Force, Work & Energy

Pushes and Pulls

A push or a pull is called a **force.**
When you kick a football, you push it.
When you lift a football with your hands, you pull it towards yourself. How many times do you push or pull something every day?

- We push a cricket ball with the bat.
- We push books to keep it in a bag and pull the books to take it out from the bag.
- We pull the door of a refrigerator to open it, we push the door to close it.

A force can do many things.

It can make an object **move**.

It can **slow down** or **stop** a moving object.

It can **change the direction** of moving objects.

Force can change the speed of a moving object. When we are riding a bicycle, high speed wind from the opposite direction can reduce the speed of moving bicycle.

High speed wind acts as force**Types of Forces**
There are many different types of forces. Let us study some that we come across often in our daily life.

➤ Muscular Force

The force that uses the power of muscles of our body is called muscular force. When we push or pull something, we apply force by using parts of our body such as hands and feet.

Muscular force

➤ Gravitational Force or Gravity

The force of the earth that pulls everything towards itself is called gravitational force or gravity. Throw up a ball. Observe it carefully. It slows down, stops, and then comes down. Why doesn't it keep going up? This is because gravitational force pulls everything down. You are able to stand on the ground because gravity pulls you down. If there was no gravity we would all be floating in air.

Gravitational force

➤ **Magnetic Force**

A **magnet** applies a force on things made of iron and steel and pulls them towards itself.

This force is called **magnetic** force.

The magnet does not pull things made of other substances such as paper, plastic.

Magnet attracting iron nails

➤ **Friction**

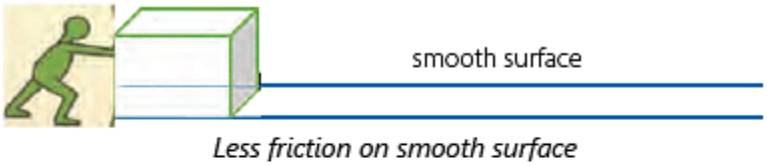
Friction is a force between two surfaces which are in contact. Roll a ball on the ground. It slows down and stop. Why does it not keep going?

Ball rolled on rough surface

Ball rolled on smooth surface

It stops because friction acts on it. The ball will go further on a smooth surface than on a rough surface. This is because the force of friction is more on rough surfaces. It is less on smooth surfaces.
If the box is kept on a smooth surface, less force is required to move it. If the box is kept on a rough surface, greater force is required to move it. This is because of friction.
Now we know that

- moving object will go further if the friction is less.
- stationary object will be easier to move if the friction is less.



Less friction on smooth surface

More friction on rough surface

Disadvantages of Friction

- Friction wastes energy because it makes it difficult for things to move.
- The soles of your shoes wear away after some time because of friction.
- Friction causes parts of the moving machine to wear out.

Advantages of Friction

- We are able to walk because of friction between our feet and the ground. Without friction we will slip and fall. Have you ever tried to walk on ice? Why is it difficult? Ice is very smooth, so there is very little friction and

you can slip easily.

- Cars and buses are able to run on roads because of friction between the tyres and the road. Sometimes, cars slip on wet roads because the friction is less.

Tips

Be very careful if you have to walk on a smooth tiled floor on which someone has spilled water. You can easily slip on it since friction on such a surface is low.
Check your car or scooter tyres. Have they got worn out? If so, they must be changed. Otherwise, the car or scooter can slip on a wet road.

Reducing Friction

Take a carrom board. Place the striker on it and shoot it with your fingers. See how far it goes before it stops.
Now spread talcum powder all over the board. Again, hit the striker with the same force. See how far it goes now. Does it go further? Why?
Talcum powder is smooth. It reduces the friction on the board, so the striker travels further.

Reducing friction

Oiling reduces friction between surfaces because it makes the surfaces smooth. If you put oil on the moving parts of your bicycle, it will run more smoothly. Oiling is done in machines in functions. It saves parts of machines from wearing out soon.

Oiling in machines

What is Work

You already know that a push or a pull is called force. A force can make things move. When a force moves something, **work** is done.
When you open a door you do work. When you kick a football you do work. Look at the given pictures. The man is pulling a cart. Thus, the work is done.

However, in the second case, the boy is pushing a wall. The wall does not move. Thus, the work is not done in this case. This is because, there is insufficient force being applied on the wall, which does not move it. On the other hand, if we apply a greater force on the wall, say using a crane, the wall will break. Thus, in that case work will be done.

Work done

No work done

Energy

When you do work, you use **energy**. How do you feel after doing a lot of work? Do you feel tired? From where can you get more energy? You can get energy from food.

Working

Feeling tired

Getting energy from food

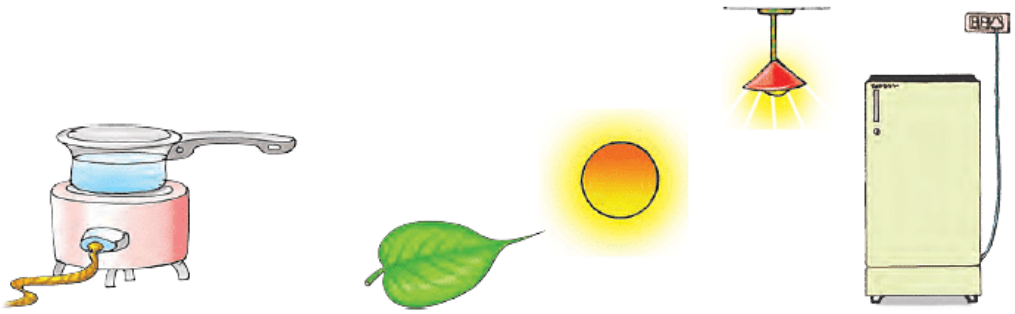
Energy is the ability to do work.

