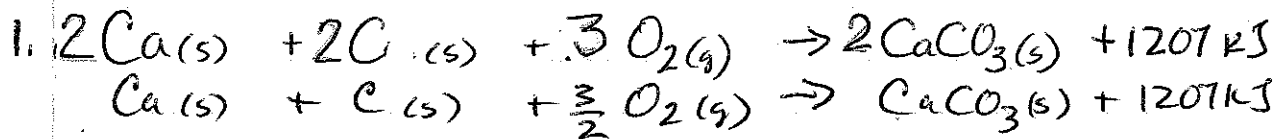
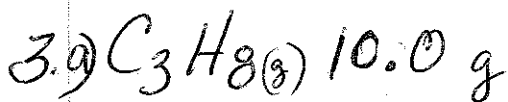
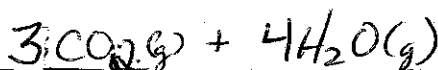


Thermochemical Equations & Calorimetry #2



$$\Delta H_{\text{comb}} = -5720.2$$



$$\text{C} \quad 3 \times 12.01 = 36.03$$

$$\text{H} \quad 8 \times 1.01 = 8.08$$

$$\underline{44.11 \text{ g/mol}}$$

$$10.0 \text{ g C}_3\text{H}_8(g) \times \frac{1 \text{ mol}}{44.11 \text{ g}}$$

$$= 0.2267 \text{ mol} \times \frac{104 \text{ kJ}}{\text{mol}}$$

$$= 23.58 \text{ kJ} \rightarrow 23.6 \text{ kJ}$$

OR

$$10.0 \text{ g C}_3\text{H}_8(g) \times \frac{1 \text{ mol}}{44.11 \text{ g}} \times \frac{104 \text{ kJ}}{\text{mol}} = \begin{array}{l} 23.58 \text{ kJ} \\ 23.6 \text{ kJ} \end{array}$$

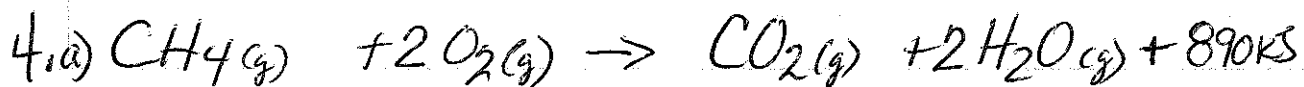
The heat released by the formation of 10.0g of propane from its elements is 23.6 kJ

$$3) \text{C}_3\text{H}_8(\text{g}) \quad 10.0\text{g} = 0.2267\text{mol}$$

complete combustion -2324 kJ/mol

$$0.2267 \text{ mol} \times \frac{2324 \text{ kJ}}{\text{mol}} = 526.85 \text{ kJ}$$
$$527 \text{ kJ}$$

The heat released during the complete combustion of $10.0\text{g C}_3\text{H}_8(\text{g})$ is 527 kJ .



$$b) 18.5\text{g CH}_4(\text{g}) \times \frac{1\text{mol}}{16.05\text{g}} = 1.1526\text{mol}$$

$$\begin{array}{r} 1 \times 12.01 \\ 4 \times 1.01 \\ \hline 16.05 \end{array}$$

$$1.1526\text{mol} \times \frac{890 \text{ kJ}}{\text{mol}} = 1025 \text{ kJ}$$

$$= 1.03 \times 10^3 \text{ kJ}$$

OR

$$18.5\text{g CH}_4(\text{g}) \times \frac{1\text{mol}}{16.05\text{g}} \times \frac{890 \text{ kJ}}{\text{mol}} = 1025 \text{ kJ}$$
$$1.03 \times 10^3 \text{ kJ}$$

