

UNIT – II

Energy Transfer of Energy

Chapter – 2:– Energy Transfers

The ability of matter to do work or make things happen is known as Energy. There are various forms of energy. Kinetic energy is the energy of movement, while the energy related to the position is known as

Forms of Energy	What happens	Examples
Kinetic energy	Energy of motion	Roller-coaster car moving down the hill
Potential energy	Energy stored in position	Roller-coaster car at top of the hill
Sound energy	Particles vibrate	speakers
Electrical energy	Electrons move	lightning, household electricity
Nuclear energy	Nuclear fission or fusion reactions	Nuclear power plants, submarines
Light energy	Travels as waves	X-rays , microwaves, light
Mechanical energy	Objects move	Falling water in a waterfall
Heat energy	Materials rub together and result in friction	Tire skidding on pavements
Chemical energy	Chemical changes take place	Burning of oil, wood, or coal

potential energy.

The following table summarizes the different kinds of energy:

Energy can exist in many forms. Under the right condition, any type of energy can be changed into any other type. The amount of energy in a system can be measured. For example – heat energy can be measured by using a calorimeter; kinetic energy can be calculated by using mass and speed of an object; potential energy can be calculated from its mass and height.

Energy cannot be created or destroyed but can be changed from one form to another. For example, a light bulb changes electrical energy into heat and light, the human body changes the chemical energy in food into mechanical energy. Total amount of energy remains the same before and after energy transfer, although some amount of energy is lost as heat during the exchange.

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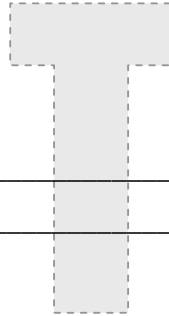
How will you define energy?

READING CHECK:

What is kinetic energy?

READING CHECK:

What is potential energy?



READING CHECK:

How energy of a system can be measured? Give examples.

READING CHECK:

Give an example of mechanical energy.

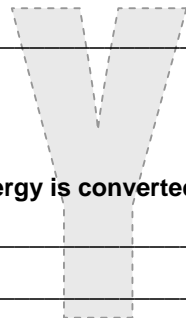


READING CHECK:

Give an example in which chemical energy is converted into mechanical energy.

READING CHECK:

Give an example in which electrical energy is converted into heat and light.



READING CHECK:

What happens with the amount of energy during an energy transfer?

CONVERSION OF ENERGY

According to the law of conservation of energy, Energy can neither be created nor destroyed, but can be changed from one form to another. But in actual energy, transfers are not 100% efficient and some amount of useful energy is always lost as heat. Heat energy is not useful to do work.

The amount of energy which is not available to do work is described by Entropy. It measures the disorder of energy in a system. With time, the amount of entropy in a system is decreasing and the amount of useful energy available to do work is decreasing. During each of the energy transfer, some of the useful energy is lost as heat. This loss of energy increases the entropy of the universe.

READING CHECK:

What is the law of conservation of energy?

READING CHECK:

How will you define entropy?

READING CHECK:

How energy transfers result in the increase in the entropy of the universe?

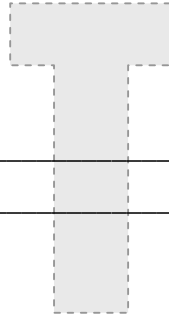
ENERGY FROM THE SUN

The energy is produced in the sun through a process known as nuclear fusion. This process creates a large amount of energy. Although only a small part of this energy reaches the earth's atmosphere, this part still represents an enormous amount. Most of the energy released from the sun is in the form of visible light and heat. The sun also releases smaller amount of other kinds of light such as X-ray, ultraviolet light and microwaves. The earth's atmosphere blocks and therefore reduces the amount of energy reaching the surface. Most of the X-rays are absorbed by upper atmosphere. Most of the ultraviolet light is absorbed by the ozone layer. The atmosphere and cloud scatter or absorb most of the heat and a small amount of the visible light. Half of the energy reaches the earth's surface from the sun is a visible light, another half is heat, and a

small amount is ultraviolet. The sun supplies energy to whole of the solar system. We can see the moon because it reflects light from the sun. The earth's water circle is also driven by the sun's energy which is also used by the plants to make energy through photosynthesis, which in turn supplies food to all other living things on the planet.

READING CHECK:

How energy is produced in the sun?



READING CHECK:

In which of the various forms energy is released from the sun?

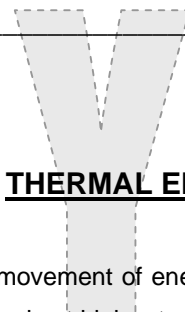
READING CHECK:

How moon is visible to us?



READING CHECK:

What is the role of the sun's energy in supplying food to all the living things on the planet?



THERMAL ENERGY

It is a type of energy which involves the movement of energy from one place to another due to difference in temperature. Heat always moves from a body at higher temperature to a body at lower temperature. Heat can flow in three different ways explained below:

Conduction occurs when two objects with different temperatures are in contact with other. The heat moves from a hotter body to the cooler one until both attain the same temperature. For example, a cup of hot tea gets heated due to conduction.

