

# Gases APQs

1 of 3

1a) need pressure of just  $H_2$  :  $745 \text{ mmHg total} - 23.8 \text{ mmHg } H_2O$

$$n = \frac{\left(\frac{721.2}{766}\right) \cdot 0.0900 \text{ L}}{0.08206 \frac{\text{atm} \cdot \text{L}}{\text{mol} \cdot \text{K}} \cdot 298.15 \text{ K}}$$

$$P_{H_2} = 721.2 \text{ mmHg}$$

$$0.08206 \frac{\text{atm} \cdot \text{L}}{\text{mol} \cdot \text{K}} \cdot 298.15 \text{ K}$$

$$n = \boxed{3.49 \cdot 10^{-3} \text{ mol } H_2}$$

$$b) n = \frac{\left(\frac{23.8 \text{ mmHg}}{760 \text{ mmHg/atm}}\right) \cdot 0.0900 \text{ L}}{0.08206 \frac{\text{atm} \cdot \text{L}}{\text{mol} \cdot \text{K}} \cdot 298.15 \text{ K}}$$

$$= \boxed{1.15 \cdot 10^{-4} \text{ mol } H_2O}$$

$$c) \frac{V_{H_2}}{V_{H_2O}} = \sqrt{\frac{18.016}{2.016}} = \boxed{2.99}$$

$$2) a) P_{H_2+O_2} = \frac{(2.50 + 5.00) \cdot 0.08206 \frac{\text{atm} \cdot \text{L}}{\text{mol} \cdot \text{K}} \cdot 400.15}{8.20 \text{ L}} = 12.0 \text{ atm}$$

$$12.0 \text{ atm} + 2.00 \text{ atm} = \boxed{14.0 \text{ atm Total}}$$

$$b) \text{ need moles of Ar } n_{Ar} = \frac{2.00 \cdot 8.20 \text{ L}}{0.08206 \frac{\text{atm} \cdot \text{L}}{\text{mol} \cdot \text{K}} \cdot 400.15} = 0.500 \text{ mol}$$

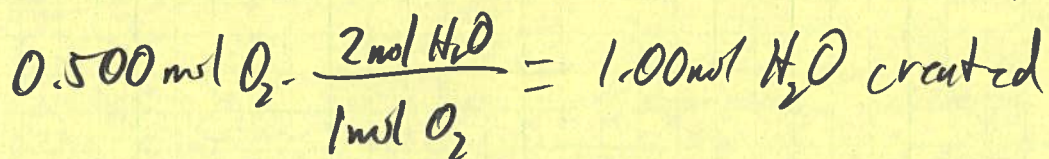
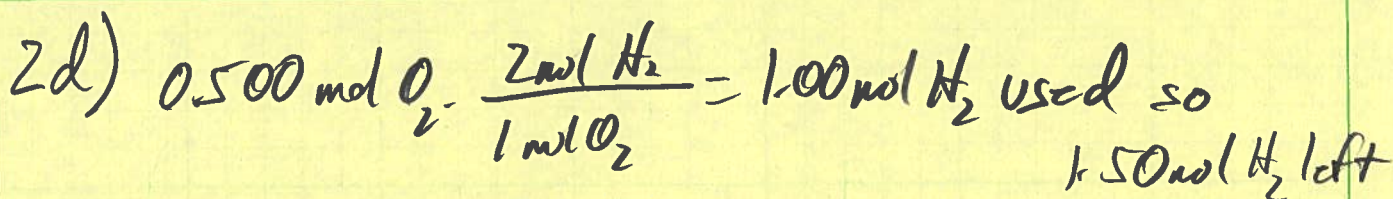
$$\frac{2.50 \text{ mol } H_2}{3.50 \text{ mol total}} = \boxed{0.714}$$

$$c) 2.50 \text{ mol } H_2 \cdot \frac{2.016 \text{ g}}{1 \text{ mol}} = 5.04 \text{ g}$$

