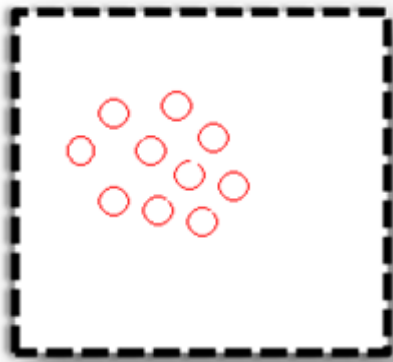
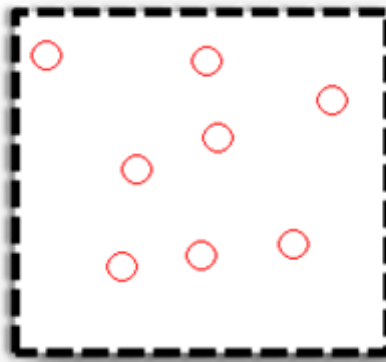


Conservation of Energy

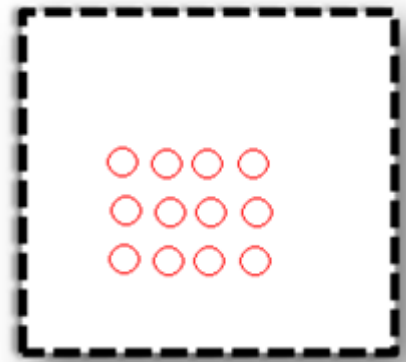
Energy can be in many different forms. Students should know sources and properties of the following forms of energy:



State of Matter: liquid
Temperature: 20 degrees Celcius
Particle Motion: slow



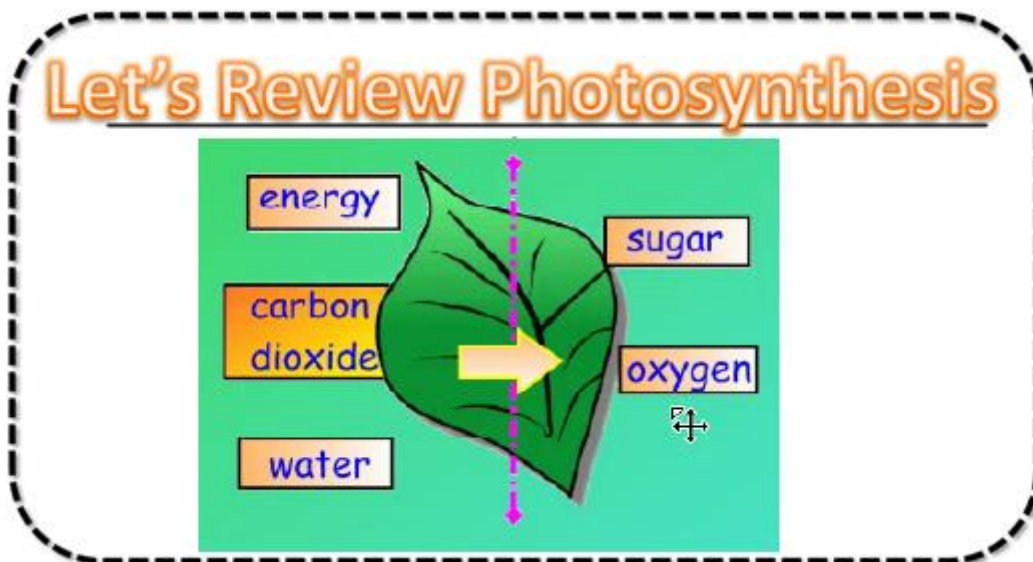
State of Matter: gas
Temperature: 100 degrees Celcius
Particle Motion: fast



State of Matter: solid
Temperature: -1 degrees Celcius
Particle Motion: not moving

Heat energy is the transfer of thermal energy (energy that is associated with the motion of the particles of a substance).

- Remember that all matter is made up of particles too small to be seen (5th grade).
- As heat energy is added to a substance, the temperature goes up indicating that the particles are moving faster. The faster the particles move, the higher the temperature.
- Material (wood, candle wax) that is burning, the Sun, and electricity are sources of heat energy.

