CALORIMETRY

This is the branch of thermal physics that studies the quantity of heat in relation to temperature. The quantity of heat that will change the temperature of a substance depends on the mass, temperature and nature of the substance.

When heat is applied to an object, the heat energy may increase the random molecular motion and thereby increase the temperature of the object. The quantity of heat (Q) required to change the temperature of an object is proportional to the mass (m) of the object and to the change in the temperature . That is:

Or

c in the equation above is called the specific heat capacity

Generally, heat lost or heat gained by a body is given as

“c” is a constant called the specific heat capacity of and it depends on the (nature of) the substance.

The specific heat capacity is defined as the heat energy required to change a unit mass of the substance by a degree rise in temperature. For example, if the specific heat capacity of copper is 400J/kgK, it means 400 J of heat is required to change 1kg of copper by 1 kelvin.

For an infinitesimal temperature change dT and corresponding of heat dQ

The above relations do not apply if a phase (or state) change is encountered because the heat added or removed during a phase change does not change the temperature.

HEAT CAPACITY

This is defined as the heat energy required to change the total mass of a substance by a degree rise in temperature. It is also known as thermal capacity.

Mathematically it is the product of the mass of the substance and the specific heat capacity

The total mass m of object is equal to the mass per mole M multiplied by the number of moles n

m = nM

But

Therefore,

On differentiating the above with respect to time, we have

From this we can say

CALCULATING THE SPECIFIC HEAT CAPACITY OF A SUBSTANCE

1. Method of mixture: One of the methods used to determine the specific heat capacity of a substance is by the method of mixture.

When two substances of different temperatures are mixed, heat lost by the hot object equals the heat gained by the cold object. After some time, the two bodies will have the same temperature. This temperature is known as the temperature of the mixture.

The temperature of the mixture will be greater than the initial temperature of the cold object and will be lower than the initial temperature of the hot object.

The following should be done when determining the specific heat capacity of a substance by method of mixture.

The calorimeter should be lagged with an insulating material such as cotton wool. Lagging is the process of reducing heat.

The hot substance should be quickly transferred to the calorimeter to prevent heat loss to the surrounding

The mixture should be stirred continuously in order to achieve uniform temperature.

1. Electrical Method: The specific heat capacity of a substance can also be determined by electrical method. The basic principle is that the electrical energy in electrical appliances is converted into heat energy.

LATENT HEAT

This can be defined as the heat energy required to change a substance from one state to another without a corresponding change in temperature. There are two types of latent heat

1. Latent heat of fusion: This is the latent heat that has to do with solid and liquid. It could be defined as the latent heat when a substance changes from solid to liquid
2. Latent heat of vaporization: It is the latent heat when a substance changes from liquid to gas.

Latent heat is absorbed when a substance changes from solid to liquid or from liquid to gas.

Latent heat is given off when a substance changes from gas to liquid or liquid to solid.

Generally, the quantity of heat that will change a substance from one state to another depends on the mass and the nature of the substance. The quantity of heat of heat is given as

Here, “l” is called the specific latent heat.

The specific latent heat of fusion can be defined as the heat energy required to change a unit mass of a substance from the solid state to the liquid state without a corresponding change in temperature.

When determining the slh of fusion of ice, dry ice should be used so as not to affect the mass of water. Dry ice can be obtained by coating ice with blotting paper.

In determining the slh of vaporization of steam, dry steam should be used

If a block of ice floats on water inside a container and the ice gets completely melted, the level of water in the container will remain the same. This is because the ice has already occupied a specific volume before melting. Therefore, the level of water remains unchanged.

REGELATION

This is also called anti-freezing

This process has to do with pressure on a solid (block of ice).

If a thin wire or thread of heavy weight is attached at both ends and hung on the block of ice resting on a support. The wire begins to cut through the block of ice while the block of ice remains solid behind the wire.