

21. The answers to this exercise do not depend on the engine being of the Carnot design. Any heat engine that in-takes energy as heat (from, say, consuming fuel) equal to  $|Q_H| = 52 \text{ kJ}$  and exhausts (or discards) energy as heat equal to  $|Q_L| = 36 \text{ kJ}$  will have these values of efficiency  $\varepsilon$  and net work  $W$ .

(a) Eq. 21-10 gives

$$\varepsilon = 1 - \left| \frac{Q_L}{Q_H} \right| = 0.31 = 31\% .$$

(b) Eq. 21-6 gives

$$W = |Q_H| - |Q_L| = 16 \text{ J} .$$