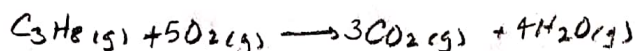


YOU MUST SHOW ALL YOUR WORK FOR CREDIT. NO WORK, NO CREDIT!!!!

1. A liter of methane gas, CH_4 , at STP contains more atoms of hydrogen than does a liter of pure hydrogen, at STP. Using Avogadro's Law, explain why?

Equal volumes of any gases @ the same temperature and pressure contain the same number of particles, which means one mole of CH_4 is equal to one mole of H_2 @ STP. But one mole of CH_4 contains 4 moles of hydrogen atoms and one mole of H_2 contains 2 moles of hydrogen atoms. So 1 liter of CH_4 @ STP will have twice as many hydrogen atoms as 1 liter of hydrogen gas @ STP.

2. What is the total volume of the $\text{CO}_2(\text{g})$ and $\text{H}_2\text{O}(\text{g})$ at 600°C and 735 torr produced by the combustion of 1.00 L of $\text{C}_3\text{H}_8(\text{g})$ measured at STP? Assume that the products are the only materials remaining.



$$V = \frac{nRT}{P}$$

1.00 L C_3H_8	1 mol	7 mol $\text{CO}_2 + \text{H}_2\text{O}$	0.0821 L·atm	(600 °C + 273.15) K	735 torr	760 torr	= 23.2 L $\text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{g})$
	22.4 L	1 mol C_3H_8	mol·K		1 atm	1 atm	

3. What is the partial pressure of CO_2 in the product gases from #2.

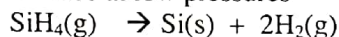
① from % volume $\Rightarrow \frac{3}{7} \cdot 735 \text{ torr} = 315 \text{ torr}$

② from stoich

$$P = \frac{nRT}{V}$$

1.00 L C_3H_8	1 mol	3 mol CO_2	0.0821 L·atm	(600 + 273.15) K	760 torr	= 315 torr
	22.4 L	1 mol C_3H_8	mol·K		23.2 L	

4. Thin films of amorphous silicon for electronic applications are prepared by decomposing silane gas, SiH_4 , on a hot surface at low pressures



What volume of silane gas at 130 Pa and 800 K is required to produce a 10.0 cm x 10.0 cm film that is 200 angstroms thick? The density of amorphous silicon is 1.9 g/cm³.

$$V = \frac{nRT}{P}$$

10.0 cm	10.0 cm	200 Å	1 cm	1.9 g Si	1 mol Si	1 mol SiH_4	0.0821 L·atm	800 K	101325 Pa	= 0.7 L SiH_4 (0.693 L SiH_4)
		$1 \times 10^8 \text{ Å}$	1 cm ³	28.09 g Si	1 mol Si	1 mol Si	mol·K		130 Pa	

Vol of $\text{Si}(\text{s}) \times \text{density} \times \text{m.m} = \text{mol Si}$

5. Cyclopropane, a gas used with oxygen as a general anesthetic, is composed of 85.7% carbon and 14.3% hydrogen by mass. If 1.56 g of cyclopropane has a volume of 1.00 L at 0.984 atm and 50.0°C , what is the molecular formula of cyclopropane?

E.F. $\Rightarrow \frac{85.7 \text{ g C}}{12.01 \text{ g C}} = 7.14 \text{ mol C} / 7.14 \approx 1 \text{ CH}_2$

$\frac{14.3 \text{ g H}}{1.01 \text{ g H}} = 14.2 \text{ mol H} / 7.14 \approx 2$

m.m. $\Rightarrow \frac{g}{V} = \frac{g}{PV} \cdot RT \Rightarrow \frac{1.56 \text{ g C.P.}}{1.00 \text{ L}} \cdot \frac{0.0821 \text{ L·atm}}{\text{mol·K}} \cdot \frac{(50.0^\circ\text{C} + 273.15) \text{ K}}{0.984 \text{ atm}} = 42.19 \text{ g/mol}$

$$n = \frac{PV}{RT}$$

m.F. = E.F. $\times \frac{\text{m.m}}{\text{E.F.M}} = \text{CH}_2 \cdot \left(\frac{42.19 \text{ g/mol}}{14.03 \text{ g/mol}} \right) = \text{C}_3\text{H}_6$