Chapter 15

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| 2. | *How much heat transfer occurs from a system, if its internal energy decreased by 150 J while it was doing 30.0 J of work?* [-120J] |
| 4. | *What is the change in internal energy of a system which does*  *of work while*  *of heat transfer occurs into the system, and*  *of heat transfer occurs to the environment?* [-5.45 x 106 J] |
| 10.  | *A car tire contains*  *of air at a pressure of*  *(about 32 psi). How much more internal energy does this gas have than the same volume has at zero gauge pressure (which is equivalent to normal atmospheric pressure)?* [6770 J] |
| 13. | *A hand-driven tire pump has a piston with a 2.50-cm diameter and a maximum stroke of 30.0 cm. (a) How much work do you do in one stroke if the average gauge pressure is*  *(about 35 psi)? (b) What average force do you exert on the piston, neglecting friction and gravitational force?* [35.3 J, 118 N] |
| 14. | *Calculate the net work output of a heat engine following path ABCDA in the figure below.* [4500 J] |

20. *A certain heat engine does 10.0 kJ of work and 8.50 kJ of heat transfer occurs to the environment in a cyclical process. (a) What was the heat transfer into this engine? (b) What was the engine’s efficiency?* [a. 18.5 kJ, b. 54.1%]

45. *A 4-ton air conditioner removes*  *(48,000 British thermal units) from a cold environment in 1.00 h. (a) What energy input in joules is necessary to do this if the air conditioner has an energy efficiency rating () of 12.0? (b) What is the cost of doing this if the work costs 10.0 cents per*  *(one kilowatt-hour)? (c) Discuss whether this cost seems realistic. Note that the energy efficiency rating () of an air conditioner or refrigerator is defined to be the number of British thermal units of heat transfer from a cold environment per hour divided by the watts of power input.*[a. 1.44 x 107 J, b. 40 cents, c. $9.60 a day, so reasonable]

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| 54. | *Find the increase in entropy of 1.00 kg of liquid nitrogen that starts at its boiling temperature, boils, and warms to  at constant pressure.* [3.81 x 103 J/K] |
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