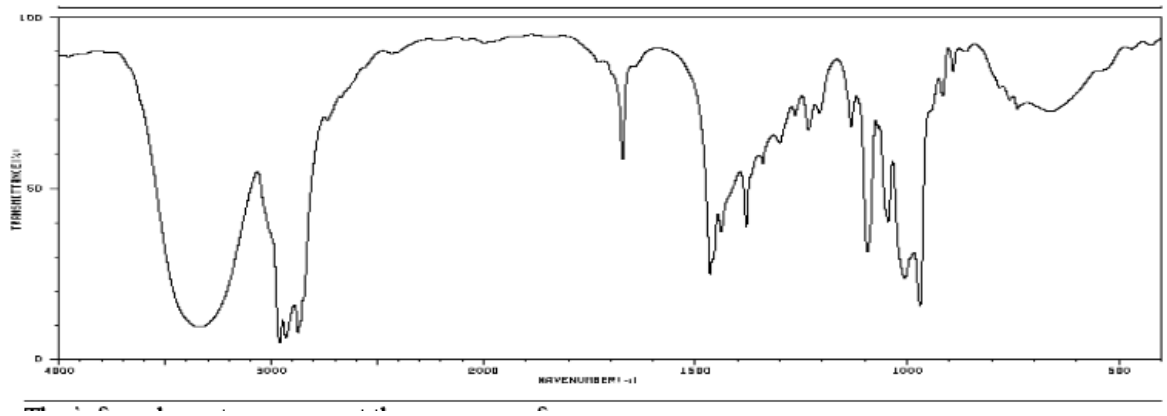
INFRARED SPECTROSCOPY – TEST 1

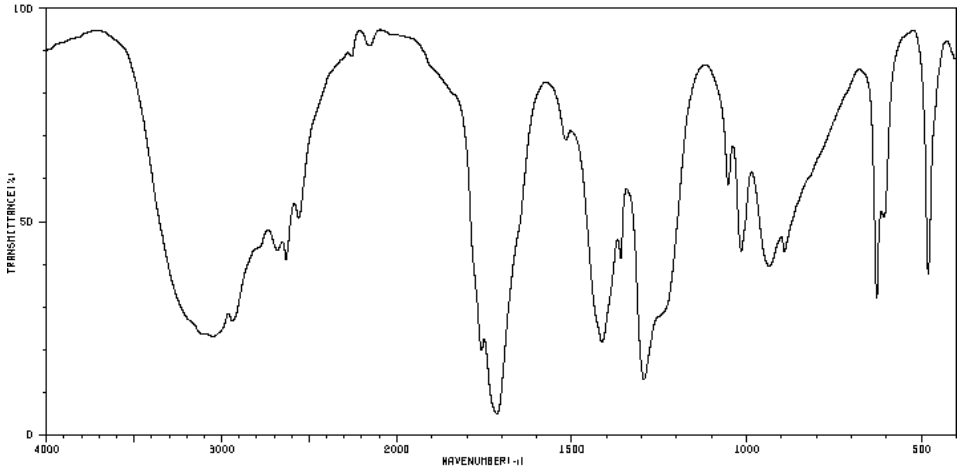
QUESTION 1



The IR spectrum above could be that of

A a carboxylic acid
B an ester
C an alcohol
D none of the above

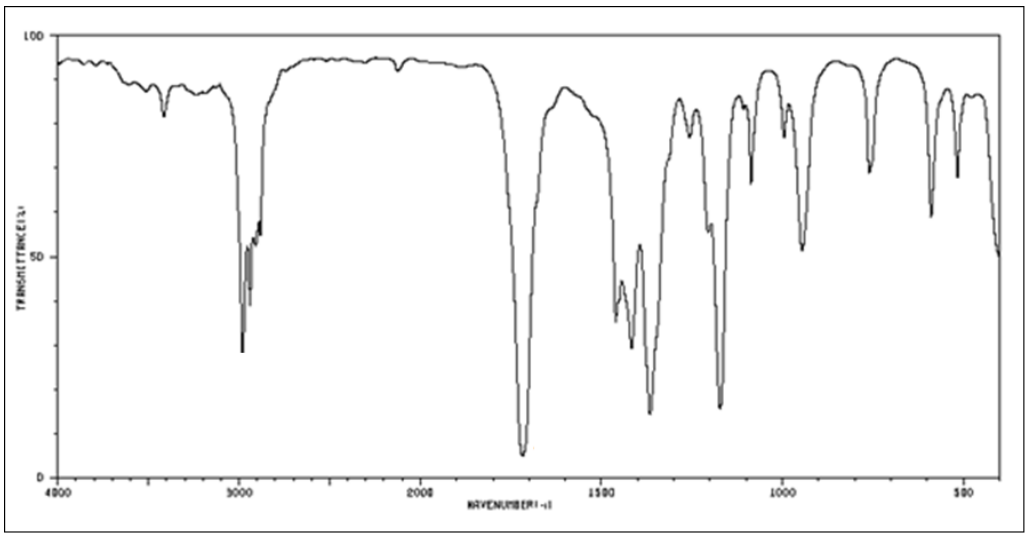
QUESTION 2



The IR spectrum above could be that of

A a carboxylic acid
B an ester
C an alcohol
D none of the above

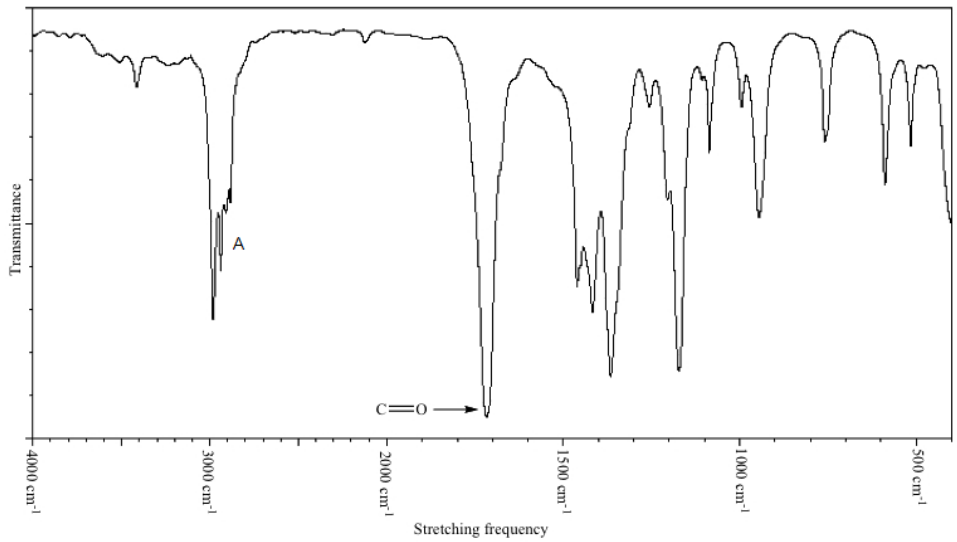
QUESTION 3



The IR spectrum above could be that of

