

What is meant by IC engine?

*Internal Combustion engine* (IC engine) is a heat engine which converts the chemical energy of a fuel into mechanical energy. Chemical energy of a fuel is first converted into thermal energy by means of products of combustion or oxidation with air inside the engine. This thermal energy is converted into useful work through the mechanical mechanism of the engine.

2. *Discuss the relative advantages and disadvantages of internal combustion.*

*Advantages of internal combustion engines:*

1. It provides lower weight to power output ratio.
2. It is simple in design.
3. It needs less initial cost.
4. It produces high efficiency.

*Disadvantages of internal combustion engines:*

1. As much as rich fuel hydrocarbon based fuel should be used.
2. They need of some governing mechanisms to stabilize the output power throughout cycle.

3. *What are the main components of I.C engine?*

[Anna Univ. Nov'16]

- (i) Cylinder block
- (ii) Cylinder head
- (iii) Crankcase
- (iv) Oil sump or oil pan
- (v) Cylinder liners
- (vi) Piston
- (vii) Connecting rod
- (viii) Piston rings
- (ix) Crank shaft
- (x) Flywheel
- (xi) Cam shaft
- (xii) Spark plug and valves.

4. *State the functions of push rod and rocker arm.*

[Anna Univ. May'17]

The push rod and rocker arm actuates valves according to the engine stroke by cams. They allow the pushrods to push up on the rocker arms and therefore, push down on the valves.

5. *State the function of engine flywheel.*

[Anna Univ. Nov'17]

The flywheel is heavy and perfectly balanced wheel usually connected to the rear end of the crankshaft. Flywheel serves as an energy reservoir. It stores energy during power stroke and releases energy during other strokes. Thus, it gives a constant output torque.

6. *State the functions of connecting rod, piston and crankshaft.*

[Anna Univ. Nov'17 & May'18]

*Connecting rod:*

It is used to connect the piston and crankshaft with the help of bearings. It is usually steel forging of circular, rectangular, I, T or H cross-sections. Its small end is connected to the piston by the piston pin and its big end is connected to the crank by the crank pin.

*Piston:*

It is a cylindrical shaped mass which reciprocates inside the cylinder. The piston serves the following purposes.

- It acts as a movable gas-tight seal to keep gases inside the cylinder.
- It transmits the force of explosion in the cylinder to the crankshaft through connecting rod.

*Crankshaft:*

The crankshaft is used to convert the reciprocating motion of the piston into rotary motion. The big end of the connecting rod is connected to the crankshaft. It can be a single crank type for single cylinder engines and a multiple crank type for multi-cylinder engine.

7. *Draw the port timing diagram of a petrol engine.*

[Anna Univ. Dec'08]

IPO = Inlet Port Open

IPC = Inlet Port Close

IS = Ignition Start

EPO = Exhaust Port Open

TPO = Transfer Port Open

TPC = Transfer Port Close

EPC = Exhaust Port Close

TDC = Top Dead Center and BDC = Bottom Dead Center.

