Chapter 22 Even Answers

2. (a) 33.3% (b) 2 / 3
4. 667 J, 467 J
6. 55.4%
8. 197 kJ
10. (a) 26.8% (b) 42.3%
12. 546˚C
14. (a) 564 K (b) 212 kW (c) 47.5%
16. 453 K
18. (a)

State	P (kPa)	V(L)	T(K)
A	1400	10.0	720
B	875	16.0	720
C	445	24.0	549
D	712	15.0	549

(b)

Process	Q(kJ)	W(kJ)	ΔE_{int} (kJ)
$A \rightarrow B$	6.58	6.58	0
$B \rightarrow C$	0	4.99	–4.99
$C \rightarrow D$	–5.02	–5.02	0
$D \rightarrow A$	0	–4.99	4.99
$ABCDA$	1.56	1.56	0

(c) $e = e_C = 0.237$
20. (a) 51.2% (b) 36.2%
22. (a) and (b)

State	T(K)	P(kPa)	V(cm^3)	E_{int}(J)
A	293	100	500	125
B	673	1840	62.5	287
C	1023	2790	62.5	436
D	445	152	500	190
A	293	100	500	125

Process	Q(J)	W(J)	ΔE_{int}(J)
$A \rightarrow B$	0	–162	162
$B \rightarrow C$	149	0	149
$C \rightarrow D$	0	246	–246
$D \rightarrow A$	–65.0	0	–65.0
$ABCDA$	84.3	84.3	0

(c) 149 J, 65.0 J, 84.3 J (d) 0.565 (e) 1.42×10^3 rev / min
24. 11.8
26. 1.17 J
28. $Q(T_h - T_c) / T_c$
30. (a) 204 W (b) 2.43 kW
32. 4.88 kJ / kg · K
34. (a) –810 J / K (b) –113 J / K
36. 718 J / K
38. ~ 1 W / K from metabolism; much more if using powerful appliances or an automobile.

40. (a) 39.4 L (b) –2.50 kJ (c) –2.50 kJ (d) –6.87 J / K (e) +9.16 J / K
42. 1.26×10^8 J / K
44. 34.6 J / K
46. (a) 2H and 2T (b) either 4H or 4T (c) 2H and 2T
48. 8.36×10^6 J / K
50. 3.29×10^4 J
52. (a) 0.476 J / K (b) 417 J (c) $W_{net} = T_1 \Delta S_U = 167$ J
54. 77.8 W
56. (a) 2620 metric tons / day (b) \$7.65 million / year (c) 4.06×10^4 kg / s
58. $\frac{m}{t} = \frac{\wp T_c}{(T_h - T_c)\, c\, \Delta T}$
60. (a) 4.11 kJ (b) 14.2 kJ (c) –10.1 kJ (d) 28.9%
62. (a) 2.93 (b) $(COP)_{refrigerator}$ (c) cost is half as much with EER 10
64. (b) The second law refers to cycles.
66. No, $e_{max} = e_C = 0.0114$
68. (a) $V_A = 1.97$ L, $V_B = 11.9$ L, $V_C = 32.8$ L, $V_D = 5.44$ L, $P_B = 4.14$ atm, $P_D = 6.03$ atm
(b) 2.99 kJ (c) 0.333
70. (a) 20.0˚C (c) $\Delta S = +4.88$ J / K (d) Yes