

Introduction

Information Technology (IT) for interactive learning complements strategies of learning and teaching inside and outside the classroom. IT often provides an interactive environment for learners to take control of the organisation and content of their own learning. With appropriate use of IT-based resources, teachers can enhance students' understanding of chemistry concepts and processes, and develop students' IT skills which are useful for life-long learning. There are numerous opportunities in using IT to facilitate students' learning in the revised Sixth Form Chemistry Curriculum:

- ◆ 3-dimensional computer images (e.g. in the formats of PDB (Protein Data Bank) and VRML (Virtual Reality Modeling Language)) can be used effectively to help students visualise shapes of molecules and chemical structures. These graphic images can be manipulated as if one is examining a real model.
- ◆ Animations can help students visualise abstract Chemistry concepts and processes, especially at molecular level, e.g. various organic reaction mechanisms.
- ◆ Computer simulations can be used to model a chemical system e.g. a reversible reaction at equilibrium. Students are required to make decisions to manipulate variables of a system in order to accomplish a goal. Students can carry out a number of virtual experiments quickly and discover the trends for themselves. An effective simulation can help students visualise physical phenomena and grasp scientific principles.
- ◆ Spreadsheets can be used in analysing and plotting experimental data. It can also be used in the modeling of chemical systems allowing students to explore "what-if" situations. It can move students' understanding beyond repetitive calculations and plotting of numerical results.
- ◆ Dataloggers and sensors can be used in Chemistry experiments to collect and plot signals e.g. temperature, pH, light absorbance and gas pressure. Dataloggers are particularly useful for very long or short experiments or when multiple data have to be acquired simultaneously. Students can have more time to analyse, discuss and evaluate experimental results.
- ◆ Digital video allow students to review observations and laboratory techniques of chemistry experiments without actually repeating the experiments. Digital video can also be used to show experiments which are difficult or dangerous to conduct in school laboratories.
- ◆ Internet allows students to go beyond textbooks to find current and authentic information to help them understand concepts, acquire knowledge, and observe and explore the world outside schools.
- ◆ Collaborative learning platforms e.g. Knowledge Forum and CMapTools provide environments for students to construct knowledge through exchanging views and ideas.
- ◆ On-line assessment tools e.g. Hot Potatoes can be used to design assessment tools which can provide instant feedback on students' understanding of concepts and may help identify misconceptions perceived by the students.

- ♦ Web-based learning resources and multimedia CD-ROMs can be used to assist classroom teaching as well as self-paced learning for individual students.

Exemplars of learning activities on IT for interactive learning in Chemistry are provided in Activities #1-6. Some useful websites are given below for reference.

Visualisation of Chemical Structures

Alphabetical Listing of Molecules

 <http://www.wellesley.edu/Chemistry/Flick/molecules/newlist.html>

Explore the Fullerenes

 <http://buckminster.physics.sunysb.edu>

Image Gallery, the Smalley Group, Rice University

 http://smalley.rice.edu/smalley.cfm?doc_id=4866

Orbitron, University of Sheffield

 <http://www.shef.ac.uk/chemistry/orbitron>

Making Matter: the Atomic Structures of Materials

 <http://www.ill.fr/dif/3D-crystals/index.html>

Molecular geometry: VSEPR

 <http://www.shef.ac.uk/chemistry/vsepr/jmol/intro.html>

Molecular Modeling, Viewing and Drawing Programs

 <http://ep.llnl.gov/msds/dvc/viewrs.html>

Nanotechnology Now

 <http://www.nanotech-now.com/nanotube-buckyball-sites.htm>

Valence-Shell Electron-Pair Repulsion Model

 <http://www.chm.davidson.edu/vsepr/vsepr.html>

Visualization and Problem Solving for General Chemistry, Purdue University

 <http://www.chem.purdue.edu/gchelp/>

What Is VSEPR?

