11Q: A diatomic ideal gas at room temp. Expanded at const Pressure P_0
Heat Absorbed $Q = 14$ Joules.
What is maximum work?

10A: $dW = \int P dV = P(V_2 - V_1) = R(T_2 - T_1)$

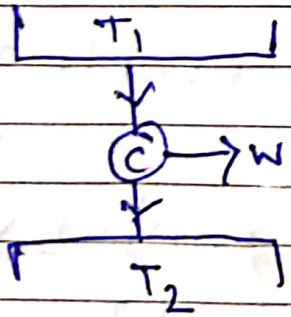
11 $dQ = C_p dT = C_p (T_2 - T_1) = \frac{\gamma R}{(\gamma - 1)} (T_2 - T_1)$

12 $\gamma = 7/5$ $\Rightarrow \frac{\gamma}{\gamma - 1} dW$

1

12.) A carnot cycle operates as heat engines between two bodies of equal heat capacities until their temp becomes equal.
If intial temp are T_1 & T_2 with $T_1 > T_2$ what is final temp of heat reservoirs.

4



Reversible engine

5 $\int_{T_1}^{T} dS = \int_{T_2}^{T} dS$

6 $\swarrow \Rightarrow -\int_{T_1}^{T} \frac{C_p dT}{T} = +\int_{T_2}^{T} \frac{C_p dT}{T}$

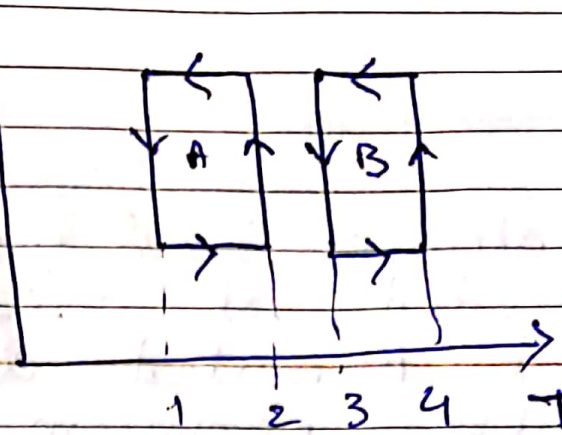
$\Rightarrow C_p \ln\left(\frac{T}{T_1}\right) = -C_p \ln\left(\frac{T}{T_2}\right)$

2021 $\Rightarrow T^2 = T_1 T_2 \Rightarrow$ [illegible] $=$ [illegible]

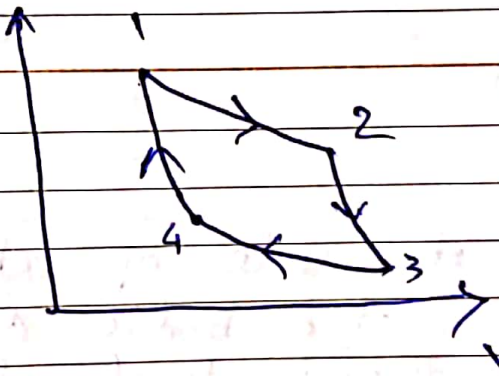
$\Rightarrow T = \sqrt{T_1 T_2}$

OCT 2021

S 31
M 13.) S
T
W
T
F 1
Wk-40 S 2



S 3
M 4
T 5 Relation b/w ~~[illegible]~~ ~~[illegible]~~ the
W 6 efficiency of two heat engines.
T 7
F 8
Wk-41 S 9 14.)



S 10
M 11
T 12
W 13
T 14
F 15
Wk-42 S 16 Ideal gas carnot engine with $\gamma > 1$.

S 17
M 18
T 19 $\left(\frac{T_2}{T_3}\right) = \left(\frac{P_2}{P_3}\right)^{X}$ what is X?
W 20
T 21
F 22 1→2 isothermal $T_1 = T_2 \Rightarrow P_1 V_1 = P_2 V_2$
Wk-43 S 23

S 24 2→3 Adiabatic $PV^{\gamma} = K$, $PV = RT$ $\Rightarrow P^{1-\gamma} T^{\gamma} = K$.
M 25 $\Rightarrow \left(\frac{T_2}{T_3}\right)^{\gamma} = \left(\frac{P_3}{P_2}\right)^{1-\gamma}$
T 26
W 27
T 28 ~~[illegible]~~
F 29 $\Rightarrow \left(\frac{T_2}{T_3}\right) = \left(\frac{P_2}{P_3}\right)^{\frac{\gamma-1}{\gamma}}$
Wk-44 S 30

