

Specific Heat Capacity

When you are out on the beach, have you noticed that the water is cold whereas the sand is hot! The sun is the same there, then why this difference in the temperature? You must have given it a thought! The temperature of a solid and liquid element rises when we supply heat to it. If we supplied the same amount of heat to two different kinds of solid then rise in temperature may be different in both the solids. So, depending upon the nature of the solid, the rise in temperature varies for different kind of solids. This phenomenon is known as Specific heat Capacity.

Definition

In other words **specific heat** of a solid or liquid is the amount of heat that raises the temperature of a unit mass of the solid through 1°C . We symbolise it as C . In S.I unit, it is the amount of heat that raises the temperature of 1 kg of solid or liquid through 1K.

Its unit in S.I system is always given as $\text{J kg}^{-1}\text{K}^{-1}$ and CGS as $\text{cal g}^{-1}\text{C}^{-1}$. If the amount of heat, ΔQ , required to raise the temperature of mass M through ΔT , then the formula for specific heat is given by:

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$$C = \Delta Q / m \cdot \Delta T \text{ or } \Delta Q = m C \Delta T.$$



Specific Heat
Capacity

Molar Specific Heat

The Molar specific heat of a solid or liquid of a material is the heat that you provide to raise the temperature of one mole of solid or liquid through 1K or 1° C. We represent it as C. Its unit is J mol⁻¹K⁻¹. So, to raise the temperature of μ moles of solid through ΔT , you would need an amount of heat equal to $\Delta Q = \mu C \Delta T$.

The molar specific heat capacity of a substance is nothing but the amount of heat you need to provide to raise the temperature of one gram molecule of the substance through one degree centigrade. It is denoted by C. Specific heat of water is taken to be 1. This is because of the reason that we defined unit of heat (calorie) by making use of water.

Specific Heat at Constant Pressure or Volume

- The volume of solid remains constant when heated through a small range of temperature. This is known as **specific heat at a constant volume**. It is denoted as C_v .
- The pressure of solid remains constant when heated through a small range of temperature. This is known as **specific heat at constant pressure** which can be denoted as C_p .

The behavior of gas when heat is supplied, the pressure and volume change in temperature and the amount of heat required to raise the temperature for 1gm of gas through 1°C depends on the way gas is heated. You can use several sets of values of P and V heat the gas.

Therefore, specific heat possesses infinite values. The specific heat of the gas is not constant if you do not supply a constant amount of heat. So, you must have specific heat at a constant volume or pressure. For an ideal gas,

$$C_p - C_v = nR$$

where C_p is heat capacity at constant pressure, C_v is heat capacity at constant volume, n is amount of substance, and $R=8.3144598(48)$ J mol⁻¹ K and is the molar gas constant.

Applications

- The utensils used for cooking use a material of low specific heat. You can heat their bottoms quickly. This is because they have aluminium or copper polished bottoms. The handle of these utensils is made of high specific heat material to sustain the heat and to save our hands.

- Insulators use materials of high specific heat. For example wood. House made of wood are more useful in High temperature or Low-temperature area.
- Due to a high specific heat of water, in swimming pool, water used to be cool as compared to the temperature outside.

Question For You

Q. Give the definition of molar specific heat.

Ans: For a solid or liquid it is the heat that us required to increase the temperature of one mole of Solid or Liquid through 1K or 1° C.