

**Attempt All Questions. Assume Any Missing Data. Thermodynamics Tables and Charts Are Allowed.**

**Question (1)**

1.a Define Refrigerating effect, Refrigerating capacity, Effective temperature, Dew point depression, Moisture content, Humidity ratio, Degree of saturation, Compressor capacity, Clearance volume, and Ton of refrigeration.

1.b Explain briefly the working of a vortex tube.

1.c A Bell-Coleman refrigerator works between 5 bar and 1 bar limits. The air is cooled to 27°C after compression. The refrigeration capacity is 30 kW at 0°C. The efficiency of compressor is 0.9 and that of expander is 0.85. Determine

i. The C.O.P.

ii. The air flow in kg/min.

iii. The piston displacement of compressor and expander.

**Question (2)**

2.a Why in practice a throttle valve is used in vapour compression refrigerator rather an expansion cylinder to reduce pressure between the condenser and evaporator?

2.b What is the effect of clearance volume in a reciprocating compressor?

2.c In a 30 TR vapour compression system using R12 the evaporation temperature is -13°C and the condensation temperature is 27°C. A liquid-suction vapour heat exchanger to subcool the liquid to 20°C. Sketch the cycle on P-h and T-s diagram and determine

i. The mass of refrigerant circulated per minute.

ii. The power required to drive the compressor.

iii. The piston displacement of the compressor.

iv. The C.O.P.

**Question (3)**

3.a What are the factors considered for the selection of refrigerant?

3.b An Ammonia vapour compression system is shown in Fig. (1.a) and Fig. (1.b). Draw both cycles on P-h diagram and determine

i. The power required to run the system in Fig. (1.a).

ii. The C.O.P. for the system in Fig. (1.b).

**Question (4)**

4.a Explain briefly cooling with humidification and how it is achieved in practice.

4.b Explain briefly the working of evaporative condenser.

4.c An air conditioned hall having sensible and latent heat loads of 35 kW and 17 kW respectively is to be maintained at 26°C DBT and 50% R. H. when outside conditions are 38°C DBT and 28°C WBT. Assuming by-pass factor of 0.05. Determine

i. R.S.H.F.

ii. Supply air condition.

- iii. Rate of supply air.
- iv. Cooling coil load.
- v. Rate of water condensed.

**Question (5)**

5.a Why the fluid from Lithium Bromide system can not leak?. Why are rectifier and analyzer necessary in Ammonia-water absorption system?

5.b Explain the working of thermoelectric cooling.

5.c In a vapour absorption system heat is supplied to the generator at  $127^{\circ}\text{C}$ . The evaporator and condenser temperatures are  $-3^{\circ}\text{C}$  and  $27^{\circ}\text{C}$  respectively. Determine the rate of heat added to the generator per T.R if the actual C.O.P. is 0.6 of the maximum C.O.P.

5.d Design the duct system shown in Fig. (2) using the equal friction method. The total pressure available for the duct system is 40 Pa. The pressure loss for each diffuser at the specified flow rate is 6 Pa. Equivalent length at A = 10 m, at B = 1.5 m, C = 4 m, D = 3 m, E = 5 m.

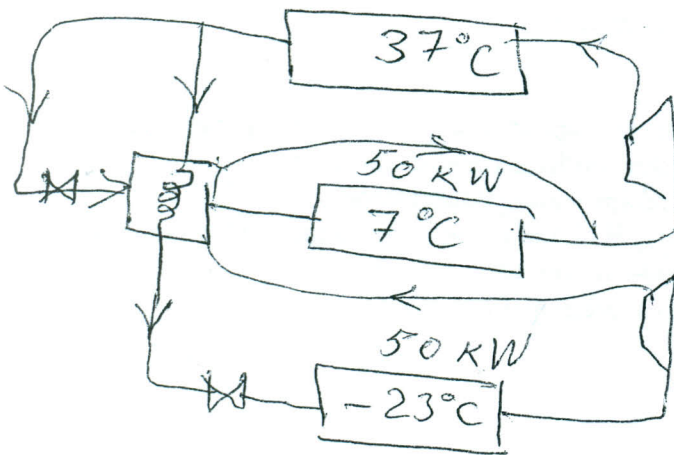


Fig. (1.a)

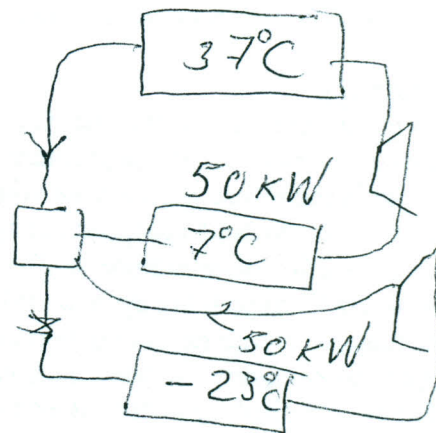


Fig. (1.b)

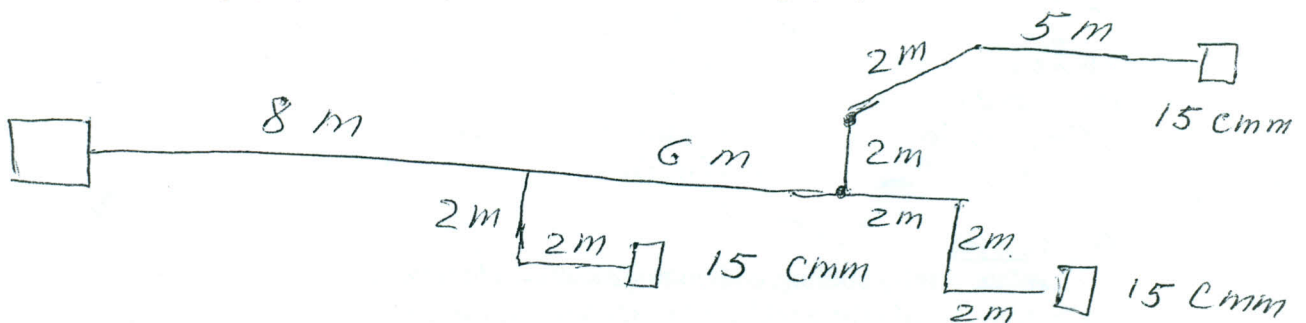


Fig. (2)

Gook Luck  
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