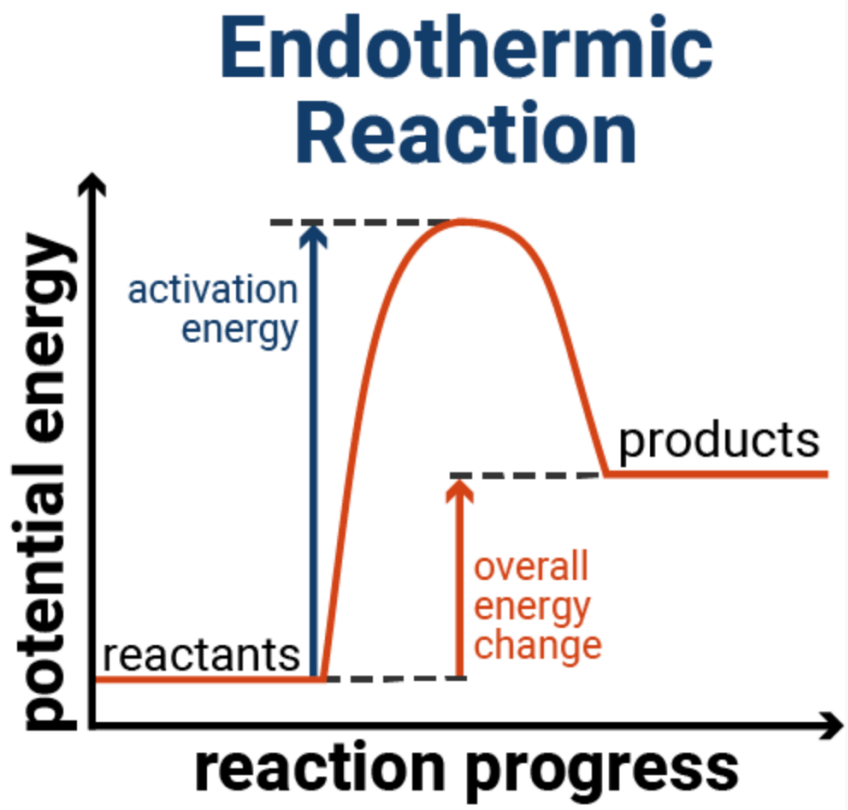
Approximately only $\sim 30\%$ efficiency

