Thermodynamics full chapter pdf download

Chapter 12 : The physics department that deals with the conversion of thermodynamic heat energy into other forms of energy and vice versa. When the macroscopic variables that characterize the system (pressure, volume, temperature, mass, composition, etc.) do not change over time, the thermodynamic system is said to be in thermal balance. Thermodynamic System The comming of a large number of particles expressed in terms of pressure, volume and temperature is called thermodynamic system. The thermodynamic system is classified as the following three systems (i) Open System. (ii) Closed System Only energy (does not matter) exchange with the environment. (iii) Isolated System Neither energy nor substance exchange with the environment. The thermodynamic system is not always balanced. For example, it allowed a gas vacuum to expand freely against. Similarly, when ignited by a spark, a mixture of gasoline vapor and air is not a state of equilibrium. Balance is achieved over time. Thermodynamic Parameters or Coordinates or Variables The state of the thermodynamic system can be defined by specifying pressure, volume, temperature, internal energy and number of me, etc. These are called thermodynamic parameters or coordinates or variables. Work done with a thermodynamic system is done with W = p * BV and p = pressure and BV = volume vary. The work done by a thermodynamic system is equal to the area between the p-V curve and the volume axis A-B = field The work done in the ABCDA Process depends not only on the first and last states of the system, but also on the path followed in the process. Studies conducted by the Thermodynamic System are taken as positive and → 4 as volume increases. Negative → 4 volumes decreased. Internal Energy (U) The total energy that any system has due to molecular motion and molecular configuration is called internal energy. The internal energy of a thermodynamic system depends on temperature. It is characteristic of the state of the system. The Zero Law of Thermodynamics According to this law, the third system and the two systems in thermal balance are in separate thermal balance. Thus, if A and B are in separate balance with C, i.e. TA = TC and TB = TC, this means that systems A and B are also in thermal balance. The first law of Thermodynamic Heat (BQ) given to the thermodynamic system is partially used when doing business against the environment, and the remaining part increases the internal energy of the system (BU). Therefore, the first law of thermodynamics is a re-expression of the principle of energy conservation. In the isothermal process, the change in internal energy is zero (BU = 0). Therefore, there is no heat exchange in the Process of BQ = BW Adiabatic, i.e. Bβ = O. Therefore, BU = – BW Adiabatic if the gas expands, the internal energy and therefore the temperature decreases and vice versa. The work done in the isocortic process is zero, i.e. BW = 0, so when some changes occur in the case of a thermodynamic system, i.e. therrnodynamiparameters of the system change over time. (i) In an isothermodynamic system, a process that occurs at constant temperature is called an isothermal process. Whethermomal processes are very slow processes. This process follows Boyle's law, which pV = constant From dU = nCvdT< as dT = 0 i.e. dU = 0, that is, internal energy is constant. From the first law of thermodynamic dQ = dW, the heat given to the system is equal to the work done by the system environment. The work done w = 2.3026μRT l0g10(Vf / Vi) = 2.3026μRT l0g10(pi / pf) here, μ = mole count, R = ideal gas constant, T = absolute temperature and Vi Vf and Pi, Pf initial volumes and pressures. After distinguishing p V = constant, the mass module of gas in the isothermal process, the β = p. P – V curve are rectangular hyperbole samples for these individuals (a) The melting process is an isothermal change because the temperature of a substance remains constant during melting. (b) Boiling process is also an isothermal process. (ii) Adiabatic Process is a process that takes place in a thermodynamic system without heat exchange between the system and its surroundings. Adibatic processes are very fast processes. This process follows Poisson's law, according to which dQ = nCdT, Cadi = 0 as dQ = 0, that is, the low heat capacity for the diabatic process is zero. From the first law, dU = – dW, that is, the work done by the system is equal to the reduction in internal energy. When a system expands adiyabatically, the work done is positive and hence the decrease in internal energy, that is, the system cools down and vice versa. The work done in an adiabatic process is where Ti and Tf start and end temperatures. Examples (a) Sudden compression or a gas expansion in a container with an excellent conductive wall. (b) Sudden explosion of the tube of a bicycle tire. (c) Propagation of sound waves in air and other gases. (iii) Isobaric Process A process that occurs