Nishant Jindal

# THERMODYNAMICS

30

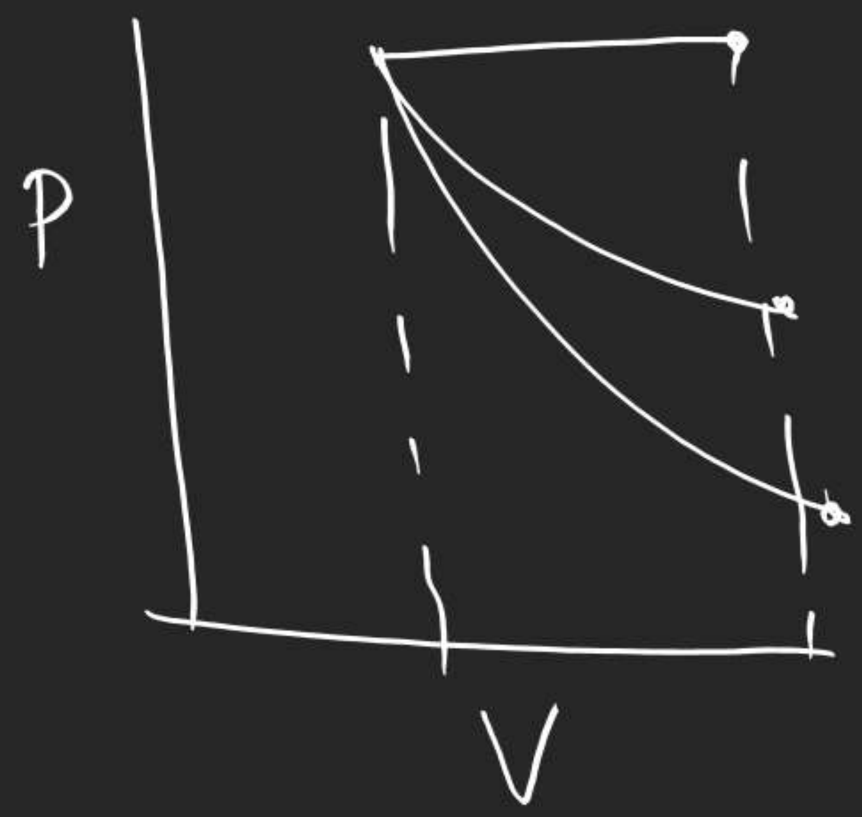
$$W_{AB} = -P_0(2V_0 - V_0) = -P_0V_0$$

$$W_{BC} = -2P_0V_0 \ln 2$$

$$W_{CD} = -\frac{P_0}{2}(2V_0 - 4V_0) = P_0V_0$$

34

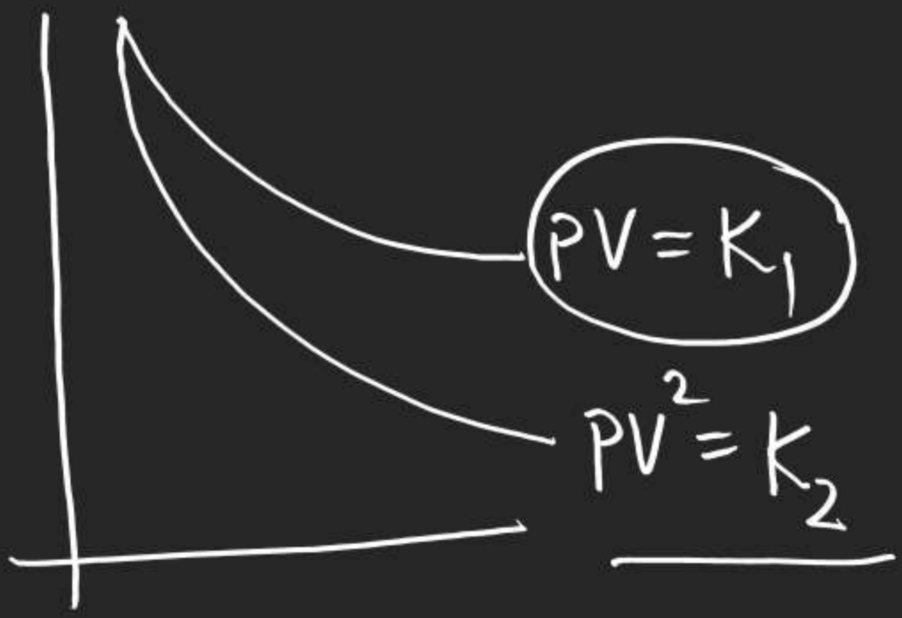
42




43

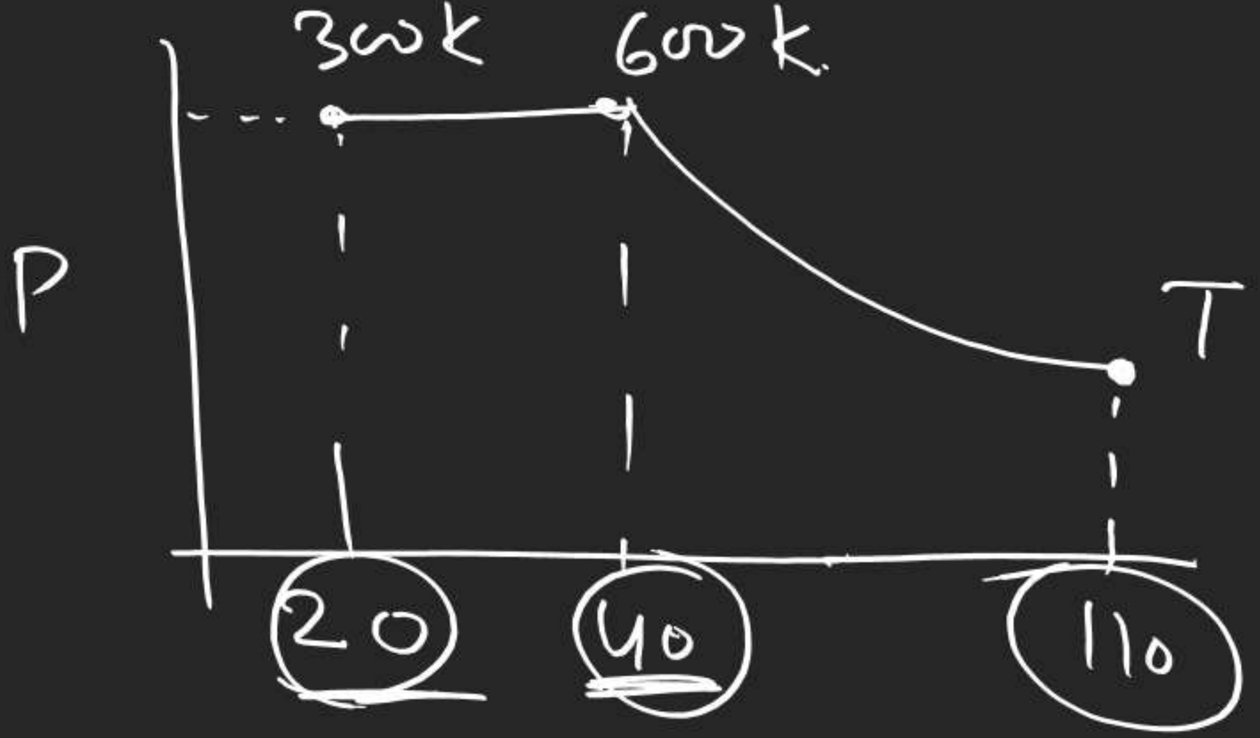
$$\Delta H = nC_p\Delta T$$

44



# THERMODYNAMICS

36




$$T V^{\gamma-1} = \text{Const}$$

37

$$(1\ \text{atm}, 30\ K) \longrightarrow (2, T)$$

# THERMODYNAMICS

38

$PV^{-2} = \text{Const}$ $\quad x = -2$

$$C = C_V - \frac{R}{x-1}$$

$$= \frac{3}{2}R - \frac{R}{-3}$$

$$= \frac{3}{2}R + R/3 = \frac{11R}{6}$$

$$Q = nC\Delta T$$

$$\Delta U = nC_V\Delta T$$

$$W = \frac{nR\Delta T}{x-1}$$

$$PV^{-2} = C$$

$$\frac{nRT}{V}V^{-2} = C$$

$$TV^{-3} = \text{Const}$$

$$T = CV^3$$

$$\frac{T_2}{T_1} = \left(\frac{V_2}{V_1}\right)^3 = \left(\frac{2}{1}\right)^3$$

