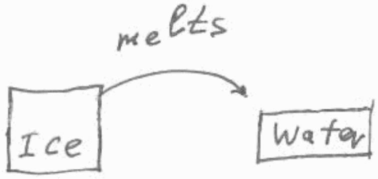
#14.8

01/18/08



$\rho_I < \rho_W$

$(\rho_I < \rho_W)$

Note: $m_I = m_W \equiv m$

$\rho_I = \frac{m}{V_I}$, $\rho_W = \frac{m}{V_W}$

$V_I = \frac{m}{\rho_I}$, $V_W = \frac{m}{\rho_W}$

$(\Rightarrow V_I > V_W)$

Atmosphere pressure is not changed → isobaric process.

Work by atmosphere:

$W = -P\Delta V$, $\Delta V = V_W - V_I$

$W = P(V_I - V_W)$

plug in values $\boxed{W = 8.8\ J}$

#14.62

Engine operates between

$T_H = 325°C \ (598°K)$

$T_L = 25°C \ (298°K)$

$Q_i = 610 kcal$

By def. efficiency of engine (eq. 14.12)

$e = \frac{W_0}{Q_i}$ => $W_0 = e \, Q_i$ (*)

another definition (eq. 14.13):

$e = 1 - \frac{T_L}{T_H} \simeq 0.5$ ← plug in # $e = 0.5$

=> use in (*)

$W_0 = 0.5 \cdot 610 = 305 \ kcal.$

Exhausted heat:

(use 14.12) => $Q_H = W_0 + Q_L$

$Q_L = Q_H - W_0 = 305 \ kcal$

to compute power:

$P = \frac{W_0}{t}$ (by definition)

for 1 s → 5 cycles

then $P = \frac{5 W_0}{1} = 5 \ \frac{305}{1} kcal/s \approx 6000 \ kW$

#14.90

To define entropy:

$$\Delta S = \frac{\Delta Q}{T} \qquad (\text{Eq. } 14.19)$$

for Carnot refrigerator, η - coeff. of performance

$$\Delta Q = \eta W_i \qquad (\text{Eq. } 14.15) \qquad W_i = 2\ \text{J}$$

use (14.17) to find η:

$$\eta = \frac{T_L}{T_H - T_L} = \frac{273}{300 - 273} = 10.1$$

$$\Delta Q = 10.1 \cdot 2 = 20.2\ \text{J}$$

for refrigerator, heat is decreasing

then

$$\Delta S = -\frac{\Delta Q}{T_L} = -\frac{20.2\ \text{J}}{273\ \text{K}} \approx -0.07\ \text{J/K}$$

$$\boxed{\Delta S = -0.07\ \text{J/K}}$$