Serway & Vuille 8th Edition
Chapter 10 Homework

1. a) $T_c = -273.15°C$ $\quad T_F = \frac{9}{5}T_c + 32 = \frac{9}{5}(-273.15) + 32$

$= -459.67°F \approx -460°F$

b) $T_f = 98.6°F$ $\quad T_c = \frac{5}{9}\left[T_F - 32\right] = \frac{5}{9}\left[98.6 - 32\right] = 37°C$

c) $T_k = 100K$ $\quad T_c = T_k - 273 = 100 - 273 = -173°C$

$T_F = \frac{9}{5}(-173) + 32 = -279.4°F$

$\approx -279°F$

5. Let $T_F = T_c = T$ $\quad T_F = \frac{9}{5}T_c + 32$

$\therefore T = \frac{9}{5}T + 32 \quad -32 = \frac{4}{5}T \therefore T = -40°$

11. $\Delta T = 35°C - (-20°C) = 55°C$

$\alpha_{steel} = 11 \times 10^{-6}\ 1/°C$ $\quad \Delta L = L_0 \alpha \Delta T$

$L_0 = 518m$ $\quad = (518m)(11 \times 10^{-6}\ 1/°C)(55°C)$

$= 0.31m$ or $31cm$

13. $\alpha_{epoxy} = 1.30 \times 10^{-4}\ °C^{-1}$ $\quad \Delta R = \alpha R_i \Delta T$

$.01cm = (1.30 \times 10^{-4}\ °C^{-1})(2.20cm)\Delta T$

$\Delta T = 35.0°C$

$R_i = 2.20cm$, $R_f = 2.21cm$ $\Big\}\ \Delta R = 0.01cm$

$\therefore T_f = T_i + \Delta T = 55.0°C$

25. $\beta = 5.81 \times 10^{-4} (^\circ C)^{-1}$

$V_0 = 50.0\ gal$

$T_i = 10.0^\circ C$

$T_f = 30.0^\circ C$ $\quad \Delta T = 20.0^\circ C$

$\alpha_{steel} = 11 \times 10^{-6} (^\circ C)^{-1}$

$\Delta V_{carbon\ T.} = \beta V_0 \Delta T$

$\Delta V_{steel} = 3\alpha V_0 \Delta T$

$$V_{spill} = \Delta V_{carbon\ T} - \Delta V_{steel}$$

$$V_{spill} = \beta V_0 \Delta T - 3\alpha V_0 \Delta T = \left[\beta - 3\alpha\right] V_0 \Delta T$$

$$= \left(5.81 \times 10^{-4} - 33 \times 10^{-6}\right)(^\circ C)^{-1} (50.0\ gal)(20.0^\circ C)$$

$$= 0.545\ gal$$

33. n_1 moles

$P_1 = 11.0\ atm$

$t_1 = 25.0^\circ C \Rightarrow T_1 = 298\ K$

$n_2 = \frac{n_1}{3}$

$t_2 = 75.0^\circ C \Rightarrow T_2 = 348\ K$

$P_2 = ?$

$V_1 = V_2$

$PV = nRT$ equation of state $\quad \therefore V = \frac{nRT}{P}$

$$\frac{n_1 R T_1}{P_1} = \frac{n_2 R T_2}{P_2}$$

$$\frac{n_1 R (298\ K)}{11.0\ atm} = \frac{\left(\frac{n_1}{3}\right) R (348\ K)}{P_2}$$

$\therefore P_2 = 4.28\ atm$

37. $V_1 = 1.50\ cm^3$

$h = 100\ m$

$P_1 = P_{Atm} + \rho g h$

$P_2 = P_{Atm} = 1.01 \times 10^5\ Pa$

$T_1 = T_2$

$V_2 = ?$

$P_1 = 1.01 \times 10^5\ Pa + \left(10^3 \frac{kg}{m^3}\right)\left(9.80 \frac{m}{s^2}\right)(100\ m)$

$= 1.08 \times 10^6\ Pa$

$P_1 V_1 = P_2 V_2 \quad \therefore V_2 = \frac{P_1 V_1}{P_2}$

$$V_2 = \frac{(1.08 \times 10^6\ Pa)(1.50\ cm^3)}{1.01 \times 10^5\ Pa} = 1.60 \times 10^{-5}\ m^3$$

$= 16.0\ cm^3$

39. $T = 300K$

$$\overline{KE} = \frac{3}{2}kT = \frac{3}{2}\left(1.38 \times 10^{-23} J/K\right)(300K) = 6.21 \times 10^{-21} J$$

43. $T = 77.0°C = 350K$

$$\overline{KE} = \frac{3}{2}kT = \frac{3}{2}\left(1.38 \times 10^{-23} J/K\right)(350K)$$

$$= 7.25 \times 10^{-21} J$$