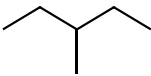
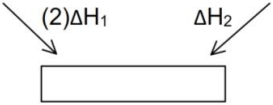


Question 9 (Answer: B)

- $\Delta H = \sum \Delta H_f(\text{products}) - \sum \Delta H_f(\text{reactants})$.
- Products: $4(-1279) = -5116$. Reactants: $-3012 + 6(-286) = -4728$.
- $\Delta H = -5116 + 4728 = -388 \text{ kJ mol}^{-1}$.

3(a)	M1 (family of molecules / compounds / series with) same general formula OR (family of molecules where) molecular formula differs (only) by (units of) $\text{CH}_2(n)$. M2 similar chemical properties / reactions
3(b)	M1 strong C—H (bonds) M2 non-polar (C—H / molecule / bonds)
3(c)	cracking
3(d)(i)	M1  M2 
3(d)(ii)	M1 B < A < hexane. M2 hexane / unbranched has stronger / more IMFs M3 hexane / unbranched requires most / more energy
3(e)(i)	$\text{H}_2 (\text{g})$ OR hydrogen (gas)
3(e)(ii)	M1 $+215 + (-156) - (+48) =$ M2 $+11 \text{ kJ mol}^{-1}$
3(e)(iii)	$\text{C}_6\text{H}_{14} + 9\frac{1}{2}\text{O}_2 \rightarrow 6\text{CO}_2 + 7\text{H}_2\text{O}$

1(a)	I Unambiguous headings AND units for all six recorded readings and calculated values in experiment 1: • (mass of) container + FB 2 / solid / g • (mass of) container (+ residue) / g • (mass of) FB 2 / solid (used / added) / g • initial temperature OR temperature of FB 1 / °C • final temperature / °C • temperature change / °C
	II • All four weighings recorded to same decimal places (either 2 or 3). • All four temperatures recorded to .0 or .5°C
	III Correct subtractions to give all four calculated values: • mass of FB 2 used and mass of FB 3 used • changes in temperature for experiments 1 and 2.
	Accuracy (Q) marks Calculate the candidate's <i>temperature to mass ratio</i> for experiment 1 to 2 d.p.: Ratio = ΔT (experiment 1) / mass of FB2 . Calculate the supervisor's ratio for experiment 1 to 2 d.p. Calculate the difference, δ , between the candidate's value (rounded to 2 d.p.) and the supervisor's value (rounded to 2 d.p.)
	IV award if $\delta \leq 0.50$
1(b)(i)	M1: Correctly calculates both M_r values: M_r of $\text{NaHCO}_3 = 84$ AND M_r of $\text{Na}_2\text{CO}_3 = 106$
	M2: Correctly calculates both amounts using subtractions from (a) $n = \text{mass in (a)} / M_r (\text{mol})$ AND both answers given to 2–4 sf
1(b)(ii)	Correctly calculates both values of energy change energy change = $20 \times 4.18 \times \Delta T$ (J) AND both answers given to 2–4 sf
1(b)(iii)	M1: Correct display of $\Delta H = (\text{b})(\text{ii}) / (\text{b})(\text{i})$ for experiment 1 or experiment 2.
1(b)(iv)	M1: Drawing of enthalpy cycle $(2\text{NaHCO}_3(\text{s}) \rightarrow \text{Na}_2\text{CO}_3(\text{s}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g}))$ 
	M2: Correctly calculates $\Delta H_r = 2\Delta H_1 - \Delta H_2$