

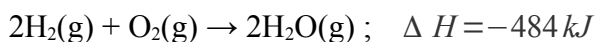
## CHM 110-01 - Summer 2013 - In-Class Practice Work

Write your names in the blanks below:

**SOLUTIONS**

Solve the problem, and show your work on the page below.

1) What volume of hydrogen gas at 125 °C and 1.05 atm pressure would be required to provide 1550 kJ of heat via the following reaction?



Answer: 199 L H<sub>2</sub>

$$2 \text{ mol H}_2 = -484 \text{ kJ}$$

$$-1550 \text{ kJ} \times \frac{2 \text{ mol H}_2}{-484 \text{ kJ}} = 6.404958678 \text{ mol H}_2$$

$$V = \frac{nRT}{P} \quad \left| \quad \begin{array}{l} n = 6.404958678 \text{ mol H}_2 \quad T = 125^\circ\text{C} = 398 \text{ K} \\ R = 0.08206 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}} \quad P = 1.05 \text{ atm} \end{array} \right.$$

$$V = \frac{(6.404958678 \text{ mol H}_2)(0.08206 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}})(398 \text{ K})}{(1.05 \text{ atm})}$$

$$= 199.223982684 \text{ L H}_2$$

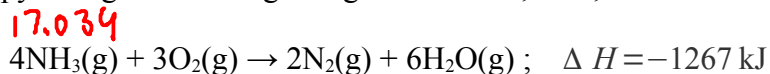
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2) What is the enthalpy change on burning 175 g of ammonia,  $\text{NH}_3$ , in the following reaction?



Answer: -3250 kJ

$$17.034 \text{ g NH}_3 = \text{mol NH}_3 \quad 4 \text{ mol NH}_3 = -1267 \text{ kJ}$$

$$175 \text{ g NH}_3 \times \frac{\text{mol NH}_3}{17.034 \text{ g NH}_3} \times \frac{-1267 \text{ kJ}}{4 \text{ mol NH}_3} = -3254.157458 \text{ kJ}$$

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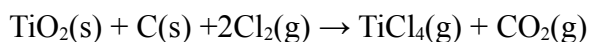
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**SOLUTIONS**

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Solve the problem, and show your work on the page below.

3) What mass of  $\text{TiO}_2$  solid would (given enough carbon and chlorine) be required to produce 375 L of  $\text{CO}_2$  gas at 525 °C and 1.25 atm in the following reaction?



Answer: 572 g  $\text{TiO}_2$

$$n = \frac{PV}{RT} \quad \left| \quad P = 1.25 \text{ atm} \quad V = 375 \text{ L} \quad R = 0.08206 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}} \right.$$
$$\left. \quad \quad \quad T = 525^\circ\text{C} = 798 \text{ K} \right.$$

$$n_{\text{CO}_2} = \frac{(1.25 \text{ atm})(375 \text{ L})}{(0.08206 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}})(798 \text{ K})} = 7.158250244 \text{ mol CO}_2$$

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$$\text{mol CO}_2 = \text{mol TiO}_2 \quad 79.87 \text{ g TiO}_2 = \text{mol TiO}_2$$

$$7.158250244 \text{ mol CO}_2 \times \frac{\text{mol TiO}_2}{\text{mol CO}_2} \times \frac{79.87 \text{ g TiO}_2}{\text{mol TiO}_2} = 571.729447003 \text{ g TiO}_2$$

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4) What volume (in mL) of 6.00 M HCl solution would be required to produce 55.0 L of CO<sub>2</sub> gas at 0.975 atm and 27.0 °C in the following reaction? Assume there is sufficient sodium carbonate



Answer: 726 mL of 6.00 M HCl

$$n = \frac{PV}{RT} \quad \left| \quad P = 0.975 \text{ atm} \quad V = 55.0 \text{ L} \quad R = 0.08206 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}} \right.$$
$$\left. \quad T = 27.0^\circ\text{C} = 300.2 \text{ K} \right.$$

$$n_{\text{CO}_2} = \frac{(0.975 \text{ atm})(55.0 \text{ L})}{\left(0.08206 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}}\right)(300.2 \text{ K})} = 2.17683296 \text{ mol CO}_2$$

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$$2 \text{ mol HCl} = 1 \text{ mol CO}_2 \quad 6.00 \text{ mol HCl} = 1 \text{ L} \quad \text{mL} = 10^{-3} \text{ L}$$

$$2.17683296 \text{ mol CO}_2 \times \frac{2 \text{ mol HCl}}{1 \text{ mol CO}_2} \times \frac{1 \text{ L}}{6.00 \text{ mol HCl}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 725.610986777 \text{ mL}$$

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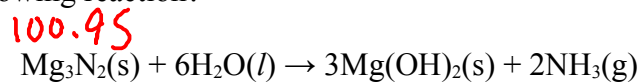
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**SOLUTIONS**

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Solve the problem, and show your work on the page below.

5) What volume of ammonia gas is produced at STP from the reaction of 25.0 g of  $\text{Mg}_3\text{N}_2$  with sufficient water in the following reaction?



Answer: 11.1 L  $\text{NH}_3$

$$100.95 \text{ g Mg}_3\text{N}_2 = 1 \text{ mol Mg}_3\text{N}_2 \quad 2 \text{ mol NH}_3 = 1 \text{ mol Mg}_3\text{N}_2$$

$$25.0 \text{ g Mg}_3\text{N}_2 \times \frac{1 \text{ mol Mg}_3\text{N}_2}{100.95 \text{ g Mg}_3\text{N}_2} \times \frac{2 \text{ mol NH}_3}{1 \text{ mol Mg}_3\text{N}_2} = 0.4952947 \text{ mol NH}_3$$

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$$V = \frac{nRT}{P} \quad \left| \begin{array}{l} n = 0.4952947 \text{ mol NH}_3 \\ R = 0.08206 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}} \\ T = 0^\circ\text{C} = 273.15 \text{ K} \\ P = 1.00 \text{ atm} \end{array} \right.$$

$$V = \frac{(0.4952947 \text{ mol NH}_3)(0.08206 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}})(273.15 \text{ K})}{(1.00 \text{ atm})}$$

$$= 11.101876672 \text{ L}$$

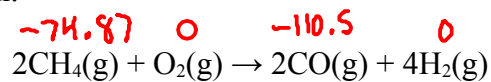
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6) Using standard enthalpies of formation (see your textbook), calculate the enthalpy change  $\Delta H^\circ$  for the reaction below, as written:



Answer:  $\Delta H^\circ =$  -71.3 kJ

$$\begin{aligned} \Delta H^\circ &= [2(-110.5) + 4(0)] - [2(-74.87) + 1(0)] \\ &= -71.26 \text{ kJ} \end{aligned}$$