SNS COLLEGE OF TECHNOLOGY
AN AUTONOMOUS INSTITUTION

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DEPARTMENT OF AGRICULTURAL ENGINEERING

COURSE CODE & NAME: 23AGT203 – THERMODYNAMICS AND HEAT TRANSFER

II YEAR / III SEMESTER

UNIT III – HEAT ENGINES

TOPIC : Introduction to refrigeration

INTRODUCTION

- **Refrigeration** may be defined as a process of *removing heat* from a substance and pumping it to the surroundings
- It also includes the process of maintaining and reducing the temperature of a body below the general temperature of its surroundings
- Thus in a refrigerator heat is prepared from low temperature to high temperature
- Theoretically, the refrigerator is a heat pump which pumps heat from a cold body and delivers it to a hot body

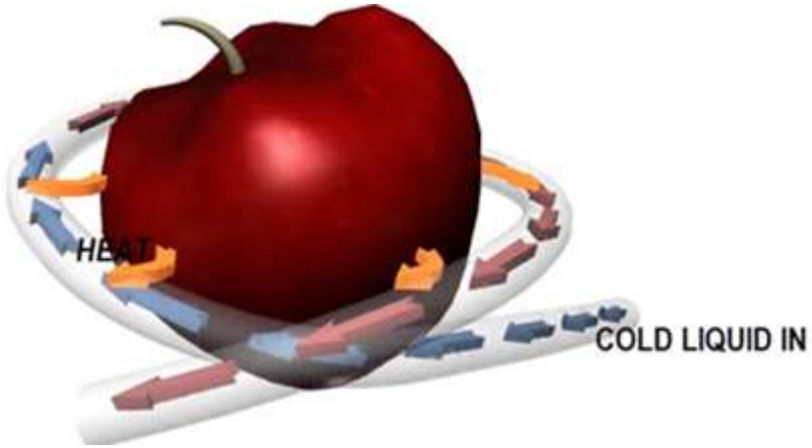
Refrigerator

INTRODUCTION

- Equipment used for removing the heat continuously for maintaining a low temperature in a space is called '**refrigerator**'.

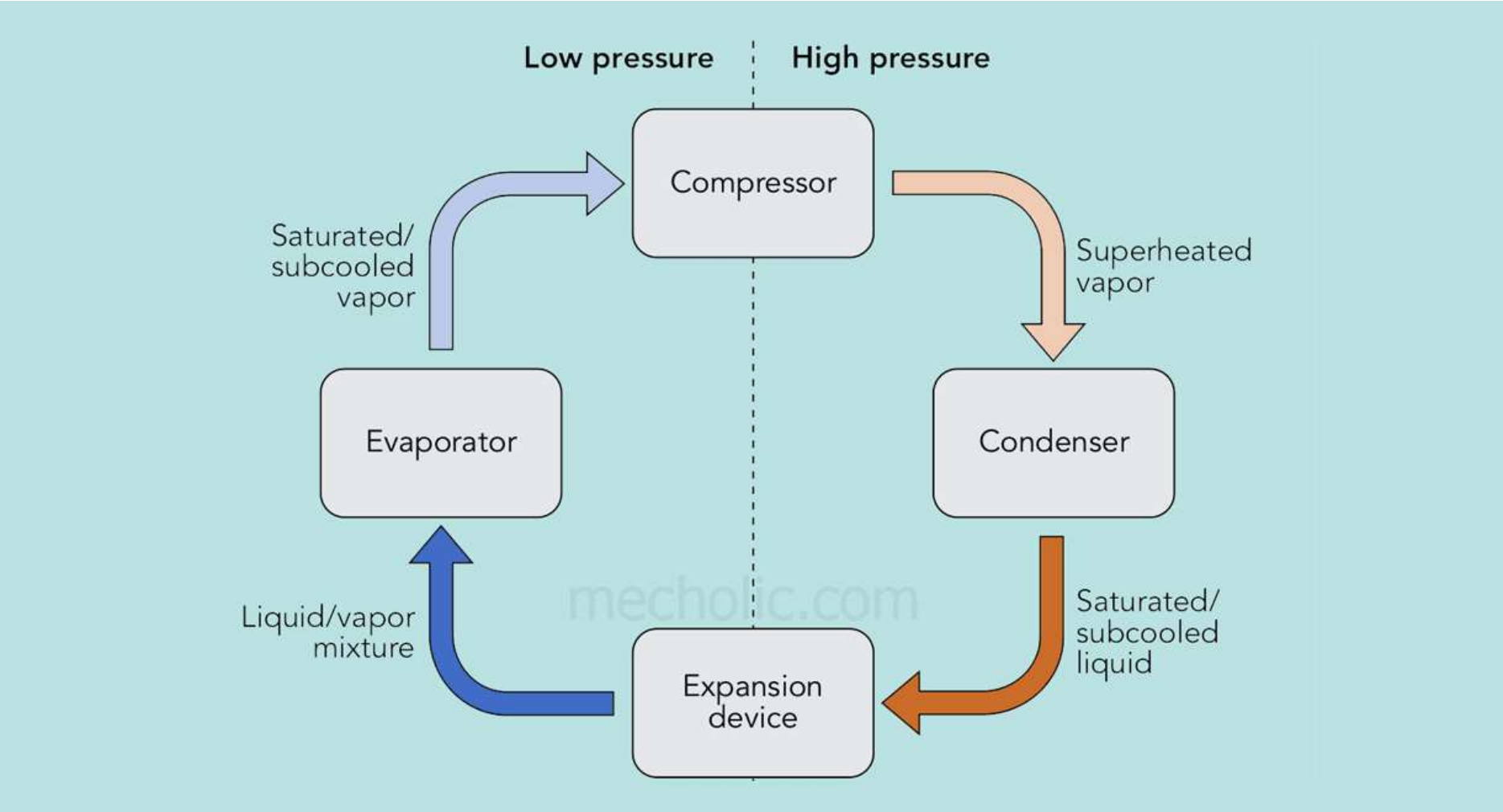
- The working fluids used for carrying away heat are called **'refrigerants**' which are used in both refrigeration and air conditioning equipment.

