AS level Chemistry A

H032/02 Depth in chemistry

Question Set 3

3. Alkanes are saturated hydrocarbons with the general formula C_nH_{2n+2}.

(a) A student carries out an experiment to measure the enthalpy change of combustion, $\Delta_c H$, of hexane.

The student finds that combustion of 1.29 g of hexane changes the temperature of 200 g of water from 20.5 °C to 65.5 °C.

(i) Calculate the enthalpy change of combustion, $\Delta_c H$, of hexane, in kJ mol^{-1}. **[4]**

Give your final answer to an **appropriate** number of significant figures.

(ii) The calculated value of $\Delta_c H$ for hexane from this experiment is different from the databook value. **[2]**

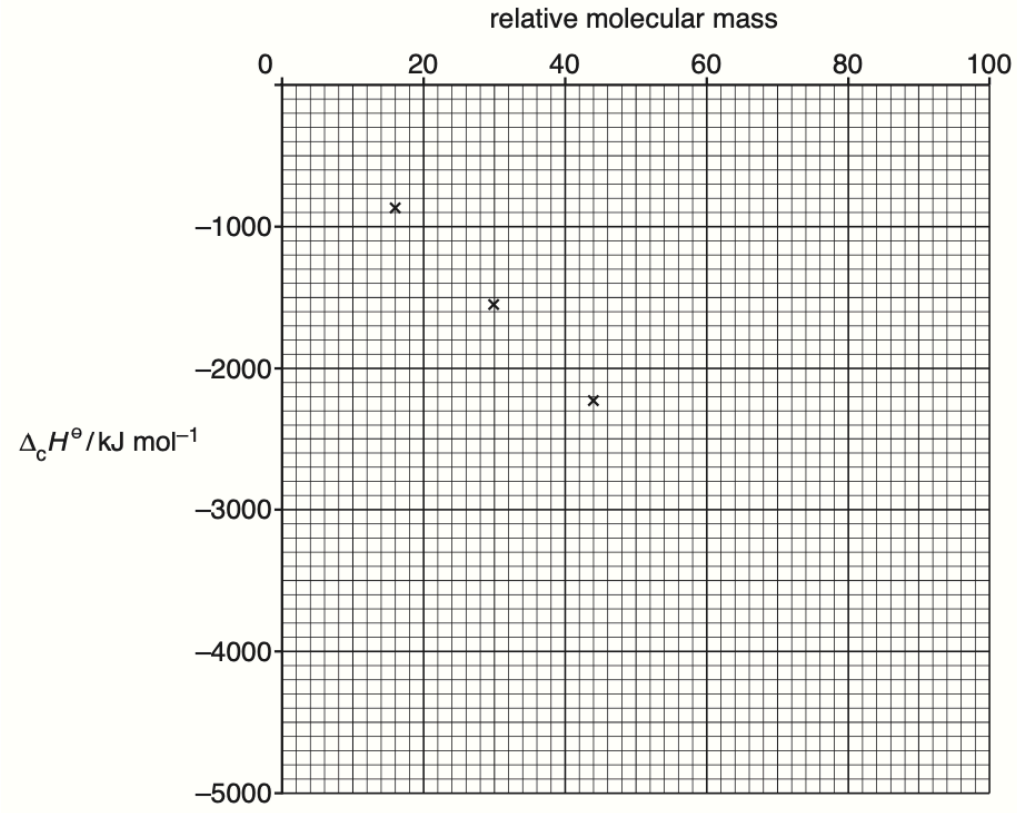
Suggest **two** reasons for this difference.

(b) Data book values for the standard enthalpy changes of combustion, $\Delta_c H$, of the first four alkanes are shown in the table.

Alkane	methane	ethane	propane	butane
$\Delta_c H^{\ominus}$ / kJ mol^{-1}	–890	–1560	–2219	–2877

(i) The values for the first three alkanes are plotted on the graph below. **[1]**

Plot the value for butane on the graph.



(ii) Use the graph to estimate the energy released, in kJ, during complete combustion of 1.80 g of pentane. **[3]**

Show relevant working below and on the graph.

energy released = ... kJ

(c) The equation for the complete combustion of cyclohexane is shown below. **[3]**

$C_6H_{12}(l) + 9O_2(g) \rightarrow 6CO_2(g) + H_2O(l)$

Standard enthalpy changes of formation, $\Delta_f H$, are shown in the table.

Substance	$C_6H_{12}(l)$	$CO_2(g)$	$H_2O(l)$
$\Delta_f H^\ominus$ / kJ mol^{-1}	–156.3	–393.5	–285.8

Calculate the standard enthalpy change of combustion, $\Delta_c H$, in kJ mol^{-1}, of cyclohexane.

Total Marks for Question Set 3: 13