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THERMODYNAMICS

12

A: 500 K, 5 bar $\longrightarrow$ B: 500 K, 2 bar $\xrightarrow{V = \text{Const}}$ C: 250 K, 1 bar $\longrightarrow$ D

D:
$T = ?$
$P = 3$ bar

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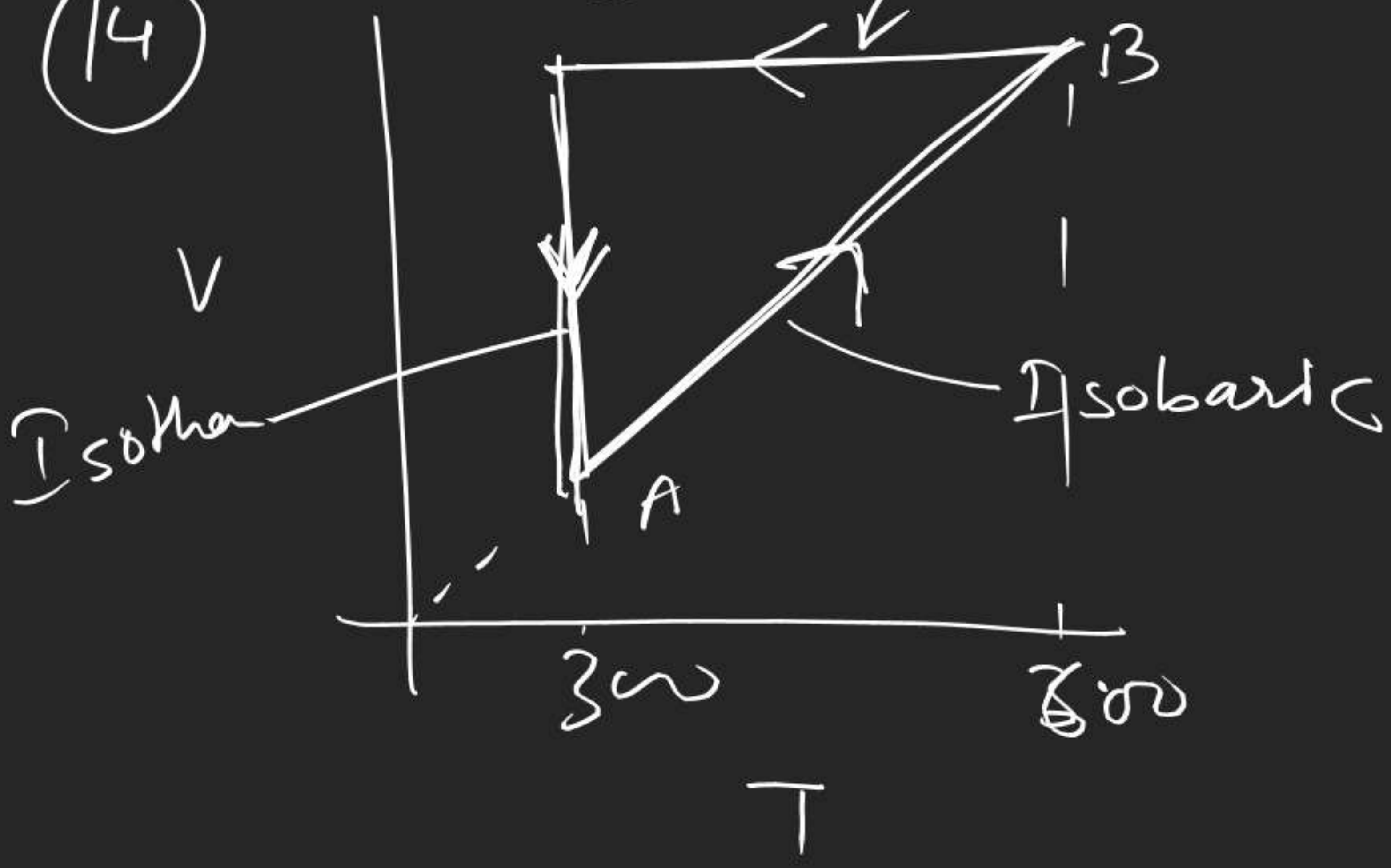
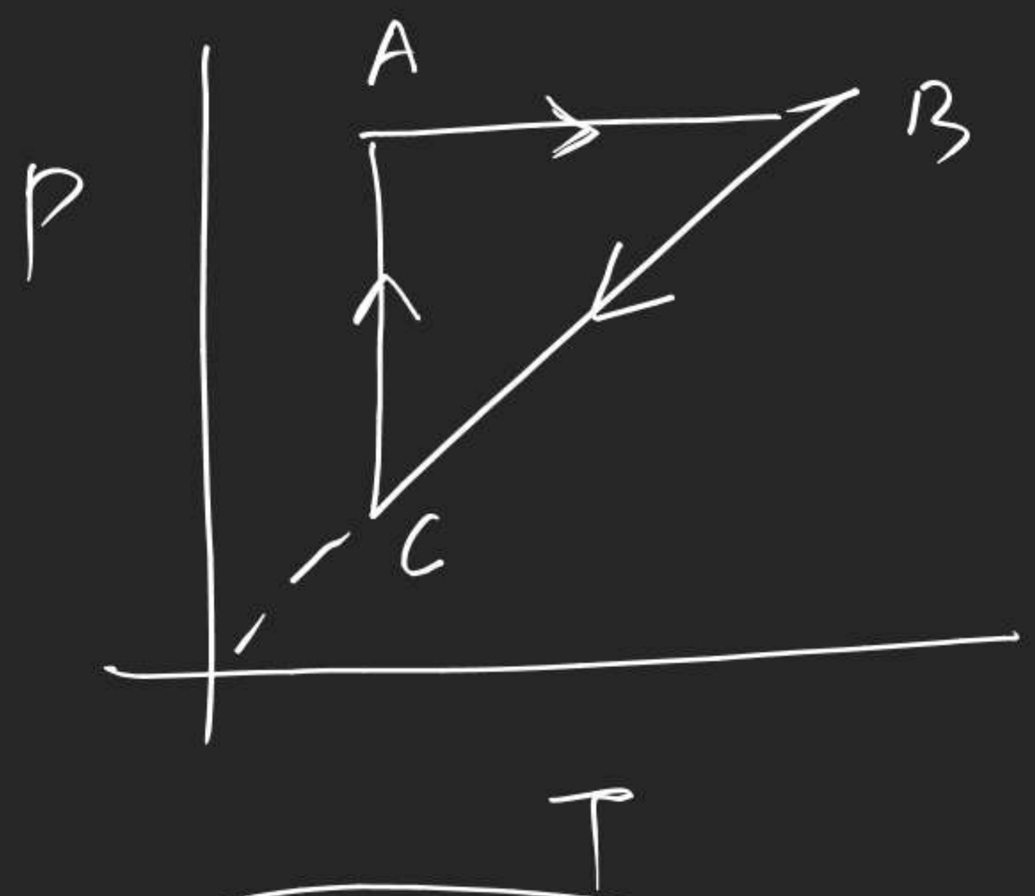
TD-1 O-II