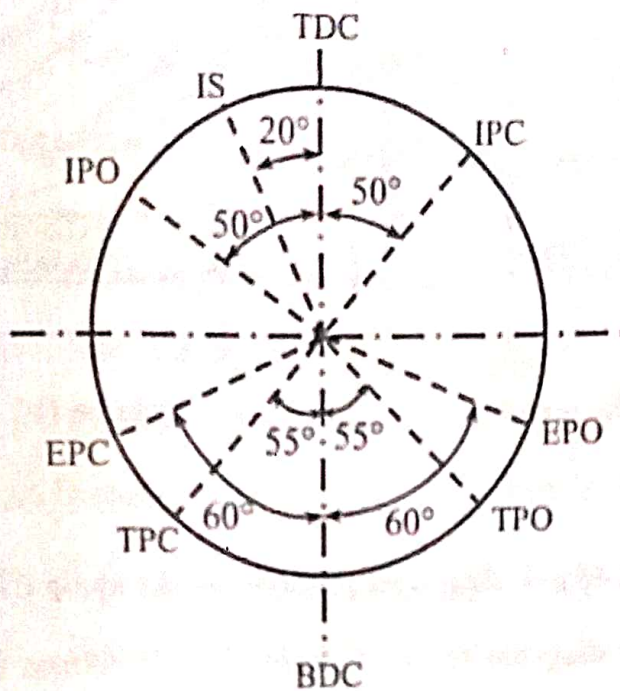


Figure 3.43 Port timing diagram for SI engine

8. Draw the actual  $p$ - $V$  diagram of the four stroke petrol engine and indicate the salient points and ignition position. [Anna Univ. Nov'10]

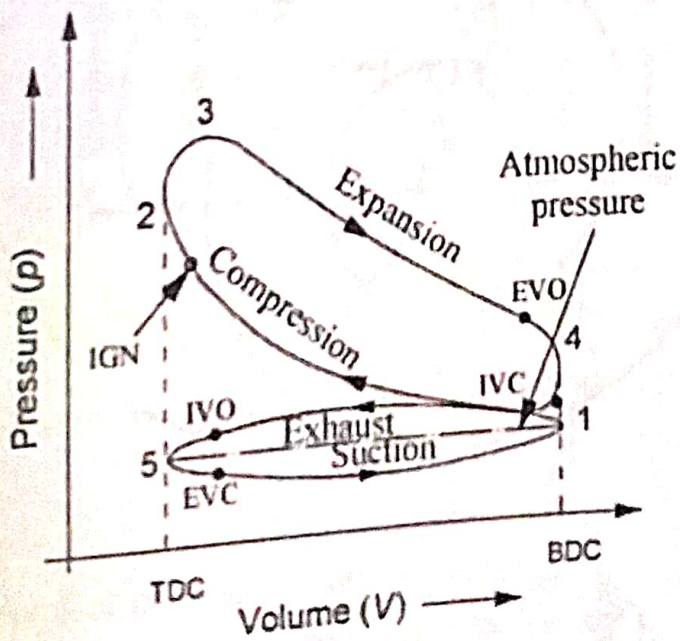


Figure 3.39  $p$ - $V$  diagram

9. Draw the actual  $p$ - $V$  diagram of a four-stroke diesel engine and indicate all the processes. [Anna Univ. Nov'17]

