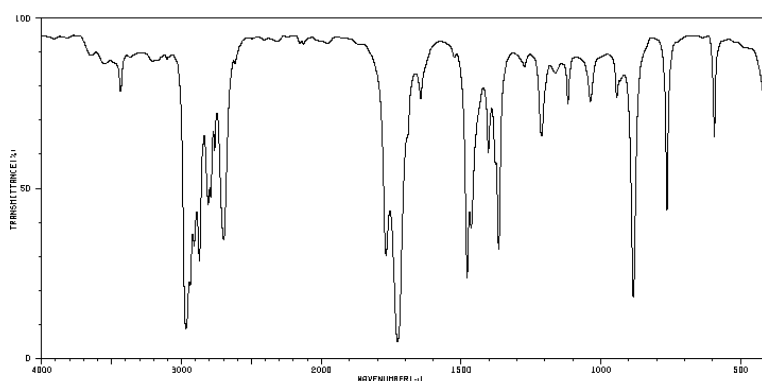


INFRARED QUESTIONS

Exercise 1 The following IR spectrum has been produced from a sample of one of the following compounds – an ester, alcohol, carboxylic acid, aldehyde or ketone.

Identify which class of compound this spectrum belongs to. Explain your answer in terms of the presence (or absence) of specific absorption bands



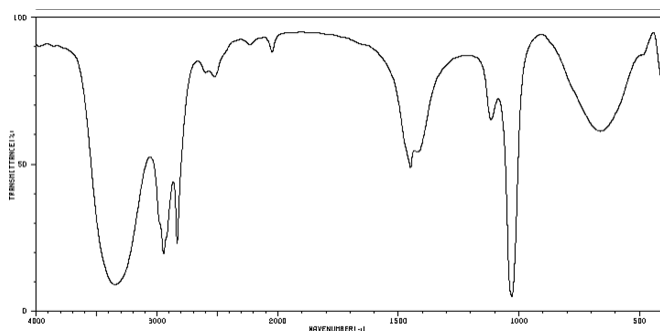
ANSWER: THIS IS AN ALDEHYDE.

Positive identification: As well as the C-H absorption at ~ 3000 , we can see a C=O band at ~ 1700 and an aldehyde C-H at ~ 2800

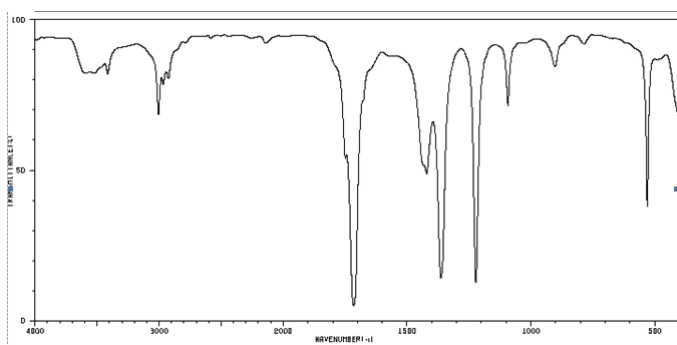
Negative identification: There is no broad -OH band at 3200-3600, so that eliminates alcohol and carboxylic acids. There is also a band at 2800, hence it is not a ketone (which would have no band), and there are no bands at 1100 and 1300 which eliminates the ester.

Exercise 2 Identify the bonds responsible for all the peaks in the non-fingerprint region of the following infra-red spectra, and hence state the functional group present:

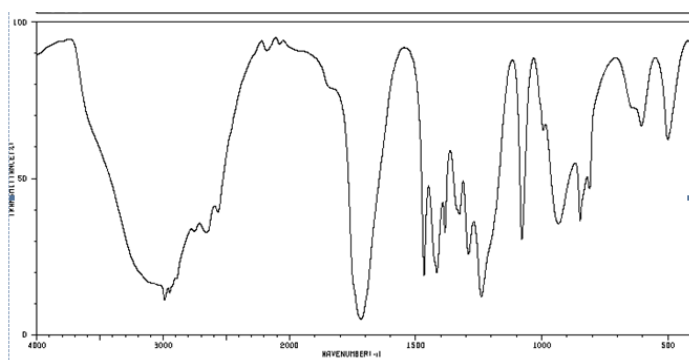
a) This is an ALCOHOL ($\sim 3200-3600$)



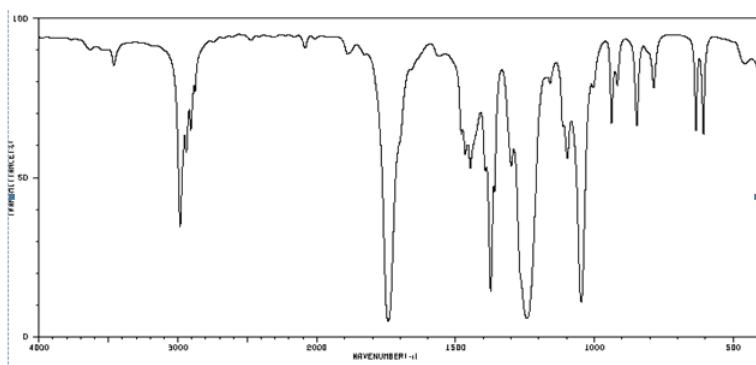
b) This is a KETONE – sharp peak @ 1700 + (small) C-H band @ ~3000



c) This is a CARBOXYLIC ACID – broad -OH peak @ 3200-3600 and also a C=O peak @ 1700 and a C-O @ 1200



d) This is probably an ESTER – it has a carbonyl C=O @ 1700 and there is also a C-O peak @ 1000-1100 and @ 1300. (There could be a double Br peak down around 500-600, but it is more likely to be an ester. This could be confirmed using other spectra)



Exercise 3

Three compounds A, B and C, all with molecular formula $C_4H_8O_2$, are found to have very different infra-red spectra. All three spectra contain a sharp peak at 1700 cm^{-1} , but the infra-red spectrum of A contains a broad peak at $2500 - 3000\text{ cm}^{-1}$, the infra-red spectrum of B contains no broad peaks, and the infra-red spectrum of C contains a broad peak at $3000 - 3300\text{ cm}^{-1}$. Suggest possible structures for A, B and C.

A is likely to be a carboxylic acid (-OH broad peak and a carbonyl at 1700)

B is likely to be a ketone with no other peaks

C is likely to be an amide with a carbonyl peak @ 1700 and an N-H peak at 3000-3300. It could also be an alcohol and a ketone.