Exercises

Exercise 01

In IR spectroscopy, the vibrational mode of the **C=O** bond in the molecule $CH_3-CO-CH_3$ produces a fundamental absorption frequency of $\overline{\nu_0} = 1713\ cm^{-1}$, corresponding to a transition from **v = 0** to **v = 1**.

1- Calculate the force constant **k** for the **C=O** bond by dyne/cm.

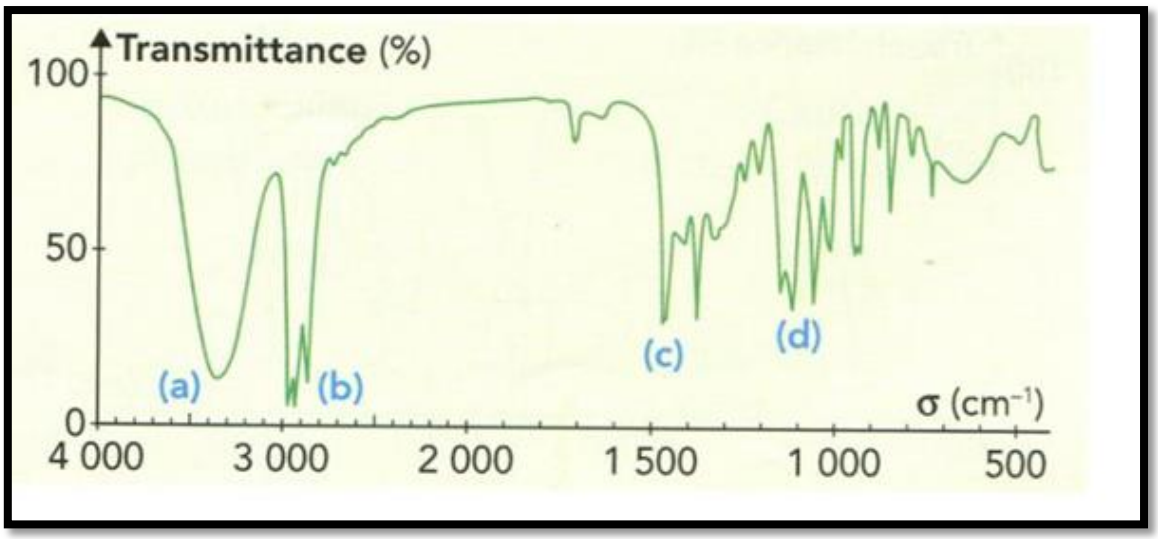
2- Compare this value to that of **HCl** ($k_{HCl} = 4.8 \times 10^5$ **dyne/cm)** and conclude (we will neglect the effect of CH_3 on the vibrator.

Exercise 02

An excerpt from the **IR** spectrum of **hexan-2-ol** is given below.

1- Write the semi-developed formula of **hexan-2-ol**, Deduce the characteristic group and functional group?

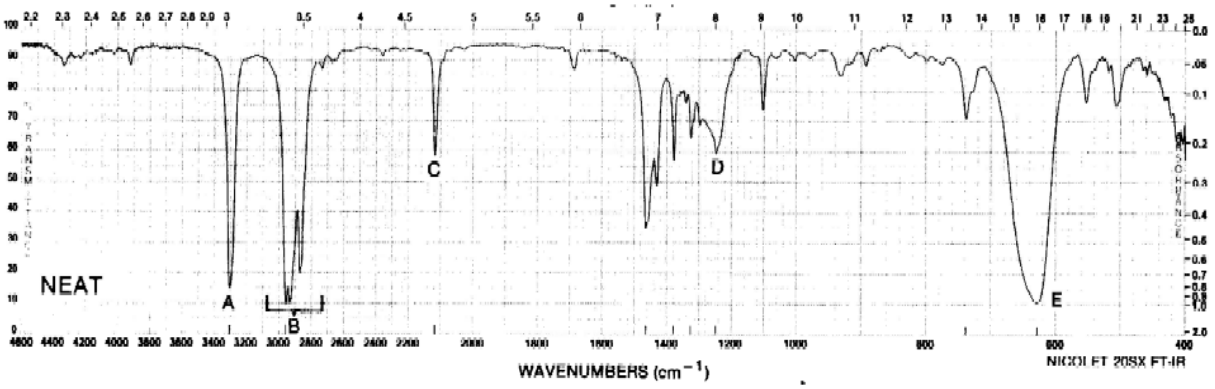
2- Identify the absorption bands labeled (**a**), (**b**), (**c**), and (**d**)?



