Energy conversion processes in everyday life

Cooking, seeing, sunbathing – energy conversion is taking place everywhere around us. We're not always aware of it because it is so commonplace. In terms of physics, an energy conversion process can be observed in everything that happens. And sometimes the "energy conversion chains" don't start on Earth, but with the sun. Without the conversion process of nuclear fusion, a phenomenon that may seem exotic and is not directly observable, life on Earth as we know it wouldn't be possible.

This document lists energy conversion processes in everyday occurrences.

Sunbathing

During sunbathing, the sun's rays shine on our skin and clothing and warm them up. In this case, radiant energy is being converted to thermal energy. The fact that radiant energy results from the conversion of nuclear energy in the sun was already mentioned above.

Vision

Rods and cones in the eye are light-sensitive sensory cells. They convert the light impinging on the retina to electrical impulses, which can be processed in our brain. In this case, radiant energy is being converted to electrical energy.

Hand warming

When you rub your hands together in winter to warm yourself up, you're converting mechanical energy to thermal energy.

Heat radiation

Every body emits radiation corresponding to its temperature, its surface, and its molecular composition. The radiation's wavelengths are distributed continuously across a wide spectrum.
This effect, which explains the glow of heated metal, for example, can be made "visible" using a thermal imaging camera.

Joule's first law

If current flows through an electrical conductor, the conductor heats up. As the current flows, electrons collide with molecules in the conductor, thereby transferring kinetic energy to these molecules. In this case, electrical energy is being converted to thermal energy.
This effect is used in households, for example, in electric kettles and hotplates (also ceramic cooktops).

An incandescent lamp combines the two principles of Joule's first law and heat radiation to convert electrical energy to radiant energy. Current with high amperage flows through a thin wire, causing the wire to become very hot (Joule's first law). Due to the wire's high temperature, a portion of its heat radiation is in the visible range. However, because most of the emitted radiation lies in the infrared range, meaning it is not useful for lighting, this type of lighting is inefficient. That's why the incandescent lamp will be phased out in Europe sooner or later.

LED

Unlike an incandescent lamp, an LED converts electricity directly to radiation. In the process, only the radiation of a particular wavelength is released. The efficiency of LEDs is significantly higher than that of incandescent lamps.

Chemical reactions

In an exothermic reaction, energy is released to the surroundings. In this case, chemical energy is being converted to another energy form. Examples include the following:

- **Combustion:**
  When a substance such as wood burns, energy is released in the form of heat.
- **Chemiluminescence:**
  Chemical reactions release radiation in a narrowly limited spectrum. These reactions are responsible for the light emitted by fireflies and glow sticks.
- **Muscles:**
  A series of chemical reactions leads to movements at the molecular level. Our muscular system is designed so that these small movements are bundled into one large movement. In this case, chemical energy is being converted to mechanical energy.

Reactions that absorb energy from their surroundings are called endothermic. One example of this is:

- **Photosynthesis:**
  During photosynthesis, plants absorb the sun's radiant energy and covert it to chemical energy. We can then absorb this chemical energy through plant-based foods, such as an apple.

Nuclear energy

The nucleus of an atom consists of protons and neutrons. Even though the positively charged protons repel each other, the protons and neutrons are held together by a strong interactive force. Just as in a chemical bond, energy is stored in a nuclear bond. This energy can also be released again, as the following examples show.

- **Nuclear fission:**
  During nuclear fission, the bond between the protons and neutrons in the atomic nucleus is broken and energy is released.
- **Nuclear fusion:**
  During nuclear fusion, two atomic nuclei fuse to form a single nucleus. If less energy is bound in the new atomic nucleus than in the two original nuclei combined, the difference in energy is released.
  Nuclear fusion takes place in the sun, for instance, causing its high temperature. The sun's thermal radiation then transports the energy to us on Earth.