

Energy Transformation and Electrical Circuits



Vocabulary

| Word | Definition |
|-----------------------|--|
| Energy | The ability to do work. Anything that makes matter move or change. |
| Energy transformation | When energy is changed from one form to another. For example, electrical energy into light energy. |
| Force | A push or a pull. |
| Electrical Force | The pushing and pulling by moving electrons. |
| Electricity | The presence or movement of charged particles called electrons. |
| Electrical Energy | Energy from interactions between charged particles (electrons). |
| Current | A steady flow of electrons. |
| Circuit | The complete loop through which an electrical current can pass. |
| Green energy | Energy that comes from sources that do not pollute the Earth. |
| Primary Energy | Energy sources found in nature that have not been subjected to any conversion or transformation process. |
| Secondary Energy | Energy which has been transformed from another source. |

What is Energy?

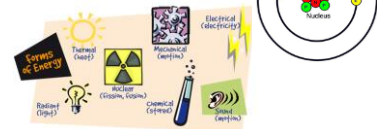
- **Energy** can mean lots of things. It's everywhere!
- In physics, **energy** refers to the ability to do **work** (and usually has something to do with movement or action).
- **Energy** is anything that can make matter **move** or **change**.



What is Energy?

Energy comes in a number of forms including:

- * **potential energy**, which is energy that's stored in a system and waiting to come out;
- * **kinetic energy**, which is the energy in a moving system;
- * **chemical energy**, which is energy that's stored in chemical bonds between atoms;
- * **electrical energy**, which is energy from interactions between charged particles;



What is Energy?

* **thermal energy**, which relates to heat energy of molecules;

* **nuclear energy**, which is energy that's stored between the particles within atoms.

* **Light and other forms of electromagnetic radiation** such as gamma rays or X-rays are also thought of as a form of energy.

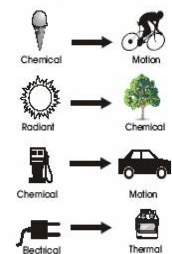
"The physicist Albert Einstein showed that in fact, pretty much all mass is a form of energy too!"

$$E=mc^2$$

Energy Transformation

- The Law of **Conservation** of Energy states that energy **cannot** be created or **destroyed** in a system. Instead, it must be **converted**, or transformed, into another type of energy.
- **Energy transformation** is when energy is **changed** from one form to another.

Energy Transformations



Energy Transformation

*You can see the idea of energy transformation when you think about lighting a match. What happens is that the chemical energy stored in the match is converted into heat energy and light energy.

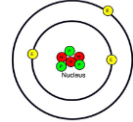


*When electrical energy passes through a light bulb, electrical energy is transformed into light energy.



Electric Circuits

* **Electricity** is the presence or movement of electrons, which are tiny, negatively charged particles that orbit an atom's nucleus. Electricity is what we get when electrons move from one place to another.



• Energy can be transferred from one system to another when two objects push or pull on each other over a distance. In the case of electricity, electrons are pushed and pulled through a circuit.

• A **force** is a push or a pull. There are many types of forces. The pushing and pulling of moving electrons is an **electrical force**.



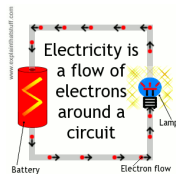
Electric Circuits

• Electricity is naturally present in lightning and static electricity, but the flow of the electrons in lightning and static electricity are not controlled or steady.



• In order for electricity to be useful in our homes and devices, there needs to be a steady flow of electrons called a **current**.

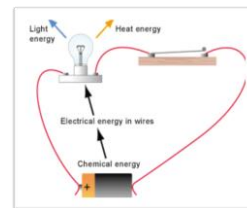
• There also needs to be a complete **circuit** or a complete loop through which the electrical current can pass.



Electric Circuits

• In a complete circuit, energy starts at a power source (for example a battery), moves through a **conductor** (for example, a metal wire), passes through a load (a device that uses electricity such as a light bulb or toaster) and returns back to the power source.

• It starts out in one place, travels around the circuit, and ends up back at the place where it originated. The electrons are pushed and pulled through the circuit.



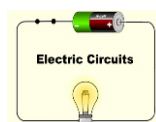
Batteries and Circuits

• Batteries are devices that use "**energy transformation**" to produce electricity. They work by changing stored chemical energy into electrical energy.

• A **chemical** reaction inside a battery creates electrons. These electrons are stored in the negative terminal (-) of the battery. When a battery is part of a complete circuit, the negative terminal pushes the electrons out.

• The electrons travel from the negative terminal, through the circuit to the positive terminal (+). The positive side of the battery pulls the electrons in.

• Batteries create an **electrical force** by pushing and pulling electrons through a complete circuit.



Generating Electricity

• Power plants use generators to produce electricity. The electricity produced through these generators are secondary energy sources.

• **Primary energy** sources are found in nature and have not been subjected to any conversion or transformation process such as sunlight, wood, oil, coal and natural gas.

• **Secondary energy** sources have been transformed from another source.

• To produce electricity through a **generator**, a heat source is needed to create the conditions in which electrical currents form. This heat can come from a variety of different primary energy sources including coal, hydro power, wind power, nuclear and solar energy.



Generating Electricity

Water, wind and solar are some sources of green energy—meaning they do not pollute the environment.



You need a complete circuit for electrons to flow and have an electrical current. Electricity is important because we can use it to make so many things work. When electrons are pushed or pulled through a circuit (electrical force), the electrical energy can be converted through energy transformation into many other types of energy including light, heat, and sound.