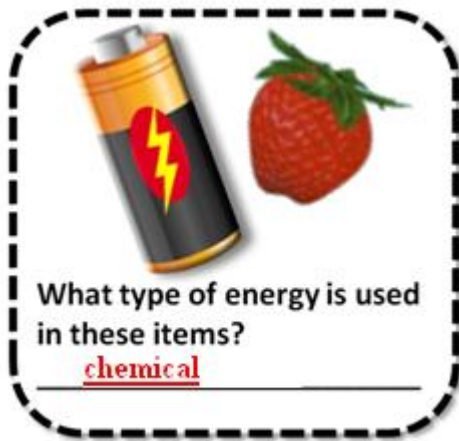


produce sugar, which contains stored chemical energy.

- Most of the energy that we use on Earth originally came from the Sun.

Solar energy is the energy from the Sun, which provides heat and light energy for Earth.

- Solar cells can be used to convert solar energy to electrical energy.
- Green plants use solar energy during photosynthesis to

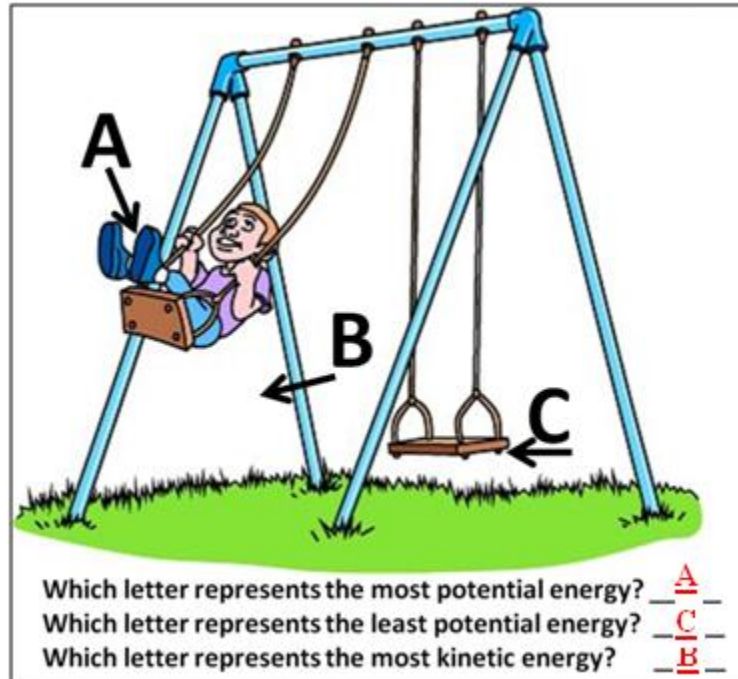


Chemical energy is energy stored in particles of matter.

- Chemical energy can be released, for example in batteries or sugar/food, when these particles react to form new substances.

Electrical energy is the energy flowing in an electric circuit.

- Sources of electrical energy include: stored chemical energy in batteries; solar energy in solar cells; fuels or hydroelectric energy in generators.



Mechanical
the motion
(potential) of

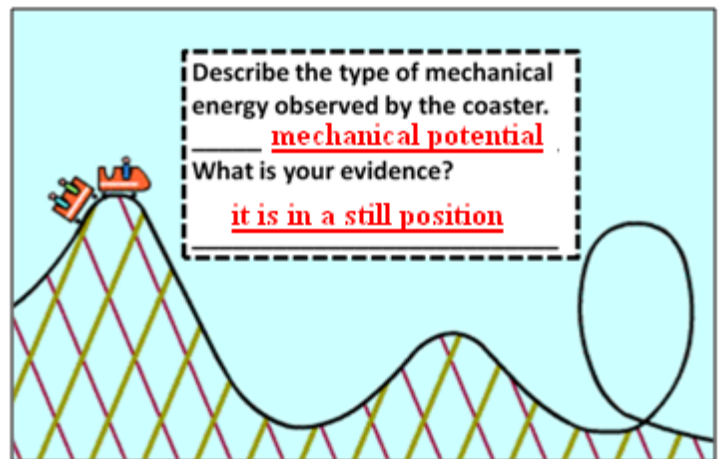
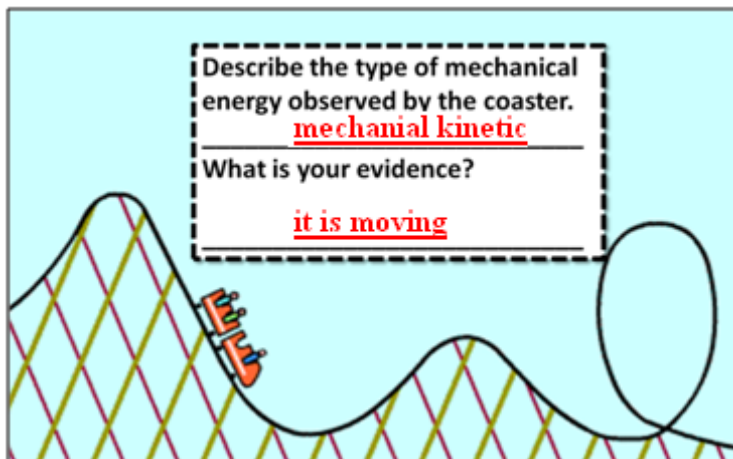
motion or are in
be set in
mechanical