Basic principle of Refrigeration

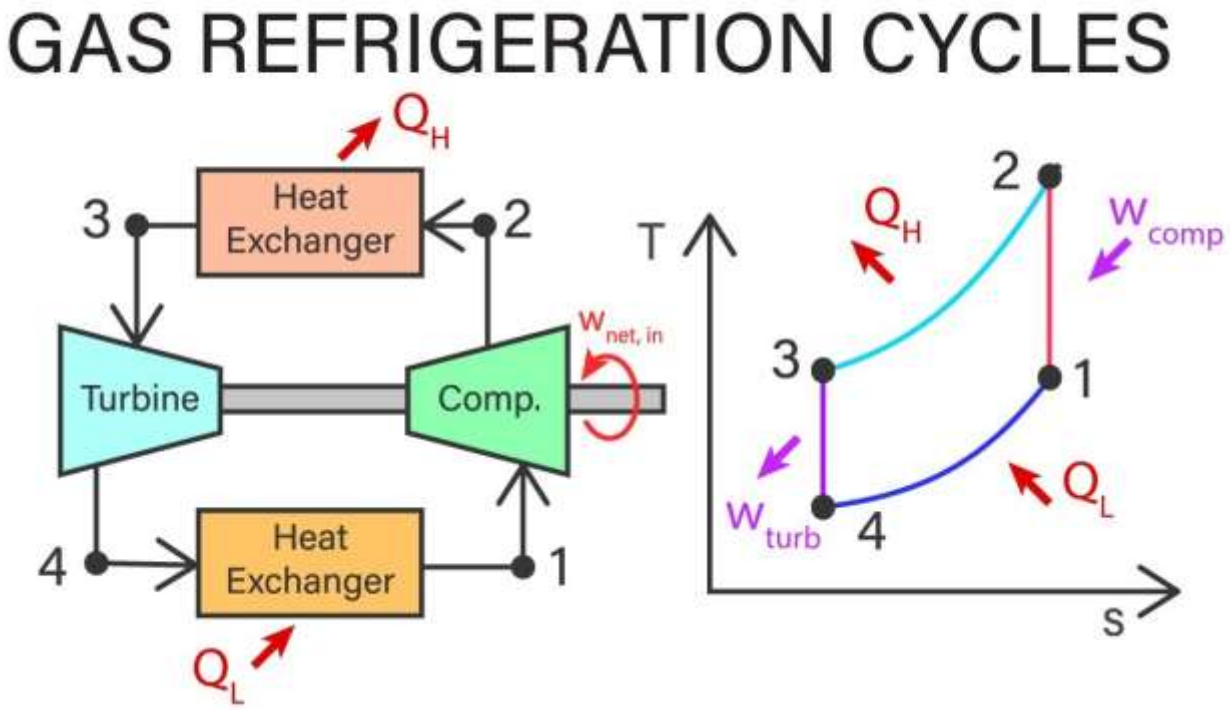


Basic principle of refrigeration is simple - Just pass a colder liquid continuously around the object which is to be cooled. This will take heat out from the object.

Refrigeration cycle



Refrigeration cycle



$$COP_{refrigeration\ cycle} = \frac{\dot{Q}_c}{\dot{W}} = \frac{T_c}{T_h - T_c}$$

QH = heat rejected to high temperature medium
QL = heat input from low temperature medium
Qc , the heat expelled to the cold reservoir.

Components of Refrigerator

It has got 4 main components;

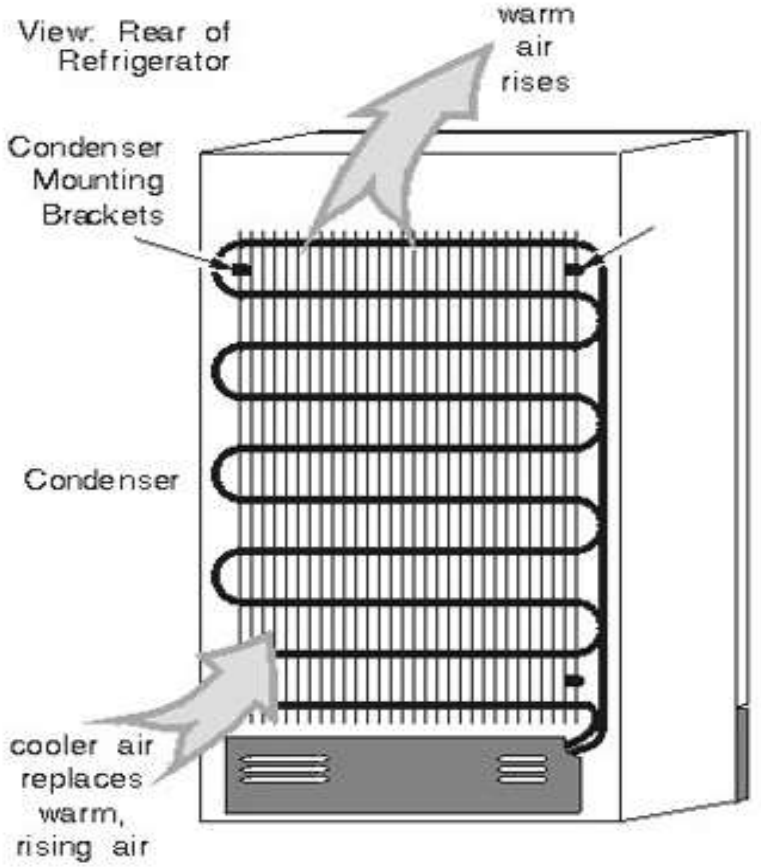
- Compressor
- Condenser
- Evaporator and
- Throttling Device/Expansion valve

Compressor

- Compression is the first step in the refrigeration cycle, and a compressor is the piece of equipment that increases the pressure of the working gas.
- Refrigerant enters the compressor as low-pressure, low-temperature gas, and leaves the compressor as a high-pressure, high-temperature gas.
- Hermetically sealed reciprocating type
- Now the refrigeration is high pressure vapor

