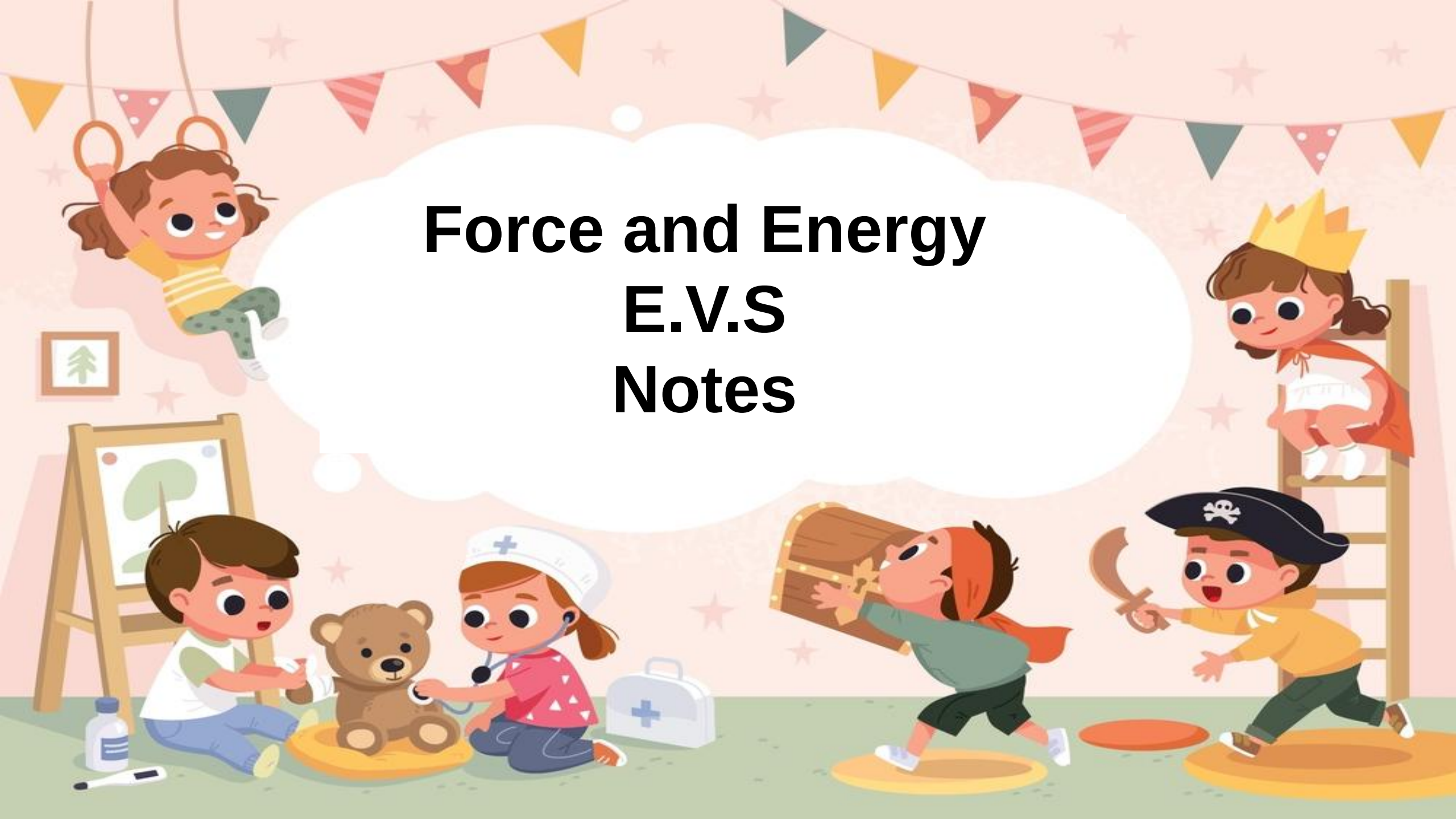
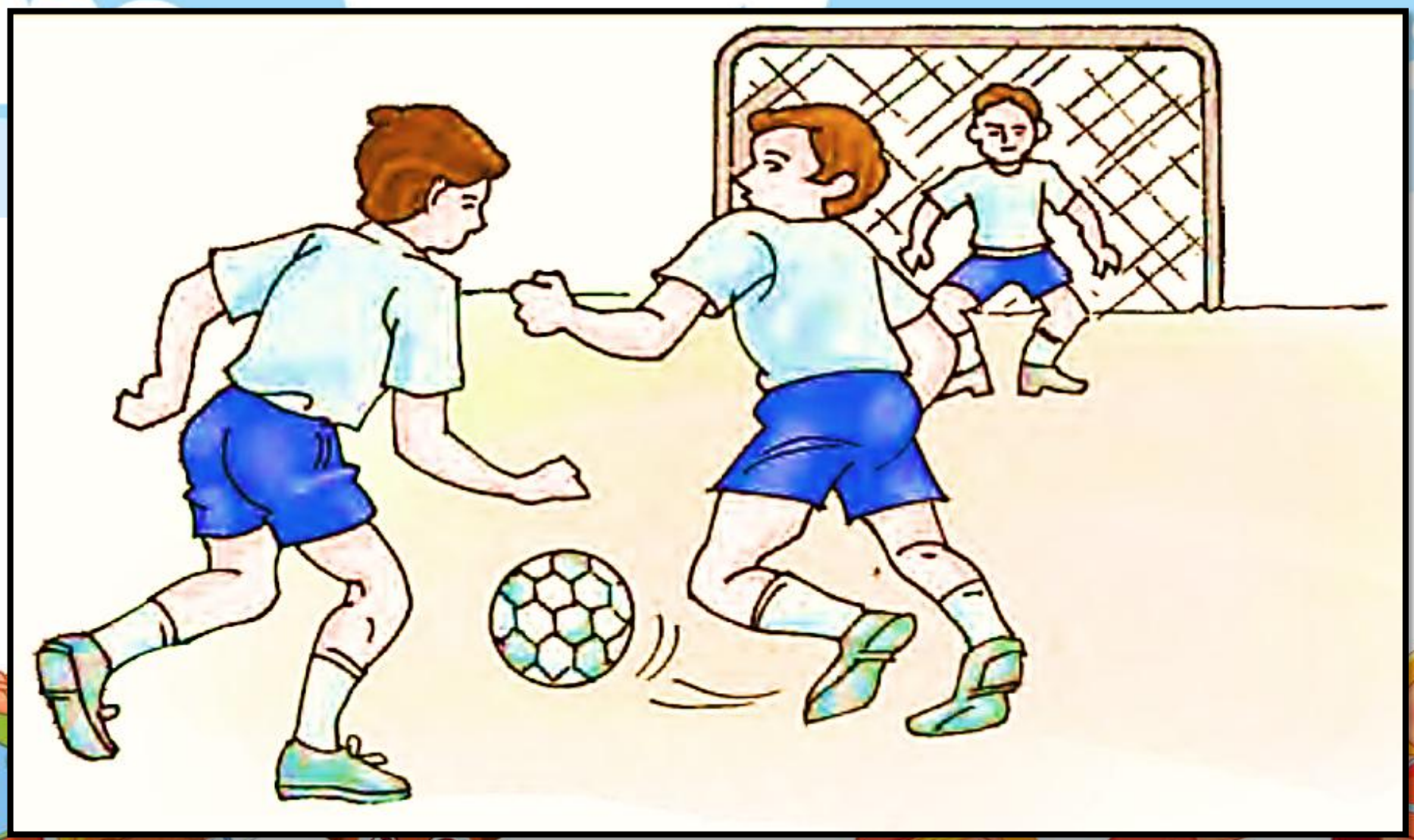
Force and Energy
E.V.S
Notes



INTRODUCTION

Motion simply means movement. It could be of any object or a thing or a person. Various activities in our daily life include motion or movements of different objects, such as kicking a football, opening a door, hitting a ball with a bat etc. See the pictures given below.



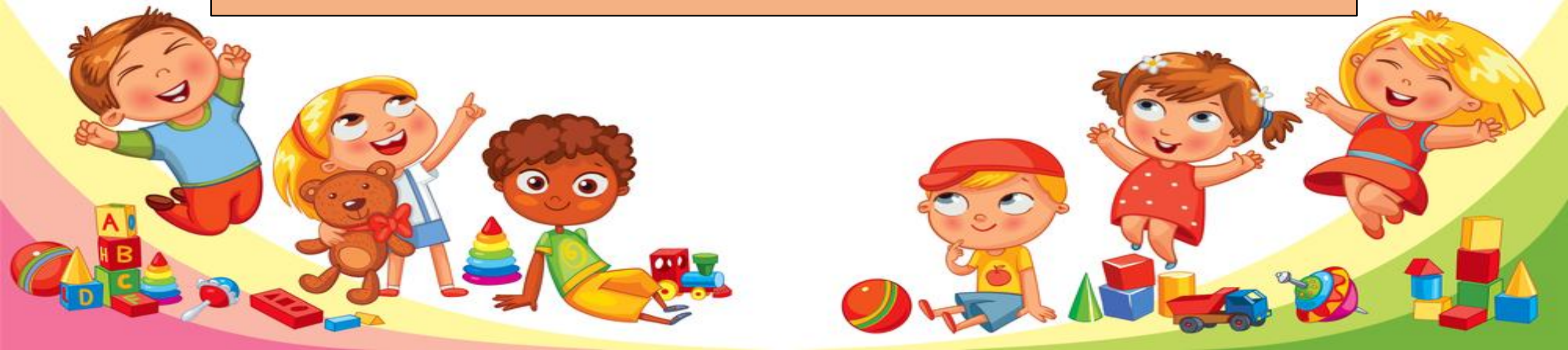
All these activities have moving objects and in order to move the objects, force is required.

FORCE

As you have already read in the previous class that force is a push or pull applied on an object to make it move. For example, to open a door force of hand is used to push or pull and open a door.

