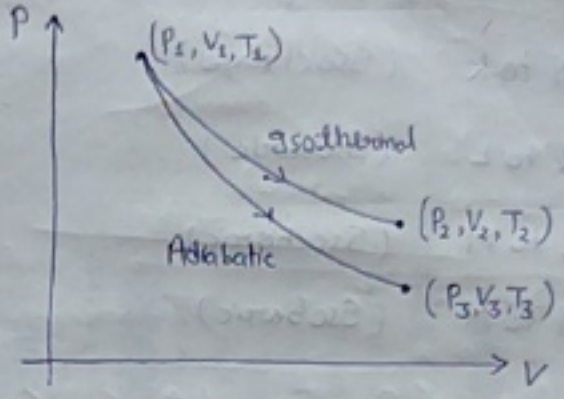
(EXERCISE – J- ADVANCED)

Solution-1 (Ans- A, D)



(A) $\boxed{T_1 = T_2}$

(Isothermal path)

(B) $T_3 < T_2 (= T_1)$

final temperature (for same volume expansion, from same initial state) of Adiabatic expansion is less than Isothermal expansion

ie $T_1 = T_2$ (Isothermal Expansion)

$T_3 < T_1$ (Adiabatic expansion)

(C) Area under P-V curve for

$A_{Isothermal} > A_{Adiabatic}$

$W_{Isothermal} < W_{Adiabatic}$ [$W = -A$ expansion]

(D) $\Delta U = n C_{vm} \Delta T$ (ideal gas)

$\Delta T_{Isothermal} = 0$

$\Delta T_{Adiabatic} < 0$ $(T_3 < T_1)$

So $\boxed{\Delta U_{Isothermal} > \Delta U_{Adiabatic}}$

Solution-2 → (Ans - B)

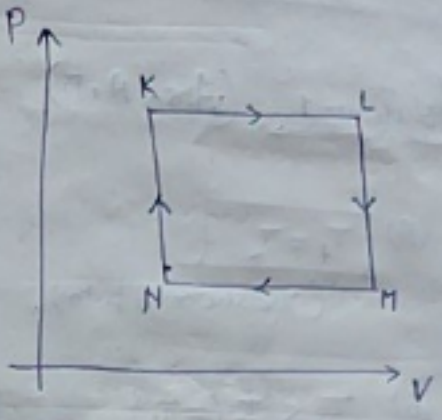
From P-V graph

N to K (Isochoric)

K to L (Isobaric)

L to M (Isochoric)

M to N (Isobaric)



So pair of Isochoric path (V: Constant) is L to M and N to K

Solution-3 → (Ans - C)

K to L (Isobaric)

P: Constant

$V \propto T$

V is increasing so Heating

L to M (Isochoric)

V: Constant

$P \propto T$

P is decreasing so cooling

M to N (Isobaric)

P: Constant

$V \propto T$

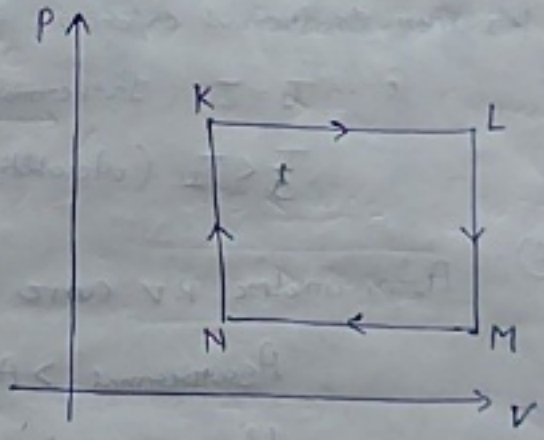
V is decreasing so cooling

N to K (Isochoric)

V: Constant

$P \propto T$

P is increasing so Heating



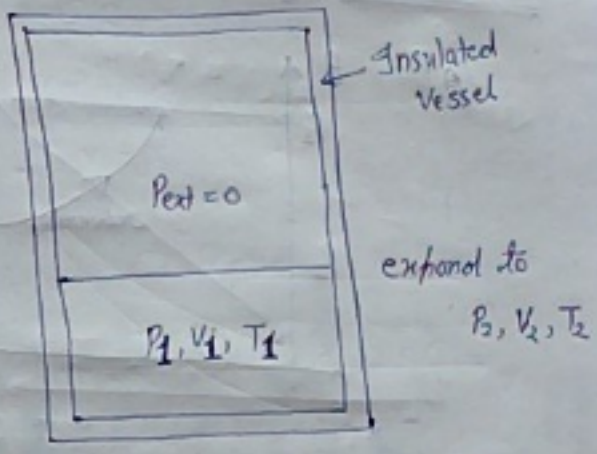
So option is

Heating, cooling, cooling, Heating

Solution-4 → (Ans. A,B,C)

(A) $\boxed{q = 0}$

(Insulated vessel)



(B) $w = 0$ ($P_{ext} = 0$)

$\Delta U = q + w$

$0 \quad 0$

$\Delta U = 0$

$\Rightarrow n C_{vm} \Delta T = 0$ (Ideal gas)

