

1. Overview

Spectroscopy has become a very valuable scientific tool and finds applications in areas as diverse as chemistry, pharmacy, food, agriculture, forensics, astrophysics, etc. A special feature of spectroscopy is that it can be used to analyse even when only tiny traces of material are available and it doesn't harm the sample. Many school laboratories have a spectrometer and students would benefit from the opportunity to become familiar with it. Students are required to understand continuous spectra as well as emission and absorption spectra.

Mention was made of emission spectra arising when electrons move to lower energy levels in an atom, emitting photons of surplus energy. Reference was also made to the Doppler effect whereby the red shift in spectral lines provide evidence for the expanding universe. Advances in recent decades include the use of reflective diffraction gratings as well as the use of UV and infrared spectroscopy. A short video about spectrometers was recommended and is available at: <https://www.youtube.com/watch?v=h4RicZDeLQY>

2. Video outlining a timeline for spectroscopy

Isaac Newton first used the word "spectrum" to refer to the array of colours in a rainbow. In 1666 Newton used a glass prism to display how white light is dispersed into the same pattern of colours as a rainbow. In 1814 a German called Fraunhofer invented the spectroscope which he used to discover dark lines in the solar spectrum, now known as Fraunhofer lines or absorption lines. These lines provided the first evidence of the elements in the Sun's atmosphere. In 1859, Kirchhoff and Bunsen developed a more accurate spectroscope than Fraunhofer's one. Bunsen also invented the famous Bunsen burner which enabled the very high temperatures needed to obtain emission spectra from many substances. Together these two scientists discovered two new elements, caesium and rubidium, and made many contributions to the understanding of chemistry and physics as well as laying the foundation for astrophysics. It is a notable achievement of spectroscopy that the element Helium was first identified in the atmosphere of the sun, decades ahead of its first detection on earth. The Swiss high school teacher, Balmer, made a valuable contribution to the understanding of Hydrogen when he analysed Angstrom's spectral data and delivered the Balmer formula. This contributed to the development of the Bohr model of the atom. Nowadays, astronomers use spectroscopy to analyse the light emitted or absorbed by stars. Spectroscopy is used to detect and characterize exoplanets orbiting distant stars and to study a wide range of astronomical phenomena and to study the conditions of the early universe. Spectroscopy is increasingly used in medicine for a variety of diagnostic, imaging, and therapeutic purposes, including diagnosis of disease and medical imaging (using magnetic resonance imaging (MRI))

