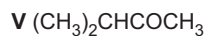
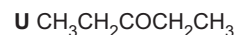
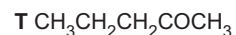
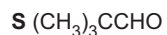
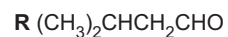
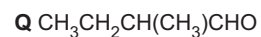
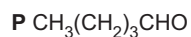
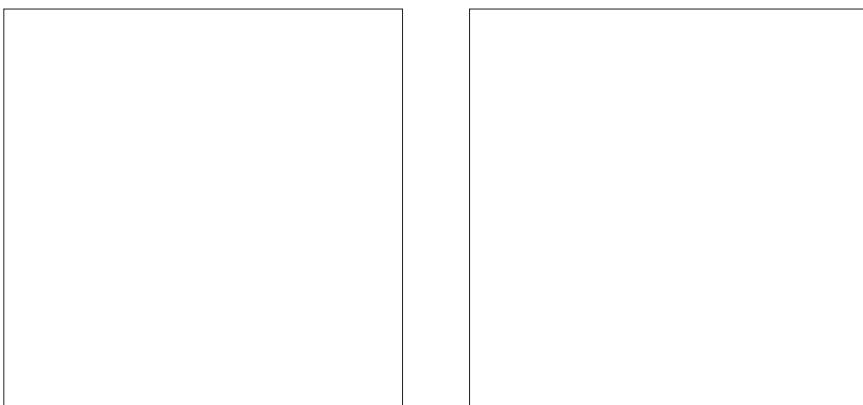


7 **P, Q, R, S, T, U,** and **V** are the seven structural isomers with molecular formula $C_5H_{10}O$ that have a carbonyl group.



(a) Only one of these seven compounds has stereoisomers.

Draw three-dimensional diagrams of the **two** stereoisomers of this compound.



[2]

(b) **P, Q, R, S, T, U,** and **V** are treated separately with alkaline $I_2(aq)$ and the product mixture is acidified.

(i) Identify the **two** compounds that give a positive result with alkaline $I_2(aq)$.

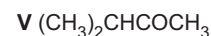
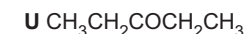
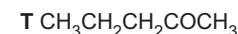
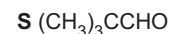
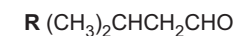
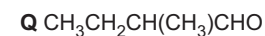
..... and [1]

(ii) Describe the observations when **one** of the compounds you have identified in (b)(i) is treated with alkaline $I_2(aq)$ and give the structural formulae of the **two** carbon-containing products of this reaction.

observations

two carbon-containing products

and [2]



(c) The proton (1H) NMR spectra of **P, Q, R, S, T, U,** and **V** are compared.

(i) Identify the only compound that gives a spectrum with two singlets and no other peaks.

..... [1]

Fig. 7.1 shows the spectrum obtained from one of the compounds.

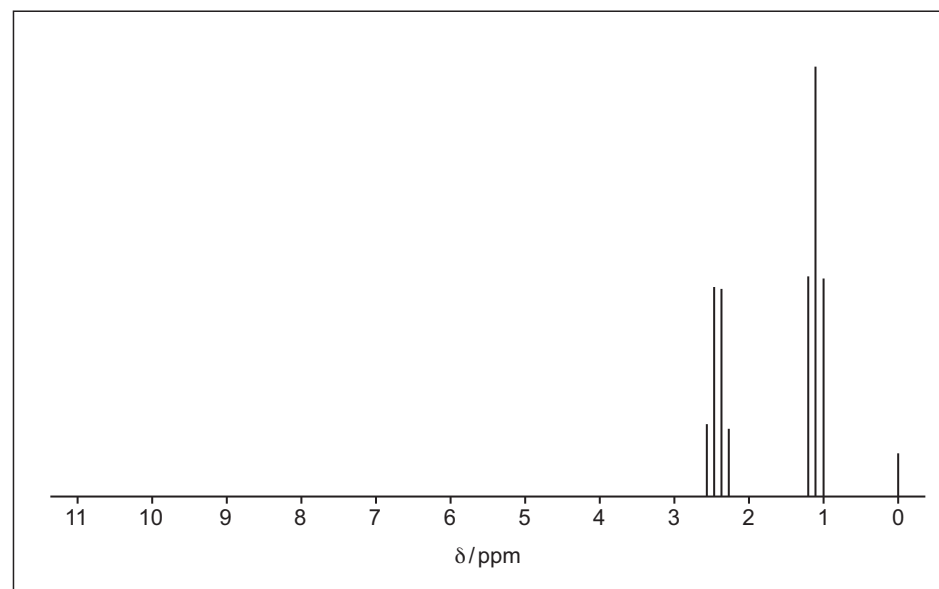


Fig. 7.1

(ii) Identify the compound that gives this spectrum.

..... [1]

(iii) Name the splitting pattern of the peak at $\delta = 1.1$ in Fig. 7.1.

Give the reason for this splitting.

name

reason [1]

(iv) Identify the substance that gives the small peak at $\delta = 0$ in Fig. 7.1.

..... [1]

(d) The carbon-13 NMR spectra of **R**, **S**, **T** and **U** are compared.

Complete Table 7.1 to state the number of peaks in the spectrum of each compound.

Table 7.1

compound	number of peaks
R $(\text{CH}_3)_2\text{CHCH}_2\text{CHO}$	
S $(\text{CH}_3)_3\text{CCHO}$	
T $\text{CH}_3\text{CH}_2\text{CH}_2\text{COCH}_3$	
U $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_3$	

[2]

[Total: 11]