PHYS 133

CH. # 13.
H.W. Solution

#5, $T_F = \frac{9}{5} T_C + 32$

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

when $T_F = 136$

$T_C = \frac{5}{9}[136 - 32]$

$= \frac{5}{9}[104]$

$= 57.77^\circ C$

when $T_F = -129$

$T_C = \frac{5}{9}[-129 - 32]$

$= -89.44^\circ C$

#9,

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

$\alpha = 12 \times 10^{-6} /^\circ C$

$\Delta L = 14 \times 12 \times 10^{-6} \times (50 - 20)$

$= 5 \times 10^{-3}$ m

$= 0.5$ cm.

#17

The radius $= \frac{14.5}{2} = 7.25$ cm

$= 7.25 \times 10^{-2}$ m.

$V_0 = \frac{4}{3} \pi R_0^3$

$\Delta V = V_0 \times 3\alpha \, \Delta T$

$\alpha = 0.4 \times 10^{-6} / {}^oC$

$\Delta V = \frac{4}{3} \pi (7.25)^3 \times 0.4 \times 10^{-6} \times 170$

$= 1.08 \times 10^{-1}$ cm3.

#25 $\frac{F}{A} = \alpha E \Delta T$

$= 25 \times 10^{-6} \times 70 \times 10^{9} \times (35 - 15)$

$= 3.5 \times 10^{7}$ N/m2.

#31. STP means standard temperature and pressure

$T_0 = 273^oK$ and $P_0 = 1$ atm

$= 1.013 \times 10^{5}$ N/m2.

$V_0 = 3.00$ m3

$P_0 V_0 = n R T_0$

$PV = nRT$

$P = 4$ atm , $T = 273 + 38 = 311^oK$

31 cont.

$$\frac{PV}{P_0V_0} = \frac{T}{T_0}$$

or $V = \dfrac{P_0 V_0 T}{T_0 P}$

$= \dfrac{1 \times 3 \times 311}{275 \times 4}$

$= 0.85\ m^3.$

34: The molecular wieght for $N_2 = 28\ g/m$

∴ The Initial number of moles is

$n_0 = \dfrac{18500}{28} = 1017.85$ moles

$n = \dfrac{18500 + 15000}{28} = 1196.42$ moles

a. $P_0 V_0 = n_0 R T_0$

$V_0 = \dfrac{n_0 R T_0}{P_0} = \dfrac{1017.85 \times 8.31 \times 275}{1.01 \times 10^5}$

$= 2.34\ m^3$

Note: The volume of the gas will not change because it is the same as that of the tank

b. ∴ $V = V_0$

#34 conti

$$P V_0 = nRT_0$$

$$\therefore P = \frac{nRT_0}{V_0}$$

$$= \frac{1196.42 \times 8.31 \times 273}{2.34}$$

$$= 1159929.2 \ N/m^2$$

$$= \frac{1159929.2}{1.01 \times 10^5} = 1.15 \text{ atm.}$$

#38.

$P_1 = 2.45$ atm

$V_1 = 55.0$ L

$T_1 = 273 + 18 = 291\,°K$

$P_2 = ?$

$V_2 = 48.8$ L

$T_2 = 273 + 50 = 323\,°K$

$$\frac{P_1 V_1}{P_2 V_2} = \frac{T_1}{T_2}$$

$$\therefore P_2 = \frac{P_1 V_1 T_2}{V_2 T_1} = \frac{2.45 \times 55 \times 323}{48.8 \times 291}$$

$$= 3.06 \text{ atm.}$$

47:

The mass of He = 2 gm/mole

$$= \frac{2 \times 10^{-3}}{6.012 \times 10^{23}}$$

$$= 3.34 \times 10^{-27} \text{ kg}$$

$$v_{rms} = \sqrt{\frac{3 \times 1.83 \times 10^{-23} \times 6000}{3.34 \times 10^{-27}}}$$

= ~~9.93~~ m/s

$$= 9.93 \times 10^{3} \text{ m/s}.$$

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#50:

~~$\frac{V_1}{V_2}$~~ ~~V_{rms}~~

$$\frac{v_{2rms}}{v_{1rms}} = \frac{\sqrt{\frac{3KT_2}{m}}}{\sqrt{\frac{3KT_1}{m}}}$$

or $v_{2rms} = 2 v_{1rms}$

$$\therefore 2 = \sqrt{\frac{T_2}{T_1}}$$

$$\therefore \frac{T_2}{T_1} = 4$$

$$\therefore T_2 = 4T_1 = 4 \times 273 = 1092^\circ K.$$