States of Matter

Lecture 2

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Physical pharmacy

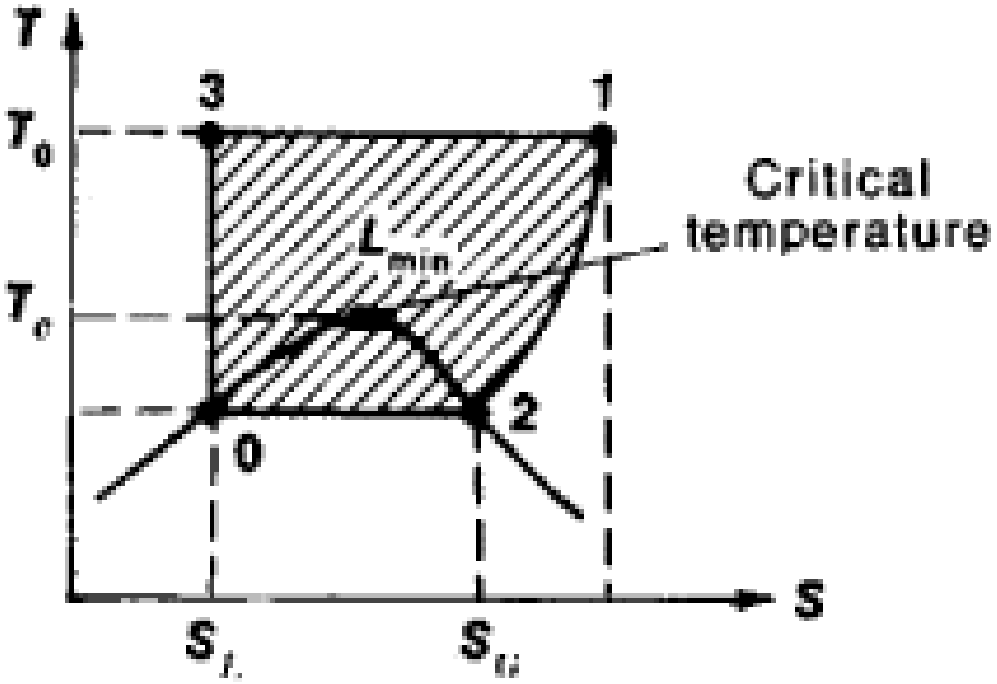
The liquid state

- **Liquefaction of gases**

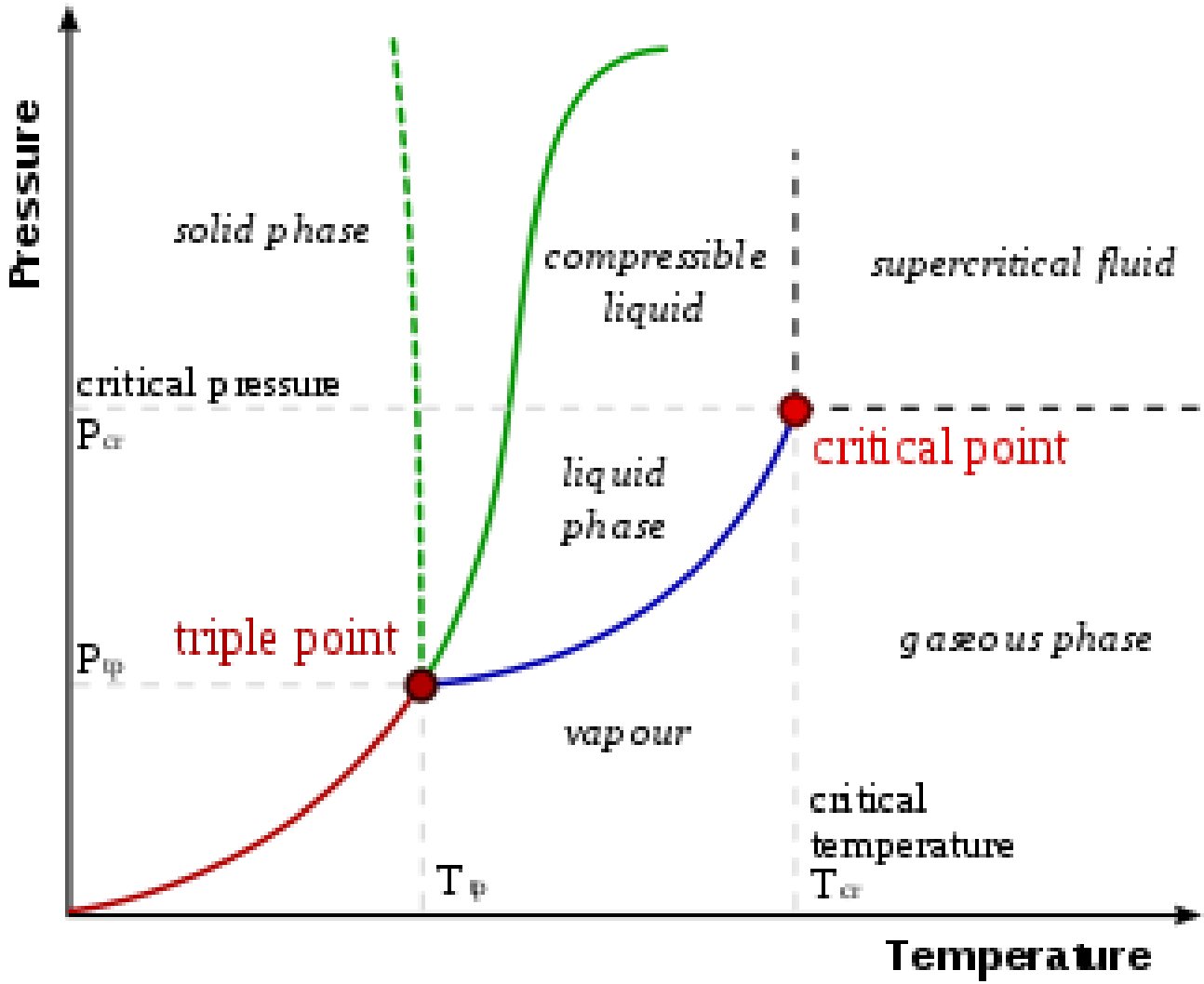
1.**Temperature** : When gas is cooled, it loses some of its kinetic energy in the form of heat, and the velocity of the molecules decreases .

