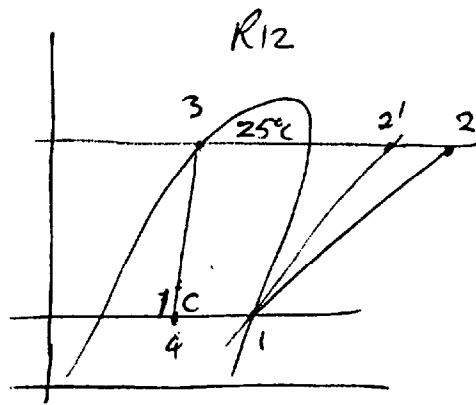


Q. 7



$$\text{Heating effect} = \dot{m} (h_2 - h_3) = 10 \text{ kW}$$

$$\text{From tables } h_1 = 187.94 \text{ kJ/kg. } h_3 = 59.7 \text{ kJ/kg}$$

$$\text{From chart } h_{2'} = 200.5 \text{ kJ/kg.} \quad 3$$

$$\frac{h_{2'} - h_1}{h_2 - h_1} = 0.6 \quad \therefore h_2 = \underline{208.87 \text{ kJ/kg}}$$

$$\therefore 10 = \dot{m} (208.87 - 59.7)$$

$$\therefore \dot{m} = \underline{0.06704 \text{ kg/s}} \quad 2$$

$$\text{Refrig effect} = \dot{m} (h_1 - h_4)$$

$$= 0.06704 (187.94 - 59.7)$$

$$= \underline{8.56 \text{ kW}} \quad 3$$

$$\text{Area of evaporator } h_x = \frac{8.56}{0.5 \times 5} = \underline{\underline{3.44 \text{ m}^2}} \quad 1$$

$$\text{Chart COP}_{hp} = \frac{h_2 - h_3}{h_2 - h_1} = \frac{208.87 - 59.7}{208.87 - 187.94} = 7.127$$

$$\text{Actual COP}_{hp} = 0.7 \times 7.127 = \underline{\underline{4.99}}. \quad 2$$

$$\therefore \text{Power input} = \frac{10}{4.99} = \underline{\underline{2 \text{ kW}}} \quad 2$$

$$\text{Cost/hour HP} = 2 \times 8.2 = 16.4 \text{ p/h}$$

$$\text{Cost/hour Gas} = 10 \times 2.3 = \underline{\underline{23 \text{ p/h.}}} \quad 2$$

c.e. Cheaper by HP!