

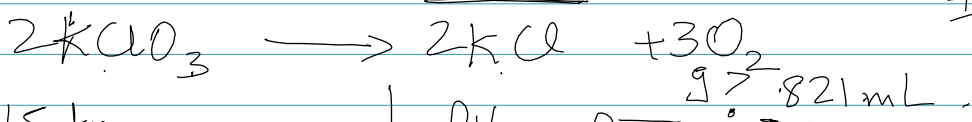
## Gas Laws: Collecting Gas Over Water

Stoichiometry, 
$$P_{\text{total}} = P_{\text{gas}} + P_{\text{H}_2\text{O}}$$

$$P_{\text{gas}} = P_{\text{total}} - P_{\text{H}_2\text{O}}$$

- 1) Calculate the mass of  $\text{O}_2$  produced by decomposition of  $\text{KClO}_3$  when 821 mL of  $\text{O}_2$  is collected over water at 30.0°C and 1.015 atm.

$\frac{30}{+273}$



$$P_{\text{total}} = 1.015 \text{ atm}$$

$$P_{\text{H}_2\text{O}} = 31.8 \text{ torr} \times \frac{1 \text{ atm}}{760 \text{ torr}} = 0.0418 \text{ atm}$$

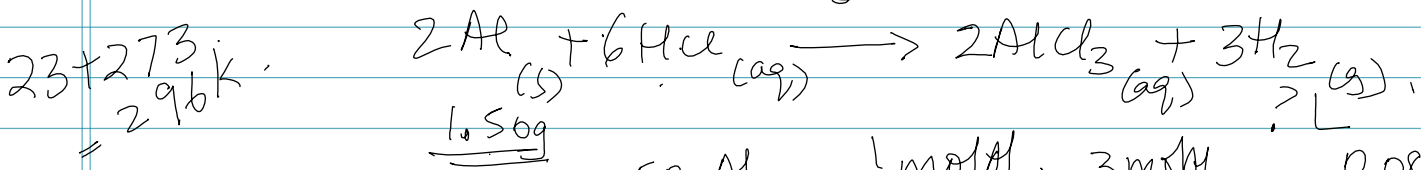
$$P_{\text{gas}} = 1.015 \text{ atm} - 0.0418 \text{ atm} = \underline{\underline{0.973 \text{ atm}}}$$

$$PV = nRT$$

$$n = \frac{PV}{RT} = \frac{0.973 \text{ atm} \times 0.821 \text{ L}}{0.0821 \frac{\text{L atm}}{\text{mol K}} \times 303 \text{ K}}$$

$$= 0.0321 \text{ mol} \times \frac{32 \text{ g O}_2}{\text{mol O}_2} = \boxed{1.03 \text{ g O}_2}$$

- 2) Hydrogen produced in the following reaction is collected over water at 23°C, when the barometric pressure is 742 torr. What volume of "wet" gas will be collected with in the reaction of 1.50g Al with excess  $\text{HCl}$ ?



$\frac{23 + 273}{296 \text{ K}}$

$$P_{\text{H}_2\text{O}} \text{ at } 23^\circ\text{C} = 21.1 \text{ torr}$$

$$P_{\text{H}_2} = P_{\text{total}} - P_{\text{H}_2\text{O}} = \frac{(742 - 21.1)}{760} = \underline{\underline{0.9487 \text{ atm}}}$$

$$1.50 \text{ g Al} \times \frac{1 \text{ mol Al}}{26.98 \text{ g Al}} \times \frac{3 \text{ mol H}_2}{2 \text{ mol Al}} = 0.0834 \text{ mol}$$

$$PV = nRT$$

$$V = \frac{nRT}{P} = \frac{0.0834 \text{ mol} \times 0.0821 \frac{\text{L atm}}{\text{mol K}} \times 296 \text{ K}}{0.9487 \text{ atm}} = \boxed{2.14 \text{ L}}$$