

## **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  $\text{kJ mol}^{-1}$ . [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]

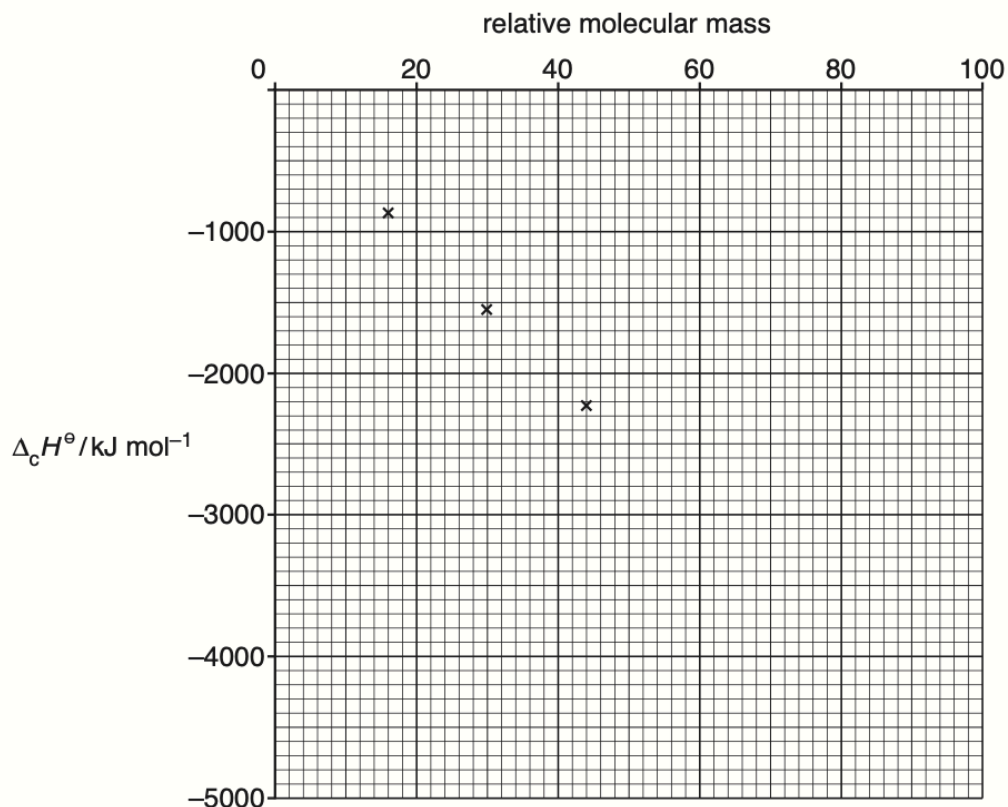
Suggest **two** reasons for this difference.

(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
$\Delta_c H^\ominus / \text{kJ mol}^{-1}$	-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.

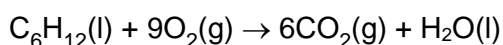


- (ii) Use the graph to estimate the energy released, in kJ, during complete combustion of 1.80 g of pentane. [3]

Show relevant working below and on the graph.

energy released = ..... kJ

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



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

Substance	$\text{C}_6\text{H}_{12}(\text{l})$	$\text{CO}_2(\text{g})$	$\text{H}_2\text{O}(\text{l})$
$\Delta_f H^\ominus / \text{kJ mol}^{-1}$	-156.3	-393.5	-285.8

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

**Total Marks for Question Set 3: 13**

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