energy:
energy.
is related to the
stretched

energy is the energy due to
(kinetic) and position
an object.

- When objects are set in a position where they can motion, they have energy.
- Mechanical Potential**
Potential energy is stored
Mechanical potential energy
position of an object. A
rubber band has potential energy. Water behind a dam has potential energy because it can fall down the dam.

- Mechanical Kinetic energy:** Kinetic energy is the energy an object has due to its motion.



- Mechanical kinetic energy increases as an object moves faster. A moving car has kinetic energy. If the car moves faster, it has more kinetic energy.

The Law of Conservation of Energy- states that energy cannot be created or destroyed. It may be transformed from one form into another, but the total amount of energy never changes.


Examples of potential and kinetic mechanical transformations might include:

- When water is behind a dam, it has potential energy. The potential energy of the water changes to kinetic energy in the movement of the water as it flows over the dam.
- When a rubber band is stretched, kinetic energy is transformed into potential energy. When a stretched rubber band is released its potential energy is transformed into kinetic energy as the rubber band moves.
- When a book is lifted to a shelf, kinetic energy is transformed into potential energy.
- If the book falls off the shelf the potential energy is transformed to kinetic energy.

Example	Energy Transformations
Book falling	Kinetic → sound, heat
Water moving over dam	Kinetic → electrical (via generator)
Green plants	Solar → stored chemical
Respiration (eating food)	Chemical → kinetic (moving)
Burning carbon-based fuel	Chemical → heat energy, electrical
Electrical circuit (using an outlet)	Electrical → mechanical, heat, sound and light

Circle all of the forms of energy you can observe in the picture.

~~ELECTRICAL~~
POTENTIAL
KINETIC
LIGHT
~~NUCLEAR~~




Explain one energy transformation seen above.

CHEMICAL → HEAT → SOUND

Circle all of the forms of energy you can observe in the picture.

~~ELECTRICAL~~
POTENTIAL
KINETIC
~~NUCLEAR~~
SOUND



Explain one energy transformation seen above.

CHEMICAL → HEAT → LIGHT

Circle all of the forms of energy you can observe in the picture.

~~CHEMICAL~~
~~ELECTRICAL~~

~~LIGHT~~
~~NUCLEAR~~
SOUND

*Could be chemical if the man ate first to get energy.

Explain one energy transformation seen above.

POTENTIAL → KINETIC → HEAT

Circle all of the forms of energy you can observe in the picture.

~~CHEMICAL~~
~~ELECTRICAL~~

HEAT

~~LIGHT~~
~~NUCLEAR~~

*Could be chemical if the Panda ate first to get energy.

Explain one energy transformation seen above.

POTENTIAL → KINETIC → SOUND

Circle all of the forms of energy you can observe in the picture.

CHEMICAL
POTENTIAL
KINETIC

~~NUCLEAR~~
~~SOUND~~

*Could be chemical if it were a tablet or iPad that was charged.

Explain one energy transformation seen above.

ELECTRICAL → LIGHT → HEAT

Circle all of the forms of energy you can observe in the picture.

~~CHEMICAL~~
~~ELECTRICAL~~

HEAT

~~LIGHT~~
~~NUCLEAR~~

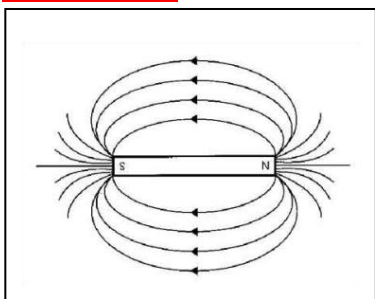
Select answers from the perspective of the man.

*Could be chemical if the man ate first to get energy.

Explain one energy transformation seen above.

POTENTIAL → KINETIC → SOUND

Magnetism is the force of attraction or repulsion of magnetic materials.



