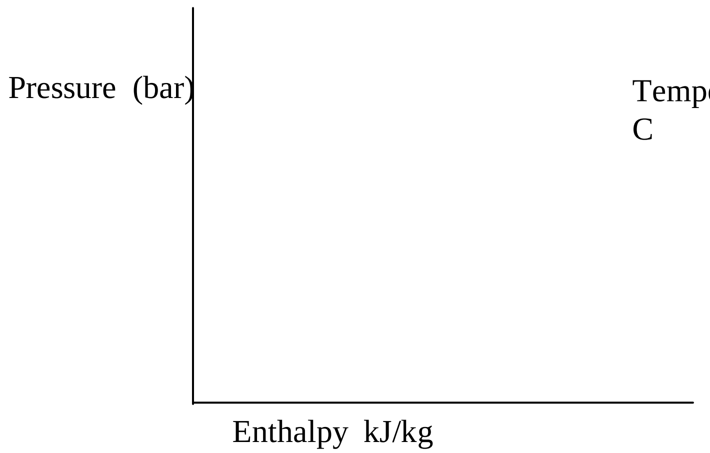
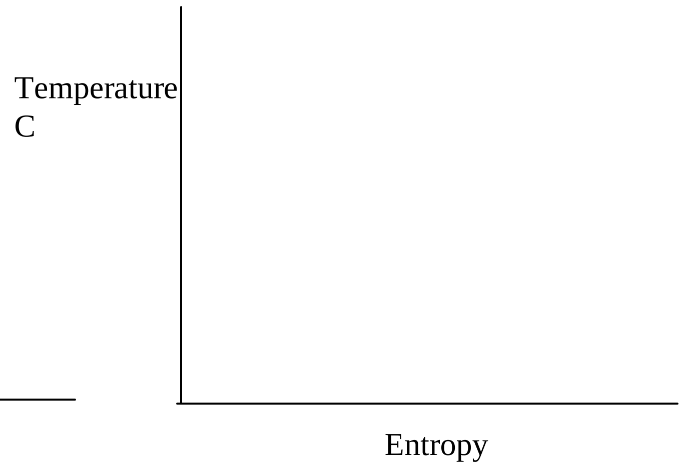
Refrigeration (contd)

PRESSURE ENTHALPY DIAGRAMS

Pressure-enthalpy diagrams are useful in designing and analyzing vapor compression refrigeration systems.
These diagrams are available for all types of refrigerants.





MATHEMATICAL EXPRESSIONS USEFUL IN THE ANALYSIS OF VAPOR-COMPRESSION REFRIGERATION

COOLING LOAD:

A common unit of cooling load is "ton of refrigeration"

1 ton of refrigeration = 288,000 Btu/24 hr
= 303,852 kJ/24 hr

REFRIGERANT FLOW RATE

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refrigerant flow rate $= \frac{\textbf{Cooling Load}}{\mathbf{H_2 - H_1}}$

COMPRESSOR

The work done on the refrigerant during the compression step is the

rate of work done on the compressor = (refrigerant flow rate) (H_3-H_2)

CONDENSER

The heat rejected to the environment in the condenser depends upon the

heat rejected
in the = (refrigerant flow rate) (H_3-H_1)
condenser

EVAPORATOR

The heat absorbed by the evaporator depends upon the

heat absorbed
by the = (refrigerant flow rate) (H_2-H_1)
evaporator

COEFFICIENT OF PERFORMANCE

The coefficient of performance is a ratio between the heat absorbed by the refrigerant as it flows through the evaporator to the heat equivalent of the energy supplied to the compressor:

EXAMPLE:

A LOW AIR VELOCITY freezer room is cooled by a vapor compression refrigeration system that uses ammonia. The refrigeration load is 5 tons. The evaporator temperature is -10 C and the condenser temperature is 40 C . Calculate the mass flow of refrigerant, the compressor horsepower requirements, the heat discharged at the condenser, and the C.O.P.

SOLUTION:

From the Pressure Enthalpy diagram,

H_1 =

H_2 =

H_3 =

Refrigerant Flow Rate =

Compressor Horsepower =

Heat Discharged at the Condenser =

C.O.P. =