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PERIODIC TABLE SOFTWARE FOR HIGH SCHOOL
(Second Edition)

ABSTRACT: The first edition of this software was running under DOS and was presented at the 2nd ECRICE in 1993. The second edition which is described in this paper runs in Microsoft Windows95 and contains a periodic table (109 elements) with hyperlinks from each element to data. It illustrates a way of teaching of high school chemistry students (in French) about the periodic table and atomic structure. Ion structures, new exercises, a glossary hypertext, and a presentation of great scientists have beeen added. The new environment allows the display of the content of an exercise and help when neccessary. [*Chem. Educ. Res. Pract. Eur.*: 2000, *1*, 401-404]

The study of the periodic table is very important for the high school chemistry curriculum (Durandeau, 1997). Many interactive periodic table software programs exist that contain graphical and descriptive databases of the elements, including images showing the elements and their uses; examples are the following: Banks (1989); Schatz, Moore, Holmes, & Kotz (1995); Banks & Holmes (1997); Winter; Cabrol-Bass & Cleva (1999). Banks and Holmes (1997) present the reactivity of each element with air, water, acids and bases.

Our periodic table software for high school is in French and is intended for beginners in chemistry. The data are limited and the goal of the content is the learning of the atomic structure from the periodic table. The program presents a visual background of atomic structure, with many tests and exercices about the first 18 elements. The first edition was running under DOS and was presented at the 2nd ECRICE in 1993 (Viossat & Brosset,1993; see also Brosset, Rozoy, & Viossat, 1995). The second edition runs in Microsoft Windows95 and was devised by Viossat (1999). Both versions present the atomic structure (composition, electronic structures, Lewis diagrams), but in the new version some modifications have been made, and new topics added: isotopes, ion structures, new exercises, a glossary hypertext, and a presentation of great scientists.

Presentation

The software illustrates the topics atomic structure and the periodic table. It contains a simplified description of the atomic structure of atoms belonging to the first three rows, exercices and tests. It deals with concepts and topics about the atomic structure (composition,
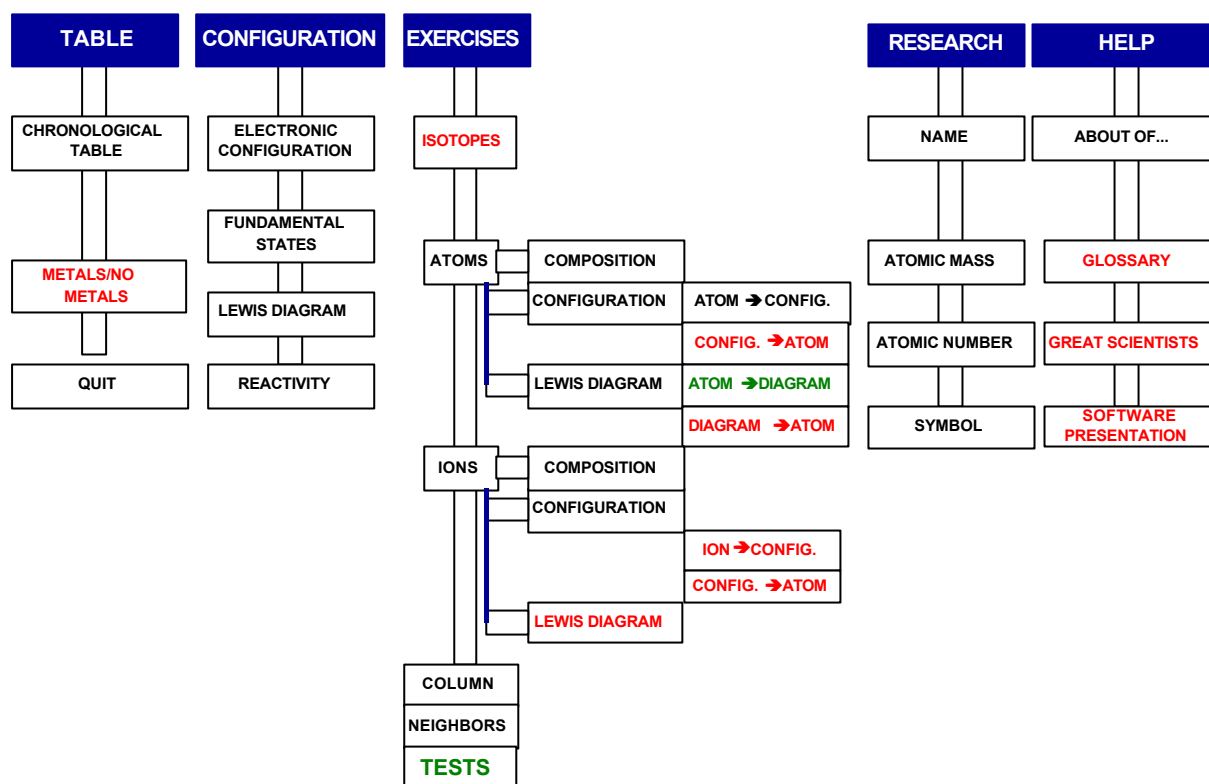
FIGURE 1. *Content of the software.*

