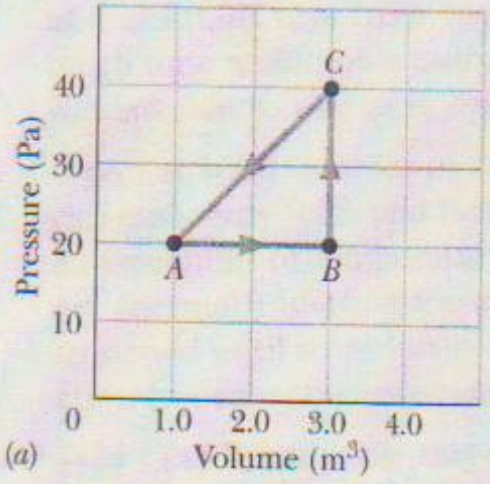
•42 A thermodynamic system is taken from state A to state B to state C, and then back to A, as shown in the p-V diagram of Fig. 18-35*a*. (a)–(g) Complete the table in Fig. 18-35*b* by inserting a plus sign, a minus sign, or a zero in each indicated cell. (h) What is the net work done by the system as it moves once through the cycle $ABCA$?



(a) (b)

	Q	W	ΔE_{int}
$A \rightarrow B$	(a)	(b)	+
$B \rightarrow C$	+	(c)	(d)
$C \rightarrow A$	(e)	(f)	(g)

Fig. 18-35 Problem 42.

$\Delta E_{int} = Q - W$

(a) + ($Q > 0$)

(b) + ($W > 0$)

(c) $W = 0$

(d) $\Delta E_{int} > 0$

(e) $Q < 0$

(f) $W < 0$

(g) $\Delta E_{int} < 0$

•45 A gas within a closed chamber undergoes the cycle shown in the p-V diagram of Fig. 18-37. Calculate the net energy added to the system as heat during one complete cycle. SSM ILW

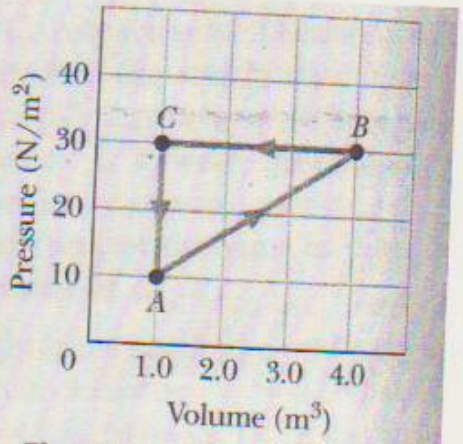


Fig. 18-37 Problem 45.

For cyclic process (A → B → C → A)

$\Delta E_{int} = 0$

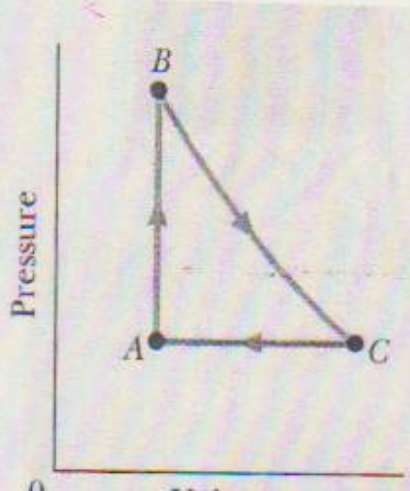
$\Rightarrow Q = W$

W = area enclosed (in this case it is negative) $= -\frac{1}{2}(3 \times 20) = -30\,J$

$Q = -30\,J$

$\Delta E_{int} = -30 - (-30) = 0$!

•48 Gas within a chamber passes through the cycle shown in Fig. 18-40. Determine the energy transferred by the system as heat during process CA if the energy added as heat Q_{AB} during process AB is 20.0 J, no energy is transferred as heat during process BC, and the net work done during the cycle is 15.0 J.