 <http://www.chem.purdue.edu/gchelp/vsepr/>

Animations

Animated Atoms, Tanner's General Chemistry

 <http://www.tannerm.com>

Chemistry Animations, University of Nebraska-Lincoln

 <http://chemmovies.unl.edu/ChemAnime/index.htm>

Chemistry Animations, Louisiana State University

 http://www.chem.lsu.edu/htdocs/people/jchogan/CHEM_1201/animation_links.html

Chiral Molecules, Nobel Prize Chemistry 2001

 <http://nobelprize.org/chemistry/educational/poster/2001/game.html>

Computer Animations and Simulations in General Chemistry

 <http://www.science.uwaterloo.ca/~cchieh/cact/trios/simulation.html>

Flash Animations, Raymond Chang

 <http://www.mhhe.com/physsci/chemistry/essentialchemistry/flash/flash.mhtml>

Infra-red Absorption Spectroscopy

 <http://www.shu.ac.uk/schools/sci/chem/tutorials/molspec/irspec1.htm>

Organic Online: Mechanism Movie, Chime Molecules

 <http://www.jbpub.com/organic-online/webhome.htm>

The Poon-Mundy Computer Demonstrations

 <http://www.colby.edu/chemistry/OChem/demoindex.html>

Simulations

ChemLand, University of Massachusetts

 <http://colossus.chem.umass.edu/bvining/downloads/chemland2>

Chemistry Experiment Simulations, Iowa State University

 <http://www.chem.iastate.edu/group/Greenbowe/sections/projectfolder/animationsindex.htm>

Chemistry Experiments and Exercises, David N. Blauch, Davidson College

 <http://www.chm.davidson.edu/ChemistryApplets>

Electromagnetic Spectrum Calculator

 <http://lectureonline.cl.msu.edu/~mmp/applist/Spectrum/s.htm>

ICT resources to support Chemistry teaching for the 11-19 age range, Royal Society of Chemistry

 <http://www.chemit.co.uk/pageshow.aspx?PageID=43&selection=1>

Interactive Organic Reaction Mechanism, Oxford University

 <http://www.chem.ox.ac.uk/vrchemistry/iom>

Interactive Spreadsheet Demonstrations for Introductory, Inorganic, Analytical and Physical Chemistry

 <http://www.wellesley.edu/Chemistry/chem120/sheets.html>

Iodine Clock Reaction, Gary L. Bertrand, University of Missouri-Rolla

 <http://web.umr.edu/~gbert/IClock/IClock.html>

Journal of Chemical Education WebWare: Open Review Collection

 <http://www.jce.divched.org/JCEDLib/WebWare/collection/open/index.html>

Using Excel Spreadsheets to model Equilibria within A Level Chemistry

 <http://ferl.becta.org.uk/display.cfm?resID=2699>

Virtual chemistry lab for acid-base titration

 http://lrs.ed.uiuc.edu/students/mihyewon/chemlab_experiment.html

Maxwellian Velocity Distribution, University of Oregon

 <http://jersey.uoregon.edu/vlab/Balloon/index.html>

Web Experiments, Dr Nutt's CHE 115 Course, Davidson College

 http://www.chm.davidson.edu/ronutt/che115/che115_2.htm

Interactive Periodic Tables

Atomic and Emission Spectra of Elements, University of Oregon

 <http://jersey.uoregon.edu/vlab/elements/Elements.html>

Periodic Table, American Chemical Society

 http://www.chemistry.org/portal/a/c/s/1/acdisplay.html?DOC=sitertools%5Cperiodic_table.html

Periodic Table with Electronic Configurations, ChemCollective

 <http://www.chemcollective.org/applets/pertable.php>

David's Whizzy Periodic Table

 <http://www.colorado.edu/physics/2000/applets/a2.html>

Internet Activity: The Periodic Table Comic Book

 http://www.phschool.com/atschool/chemistry/AW/Student_Area/AWCHEM_SC14_ACT_index.html

Visual Elements of Periodic Table, Royal Society of Chemistry

 http://www.chemsoc.org/viselements/pages/periodic_table.html

Pictorial Periodic Table

 <http://chemlab.pc.maricopa.edu/periodic/default.html>

Periodic Table

 <http://www.ch.cam.ac.uk/SGTL/elements/>

WebElement Periodic Table

 <http://www.webelements.com/index.html>

Video

Chemistry Film Studio

 <http://www.chem.ox.ac.uk/vrchemistry/FilmStudio/fshome.htm>

Delights of Chemistry, University of Leeds

 <http://www.chem.leeds.ac.uk/delights>

Experiments on the Web, Swiss Federal Institute of Technology Zurich

 <http://www.cci.ethz.ch/index.html>

Organic Chemistry Demonstration Experiments on Video Chemistry Visualized

 http://www.uni-regensburg.de/Fakultaeten/nat_Fak_IV/Organische_Chemie/Didaktik/Keusch/D-Video-e.htm

Online Tutorials

Chemistry Homework Help, Oakland Community College

 http://www.occ.cc.mi.us/iic/iicah/ah_www_che.htm

Tutorial Materials and Resources by Professor Gary L. Bertrand

 <http://web.umr.edu/~gbert/links.html>

Organic Chemistry Online

 <http://www.chem.uic.edu/web1/OCOL-II/WIN/HOME.HTM>

Basic Organic Nomenclature, Okanagan University College

 <http://www.sci.ouc.bc.ca/chem/nomenclature/nom1.htm>

Chemguide

 <http://www.chemguide.co.uk>