Force can be used to perform different activities such as:

- **To move a motionless object.**
- **To stop a moving object.**
- **To make a moving object move faster.**
- **To slow down a moving object.**
- **To make changes in shape and size of an object.**
- **To make changes in the direction of a moving object.**



Types of Force

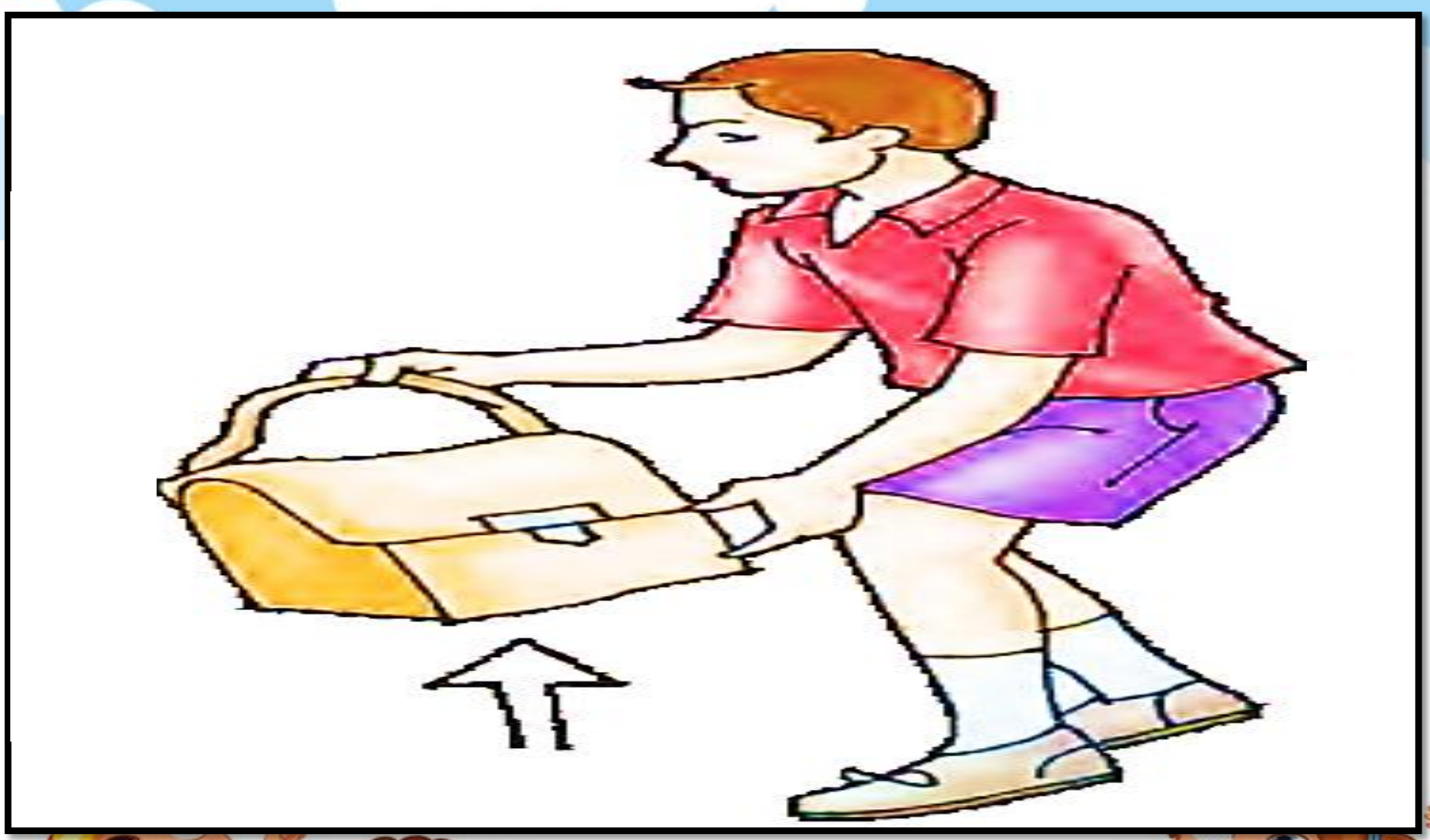
There are different types of force working on different things individually or together simultaneously.

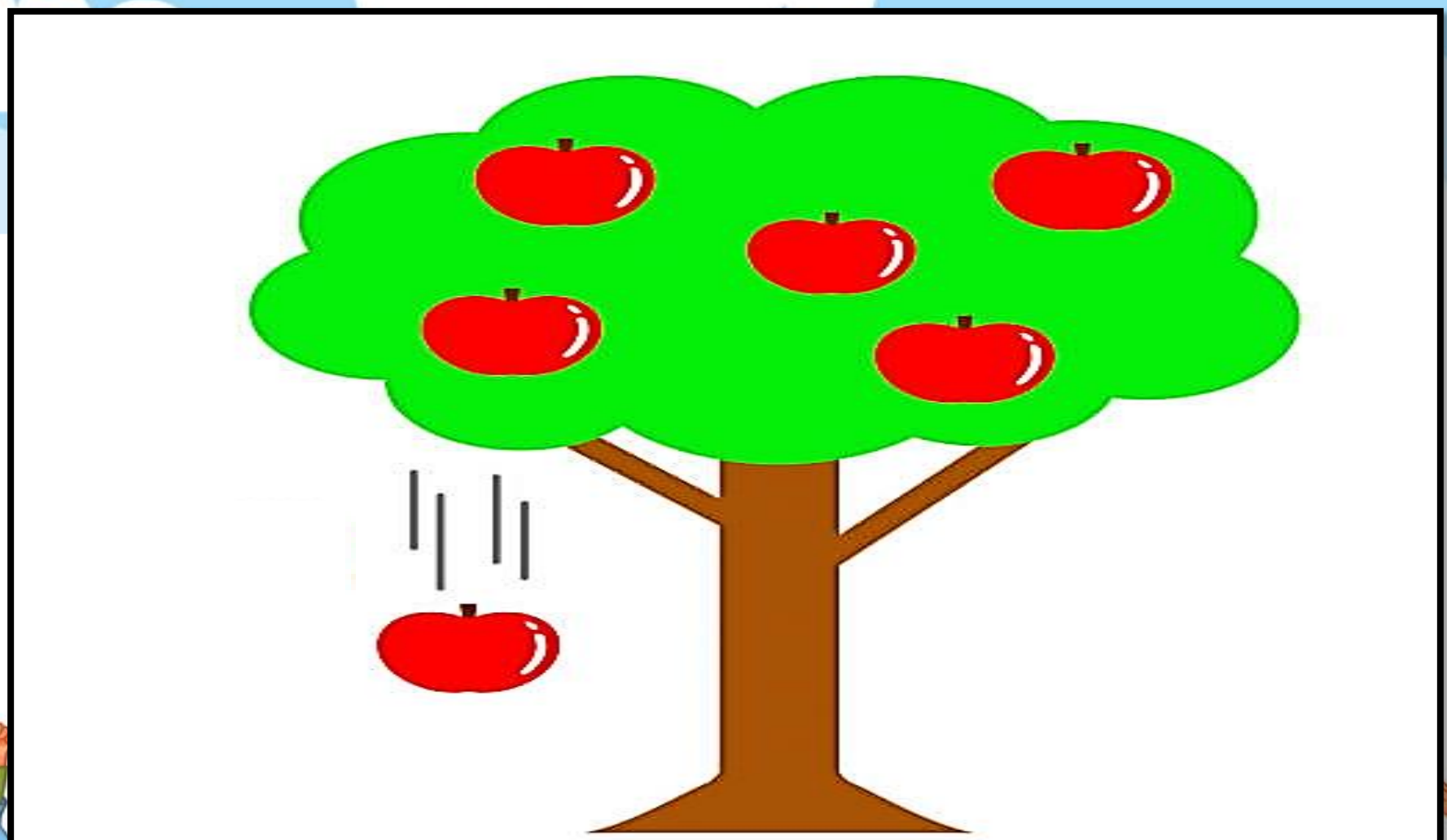
Force

- Gravitational Force
- Frictional Force
- Elastic Force
- Mechanical Force
- Buoyant Force

Gravitational Force

You often ask this question to your mother that, why does the ball you throw in the air always comes down on the earth? Why does a pencil from the table, always fall down on the floor? Why everything falls downwards always? All these questions have only one answer, gravitation. Earth applies a pull to all objects which is called gravitational force. We can walk and stay on the ground only because of the gravitational force of the earth.





Gravitational Force

Frictional Force

Frictional force acts against the motion and stops a moving object. You have seen, when you kick a football after some time the ball slows down and stops. This is because of the friction from the ground. Friction helps us in walking on the ground without slipping.

Frictional Force

DID YOU KNOW

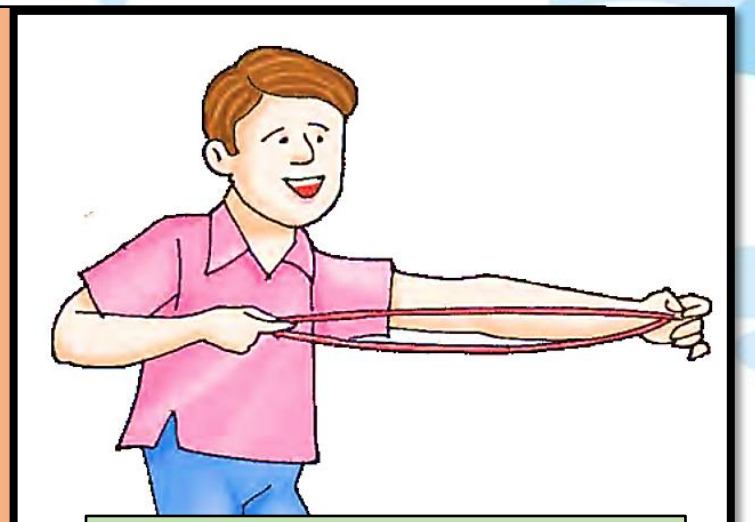
INTERESTING FACT:

You must have seen on TV or heard about the fact that early man used to create fire by rubbing two stones together. Ever wondered how does this happen? This is because of a frictional force. Friction causes heat and ignites fire.

Rubbing stones

Elastic Force

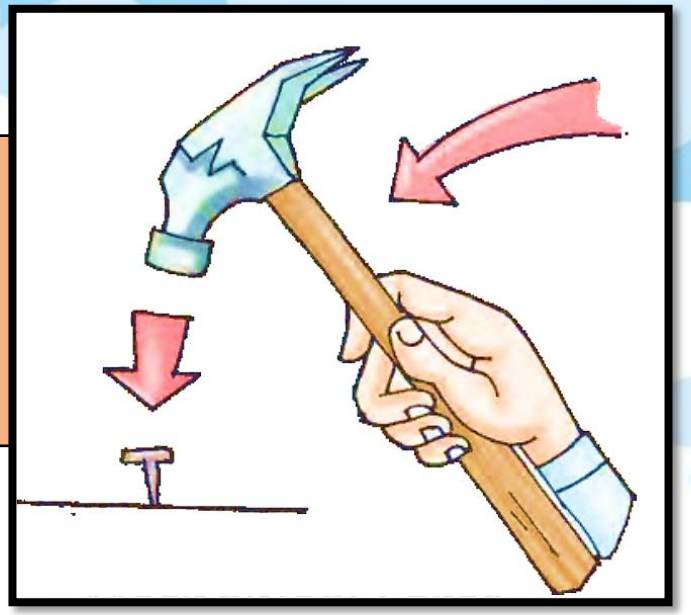
Elastic force acts when an object is stretched or contracted. For example, a stretched rubber band comes back to its original shape and size after releasing. This happens due to elastic force. Any change in the shape of object is due to elastic force.