September 2021

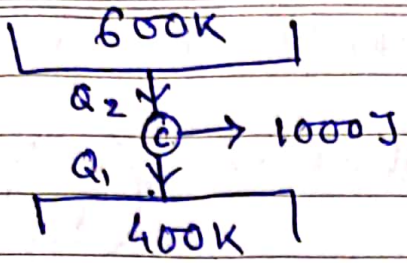
M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

November 2021

M	T	W	T	F	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

OCT NOV

Entropy
Substance

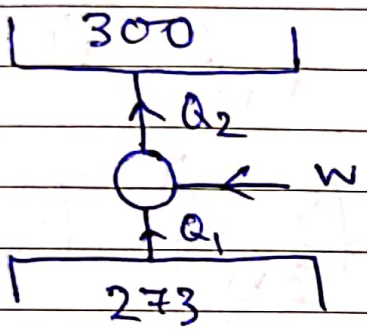
15.) 

$\eta = 1 - \frac{400}{600} = \frac{200}{600} = \frac{1}{3}$.

$\eta = \frac{1}{3} = \frac{W}{Q_2}$

$Q_1 = ?$.

$Q_1 =$

16.) 

$\eta = \frac{1}{1+\beta}$

$Q_2 = 450\ KJ\ s^{-1} = Q_1 + W$

$\beta = \frac{273}{27} = \frac{Q_1}{W} =$

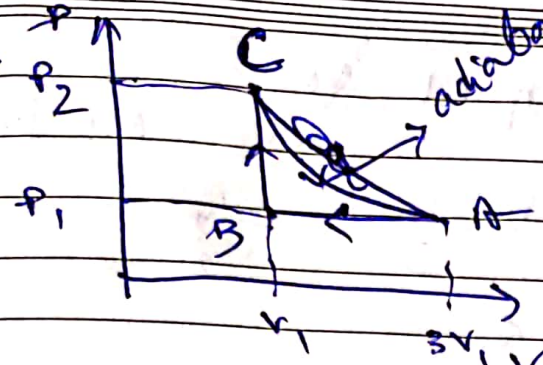
$Q_1 = ?$.

17.) A gas expanded adiabatically $V_1 \rightarrow V_2$ by reversible path. Temp decreased $T_1 \rightarrow T_2$, & again by a irreversible path $T_1 \rightarrow T_2'$.

How T_2 & T_2' are related.

A. $T_2' > T_2$

2021

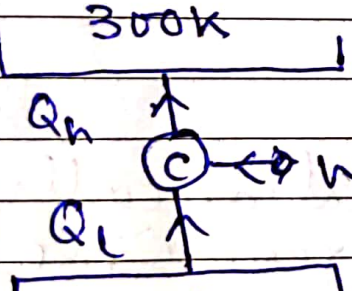
18.) 

monoatomic ideal gas.

what is $\left(\frac{P_1}{P_2}\right)$.

Along CA $\quad P_2 V_1^{\gamma} = P_1 (3V_1)^{\gamma}$

$$\Rightarrow \frac{P_1}{P_2} = \left(\frac{V_1}{3V_1}\right)^{\gamma} = \left(\frac{1}{3}\right)^{\gamma}$$

19.) 

Heat capacity of refrigerator is 4.2 kJ/K.

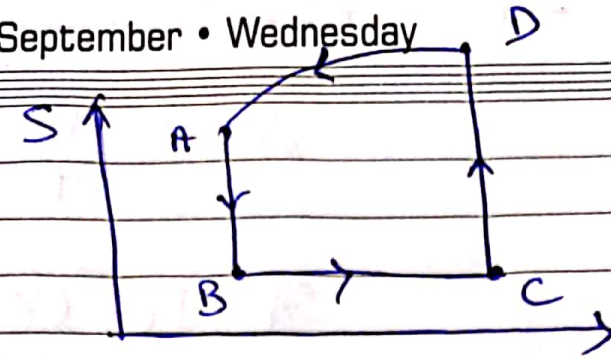
Find the min work that must be done to lower the temp from 18°C → 17°C

$$\beta = \frac{T_c}{T_h - T_c} = \frac{273+18}{300-(273+18)} = \frac{291}{9}$$

$$\Delta Q = C_p dT = 4.2$$

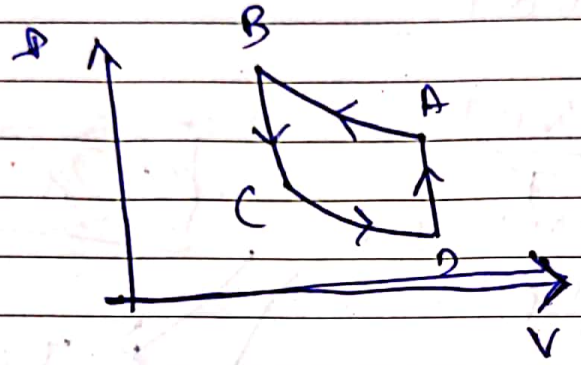
$$\beta = \frac{Q_L}{W} \Rightarrow W = \frac{\Delta Q_L}{\beta} = \frac{4.2 \times 9}{(291/9)}$$

20.)

