

50. (a)
- During process  $A \rightarrow B$ , the system is expanding, doing work on its environment, so  $W > 0$ , and since  $\Delta E_{\text{int}} > 0$  is given then  $Q = W + \Delta E_{\text{int}}$  must also be positive.
  - During process  $B \rightarrow C$ , the system is neither expanding nor contracting, so  $W = 0$ ; therefore, the sign of  $\Delta E_{\text{int}}$  must be the same (by the first law of thermodynamics) as that of  $Q$  (which is given as positive).
  - During process  $C \rightarrow A$ , the system is contracting (the environment is doing work on the system), which implies  $W < 0$ . Also,  $\Delta E_{\text{int}} < 0$  because  $\sum \Delta E_{\text{int}} = 0$  (for the whole cycle) and the other values of  $\Delta E_{\text{int}}$  (for the other processes) were positive. Therefore,  $Q = W + \Delta E_{\text{int}}$  must also be negative.
- (b) The area of a triangle is  $\frac{1}{2}(\text{base})(\text{height})$ . Applying this to the figure, we find  $|W_{\text{net}}| = \frac{1}{2}(2.0 \text{ m}^3)(20 \text{ Pa}) = 20 \text{ J}$ . Since process  $C \rightarrow A$  involves larger negative work (it occurs at higher average pressure) than the positive work done during process  $A \rightarrow B$ , then the net work done during the cycle must be negative. The answer is therefore  $W_{\text{net}} = -20 \text{ J}$ .