Problem 48

$Q_{AB} = 20\,J \qquad W_{AB} = 0$

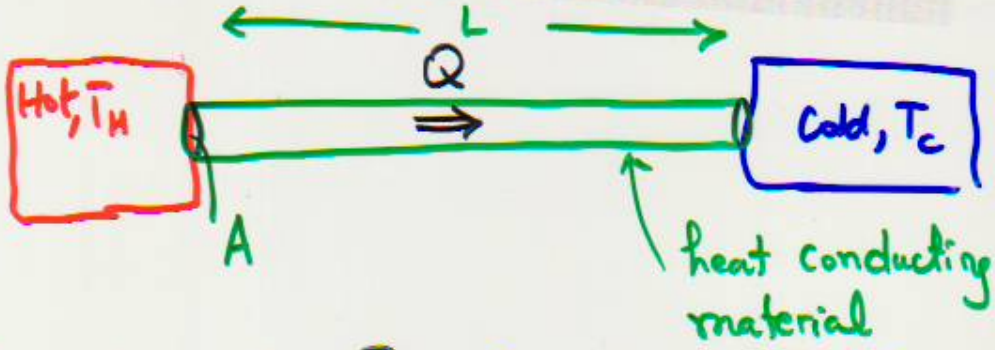
$Q_{BC} = 0 \qquad W_{BC} = ?$

$W_{AB}^{0} + W_{BC} + W_{CA} = 15\,J = Q_{AB} + Q_{BC} + Q_{CA}$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad = 20\,J \quad 0$

$Q_{CA} = 15\,J - 20\,J = -5\,J$

•51 Consider the slab shown in Fig. 18-18. Suppose that $L = 25.0$ cm, $A = 90.0$ cm^2, and the material is copper. If $T_H = 125°C$, $T_C = 10.0°C$, and a steady state is reached, find the conduction rate through the slab. SSM



Conduction rate $P = \frac{Q}{t} = k A \frac{T_H - T_c}{L}$

$P = 401 \times 90 \times 10^{-4} \times \frac{(125 - 10)}{0.25} = 1660$ J/s

43 E. A sample of gas expands from 1.0 m³ to 4.0 m³ while its pressure decreases from 40 Pa to 10 Pa. How much work is done by the gas if its pressure changes with volume via each of the three paths shown in the p-V diagram in Fig. 19-34?

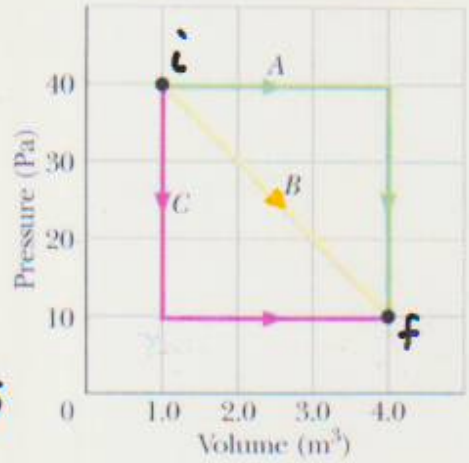


FIGURE 18-36
Exercise 43

W = area under the curve.

W_A = 120 J

W_B = 30 + 45 = 75 J

W_C = 30 J

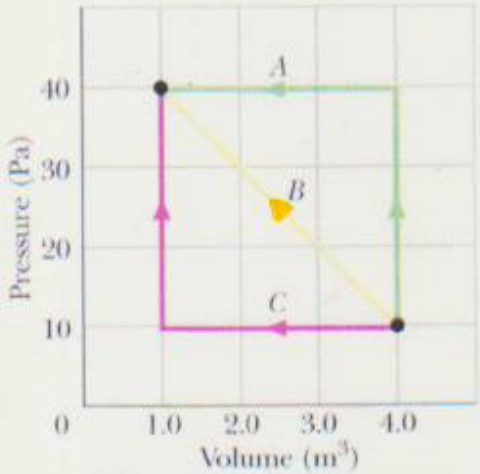


FIGURE 18-35
Exercise 42.

W_A = −120 J

W_B = −75 J

W_C = −30 J

49 E. Consider that 200 J of work is done on a system and 70.0 cal of heat is extracted from the system. In the sense of the first law of thermodynamics, what are the values (including algebraic signs) of (a) W, (b) Q, and (c) ΔE_{int}?

$Q = -70 \text{ cal} = -70 \times 4.186 = -293 \text{ J}$

$W = -200 \text{ J}$

$\Delta E_{int} = Q - W = -293 - (-200) = -93 \text{ J}$