Elastic Force

Mechanical Force

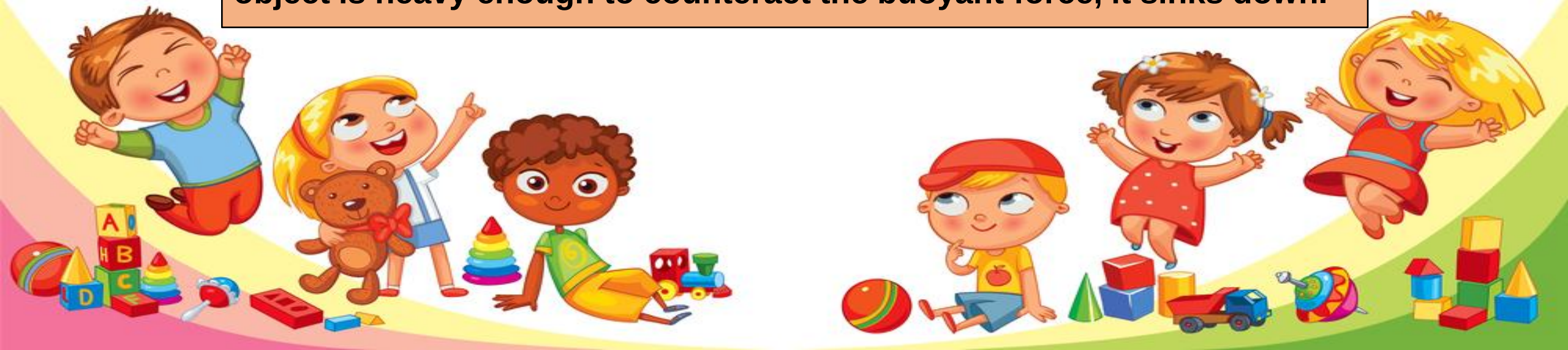
Mechanical force is a force used by machines. For example, a hammer uses mechanical force to beat something.



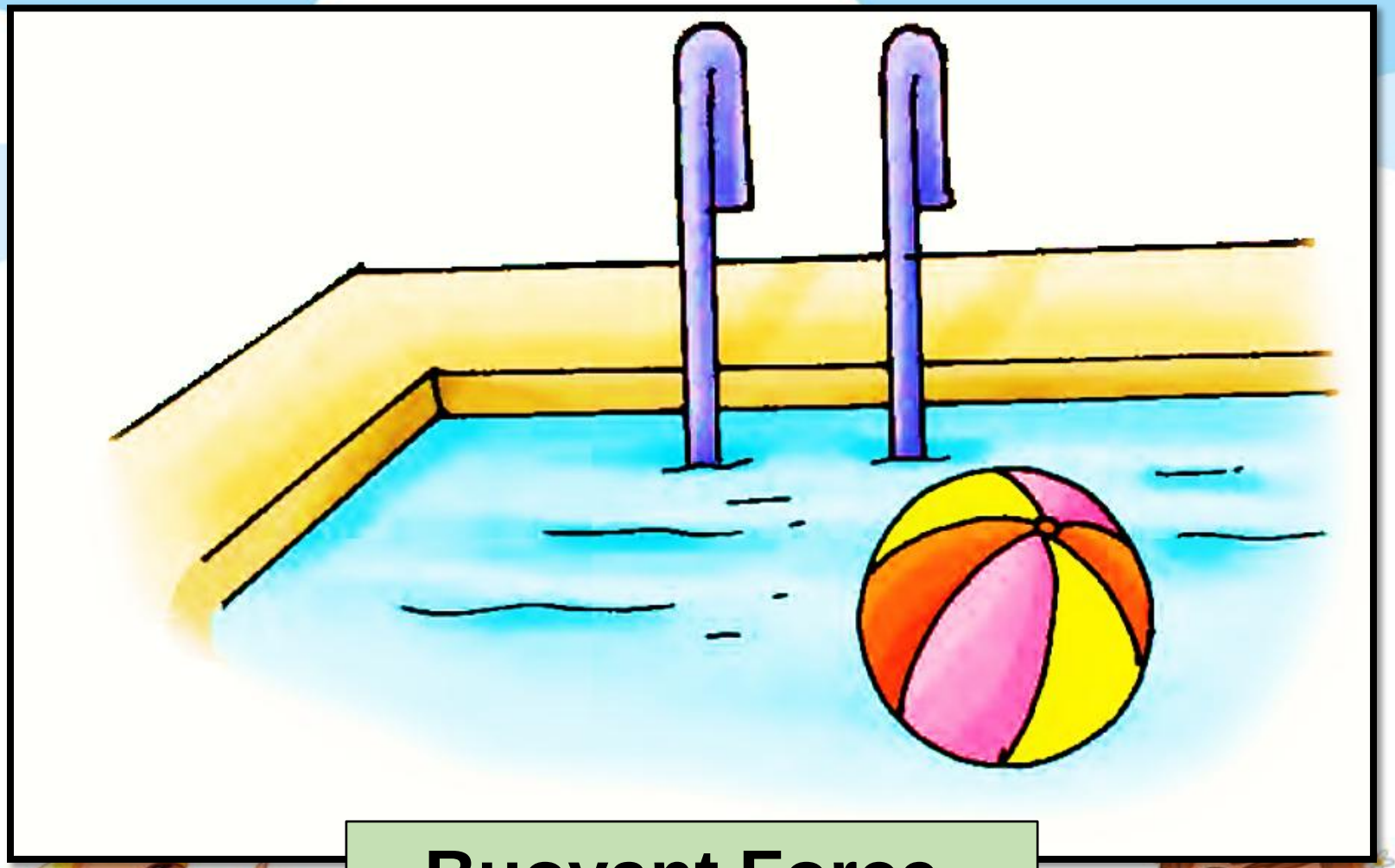
Mechanical Force

Buoyant Force

Ever wondered how do things float on water? The answer is simple: due to buoyant force. This force applies an upward push to any object on the surface of water, making it float. For example, a plastic ball floating on water. This force acts on all the bodies, even on human beings. This force helps you swim on the surface of water. But if an object is heavy enough to counteract the buoyant force, it sinks down.



There are some other forces as well, like electrostatic force and magnetic force, about which you will study in higher classes.



