

Teaching ideas for Option A, *Modern analytical chemistry*

Questions

Two worksheets of questions are provided:

- the first worksheet deals with the Standard Level part of the syllabus
- the second worksheet is for Higher Level only.

There are also a large number of questions available in the Coursebook and on the accompanying CD-ROM.

Practical activities

Safety

Extreme care must be exercised when carrying out any practical activities in the classroom and a risk assessment should be conducted before carrying out the experiments.

Demonstrations

The demonstrations that can be carried out for this option depend on the equipment available. If no instruments are available the students could be shown videos of the techniques or a visit to an analytical laboratory could be arranged.

- Thin-layer and paper chromatography can be demonstrated using coloured inks or dyes. Similarly, column chromatography can be demonstrated in the same way.
- The factors that affect the colours of transition metal complexes can be demonstrated by showing students solutions of various transition metal salts. The effect of changing ligands can be illustrated by adding concentrated ammonia solution or concentrated hydrochloric acid (**Care!**) to copper sulfate solution.
- The idea of conjugated systems and their influence on colour can be illustrated by adding bromine water (**Care!**) to tomato ketchup (to which some water has been added). The colour changes are caused by addition of bromine to the conjugated system of lycopene in the ketchup.
- Students require practice on interpreting spectra and there are many databases available (details given below).
- The application of each technique to real world problems could be discussed.
- The use of various analytical instruments in space probes could be discussed.
- The selection of molecules for sun creams could be discussed/researched. Are different ingredients acceptable in different countries?

Student practicals

- Assuming that suitable apparatus is available, the effect of concentration on the absorbance of light can be investigated. Students could make up various concentrations of copper sulfate and measure the absorbance at a suitable wavelength. Once a calibration curve has been constructed they can determine the concentration of an unknown solution.

ICT

There are many opportunities for using IT in this topic.

- Databases of spectra:
http://riodb01.ibase.aist.go.jp/sdbs/cgi-bin/cre_index.cgi?lang=eng
<http://webbook.nist.gov/chemistry/>

- Databases:
http://www.rsc.org/Education/Teachers/Resources/Databook/index_databases.htm
<http://www.science-and-fun.de/tools/>
<http://www.lohninger.com/spectroscopy/dball.html>
- Spectra, tutorials and videos of techniques:
<https://www.le.ac.uk/spectraschool/>
- Videos of modern chemical techniques can be found in the RSC section of YouTube:
<http://www.youtube.com/profile?user=wwwRSCorg#g/u>
- Description of some techniques:
<http://chem-ilp.net/labTechniques/LabTechniques.htm>
- Mass spectrometry simulation:
<http://www.oraxcel.com/projects/masssim/index.htm>
- More in-depth description of NMR spectroscopy:
<http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/Spectrpy/nmr/nmr1.htm>
- NMR questions:
<http://www.chem.ucla.edu/~webspectra/>
<http://heat.usc.edu/chem322a/interactive/c4h10o.html>
- Spectroscopy problems:
<http://orgchem.colorado.edu/hndbksupport/spectprob/problems.html>
<http://www.chem.ucalgary.ca/courses/351/spectroscopy/index.html>
<http://www.nd.edu/~smithgrp/structure/workbook.html>
- AAS and chromatography:
http://www.shsu.edu/~chm_tgc/sounds/sound.html
- Colours of transition metal complexes:
<http://michele.usc.edu/105b/105bfall98/resources/resource.html>
- Animations on spectroscopy and chromatography:
http://www.shsu.edu/~chm_tgc/sounds/sound.html
- Azo dye synthesis:
http://www.chem.cuhk.edu.hk/English/RBS6E_Student/Student_Expt_8_eng.pdf
<http://www.users.muohio.edu/taylorrt/combichem/Lab%20Experiment%20in%20Azo%20Dye%20Preparation.htm>

Theory of knowledge (TOK)

The use of reasoning to determine the structures of molecules could be discussed.