



Using I.C.T. in Chemistry Education

Lokendra Kumar Ojha, Lovely Professional University, Jalandhar, Punjab¹

There are several topics in chemistry which required computational technique to learn and use of ICT enhance learning capacity of learner as well as facilitator. The present article deals with the use of ICT in some of the topic of chemistry. We tried to overcome from routine chalk and talk method to understand the several topic viz. stereochemistry, IUPAC naming and other organic chemistry topics. All though chalk and talk method has gain attention of the students but it has been found that using ICT to teach such topic of chemistry helps teacher to overcome from class room difficulty like presenting 3 D structure of molecule with model. The objective is to reveal teachers' ICT experiences and views on ICT integration into teaching-learning process as well as uncover the perceived obstacles to the integration process. Chemistry education pedogogy in this country will have to shift its present at all levels attracts the best talen, retains them and works for their professional development. To acquire this goal teaching profession will have to be made more attractive. Teachers like researchers should be duly recognized for their contributions in form of fellowship and awards.

Keywords: ICT, Chemistry, ICT in education, Education

¹Contact details ojha.lokendra@gmail.com



Introduction

Information and Communications Technology (ICT) is an umbrella term that includes all technologies for the manipulation and communication of information. The term is sometimes used in preference to Information Technology (IT). A large number of commercial software packages offer teachers exciting and visually appealing approaches to teaching. These often drive the pedagogy and to a certain extent might restrict flexibility in teaching. In addition, some teachers resist the opportunity of teaching someone else's lesson and report that commercial software packages might not be available to pupils outside school. Experienced ICT practitioners can produce very effective lesson material using Microsoft® applications which can be uploaded to a school's intranet and internet and in a number of other ways can be made available for pupils to use outside school. Sharing lesson material is helpful for colleagues who can customize files to suit their own approach.

Teachers require continuous support and training to effectively integrate technology initiatives. Successful technology integration involves the allocation of time for teachers to experiment with new technologies, collaborate with peers, and the provision of professional development opportunities. As teachers collaborate and plan lessons that integrate technology, they reframe their perceptions towards innovative technology implementation and, ultimately, student achievement.

ICT in Chemistry

In chemistry education, ICT can provide solutions to many of the problems afflicting chemistry education and thus help enhance the quality of chemistry education in chemistry. Traditional classroom teaching, as we all know, is basically a talk- and- chalk method. Besides, there is also pressure on the teacher to finish the syllabus on time and therefore, even though a teacher wants his students to acquire an in depth understanding of the subject. Chemistry extended knowledge of information and communication technology, with particular emphasis on tools and methods are used in teaching chemistry at the lower and upper secondary school level. The traditional chalk and talk method could not help out to solve the problem of learner and hence the need of ICT as a tool can enhance the knowledge as well as learning experience. There are many concepts that can be used to describe the motivational aspect of science teaching and learning. Computers have



been used in education in many ways from the very beginning of their history. Several ways to analyses use of computer and ICT in education is govern the importance of one and all. Any particular technology is often treated as a particular tool to accomplish their task in more efficient way.

There are so many topics which can be covered with the help of chemsketch.

1. Aromaticity
2. 3D structure optimization
3. Tautomeric forms
4. Auto renumbering
5. Calculation of Molar Refractivity, Surface tension, Parachor, Index of refraction, Density, Polarizability and dielectric constant.
6. IUPAC Nomenclature
7. Import and export of molecule
8. Conversion of 2D into 3D
9. Advance form of periodic table
10. Structure of Carbohydrate
11. Structure of Fullerene and other bigger molecule
12. Editing of molecule structure.

ICT increases teacher efficiency and can reduce teachers' time spent performing administrative tasks (Koszalka & Wang, 2002; et al.). It is important for both students and teachers to use ICT regularly in their courses (Figg, 2000 et al.). Students higher-order thinking skills are enhanced in learning environments where ICT is used (Allegra, Chifori, & Ottaviano, 2001 et al.).

To be able to use ICT in the courses effectively, teachers should;

- be aware of its potential,
- select tools and methods which are appropriate with the needs of students,
- design their teaching methods effectively,
- develop new teaching strategies,
- Know and apply classroom management rules in order to cope with problems encountered in technology-aided learning environments (Becker, 2001 et al.).