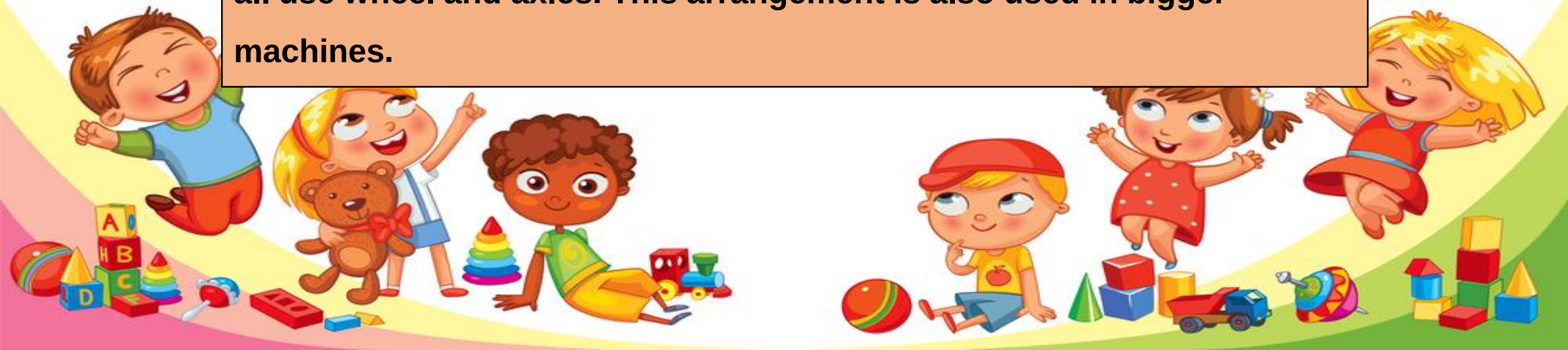
Buoyant Force

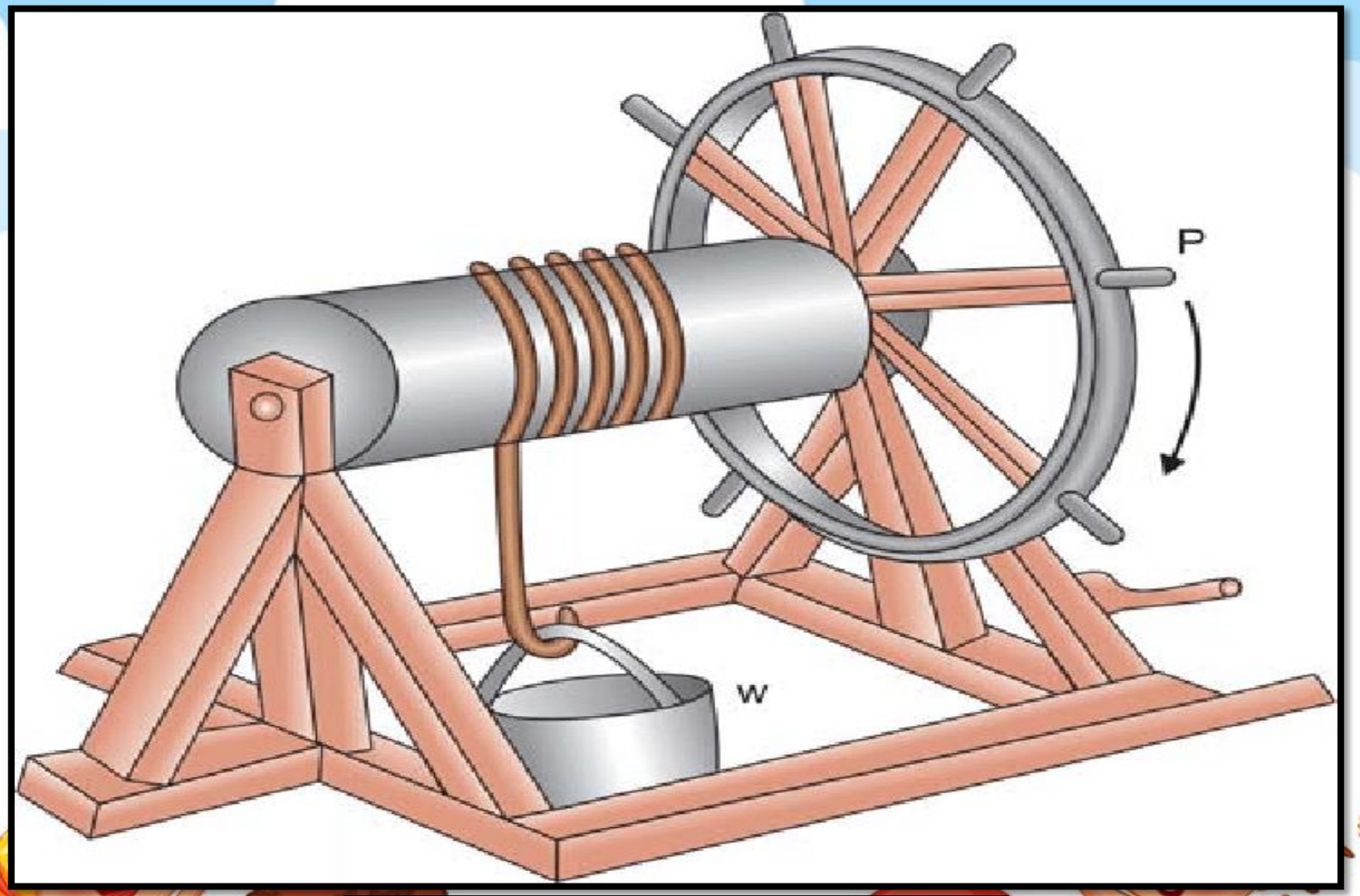
Simple Machines of Force

Machines are a set of objects, combined together to apply force in such a way, so that we get the desired work done. Machines help in applying force at a point in required direction. Machines increase the applied force which makes them very useful tools. Some simple machines are wheel and axle, screw, lever, inclined plane and pulley.

Wheel and Axle

Wheel is the simplest machine but it cannot function without an axle. A wheel turns around a axle rod called an axle. It is difficult for an individual to axle move a heavy load by pushing but if a wheel and axle arrangement is used the work becomes effortless and can be moved fast. Carts, steering wheels, cycles, roller skates and sewing machines all use wheel and axles. This arrangement is also used in bigger machines.





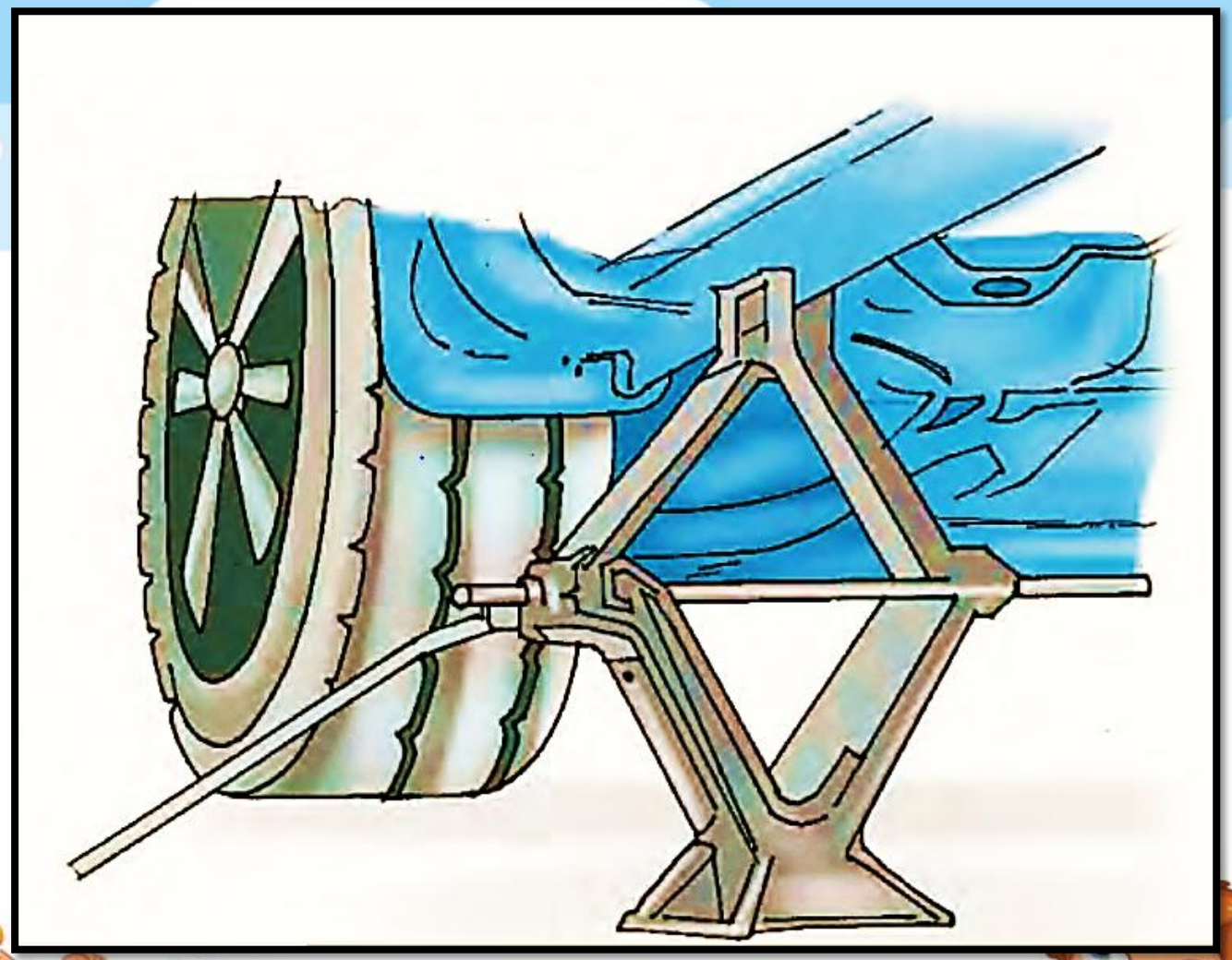
Wheel and axle

DID YOU KNOW ?

The mechanical advantage of a wheel and axle depends upon the ratio of the radius of the wheel to the radius of the axle. If the radius of the wheel is four times greater than the radius of the axle, every time you turn the wheel once, your force will be multiplied four times.

Screw

A screw is used to join two things together. It is a nail which is spiral in shape and interlocks two surfaces after which they cannot be separated easily. It is different from a nail as it holds things through the threads into which it divides the force. Screw can also be a screwjack, used to lift cars up.

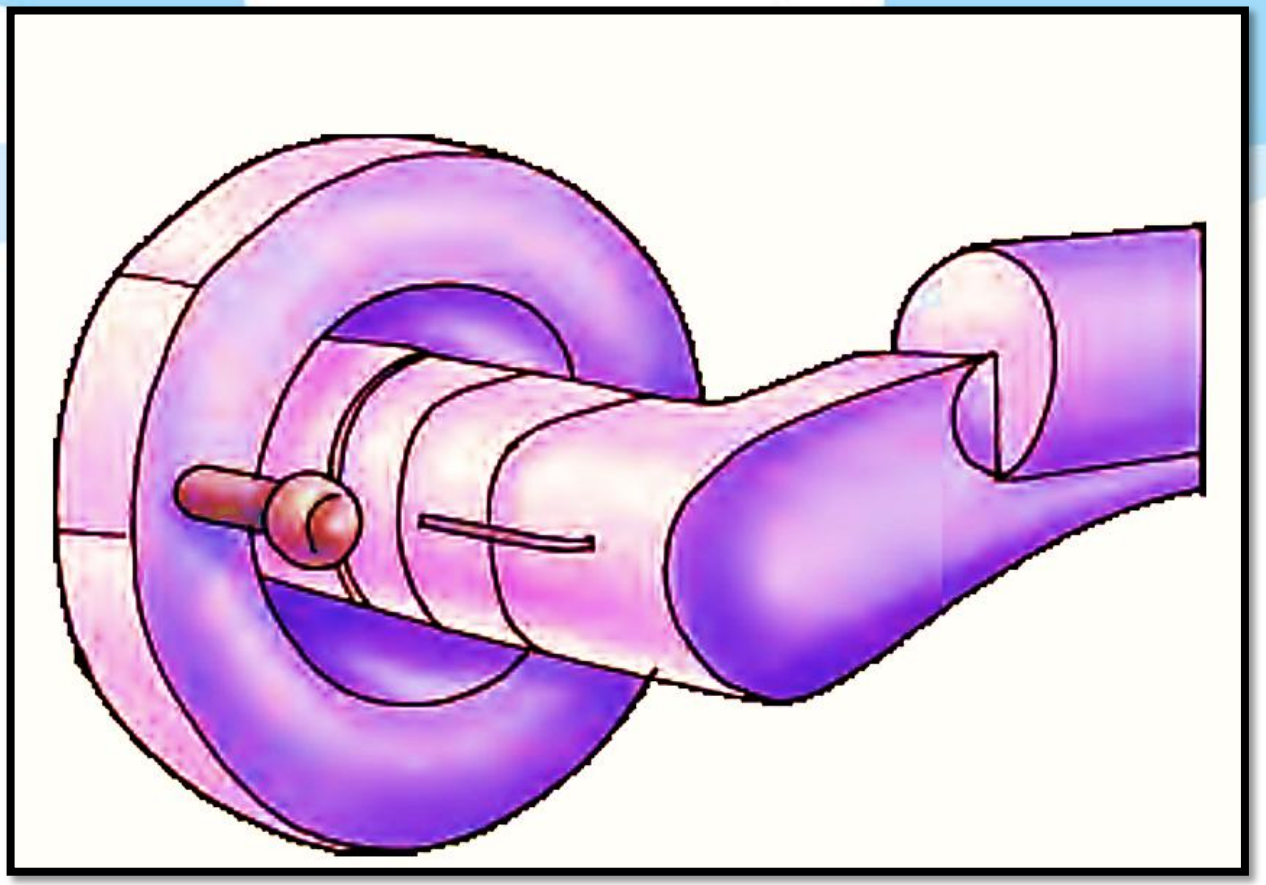


Screwjack

Screw

Lever

A lever is a simple machine with a bar that rests on a fulcrum. To understand lever you must know first first what a fulcrum is?