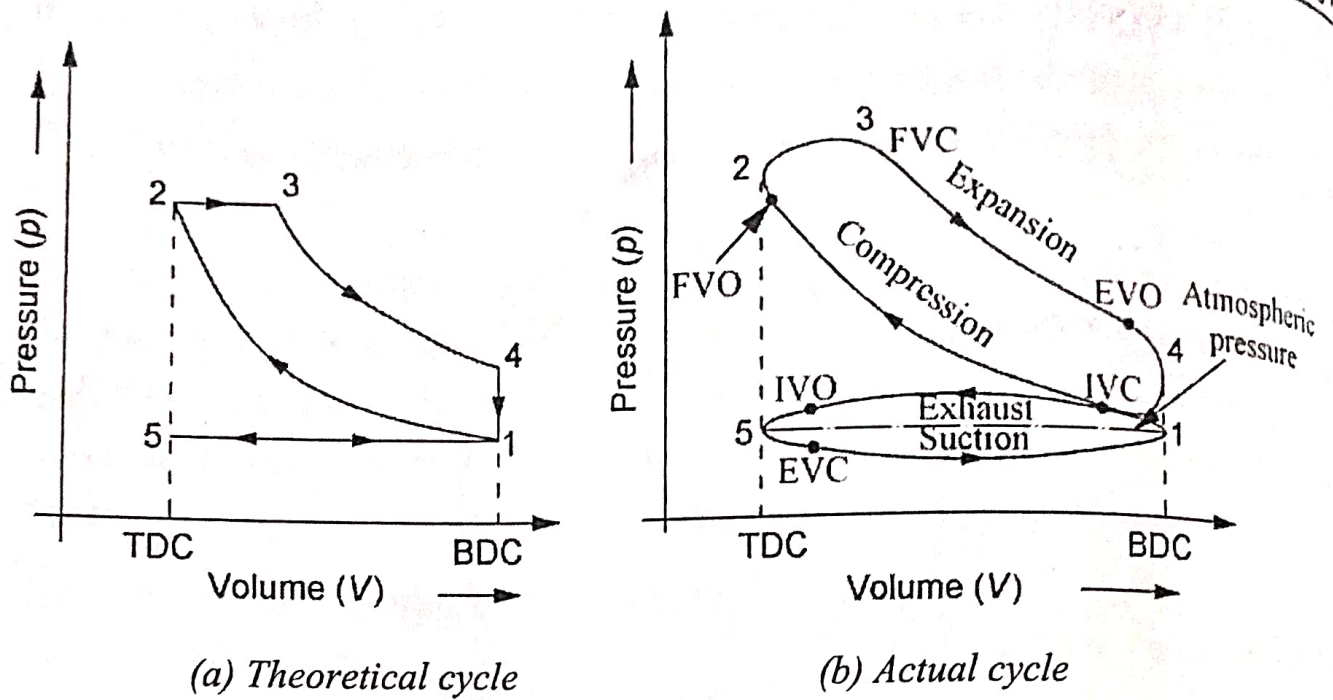


Figure 3.40 p-V diagrams for four stroke cycle CI engine

10. Draw the valve timing diagram for a CI engine.

[Anna Univ. Dec'10 & May'18]

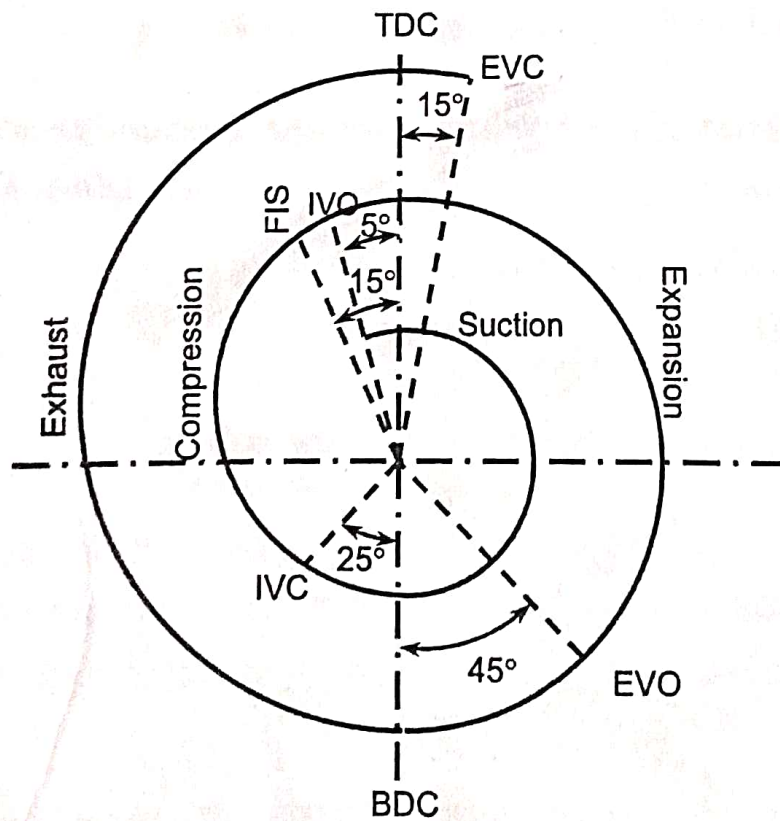


Figure 3.41 Actual valve timing diagram

- IVO  $\Rightarrow$  Inlet Valve Open
- IVC  $\Rightarrow$  Inlet Valve Close
- FIS  $\Rightarrow$  Fuel Injection Start