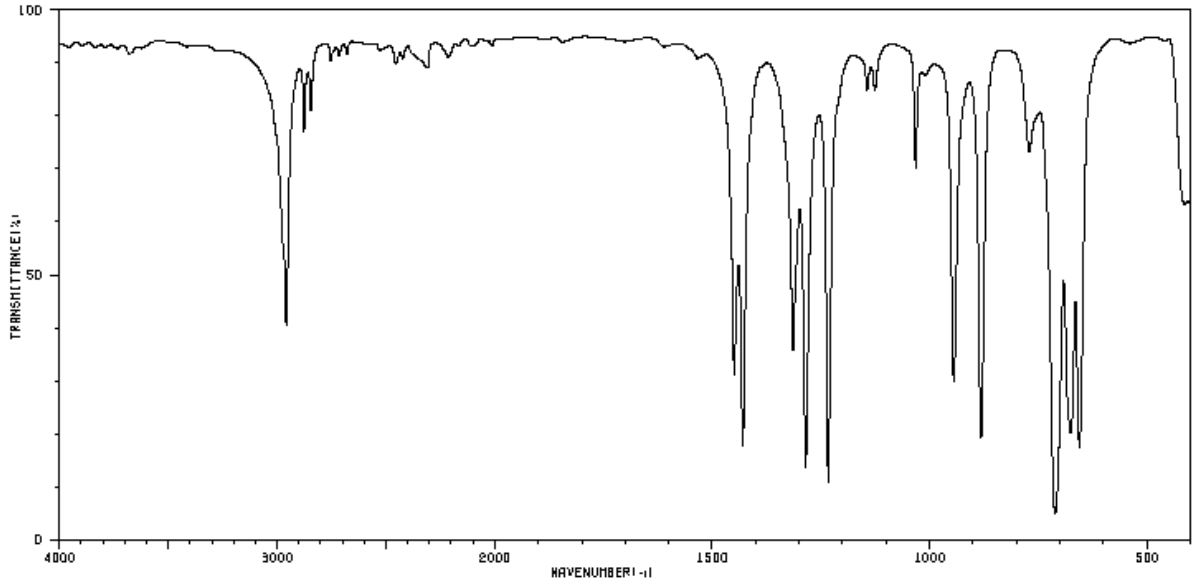
A a carboxylic acid
B an ester
C an alcohol
D none of the above

QUESTION 4
The trough at 'A' could be due to:



A N-H
B C-H
C O-H
D C-O

QUESTION 5
The spectrum below could be that of



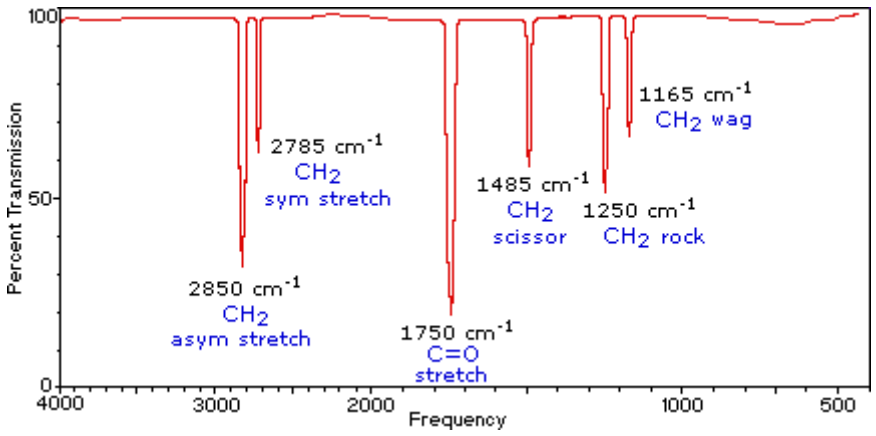
A CH_3CHCl_2

B CH_3OH

C CH_3COOH

D CH_3NH_2

QUESTION 6



Using the diagram above it is possible to conclude that

A CH_2 asymmetric stretches absorb more energy than CH_2 symmetric stretches

B CH_2 scissors absorb more energy than CH_2 symmetric stretches

C CH_2 bonds only absorb at a high wave numbers

D CH_2 stretches absorb less energy than $C=O$ stretches

QUESTION 7
In general, the energies absorbed by a molecule increases as

A the bond strength decreases and the mass of the atoms increases
B the bond strength decreases and the mass of the atoms decreases
C the bond strength increases and the mass of the atoms increases
D the bond strength increases and the mass of the atoms decreases