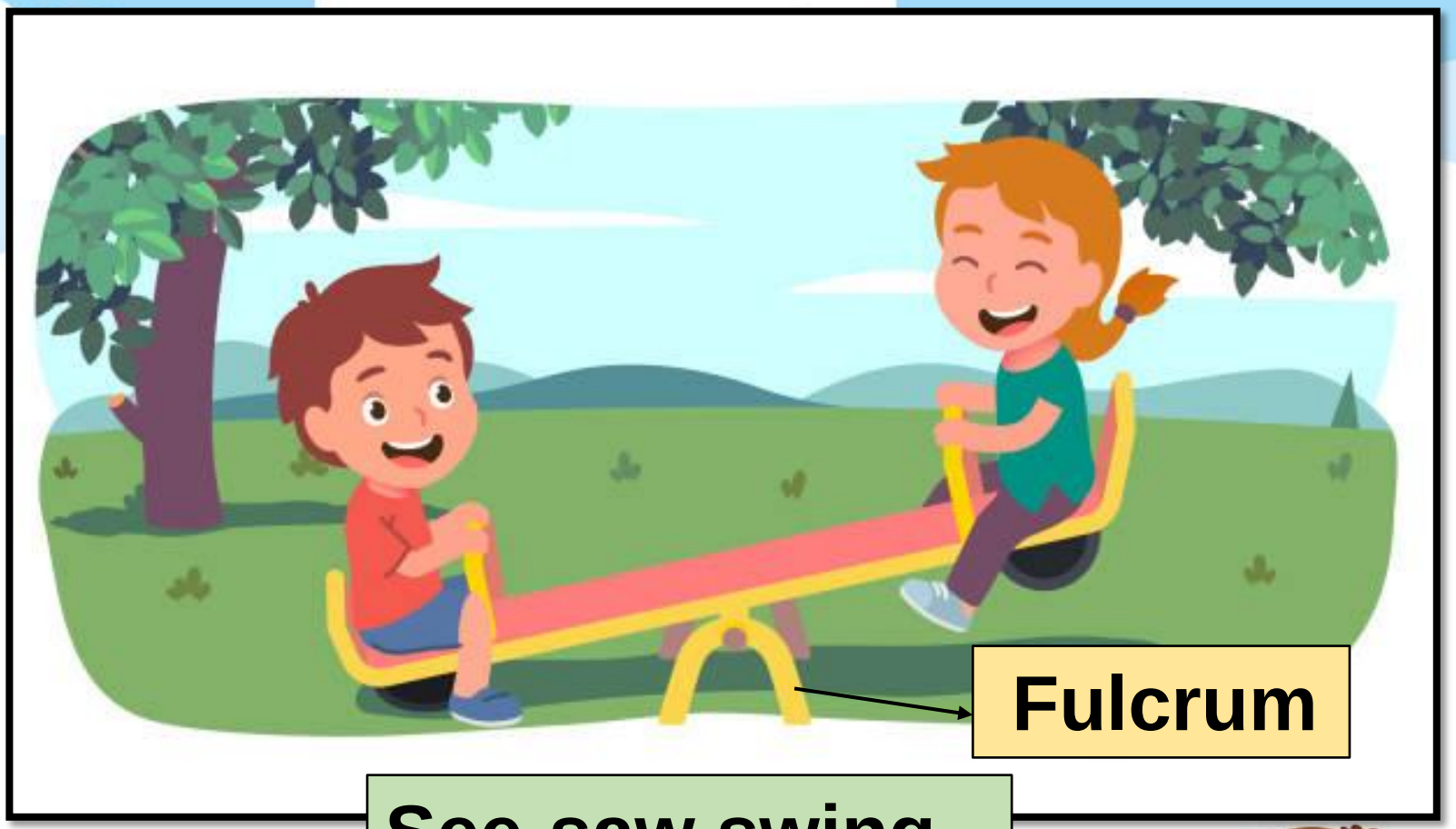
Lever

Lever

Look at the given diagram of see-saw swing which shows how a lever functions. A rod is used to lift an object with a stone kept in between. The point against which a lever is placed on which it turns or is supported is called fulcrum . The force used is called effort.

saw is the classic example of a lever.

When force is applied to one side and is pushed down, the other side lifts up. Any tool resting on a pivot is called levers . Scissors and staplers are common items that use levers.

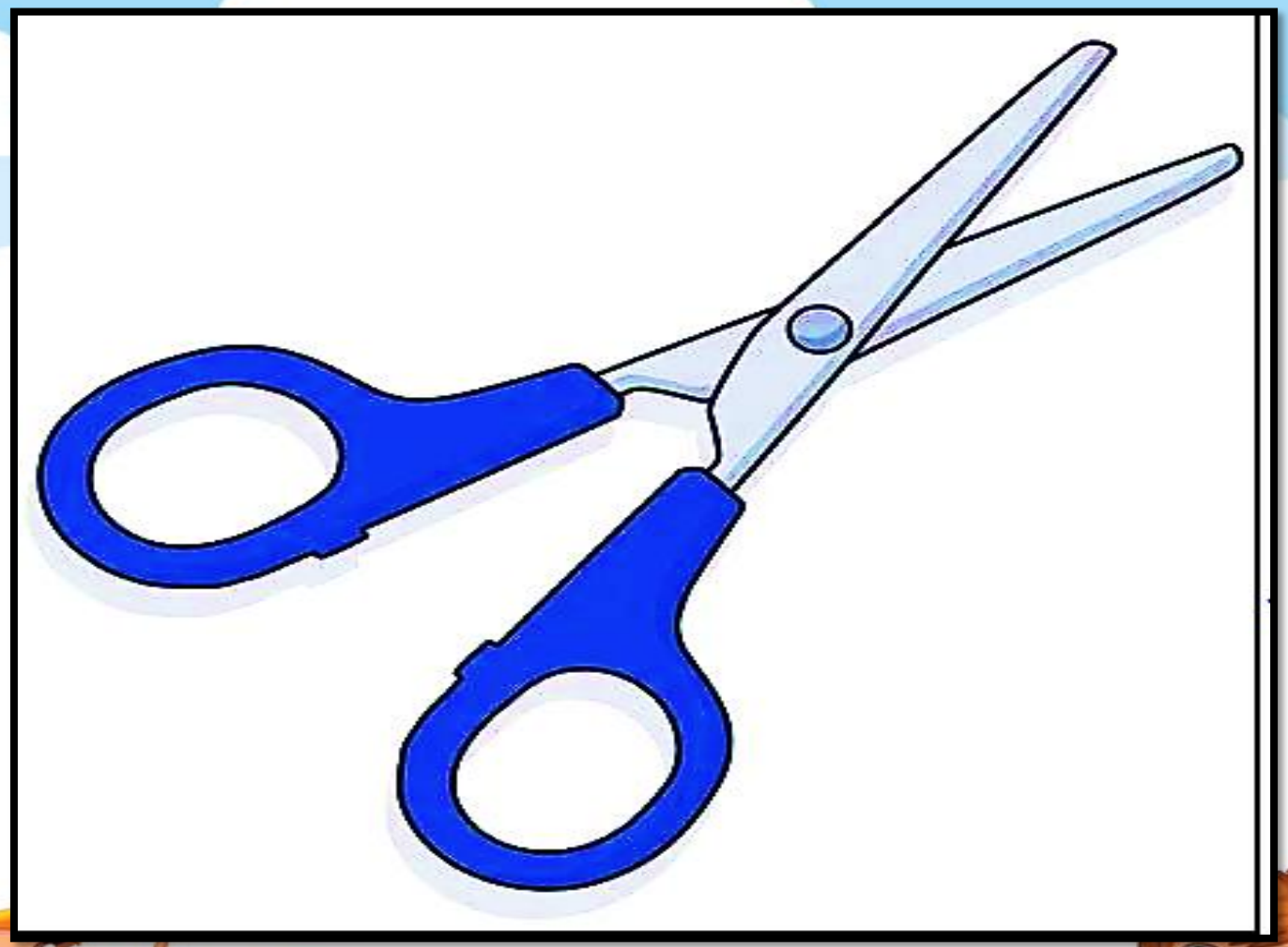


See-saw swing

Types of Lever

There are three types of levers:

- **First class lever: It is a lever in which fulcrum is between load and effort. For example, pliers and scissors.**



scissor

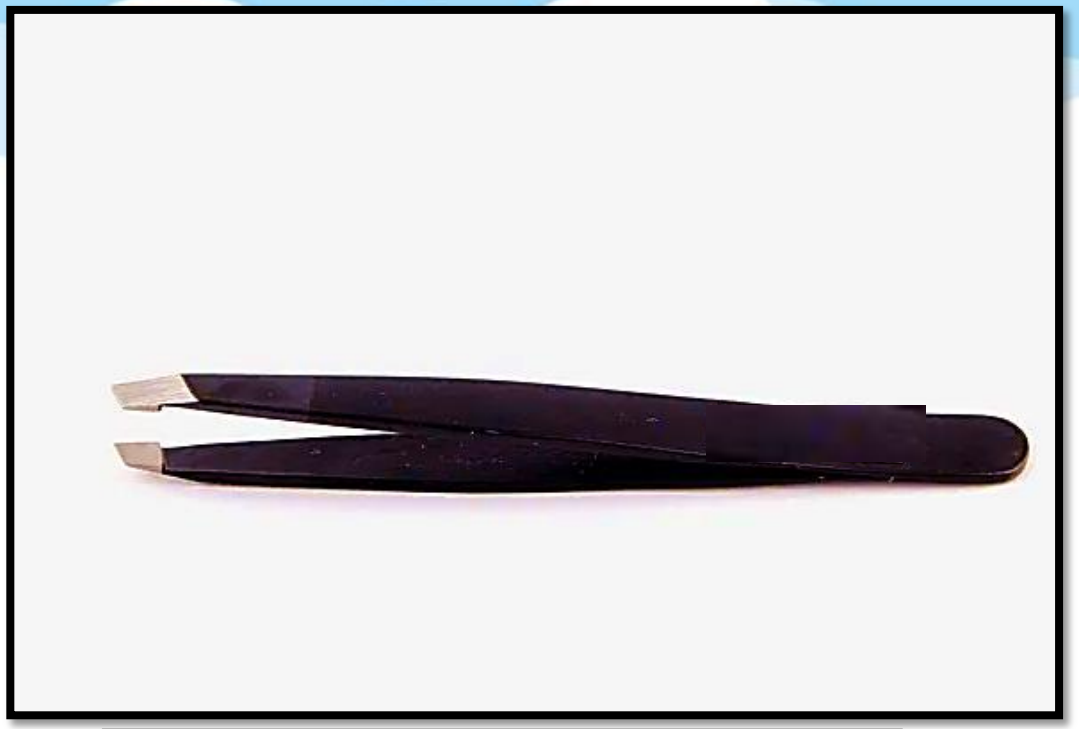
Plier

- **Second class lever: It is a lever in which the load is between fulcrum and effort. For example, wheel barrow and bottle opener.**