Surrounding a magnet is a magnetic field that applies a force, a push or pull, without actually touching an object.

An electric current flowing through a wire wrapped around an iron core forms a magnet.

A coil of wire spinning around a magnet or a magnet spinning around a coil of

wire can form an electric current.

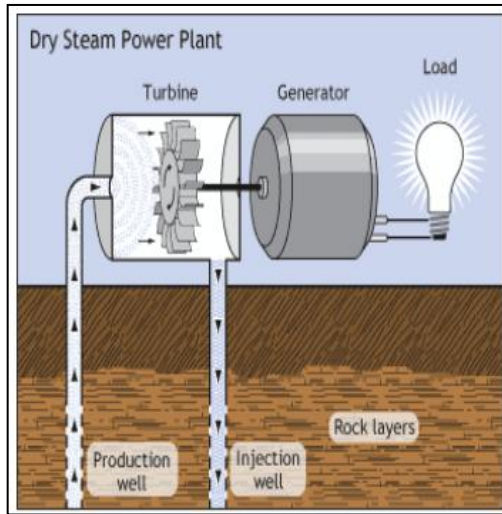
Examples of how magnetism and electricity are interrelated can be demonstrated by the following devices:

- An electromagnet is formed when a wire in an electric circuit is wrapped around an iron core producing a magnetic field. The



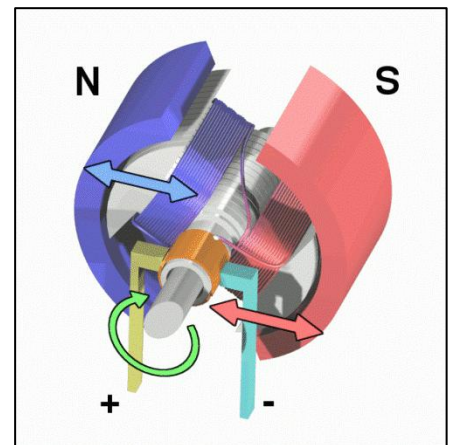
magnet that results loses its **magnetism** if the electric current stops flowing.

- A **generator produces** an **electric current** when a coil of wire wrapped around an iron core is **rotated** near a **magnet**. Generators at power plants produce electric energy for our homes.



- A generator contains coils of wire that are stationary, and rotating magnets are rotated by **turbines**. Turbines are huge **wheels** that rotate when pushed by **water**, **wind**, or **steam**.
- Thus **mechanical** energy is changed to **electrical** energy by a **generator**. Smaller generators may be powered by **gasoline**.
- An **electric motor** changes **electrical** energy to **mechanical** energy. It contains an **electromagnet** that rotates between the poles of a magnet.

- The coil of the electromagnet is connected to a **battery** or other source of **electric current**.
- When an electric current flows through the wire in the electromagnet, a **magnetic field** is produced in the coil.
- Like poles of the magnets **repel** and unlike poles of the magnets **attract**.
- This causes the coil to **rotate** and thus changes **electrical** energy to **mechanical** energy.
- This rotating coil of wire can be attached to a shaft and a blade in an electric fan.



Electrical energy can be transformed to light, sound, heat, and mechanical motion in an electric circuit.

An electric **circuit** contains a source of **electrical** energy, a **conductor** of the electrical energy (**wire**) connected to the energy source, and a device that uses and transforms the electrical energy.

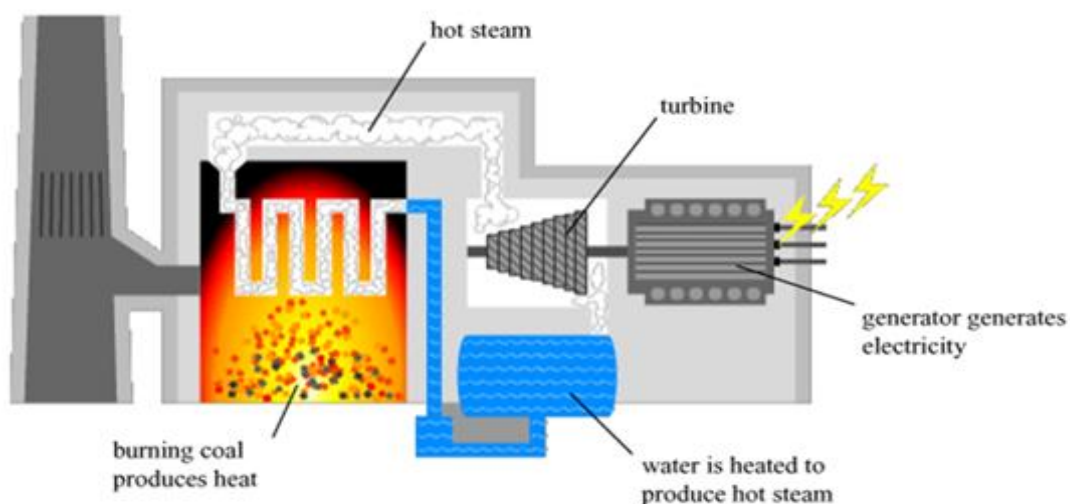
Source	Energy comes from ...
Battery	Stored chemical energy
Solar cell	Light energy from sun
Electrical outlets	Power Plants Chemical energy (burning coal) Nuclear energy Geothermal energy

