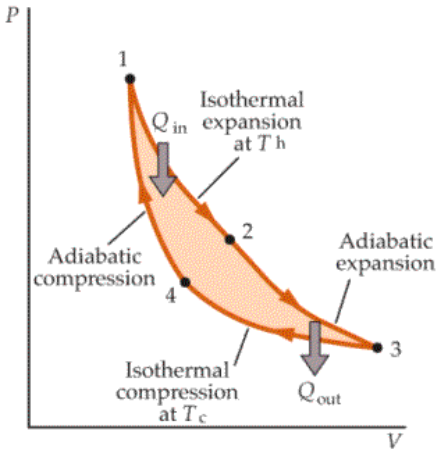

Figure 1: Problem 1

___ 1 The diagram in Fig. 1 illustrates a Carnot engine. Along which two path segments of the cycle is the work done by the gas positive.

A) $1 \to 2,\ 2 \to 3$ B) $4 \to 1,\ 1 \to 2$ C) $2 \to 3,\ 3 \to 4$ D) only $1 \to 2$ E) $3 \to 4,\ 4 \to 1$

___ 2 A Carnot engine operating between reservoir temperatures of 460 °C and 48 °C has an efficiency of

A) 28.% B) 84.% C) 68.% D) 42.% E) 56.%

___ 3 A car of mass 2500 kg is traveling at 18 m/ s on a day when the temperature is 23 °C. The driver steps on the brakes and stops the car. The wheels do not slide on the road surface. By how much does the entropy of the universe increase?

A) 1.4 kJ/ K B) 1.8 kJ/ K C) 0.55 kJ/ K D) 0.68 kJ/ K E) 2.7 kJ/ K

___ 4 A steam power plant with an efficiency of 55% of the maximum thermodynamic efficiency operates between 250 °C and 40 °C. What is the change in the entropy of the "universe" when this plant does 1.00 kJ of work?

A) 1.31 J/ K B) 2.61 J/ K C) 4.97 J/ K D) 106. J/ K E) 19.9 J/ K

___ 5 An amount of 2 mole of an ideal gas undergoes a reversible isothermal expansion from a volume of 1 L to a volume of 3 L. The change in entropy of the gas in terms of the universal gas constant R is

A) $2R \ln 3$ B) $2R \ln \frac{1}{3}$ C) All other choices are wrong
D) $\frac{2}{3}R$ E) $6R$

___ 6 Three moles of a gas at $T = 250$ K expand reversibly and adiabatically from an initial volume of 20 L to a final volume of 60 L. The change in entropy of the gas during this expansion is ($R = 8.314$ J/ mol · K)

A) −27.4 J/ K B) 54.8 J/ K C) −54.8 J/ K D) 27.4 J/ K E) 0