

28. During the adiabatic processes (the vertical lines in Fig. 21-9) there is no heat transfer, so we only consider the isothermal processes (the horizontal lines). We can interpret Eq. 21-2, $Q = T\Delta S$, as represent the “area” (with appropriate \pm sign) under the horizontal lines. Since $a \rightarrow b$ is in the positive direction while $c \rightarrow d$ is in the negative direction, then there is a partial cancellation in the “areas” under the two lines, and the net contribution is the rectangular area between them. This can be seen explicitly as follows:

$$Q_{\text{net}} = T_{\text{H}} (S_b - S_a) + T_{\text{L}} (S_d - S_c) = (T_{\text{H}} - T_{\text{L}}) (S_{\text{max}} - S_{\text{min}})$$

where we have used the fact that $S_b = S_c = S_{\text{max}}$ and $S_a = S_d = S_{\text{min}}$.