All these components must be connected in a complete, unbroken path in order for energy transformations to occur.

The electrical energy in circuits may come from many sources including:

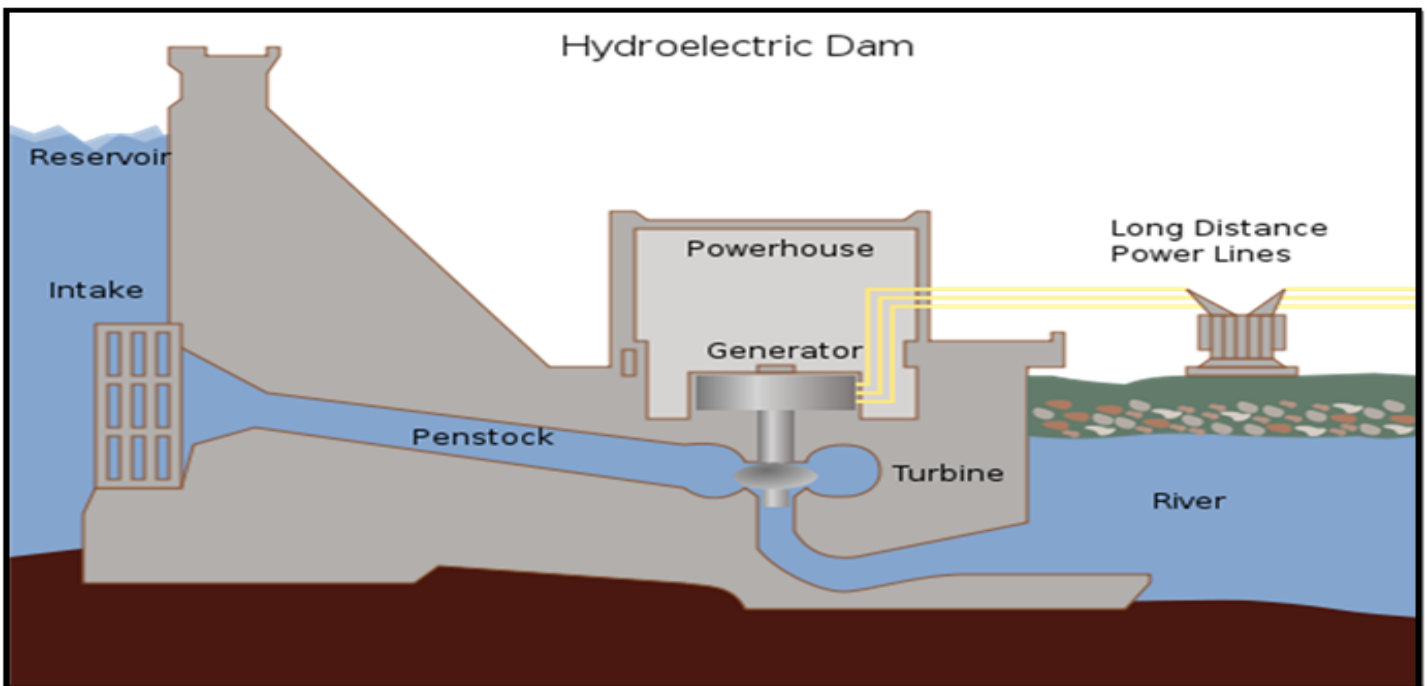
Devices used in electrical circuit	Energy Transformations
light, lightbulb	Chemical (battery) → electrical → light & heat
sound; buzzer, radio, t.v. lamp	Chemical (battery) → electrical → sound
held hand fan motor	Electrical (outlet) → heat & light
Generators <u>Coal-burning Plant</u>	Chemical energy (coal burning) → heat (steam) → mechanical (turning turbine) → electrical
Generators <u>Hydroelectric Plant</u>	Mechanical energy (moving water from dam) → mechanical (turning turbine) → electrical
Generators <u>Nuclear Plant</u>	Heat (steam) → mechanical (turning turbine) → electrical

Coal-burning Plant



Describe the energy transformations in a coal plant.