Convection occurs when a liquid or gas moves and carries heat along with it. For example, in convection over the circulation of hot air takes place.

Radiation involves the transfer of energy through waves or small particles. The sun's energy reaches the earth through this process.

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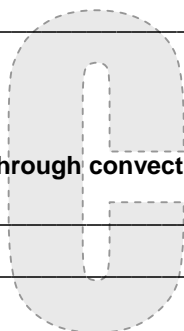
How will you define thermal energy?



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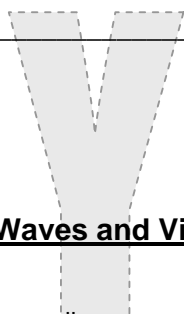
Give one example in which heat flows through conduction?

READING CHECK:
Give one example in which heat flows through convection?



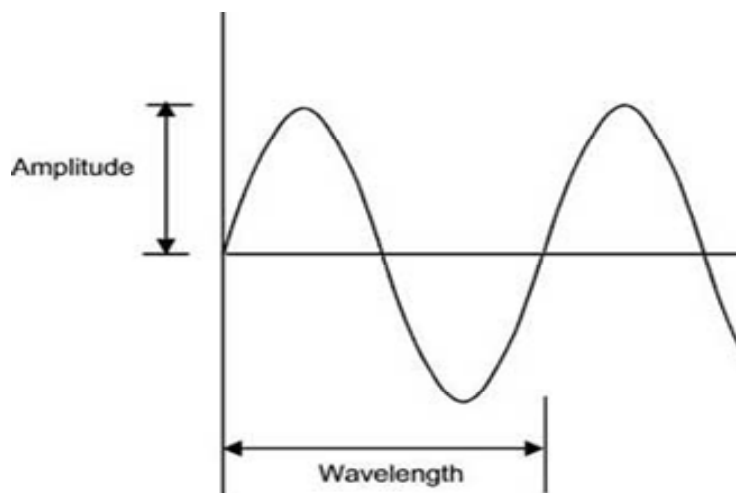
READING CHECK:

Give one example in which heat transfer takes place through radiation.



Waves and Vibration

Matter is said to possess particle nature as well as wave nature. A wave consists of a series of crests and troughs. The upper mountain shapes portion of the wave is called crest and the lower valley- shaped portion of the wave is called trough.



A wave is described by the following properties:

WAVELENGTH: It is the distance between two adjacent crests or troughs. It is usually measured in meters, micrometers, or nanometers.

AMPLITUDE: It is called the height of the wave. It is the height of crest or depth of trough of wave. Amplitude is also measured in unit of distance.

FREQUENCY: It is the number of waves which pass through a given point in one second. Frequency is measured in hertz, or cycles per second. Frequency describes the energy of the wave and it is inversely proportional to the wavelength.

READING CHECK:

How will you define crest in a wave?

READING CHECK:

How will you define trough in a wave?

READING CHECK:

What is the relation between frequency and wavelength?

READING CHECK:

What is the amplitude of a wave?

VIBRATION

Back-and-forth shaking motion of matter is called vibrations. Waves are produced when an object vibrates. Mechanical waves (such as sound, water, seismic waves) require a medium or material in order to travel. Speed of a mechanical wave depends on the medium through which it passes. Electromagnetic waves (such as gamma, visible light and infrared waves) do not require any medium to travel. All the electromagnetic waves travel at the same speed (speed of light)

READING CHECK:

What is vibration?

READING CHECK:

Give two examples of mechanical waves.

READING CHECK:

Give two examples of electromagnetic waves.

READING CHECK:

Which types of waves cannot travel through empty space?

READING CHECK:

What do you know about the speed of electromagnetic waves?

SOUND AND ECHOES:

Sound is an example of mechanical wave. When an object vibrates, air around it is set in motion. The sound travels as wave, reaches our ear, where the bones of the ear detect and brain decodes the waves. Sound requires a medium in order to travel. The speed of the sound waves depends upon the medium. The speed of the sound waves in various medium decreases in order solids > liquids > gaseous.

Pitch and volume are the characteristics of the sound. Pitch describes how high or low a sound seems to us. Pitch is directly proportional to the frequency of the sound. The volume of the sound is directly proportional to the amplitude of the wave. Reflecting of the sound waves back to the source after bouncing of a hard surface produces echoes.

READING CHECK:

What happens when an object vibrates?

READING CHECK:

How do we listen to sound?

READING CHECK:

What is the speed of sound waves in various mediums?

READING CHECK:

How would you define pitch of the sound?

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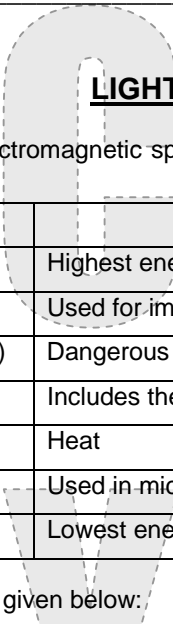
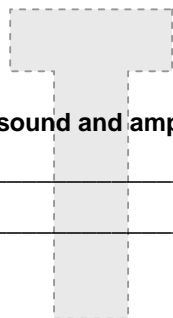
What is the relation between pitch and frequency of the sound?

