

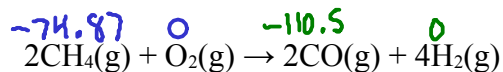
CHM 110

Heat Practice Set

SOLUTIONS

Solve the following problems Write the answer in the answer blank, and show work in the space provided.

1) Using standard enthalpies of formation (see your textbook), calculate the enthalpy change ΔH° for the reaction below, as written:



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

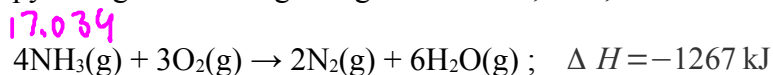
$$\begin{aligned}\Delta H^\circ &= [2(-110.5) + 4(0)] - [2(-74.87) + 1(0)] \\ &= -71.26 \text{ kJ}\end{aligned}$$

2) A 1.50 kg block of iron cools from a temperature of 100.0 °C to 23.5 °C. Calculate the heat, Q, associated with this change. Assume the specific heat of iron is $0.449 \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}}$

Answer: Q = -51500 J

$$\begin{aligned}Q &= 1500 \text{ g} \times 0.449 \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}} \times (23.5^\circ\text{C} - 100.0^\circ\text{C}) \\ &= -51522.75 \text{ J}\end{aligned}$$

3) What is the enthalpy change on burning 175 g of ammonia, NH_3 , in the following reaction?

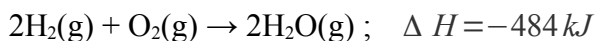


Answer: -3250 kJ

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

$$175 \text{ g NH}_3 \times \frac{\text{mol NH}_3}{17.034 \text{ g NH}_3} \times \frac{-1267 \text{ kJ}}{4 \text{ mol NH}_3} = -3254.153458 \text{ kJ}$$

4) 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_2

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

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

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

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

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