Question and Answers

1. What are the number of phases and components for the following reaction in a closed system ?

Answer : $NH_4Cl\ (s) \rightleftharpoons NH_3(g) + HCl(g)$

Number of component = 1

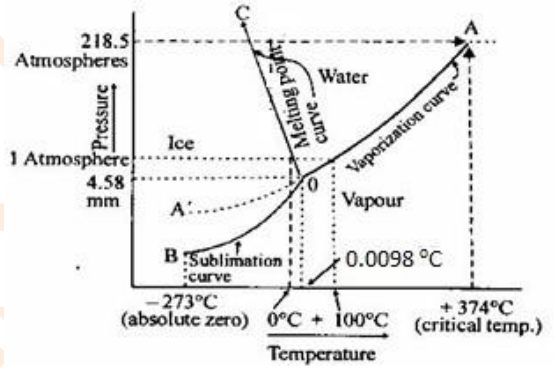
Number of phases = 2

2. i) What is Gibb's phase rule?

Answer: It was stated by Williams Gibb's in 1874. It may be stated as, "When an equilibrium between any number of phases is influenced only by temperature, pressure and concentration, but not influenced by gravity, or electrical or magnetic forces or by surface tension then the number of degree of freedom (F) of the system is related to the number of components (C) and of phases (P) by the phase rule equation. F = C – P + 2.

ii) Draw a neat labeled diagram of water system indicating the different areas and lines. Give the temperature and pressure values corresponding to triple point and critical point.

Answer :



At Triple point : 0.0098 ^oC and 4.58 mmHg

At Critical point : 374 ^oC and 218 atm pressure

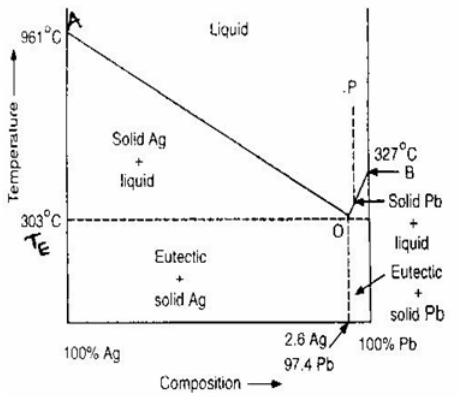
iii) With the help of Clausius Clapeyron equation explain why melting point curve has a negative slope.

Answer :

$$\frac{dp}{dT} = \frac{\Delta H_{Vapourisation}}{T\Delta V} = positive$$

3. With the help of Pb-Ag phase diagram explain Pattionson's process.

Answer:



The process of heating argentiferous lead containing a very small quantity of silver (~0.1 %) and cooling to get pure lead and liquid richer in silver is known as the Pattinson'sprocess.This process can be understood by following the phase diagram of the lead-silver system. The argentiferous lead is melted and heated to a temperature above the melting point of pure lead. This system is then allowed to cool slowly and the temperature of the melt decreases and reaches the freezing curve of Pb where solid lead starts separating.As the system further cools, more and more lead separates and the liquid in equilibrium with the solid lead gets richer in silver. The lead that separates, floats and is continuously removed by ladles. When the temperature of the liquid reaches the eutectic temperature, solid lead is in equilibrium with the liquid having the eutectic composition. After removing the lead that separates, the liquid is cooled further when it solidifies to give a mixture of lead and silver having the eutectic composition of 2.6 % of silver. This solid mixture of lead and silver is subjected to other processes for the recovery of silver.