

SCIENCE FORM 1

CHAPTER 7 HEAT

Heat is energy that makes an object hot.

- The Sun is the primary source of heat energy.
- Heat can be used to do work.
- Heat energy is also called as thermal energy.
- Heat can be produced in various ways from different forms of energy:
 - All forms of burning
 - All hot objects
 - Friction
 - Electricity
 - Chemical reaction

Uses of Heat energy in our daily life

- To cook food and boil water for drinking.
- To dry clothes and hair.
- To drive steam generators that produce electricity.
- To evaporate sea water to produce salt and to dry tea leaves.
- To warm our body during cold weather.
- To sterilise instruments

Differences between Heat and temperature

Heat	Temperature
Heat is a form of energy	Temperature is the measure of the degree of hotness or coldness of an object by using a thermometer the substance
• Heat energy is the total amount of energy of all the particles in the substance	It is not a measure of the quantity
The unit of measuring heat energy is the joule (J).	It is not a measure of the quantity of heat in a substance.
An object becomes hotter when it absorbs heat and becomes cooler when it loses heat	The two common temperature scales are the Celsius($^{\circ}\text{C}$) and Kelvin (K) scales.

	Temperature is also a measure of the average value of the kinetic energy of each particle in a substance.
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- Expansion – The volume of the object generally increases when the object is heated.
- Contraction – The volume of the object generally decreases when the object is cooled.

Heat Flow

Heat energy moves from an area of high temperature to an area of low temperature.

- The rate of heat transfer depends on the difference in temperature between the two objects.
- The greater the difference in temperature, the faster heat flows.

Heat can travel in three ways.

conduction

- Conduction is the flow of heat through solids.
- The particles in the medium do not flow.
- Heat is transferred from the hotter end of the object to the cooler end by the vibration of particles in the object.
- Metals are very good conductor of heat

convection

- Convection is the transfer of heat from one part of a fluid (substances which can flow) to another by the circulating movement of that heated fluid.
- Liquids and gases are fluids.
- This circulating movement is called a convection

radiation

- Radiation is a process of heat transfer that does not require a medium.
- Radiation can take place in a vacuum.
- Properties of radiant heat:
 - Travels as electromagnetic waves
 - Travels at the speed of light

- Travels in a straight line
- Travels through a vacuum
- Can be absorbed or reflected

Heat Flow in Natural Phenomena

1. Sea breeze

- During the day, the land becomes hot faster than the water.
- The air above the warm land is heated by conduction and becomes less dense and rises.
- The cooler and denser air from over the sea flows in over the land to fill the place left by the heated air.

2. Land breeze

- At night, the land cools faster than the sea.
- The hot air above the sea rises and the cool air above the land flows out towards the sea.

The Effects of Heat Flow on Matter

1. Conductors

- A conductor is a material that allows heat to move through it easily.
- A good heat conductor becomes hot or cold easily.
- Generally, metals are very good heat conductors.
- Example: silver, mercury, copper, iron, etc.

2. Insulators

- Insulators or poor heat conductors conduct heat much more slowly.
- Generally, non -metals are good insulator.
- Example: air, water, glass, asbestos, polystyrene, etc.
- A vacuum is the best insulator.

Uses of Heat Conductors in daily life

- Cooking utensils
 - Handles of cooking utensils are made of insulators like wood or plastic.
 - In this way the handles will not get too hot for us to hold.
 - To prevent table tops from being burnt by hot kitchenware, table mats are used as heat insulators.
- In laboratory
 - Asbestos sheets or tiles to prevent the table from being burnt.
- Woolen blanket
 - It is used to keep the body warm.
 - The wool traps air which is an insulator.
 - The woolen blanket and the air layer prevent heat loss from the body.
- Sawdust
 - It is used to cover ice blocks to slow down melting.
 - Sawdust prevents heat from reaching the ice.
- Sleeping bags
 - Sleeping bags are made of thick cotton which keeps the body warm.
 - The cotton and air in the bags are good heat insulator
- Styrofoam food containers keep food warm

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Effect of heat on matter

- Matter undergoes a change of state when amount of heat energy in it changes.
- When a substance is heated, it absorbs heat.
- When a substance cools down, it release heat

The physical processes involved in the changes of state of matter are

- melting,
- condensation
- boiling,
- freezing
- evaporation
- sublimation

Melting and Freezing

- Melting is a process in which a substance changes from being in a solid state to being in a liquid state.
- The temperature at which a pure substance melts is called the melting point of the substance.
- Freezing is a process when a liquid becomes a solid.
- The temperature at which a pure substance freezes is called the freezing point of the substance.

Boiling and Condensation

- Boiling is the process by which a substance changes from a liquid state to a gaseous state.
- The temperature at which a substance boils is called its boiling point.
- Condensation takes place when a substance changes from a gaseous state to a liquid state.

Evaporation

- Evaporation is a process in which a liquid becomes a gas without boiling.
- Evaporation takes place at any temperature and heat is absorbed from the surroundings.
- It only occurs on the exposed surface of a liquid.

Sublimation

- Sublimation is the process in which substance changes directly from a solid to a gas or from a gas to a solid without having changed into a liquid first when it is heated or cooled respectively.
- A piece of dry ice (solid carbon dioxide) will absorb heat from its surroundings and quickly become carbon dioxide gas.
- The mothballs in the cupboard and some air fresheners also undergo sublimation.
- Substances in the laboratory that can be used to demonstrate sublimation are iodine crystal, sulphur, ammonium chloride and naphthalene.