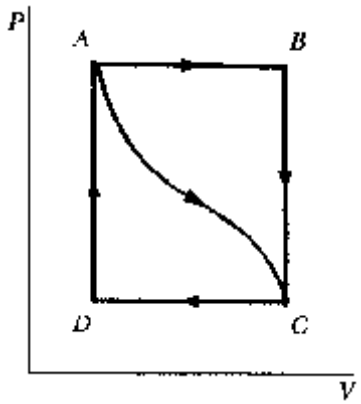
In the figure , the change in internal energy of a gas that is taken from A to C is + 800J. The work done along path ABC is + 500J.



(a) How much thermal energy has to be added to the system as it goes from A through B to C?

(b) If the pressure at point A is five times that of point C, what is the work done by the system in going from C to D?

(c) What is the thermal energy exchanged with the surroundings as the cycle goes from C to A?

(d) If the change in internal energy in going from point D to point A is + 500J, how much thermal energy must be added to the system as it goes from point C to point D?

$\Delta U_{AC} = 800\ J = \Delta U_{ABC}$ from conservation of energy (same end points)

$W_{ABC} = 500\ J = W_{AB}$ since $W_{BC} = 0$

A) $\Delta U_{ABC} = Q_{ABC} - W_{ABC}$

$\therefore Q_{ABC} = \Delta U_{ABC} + W_{ABC} = 800\ J + 500\ J = 1300\ J$ added

B) For an isobaric process $W = P\,\Delta V$

Note: $\Delta V_{CD} = -\Delta V_{ABC}$

$$\Rightarrow \frac{W_{ABC}}{W_{CD}} = -\frac{P_A}{P_D} = -5 \quad \Rightarrow W_{CD} = -100\,J = W_{CDA}$$

C) $\Delta U_{CDA} = Q_{CDA} - W_{CDA}$

$\therefore Q_{CDA} = \Delta U_{CDA} + W_{CDA} = -\Delta U_{ABC} + W_{CDA} = -800\ J = 100\ J = -900\ J$ extracted

D) $\Delta U_{CDA} = \Delta U_{CD} + \Delta U_{DA}$

$\therefore \Delta U_{CD} = \Delta U_{CDA} - \Delta U_{DA} = -800\ J - 500\ J = -1300\ J$

$Q_{CD} = \Delta U_{CD} + W_{CD} = -1300\ J - 100\ J = -1400\ J$