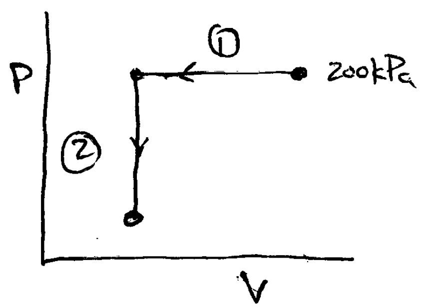
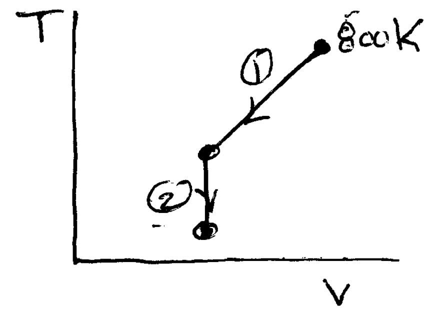
SOLUTIONS TO T3 BY WAITZ

a)





b) GIVEN TWO INDEPENDENT PROPERTIES FOR INITIAL CONDITION
∴ FULLY DEFINES THE STATE OF THE SYSTEM

$p = 200\text{kPa}, \; T = 800\text{K}$

$p = \rho R T \quad \therefore \; \rho = 0.87 \text{ kg/m}^3 \quad (R = 287 \text{ J/kg-K})$ & $V = 1\text{m}^3$ (from sketch)

COOLED AT CONSTANT PRESSURE TO ½ VOLUME

$\therefore \; \rho = (0.87)2 \text{ kg/m}^3 = 1.74 \text{ kg/m}^3$

NOW USE IDEAL GAS LAW TO GET TEMP.

$$T = \frac{200\text{kPa}}{1.74 \text{kg/m}^3 \cdot 287 \text{J/kg-K}} = 400\text{K} \qquad \boxed{T = 400\text{K}}$$

c) NOW CONSTANT VOLUME COOLING

$\therefore \; \rho = 1.74 \text{ kg/m}^3 = \text{constant}$

$T = 300\text{K}$ so $p = 1.74 \cdot 287 \cdot 300 =$

$\boxed{p = 150 \text{ kPa}}$

d) WORK DONE IN FIRST PROCESS.

ASSUME IT IS A QUASI-STATIC PROCESS

$p = \text{const.}$ SO $w = p\Delta v$ (J/kg)

OR $W = p\Delta V$ (J)

$W = 200\,\text{kPa}\,(V_{final} - V_{initial})$

$= 200\,\text{kPa}\,(-1\,\text{m}^3)$

$$\boxed{W = -200\ \text{kJ}}$$

e) WORK DONE BY SYSTEM IN SECOND COOLING PROCESS IS $\boxed{\text{ZERO}}$