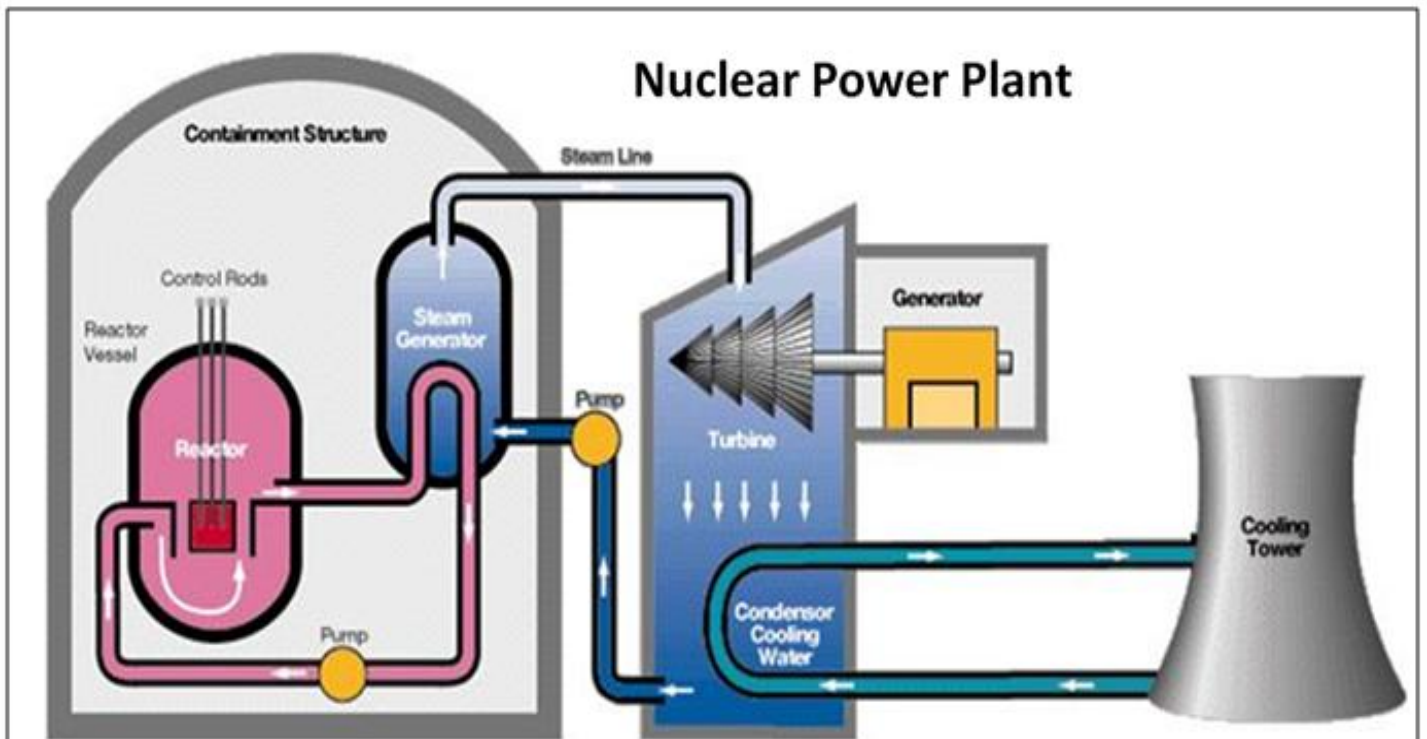
Chemical energy (coal burning) → heat (steam) → mechanical (turning turbine) → electrical



Describe the energy transformations in a hydroelectric plant.

Mechanical
Potential
(water
behind
dam)

→ Mechanical
(moving water
from dam) → mechanical
(turning
turbine) → electrical



Describe the energy transformations in a nuclear power plant.

**Nuclear
reaction**

→ Heat (steam) → mechanical
(turning
turbine) → electrical

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