**3** The alkanes are a homologous series of organic molecules. Alkanes are generally unreactive and are commonly used as fuels.

**(a)** Define homologous series.

.....

..... [2]

**(b)** Give two reasons to explain the general unreactivity of alkanes.

1 .....

2 .....

[2]

**(c)** Alkanes with low relative molecular mass, $M_r$, are more useful than those found in heavier crude oil fractions.

Name the process that is used to obtain alkanes with low $M_r$ from heavier crude oil fractions.

..... [1]

**(d)** Hexane, $C_6H_{14}$, has four structural isomers.

Fig. 3.1 shows hexane and two of its structural isomers.

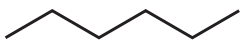
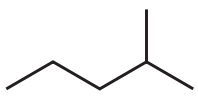
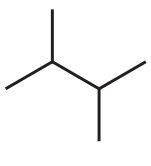
| hexane | A | B | C | D |
|---|---|---|---|---|
|  |  |  | | |

**Fig. 3.1**

**(i)** Complete Fig. 3.1 by drawing structures for **C** and **D**, the other two structural isomers of hexane. [2]

**(ii)** **A**, **B** and hexane have different boiling points.

Arrange **A**, **B** and hexane in order of increasing boiling point.

Explain your answer.

lowest ..... < ..... < ..... highest

.....

.....

.....

[3]

**(e)** Hexane can be converted into compounds **E** and **F** at high temperature and pressure. Fig. 3.2 shows the reaction scheme involving hexane, **E** and **F**.

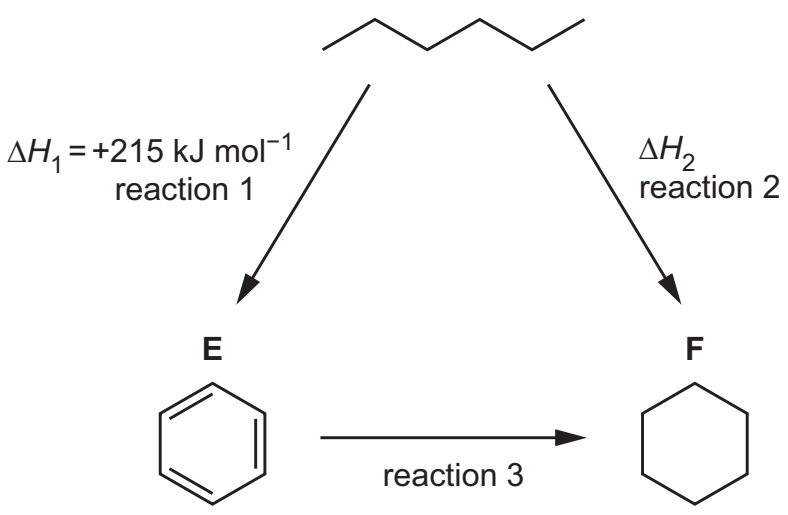



**Fig. 3.2**

**(i)** Identify a suitable reagent for reaction 3.

..... [1]

**(ii)** Use the data in Fig. 3.2 and in Table 3.1 to calculate the enthalpy change of reaction 2, $\Delta H_2$.

**Table 3.1**

| compound | enthalpy change of formation, $\Delta H_f$ / kJ mol$^{-1}$ |
|---|---|
|  | −156 |
|  | +48 |

$\Delta H_2$ = ..... kJ mol$^{-1}$ [2]

**(iii)** Write an equation for the complete combustion of hexane.

..... [1]

[Total: 14]