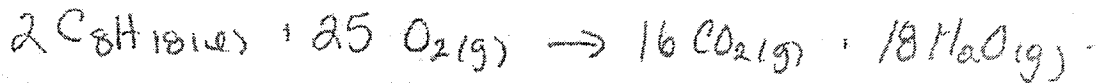


3. The molar enthalpy of combustion of octane is reported to be -1.3 MJ/mol .
 a) Write the balanced equation using whole number coefficients, and determine the enthalpy change for the reaction.



$$\Delta H = n \Delta_r H = 2 \text{ mol} \times -1.3 \frac{\text{MJ}}{\text{mol}} = -2.6 \text{ MJ} = -2.6 \times 10^3 \text{ kJ}$$

- b) If 500 grams of octane is burned, calculate the quantity of energy released in MJ.

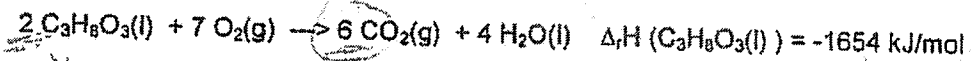
$$\Delta H = n \Delta_r H = \frac{500 \text{ g}}{114.26 \frac{\text{g}}{\text{mol}}} \times -1.3 \frac{\text{MJ}}{\text{mol}} = \boxed{-5.7 \text{ MJ}}$$

- c) How many grams of octane must be burned to produce 500 kJ of energy?

$$n = \frac{\Delta H}{\Delta_r H} = \frac{-500 \text{ kJ}}{-1.3 \times 10^3 \frac{\text{kJ}}{\text{mol}}} = 0.38 \text{ mol}$$

$$m = nM = 0.38 \text{ mol} \times 114.26 \frac{\text{g}}{\text{mol}} = \boxed{44 \text{ g}}$$

4. Glycerol ($\text{C}_3\text{H}_8\text{O}_3(\text{l})$) combusts according to the following chemical equation:



- a) Calculate the enthalpy change when 25.0 g of glycerol combusts.

$$\Delta H = n \Delta_r H = \frac{25.0 \text{ g}}{92.11 \frac{\text{g}}{\text{mol}}} \times -1654 \frac{\text{kJ}}{\text{mol}} = \boxed{-449 \text{ kJ}}$$

- b) What is the enthalpy change if 350 g of carbon dioxide is released from the reaction?

$$\Delta H = n \Delta_r H$$

$$= \frac{350 \text{ g}}{44.01 \frac{\text{g}}{\text{mol}}} \times -551 \frac{\text{kJ}}{\text{mol}}$$

$$= \boxed{-4.236 \times 10^3 \text{ kJ}}$$

Find $\Delta_r H$ per CO_2

$$\textcircled{1} \Delta_r H = n \Delta_r H = 2 \text{ mol C}_3\text{H}_8\text{O}_3 \times -1654 \frac{\text{kJ}}{\text{mol}} = -3308 \text{ kJ}$$

$$\textcircled{2} \Delta_r H = \frac{\Delta H}{n} = \frac{-3308 \text{ kJ}}{6 \text{ mol CO}_2} = \boxed{-551 \frac{\text{kJ}}{\text{mol}}}$$

- c) If a sample of glycerol is burned and 4000 kJ of energy is released, calculate the mass of glycerol that burned.

$$n = \frac{\Delta H}{\Delta_r H} = \frac{-4000 \text{ kJ}}{-1654 \frac{\text{kJ}}{\text{mol}}} = 2.41837 \text{ mol}$$

$$m = nM = 2.41837 \text{ mol} \times 92.11 \frac{\text{g}}{\text{mol}}$$

$$= \boxed{222.8 \text{ g}}$$