HEAT

All substances in our surrounding are made up of molecules. These molecules are generally at motion and posses kinetic energy. At the same time each molecule exerts a force of attraction on other molecules and so they posses potential energy.

Internal energy = kinetic energy + potential energy

This is internal energy when flows out is called heat energy.

EFFECT OF HEAT ENERGY

1.Change in Temperature:

When heat energy is added to a substance, the kinetic energy of its particles increases and so the particles move at higher speed. This causes rise in temperature.

2.Change in State:

Solid→ liquid→ gas

3.Chemical changes:

Since heat is a form of energy it plays a major role in chemical changes. In some cases, chemical reactions need heat to begin and also heat determines the speed at which reactions occur. When we cook food, we light the wood and it catches fire and the food particles become soft because of the heat energy.

4.Expansion of substance:

When heat is added to a substance, the molecules gain energy and vibrate and force other molecules apart. As a result, expansion takes place.

Example: some space being left in railway tracks, when thermometer is place in warm water.

All forms of matter (solid, liquid, gas) undergo expansion on heating.

a) **Expansion of solid**

- Linear expansion (length)
- Super facial expansion (area)
- Cubical expansion (volume)

b) Expansion on liquids:

When a liquid is heated, it is done by keeping the liquid in some container and supplying heat energy to the liquid through the container. The thermal energy supplied will be partly used in expanding the container and partly used in expanding the liquid.

Thus what we observe may not be the actual or real expansion of the liquid. Hence for liquids we can define.

a) Real expansion
b) Apparent expansion

Coefficient of real expansion is defined as the ratio of the true rise in the volume of the liquid per degree rise in temperature to its unit volume

S.I unit is k^{-1}

Coefficient of apparent expansion is defined as the ratio of the apparent rise in the volume of the liquid per degree rise in temperature to its unit volume.

S.I unit is k^{-1-}

FUNDAMENTAL LAWS OF GASES

1) **Boyle's law:**

When the temperature of a gas is kept constant, the volume of a fixed mass of gas is inversely proportional to it's pressure.

$P \propto \frac{1}{V}$

2) **Charle's law: (The law of volume)**

When the pressure of gas is kept constant the volume of a gas is directly proportional to the temperature of a gas.

$V \propto T$

3) **Avogodro's law:**

It states that at constant pressure and temperature, the volume of a gas is directly proportional, the volume of a gas is directly proportional to number of atoms or molecules present in it

$V \propto N$

It is the total number of atoms per mole of the substance. It is equal to 6.023×10^{23}/mol.

Transfer of Heat:

Heat transfer takes place in three ways.

1) **Conduction (Solid**):

The process of transfer of heat in solids from a region of higher temperature to a region of lower temperature without the actual movement of molecules is called conduction.

In solids, molecules are closely arranges to that they cannot move freely.

Conduction in daily life

- Aluminium is used for making utensils to cook food quickly
- Mercury is used in thermometers.
- We wear woolen clothes in winter to keep ourselves warm. Air, is a bad conductor of heat.

2) Convection (Fluids):

It is a flow of heat through a fluid from places of higher temperature to places of lower temperature by movement of the fluid itself.

Example

- Hot air balloon
- Breezes
- Winds

3) Radiation:

Radiation is the flow of heat from one place to another by means of electromagnetic waves.

It can occur even in vacuum whereas conduction and convection need matter to be present.

Example

- White coloured clothes good reflectors of heat
- Base of cooking utensils is blackened because black surface absorbs more heat from the surrounding
- Surface of airplane is highly polished, because it reflects most of the heat radiations from the sun.

Specific Heat Capacity:

Its is defined as the amount of heat required to raise the temperature of 1kg of the substance by 1°c or 1k.

S.I unit – $JKg^{-1}K^{-1}$ (or) J/Kg°C (or) J/g°C

Water has the highest heat capacity and its Value is 4200) J/Kg°K.

Ice (solid state) – 2100 $JKg^{-1}K^{-1}$

Steam (Gas state) – 460 $JKg^{-1}K^{-1}$

It means that water absorbs a large amount of heat for unit rise in temperature. It is because of this reason temperature of water in the lake does not change during day time.

Heat Capacity (Or) Thermal Capacity:

It is the heat required to raise the temperature of entire mass of the body by 1°C.

Heat capacity = $\frac{Quantity\ of\ heat\ required}{raise\ in\ temperature}$

SI unit is J/K (or) Cal/°C. (or) kcal/°C.

Latent Heat :

When a substance changes from one state to another a considerable amount of heat energy is absorbed or liberated. This energy is called latent heat.

Specific latent heat is the amount of heat energy absorbed or liberated by unit mass of a substance during change of state without causing any change temperature.

S.I unit J/Kg.

Practice Questions

Heat

1. Ice has a specific heat capacity of ____.
   a. 4200$Jkg^{-1}k^{-1}$ b. 460 $Jkg^{-1}k^{-1}$
   c. 2100 $Jkg^{-1}k^{-1}$ d. 2200 $Jkg^{-1}k^{-1}$

2. The amount of heat energy absorbed or released by a substance during a change in its physical states without any change in its temperature. It is known as ____
   a. Specific latent heat b. Sublimation
   c. Latent heat d. Heat capacity

3. When two objects of same mass are heated at equal rates, the object with smaller specific heat capacity will have a ___?
   a. temperature decrease **b. faster temperature increase**
   c. faster temperature decrease d. None of the above

4. Thermal expansion is the tendency of matter to change in shape, area and volume due to a ____?
   a. Change in laten heat **b. Change in temperature**
   c. Change in heat capacity d. Change in volume

5. When the hot boiled egg is drop in cold water the egg shell can be removed easily. It is because ____
   a. different thermal expansion b. different volume
   c. different temperature d. none of the above