Investigating teachers' beliefs on ICT as well as their current level of ICT use have particular importance in ICT integration studies (Bucci, Copenhaver, Lehman, & O'Brien, 2003 et al.). The use of ICT as an effective tool for student learning inspired a growing debate among educators and policy makers. Teachers, students, parents and many others with an interest in technology integration frequently are overwhelmed by providing and assessing quality technological instruction. ICT is playing a central role in cooperation between schools and the community and to engage parents in the learning process. ICT is widely promoted by central authorities as a tool for teaching and learning but large implementation gap remains. ICT is often recommended for assessing competences but steering documents rarely indicate how it should be applied. Teachers usually acquire ICT teaching skills through their initial education but further professional development is less common

Stereochemistry

An important branch of stereochemistry is the study of chiral molecules. (March, 1985) Stereochemistry is also known as 3D chemistry because the prefix "stereo-" means "three-dimensionality". (<http://dictionary.reference.com/browse/stereo>) Teaching stereochemistry with chalk and talk method is always a tedious job for teacher because it requires a lot of 3D structure of molecule and drawing 3D object on black board is not possible. There is several drawing tools available free on internet in which 3D object can easily draw and several other information viz. bond angle, angle strain, chiral carbon etc. can easily calculate.

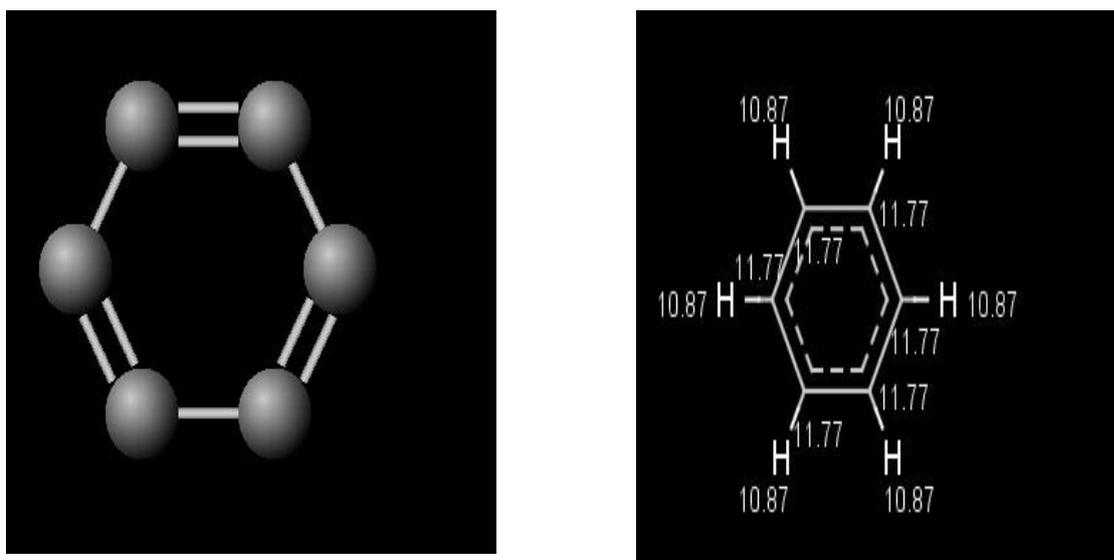


Fig. 1 Stereochemistry of benzene

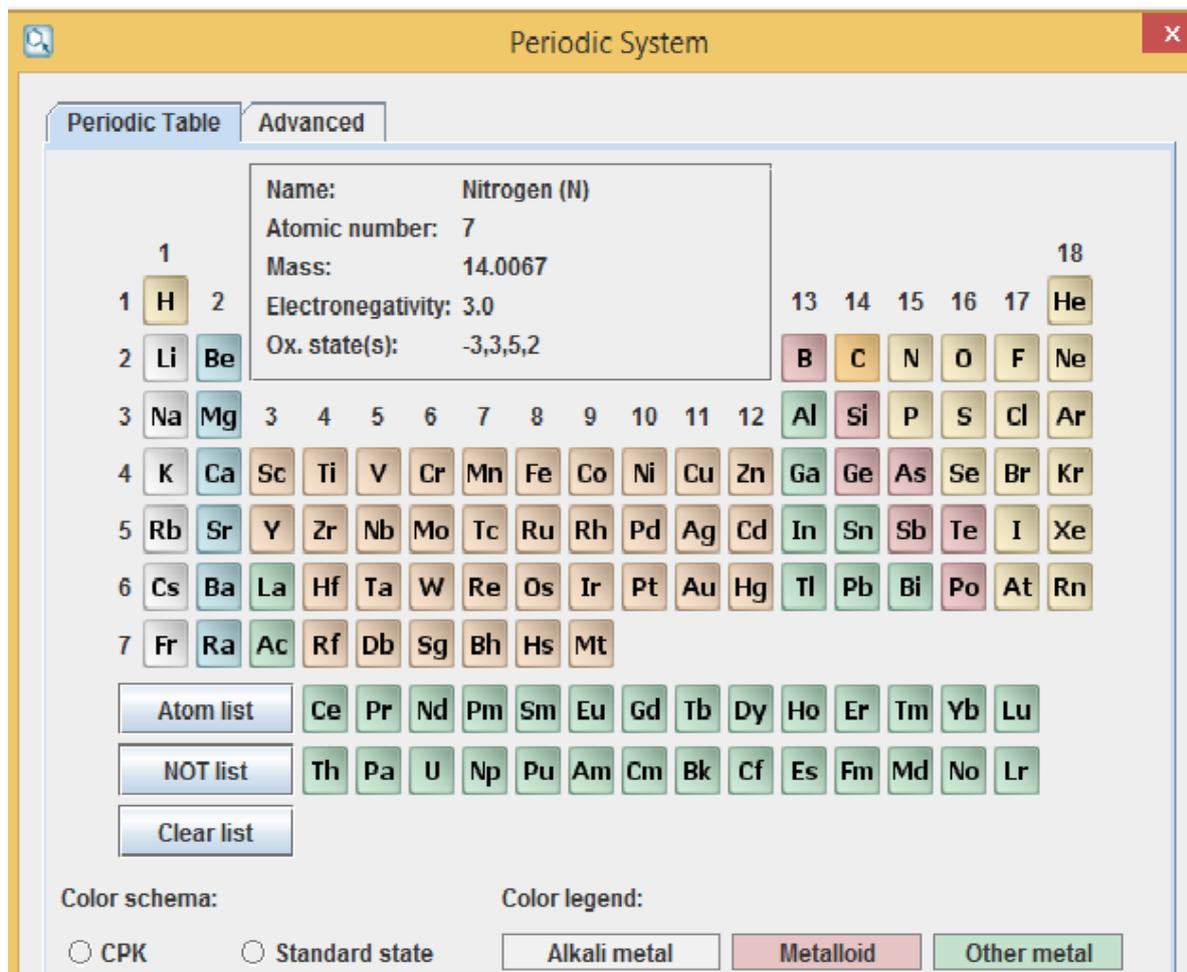


Fig. 2 Snapshot of Periodic Table

Periodic Table

Concept of periodic table used in every aspects of chemistry. Whether it is organic, inorganic and physical chemistry or pharma, drug, and medicinal chemistry. But it is always a challenge to remember all the properties of periodic table. With the help of this tool we can teach periodic table in more effective manner. All elements from atomic numbers 1 (hydrogen) to 118 (ununoctium) have been discovered or synthesized, with elements 113, 115, 117, and 118 being confirmed by the IUPAC on December 30, 2015 (Chemistry: Four elements added to periodic table". *BBC News*)

The periodic table is organized like a big grid. Each element is placed in a specific location because of its atomic structure. As with any grid, the periodic table has rows (left to right) and columns (up and down). Each row and column has specific characteristics. For example, beryllium (Be) and magnesium (Mg) are found in column two and share certain similarities while potassium (K) and calcium (Ca) from row four share different characteristics.

IUPAC Naming

In chemical nomenclature, the IUPAC nomenclature of organic chemistry is a systematic method of naming organic chemical compounds as recommended (The Commission on the Nomenclature of Organic Chemistry, 1971) by the International Union of Pure and Applied Chemistry (IUPAC).

