

Spectroscopy exercises (2010 VCE)

1) Which of the following would be the most suitable analytical technique to determine the ratio of ^{235}U to ^{238}U in a sample of uranium metal?

- A. mass spectroscopy
- B. gas liquid chromatography
- C. atomic absorption spectroscopy
- D. nuclear magnetic resonance spectroscopy

Solution will appear here

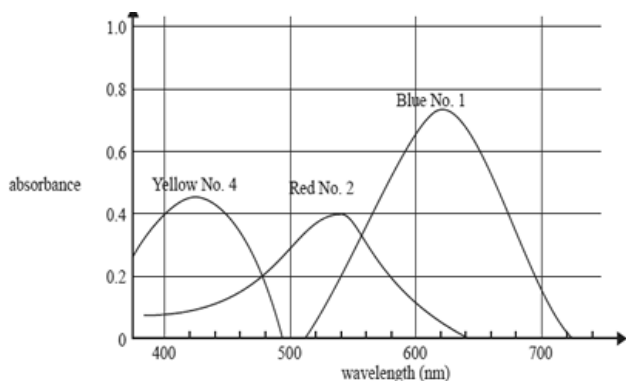
Solution

2) When a sample absorbs infrared radiation

- A. covalent bonds are broken.
- B. covalent bonds stretch and vibrate.
- C. the spin alignment of certain nuclei changes.
- D. electrons in atoms move to higher energy levels.

Solution

3) The graph shows the absorption spectra of three food dyes: Blue No. 1, Red No. 2 and Yellow No. 4.



Solution will appear here

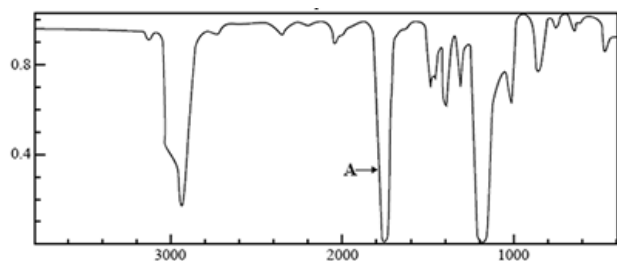
Which one of the following is the best wavelength to determine the concentration of Red No. 2 dye in a solution containing a mixture of all three dyes?

- A. 430 nm
- B. 500 nm
- C. 540 nm
- D. 620 nm

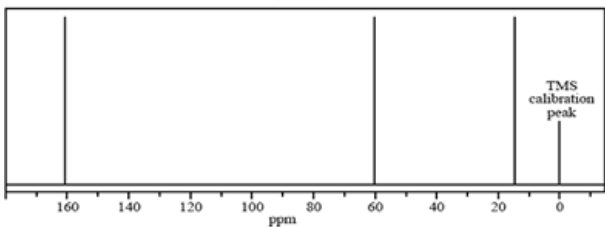
Solution

4) The molecular formula of an unknown compound, X, is $\text{C}_3\text{H}_6\text{O}_2$.

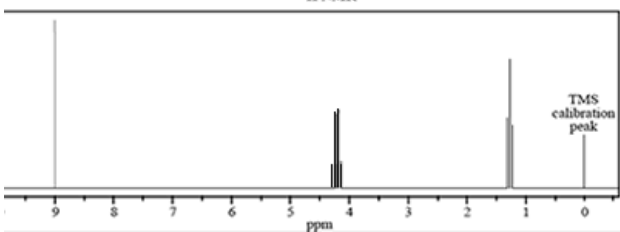
The infrared ^{13}C NMR and ^1H NMR spectra of this compound are shown below.



¹³C NMR



¹H NMR



Using the Infrared absorption [data on page 7 of the Data Book](#), identify the atoms and the bonds between them that are associated with the absorption labelled A on the infrared spectrum.

[Solution](#)

b. How many different carbon environments are present in compound X?

[Solution](#)

c. How many different hydrogen environments are present in compound X?

[Solution](#)

d. i. The signal at 1.3 ppm is split into a triplet. What is the number of equivalent protons bonded to the adjacent carbon atom?

[Solution](#)

ii. Draw the grouping of atoms that would give rise to the triplet and quartet splitting patterns.

[Solution](#)

e. A chemical test showed that compound X does not react with a base. Propose a structure for compound X that is consistent with all the evidence provided.

[Solution](#)

Solution will appear here

[Continue](#) with mass spectrometry from the 2010 VCE exam