Chemistry 2.4 AS 91164 Demonstrate understanding of bonding, structure, properties and energy changes

Writing Excellence answers to **Thermochemical Calculations** questions

Thermochemical Calculations QUESTION	
Question: Hexane, C_6H_{14}, like pentane, will combust (burn) in sufficient oxygen to produce carbon dioxide gas and water. **Pentane combustion**: $C_5H_{12(l)} + 8O_{2(g)} \rightarrow 5CO_{2(g)} + 6H_2O_{(l)}$ $\Delta_r H^\circ = -3509$ kJ mol^{-1} **Hexane combustion:** $2C_6H_{14(l)} + 19O_{2(g)} \rightarrow 12CO_{2(g)} + 14H_2O_{(l)}$ $\Delta_r H^\circ = -8316$ kJ mol^{-1} Justify which alkane – pentane or hexane – will produce more heat energy when 125 g of each fuel is combusted in sufficient oxygen. $M(C_5H_{12})$ = 72.0 g mol^{-1} $M(C_6H_{14})$ = 86.0 g mol^{-1} (An equation and n=m/M are required for this type of thermochemical calculation)	
ANSWER	
1. Calculate the amount of **energy per mol** from the equation (divide $\Delta_r H^\circ$ by number mol of substance in equation) – substance 1	1 mole of pentane releases 3509 kJ energy $\frac{1}{1} : \frac{3509}{1}$
2. calculate the **number of mols** of the known (K) n = m/M	*n* (pentane) = m / M *n* (pentane) = 125 g / 72.0 g mol^{-1} = 1.74 mol
3. multiply amount of energy per mol (step 1) by number of mols calculated (step 2) to get **energy per mass** *Answer with units plus 3sgf*	1.74 × 3509 = **6106 kJ energy** released.
4. Calculate the amount of **energy per mol** from the equation (divide $\Delta_r H^\circ$ by number mol of substance in equation) – substance 2	If 2 moles of hexane release 8316 kJ energy, then 1 mole of hexane releases 4158 kJ energy. $\frac{2}{2} : \frac{8316}{2}$
5. calculate the **number of mols** of the known (K) n = m/M	*n* (hexane) = m / M *n* (hexane) = 125 g / 86.0 g mol^{-1} = 1.45 mol
6. multiply amount of energy per mol (step 4) by number of mols calculated (step 5) to get **energy per mass** *Answer with units plus 3sgf*	1.45 × 4158 = **6029 kJ energy** released
7. compare both substances with **summary** statement	Pentane releases 6106 kJ of energy and Hexane releases 4158 kJ of energy, therefore **pentane releases more energy** (77.0 kJ) than hexane, per 125 g of fuel.

NOTE: The white column is how your answer would appear on your test paper so make sure you **write out complete sentences**. The grey area is just to help you structure your answer and would not appear in the question.