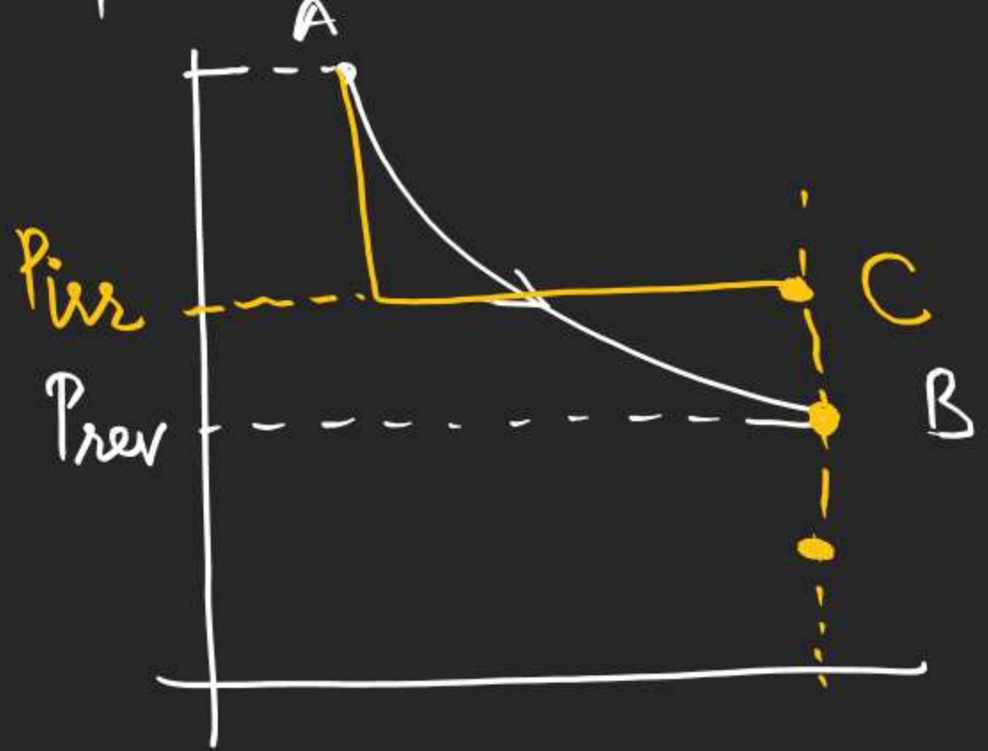
$$\frac{T_2}{100} = 8$$

Nishant Jindal

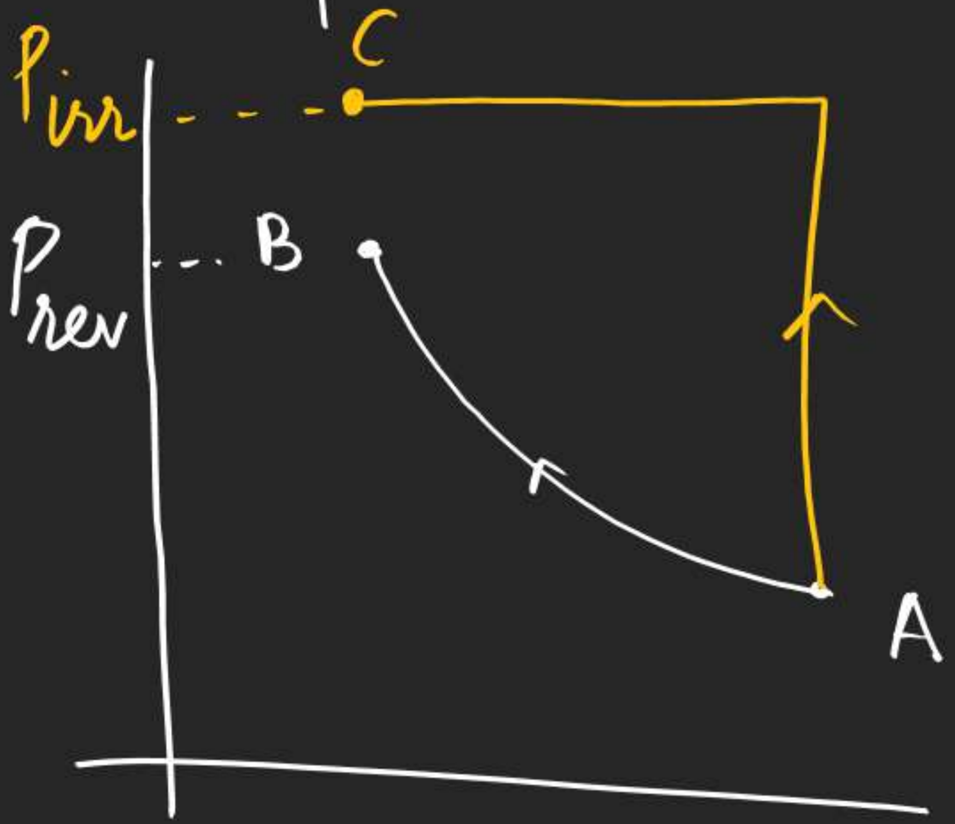
THERMODYNAMICS

Case-II for same final volume