- EVO  $\Rightarrow$  Exhaust valve Open
- EVC  $\Rightarrow$  Exhaust valve Close
- TDC  $\Rightarrow$  Top Dead Center
- BDC  $\Rightarrow$  Bottom Dead Center

11. Show the valve overlapping period of a typical 4-stroke petrol engine on valve timing diagram. [Anna Univ. May'16]

- IVO  $\Rightarrow$  Inlet Valve Open
- IVC  $\Rightarrow$  Inlet Valve Close
- EVO  $\Rightarrow$  Exhaust valve Open
- EVC  $\Rightarrow$  Exhaust valve Close
- TDC  $\Rightarrow$  Top Dead Center
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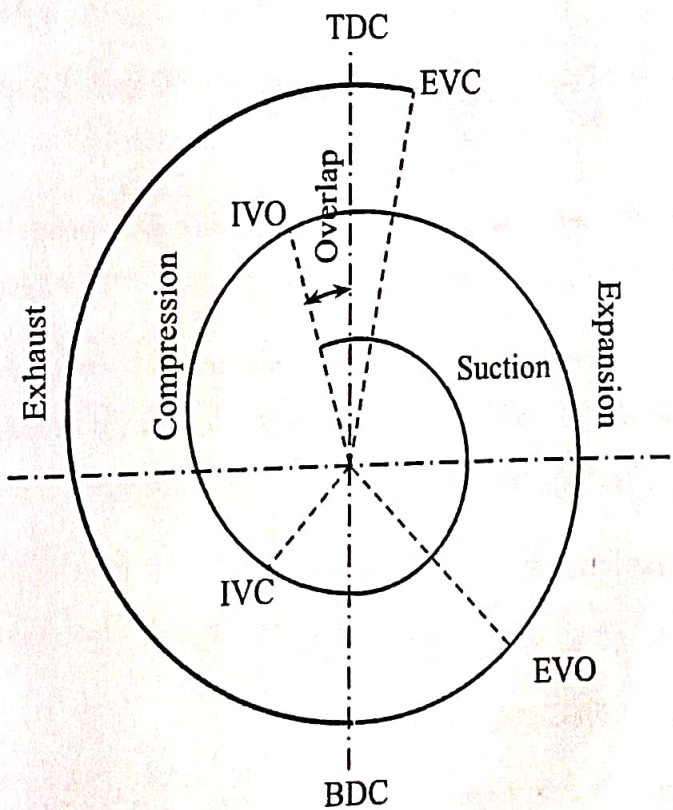


Figure 3.42 Overlap in valve timing diagram

12. During peak power operation, why does petrol engine require rich mixtures?

[Anna Univ. June'09]

During peak load, petrol engine needs to produce more power with smaller size of the engine. It is not possible with lean mixture of fuels. The use of rich mixture will replace the lean mixture during peak power operation in petrol engines.

10. What are the requirements of good Building Stone?

Strength, Durability, Hardness, Toughness, Specific gravity, Porosity, Dressing, Appearance, Seasoning, Cost.

11. Which test are conducted on stone:

Crushing strength test, Water absorption test, abrasion test, Impact test, Acid test

12. Some Basic requirements of Special Bricks:

Specially shaped Bricks

Facing Bricks

Perforated building bricks

Burnt-clay hollow bricks

Sewer bricks

Acid resistant Bricks

7. The Geological classification of stones which types are their.

Based on their origin of formation stones are classified into three major groups. That are following to.

Igneous rocks

Sedimentary rocks.

Metamorphic rocks.

8. There are the chemical classification of stones.

On the basis of their chemical composition engineers prefer to classify rocks as, silicious rocks, Argillaceous rocks, Calcareous rocks.

9. Write Small Explanation for Hardness:

It's an important property to be considered when stone is used for flooring and pavement. Coefficient of hardness is to be found by conducting test on standard specimen. In Dorry's testing machine for road works coefficient of hardness should be least found.