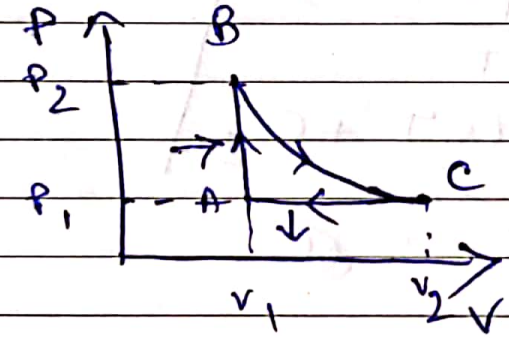


DA → isochoric
⇒ V_2 const

Find in P-V plane



21.)



1. Find η of reversible engine assuming C_p & C_v is const
2. Draw TS diagram

AB is isochoric, BC is adiabatic, CA is isobaric.

$PV = RT$

$$Q_{AB} = \int dQ_{AB} = \int C_v dT = \int C_v \frac{V dP}{R} = \frac{V_1 C_v (P_2 - P_1)}{R}$$

$W_{AB} = 0$

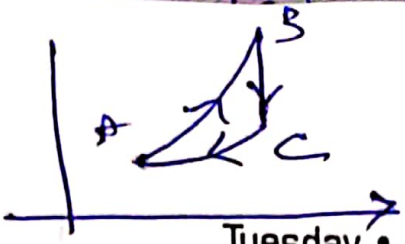
$Q_{BC} = 0$; $W_{BC} = \int C_v dT = C_v (T_2 - T_1)$

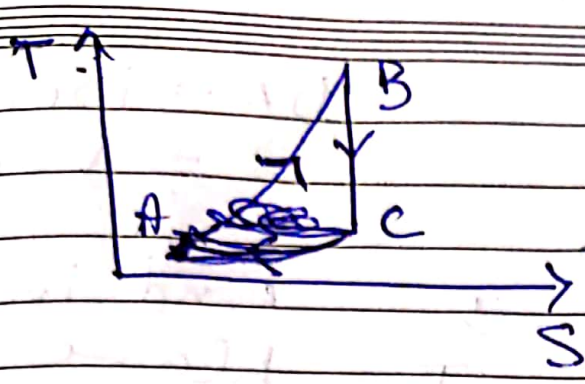
$$= C_v \left(\frac{P_2 V_2}{R} - \frac{P_1 V_1}{R} \right)$$

$$Q_{CA} = \frac{C_p}{R} (P_1 V_1 - P_1 V_2)$$

$W_{CA} = P_1 (V_1 - V_2)$

Fix sign.





$\Delta S = \frac{\Delta Q}{T}$

$\Rightarrow T = \frac{\Delta Q}{\Delta S}$

AB $\quad \Delta Q = C_v dT$

$\Delta S = \frac{C_v dT}{T}$

$\Rightarrow S = C_v \ln T + C_1$

$C_A \quad \Delta Q = C_p dT$

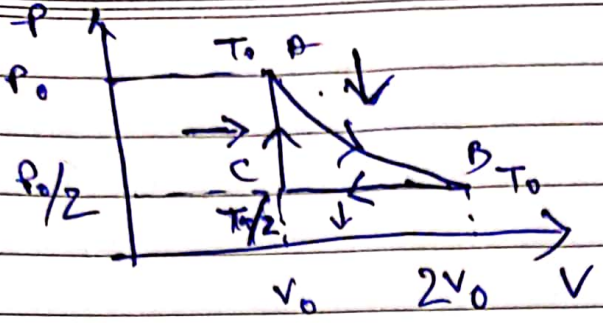
$\Delta S = \frac{C_p dT}{T}$

$S = C_p \ln T + C_2$

$\Rightarrow T = e^{S/C_p}$

$\Rightarrow T = e^{S/C_v}$

$C_p > C_v \Rightarrow \frac{S}{C_p} < \frac{S}{C_v}$



AB → isothermal
BC → isobaric
CA → isochoric

Q: Find Efficiency
Monoatomic gas

Fix sign & calculate

Fix sign.

$$Q_{AB} = RT_0 \ln 2$$

$$Q_{BC} = \frac{3}{2} R \frac{T_0}{2} + \frac{P_0 V_0}{2}$$

$$Q_{CA} = \frac{3}{2} R \frac{T_0}{2}$$

$$\eta =$$