① Expansion



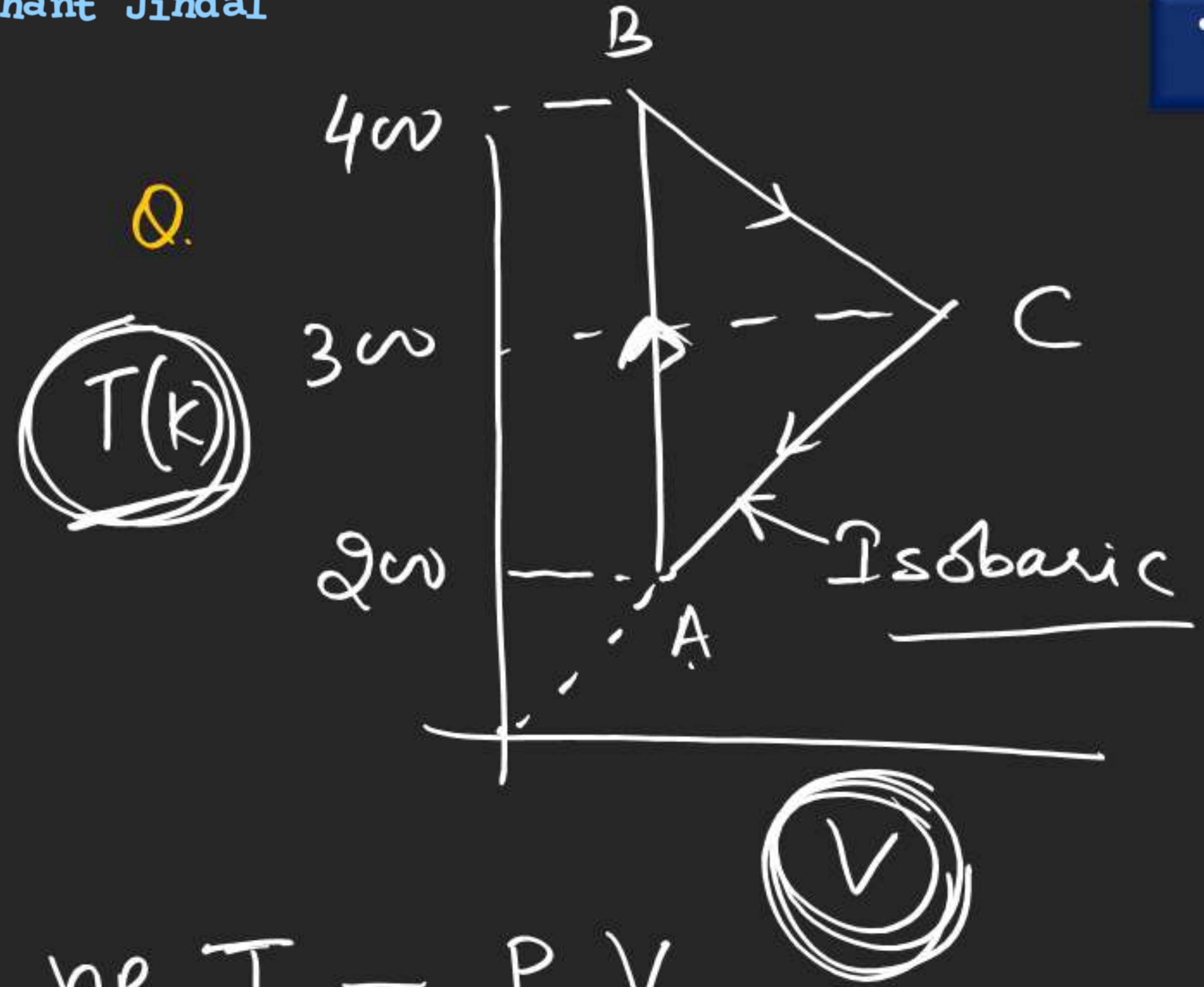

Comp$^n$



Nishant Jindal

# THERMODYNAMICS

Q.




Calculate $W_{BC}$ for 1mol ideal gas

if $Q_{Total} = 600$ cal.

