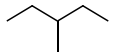
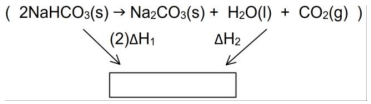
Question 9 (Answer: **B**)

- $\Delta H = \sum \Delta H_f(\text{products}) - \sum \Delta H_f(\text{reactants})$.
- Products: $4(-1279) = -5116$. Reactants: $-3012 + 6(-286) = -4728$.
- $\Delta H = -5116 + 4728 = -388$ 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) $CH_{2(n)}$. **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)	H_2 ((g)) **OR** hydrogen (gas)
3(e)(ii)	**M1** +215 + (–156) – (+48) = **M2** +11 kJ mol^{-1}
3(e)(iii)	$C_6H_{14} + 9½O_2 \rightarrow 6CO_2 + 7H_2O$

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 *temperature to mass ratio* 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.
	IV award if $\delta \leqslant 0.50$
1(b)(i)	**M1:** Correctly calculates both M_r values: M_r of $NaHCO_3$ = 84 **AND** M_r of Na_2CO_3 = 106
	M2: Correctly calculates both amounts using subtractions from **(a)** n = mass in **(a)** / M_r (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 ΔH = **(b)(ii)** / **(b)(i)** for experiment 1 or experiment 2.
1(b)(iv)	**M1:** Drawing of enthalpy cycle 
	M2: Correctly calculates $\Delta H_r = 2\Delta H_1 - \Delta H_2$