(14)





$$W_{Total} = W_{AB} + W_{BC} + W_{CA}$$

$$\eta = \frac{-W_{Total}}{Q_{AB}} \times 100$$

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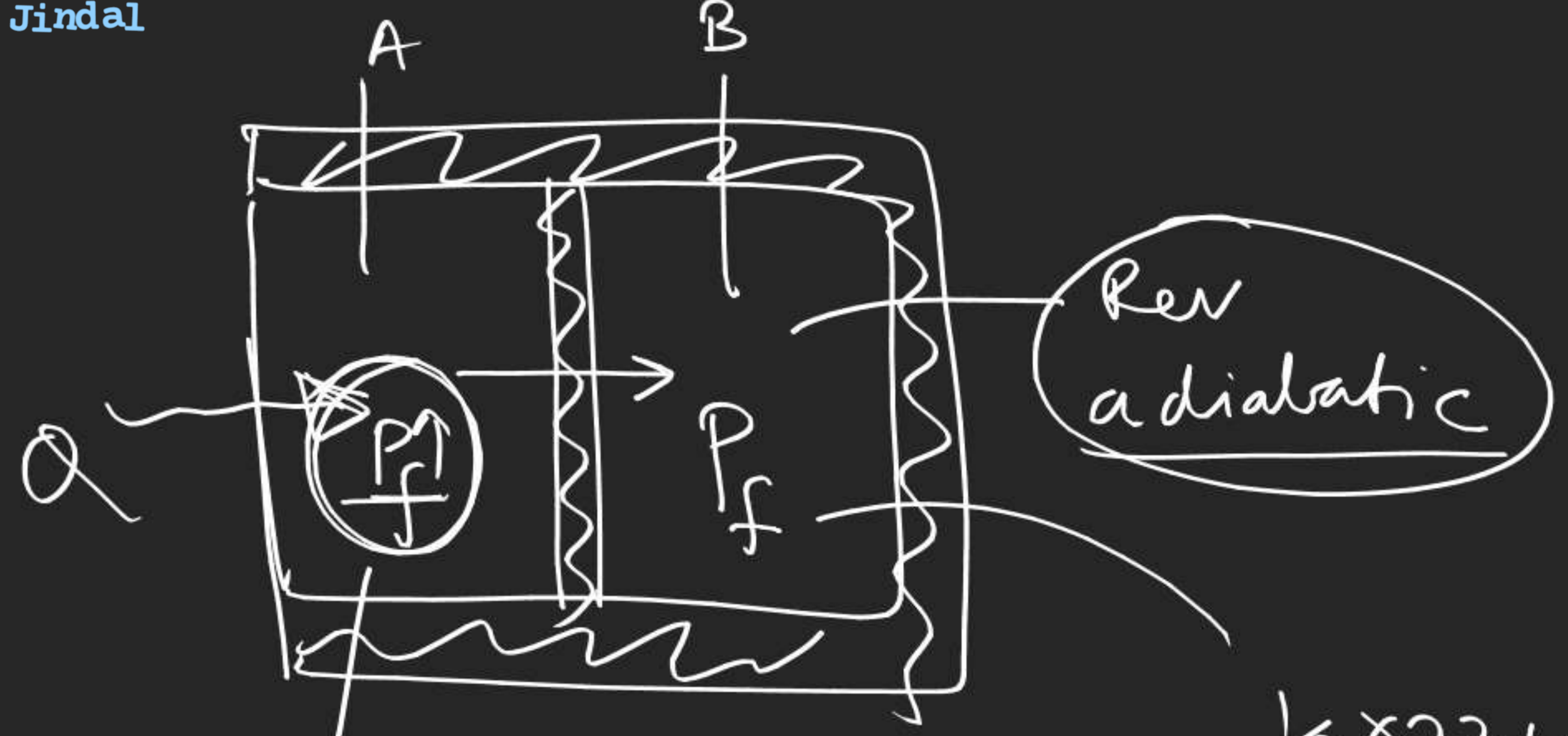

$22.4 + \frac{7}{8} \times 22.4$

T

P_f

$n = 10$

22.4 lit

27.3 K

1 atm

$n = 10$

22.4 lit

27.3 K

1 atm

$n = 10$

$\frac{1}{8} \times 22.4$

T_2

$PV = nRT_2$

$n = 10$

$TV^{\gamma-1}$

fig (1) isothermal

(2) isothermal

Isobaric

(3) cyclic

THERMODYNAMICS

A: 10 atm, 300 K $\longrightarrow$ B: 1 atm, 300 K

I	ΔS_{sys}	ΔS_{surr}	ΔS_{univ}
i	$R\ln 10$	$-R\ln 10$	0
ii	$R\ln 10$	$-9R/10$	
iii	$R\ln 10$	0	$R\ln 10$