at constant pressure in the thermodynamic system is called the Isobaric process. The molar heat capacity of the process is Cp and dQ = nCpdT. Internal energy dU = nCv dT Thermodynamic dQ from the first law = dU + dW dW = pdV = nRdT Process equation V / T = constant. The p-V curve is a straight line parallel to the volume axis. (iv) Isochromic Process A process that occurs at a fixed volume in the Tlaermodynars system is called an isocortic process. dQ = nCvdT, molar heat capacity cv for isocortic processing. Volume is constant, so dW = 0, Process equation p/T = fixed p-V curve is a straight line parallel to the pressure axis. (v) When the Circular Process returns to a thermodynamic system . the first situation after a few passes then called a circular process. The efficiency of the cycle is given by the Work done by the calculated cycle from the closed cycle of space on the p-V curve. Diabatic and Adibatic Curves For an isothermal process, the graph drawn between the pressure p and volume V of a particular mass of a gas is called the isothermal curve, and for a diabatic process it is called adiabatic curve. Slope of adiabatic curve = γ x Elasticity slope of gases Volume elasticity of gases (i) Elasticity module of elasticity ET = γ p Elasticity module The ratio between elasticity ET = γ p Elasticity module between elastic and adibatic modulus ES / ET = Cp / CV γ= Cp / CV where Cp and Cv are certain temperatures of gas at constant pressure. An isothermal process is βt = 0, so specific heat, c = B δ / m Bt = &infi; For an adiabatic process 119= 0, so special heat, c = 0 / m Bt = 0 The Second Law of Thermodynamics The second law of thermodynamics provides a fundamental limitation for the efficiency of the heat engine and the performance coefficient of the refrigerator. It says that the efficiency of a heat engine is never unity (or 100%). This means that the temperature released into the cold chamber can never be zeroed in. Kelvin's Expression It is not possible to obtain a continuous source of work by cooling from a body to a temperature below the coldest temperature around it. Clausius' Statement It is not possible to transfer heat from a lower temperature object to a higher temperature body without using an ecthemal agency. Planck's Statement It is not possible to build a heat engine that will completely turn heat into work. All these expressions are equivalent to one that can be obtained from the other. Entropy Entropy is a physical amount that remains constant during recycleable diabatic change. The change in entropy is given with dS = βQ / T Where, βQ = heat given to the system and T = absolute temperature. The entropy of a system never diminishes, so it's ≥ dS. The entropy of a system increases in an irreversable process Heat Engine A heat energy engine is a device that converts heat energy into mechanical energy. A heat engine consists of three parts (i) High temperature heat source (ii) Working agent (iii) Thermal efficiency of a heat engine is given where Q1 is absorbed from the source, Q2 is denied heat to the sink and T1 and T2 welding and sink temperatures. Two types of heat engine (i) External Combustion Engine This engine is burned in a room outside the main body of the fuel engine. for example, the steam machine. In practical life, the thermal efficiency of the steam machine varies between 12% and 16%. (ii) Internal Combustion Engine in this engine. fuel is burned inside the main body of the engine. for example, petrol and diesel engine. In practical life, the thermal efficiency of the petrol engine is 26% and the diesel engine is 40%. Carnot's Cycle designed an ideal working cycle for Carnot The heat engine is called the Carnot cycle. A Carnot cycle contains the following four processes (i) Isodal expansion (EU) (ii) Adiabatic expansion (BO) (iii) Isothermal compression (CD) (iv) Adiabatic compression (DA) Net work per cycle by the motor is numerically equal to the loop area representing the Carnot cycle. After doing calculations for different processes [Carnot engine efficiency can indicate that the maximum (not 1000/0) given temperatures are for T1 and T2. Nevertheless, the Carnot engine is not a practical engine, because many ideal situations are assumed when designing this engine, which is practically undetable.] Refrigerator or Heat Pump Is a device used for cooling things in a refrigerator or heat pump. It absorbs heat from the sink at a lower temperature and rejects a larger amount of heat to the source at a higher temperature. The performance coefficient of the refrigerator Q2's heat absorbed from the sink is given according to the source of Q1 and the welding and sink temperatures of T1 and T2. Relationship between efficiency (η) and performance coefficient (β) Click below to download PDF THERMODYNAMICS Part 1 To download PDF THERMODYNAMICS Part 2 Please send your questions ncerthelp@gmail.com you can visit our facebook page for quick help. Our Facebook page is linked to the sidebar