Energy is also required to change matter. Energy is required to change ice to water, or water to steam, or wood to smoke and ash.

Forms of Energy

There are many forms in which we get energy. Some of these are as follows.

- **Heat energy** is used to cook food. It also changes water to steam, and make steam engines move.
- **Light energy** helps us to see things. Plants use light energy to make food.
- **Electrical energy** is used in our homes and many other places. It runs the washing machine, refrigerator, geysers, electric flat iron and many other appliances in our house.



Heat energy *Light energy* *Electrical energy*

- **Sound energy:** Sound energy from a loud thunder can make the windowpanes in our house rattle.

Sound energy

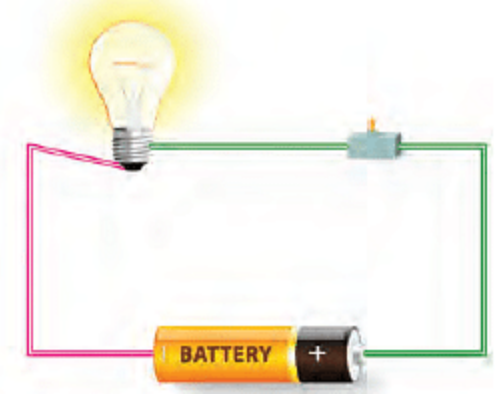
Sources of Energy

Energy can be stored for later use, in various ways. Energy is stored in food. Our body stores energy in the form of body fat. A battery has stored energy, which can be changed to electrical energy.

Food, batteries and fuels, which have energy stored in them, are sources of energy. Anything that gives us energy is called **source** of energy.

Let us look at some of the main sources of energy.

Food has stored energy



A battery has stored energy

➤ **Sun as a Source of Energy**

Sun is the greatest source of energy on Earth. The energy from the sun is called **solar energy.**

Plants use this light energy to make food for the entire living world. So, the energy we get from food also comes from the Sun.
Today we have discovered many other uses of solar energy, for example-

- Food can be cooked in solar cookers. They use sun's energy to cook food.


Solar cooker

- Solar energy is often used to heat water in solar water heater.
- Solar power is the conversion of energy from the sun into electricity. It can be used to run air conditioners, water heaters, and everything that runs on natural gas, electricity. It's a cheaper, safer, and more eco-friendly solution.

Solar panel charges solar batteries

- Solar batteries are used to light up calculators, watches and bulbs.

➤ Wind Energy

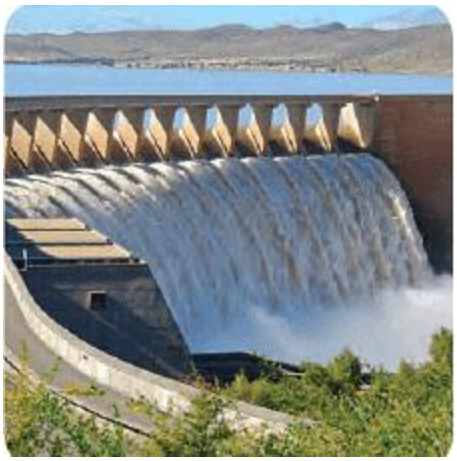
The air or wind that blows has energy. This wind energy is used to help a boat sail and turn the shafts of a windmill. The turning shaft of the windmill provides power to a machine called a generator to produce electricity.

Windmill

➤ Water Energy

Water is another very important energy source. People, plants and animals all depend on water.

Hydropower is energy that comes from the force of moving water. Like wind energy, water energy helps to generate electricity.



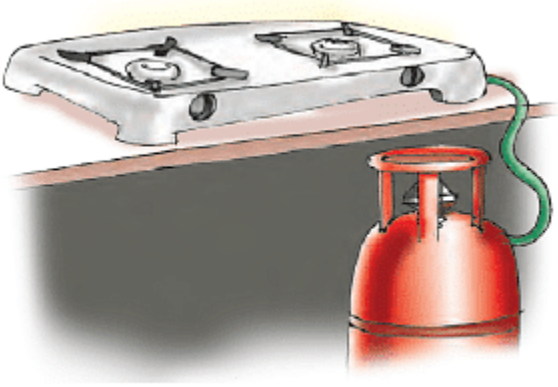
Water dam

➤ Fuel Energy

Things which can be burnt to produce energy, such as wood, petrol, coal or LPG are called fuels. Fuels are burnt to produce heat and power.

Energy is stored in wood. When wood is burnt, this energy is given out as light and heat. LPG (Liquid Petrolium Gas, the 'gas' we use at home to cook food) has stored energy too. Petrol, diesel and CNG (Compressed Natural Gas) are used to run vehicle and machines.

Wood



LPG

Fuels

Tips

Here are some simple ways to save electricity:

- Put off lights and fans when not in the room.
- Use bulbs that use less electricity, e.g. CFL bulbs or LEDs.
- As far as possible use fans and desert coolers instead of air conditioners. Air conditioners use much more electricity. Think of other ways of saving electricity.

Important Points

1. A push or a pull is called a force.
2. Force can move an object, stop a moving object, change the direction and speed of a moving object, or change the shape of an object.
3. Gravity of the earth pulls everything towards itself.
4. Friction is the force between two surfaces in contact.
5. Work is done when a force moves an object.
6. Energy is required to do work or to change matter.
7. There are various forms of energy—heat, light, electrical and sound energies.
8. Energy can be stored for later use.
9. Sun is the main source of energy.