READING CHECK:

What is relation between volume of the sound and amplitude of the sound waves?

READING CHECK:

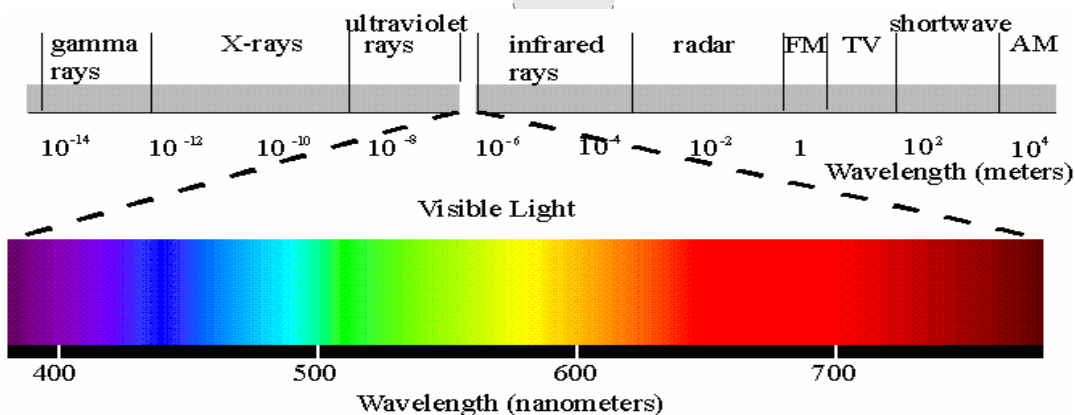
How would you define echoes?



Light is an electromagnetic wave. The electromagnetic spectrum contains seven categories of light as given below:

Category	Properties
Gamma rays	Highest energy light
X-rays	Used for imaging
Ultraviolet(UV)	Dangerous for skin
Visible	Includes the color of the rainbow
Infrared	Heat
Microwave	Used in microwave oven
Radio	Lowest energy light

The complete electromagnetic spectrum is given below:



READING CHECK:

Which category of light has the highest energy?

READING CHECK:

Which category of light has the lowest energy?

READING CHECK:

Which colors are present in the visible region of the electromagnetic spectrum?

LIGHT INTERACTIONS

White light is a combination of all the colors of the visible region of the electromagnetic spectrum. This can be demonstrated by passing the white light through a prism.

The color of an opaque object depends on which color it absorbs and which color it reflects. A red object appears red because it absorbs all the colors except red. A white object reflects all the colors and absorbs none; a black object absorbs all the colors and reflects none.

A translucent object transmits most of the light that passes through it. A colored translucent object only allows that color of the light to pass through it.

READING CHECK:

Colors of which region of the electromagnetic spectrum are present in the white light?

READING CHECK:

What does happen when white light is passed through a prism?

READING CHECK:

Why does a red object appear red?

Chapter 5:– Energy in our Lives

Using Energy to Improve the Quality of Life

Life on the earth is possible because of the energy supplied from the sun in the form of light and heat. The following table summarizes some of the ways that energy can be used to improve the quality of life.

Tool	How it works	Results
Microwave oven	Cook and heat food by using microwaves	Time is saved
Radiation treatment	Uses high energy electromagnetic waves to kill cancer cells	Lives are saved
Electricity	It is used to drive a wide variety of home appliances and other tools	Saves time and human labor.
Medical Imaging	Inside of the body is imagined by using X – rays or sound waves	Reduces the need for a surgery
Fuels	Used in heating and transportation	Make travel possible; increase personal comfort

READING CHECK:

How energy has made life possible on the earth?

READING CHECK:

How energy has made travel possible?

FOSSIL FUELS: Fossil fuels (like petroleum, coal, and natural gas) are a source of energy that form from buried plants and microorganisms millions of years ago. With the increase in the temperature and pressure below the earth's surface, some of the fossils were very slowly changed into hydrocarbons. These

hydrocarbons store energy that can be released by burning the fossil fuels. Fossil fuels are a nonrenewable resource of energy. When the fossil fuels disappear, new sources of energy (such as solar energy and wind energy) will need to be developed to replace them.

Advantages: Fossil fuels are easy to extract, transport and store. They are relatively cheap, safe and inexpensive to use. Nowadays, technologies have been designed to work with them.

Disadvantages: Extraction of the fossil fuels disturbs the local environment, contributes to air pollution, acid rain, the Greenhouse Effect, oil spills. These are limited and non-renewable source of energy.

READING CHECK:

What are fossil fuels?

READING CHECK:

What conditions are required for the production of the fossil fuels?

READING CHECK:

What are the advantages of using the fossil fuels?

READING CHECK:

What are the disadvantages of using the fossil fuels?

READING CHECK:

What can be the possible replacements of the fossil fuels?