electronic structure, Lewis scheme), allowing the pupil to spot rapidly the main characteristics of an element. In addition, it evaluates the level of knowledge by exercises and tests with help windows. Finally, it supplies complementary information about the chronology of element discoveries, and the life of great chemists.

Hyperlinks allow the display of the data concerning each element (name, symbol, mass, electronic structure). The content of the software is given in Figure 1. This new edition has been enriched with the addition of ion structures, a glossary and new exercices.

The development product is Delphi3 Borland. It allows the construction of windows, of menus, of hypertext and sounds. This environment by the opening of several windows offers access modes for visualization of information. The software is interactive. Its use is very easy since it uses windows tools. The advantages for the pupil are:

- the visual attraction ;
- the easiness to move around in the software ;
- the juxtaposition of several windows for exercises with help windows;
- the possibility of consulting a glossary for definition of many terms used in the software,
- the historic periodic table with a display of a few great chemists;
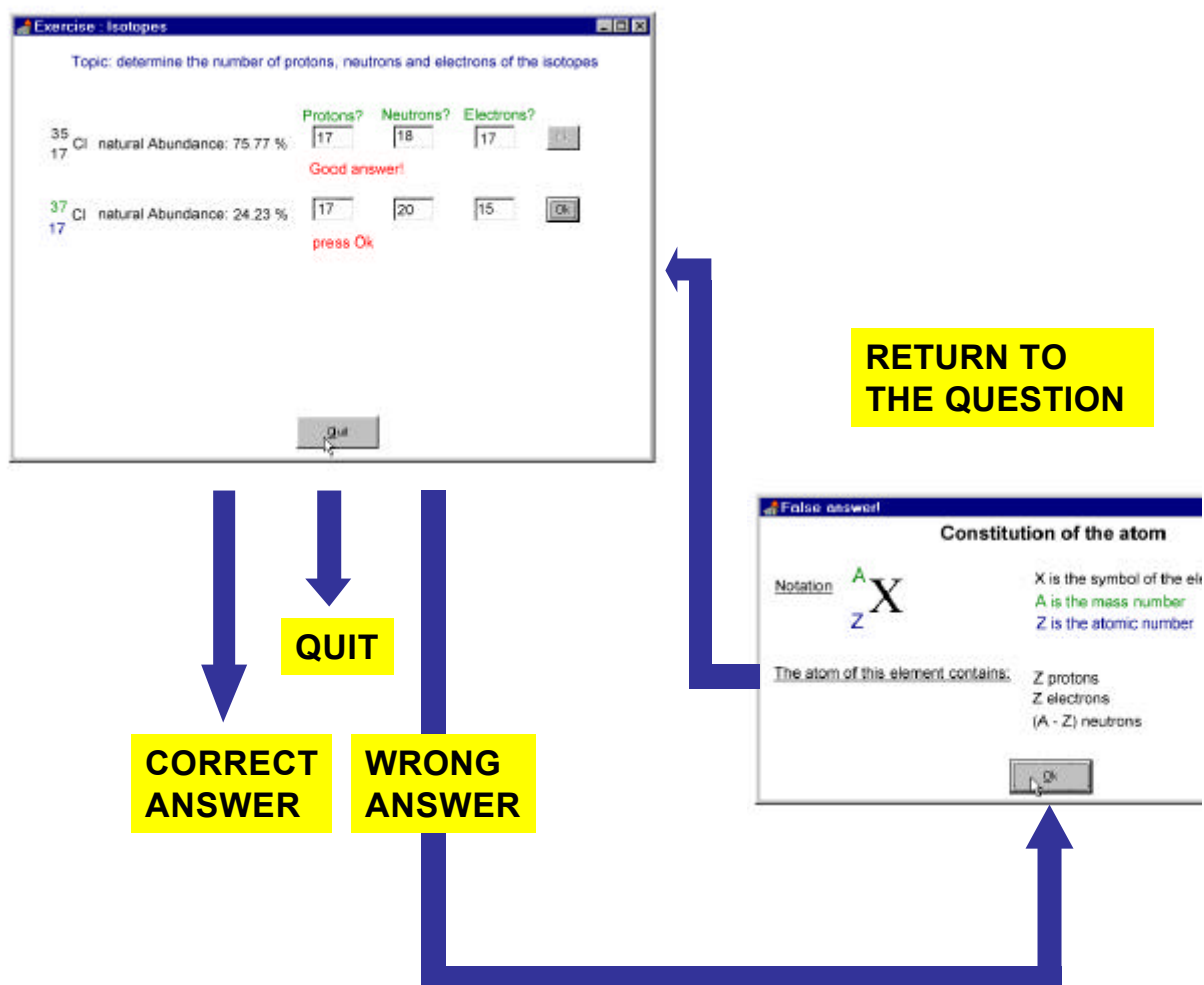- the presentation of the software.

FIGURE 2. *Example of exercise with help.*

The main window contains the periodic table with the menus at the top. Numerical data for an element are obtained by clicking on an element. In the different menus, two types of windows are used: firstly, the information windows with a summary of the lecture, data about the elements, and help windows; and secondly, the windows concerning the exercises with string typing or clicking on patterns. In most exercises, an element is chosen by clicking and questions are proposed according to different subjects.

Figure 2 presents an exercise about the isotopes. It corresponds to the submenu *exercises/isotopes*. The questions are chosen with random access.

At the opening, the first question appears. The pupil types the answer in the box. If the answer is correct, he/she moves to the following question. If the answer is wrong, an help window is displayed. If two wrong answers are given, the correct answer appears in the window.

Pedagogical experiment

Two classes tested this software during an annual event "Science en Fête" organized by the University. This experiment was interesting because the two classes did not have the same background in chemistry; the subject had been treated in one class but not in the other. The first pupils began with the exercises; the submenus "atoms" and "ions" were the most used; after that they displayed the submenu "chronological table" and "the great scientists".

The other pupils opened the submenu "Software presentation" and followed the suggestions for using the software. In both cases, the pupils found it easy to use the software and a "true dialogue takes place between the pupil and the computer" as noted by Avitabile, Guibal, & Bennett (1993). The pupils were very stimulated by the "chemistry game". Otherwise, this software is used as a revision tool by the students beginning their studies in our University.

Concluding remark

This periodic table software illustrates a way of teaching chemistry at the high school by developing the atomic structure. To our knowledge, it is different from existing softwares. This approach is unique; the student is active and we provide evidence of its success in use.

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