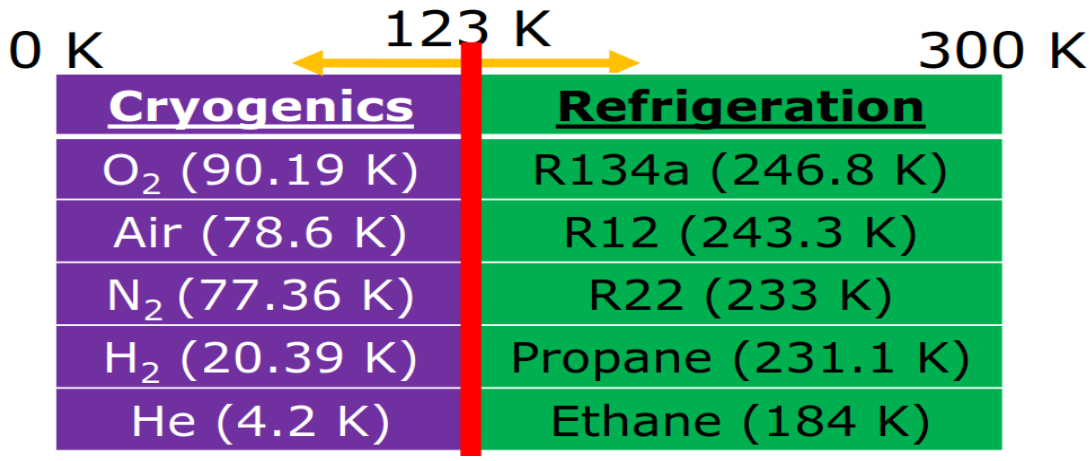
Introduction

What is Cryogenics?

- Cryogenics is the science and technology associated with generation of low temperature below 123 K.



Temperature

Kelvin (K)	Celsius (°C)	Rankine (°R)	Fahrenheit (°F)
0	-273.15	0	-459.67
273.15	0	491.67	32
373.15	100	671.67	212

Room Temperature ~ 300 K

Cryogen	Temp (K)	Cost (Rs/Lit)
LN_2	77.36	25
LH_2	20.39	
LHe	4.2	1000

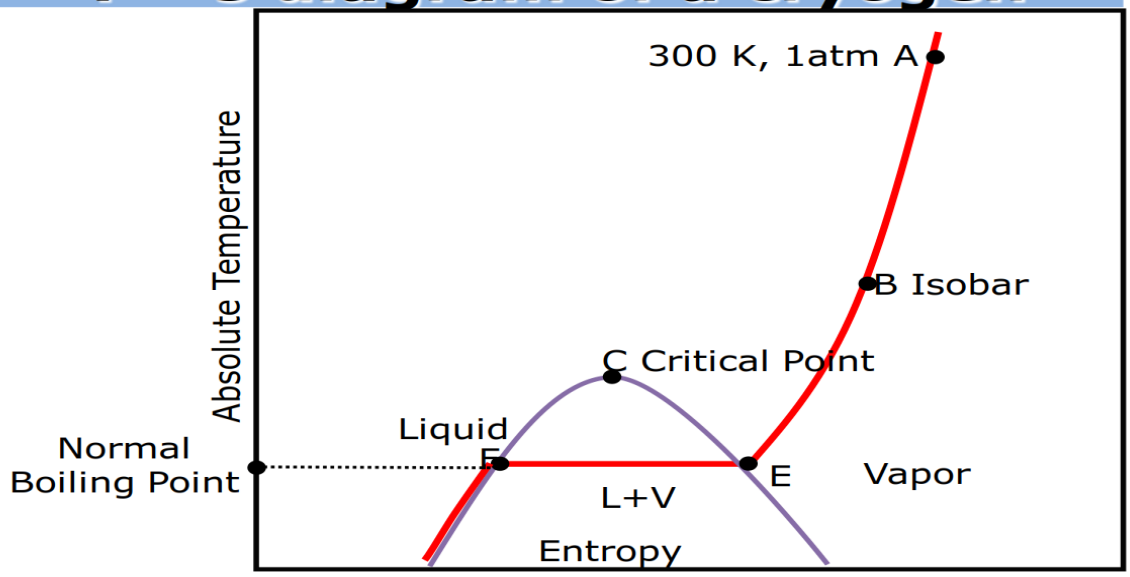
Cryogen

- Fluid with normal boiling point less than 123 K.

Cryogen	Boiling Point (K)	Triple Point (K)
Methane, CH_4	111.67	90.69
Oxygen, O_2	90.19	54.36
Argon, Ar	87.30	83.81
Air(N_2+O_2+Ar)	78.6	59.75

Nitrogen, N_2	77.36	63.15
Normal H_2	20.39	13.96
He^4	4.230	-
He^3	3.191	-

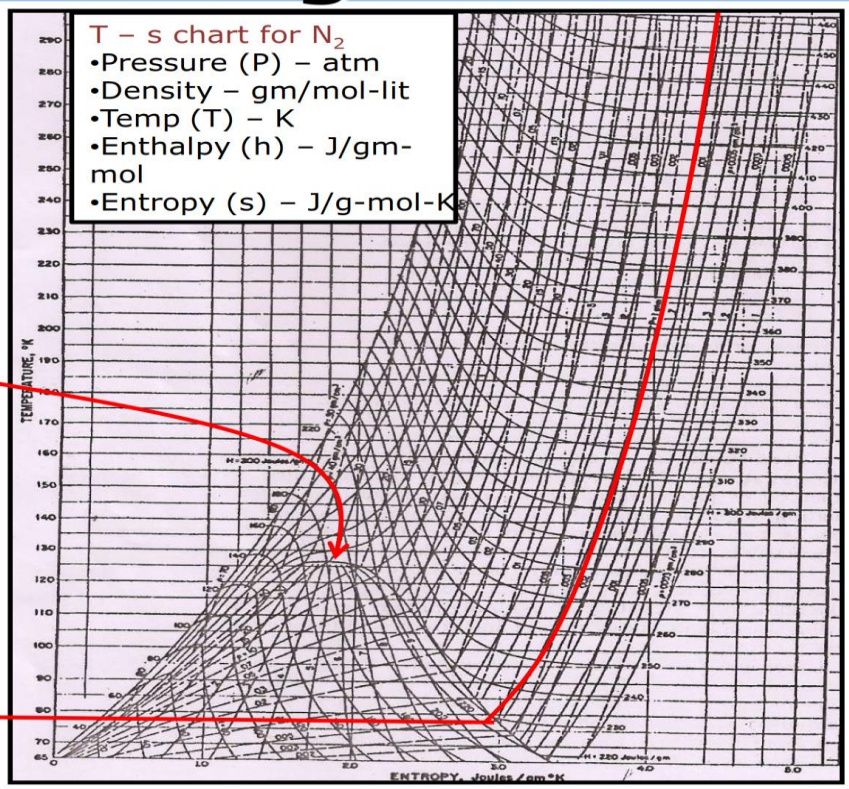
T – s diagram of a cryogen



Properties of few Cryogens

Sat. Liq. at 1atm		LHe 4	LH_2	LN_2	LAir	LOX
Normal Boiling Point	K	4.214	20.27	77.36	78.8	90.18
Critical Pressure	Mpa	0.229	1.315	3.39	3.92	5.08
Density	kg/m^3	124.8	70.79	807.3	874	1141
Latent Heat	kJ/kg	20.90	443	199.3	205	213

T – s diagram of Nitrogen



Critical Pt.
33.9 atm,
126 K

1 atm,
77.36 K