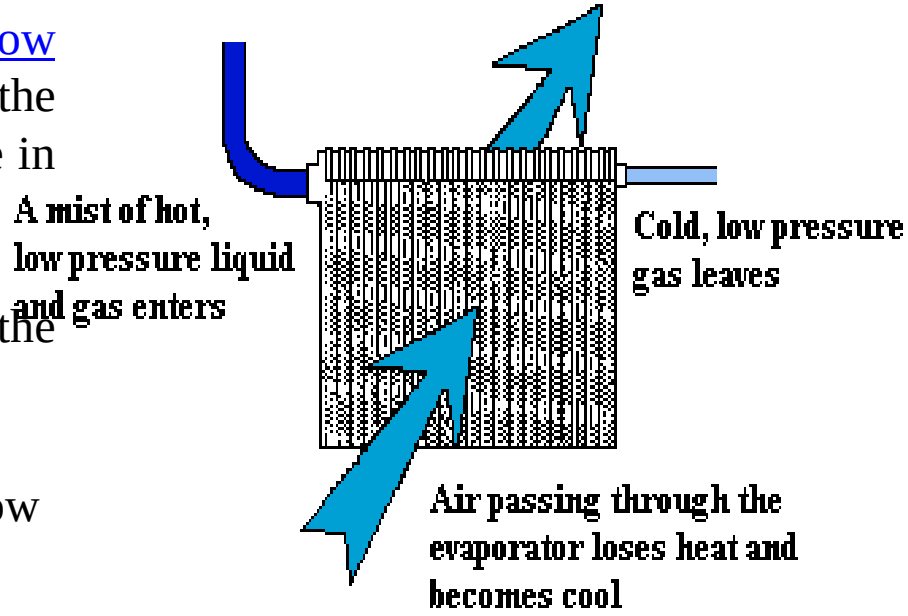
Condenser

- The condenser, or condenser coil, is one of two types of heat exchangers used in a basic refrigeration loop.
- This component is supplied with high-temperature high-pressure, vaporized refrigerant coming off the compressor.
- The condenser removes heat from the hot refrigerant gas vapor until it condenses into a saturated liquid state, a.k.a. condensation.
- After condensing, the refrigerant is a high-pressure, low-temperature liquid, at which point it's routed to the loop's expansion device.
- Heat exchanger is fitted outside refrigerator
- Condensed to liquid level
- Now the refrigerant is high pressure liquid



Evaporator

- The evaporator is the second heat exchanger in a standard refrigeration circuit, and like the condenser, it's named for its basic function.
- It serves as the "business end" of a refrigeration cycle, given that it does what we expect air conditioning to do – absorb heat.
- This happens when refrigerant enters the evaporator as a low temperature liquid at low pressure, and a fan forces air across the evaporator's fins, cooling the air by absorbing the heat from the space in question into the refrigerant.
- After doing so, the refrigerant is sent back to the compressor, where the process restarts.
- Hot, liquid refrigerant flows through the expansion device in the low side to become a fine mist.
- Refrigerant boils or evaporates to become a gas inside the evaporator.



Throttling Device/Expansion Valve

- The **expansion valve** removes pressure from the liquid refrigerant to allow **expansion** or change of state from a liquid to a vapor in the evaporator.
- The high-pressure liquid refrigerant entering the **expansion valve** is quite warm.
- This pressure drop will cause some of that refrigerant to quickly boil, creating a two-phase mixture.
- Throttling device is an obstruction to the flow
- It is responsible for the production of cold liquid

Applications of Refrigeration

The applications of refrigeration can be grouped into following four major equally important areas:

- Food processing, preservation and distribution.
- Chemical and process industries
- Special applications
- Comfort air conditioning

Refrigeration in Food processing, preservation and distribution:

Food preservation is one of the most important application of refrigeration. It is well known that food products can be preserved for a longer time, if stored them at lower temperatures. Both the live and dead products can be preserved for longer time using refrigeration.

Refrigeration video: https://www.youtube.com/watch?v=EIP3pSio7-M

Assessment

1. Freon group of refrigerants are
   (A) Inflammable
   (B) Toxic
   (C) Non-inflammable and toxic
   (D) Nontoxic and non-inflammable

2. In a refrigeration system, the expansion device is connected between the
   (A) Compressor and condenser
   (B) Condenser and receiver
   (C) Receiver and evaporator
   (D) Evaporator and compressor

THANK YOU...