Endothermic and Exothermic Reactions

Exo - external; exothermic reactions give off heat

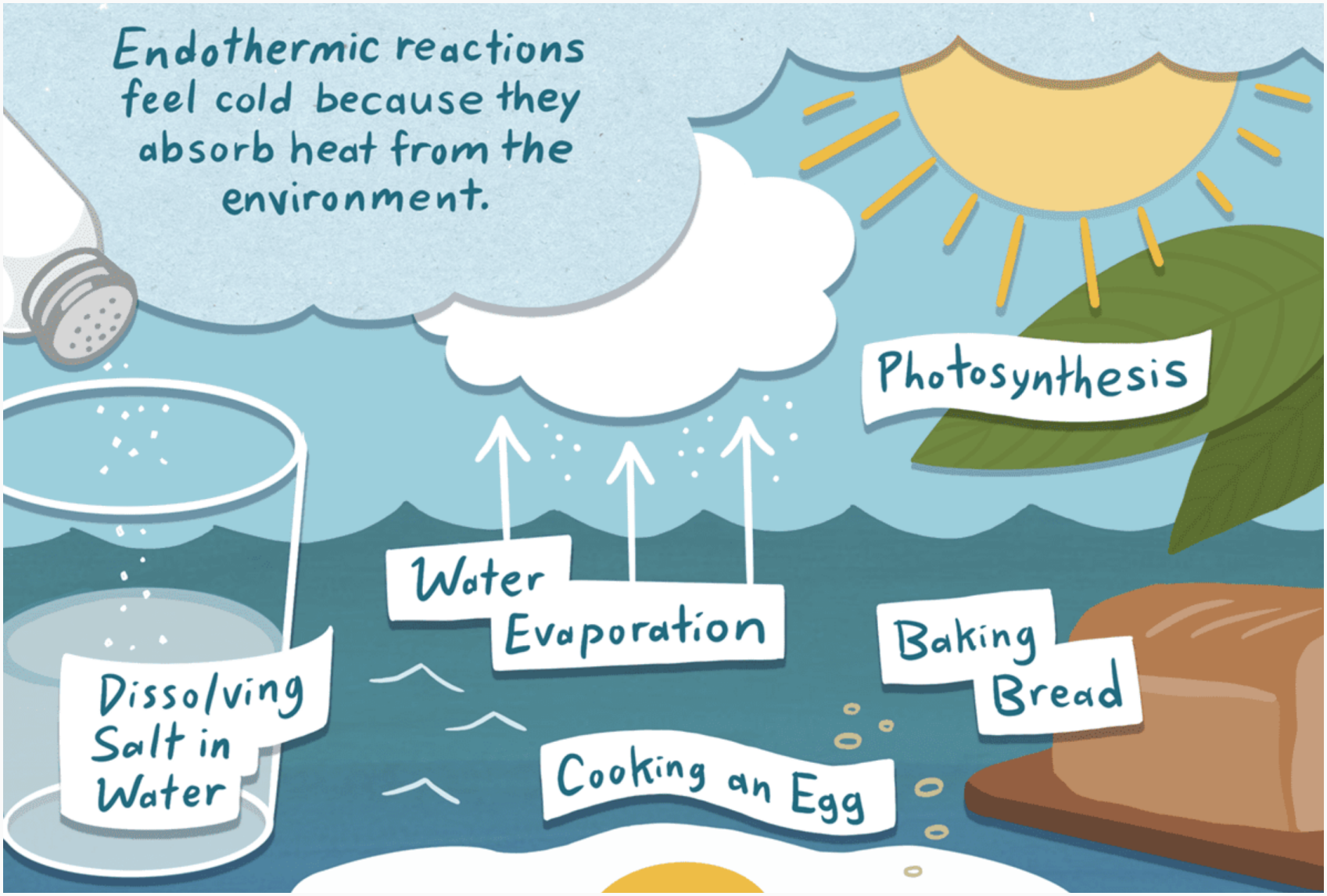
Endo - internal; endothermic reactions absorb heat

Endothermic Reaction Diagram

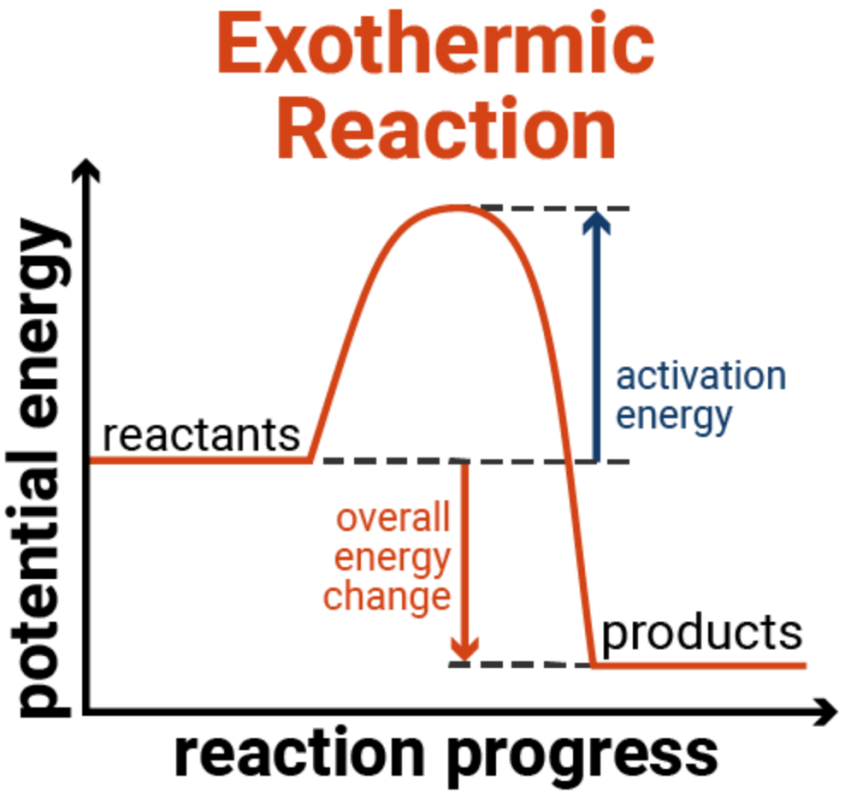


- **Recall Potential energy** - ability to do work; $\Delta E_{\text{products}} > \Delta E_{\text{reactants}}$
- **Activation energy** - minimum energy to start the reaction; determines the rate at which the reaction undergoes

