Nicholas Brown
Student ID: 000968160
HW #1, Due: 09/10/12

Question #2

Given/Known:
Height = 807**m**
$T_{initial}$= 15℃
c_{water}= $4186\frac{\boldsymbol{J}}{\boldsymbol{kg}} * ℃$

Solution:
ΔU = Q = mgh
Q = mcΔT, Therefore: ΔT = $\frac{Q}{m*c_{water}}$

Combining the two equations: ΔT = $\frac{mgh}{m*c_{water}} = \frac{gh}{c_{water}}$

So, ΔT = $\frac{(9.8\frac{\boldsymbol{m}}{\boldsymbol{s}^2})(807\boldsymbol{m})}{4186\frac{\boldsymbol{J}}{\boldsymbol{kg}}*℃}$, $T_f - 15℃ = 1.889℃$, $\boldsymbol{T_f = 16.9}℃$

Question #14

Given/Known:
m = 40**g** = 0.04**kg**
T_i = -10℃
T_f = 110℃
c_{ice}= 2090 $\frac{J}{kg}$℃
c_{water}= $4.19 * 10^3 \frac{J}{kg}$℃
c_{steam}= $2.01 * 10^3 \frac{J}{kg}$℃
L_{fusion}= $3.33 * 10^5 \frac{J}{kg}$
$L_{vaporization}$= $2.26 * 10^6 \frac{J}{kg}$

Solution (consisting of 5 steps):

(1) Raising the ice from -10℃ to 0℃

Q = $m_i c_i \Delta T$ = 0.04**kg** 2090 $\frac{J}{kg}$℃ 10℃ = 836**J**

(2) Phase change from ice to water

$Q = L_f \ \Delta m_w$ = $(3.33 * 10^5 \frac{J}{kg})(0.04\mathbf{kg}) = 13{,}320\mathbf{J}$

(3) Raising the water from 0℃ to 100℃

Q = $m_w c_w \Delta T$ = 0.04**kg** $4.19 * 10^3 \frac{J}{kg}$℃ 100℃ = 16,760**J**

(4) Phase change from water to steam

$Q = L_v \ \Delta m_s$ = $(2.26 * 10^6 \frac{J}{kg})(0.04\mathbf{kg}) = 90{,}400\mathbf{J}$

(5) Raising the steam from 100℃ to 110℃

Q = $m_s c_s \Delta T$ = 0.04**kg** $2.01 * 10^3 \frac{J}{kg}$℃ 10℃ = 804**J**

Final Answer (combining results from all 5 steps)

$Q_{total} = 836J + 13{,}320J + 16{,}720J + 90{,}400J + 804J$

$\mathbf{Q_{total} = 122,120J}$

Question #24

Given:

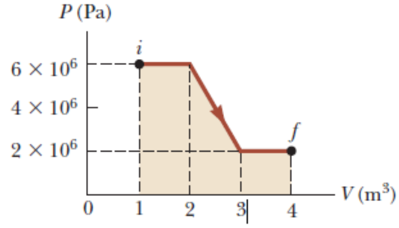

Figure P20.24

Solution (a):

$$W = - {}_{V_i}^{V_f} PdV$$

$$W = - \quad 6 * 10^6 \boldsymbol{Pa} \quad 1\boldsymbol{m^3} \quad - \quad \frac{6*10^6\boldsymbol{Pa} + 2*10^6\boldsymbol{Pa}}{2} \quad 1\boldsymbol{m^3} \quad -[(2 * 10^6\boldsymbol{Pa})(1\boldsymbol{m^3})]$$

$$\boldsymbol{W = -12 * 10^6 J}$$

Solution (b):

If the gas is compressed from *f* to *i*, the answer will be the negation of solution (a),

$$\boldsymbol{W = 12 * 10^6 J}$$

Question #29

Given/Known:

$\Delta E_{int,f} = -500\boldsymbol{J}$
$W_i = -220\boldsymbol{J}$

Solution:

$E_{int,i} = E_{int,f}$
$\Delta E_{int} = Q - W$

Combining the two equations:
$Q - W = E_{int,f}$

$Q - (-220\boldsymbol{J}) = -500\boldsymbol{J}$

$\boldsymbol{Q = -720J}$

Question #36

Given/Known:

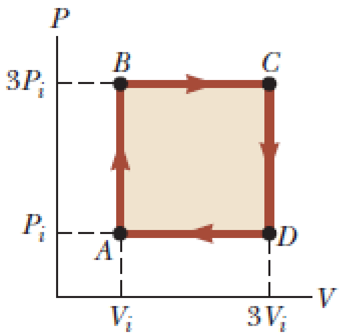

Figure P20.35

**ΔV will be zero for $W_{A\rightarrow B}$ and $W_{C\rightarrow D}$, so their values will also be zero in the solution (a) below.

Solution (a):
$W = -P\Delta V$
$W_{total} = W_{A\rightarrow B} + W_{B\rightarrow C} + W_{C\rightarrow D} + W_{D\rightarrow A}$

Using both of these equations:

$W_{total} = 0 - \quad 3P_i \quad 3V_i - 1V_i \quad - 0 - [\ 1P_i \quad 1V_i - 3V_i\ ]$

$W_{total} = -\ 9P_iV_i - 3P_iV_i \ - \ 1P_iV_i - 3P_iV_i$

$W_{total} = -6P_iV_i + 2P_iV_i$

$\mathbf{W_{total} = -4P_iV_i}$

Solution (b):

If: $E_{int} = 0$ and $E_{int} = Q + W$

Then:
$Q = -W$
$\mathbf{Q = 4P_iV_i}$