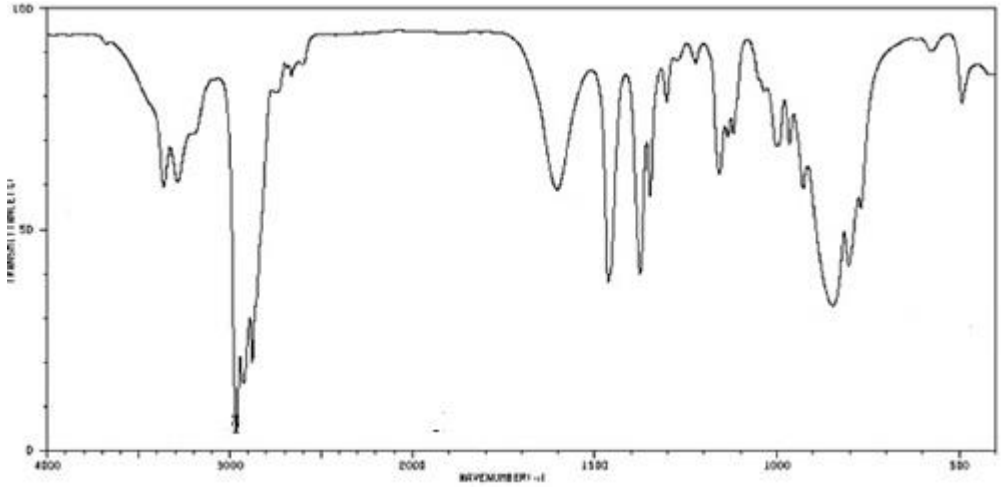
QUESTION 8
Which of the following molecules will not absorb infrared radiation?

A CO_2
B $CH_3CH_2CH_3$
C Cl_2
D CH_3CH_2COOH

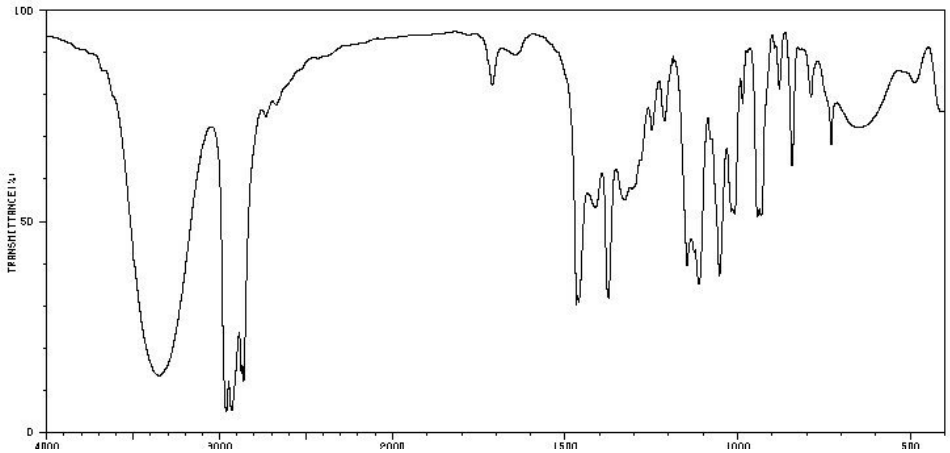
QUESTION 9

The spectra of an alcohol and an amine are shown below. Determine which spectrum belongs to which molecule. Give a reason for your answer.

Spectrum A

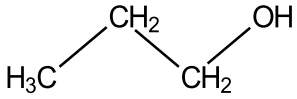


Spectrum B

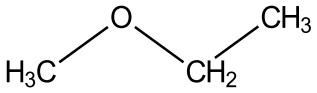


QUESTION 10

One of the isomers of propanol is an ether. The two isomers are shown below



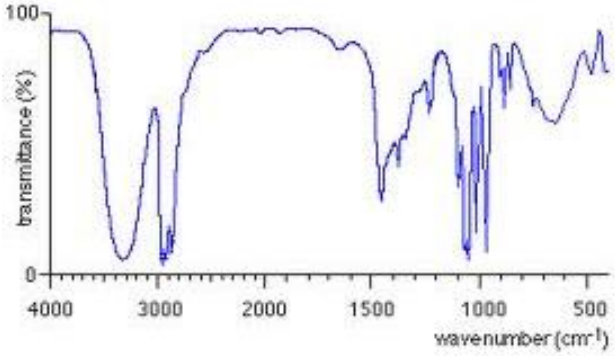
Propanol



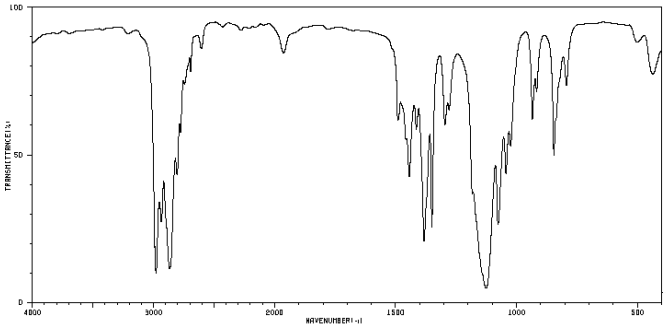
Methoxyethane (ether)