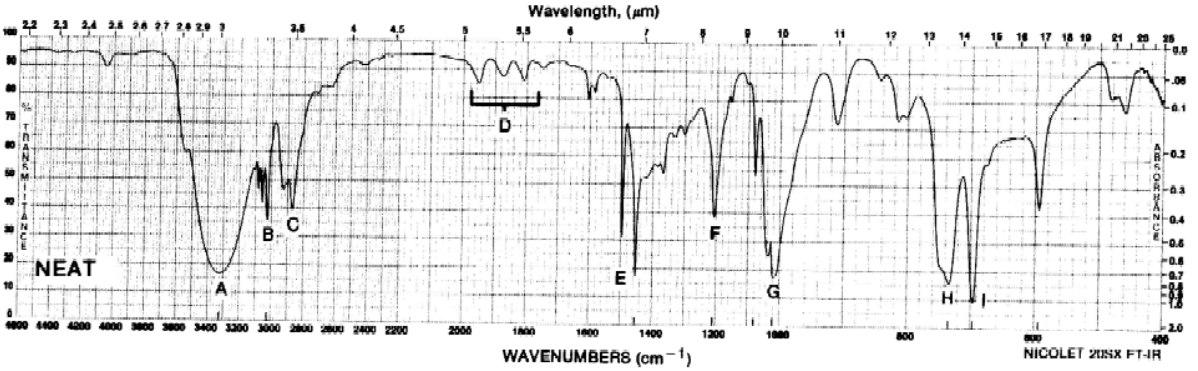
Exercise 03

Consider infrared **spectra 1-3** shown below. They each correspond to a compound in the following list: **amino benzene**, **pentan-2-one**, **phenyl methanol**, **methylbenzene**, **hex-1-yne**, **phenol**.

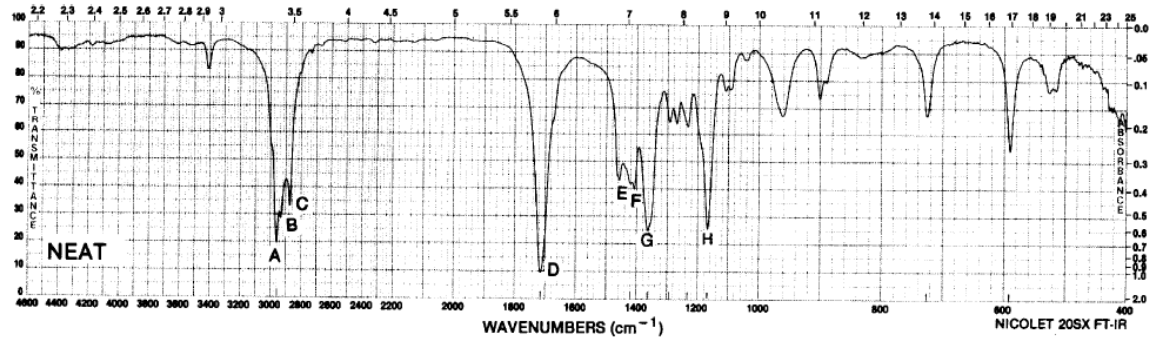
- Assign each spectrum the corresponding compound, indexing the most important bands.



