

$$Gr = \frac{\rho^2 \beta g l^3 \Delta T}{\mu^2}$$

For air at 300°C (surface temp.)

$$\rho = \frac{1}{1.624} = 0.6158 \text{ kg/m}^3$$

$$\mu = 0.030 \times 10^{-3} \text{ kg/sm}$$

$$Pr = 0.69 \text{ \& } \lambda = 0.045 \text{ W/mK}$$

For air at 17°C

$$\beta = \frac{1}{T} = \frac{1}{273+17} = \frac{1}{290}$$

$$\therefore Gr = \frac{(0.6158)^2 \frac{1}{290} \times 9.81 \times (150 \times 10^{-3})^3 (300-17)}{(0.030 \times 10^{-3})^2}$$

$$= 13.61 \times 10^6$$

$$\therefore Nu = 0.527 \cdot 0.69^{\frac{1}{2}} (0.69 + 0.952)^{\frac{1}{4}} (13.61 \times 10^6)^{\frac{1}{4}}$$

$$= 23.49$$

$$h = \frac{\lambda Nu}{d} = \frac{0.045 \times 23.49}{150 \times 10^{-3}} = \underline{7 \text{ W/m}^2\text{K}}$$

$$\dot{Q} = h A \Delta T = 7 \times \pi \times 150 \times 10^{-3} \times 1 (300-17)$$

$$= \underline{940 \text{ W/m}}$$