PHYS 262 Homework 5 (Ch 19) Spring '03

1. (SB 1) $T_C = \frac{5}{9}(T_F - 32)$

$T = T_C + 273.15$

(a) $T_F = 98.6\,F \Rightarrow T_C = 37.0\,^\circ C$ #

$T = 310\,K$ #

(b) $T_F = -5.00\,F \Rightarrow T_C = -20.6\,^\circ C$ #

$T = 253\,K$ #

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2. (SB 7) (a) $\Delta T_F = \frac{9}{5}\Delta T_C = 810\,^\circ F$ #

(b) $\Delta T = \Delta T_C = 450\,K$ #

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3. (SB 11) (a) $\Delta L = \alpha_{Al} L_i \Delta T = (24\times10^{-6})(3)(100-20)\,m$

$L = L_i + \Delta L = 3.0058\,m$ #

(b) $L = L_i(1+\alpha_{Al}\Delta T) = (3)[1+(24\times10^{-6})(0-20)]\,m$

$= 2.9986\,m$ #

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4. (SB 12) (a) $L_{Al}(1+\alpha_{Al}\Delta T) = L_{Brass}(1+\alpha_{Brass}\Delta T)$

$$\Delta T = \frac{L_{Al} - L_{Brass}}{L_{Brass}\alpha_{Brass} - L_{Al}\alpha_{Al}} = -199\,^\circ C$$

$\therefore T = 20\,^\circ C - 199\,^\circ C$

$= -179\,^\circ C$ #

(b) if $L_{Al} = 10.02\,cm$, $\Delta T = -396\,^\circ C$

$\therefore T = -376\,^\circ C < 0\,K$!!

unattainable!

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5. (SB 20) (a) The width of the gap will increase.

(b) $L = L_i(1+\alpha_{steel}\Delta T)$

$= (1.600)[1+11\times10^{-6}(190-30)]\,cm$

$= 1.603\,cm$ #

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6. (SB 24) (a) $L_{Brass} = L_{Al}(1+\alpha_{Al}\Delta T)$

$5.0500\,cm = (5.0000)[1+24\times10^{-6}\,^\circ C^{-1}(T-20\,^\circ C)]\,cm$

$T = 437\,^\circ C$ #

(b) $L_{Brass}(1+\alpha_{Brass}\Delta T) = L_{Al}(1+\alpha_{Al}\Delta T)$

$\Rightarrow \Delta T = 2080\,^\circ C$

$\therefore T = 3000\,^\circ C$, Al melts at 660°C!

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7. (SB 27) $PV = N k_B T$

$P = 101\,kPa$

$V = (10.0)(20.0)(30.0)\,m^3 = 6000\,m^3$

$T = (20 + 273.15)\,K = 293.15\,K$

$k_B = 1.38\times10^{-23}\,JK^{-1}$

$\therefore N = 1.50\times10^{29}$ #