Determine which of the following spectra belong to which molecule. Give a reason for your answer.

Spectrum A

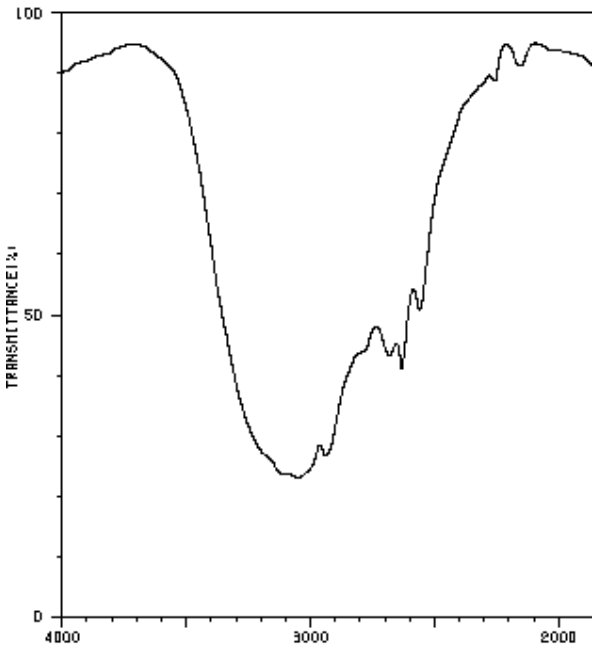


Spectrum B



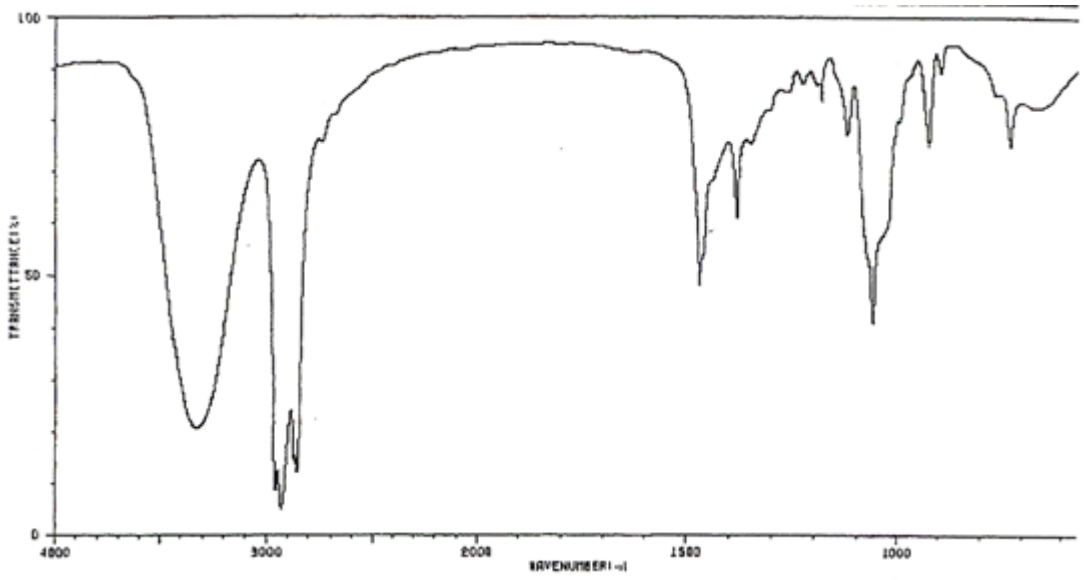
QUESTION 11

A student was analysing an IR spectrum but part of the spectrum had been ripped away. The student knew that the molecule was either an alcohol or a carboxylic acid. Use the partial spectrum below to determine which type of molecule it is. Give a reason for your answer.