$\Delta U_{Total} = 0$

$W_{Total} = -Q_{Total} = -600$

$W_{AB} + W_{BC} + W_{CA} = -600$

$0 + W_{BC} - nR\Delta T = -600$

$W_{BC} - 1 \times 2(-100) = -600$

$W_{BC} = -800$

$nRT = PV$

$T = \frac{P}{nR} V$

$-300$

$-900$

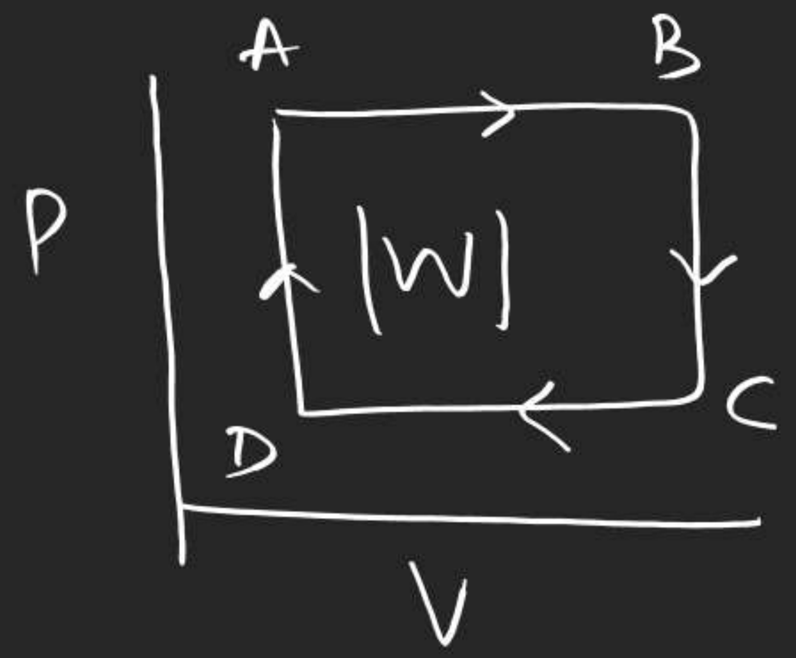