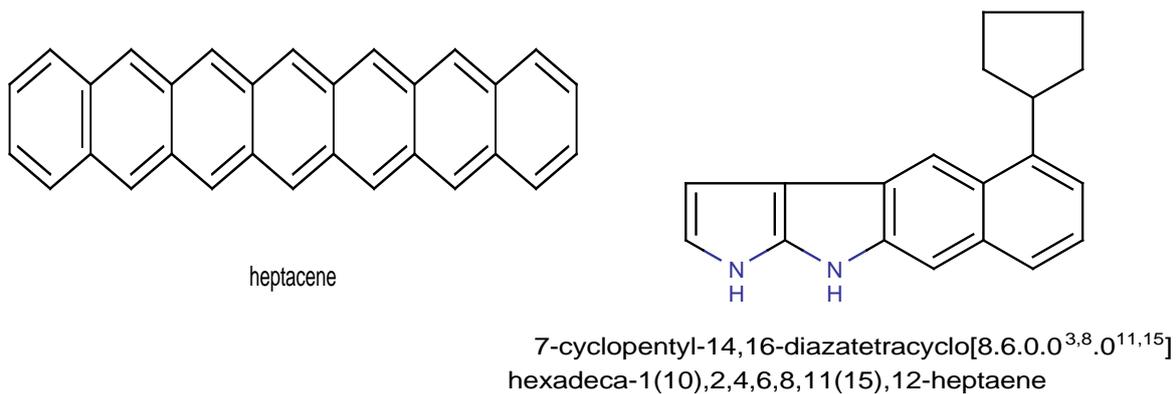


Fig. 3 IUPAC Nomenclature

3D Structure

A simple example of a 3D Structural Formula is that for methane, whose molecular formula is CH₄. Compare the following two representations of methane (CH₄):

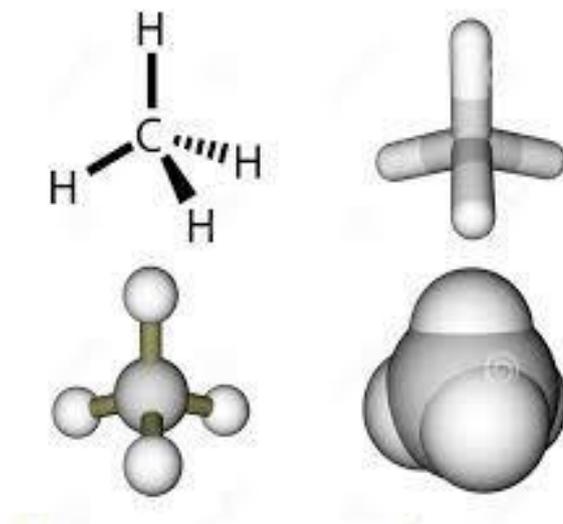


Fig. 4 3 D Structure of Methane

The sketched 3D structural formula of methane (on the left) may be understood even more clearly by comparison with the ("ball and stick") model of the 3D structure of methane (on the right).

Review the meanings of the dashed line and thin-wedge symbols given in the text above, in the context of their use in the sketched 3D structural formula of methane in the diagram.

