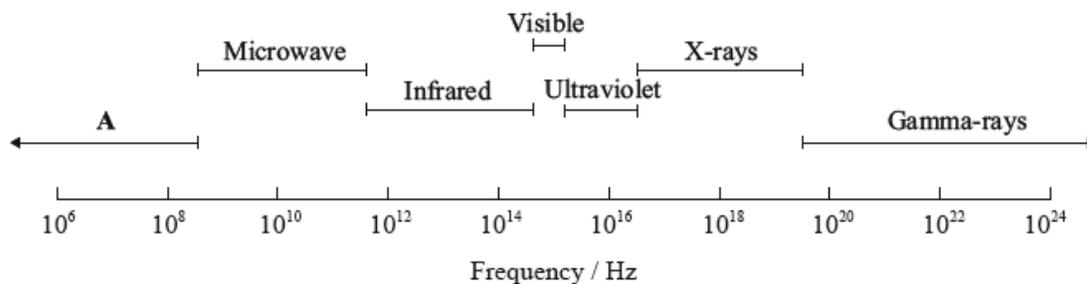


SL Paper 3

Selected regions of the electromagnetic spectrum are represented in order of increasing frequency below.



- a. Identify region **A**. [1]
- c. State which region of the electromagnetic spectrum can be used to identify the functional groups present in a molecule. [1]
- d. Explain why the absorptions in infrared (IR) spectroscopy occur at much higher frequency than those in _____ spectroscopy. [2]

Modern analytical techniques are used widely for different purposes in everyday life.

Two types of spectroscopy are absorption and emission. Distinguish between each type of spectra, including how each is produced.

Absorption spectra:

Emission spectra:

Electromagnetic waves can transfer energy and carry information.

State the relationship between the energy of a wave and its wavelength.

a. Describe the essential difference between the **emission** spectrum of sodium and the **absorption** spectrum of sodium. [1]

b. Identify the five missing components in the following table. [4]

Type of spectroscopy	Type of atomic or molecular process	Region of electromagnetic spectrum
^1H NMR		
IR		infrared
	electronic transitions	

Paper chromatography is a simple method used to separate and identify the components in a mixture. To aid identification, the retention factor, R_f , of an unknown component can be compared with the R_f values of pure samples of the possible components.

Describe how the wavelength, the frequency, and the energy, change in moving from the infrared region of the electromagnetic spectrum to the radio region of the electromagnetic spectrum.

Wavelength:

Frequency:

Energy:

Nuclear fission of ^{235}U is one source of electrical energy that has a minimal carbon footprint.

a.i. Natural uranium needs to be enriched to increase the proportion of ^{235}U . Suggest a technique that would determine the relative abundances of ^{235}U and ^{238}U . [1]

a.ii. Explain how ^{235}U fission results in a chain reaction, including the concept of critical mass. [3]

b. Suggest one reason why there is opposition to the increased use of nuclear fission reactors. [1]