$-4300/3$

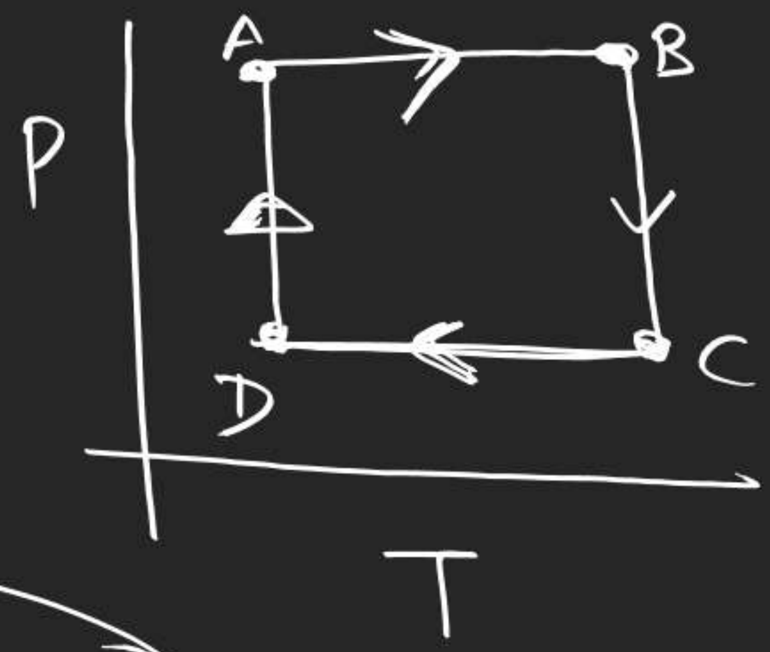
$-800$

$-600$

Nishant Jindal

# THERMODYNAMICS

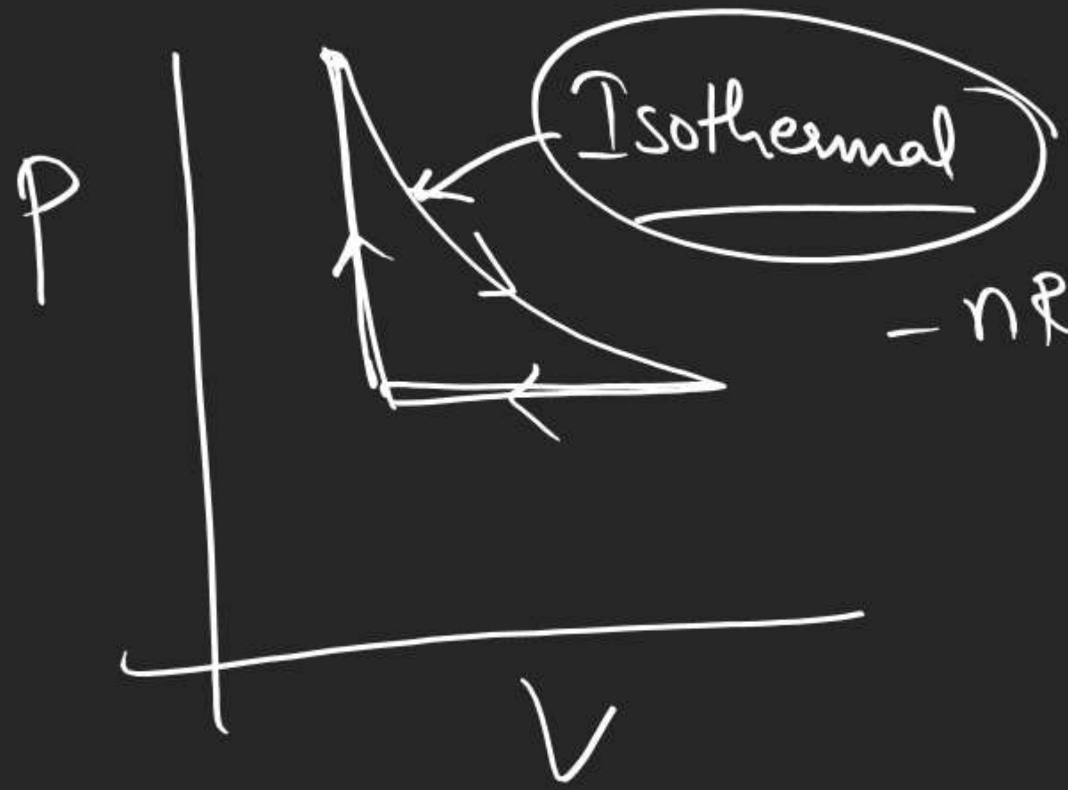



Isothermal

$$W_{Total} = \underbrace{W_{AB}}_{} + \underline{W_{BC}} + \underbrace{W_{CD}}_{} + \underline{W_{DA}}$$