QUESTION 12

The absorption spectrum of a molecule containing two carbons is shown below. Draw the structure of the molecule.



SOLUTIONS

QUESTION 1 **Answer is C**

QUESTION 2 **Answer is A**

QUESTION 3 **Answer is B**

QUESTION 4 **Answer is B**

QUESTION 5 **Answer is A**

QUESTION 6 **Answer is A**

QUESTION 7 **Answer is D**

QUESTION 8 **Answer is C**

QUESTION 9

N-H and O-H bonds produce troughs at about the same wave number however the shape of the troughs is different. The N-H trough is jagged whereas the O-H trough is large and broad.

Spectrum A = amine
Spectrum B = alcohol

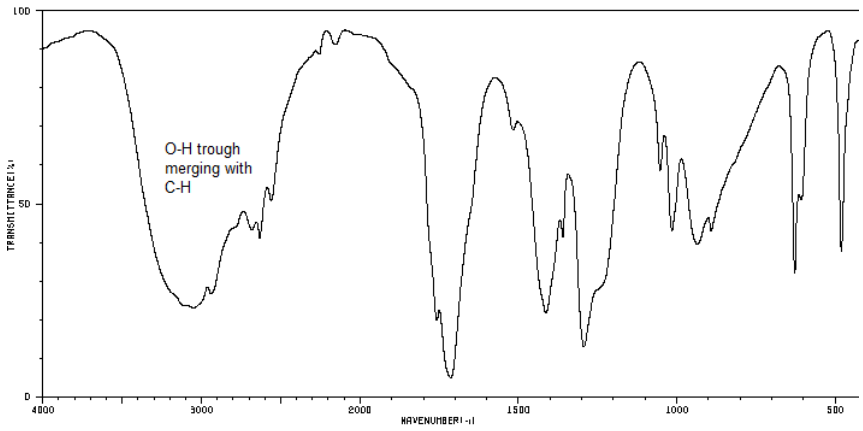
QUESTION 10

Spectrum A is propanol since it has a large broad trough at approximately 3300 cm^{-1} that corresponds to a O-H bond. An ether does not contain an O-H bond and therefore should not have a trough in this position which is consistent with spectrum B.

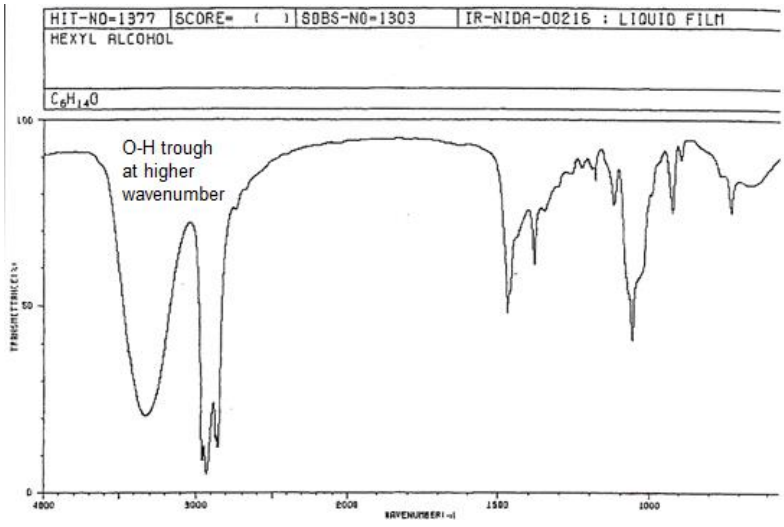
QUESTION 11

The molecule is a carboxylic acid since the O-H trough is merging into the C-H trough. If the molecule was an alcohol, the O-H trough would have a higher wavenumber and would be distinct from the C-H trough.

Carboxylic acid spectrum:



Alcohol Spectrum:



QUESTION 12