

Probl^m. In a simple V-C cycle, following are the properties of refrigerant at various points -
 compr. inlet: $h_1 = 183.2 \text{ kJ/kg}$; $v_1 = 0.0767 \text{ m}^3/\text{kg}$
 compr. exit: $h_2 = 222.6 \text{ kJ/kg}$; $v_2 = 0.0614 \text{ m}^3/\text{kg}$
 condenser exit: $h_3 = 84.9 \text{ kJ/kg}$; $v_3 = 0.00083 \text{ m}^3/\text{kg}$.
 The swept volume for the compressor is 1.5 l & its volumetric efficiency is 80% , compressor speed is equal to 1600 rpm . Find

i) power rating of compressor in kW.

ii) refrigeration capacity in kW.

Solⁿ. $V_s = 1.5 \text{ l}$, $\eta_v = 0.80$, $N = 1600$
 $= 1.5 \times 10^{-3} \text{ m}^3$ [$1 \text{ l} = 10^{-3} \text{ m}^3$]

$$\eta_v = \frac{\dot{m} v_1}{\frac{\pi}{4} D^2 \times L \times N \times K} = \frac{\dot{m} v_1}{V_s \times N \times K}$$

$$0.80 = \frac{\dot{m} \times 0.0767 \times 60}{1.5 \times 1600 \times 1 \times 10^{-3}}$$

$$\dot{m} = 0.417$$

$$h_1 = 176.5 \text{ kJ/kg}$$

$$h_3 = h_f \text{ at } 35^\circ \text{C}$$

$$h_3 = 69.6 \text{ kJ/kg}$$

$$\text{COP} = \frac{176.5 - 69.6}{225.5 - 176.5}$$

$$\text{COP} = 2.102$$

$$\text{RC} = 5 = \dot{m} (h_1 - h_3)$$

$$5 = \dot{m} (176.5 - 69.6)$$

$$\dot{m} = 0.046 \text{ kg/sec Ans.}$$

$$P_{in} = \dot{m} (h_2 - h_1)$$

$$P_{in} = 0.046 (225.5 - 176.5)$$

$$P_{in} = 2.29 \text{ kW Ans.}$$