Spectre 1



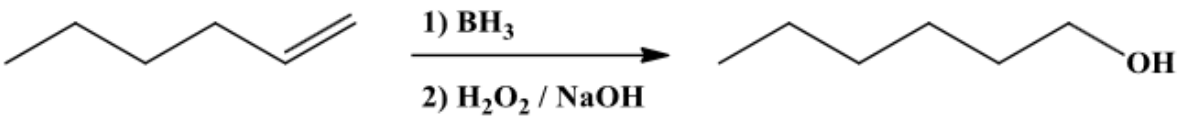
Spectre 2



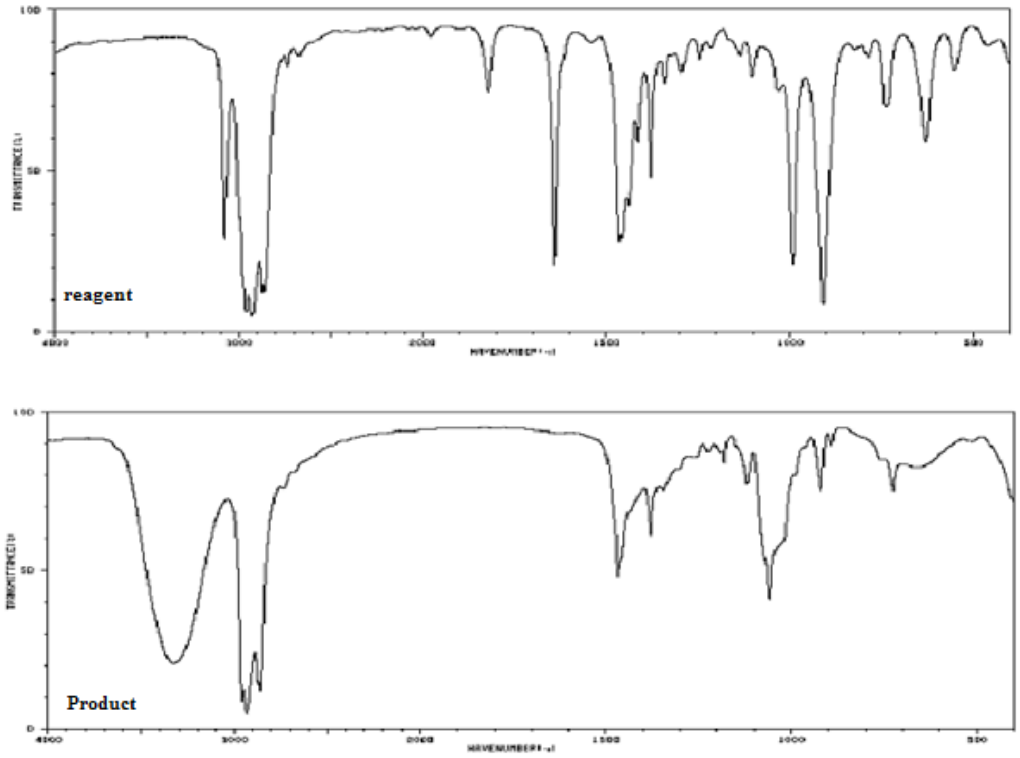
Spectre 3

Exercise 04

The following hydroboration reaction is studied:

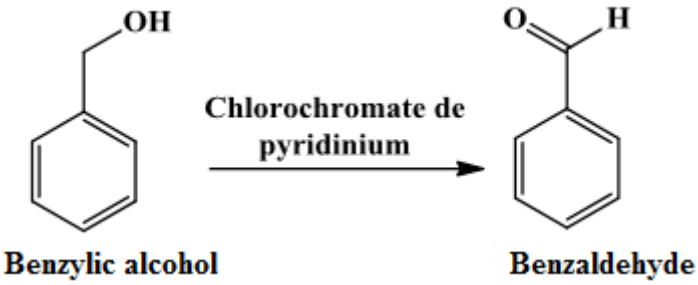


According to the two spectra below, did we obtain the desired product or not, justify your answer?

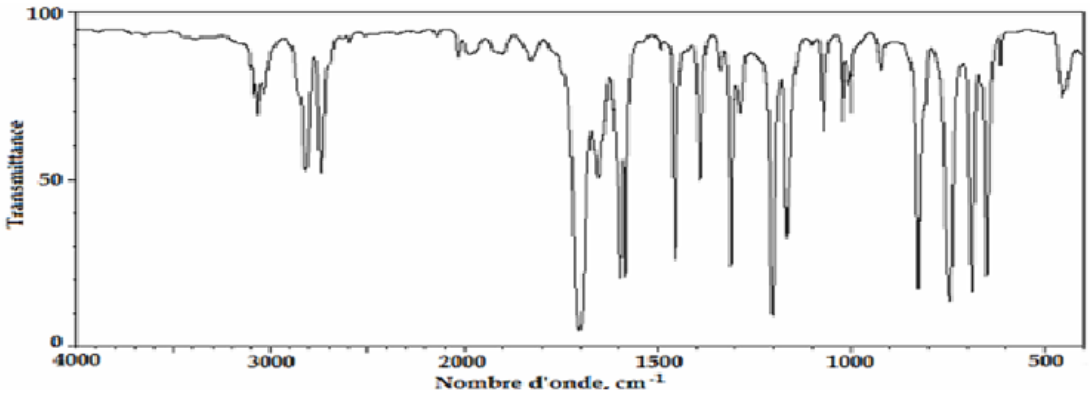


Exercise 05

The oxidation reaction of benzyl alcohol to benzaldehyde is studied:



An unknown product is obtained at the end of the reaction. Its **IR** spectrum is produced. Not knowing whether the chemical transformation has taken place, indicate by analyzing the IR spectrum whether the product obtained is benzyl alcohol or benzaldehyde.



Exercise 06

We have the infrared spectrum of an organic compound that contains oxygen, carbon, and hydrogen with the molecular formula $\mathbf{C_7H_6O_3}$.

1. **Calculate the degree of unsaturation.**
2. **Identify (interpret) the IR spectrum.**
3. **Provide the characteristic bands.**
4. **Determine the topological formula of the product.**