$\Rightarrow \Delta T = 0$

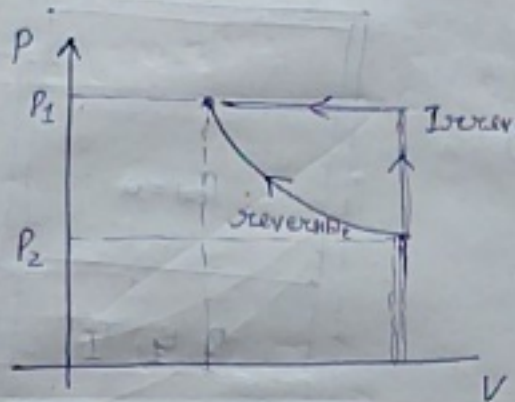
$\Rightarrow \boxed{T_1 = T_2}$

(C) $\boxed{P_1 V_1 = P_2 V_2}$ ($T_1 = T_2$)

(D) $P_1 V_1^{\gamma} \neq P_2 V_2^{\gamma}$ (Irreversible, $P_{ext} = 0$, $P_{ext} \neq P_{gas}$)

Solution-5 → (Ans - A B. D)

(A)



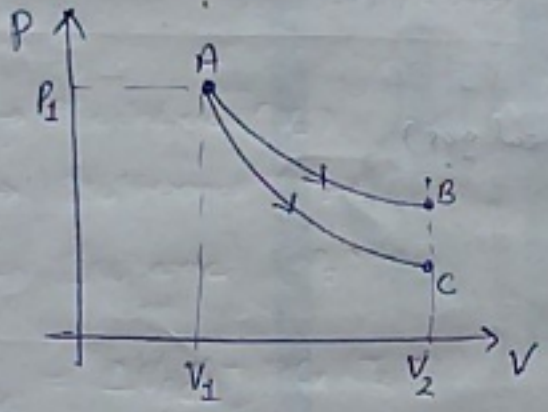
Area under P-V curve

$A_{irr} > A_{rev}$

$W = +A$ (Compression)

$\boxed{W_{irr} > W_{rev}}$

(B)



AB: Reversible Isothermal

AC: Reversible Adiabatic

$A_{AB} > A_{AC}$ (Area)

$W_{AB} < W_{AC}$ [$W = -A$ expansion]

$\boxed{|W_{AB}| > |W_{AC}|}$

C) (i) $\Delta U = nC_{vm}\Delta T = 0$ (Isothermal $\Delta T = 0$)

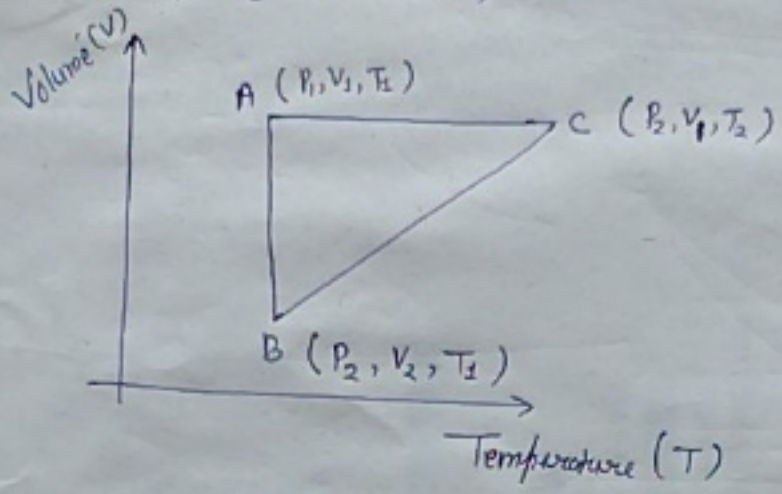
(ii) $\Delta U = q + W = -ve$ ($q = 0$, $W < 0$)

So $\Delta U = nC_m\Delta T \Rightarrow \boxed{\Delta T < 0}$

D) $q = 0$ (adiabatic), $W = 0$ (free expansion)

$\Delta U = 0 \Rightarrow \boxed{\Delta T = 0}$ (Isothermal)

Solution-6 → (Ans - B, C)



AC → Isochoric (V_1)

AB → Isothermal (T_1)

BC → Isobaric (P_2)

(A)* $q_{AC} = \Delta U_{BC} = nC_v(T_2 - T_1)$ $\left[q_{AC} = \Delta U_{AC} = \Delta U^{\overset{0}{\text{Isothermal}}}_{AB} + \Delta U_{BC} = \Delta U_{BC}\right]$

$w_{AB} = -nRT_1 \ln\left(\frac{V_2}{V_1}\right)$

But given $w_{AB} = P_2(V_2 - V_1)$ → (A wrong)

(B)* $q_{BC} = \Delta H_{BC} = \Delta H^{\overset{0}{\text{Isothermal}}}_{BA} + \Delta H_{AC} = \Delta H_{AC}$

$q_{BC} = \Delta H_{AC} = nC_p(T_2 - T_1)$

$\boxed{w_{BC} = -P_2(V_1 - V_2)}$ → (B - correct)

(C)* $nC_p(T_1 - T_2) < nC_v(T_1 - T_2)$

$\boxed{\Delta H_{CA} < \Delta U_{CA}}$ (C - correct)

(D)* $\Delta H_{CA} < \Delta V_{CA}$ (D - wrong)