Welcome student, I'm Dr. Miskil Naik Assistant Professor in Physics, DCT's Dhempe College of Arts and Science, Miramar, Goa. Today I'll be discussing topic from classical Mechanics and Thermal physics.

Unit 2 Production of low temperature. In this module I'll be discussing about Enthalpy and heat flow, throttling process, isenthalpic process.

At the end of this module, learner will be able to explain the enthalpy and isenthalpic process.

In thermodynamics, we often discuss about system and surrounding. Here we have a cup filled with hot coffee. It is called as the system. Anything outside this cup is called as the surrounding.

Enthalpy . Enthalpy is the thermodynamic property of the system,it determines the heat flow that is absorbed during the process.

Enthalpy is measured in terms of Joules . It has the units of that of energy.

It is also a state function.That is, it depends upon the initial and final state.

And not on the process.

But enthalpy cannot be measured

unlike potential energy, we cannot measure.

But change in enthalpy is measurable.

Mathematically, enthalpy is

given as, Internal energy represented as U plus work

done given in terms of pressure and volume .

Change in enthalpy at constant pressure is given by

differentiating above equation dH equals to dU plus P dV.

Q is the heat flow that is heatt flows from a body or to a

body.Work done by a body or on the body. Work is path dependent

function. Internal energy for ideal gas is a function of

temperature. It only

depends upon kinetic energy of the molecule, however for a

real gas it is function of temperature and volume and it is

represented as sum of kinetic energy and potential energy.

In the adiabatic process, change in energy, change
in heat content dQ is constant.

In Isothermal process change in temperature dT is constant.

In isobaric process.

Change in pressure dP remains constant. In isochoric

process change in volume dV remains constant.

What is the importance of enthalpy By measuring

enthalpy, one can determine whether the reaction is endothermic or exothermic. Measuring enthalpy also helps in evaluating the throttling process.

Throttling process, throttling is the mechanism by which fluid flow is managed. Suppose we have a duct in which water is flowing through the duct and we can control the flow of fluid by means of stopper.

Suppose we start closing the stopper, then the path of flow of fluid narrows down. That is called as the throttling of the fluid.

Suppose P_1 is the pressure that is the inlet pressure.

And P_2 is the outlet pressure.

Pressure P_1 is greater than pressure P_2 .Consider case of that of tap through which the water is flowing when we open the tap, water falls from higher pressure to that of lower pressure. Let T_1 be the temperature at the inlet and let T_2 the temperature at the outlet.

For ideal gas temperature T_1 is equal to T_2.

For real, this temperature T_1 either greater than T_2 or it is equal to T_2 or it is less than T_2.

Q which is heat supply to the working substance or the system.

and W be the work done in taking the system from state one

to state 2. Then increase in energy which is given by U2 minus U1

equals to Q - W.

Where U_1 and U_2 are the initial and final

values of internal energy.

In throttling process no heat is absorbed or it is rejected.

That is, Q is zero.

Substituting equation 2 in equation 1 we get W that is,

the work done is equals two U_1- U_2. That is difference

in internal energy.

Also, we know that work done depends upon the path, so in

terms of path it is given as

$P_2 V_2$ -- P_1V_1.

So comparing equations three and four we get.

U_1-U_2 equals to P_2V_2 - P_1V_1

Rearranging this equation,$P_1 V_1 + U_1$ equals to

P_2V_2 plus U_2.

Left hand side , which is equal to H_1 and right hand side equals to

H2. So we see that the enthalpy is remaining constant.

So during throttling process there is no change in enthalpy of the

system. This process is also called as isenthelpic

process. Where by the enthalpy of the system remains constant.

For one mole of a gas, H is given as U plus PV.

When small amount of heat dQ is absorbed then the enthalpy

increases by dH.

That is, dH is equals to dQ.

Differentiating equation one we get dH equals dU plus PdV

plus VdP.

For isobaric process, dP equals to zero.

That is, by

substituting 3 in equation 2 we get dH equals to dU plus

PdV.

Also we know that change in heat process is equals to dU plus PdV.

Comparing 4 and 5 we get H_2 minus H_1 is equal to dQ.

That is for isobaric process the change in enthalpy is equal

to heat transfer during the process.

For isobaric adiabatic process dP is zero

that is change in pressure is zero

And change in heat content is also zero so

Change in enthalpy is also zero

So H is constant, so enthalpy remains constant in a reversible

isobaric process.

These are the books for further reference.

Thank you.