Bottle opener

Wheel barrow

- **Third class lever: It is a lever in which effort is between the load and the fulcrum. For example, ice tongs and tweezers.**



Tweezer

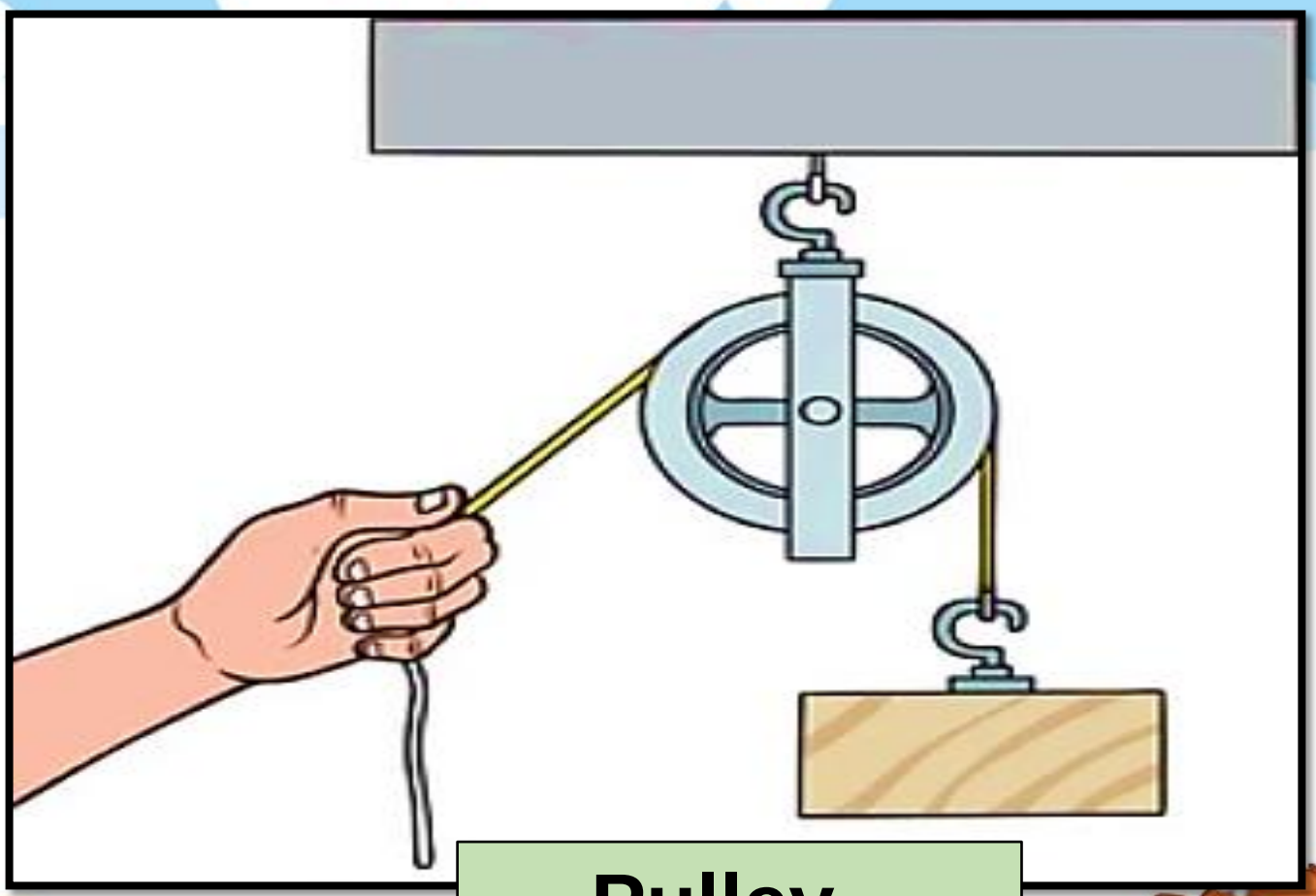
Ice tongs

Inclined Plane

A ramp, or inclined plane, is a simple machine with a slanted surface. It helps people and things move between higher and lower places. It takes a lot of force to lift and move something heavy, but it's much easier to push it up a ramp.

Pulley

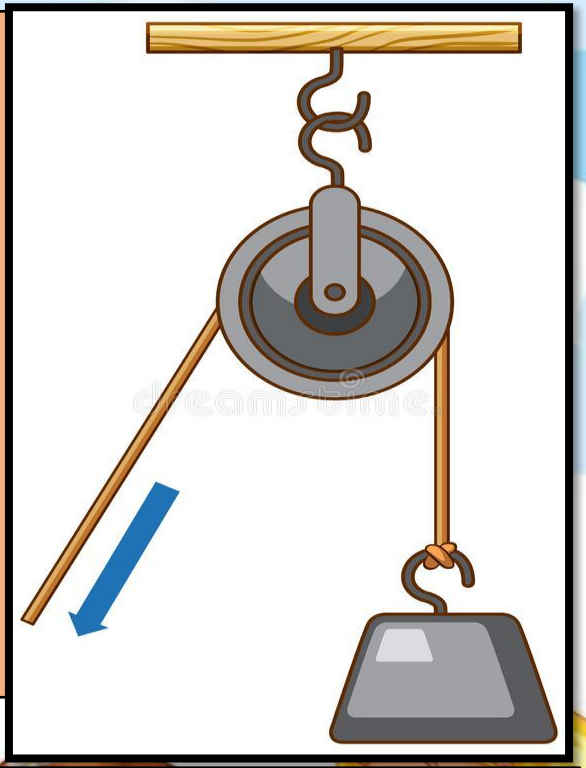
A pulley is made of a wheel on an axle with a groove around its circumference. A pulley is used to lift heavy objects, when used with a rope. There are different types of pulley systems.



Pulley

- **Fixed pulley: Fixed pulley is fixed at one place. A rope is passed over the pulley**

and by pulling one end of the rope the weight comes up. This system works for lifting heavy weights. A pulley makes the work done with lesser effort, by changing the direction of force. It is commonly used to draw water from wells, when fitted with a support.



Fixed pulley

- **Movable pulley: A movable pulley can move heavy loads very easily. In a movable pulley one end of the rope is fixed, it then runs around the pulley and the other end is free to apply force or attach the load. It does the same work as the fixed pulley does except it can move the weight as well.**

Movable pulley

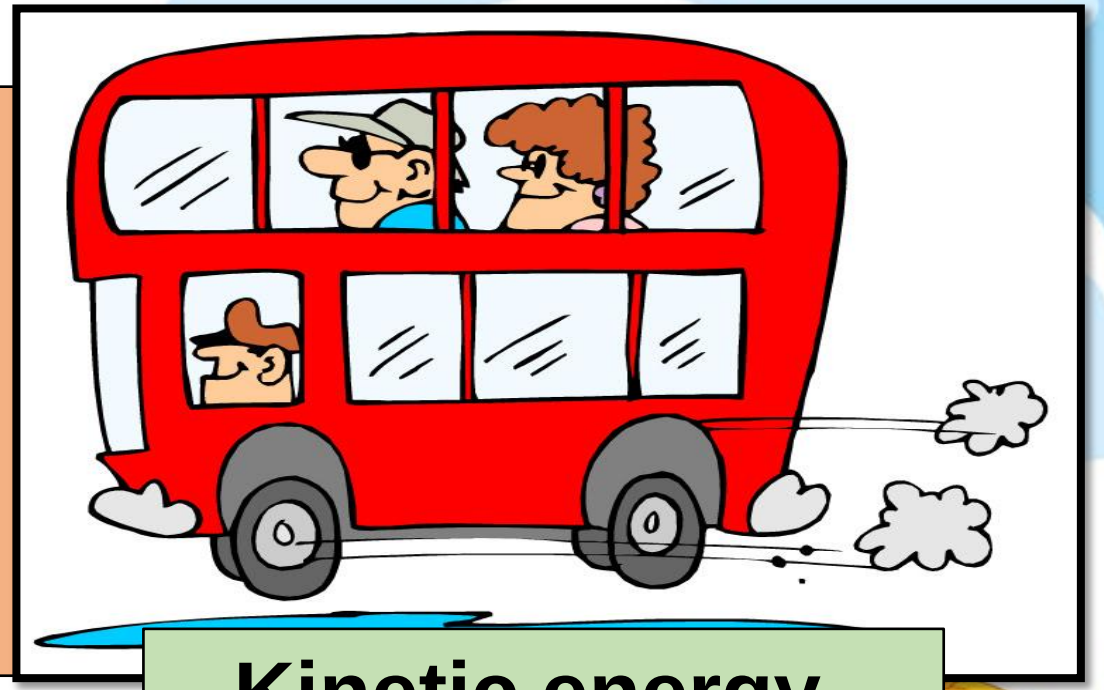
ENERGY

The ability to do work is called energy. There are two types of energy sources— Natural and Man-made . We also need energy to do work therefore we eat food and other nutritious substance. Some natural source of energy are sunlight, water, wind, plants and animals.

Different Forms of Energy

Mechanical Energy

All machines use mechanical energy. It is the energy possessed by an object due to its position or its motion. There are two kinds of mechanical energy—Potential and Kinetic. A man standing on a roof top has a potential



Kinetic energy

energy, due to its height. Stretched rubber band has an elastic potential energy, due to its stretched position. A moving bus has a kinetic energy, due to its motion.