III

$\Delta U = 0$

$W = 0$

$Q_{irr} = 0 = Q_{surr}$

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

$\Delta S_{surr} = 0$

$$\Delta S = nC_v \ln\frac{T_2}{T_1} + nR\ln\frac{V_2}{V_1}$$

$A \longrightarrow B$

$C \longrightarrow D$

$C \longrightarrow E$

$C \longrightarrow F$

THERMODYNAMICS

Q. Calculate ΔS_{sys}, ΔS_{surr} and ΔS_{univ} for 1mol non-linear triatomic ideal gas undergoing adiabatic expansion from $(300K, \underline{16\ atm})$ to $(\underline{1\ atm}, T_2)$.

(i) Rev $T_f = 150K$

(ii) Irrev $T_f = 230K$

(iii) free $T_f = 300K$

(i) $P^{1-\gamma}T^{\gamma} = \text{Const}$ $\quad T_2 = 150K$

$$\Delta S_{sys} = 4R\ln\frac{150}{300} + R\ln\frac{16}{1}$$

$$\Delta S_{sys} = 4R\ln\frac{1}{2} + 4R\ln 2 = 0$$

$$Q_{rev} = 0$$

$$\boxed{\Delta S_{sys} = \Delta S_{surr} = \Delta S_{univ} = 0}$$

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(ii) $Q_{irr} = 0$ $\boxed{\Delta S_{surr} = 0}$

$$\Delta S_{sys} = 4R\ln\frac{230}{300} + R\ln\frac{16}{1}$$

(iii) $Q_{irr} = 0$ $\Delta S_{surr} = 0$

$$\Delta S_{sys} = 4R\ln\frac{300}{300} + R\ln 16$$

$$= 0 + R\ln 16$$

ΔS_{sys}	ΔS_{surr}	ΔS_{univ}	
0	0	0	Rev
$C_p\ln\frac{T_2}{T_1} + nR\ln\frac{P_1}{P_2}$	0	>0	Irrev
$C_p\ln\frac{T_2}{T_1} + nR\ln\frac{P_1}{P_2}$	0	>0	free exp

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Entropy change for phase transformation :→

Boiling point :→ Temperature at which vapour pressure equals to external pressure

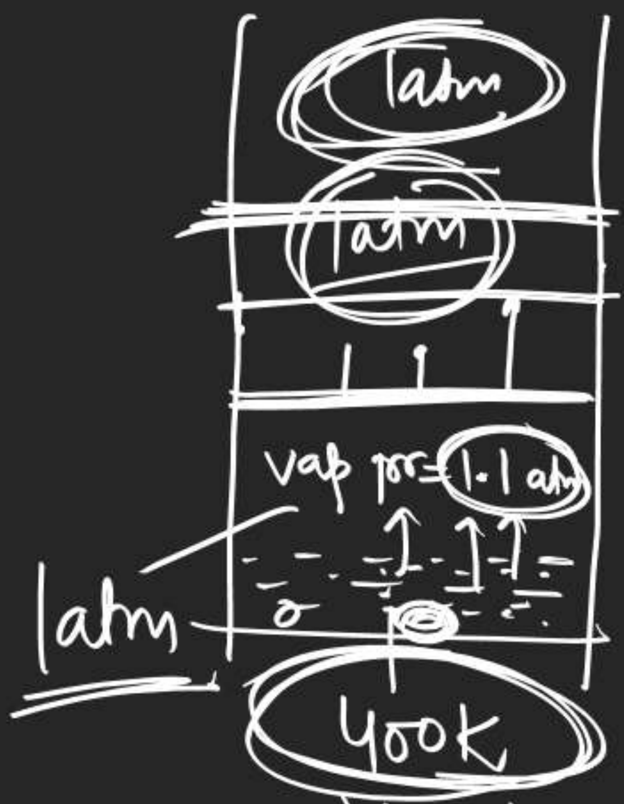
or

Temperature at which liq and gas are in eqlbm.

