WEEK 1

Chapter 12: ~~1 5~~, ~~7~~, ~~17~~, ~~27~~, ~~45~~, ~~73~~, ~~81~~, ~~91~~

Chapter 13: ~~1 3~~, ~~5~~, ~~9~~, ~~31~~, 35

12.1 What is 98.6°F in °C?

(12.1) $T_c = \frac{5}{9}(T_F - 32°) = \frac{5}{9}(98.6° - 32°)$

$\boxed{T_c = 37\,°C}$

12.5 Find T_c where it crosses the vertical axis.

Line is just (12.1) graphically.

$T_c = \frac{5}{9}(T_F - 32°)$ y-intercept is when $T_F = 0$

$T_c = \frac{5}{9}(0 - 32°) = \boxed{-17.8\,°C = T_{c1}}$

12.7 $T_{univ} = 2.726$ K.

What is this in °C?

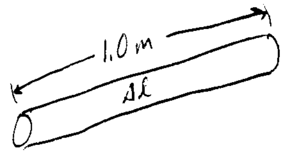
$T_c \rightarrow T_K - 273$

$T_c = 2.726 - 273.15$

$\boxed{T_c = -270.4\,°C}$

$\boxed{12.17}$ 1.00 m Al rod @ 20°C

What is ΔL for $\Delta T = 1.00°C = 1.00\ K$



$\Delta L = L_0 \alpha \Delta T$ (12.3)

$\alpha_{Al} = 25 \times 10^{-6}\ K^{-1}$ (Table 12.2, pg. 510)

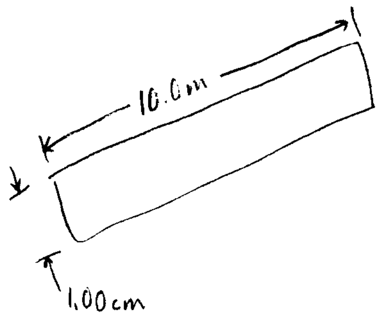
$L_0 = 1.00\ m$

$\Delta L = (1.0\ m)(25 \times 10^{-6}\ K^{-1})(1.00\ K) = 25 \times 10^{-6}\ m$

$\boxed{\Delta L = 25 \times 10^{-6}\ m = 25\ \mu m}$

$\boxed{12.27}$ Calibrated @ 20°C

What is L when $T = 96.8°F$?



$L' = L_0 + \Delta L$

$\Delta L = L_0 \alpha \Delta T$

$L_0 = 10.0\ m$

$\Delta T = T_f - T_i$ $T_i = 20°C$ $T_f = 96.8°F$

$\alpha = 12.15 \times 10^{-6}\ K^{-1}$ $T_f = \frac{5}{9}(96.8 - 32) = 36°C$

$\Delta L = (10.0\ m)(12.15 \times 10^{-6}\ K^{-1})(36°C - 20°C)$

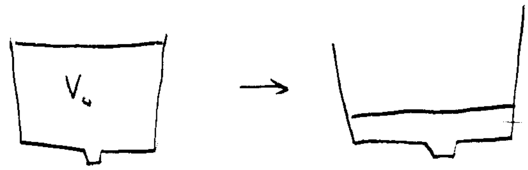
$= 0.0019\ m = 1.94\ mm$

$L' = L_0 + \Delta L$

$= 10.0\ m + 0.0019\ m$

$\boxed{L' = 10.0019\ m}$ This change is negligible.

$\boxed{12.45}$ Syringe



$V_f = \frac{1}{10} V_o$

- Constant temperature compression - ISOTHERMAL
- Constant mass

$\Rightarrow$ $PV = \text{constant}$ (12.5) Boyle's Law

$P_o V_o = P_f V_f$

$P_o = 1$ atm (since it was open to the atmosphere

V_o

$(1 \text{ atm}) V_o = P_f \left(\frac{1}{10} V_o\right)$

$P_f = ?$

$P_f = 10$ atm

$V_f = \frac{1}{10} V_o$

$$\frac{10 \text{ atm} \mid 0.101 \text{ MPa}}{\mid 1 \text{ atm}} = \boxed{1.01 \text{ MPa} = P_f}$$

$\boxed{12.73}$ $n = 1.4$ moles NH_3 gas

10.0 L container @ 202.6 kPa

What is T?

$PV = nRT$

$P = 202.6 \times 10^3$ Pa

$$V = \frac{10.0 \text{ L} \mid 10^{-3} \text{ m}^3}{\mid 1 \text{ L}} = 0.01 \text{ m}^3$$

$\Rightarrow T = \frac{PV}{nR}$

$n = 1.4$

$R = 8.315 \text{ J/mol·K}$

$$T = \frac{(202.6 \times 10^3 \text{ Pa})(0.01 \text{ m}^3)}{(1.4)(8.315 \text{ J/mol·K})}$$

$$\boxed{T = 174 \text{ K} = 99.0\ °C}$$

12.81 Lung capacity

$V = 500\ \text{cm}^3 \left(\frac{1\ \text{m}}{100\ \text{cm}}\right)^3 = 5.0 \times 10^{-4}\ \text{m}^3$

Estimate # molecules per breath.

$P = 761\ \cancel{\text{mmHg}} \cdot \frac{1.33 \times 10^2\ \text{Pa}}{1\ \cancel{\text{mmHg}}} = 0.101\ \text{MPa}$

$PV = N k_B T$ (12.11)

or $PV = nRT$

$\Rightarrow N = \frac{PV}{k_B T}$

$nR = N k_B$

$k_B = 1.38 \times 10^{-23}\ \text{J/K}$

$= \frac{(1.01 \times 10^5\ \text{Pa})(5.0 \times 10^{-4}\ \text{m}^3)}{(1.38 \times 10^{-23}\ \text{J/K})(310\ \text{K})}$

$T = T_{body} = 37\,^\circ\text{C} = 310\ \text{K}$

$\boxed{N = 1.2 \times 10^{22}\ \text{molecules}}$

12.91 $m = 5.3136 \times 10^{-26}\ \text{kg}$

What is v_{rms} @ $T = 293.15\ \text{K}$

$$v_{rms} = \sqrt{\frac{3 k_B T}{m}} = \sqrt{\frac{3(1.38 \times 10^{-23}\ \text{J/K})(293.15\ \text{K})}{(5.3136 \times 10^{-26}\ \text{kg})}}$$

$\boxed{v_{rms} = 478\ \text{m/s}}$