Bearing of a line there are two  
of compass that are commonly used.

The prismatic compass.

The surveyor compass.

4. How to check the levelling?

The compass should then be levelled  
by eye by means of a ball and socket joint so  
that the graduated ring may swing quite  
freely. It should be clamped when leveled,  
observing bearing. A ranging rod is kept  
at the next station.

5. Estimate the theodolite survey?

The theodolite is the most precise  
instrument used for measurement of horizontal  
and vertical angles. It can be used for various  
surveying operations such as established grade  
setting out curves extending survey lines.  
Determining difference in elevation.

Transit theodolite.

Non-transit theodolite.

6. What is levelling and the uses of instruments  
on the levelling

Levelling may be defined as the art  
of determining the relative height or elevations  
of points or object on the earth's surface.  
Level, levelling staff.



## UNIT II

Two marks.

1. What is Surveying?

Surveying is the art of determining the relative position of points on or above or beneath the surface of the earth by means of direct or indirect measurements of distance, direction and elevation.

2. Classification of Surveying?

Chain Surveying

Compass Surveying

Theodolite Surveying

Plane Table Surveying

Tachometric Surveying

3. What are the instruments used for Chain Surveying?

Chain, arrows, peg, ranging rods, offset rods, plumbing bob.

4. What is Compass Survey?

When the area to be surveyed is large chain and compass surveying is preferable. A compass is used to measure the magnetic

## 5.28. TWO MARK QUESTIONS AND ANSWERS

1. *Which thermodynamic cycle is used in air conditioning of airplanes using air as refrigerant?* [Anna Univ. June'09]

Air cycle refrigeration with reverse Brayton cycle (Gas turbine cycle) is mainly used as an air-conditioning system in airplanes due to the reason of readily available compressed air.

2. *What are the requirements of a refrigerator?* [Anna Univ. Dec'17]

A refrigerator is essential equipment in the kitchen for keeping foods safe. When the power goes off or the unit fails, putting our food's safety in jeopardy to our daily lives. Refrigeration slows bacterial growth. Bacteria exist everywhere in nature. They are in the soil, air, water and the foods what we eat. When they have nutrients (food), moisture and favorable temperatures, they grow rapidly in increasing numbers to the point where some types of bacteria can cause illness. Especially, bacteria grow most rapidly in the range of temperatures between  $4.4^{\circ}\text{C}$  and  $60^{\circ}\text{C}$ . So, a refrigerator can be set at  $4.4^{\circ}\text{C}$  or below will protect most foods.

3. *Define tonne of refrigeration.*

[Anna Univ. May'04, May'06, Dec'06, Nov'10, May'14 & May'15]

A *tonne of refrigeration* is defined as the quantity of heat to be removed from one tonne of water (1000 kg) at  $0^{\circ}\text{C}$  to convert that into ice at  $0^{\circ}\text{C}$  in 24 hours.

$$1 \text{ tonne of refrigeration} = 210 \text{ kJ/min} = 3.5 \text{ kW}$$

4. Show the air-refrigeration cycle on  $p$ - $V$  and  $T$ - $s$  diagrams.

[Anna Univ. Nov'03]