1 atm, 400 K — only gas

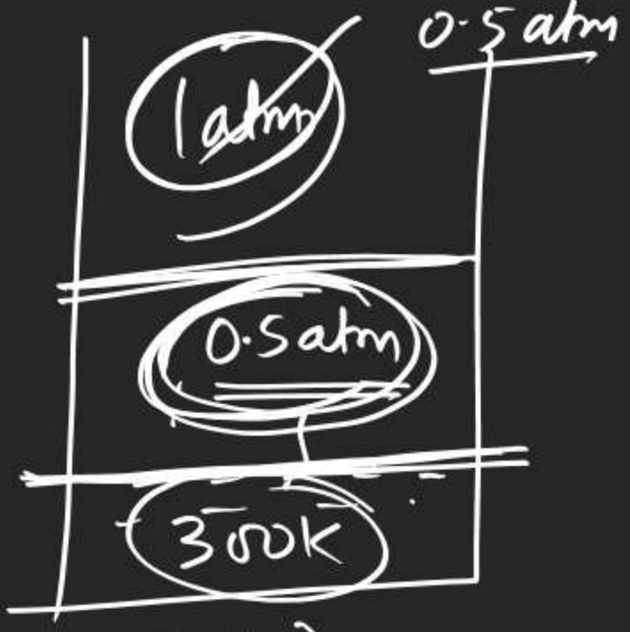
1 atm, 300 K — ~~only liq~~ ~~liq + gas~~ only liq