Isobaric




$$-nRT\ln\frac{V_2}{V_1}$$

Nishant Jindal

# THERMODYNAMICS

## Entropy (S)

$$dS = \left(\frac{q_{rev}}{T}\right)$$

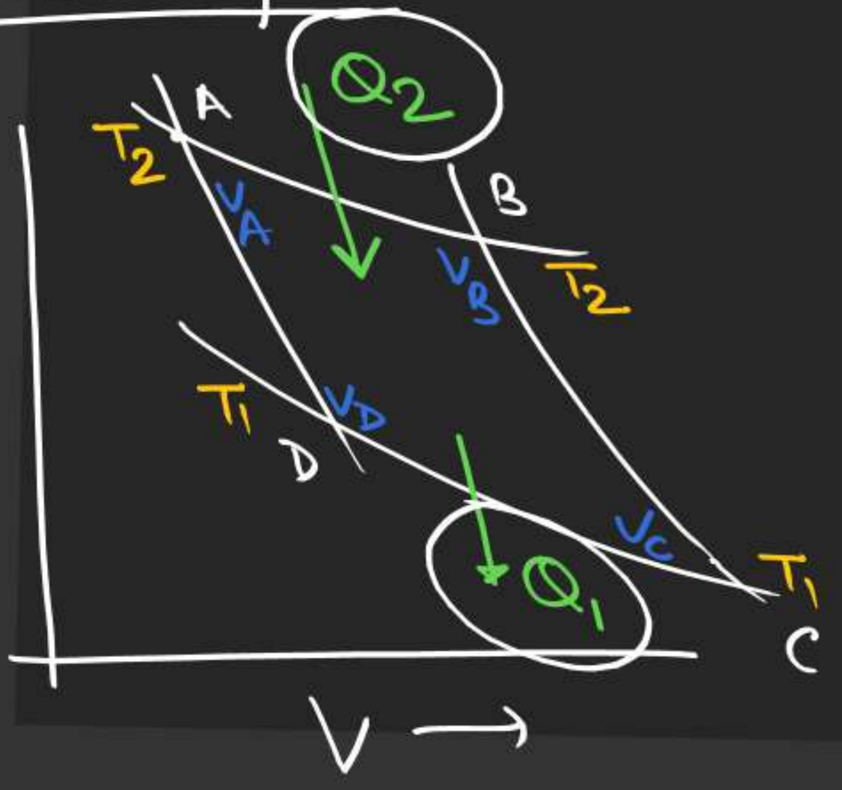
$$\Delta S = \int \frac{q_{rev}}{T}$$

$$\oint d\phi = 0$$

# Carnot cycle

$W = -50\ \text{kJ}$

work done by the system $= 50\ \text{kJ}$




AB : Isothermal expansion

$Q_2 = -W_{AB} = nRT_2 \ln V_B/V_A$

BC : Adiabatic exp

$W_{BC} = nC_v(T_1 - T_2)$

CD : Isothermal compn

$Q_1 = -W_{CD} = nRT_1 \ln V_D/V_C$

DA : Adiabatic compn

$W_{DA} = nC_v(T_2 - T_1)$

$$W_{Total} = W_{AB} + \cancel{W_{BC}} + W_{CD} + \cancel{W_{DA}}$$

$$W_{Total} = W_{AB} + W_{CD}$$

$$\eta = \frac{\text{Total work done by the system}}{\text{Heat supplied}} \times 100$$