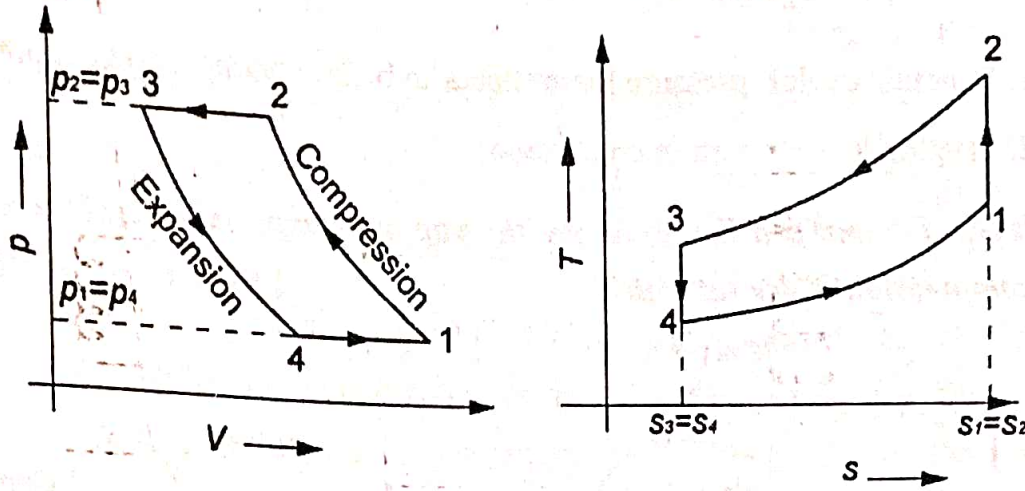


Figure 5.139  $p$ - $V$  and  $T$ - $s$  diagrams

5. Define tonne of refrigeration. Heat is removed from a space at a rate of 42,000 kJ/h. Express this heat removal rate in tons.

[Anna Univ. May'05]

Definition is same as previous Q3.

Heat removed,  $Q = 42000 \text{ kJ/h} = 700 \text{ kJ/min}$

$$1 \text{ tonne of refrigeration} = 210 \text{ kJ/min} = \frac{700}{210} = 3.33 \text{ tonnes} \quad \text{Ans. } \rightarrow$$

6. Define the COP of refrigerators.

[Anna Univ. Nov'07 & Dec'10]

Coefficient of performance (COP) is defined as the ratio of heat absorbed by the evaporator or refrigeration effect to the compressor work.

$$\text{COP} = \frac{\text{Refrigeration effect}}{\text{Work done}}$$

7. A Carnot refrigerator requires 1.3 kW per tonne of refrigeration to maintain a region at low temperature of  $-38^\circ \text{C}$ . Determine the COP of the refrigerator and the higher temperature of the cycle.

[Anna Univ. May'07]

1 tonne of refrigeration = 3.5 kW of heat will be removed

Heat required = 1.3 kW

$$\text{COP} = \frac{\text{Refrigeration effect}}{\text{Work done}} = \frac{3.5}{1.3} = 2.69$$

$$\text{Carnot COP} = \frac{T_2}{T_1 - T_2} = \frac{235}{T_1 - 235}$$

$$\therefore T_1 = 322.36 \text{ K} = 49.36^\circ \text{C}$$

Ans.  $\rightarrow$

8. How does the actual vapor compression cycle differ from that of the ideal cycle?

[Anna Univ. Apr'05]

1. In actual cycles, pressure losses occur in both condenser and evaporator.
2. Friction losses occur in compressor.

9. Sketch the T-s and p-h diagrams for the vapour compression cycle when the vapour after compression is dry saturated.

[Anna Univ. Dec'11 & May'16]

