

- 28** Two hydrocarbons, $R-CH_3$ and $R'-CH_3$, react separately with bromine in the presence of ultraviolet light. One of these hydrocarbons is unsaturated.

In each case, free radical substitution reactions occur.

R is $CH_3CHC(CH_3)_2$.

R' is $CH_3CH(CH_3)CH_2$.

Which row is correct?

	a propagation stage for the saturated hydrocarbon	a termination stage for the unsaturated hydrocarbon
A	$R-CH_2\cdot + Br\cdot \rightarrow R-CH_2Br$	$R'-CH_2\cdot + Br\cdot \rightarrow R'-CH_2Br$
B	$R-CH_2\cdot + Br_2 \rightarrow R-CH_2Br + Br\cdot$	$R'-CH_2\cdot + Br_2 \rightarrow R'-CH_2Br + Br\cdot$
C	$R'-CH_3 + Br\cdot \rightarrow R'-CH_2\cdot + HBr$	$2R-CH_2\cdot \rightarrow R-CH_2CH_2-R$
D	$2R'-CH_2\cdot \rightarrow R'-CH_2CH_2-R'$	$R-CH_3 + Br\cdot \rightarrow R-CH_2\cdot + HBr$

- 29** The fumes from the exhausts of petrol-burning cars contain the following pollutants.

- 1 unburnt hydrocarbons
- 2 nitrogen dioxide
- 3 carbon monoxide

Which pollutants are removed by oxidation in a catalytic converter?

- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

- 25** Two hydrocarbons, $CH_3CHC(CH_3)CH_3$ and $CH_3CH(CH_3)CH_2CH_3$, react separately with chlorine in the presence of ultraviolet light.

In each reaction, free-radical substitution occurs.

Which row is correct?

	identity of the hydrocarbon that can also undergo electrophilic addition	a termination stage of the free-radical substitution of the saturated hydrocarbon
A	$CH_3CHC(CH_3)CH_3$	$CH_3CH(CH_3)CH_2CH_2\cdot + Cl\cdot \rightarrow CH_3CH(CH_3)CH_2CH_2Cl$
B	$CH_3CHC(CH_3)CH_3$	$CH_3CHC(CH_3)CH_2\cdot + Cl\cdot \rightarrow CH_3CHC(CH_3)CH_2Cl$
C	$CH_3CH(CH_3)CH_2CH_3$	$CH_3CH(CH_3)CH_2CH_2\cdot + Cl\cdot \rightarrow CH_3CH(CH_3)CH_2CH_2Cl$
D	$CH_3CH(CH_3)CH_2CH_3$	$CH_3CHC(CH_3)CH_2\cdot + Cl\cdot \rightarrow CH_2CHC(CH_3)CH_2Cl$

- 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.

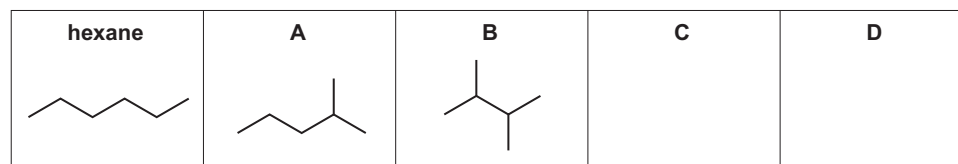


Fig. 3.1

- (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**.

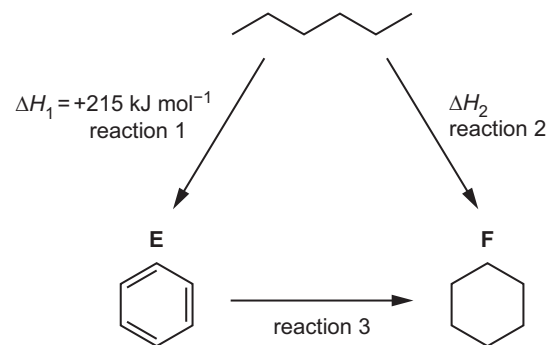


Fig. 3.2

- (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, ΔH_2 .

Table 3.1

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

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

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

..... [1]