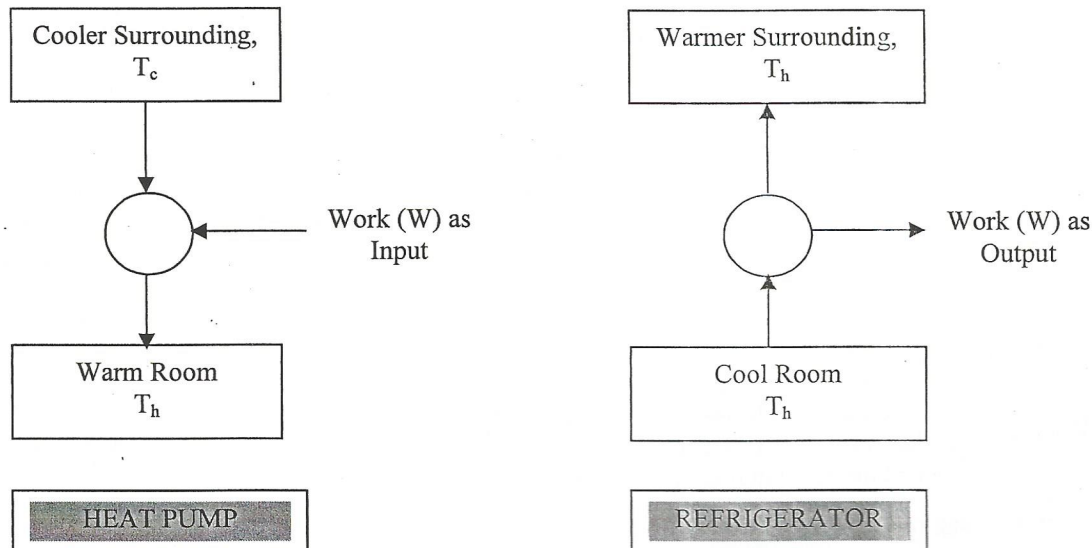


A work producing engine is normally called a **HEAT ENGINE**, while that for cooling and heating is called a **REFRIGERATOR** or **HEAT PUMP** respectively.

Consider the working principle of an air conditioner that has both cooling and heating options.



In summer, the air conditioner removes heat from a cool room and transfers it to a warm environment using work to perform the task. The air conditioner working under this mode is referred to as a **REFRIGERATOR**. The refrigerator works between the temperatures of the cold body (cooled space) and the surrounding.

In winter, the operation is reversed. The heat is removed from a cooler surrounding and transferred to a warmer room. The air conditioner working under this mode is referred to as a **HEAT PUMP**. The heat pump works between the temperatures of the hot body (heated space) and the surrounding.

**27. CALORIFIC VALUE (kJ or MJ)**

This is the amount of heat energy (in heat units) that is liberated by a unit quantity of a fuel when burned.

Two cases can arise:

**Higher or Gross Calorific Value (HCV):** This is the energy liberated per unit quantity (mass or volume) of a fuel when the **products of combustion are cooled to the original fuel temperature**. (For solid fuels, energy liberated per kg, and for gaseous fuels, energy liberated per  $m^3$ )

**Lower or Net Calorific Value (LCV):** In most fuels, there is a certain amount of hydrogen present along with moisture. When burnt, the hydrogen will form water and together with the moisture, this appears as steam in the exhaust products. In most cases, it is not possible to cool the exhaust products significantly to water and hence the moisture leaves as steam. The moisture thus leaves without giving up the enthalpy of evaporation to the plant. Hence the concept of Lower Calorific Value.

*LCV*

*= HCV - Enthalpy of Evaporation per kg of steam leaving in the water contained by the combustion products.*

**28. SPECIFIC HEAT CAPACITY (J/kg or kJ/kg)**

**The Specific Heat Capacity at Constant Volume ( $C_v$ ):** This is the amount of heat transferred to or from a unit mass of gas while the temperature changes by one degree and the volume remains constant.

**The Specific Heat Capacity at Constant Pressure ( $C_p$ ):** This is the amount of heat transferred to or from a unit mass of gas while the temperature changes by one degree and the pressure remains constant.