Solar Energy

The most abundant and easily available source of energy is the sun. Sun provides us energy in the form of light and heat, which is absolutely non-polluting source of energy. You always dry your clothes in the sun with the help of solar energy. It is the easiest use of this

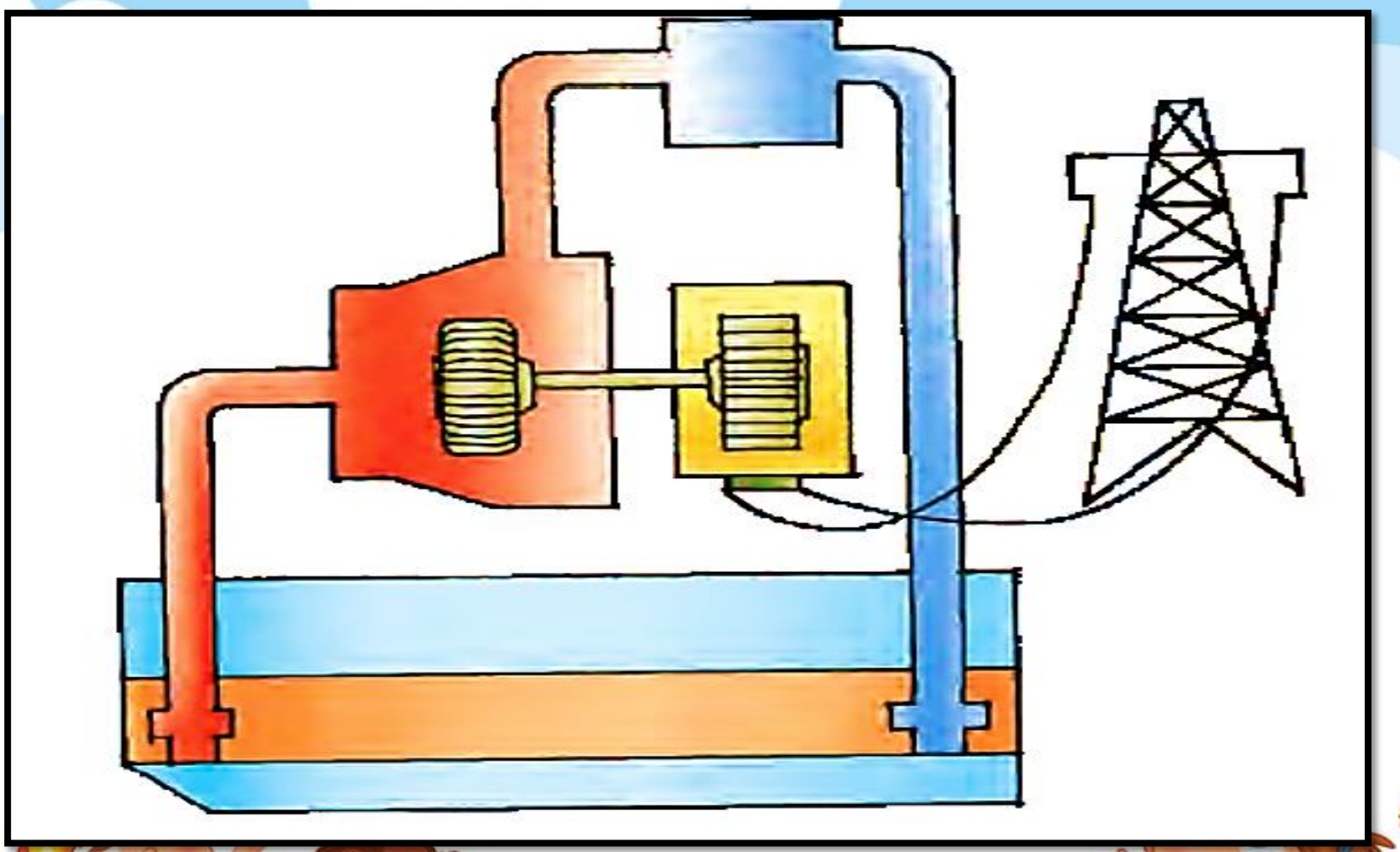
energy. These days large solar panels are created to absorb sunlight to provide heat for cooking, boiling water etc. and also producing electricity.

Solar panel

Solar Waterheater

Geo-thermal Energy

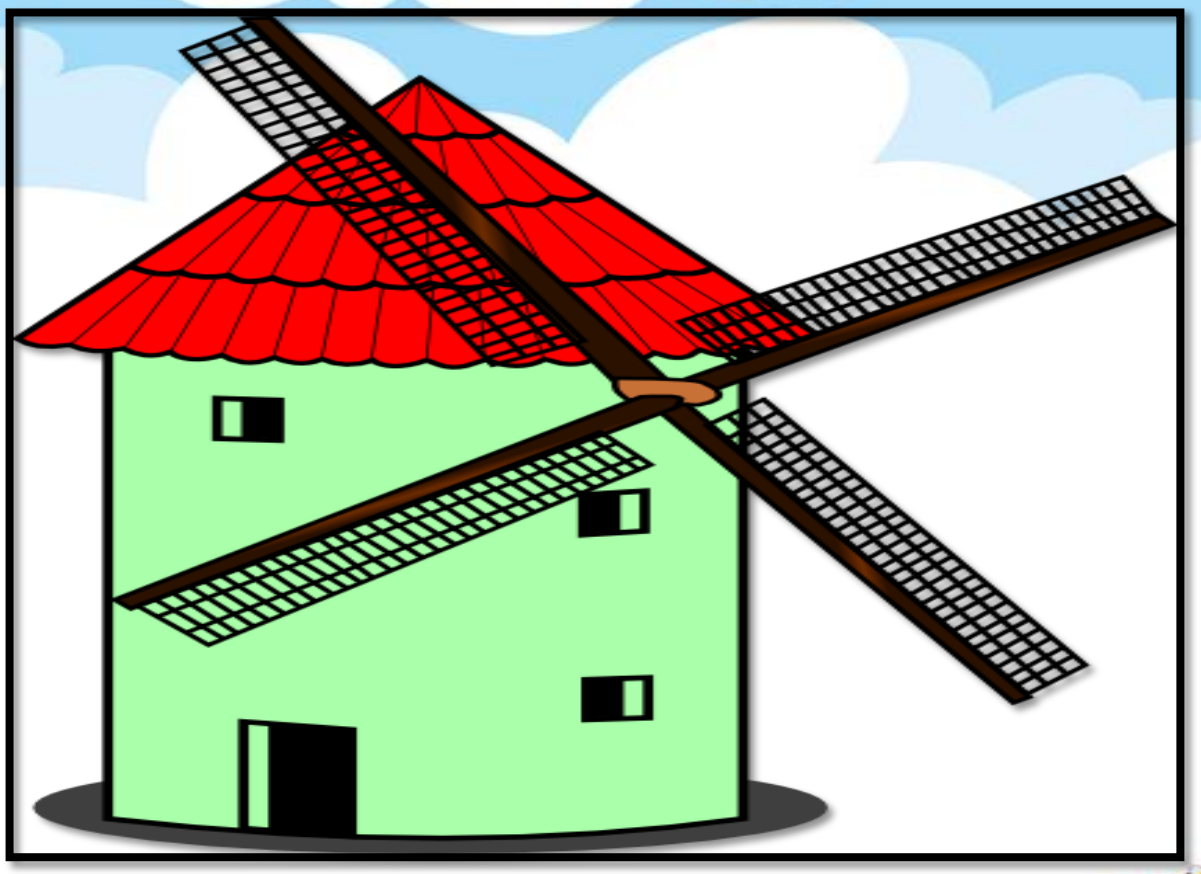
Geo-thermal energy is the heat energy inside the earth. Geo means earth and thermal means heat. Inside the earth's crust there is a source of heat energy which can be used to generate electricity. Geo-thermal energy is environment friendly and renewable source of energy.



Geo-thermal energy

Wind Energy

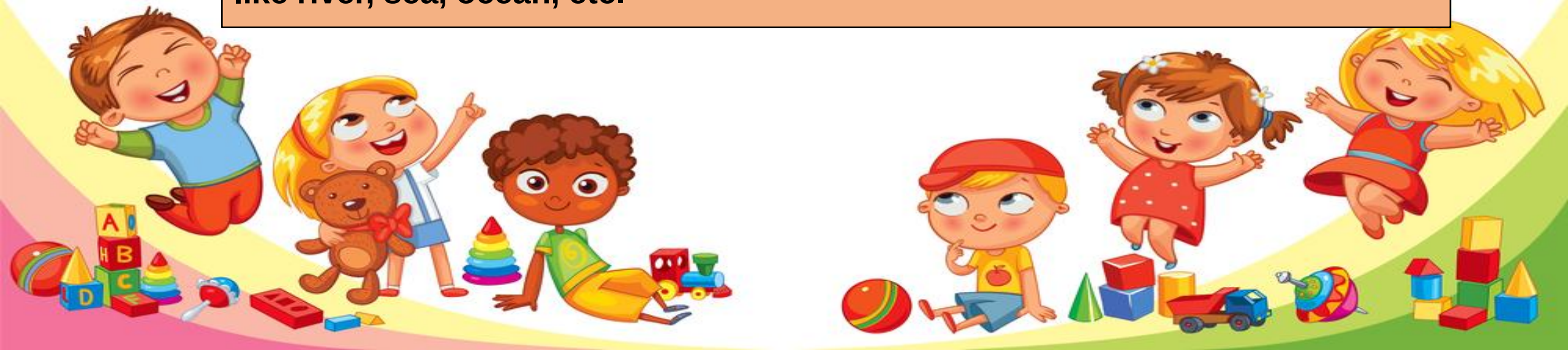
When wind blows with speed it carries energy. This energy is called wind energy. It is also a renewable source of energy. When wind blows, it moves the fans of a windmill, which moves a turbine that generates electricity. Wind energy can only be utilised at places where it is very windy.

