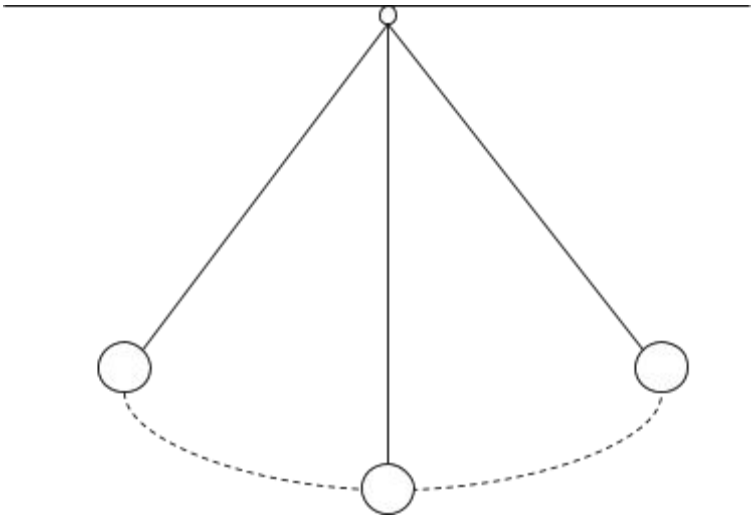
D1 Investigate and interpret the use of devices to convert various forms of energy to electrical energy, and electrical energy to other forms of energy

D1.1 identify, describe and interpret examples of mechanical, chemical, thermal, electrical and light energy

Forms of Energy

Inscience, energy is defined as the ability to do work. There are many types of energy. Five common forms of energy include mechanical, chemical, thermal, electrical, and light energy.

Mechanical Energy - The energy of movement. Mechanical energy also includes the energy an object has because of its potential to move. A pendulum is a visible example of mechanical energy. A pendulum is a mass that is suspended from a point so that it can move back and forth. The mass is lifted to one side, and the stored mechanical energy changes into moving mechanical energy when the mass falls.



Pendulum

The dotted lines show the motion.

Chemical Energy - The energy stored in chemicals. This energy is released during chemical reactions when the chemical bonds of the compound break. Batteries use chemical energy. Food stores chemical energy, which can then be used by your body to produce movement.

Thermal Energy - The total kinetic energy of all the particles in a substance. Kinetic energy refers to how fast the particles are moving. Warm objects have more thermal energy than cool objects because the particles are moving faster. Because thermal energy refers to the total kinetic energy of a substance, 100mL of water at 75ºC will have more thermal energy than 50mL of water 75ºC.

Electrical Energy - the energy from the flow of electrons through a conductor. The electricity produced is from the continuous movement of the electrons. Electrical energy is used in televisnions, computers, and many other devices.

Light Energy - energy that travels in the form of a light wave. The most common source of light energy is the sun. Light energy allows people to see.

D1.2 investigate and describe evidence of energy transfer and transformation (e.g., mechanical energy transformed into electrical energy, electrical energy transferred through power grids, chemical energy converted to electrical energy and then to light energy in a flashlight, thermal energy converted to electrical energy in a thermocouple)

Energy Transfer and Transformation

Energy can be transferred or transformed. Energy transfer occurs when one type of energy is transferred or moved from one object to another. For example, thermal energy is transferred from the stove to a frying pan through conduction. However, the type of energy does not change when energy is transferred.

Energy is transformed when it changes from one type of energy to another. When glucose is broken down in the body, chemical energy is transformed into mechanical energy for the movement of muscles and for thermal energy to keep warm. When you turn on a light bulb, electrical energy is transformed into thermal and light energy as electrons flow through the filament of the bulb.

Energy can’t be created nor destroyed; it can only be transformed from one form to another.

D1.3 investigate and evaluate the use of different electrodes, electrolytes and electrolytic concentrations in designing electrical storage cells

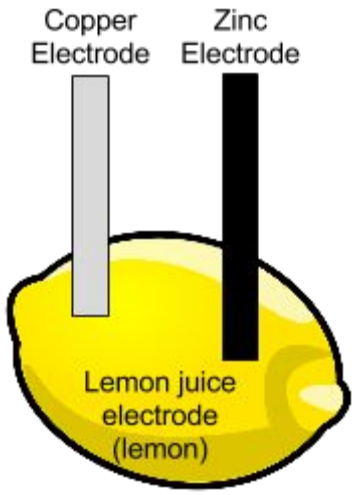
Electrical Storage Cells

A cell is commonly used device that changes chemical energy into electrical energy. This is made possible by using two different metal electrodes and an electrolyte. With a cell, a chemical reaction occurs that releases electrons that travel from one electrode to the other. Different electrolytes and electrodes will produce cells with different properties. A cell's strength can also be changed by carying the concentration of the electrolyte used. The intended purpose of the cell will determine what kinds of electrolytes and electrodes should be used and which type of cell would be best.

There are several types of ces. **Wet cells** have liquid electrolytes, while **dry cells** use a paste. Cells that cannot be recharged are called primary cells, and rechargeable cells are called secondary cells.

Two or more cells combined together make a battery. A 12-volt car battery has six cells connected in series.

Wet Cell



In the given illustration of a wet cell, a chemical reaction occurs, and the electrons move from the zinc electrode (-) to the carbon electrode (+) through the electrolyte (lemon juice).

D1.4 construct, use and evaluate devices for transforming mechanical energy into electrical energy and for transforming electrical energy into mechanical energy

D1.5 modify the design of an electrical device, and observe and evaluate resulting changes (e.g., investigate the effect of changes in the orientation and placement of magnets, commutator and armature in a St. Louis motor or in a personally-built model of a motor)

Transforming Electricity

Electricity is a form of energy that can be changed from, or into, another form of energy by technological devices.

Technological Device	Initial Energy Form	Final Energy Form
Motor	Electrical	Mechanical
Generator	Mechanical	Electrical
Thermocouple	Heat	Electrical

An **electric motor** is a device that transforms electrical energy into mechanical energy. This is made possible by the use of permanent magnets, an armature, brushes, and a split-ring commutator. Because of the continual switching of the polarity of the magnets, the armature spins.

Generators have the same basic parts as a motor, but in the case of a generator, mechanical energy is converted to electrical energy. Generators can produce direct current (DC) or alternating current (AC). The more common form of current is AC. Power companies generate AC. Power companies use high voltage (500 000 V) transmission lines to get electricity from the generating stations to your house. However, the power line going into your house is only 240 V. A **transformer** is used to step up and step down voltage depending upon the need. Inside your house, coltage is dropped again to 120 V for most appliances.