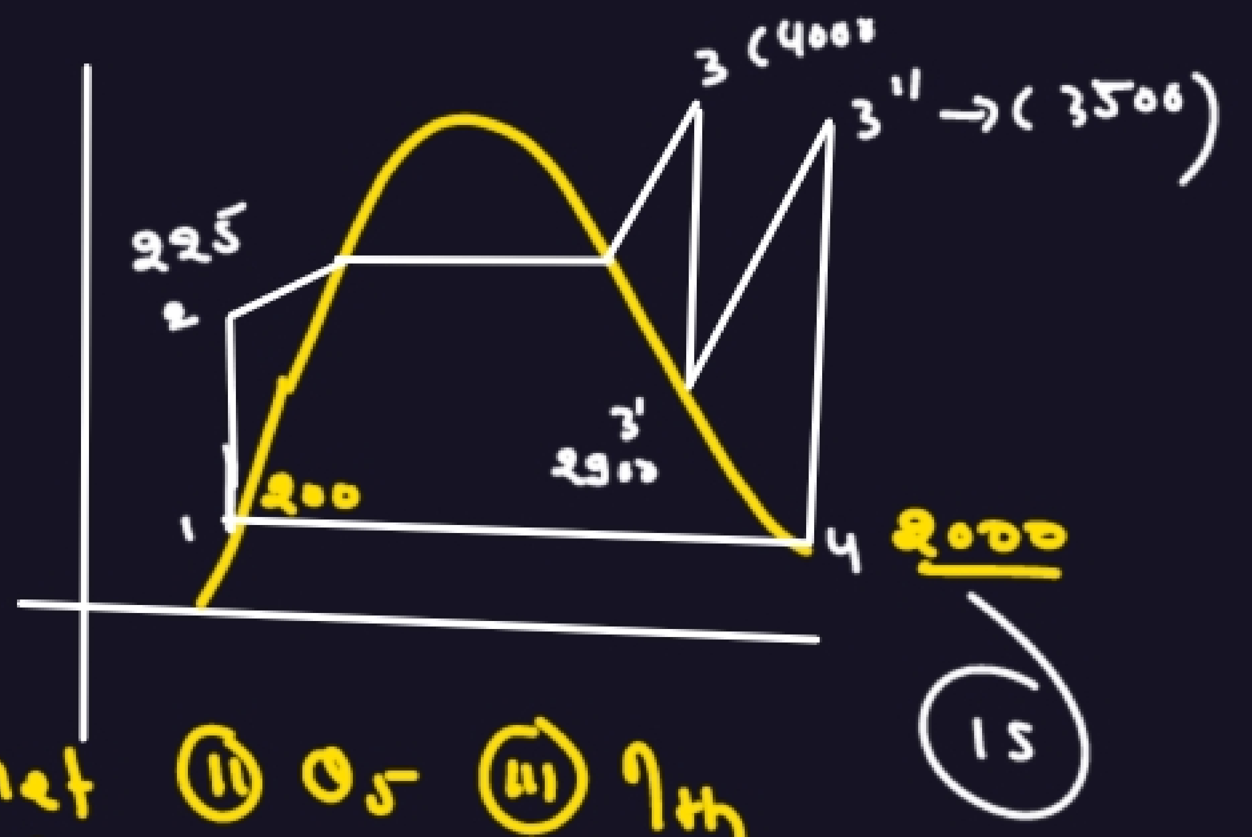
Ans:



(i) w_{net} (ii) Q_S (iii) η_{th}

$$w_T = (h_3 - h_3') + (h_3'' - h_4)$$
$$= (4000 - 2900) + (3500 - 2000)$$
$$\Rightarrow w_T = 1100 + 1500 = 2600 \text{ kJ/kg}$$

$$\& \ w_P = h_2 - h_1 = 225 - 200 = 25 \text{ kJ/kg}$$

$$w_{net} = w_T - w_P = 2600 - 25 = 2575 \text{ kJ/kg}$$

$$Q_S = (h_3 - h_2) + (h_3'' - h_3')$$
$$= (4000 - 225) + (3500 - 2900)$$
$$= 3775 + 600$$
$$= 4375 \text{ kJ/kg}$$

$$Q_R = h_4 - h_1 = 2000 - 200 = 1800 \text{ kJ}$$

$$w_{net} = Q_S - Q_R = (w_T) - w_P$$
$$= 4375 - 1800$$
$$= (\quad)$$

$$\eta_{th} = \frac{W_{net}}{Q_S} = 1 - \frac{Q_R}{Q_S}$$

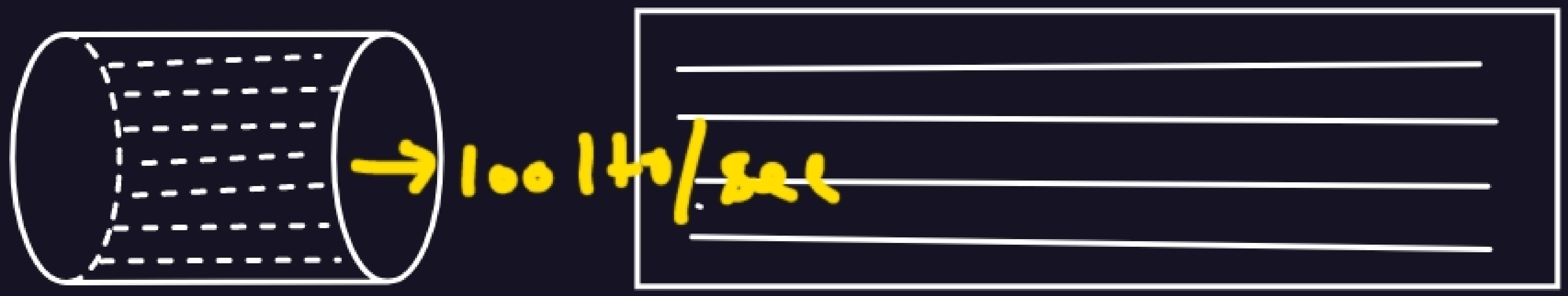
$$\eta_{th} = \frac{2575}{4375} \times 100$$

$$\eta_{th} = 58.85\%$$

$$r_b = \frac{W_P}{W_T} = \frac{25}{2600} = 0.961\%$$

$$W.R = \frac{W_{net}}{W_T} = 1 - r_b$$

Que:



Given data

$\mu = 1$ Pa-s

D = 100cm , V = 100cm/s

S = 0.85

L = 2m

find (1) flow Pattern

(2) u_{max}

(3) Pressure drop

Sol⇒:

$Re = \frac{\rho V D}{\mu} = \frac{850 \times 1 \times 1}{1}$

$Re = 850$

Re < 2000 (flow is laminar)

$Q = A u_{avg}$

$0.1 = \frac{\pi}{4} \times 1^2 \times u_{avg}$

$u_{avg} = \frac{0.1 \times 4}{\pi}$ m/s

$u_{max} = 2 u_{avg}$

$= 2 \times \frac{0.4}{\pi}$ m/s

$P_1 - P_2 = \left(\frac{32 \mu u_{avg} L}{D^2}\right)$ Pa