Physics 2305 1 May, 2000
Quiz 16—Form A

John spills a liter of water (1.00 kg, 55.5 moles) at 5.0°C (278.0 K) into a lake at 22.0°C (295.0 K). The specific heat of water is 4.186 kJ kg^{-1} K^{-1}.

1. How much does the entropy of the original lake water change?

A) −241 J/K C) −3.20 kJ/K
B) −256 J/K D) −3.23 kJ/K

2. How much does the entropy of the spilled water change?

A) 248 J/K C) 3.29 kJ/K
B) 256 J/K D) 7.14 kJ/K

Some useful equations:

$\Delta E_{int} = Q - W$ $Q = nc\Delta T = mc\Delta T$ $W = \int p\, dV$
$\Delta E_{int} = nC_v\Delta T$ $pV = nRT = NkT$
$C_v = (f/2)\, R$ $C_p = C_v + R$ $\gamma = C_p / C_v$
$pV^{\gamma} = \text{const.}$ $TV^{\gamma-1} = \text{const.}$
$\Delta S = \int dQ/T$ $S = k \ln \Omega$
$\varepsilon = 1 - T_c/T_h$ $K = T_c / (T_h - T_c)$

$R = 8.31$ J mol^{-1} K^{-1} $k = 1.38 \times 10^{-23}$ J/K

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Quiz 16—Form B

In an adiabatic process, the volume of a gas increases by a factor of 1.5, and the temperature drops from 87°C (360 K) to 2°C (275 K).

1. What is γ?

   A) 4/3 C) 3/2
   B) 7/5 D) 5/3

2. Which of the following could the gas be?

   A) He (f=3) C) CO_2 (f=6)
   B) N_2 (f=5) D) None of these.

Some useful equations:

$\Delta E_{int} = Q - W$ $Q = nc\Delta T = mc\Delta T$ $W = \int p\, dV$
$\Delta E_{int} = nC_v\Delta T$ $pV = nRT = NkT$
$C_v = (f/2)\, R$ $C_p = C_v + R$ $\gamma = C_p/C_v$
$pV^\gamma = \text{const.}$ $TV^{\gamma-1} = \text{const.}$
$\Delta S = \int dQ/T$ $S = k \ln \Omega$
$\varepsilon = 1 - T_c/T_h$ $K = T_c/(T_h - T_c)$

$R = 8.31\ \text{J mol}^{-1}\ \text{K}^{-1}$ $k = 1.38 \times 10^{-23}\ \text{J/K}$

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Quiz 16—Form C

1. An engine runs between a high-temperature reservoir of 177°C (450 K) and a low-temperature reservoir of 52°C (325 K). What is its maximum possible efficiency?

A) 28%
B) 56%
C) 72%
D) 2.6

2. You see 4 birds and 2 trees. Which of the following possibilities has the highest entropy?

A) 4 in 1 tree
B) 3 in 1 tree, 1 in the other
C) 2 in each tree
D) Entropy doesn't apply to birds.

Some useful equations:

$\Delta E_{int} = Q - W$ $\quad Q = nc\Delta T = mc\Delta T \quad W = \int p\, dV$

$\Delta E_{int} = nC_v\Delta T$ $\quad pV = nRT = NkT$

$C_v = (f/2)\, R$ $\quad C_p = C_v + R \quad \gamma = C_p/C_v$

$pV^\gamma = \text{const.}$ $\quad TV^{\gamma-1} = \text{const.}$

$\Delta S = \int dQ/T$ $\quad S = k \ln \Omega$

$\varepsilon = 1 - T_c/T_h$ $\quad K = T_c / (T_h - T_c)$

$R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$ $\quad k = 1.38 \times 10^{-23} \text{ J/K}$