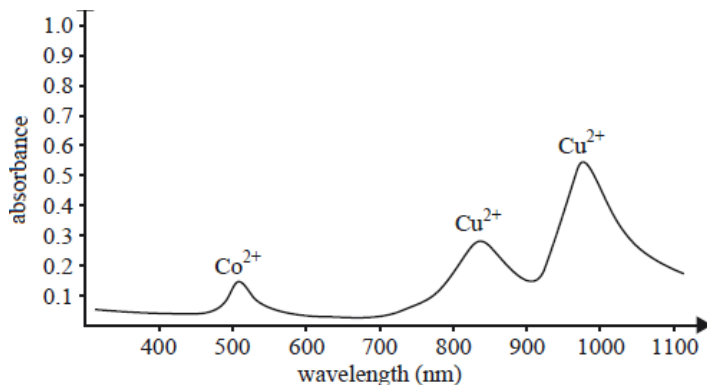


# Spectroscopy 2013 VCE

1) Chemists suspected that an impure copper lump contained a significant amount of cobalt. Cobalt would be oxidised to  $\text{Co}^{2+}$  ions that would remain in the electrolyte solution. The spectrogram below gives the results of analysis of the solution. The two ions absorb at distinctly different wavelengths.

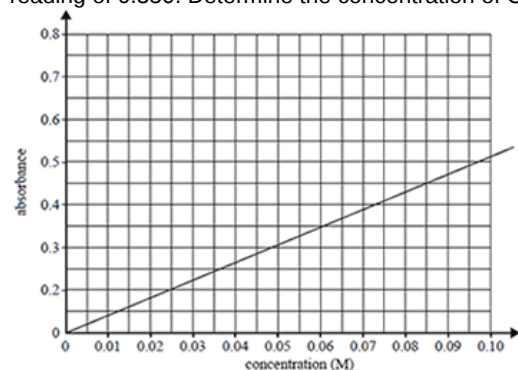


Solution will appear here

- a) i) Which analytical technique was used to perform this analysis?  
A calibration graph was constructed using  $\text{Co}^{2+}(\text{aq})$  solutions of known concentrations.  
ii. What wavelength would you select to construct this curve?

Solution

- b) A  $\text{Co}^{2+}(\text{aq})$  solution of unknown concentration registered an absorbance reading of 0.350. Determine the concentration of  $\text{Co}^{2+}$  ions in this solution.



Solution will appear here

Solution

2) An unknown organic compound, molecular formula  $\text{C}_4\text{H}_8\text{O}_2$ , was presented to a spectroscopy laboratory for identification. A mass spectrum, infrared spectrum, and both  $^1\text{H}$  NMR (proton NMR) and  $^{13}\text{C}$  NMR spectra were produced. Click on the blue writing to see the spectra. The analytical chemist identified the compound as ethyl ethanoate. A report was submitted to justify the interpretation of the spectra. The chemist's report indicating information about the structure provided by the  $^{13}\text{C}$  NMR spectrum has been completed for you.

Solution will appear here

- a. Complete the rest of the report by identifying one piece of information from each spectrum that can be used to identify the compound.

Spectroscopic technique	Information provided
$^{13}\text{C}$ NMR spectrum	The four signals in the $^{13}\text{C}$ NMR spectrum indicate four different carbon environments. $\text{CH}_3\text{COOCH}_2\text{CH}_3$ has four different carbon environments.
mass spectrum	
infrared spectrum	
$^1\text{H}$ NMR spectrum	

### [Solution](#)

c) Another compound has the same molecular formula as ethyl ethanoate. However, the carbon  $^{13}\text{C}$  NMR spectrum of this compound shows only three signals. Draw a possible structure of this compound.

### [Solution](#)

Solution will appear here