Title of the unit : unit two to Phase equilibrium, model name.

Phase diagram of 1 component system that is the water system.

Module number 11

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Bardez goa. The outline of this module, will study phase

equilibrium of 1 component system. That is, the water

system , and the

main features of the water system.

Learning outcomes. After learning the topic, students

will be able to explain the behavior of 1 component system.

Interpret the stability regions of various phases of water under

pressure temperature conditions.

Apply the theoretical concept of Gibbs Phase rule to various

systems.

Now the introduction.

Water exists in three phases,namely solid, liquid and vapor

phase and there are three forms of equilibrium now, equilibrium

from solid state to the liquid state is known as Fusion.

Equilibrium from liquid state to the vapour phase is known as

evaporation. An equilibrium from solid state to the vapour state

is known as sublimation.

Each equilibrium involves two phases, and the composition of

every phase is expressed in terms of 1 chemical constituent

water. Hence, water is a one component system. Now, by

applying the phase rule to water system where component is 1

phases are two since every equilibrium involves two phases.

Now, substituting these values in the face rule that is F is

equal to C minus P + 2, we get degrees of freedom as F=1.
This is the phase diagram of water system.Now phase diagram is used to

explain the effect of alteration in temperature or pressure of

the system. Now curve OB in the phase diagram of water

System is the curve for sublimation of ice.

Along this curve, solid ice and vapors are in equilibrium and it

shows vapor pressure of ice at different temperatures.

ThePoint B in the phase diagram of water lies at minus 273 degreesCelsius.
And has zero vapor pressure along this curve.

Phases are two components are one. So substituting these values in the phase rule that is

F is equal to C minus P+ 2, that is, F is equal to 1 minus 2 + 2.

We get degrees of Freedom as F=1,so this curve represents

Univariant system. Curve OA in the phase diagram represent

vaporization of liquid.

Along this curve, liquid water and water Vapor are in equilibrium.

If temperature is fixed, vapor pressure is fixed automatically and at 100 degrees celsius Vapor pressure of water is equal to atmospheric pressure and this is the boiling point of water, along this curve phases are two component is 1. So substituting these values in the face rule we get. F is equal to C minus P+ 2, that is, F is equal to 1 minus 2 + 2. That is, we get a degree of Freedom as F=1.

So this curve represents a univariant system.

Now the curve OC in the face diagram is forFusion of ice, along this curve solid ice and water are in equilibrium.

The slope of Line OC in the phase diagram is negative, and it tilts towards the pressure axis. Freezing point of water is 0.0078 degrees Celsius at 4.68 millimeter, and reduced to zero degrees Celsius at a higher pressure of 760 millimeters.

That is in one atmosphere.

Along this curve,phases are two and components are 1.

So substituting these values in the face rule we get F is equal to C minusP + 2. That is,F is equal to 1 minus 2 + 2.

So we get degrees of freedom as F= 1. So this curve represents a univariant system. Now O in the phase diagram is the. triple point. All the three phases that

is solid, liquid and vapors are in equilibrium at the triple point .

At the point O there are three phases and Component is1,

so substituting these values

in the phase rule that is F is equal to C minus P +2.

That is F is equal to 1 minus 3+ 2, so we get the degrees of

freedom as zero..

So the triple point represents a

invariant system. It has a fixed temperature of 0.0078

degrees Celsius and pressure of 2.58 millimeter. If heating is

caused at this point, melting of ice will occur without any rise

of temperature. When the total ice is completely melted into

liquid water at the triple a two phase system results

Which changes from an invariant to a univariant

system. The application of pressure at the triple point

will cause the vapor phase to convert into liquid and solid phase.

Now the different regions in the phase diagram are region BOA,

which represents water vapor region, region BOC, which represents

solid ice and region COA, which is for liquid water.

Now in the regions BOC ,BOA and

COA. It represents a single

phase system. Along this region phases are one and component is 1, so

substituting these values in the face rule that is F is equal

to C minus P + 2. We get degrees of freedom as F= 2.

That is, it represents a bivariance region. Now line

OA dash in the phase diagram it is a metastable equilibrium.

If water is cooled below its freezing temperature, such

that cooling does not cause separation of ice.

The water is set to be supercooled.

The vapor pressure curve of liquid water AO extends

beyond the triple point O.

And the system is set to be in a metastable equilibrium.

These are my references, thank you.