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Solutions by

Ch 11: CQ 19, 28, 40; Ex 11, 17, 19

Ch 13: CQ 1, 5 Ex 3, 7.

11 Q 19. The number of molecules is **the same**, by Avogadro's law that at the same temperature and pressure, EVERY LITER of ANY GAS contains the same number of molecules.

11 Q.28 Let $F = 3000\ N = P_1 A_1 = c \cdot (32\ psi)(200\ cm^2)$ describe the normal situation.

If the pressure is reduced to $P_2 = 16\ psi$ while the required Force remains the same, then the contact area must increase to A_2 as follows:

$$F_1 = P_1 A_1 = F_2 = P_2 A_2 \Rightarrow A_2 = \frac{P_1 A_1}{P_2} = \left(\frac{32}{16}\right) 200\ cm^2$$

i.e., New area $\boxed{A_2 = 400\ cm^2}$

11. Q 40 $T_F = 32 + \frac{180}{100} T_C$ { Check that this yields $T_F = 32°F$ at $T_C = 0°C$; $T_F = 212°F$ at $T_C = 100°C$ }

and is therefore the correct relationship between T_F & T_C

Then to get $T_F = 72°F$, T_C must satisfy $72 = 32 + \frac{9}{5} T_C$

So that $T_C = (72-32)5/9 = \frac{40 \cdot 5}{9} = \frac{200}{9} = \boxed{22.2°C = T_C}$

11. Ex 11. (a) Given Nitrogen / Hydrogen come as N_2, H_2 : 1 molecule has 2 atoms.

Also 3 L. of H combine with 1 L. of N, & this implies that Ammonia is N_1H_3 (or N_2H_6, N_3H_9 ....), since the atom ratio is 3:1. Then the fact that 2 L of Ammonia is produced shows that 2 molecules of Ammonia result from every 1 molecule of Nitrogen, which is to say from every 2 atoms of N. Thus 1 molecule of Ammonia results from each atom of N & the chemical formula is $N_1H_3 = NH_3$: 1 atom N + 3 atoms H and not N_2H_6, N_3H_9 ... or any higher multiple).

Answer: 1 N atom & 3 H atoms

11. Ex 17 $PV = nRT$ = constant when T is held constant

Then if $P \to P' = 3P$ & $V \to V' = xP$

we have $nRT = PV = P'V' = 3P \cdot xV$ $\Rightarrow x = \frac{PV}{3PV} = 1/3$

Volume is reduced by factor of 3: $V \to V' = V/3$.

$V_f = \frac{1}{3}L$.

11. Ex: 19 Ideal GAS LAW: $P_1V_1 = cT_1$; If temperature is kept constant while Pressure decreases to P_2, the new Volume is $V_2 = \frac{cT_1}{P_2}$ and the original Volume was $V_1 = \frac{cT_1}{P_1}$. Therefore $V_2 = \frac{P_1}{P_2}V_1$. Then if $V_1 = 3L$ at $P_1 = 100$ Atm. and $P_2 = 1.25$ Atm., we compute $V_2 = \frac{100}{1.25} \cdot 3L = 240L$ at 1.25 atm

So that **240 1L balloons** can be filled.

Homework Solutions, Physics 117
Home Work Problem Set # 9

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13. Q1. The gravitational potential energy is first converted to kinetic energy and then to thermal (heat) energy by the frictional forces which bring the avalanche to a halt.

13. Q5 Work and heat both change the internal energy the system and can be measured in Joules. Heat operates at a microscopic level and work a macroscopic level.

13 Ex3.

$$W = Fd = 200\,N \times 4\,m = 800\,J$$

$$Q = 800\,J \times \frac{1\,cal}{4.2\,J} = 190.5\ cal.$$

13. Ex7. Change in internal energy $= \Delta U = Q + W = 28\,J - 2\,J$

$$= 16\,J$$

[Note Text's Answer (p A11), 164J, is WRONG!]