

Gas Problems - Test Review

$$1) \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad (8.5 \text{ atm})(3.10 \text{ mL}) = (1.18 \text{ atm}) V_2$$

(285 K) 308 K

$$\boxed{24 \text{ mL} = V_2}$$

$$2) PV = nRT \quad \frac{.45 \text{ g CO}_2}{44.01 \text{ g}} = .0104 \text{ mol}$$

$$P(.160 \text{ L}) = (.0104 \text{ mol})(.0821)(295 \text{ K})$$

$$\boxed{P = 1.57 \text{ atm}}$$

$$\frac{1.57 \text{ atm}}{1 \text{ atm}} \times 760 \text{ torr} = \boxed{1190 \text{ torr}}$$

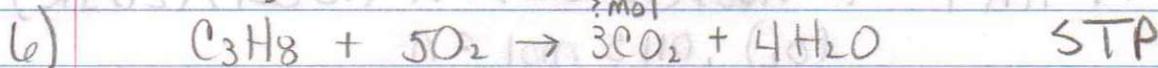
$$3) P_1 V_1 = P_2 V_2 \quad (150 \text{ kPa})(420 \text{ mL}) = P_2 (100 \text{ mL})$$

$$\boxed{630 \text{ kPa} = P_2}$$

$$4) \frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \frac{3.5 \times 10^3 \text{ L}}{273 \text{ K}} = \frac{V_2}{203 \text{ K}} \quad \boxed{V_2 = 2.6 \times 10^3 \text{ L}}$$

$$5) \frac{P_1}{T_1} = \frac{P_2}{T_2} \quad \frac{680 \text{ Torr}}{312 \text{ K}} = \frac{620 \text{ Torr}}{T_2} \quad \boxed{T_2 = 284 \text{ K}}$$

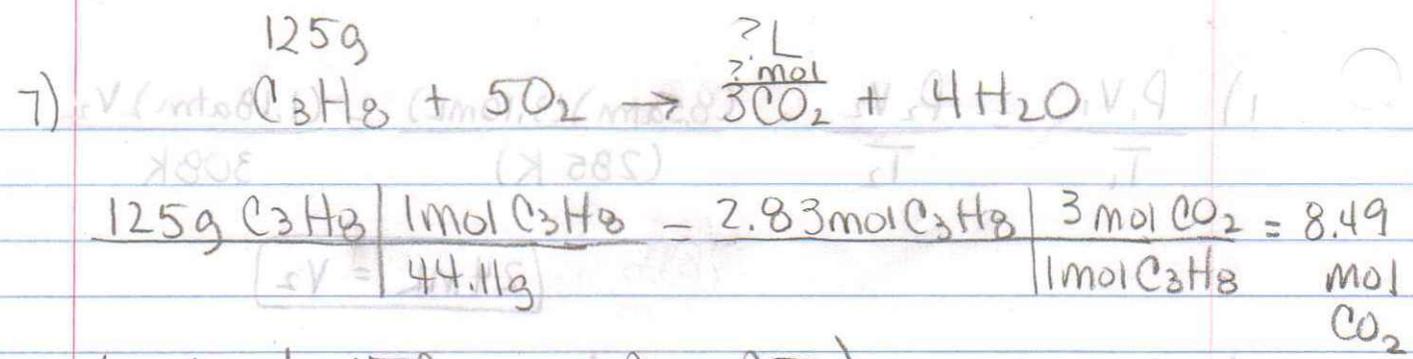
$$284 \text{ K} - 273 = \boxed{11^\circ \text{C}}$$



$$\frac{45.0 \text{ g C}_3\text{H}_8}{44.11 \text{ g}} \times \frac{1 \text{ mol}}{1 \text{ mol}} = 1.02 \text{ mol C}_3\text{H}_8 \quad \frac{3 \text{ mol CO}_2}{1 \text{ mol C}_3\text{H}_8} = 3.06 \text{ mol CO}_2$$

$$\frac{3.06 \text{ mol}}{X \text{ L}} \times \frac{1 \text{ mol}}{22.4 \text{ L}}$$

$$\boxed{X = 68.5 \text{ L}}$$



(not at STP, use $PV=nRT$)

$PV=nRT$
 $(202.6 \text{ kPa})V = (8.49 \text{ mol})(8.314)(305 \text{ K})$
 $V = 106 \text{ L}$

8) $\frac{\text{rate}_A}{\text{rate}_B} = \sqrt{\frac{MM_B}{MM_A}}$ or $\frac{\text{rate}_A}{\text{rate}_B} = \sqrt{\frac{MM_B}{MM_A}}$

$1.19 = \sqrt{\frac{x}{28.02g}}$ $1.19^2 = \frac{x}{28.02g}$ $x = 39.7g/mol$

(larger mass on top - gives > 1 rate of effusion)

9) a) $P_{total} = P_{O_2} + P_{H_2O}$
 $750 \text{ mmHg} = P_{O_2} + (9.209 \text{ mmHg})$
 $741 \text{ mmHg} = P_{O_2}$

b) $PV=nRT$ $(741/760)(2.75 \text{ L}) = n(0.0821)(283 \text{ K})$
 $0.0115 \text{ mol } O_2 \mid 32.00 \text{ g} = 0.368 \text{ g } O_2$

10) $d = \frac{(mm)(P)}{RT}$ $d = \frac{(46.01 \text{ g/mol})(1.20 \text{ atm})}{(0.0821)(302 \text{ K})} = 2.239 \text{ g/L}$

$$11) d = \frac{(MM)(P)}{RT}$$

$$3.74 \text{ g/L} = \frac{(MM)(1 \text{ atm})}{(0.0821)(273 \text{ K})}$$

$$\boxed{83.8 \text{ g/mol} = MM}$$

12) They all have the same K.E. (same temp)

13) The least massive molecule will have the greatest velocity. CH_4

$$14) \frac{\text{rate}_A}{\text{rate}_B} = \sqrt{\frac{MM_B}{MM_A}} \quad \frac{\text{rate}_{\text{SO}_2}}{\text{rate}_{\text{NH}_3}} = \sqrt{\frac{17.04 \text{ g/mol}}{64.07 \text{ g/mol}}}$$

$$\text{rate} = .5157$$

SO_2 effuses .5157x as fast as NH_3
(it's heavier)

$$\frac{\text{rate}_{\text{NH}_3}}{\text{rate}_{\text{SO}_2}} = \sqrt{\frac{64.07 \text{ g/mol}}{17.04 \text{ g/mol}}}$$

$$\text{rate} = 1.939$$

NH_3 effuses ≈ 2 x faster
than SO_2 (it's lighter)

$$15) \frac{\text{rate}_{\text{He}}}{\text{rate}_{\text{N}_2}} = \sqrt{\frac{28.02 \text{ g/mol}}{4.00 \text{ g/mol}}}$$

$$\text{rate} = 2.65$$

Helium diffuses 2.65x faster
than N_2 , because it's lighter.

$$16) \text{ rate} = \sqrt{\frac{MM_X}{MM_{O_2}}}$$

$$2.00 = \sqrt{\frac{X}{32.00 \text{ g/mol}}}$$

$$(2.00)^2 = \frac{X}{32.00 \text{ g/mol}}$$

$$128 \text{ g/mol} = X$$