1 atm, 373 K — liq + gas



$H_2O(l)$

vap pr = 1.1 atm



$H_2O(l)$

vap pr = 0.5atm

only liq

vap. pr = 1

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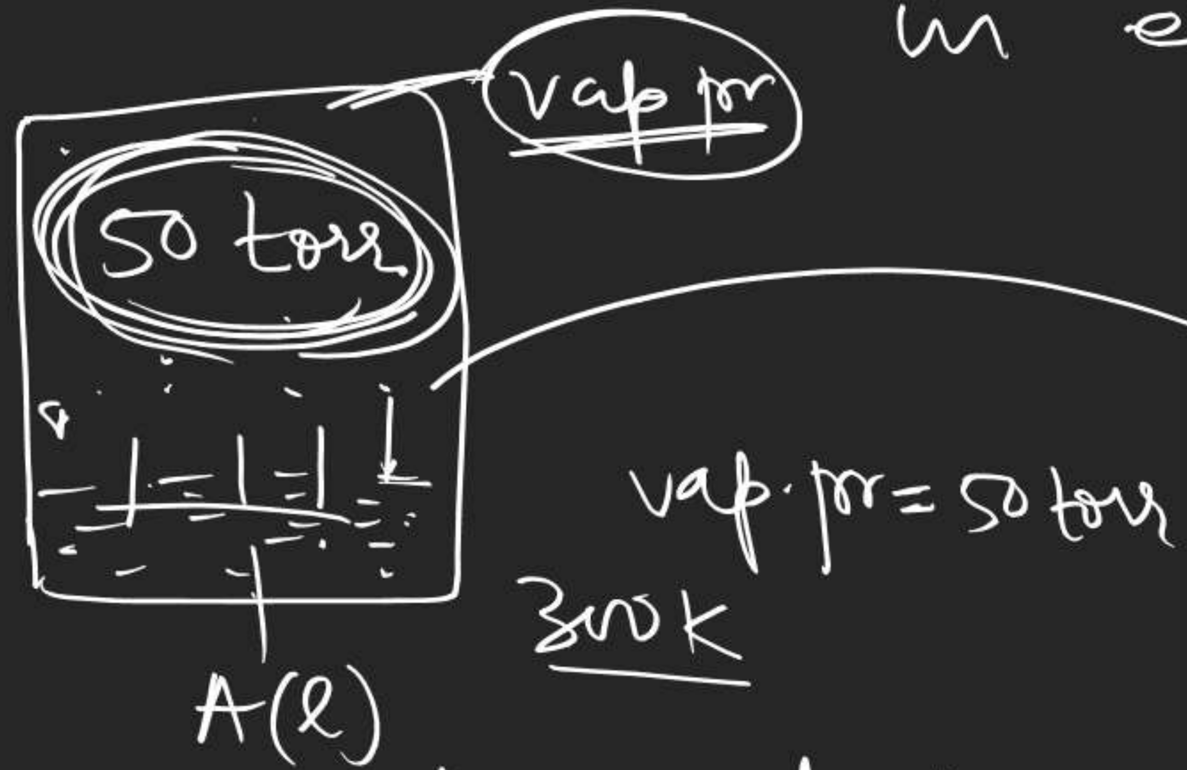
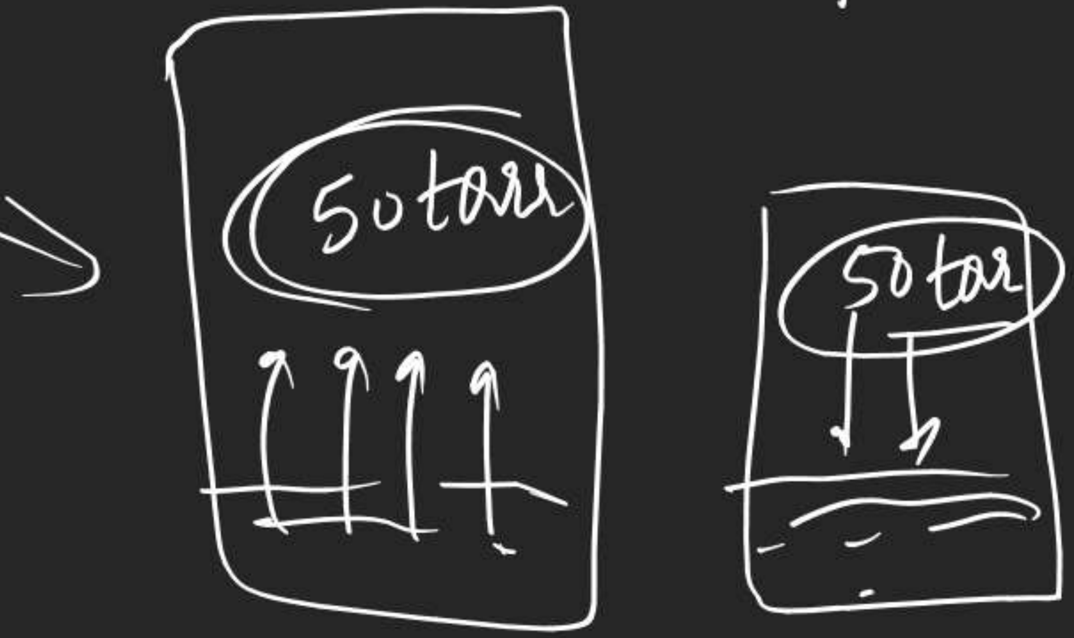
Vapour pressure : Pressure exerted by the vapours in eqlbm with its liquid state





Vap pr of liq depends only on temperature. | Independent of shape & size of container and amount of liq

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THERMODYNAMICS

TD-2

0 – I   1 – 8

S – II   1 – 8

THERMODYNAMICS

THERMODYNAMICS