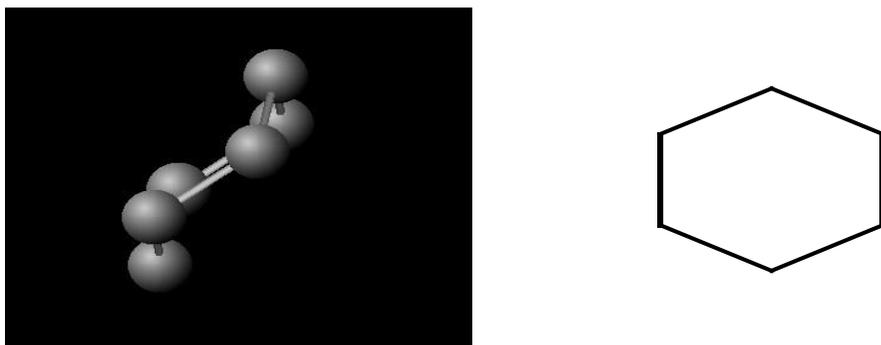


Fig. 5 3 D Structure of Cyclohexane

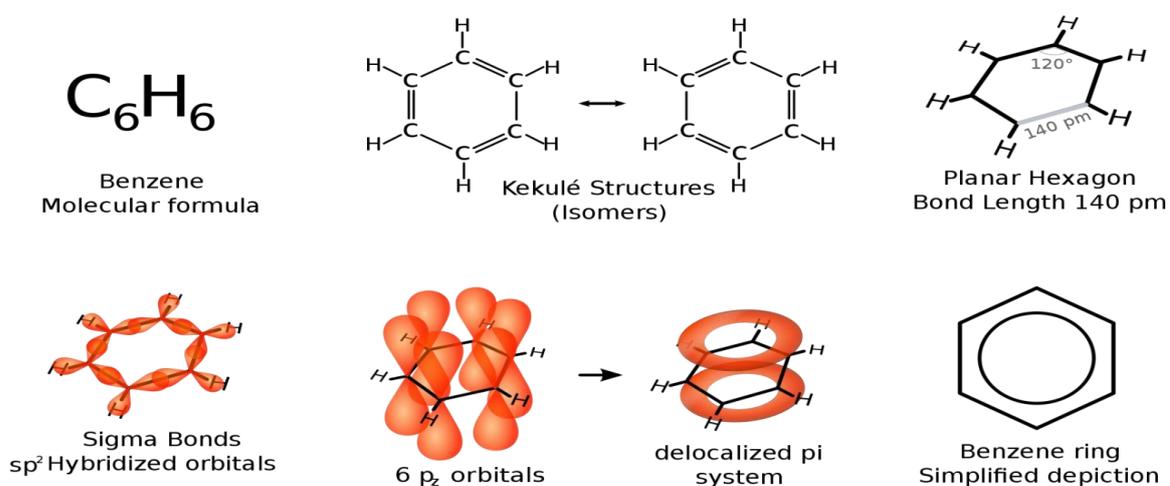


Fig. 6 Various Possible Structure of Benzene

Tools of ICT in Chemistry

There are huge amount of chemistry software available which can be readily used as an ICT tools to learn chemistry in better way. Some of them is freely available while some of them has commercial values. Drawing of molecule can be done by (Chemsketch) and (Marvin Sketch). This tools provide various additional information along with the object.



Conclusion

Software's for drawing and visualising 3D chemistry structure, predicting NMR, IR and other spectroscopic techniques, periodic table and organic chemistry other topics. It is very unfortunate that in our country more focus on theoretical knowledge rather than experimental work and ICT can play very important role in this concern. Technology initiatives can only be successful if they are compatible with the conditions of teaching. The initiative to incorporate technology effectively into classroom instruction must begin with the curriculum objectives. This ensures a consistent goal. A mismatch between values of the teacher and the technology initiative will cause an incorporation failure. If inadequate computer access or if there is a high pupil/computer ratio, teachers will be reluctant to employ technology as an instructional tool. The technology that is available must be reliable. Computers that are outdated or frequently requiring repair will cause frustration rather than a strong commitment to change. The training of a teacher as a technical specialist is instrumental to successful integration. As the specialist provides suggestions for integration technology into the curriculum and instructional activities, teachers understand how technology can be used as an instructional tool across all disciplines.

The ultimate success of ICTs for learning will be attained when we stop marvelling about the ICTs and apply our minds and emotions to the wonders of learning.”

References

- Allegra, Chifori, & Ottaviano, et al., (2001) *Information and communication technology in the class room*.
- Becker, et al, (2001), *Integrating ICT in to classrooms. A note from Turkish teachers*.
- Bucci, Copenhaver, Lehman, & O'Brien, et al., (2003), *Integrating ICT in to classrooms. A note from Turkish teachers*.
- Figg, et al., (2000), *Integrating ICT in to classrooms. A note from Turkish teachers*.
- Koszalka & Wang, 2002; et al., (1997), *Information and communication technology in the class room*.
- March, J. (1985), *Advanced Organic Chemistry: Reactions, Mechanisms, and Structure (3rd ed.)*, New York: Wiley. Available at <http://dictionary.reference.com/browse/stereo-Chemistry>: Four elements added to periodic table". *BBC News*.
- The Commission on the Nomenclature of Organic Chemistry* (1971 (3rd edition combined)) [1958 (A: Hydrocarbons, and B: Fundamental Heterocyclic Systems), 1965 (C: Characteristic Groups)]. *Nomenclature of Organic Chemistry* (3 ed.). London: Butterworths. Available: www.acdlabs.com. And Available: www.hyper.com