Liquefaction of gases

❖ **Definition**:- liquefaction of gases the process by which a gas is converted to a liquid.

For example,

Oxygen normally occurs as a gas. however, by applying sufficient amount of pressure and by reducing the temperature oxygen can be converted to a liquid.

Gas —cooled→ **velocity of molecules**

decrease **application of pressure** → **liquid**

❖ **principals of liquefaction :-**

- **Critical condition**: -it is the temperature at which liquid can no longer exist as liquid. **Example :-** critical temperature of H is -240℃
- **Joule Thomson effect**:-gas is allowed to pass from high pressure zone to a low pressure zone, which later result in cooling.

- **Inversion tempera :-** Temperature characteristics of gas bellow which only the gas cool when allow to expand.
  Example :- inversion temperature of H is - 80℃

Application of liquefaction of gases

- Used in refrigerants ex. liquid ammonia.
- Used in welding ex. Compressed oxygen.
- Used in soda fountains. Ex. Liquid co2

Method of achieving liquefaction

- Faradays method :-ex. Carbon dioxide, chlorine.
- Linde's method:- joule Thomson effect is used
- Clouds'method :-ex. Helium, ammonia.

1.faradays method:-

gas is below its critical temperature and the less pressure is sufficient to liquefy it.

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V shaped tube is used at one end where the gas is produced .

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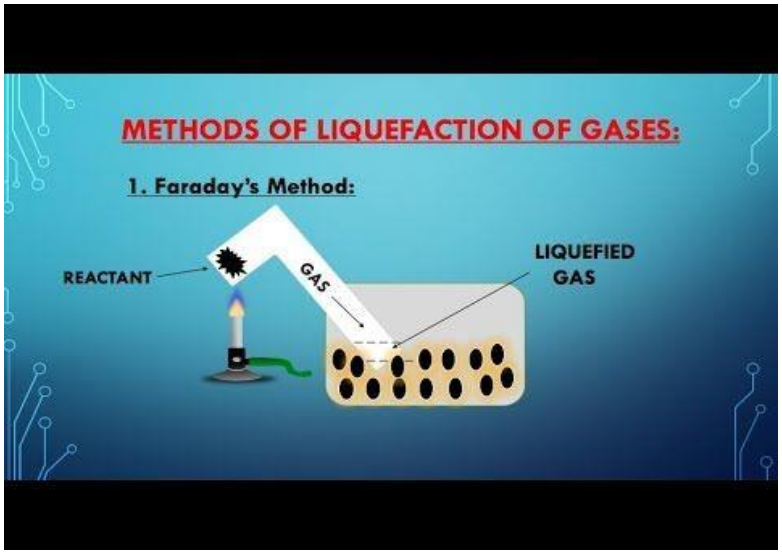
At another end the produce gas, liquefied under its own pressure with help of external cooling



2.Linde's method :-

Joule thomson principle is used.

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If a gas is compressed and suddenly allowed to expand by passing it through an orifice the gas cools down.

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It can be explained as while expanding gas molecules move apart from each other.

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In that case they have to overcome the intermolecular force of attraction.

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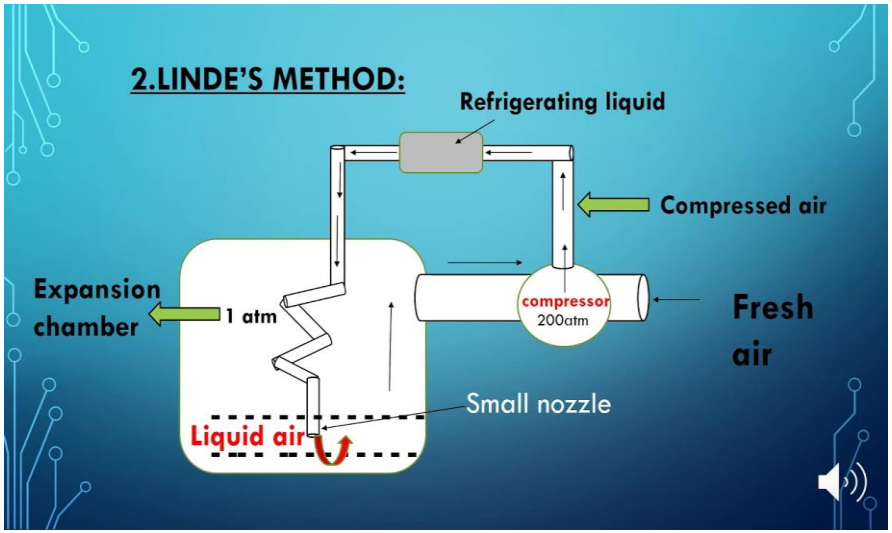
The energy used for this purpose is provided by the gas itself.this resuls in cooling.

Disadvantage: hydrogen and helium gas cannot be liquified by this method because they show negative joule thomson effect at ordinary temperature.



The gas is cooled as in lindes method by passing it under pressure through a tube and allowing it to expand by passing through an orifice .

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In addition to this the gas is made to perform work ,by driving a piston.

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Thus it is more effective than lindes method.

❖ Example:- ammonia, helium, nitrogen, chlorine, sulpher.

2.claudes method:-same as lindes method but occures some differences.

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Here, cooling effect is gretter than the lindes method as the gas does work not only by overcoming the intermolecular forces, but also in driving the engine.

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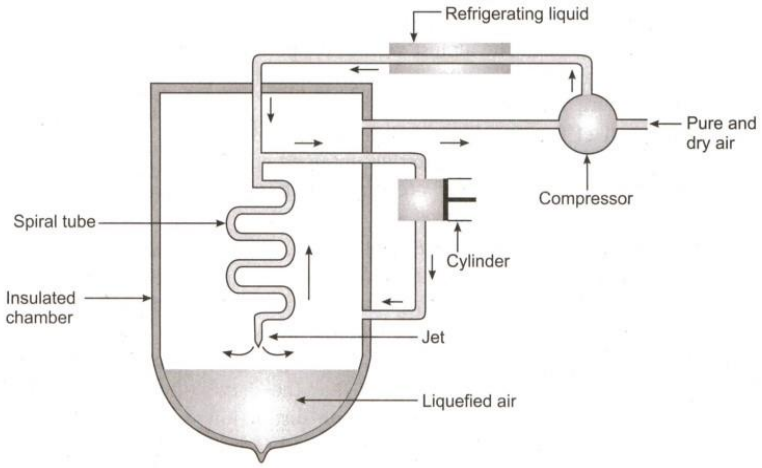

Claude's Method for Liquefaction of Gas

❖ Pioners work on liquefication of gases:

Liquifaction of gases was carried out by the English scientist michael faraday [1791-1867] in the early 1820s.

Faraday was able to liquefy gase with high critical temperature such as chorine, hydrogen sulfide, hydrogen romide and carbon dioxide by the application pressure alone.it was not until a half century later, however , that reaches found ways to qualify gas with lower critical tempreture, such as oxygen, nitrogen and carbon monoxide.

❖Recommended books(latest addition)

1.physical pharmacy by alfred martin.

2.Experimental pharmaceutics by Eugene,parrot.

3.tutorial pharmacy by copper and gunn.

4.stocklosam J. pharmaceutical calculation,lea and febiger ,pheladelphia.

5. physical pharmaceutical by C.V.S. subrmanyam.

6. Liberman H . A , lachman c, pharmaceutical dosage forms . Disperse system , volume 1,2,3. Marcel dekker inc.

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