$$= \frac{-W_{Total}}{Q_2} \times 100$$

$$\eta = \frac{-W_{AB} - W_{CD}}{Q_2} \times 100$$

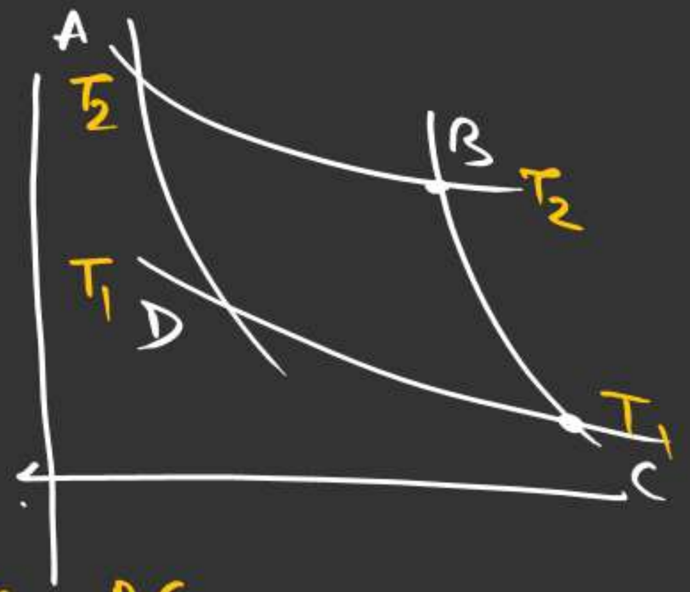
$$\boxed{\eta = \frac{Q_2 + Q_1}{Q_2} \times 100}$$

for rev as well as irrev carnot cycle

Nishant Jindal

for rev carnot cycle

$$\eta = \frac{nRT_2 \ln V_B/V_A + nRT_1 \ln V_D/V_C}{nRT_2 \ln V_B/V_A} \times 100$$




$$\boxed{\eta = \frac{T_2 - T_1}{T_2} \times 100}$$

for rev carnot cycle only

for rev and irrev

$$\boxed{\eta = \frac{Q_2 + Q_1}{Q_2} \times 100}$$

for BC

$$T_2 V_B^{\gamma-1} = T_1 V_C^{\gamma-1}$$

for AD

$$T_2 V_A^{\gamma-1} = T_1 V_D^{\gamma-1}$$

$$\frac{V_B}{V_A} = \frac{V_C}{V_D}$$

# THERMODYNAMICS

0 – I

S – 1

0 – II   1 – 10