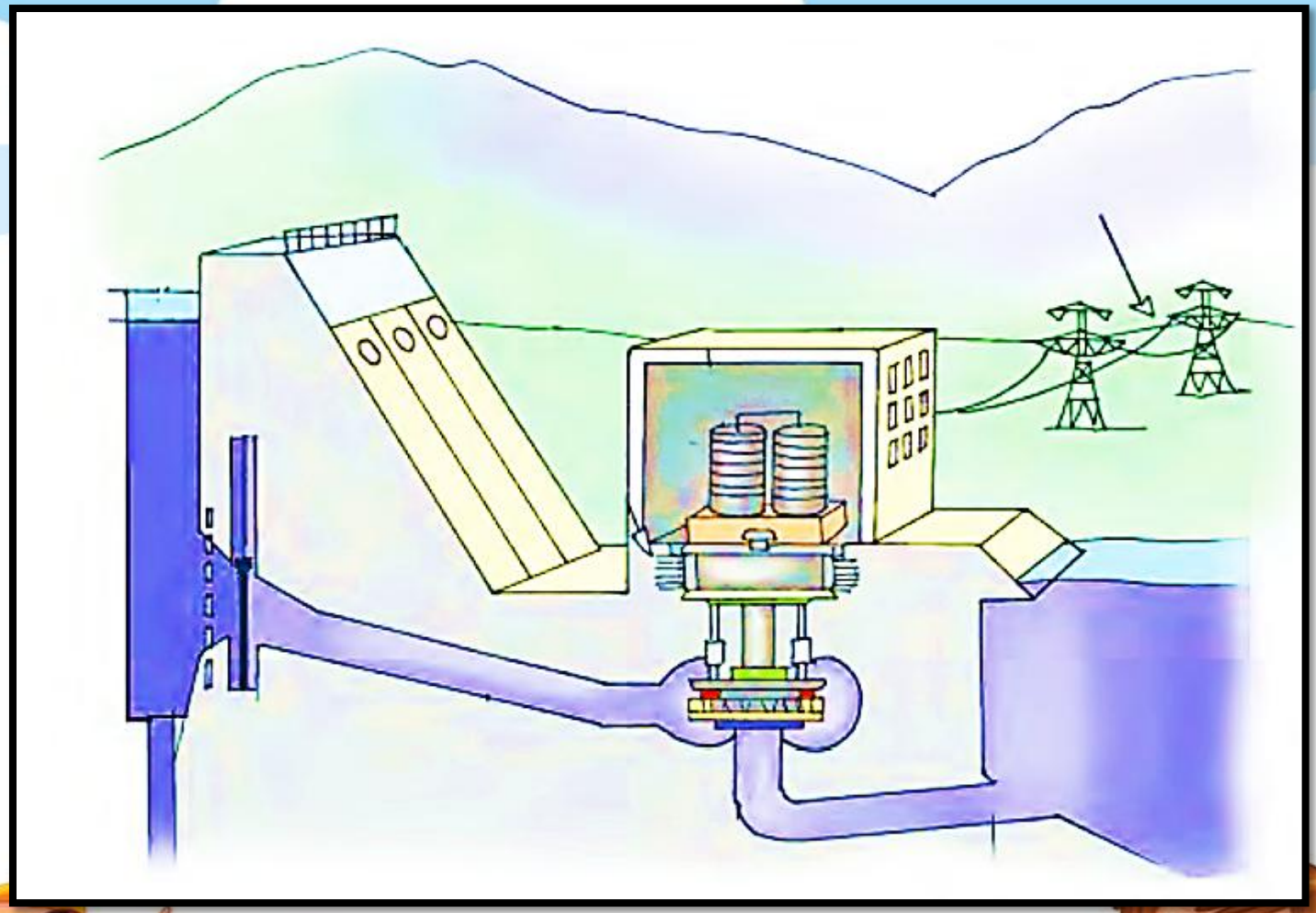


Wind mill

Hydropower (Water Energy)

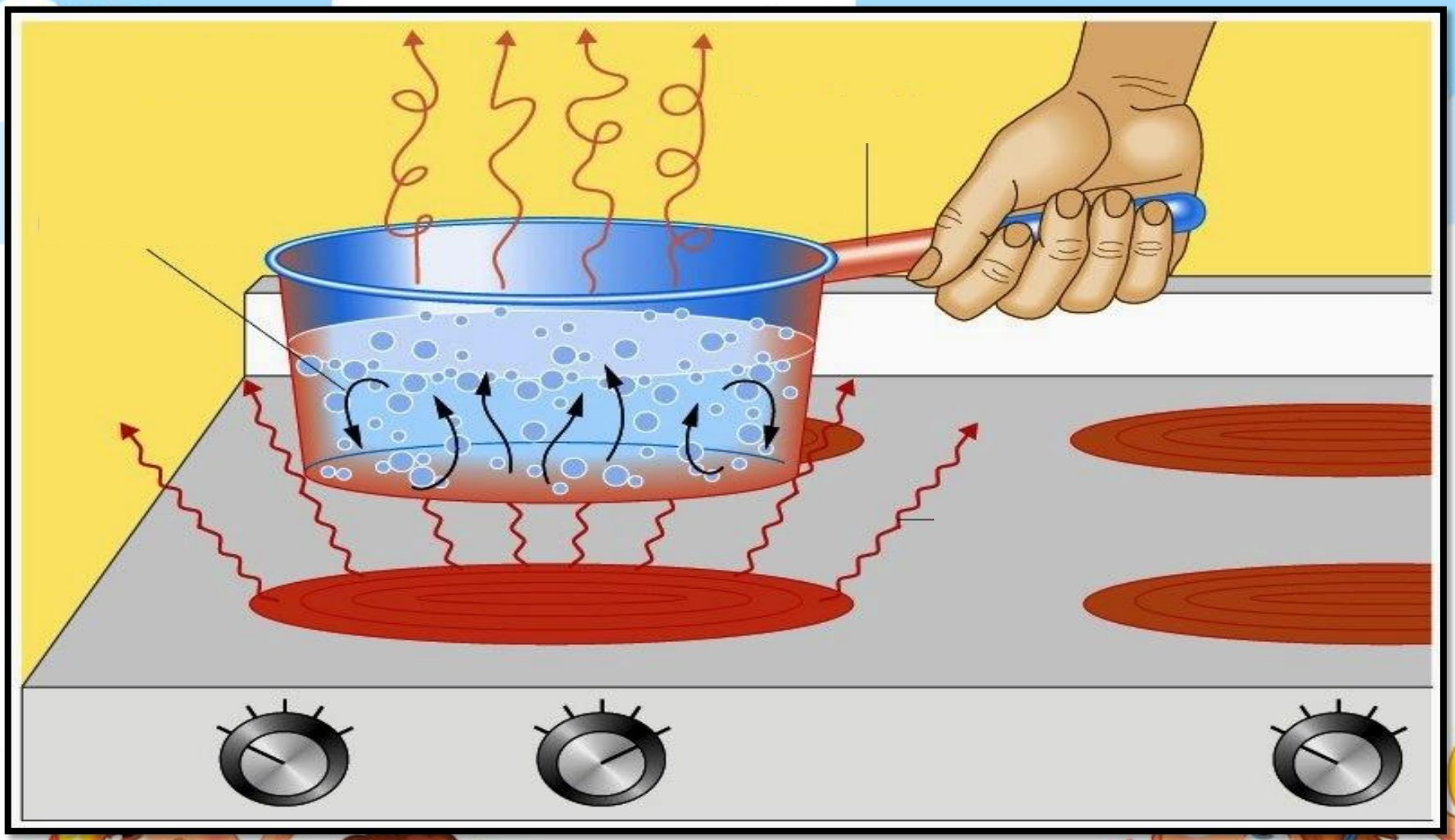
The most widely used source of energy is water. Water falls down from a height on a turbine, which then moves and produces electricity. This electricity generation through water is called hydropower. The electricity generated in our country is mostly through hydropower. To generate hydropower, the plant must be located on or near a source of water like river, sea, ocean, etc.





Hydropower

Heat Energy It is a non-renewable energy, which comes from burning fossil fuels such as coal, wood, petrol, gases etc. It can be used for several purposes such as cooking food and warming houses etc.



Heat energy

Sound Energy

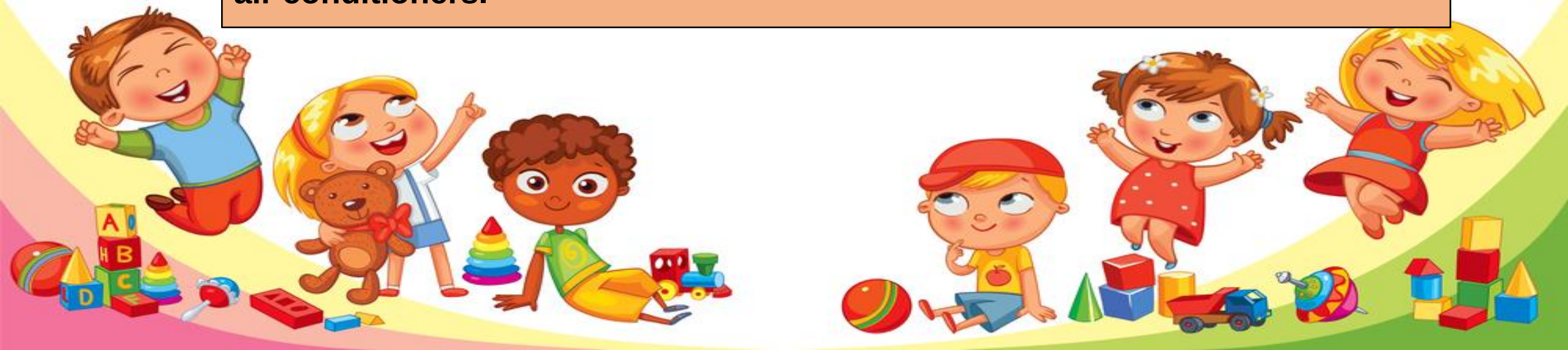
Sound is basically a disturbance in any medium. Objects vibrate and produce sound which transmits through solid, liquid and gas. Sources of sound energy are musical instruments.

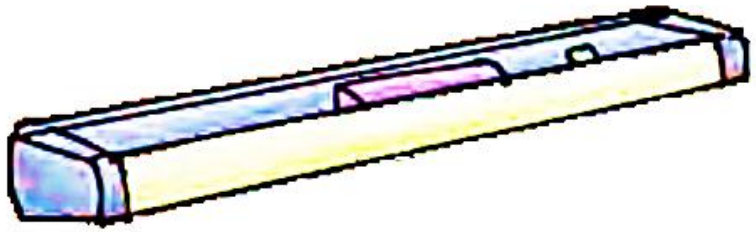
Sound energy

Sound energy

Electrical Energy

The most widely used energy in the world, without which we cannot possibly imagine our life is electrical energy. Electricity is nothing but moving charges, the energy they produce while moving is called electrical energy. We use it in electrical appliances like computers, televisions, tubelights, washing machines, fans and air conditioners.





Electricity energy

Fact File

- Motion refers to movement, which requires force.
- Earth applies a pull to all objects that is called the gravitational force.
- Buoyant force applies an upward push to any object on the surface of water, making it float.

Things to Remember

- Pulley, screw, lever, wheel, axle and inclined plane are the simple machines.
- A screw is used to join two things together.
- All machines use mechanical energy.
- Geo-thermal energy is obtained from the earth's interior.
- Heat-energy is a non-renewable energy.