$$0.500 \text{ mol Ar} \cdot \frac{39.95 \text{ g}}{1 \text{ mol Ar}} = 19.975 \text{ g}$$

$$0.500 \text{ mol } O_2 \cdot \frac{32.00 \text{ g}}{1 \text{ mol}} = 16.00 \text{ g}$$

$$\frac{41.015 \text{ g}}{8.20 \text{ L}} = \boxed{5.00 \text{ g/L}}$$



assuming temp remains const then .500 mol Ar  
generates 2.00 atm

can also calculate with  $PV = nRT$

$$P_{Ar} = 2.00 \text{ atm}$$

$$\text{eg: } P = \frac{nRT}{V} = \frac{1.00 \text{ mol} \cdot 0.08206 \cdot 400.15}{8.20 \text{ L}} = 4.00 \text{ atm}$$

$$P_{H_2O} = 4.00 \text{ atm}$$

$$P_{H_2} = 6.00 \text{ atm}$$

3) a) False, volume is irrelevant to the number of moles. All the balloons will have the same number of moles.

b) False, temperature is a measure of kinetic energy. If the temperatures are the same then the kinetic energies are the same.

c) False, the balloon with the lightest particles will have the greatest rate of shrinking. The rates of effusion depend on the mass of the particles.

4a) need mols of He and  $N_2$

$$3.22 \text{ g He} \cdot \frac{1 \text{ mol He}}{4.003 \text{ g He}} = 0.804 \text{ mol He} \quad 11.56 \text{ g } N_2 \cdot \frac{1 \text{ mol } N_2}{28.02 \text{ g } N_2} = 0.413 \text{ mol } N_2$$

$$P = \frac{n \cdot R \cdot T}{V} = \frac{(0.804 + 0.413) \cdot 0.08206 \cdot 288.15}{5.25 \text{ L}} = \boxed{5.48 \text{ atm}}$$

$$\text{a ii)} \frac{P_{N_2}}{P_{\text{Total}}} = \frac{n_{N_2}}{n_{\text{Total}}} = \frac{0.413 \text{ mol}}{1.217 \text{ mol}} = \boxed{0.339}$$

$$\text{bi)} P = \frac{9.62 \text{ g}}{1.50 \text{ L}} = \boxed{6.41 \text{ g/L}}$$

$$\text{b ii)} M.M. = \frac{6.41 \text{ g/L} \cdot 0.08206 \cdot 303}{3.62 \text{ atm}}$$

$$\text{b iii)} \text{max } \Delta C = 36.0 \text{ g}$$

$$M.M. = 43.96 \text{ g/mol}$$

$$43.96 - 36.03 = \frac{7.93}{1.008} = 7.86 \text{ H} \quad \boxed{C_3 H_8}$$

$$\text{5a)} 6.19 \text{ g } PCl_5 \cdot \frac{1 \text{ mol } PCl_5}{208.22 \text{ g } PCl_5} = 0.0297 \text{ mol } PCl_5$$

$$P = \frac{0.0297 \text{ mol} \cdot 0.08206 \frac{\text{atm} \cdot \text{L}}{\text{mol} \cdot \text{K}} \cdot 525.15}{2.00 \text{ L}} = 0.640 \text{ atm}$$

$$\text{b)} P_{\text{Total}} = P_{PCl_3} + P_{Cl_2} + P_{PCl_5} = 1.00 \text{ atm}$$

based on reactants

leftover, so =  $0.640 - P_{Cl_2}$

could also have been

$P_{PCl_3}$   
ratio  
is 1:1

$$P_{PCl_3} = P_{Cl_2}$$

So solving in

$$P_{Cl_2} = 0.360 \text{ atm} = P_{PCl_3} \quad P_{Cl_2} + P_{Cl_2} + (0.640 - P_{Cl_2}) = 1.00$$

$$P_{PCl_5} = (0.640 - 0.360) = 0.280 \text{ atm} \quad P_{Cl_2} = 1.00 - 0.640 = 0.360 \text{ atm}$$