2.Pressure: When pressure is applied to the gas, the molecules are brought within the sphere of the vander waals interaction forces and pass into the liquid state .

- If the temperature is elevated sufficiently , a value is reached above which it is impossible to liquefy a gas irrespective of the pressure applied. This temperature , above which a liquid no longer exist, is known as the ***critical temperature***.

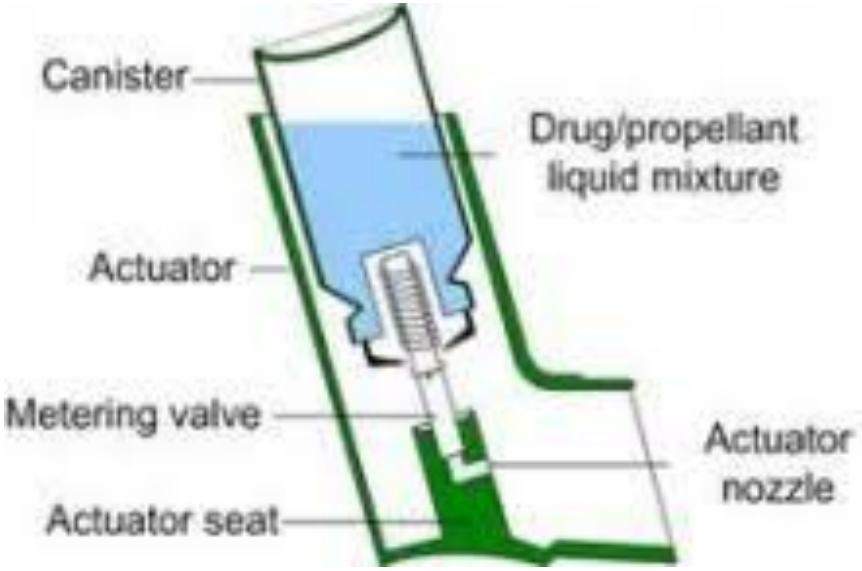


- The pressure required to liquefy a gas at its critical temperature is ***the critical pressure.***
- ***The critical pressure:*** is the minimum pressure required to liquefy a gas at its critical temperature.
- The further the gas is cooled below its critical pressure, the less pressure is required to liquefy it.
- The critical temperature of water is 374°C or 647K ,and its critical pressure is 218 atm whereas for helium are 5.2 K and 2.26atm.


Pressure
solid phase
compressible liquid
supercritical fluid
critical pressure
P_{cr}
critical point
liquid phase
P_{tp}
triple point
gaseous phase
vapour
critical temperature
T_{cr}
T_{tp}
Temperature

- **Aerosols**

- Gases can be liquefied under high pressures in a closed chamber as long as the chamber is maintained below the critical temperature. When the pressure is reduced, the molecules expand and the liquid reverts to a gas.


Canister
Drug/propellant liquid mixture
Actuator
Metering valve
Actuator nozzle
Actuator seat

- In such products, a drug is dissolved or suspended in a propellant, a material that is liquid under the pressure conditions existing inside the container but that forms a gas under normal atmospheric conditions. The container is so designed that, by depressing a valve, some of the drug–propellant mixture is expelled owing to the excess pressure inside the container. If the drug is nonvolatile, it forms a fine spray as it leaves the valve orifice; at the same time, the liquid propellant vaporizes off.