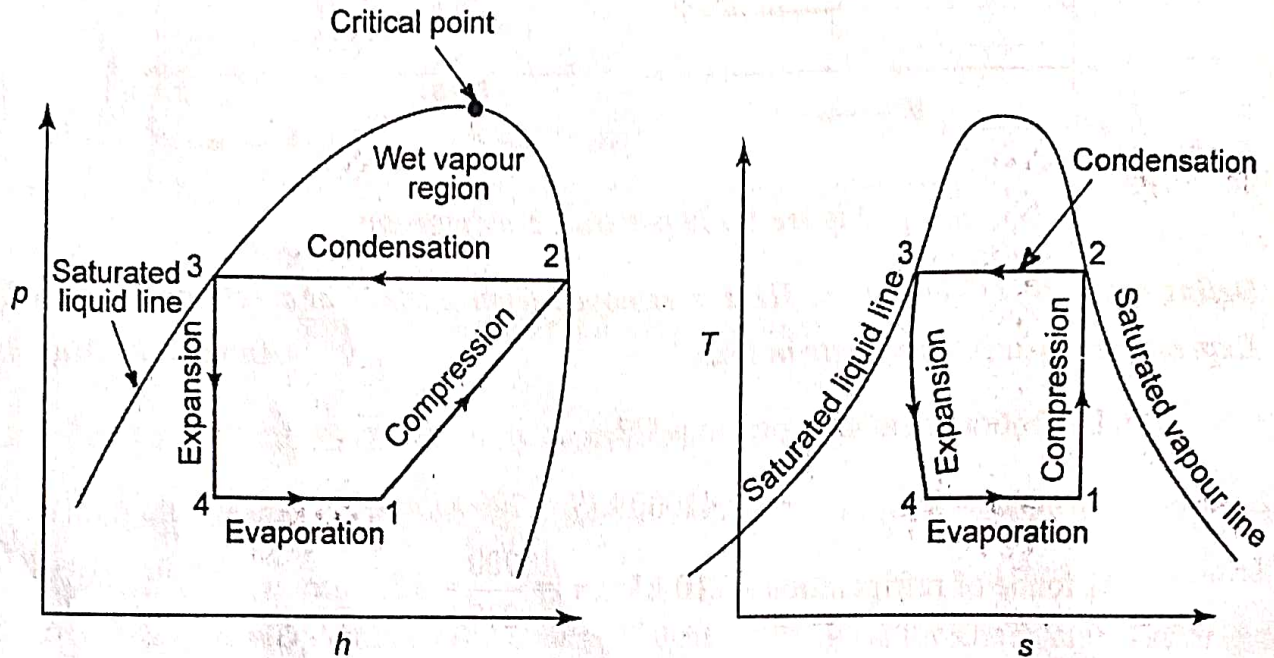


Figure 5.140

10. What is meant by refrigeration?

[Anna Univ. Nov'10]

Refrigeration is the process of providing and maintaining the temperature in space below atmospheric temperature.

11. What is the function of the throttling valve in vapour compression refrigeration system?

[MU-Oct'99]

The function of throttling valve (Expansion valve) is to allow the liquid refrigerant under high pressure and temperature to pass at controlled rate after reducing its pressure and temperature.

12. Name any four commonly used refrigerants.

[MU-Oct. 2000]

1. Ammonia ( $\text{NH}_3$ )
2. Carbon dioxide ( $\text{CO}_2$ )
3. Sulphur dioxide ( $\text{SO}_2$ )
4. Freon - 12

21. What is net refrigerating effect of the refrigerant?

[Apr'97]

Refrigerating effect is the total heat removed from the refrigerant in the evaporator.

$$\text{COP} = \frac{\text{Refrigeration effect}}{\text{Work done}}$$

$$\text{Refrigeration effect} = \text{COP} \times \text{Work done}$$

22. Name the various components used in simple vapour absorption system.

[Anna Univ. Apr'96 & Dec'13]

1. Absorber
2. Pump
3. Generator
4. Condenser
5. Throttle valve
6. Evaporator.

23. What types of condensers are in common used for vapour absorption refrigeration system?

[Oct'96]

Water-cooled condensers are commonly used for vapour absorption refrigeration system.

24. What is the function of analyzer and rectifier in an absorption system?

Analyser prevents water vapours from entering the condenser. It helps in preventing the choking of pipelines. Even after passing through the analyzer if any water vapours present that will be removed in the rectifier.

25. What is the purpose of generator assembly in vapour absorption refrigeration system?

[Anna Univ. Nov'10]

The function of generator is to heat the strong solution to form vapour of the refrigerant.

26. What is the difference between wet compression and dry compression?

[Anna Univ. Apr'08, May'11 & May'12]

In wet compression, the compression starts between saturated liquid and saturated vapour region. The vapour enters the compressor at wet vapour conditions.

In dry compression, the compression starts with saturated vapour. The vapour enters the compressor at dry vapour conditions.