Examples of Endothermic Reactions

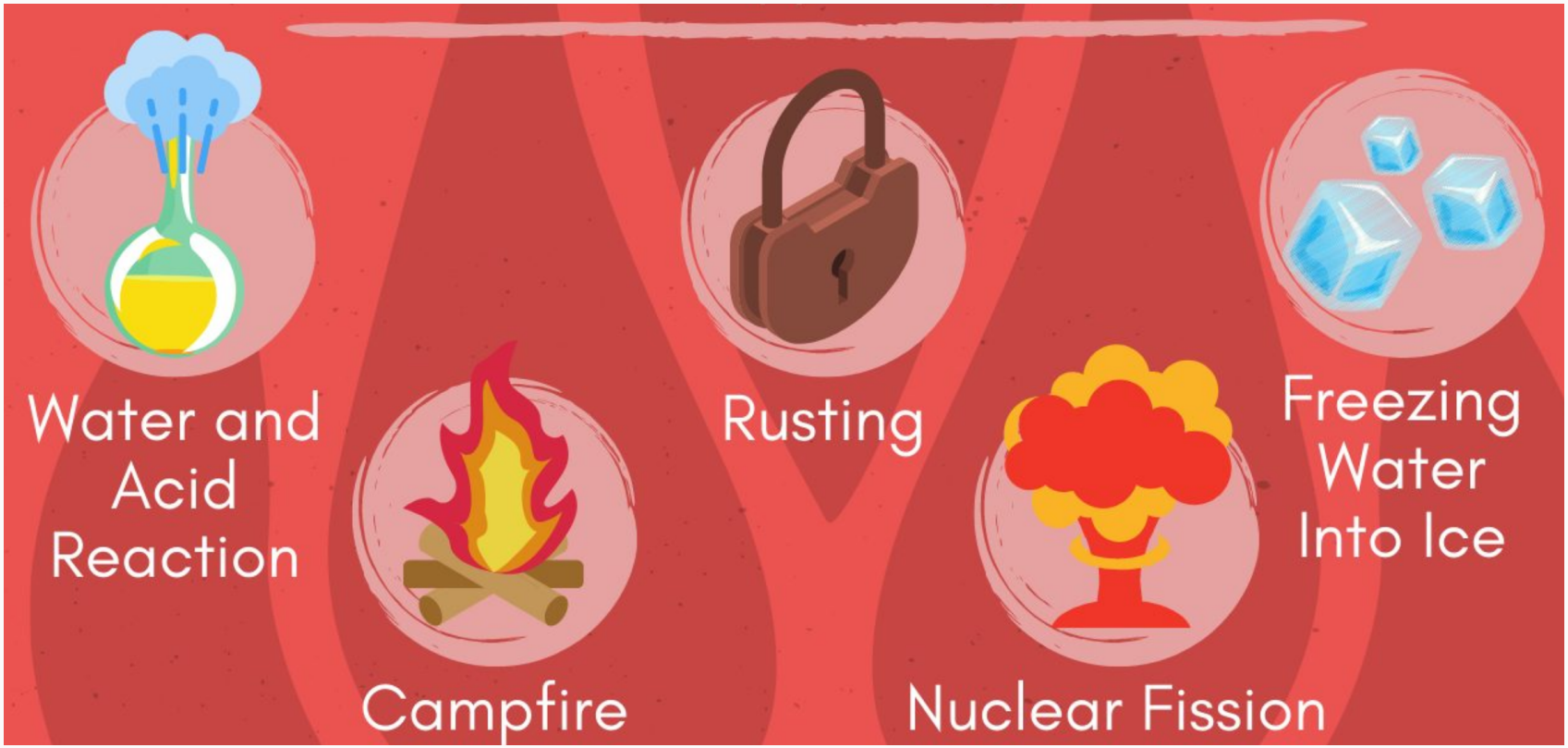


Exothermic Reaction Diagram

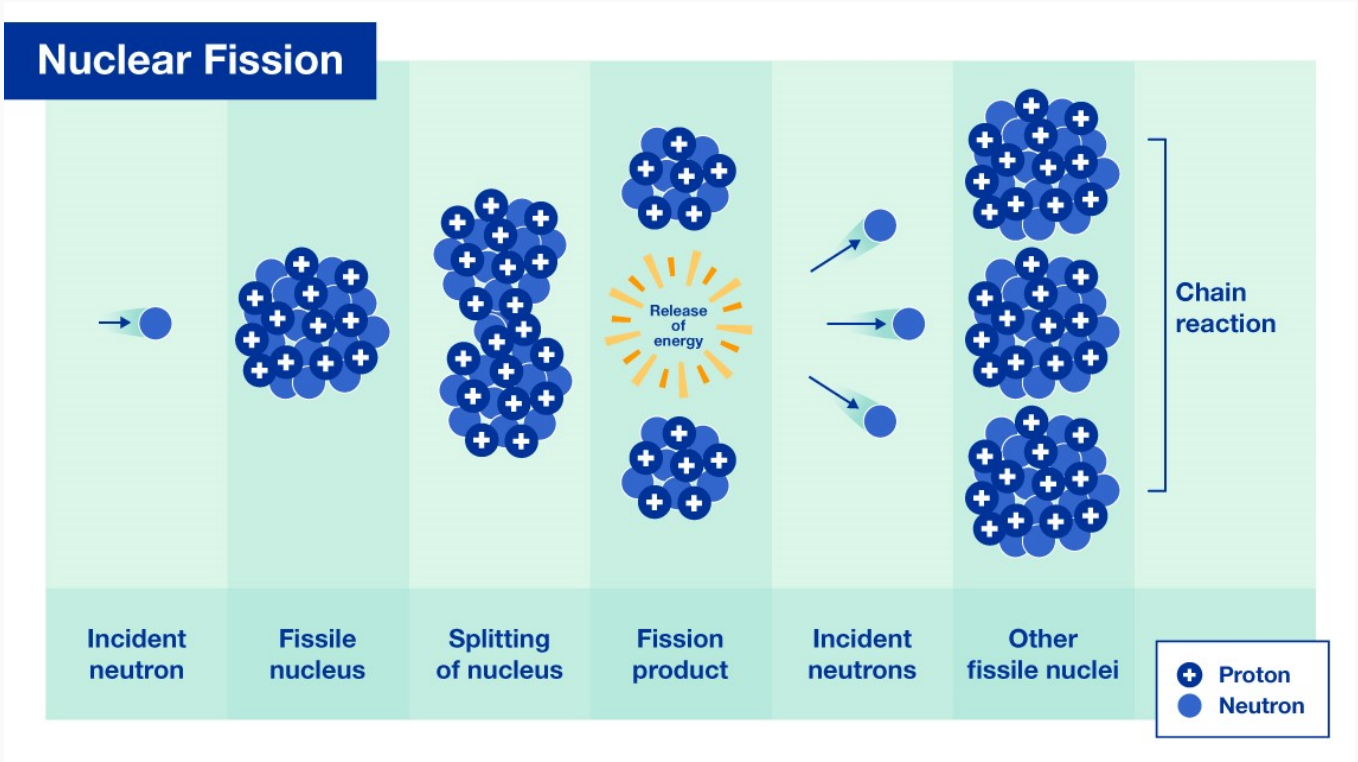


- **Potential energy** - $\Delta E_{\text{products}} < \Delta E_{\text{reactants}}$
- Products are more stable than reactants since preference for lower energy state

Examples of Exothermic Reactions



Nuclear Fission



- **Nuclear fission** - releases energy where the nucleus of an atom splits into two or smaller nuclei
- U-235 atoms breaking down to release up to 200 million eV (4.6×10^9 kcal/mol)
- **Context** - 9.71 kcal/mol to boil water

Calorimetry