Burning 18.5 of methane released $1.03 \times 10^3 \text{ kJ}$

5. Butane C_4H_{10}

$$\begin{array}{l} 4 \times 12.01 = 48.04 \\ 10 \times 1.01 = 10.10 \\ \hline 58.14 \end{array} \quad \text{a) } 25.0 \text{ g } C_4H_{10}(g) \times \frac{1 \text{ mol}}{58.14 \text{ g}} = 0.42999 \text{ mol}$$
$$0.42999 \text{ mol} \times \frac{126 \text{ kJ}}{\text{mol}} = 54.179 \text{ kJ}$$

54.2 kJ

OR

$$25.0 \text{ g } C_4H_{10}(g) \times \frac{1 \text{ mol}}{58.14 \text{ g}} \times \frac{126 \text{ kJ}}{\text{mol}} = 54.179 \text{ kJ}$$

54.2 kJ

The heat released by the formation of 25.0g of butane from its elements is 54.2 kJ

b) $25.0 \text{ g } C_4H_{10} = 0.42999 \text{ mol}$

$$0.42999 \text{ mol} \times \frac{3003 \text{ kJ}}{\text{mol}} = 1291.259 \text{ kJ}$$

$$= 1.29 \times 10^3 \text{ kJ}$$

The heat released by the combustion of 25.0g of butane is $1.29 \times 10^3 \text{ kJ}$

$$\begin{aligned} \text{Ca} &= 1.13 \text{ g} \\ \text{H}_2\text{O} &= 250.0 \text{ g} \\ T_I &= 15.9^\circ\text{C} \\ T_F &= 23.8^\circ\text{C} \\ \Delta T &= 23.8^\circ\text{C} - 15.9^\circ\text{C} \\ &= 7.9^\circ\text{C} \end{aligned}$$

$$\begin{aligned} 1.13 \text{ g Ca(s)} &\times \frac{1 \text{ mol}}{40.08 \text{ g}} \\ &= 0.028193 \text{ mol} \end{aligned}$$

$$\begin{aligned} \Delta H_r &= \frac{m \times C \times \Delta T}{\text{mol}} \\ &= \frac{250.0 \text{ g} \times 4.18 \text{ J/g}\cdot^\circ\text{C} \times 7.9^\circ\text{C}}{0.028193 \text{ mol}} \end{aligned}$$

$$= 292820 \text{ J/mol}$$

$$\begin{aligned} &= 292.8 \text{ kJ/mol} \\ &= 293 \text{ kJ/mol} \end{aligned}$$

The enthalpy change for the reaction of calcium in water is 293 kJ/mol.

7. a) HCl 50.0 mL of 4.77 mol/L 50.0 mL = 0.0500 L x 4.77 mol

NaOH 50.0 mL

$$C = 4.18 \text{ J/g} \cdot ^\circ\text{C}$$

$$\Delta T = 33.4^\circ\text{C}$$

$$= 0.2385 \text{ mol}$$

$$m = 50.0 \text{ mL} + 50.0 \text{ mL}$$

$$= 100.0 \text{ mL} \times \frac{1.00 \text{ g}}{\text{mL}}$$

$$= 100.0 \text{ g}$$

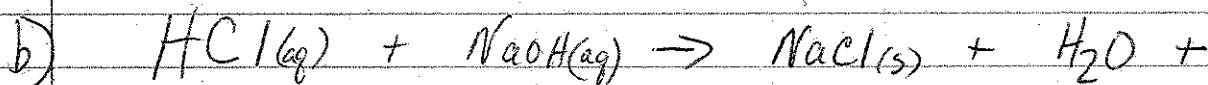
$$\Delta H_r = \frac{m \times C \times \Delta T}{\text{mol}}$$

$$= \frac{100.0 \text{ g} \times 4.18 \text{ J/g} \cdot ^\circ\text{C} \times 33.4^\circ\text{C}}{0.2385 \text{ mol}}$$

$$= 58537.52 \text{ J/mol}$$

$$= 58.5 \text{ kJ/mol}$$

The heat neutralization of HCl is 58.5 kJ/mol



or



$$\Delta H = -62.5 \text{ kJ}$$