Work, Force, Energy and Simple Machines

Work

Work refers to an activity that involves movement of the object when force is applied on it. For example, work is done when a person pushes a car and the car moves.

The formula of work is:

Work = Force × distance

It means that more work is done, if more force is applied to an object, or the object moves larger distance, or both.

If a force is applied on an object, but no motion takes place then no work is done. For example, if a person pushes against a wall, then no work is done unless the wall moves in the direction in which it is pushed.

The unit of measurement of work is unit of force multiplied by the unit of distance i.e. Newton metre (Nm) or Joule (J).

For example, if a stone is pushed with the force of 5 N and it travelled a distance of 3 metre, the work done is 15 Nm or 15 J.

Force

A push or pull acting on an object is called a force.

A force can be used to:

- Move a stationary object
- Stop a moving object
- Make a moving object move faster
- Slow down a moving object
- Change the direction of a moving object
- Change the shape and size of an object

Types of Force

There are different types of force:

Muscular Force

Muscular force is applied when we push, pull or lift something with our hand.

Gravitational Force

Gravitational force or gravity is the force that attracts objects to the centre of the earth. Because of gravitational force, we are able to stay on the ground.

Frictional Force

Frictional force is a force of resistance that tries to stop the movement of objects across a surface. On smooth surfaces less friction is exerted and on rough surfaces more friction is exerted. Due to it we are able to walk.

Elastic Force

Elastic force arises when a body deforms. When we stretch a rubber band it regains its original position because of elastic force.

Mechanical Force

Mechanical force is used by most of the simple machines. A wedge uses mechanical force to separate two objects.

Buoyant Force

Buoyant force is the upward push of water on a floating object. When we push a mug or piece of wood in water, we can feel an upward thrust.

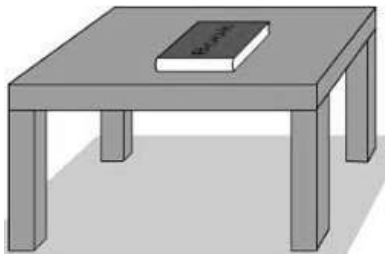
Energy

Energy is the capacity or ability to do work. Energy can exist in different forms such as mechanical energy, heat energy, chemical energy, sound energy, muscular energy, solar energy, wind energy, etc.

Forms of Energy

Mechanical energy: Mechanical energy of an object is its energy due to its position or its motion or both. Mechanical energy is classified into potential energy and kinetic energy based upon its source of origin.

Potential energy of the object is its energy due to its position. For example, a book on a table before it falls possesses potential energy.



Kinetic energy of an object is its energy due to its motion.

Boy has kinetic energy due to his motion

Heat energy: A heated substance possesses heat energy. For example, burning wood possesses heat energy. Heat energy is used to move steam engines.

Burning wood has heat energy

Chemical energy: Chemical energy is the energy released or absorbed during a chemical reaction. For example, battery possesses chemical energy.

Battery has chemical energy

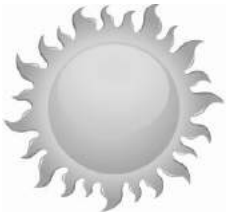
Sound energy: Energy possessed by sound wave is called sound energy. For example, sound from a music player possesses sound energy.

Music player has sound energy

Muscular energy: Energy possessed by the muscles is called muscular energy. For example a boy uses his muscular energy to lift dumbbell.

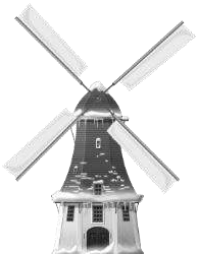
Boy uses his muscular energy to lift a dumbbell

Solar energy: Energy possessed by sunlight is called solar energy. For example, solar energy is used by plants to produce foods.



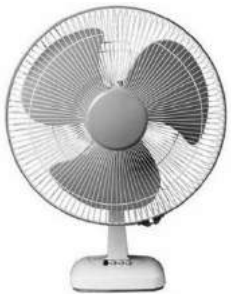
Sun has solar energy

Wind energy: Energy possessed by wind is called wind energy. For example, wind energy is used for drying clothes or moving wind mill.



Wind energy can run wind mill

Electrical energy: Energy possessed by electricity is called electrical energy. For example, a fan runs with electrical energy.



Fan runs on electrical energy

Law of conservation of energy

The law of conservation of energy states that energy can on ly be transformed, it cannot be created or destroyed. The international unit of energy is JOULE, named in the honour of scientist James Prescott Joule.

Simple Machines

Machines are simple tools which make our work easier and faster. They help us to do many works. Some examples of simple machines are lever, inclined plane, wheel and axle, pulley and screw.

Levers

Levers are commonly used tools like scissors, hammers and screw drivers.

When we lift a rock with the help of a rod, the weight lifted by the person is the load and the force with which it is lifted is the effort. The point of contact of rod and the stone is the fulcrum.

Levers can be classified into the followings according to the position of the fulcrum, the load and the effort:

First class lever-when the fulcrum lies between the load and the effort, it is called first class lever. For example, see saw, scissors, etc.

See saw

Scissors

Second class lever - when the load lies between the fulcrum and the effort, it is called second class lever. For example, a wheel barrow, a bottle opener.

Wheel barrow

Nut cracker

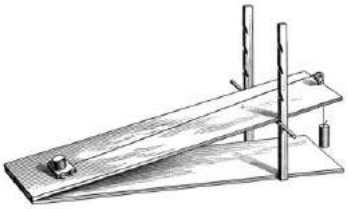
Third class lever - when the effort lies between the fulcrum and the load, it is called third class lever. For example, a stapler, a pair of tongs.

Stapler

Tong

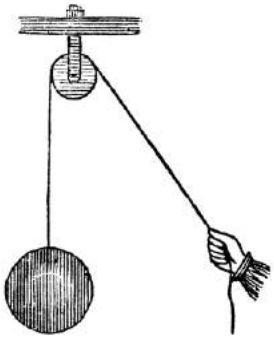
Inclined Plane

An inclined plane is a slope which makes work easier. When workers have to load or unload a truck they use a plane of wood as an inclined plane.



The Pulley

A pulley is a small wheel with a groove around its outer edge. There are two types of pulleys: fixed pulley and movable pulley. The pulley used for drawing water from a well is a fixed pulley. Movable pulleys along with fixed pulleys are used to lift loads.



The Wheel and Axle

A wheel attached to a rod (called axle) is known as a wheel and axle arrangement. It is easier to push a load on wheels than carrying it. This arrangement is used in vehicles, sewing machines and cycles.

The Screw

Screw is a tool used to hold things tightly together. Bigger screws, called screw jacks, are used to lift cars and other heavy objects. When two things are joined by a screw, they are held together through a long distance while when we join things with a nail, they are held together only through the length of the nail.