

Date: Oct. 15th 2021

Name: Ahmad Alvi

Class:

Reinforcement

Chapter 5

BLM 5-2

Thermochemical Equations and Stoichiometry

Goal

Reinforce your understanding of the stoichiometry of thermochemical equations.

Procedure

Answer the questions below in the spaces provided.

Questions

1. Consider the following thermochemical equation:



- (a) How much heat is released when 3.0 mol $\text{ZnS}_{(s)}$ reacts in excess oxygen?

$$\left(\frac{3}{2}\right)(-878.2) = -1317.3 \text{ kJ}$$

- (b) How much heat is released when 2.3×10^{-2} mol $\text{ZnS}_{(s)}$ reacts in excess oxygen?

$$\frac{2.3 \times 10^{-2} \text{ mol}}{2 \text{ mol}} \times -878.2 \text{ kJ} = -10.1 \text{ kJ}$$

- (c) What is the enthalpy change when 223.9 g $\text{ZnS}_{(s)}$ reacts in excess oxygen?

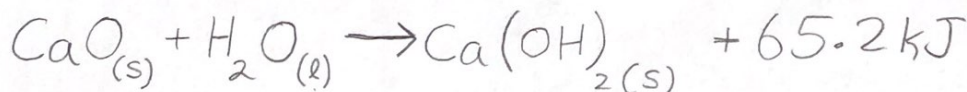
$$\textcircled{1} \frac{223.9 \text{ g}}{97.46 \text{ g/mol}} = 2.29 \approx 2.3 \quad \textcircled{2} \left(\frac{2.3 \text{ mol}}{2 \text{ mol}}\right)(-878.2 \text{ kJ}) = -1009.93 \text{ kJ}$$

- (d) What is the enthalpy change when 0.96 g $\text{ZnO}_{(s)}$ is produced?

$$\textcircled{1} \frac{0.96 \text{ g}}{81.39 \text{ g/mol}} = 0.0118 \text{ mol} \\ \textcircled{2} \left(\frac{0.0118}{2}\right)(-878.2 \text{ kJ}) = 5.18 \text{ kJ}$$

2. Slaked lime ($\text{Ca(OH)}_{2(s)}$) is produced when lime (calcium oxide, $\text{CaO}_{(s)}$) reacts with liquid water. 65.2 kJ of heat is released for each mol of Ca(OH)_2 that is produced.

- (a) Write a thermochemical equation for the reaction.



Date:

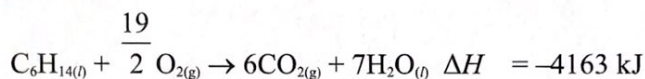
Name:

Class:

- (b) What is the enthalpy change when 523.3 kg of lime reacts with excess water?

$$\begin{aligned} * 523.3 \text{ kJ} &= 523\,300 \text{ g} \quad \textcircled{2} \frac{-65.2 \text{ kJ}}{1 \text{ mol}} = \frac{x}{9328 \text{ mol}} \\ \textcircled{1} \frac{523\,300 \text{ g}}{56.1 \text{ g/mol}} &= 9327.99 \text{ mol} \quad x = -6.08 \times 10^5 \text{ kJ} \end{aligned}$$

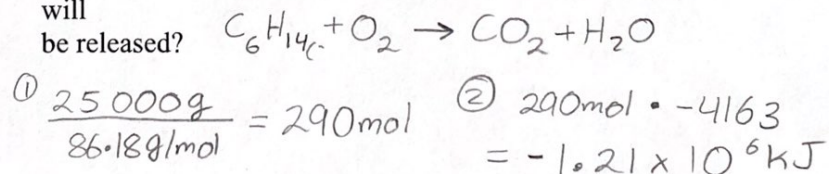
3. The following reaction represents the complete combustion of hexane, $\text{C}_6\text{H}_{14(l)}$, at SATP.



- (a) If 0.537 mol of carbon dioxide is produced in the reaction represented by the equation above, how much heat is released by the reaction?

$$\left(\frac{0.537}{6}\right)(-4163 \text{ kJ}) = -372.6 \text{ kJ}$$

- (b) If 25.0 kg of hexane is burned in sufficient oxygen, how much heat will be released?



- (c) What mass of hexane is required to produce $1.0 \times 10^5 \text{ kJ}$ of heat by complete combustion?

$$\begin{aligned} \textcircled{1} \frac{1.0 \times 10^5 \text{ kJ}}{4163 \text{ kJ}} &= 24.02 \quad \textcircled{2} 24.02 \text{ mol} \times 86.18 \text{ g/mol} \\ &= 2070 \text{ g} \\ &= 2.07 \text{ kg} \end{aligned}$$

Answers

1. (a) $-1.3 \times 10^3 \text{ kJ}$
 (b) -10 kJ
 (c) $\Delta H = -1009 \text{ kJ}$
 (d) $\Delta H = -5.2 \text{ kJ}$
2. (a) $\text{CaO}_{(s)} + \text{H}_2\text{O}_{(l)} \rightarrow \text{Ca(OH)}_2 \quad \Delta H = -65.2 \text{ kJ}$
 (b) $\Delta H = -6.08 \times 10^5 \text{ kJ}$
3. (a) -373 kJ