



## THE NOTTINGHAM UNIVERSITY / GLAXO CHEMISTRY COMPUTER GAMES

### BRIEF DESCRIPTION AND INSTRUCTIONS

The aim has been to produce a floppy disc containing a set of six computer games, which will be useful in A Level Chemistry. The games can be run on nearly any BBC computer (i.e. Model B, Master, etc., although there may be some problems with the BBC Model A and the Archimedes) and have full colour graphics, which are nevertheless usable on a monochrome TV. The data are easy to modify so that a teacher can put in his or her favourite examples. The games have a scoring element to encourage students to play them repeatedly to improve their performance.

The topics for this disc, sponsored by Glaxo, have been chosen in consultation with Mrs. Julie Brailsford, Chemistry and Careers teacher at Bilborough Sixth Form College Nottingham. There are six Programs, five with associated "utilities" which allow Teachers to change the content of the main programs. No knowledge of computing is needed to make these changes. It was this "teacher-friendliness" which made our first disc so popular.

The programs were devised by Nottingham staff members Martyn Poliakoff and Bryan Sowerby. The software has been written by the two students, John Barker (Cambridge) and Richard Acton (ex-Manchester), who wrote our first disc two years ago. The programs should be usable by nearly all of the schools which teach A-level Chemistry.

Any problems, comments or enquiries about the programs should be addressed to Dr. Martyn Poliakoff while questions about courses, admissions etc. should be directed to Dr. D. Bryan Sowerby.

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## GENERAL INFORMATION

The games are available on a standard 5 1/4 inch floppy disc, in double sided 80 track DFS or ADFS format. Note that DFS discs have blue writing, whilst ADFS have green. ADFS discs will not run on 32K machines, since the Multiple Choice program has some questions which take up more than 32K. ADFS will run, but not completely, on an Archimedes with a BBC emulator.

1. Before using the Disc to play games, BE SURE TO MAKE A BACKUP COPY! The full set of games cannot be run on a disc which is "write protected"

2. Note that the symbols < > are used to mean a particular key. Thus <?> means the key with a question mark on it.

3. To run ADFS discs:

The Disc has a Menu, which is loaded by pressing down the SHIFT key and then pressing and releasing BREAK while keeping the SHIFT key pressed. (This is the standard way of loading BBC games, so many pupils will be familiar with it already). The three games on side one of the disc are displayed in the menu. Each game is then chosen by typing in the appropriate number (1 - 3). Alternatively, to access the games on side two, type <4>. Always use this method to access the Games. Do not try to start programs directly from the Directory as the <Shift/Break/Shift> procedure sets up the system. Once the games on side two have been accessed, in order to run those on side one again it is necessary to type <CTRL> and <BREAK> simultaneously, followed by <SHIFT> <BREAK> <SHIFT> again.

4. To run DFS discs:

As with ADFS discs the Menu of the three games on side one is loaded by pressing down the SHIFT key and then pressing and releasing BREAK while keeping the SHIFT key pressed. There are two ways to access the programs on side two of the disc. The first method is to copy them onto a second disc, in which case they are loaded using the <SHIFT> <BREAK> <SHIFT> command. If you prefer to keep the programs on one disc, type \*DR.# (where # is the number of the second side of the disc drive - usually 1 or 2), followed by CH."MENU".

5. DO NOT REMOVE THE DISC DURING THE RUNNING OF THE PROGRAMS (except to load schemes for SCHEMER) because the programs make constant use of the information on the disc.

6. Some computers may be fitted with accessories, such as Sideways RAM, which may interfere with the running of the programs. If interference does occur the offending accessories should be turned off before playing the games.

7. The programs themselves are mainly menu operated and instructions are included in the programs. Be sure to read these instructions and to take note of any warnings given in them.

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### COPYRIGHT

The copyright of the programs on this disc belong to the University of Nottingham. Complete discs may be copied for Educational Purposes but the disc is supplied on the strict understanding that neither the disc nor its programs shall be used for any commercial purpose either in their present form or in any modified forms.

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## MENU ONE (ADFS); SIDE ONE (DFS):

### PROGRAM ONE: PERIODIC TABLE.

This program allows a number of options:

(i) Most simply, a complete Periodic Table can be displayed on the screen. In addition, the pupil can use the cursor keys to highlight an element and then, using the <?>, call up a "box" of information about each element. We have filled all of the boxes with data. If the Teachers want, they can fill the box with up to 256 characters of their own data by using the Utility Program. This program can be accessed by typing <0> when the main Games Menu is on screen. When using this Utility Program, <Delete> can be used to remove unwanted characters. <Delete> does not remove the final character on a line but this can be removed by over-typing it with the "space bar".

We have used the latest IUPAC (International Union of Pure and Applied Chemistry) numbering of the Groups, largely because this numbering is easier to display on the screen. If you tell your pupils to ignore the leading 1, the numbering is just the same as before for s and p blocks. Thus, Carbon is Group (1)4 ie old Group 4.

(ii) The pupil can play a game "on-screen", filling in missing elements against the clock. The computer uses upper and lower case letters as required. Pupils do not have to worry about using the <SHIFT> key but <RETURN> must be pressed before going on to the next element. The computer howls if you forget to press <RETURN>. At the end of the game, the pupil's score is displayed and, if the score is sufficiently high, the pupil's name can be added to "Hall of Fame" of distinguished chemists! Any number of elements can be blanked out, either by the Teacher beforehand or at random by the Computer. Three blanked Tables are provided

1. All elements H to Ar.
2. Most of the s and p block elements.
3. All of the elements H to Kr.

(iii) The Teacher can prepare up to three Tables with elements blanked out and store these for the game in (ii). If you store your Tables, you will overwrite ours. The same program also lets you print the Table out either complete or with some of the elements left blank, for written tests. The print out, using <C>, should work with most common printers. You may need to alter the so-called "DIP" switches, which control "Line Feed" "Carriage Return" etc., on your printer before you get a good print out.

### PROGRAM TWO: MULTIPLE CHOICE

This game is designed specifically to display organic formulae on the screen and to ask the pupil multiple choice questions about the displayed compounds. The program makes these structures extremely easy to draw and modify. The Teacher can also use the program to create a complete stand-alone game on a separate disc. The standard BBC-B computer has a rather limited memory and so this game cannot be used to its full advantage. A BBC Master will give you much more freedom.

The limited size of the computer disc has only allowed us to give you a few examples of what you can achieve with this game. It is great fun drawing your own structures and devising your own questions. To do this type <CTRL Q> when the Multiple Choice Screen is showing. You will be presented with a short menu. Drawing structures is included in "Option 2". Ignore the "New Picture" option <f0> unless you already have a picture on screen and want to start another. Choose "Edit Picture" through the red <f3> key. Then press the red <f0> key "Enter Text" and you can type something on screen. After that the instructions should be moderately self explanatory!! However, there a few words of warning.

(i) There is no room on the "Program" disc to store any further questions and the directory is locked to prevent you overwriting the existing pictures. You will need a new disc which must be formatted before you start.

(ii) Try drawing some simple structures and saving them to disc before beginning anything complicated. The limited memory of the computer means that you could lose everything until you have learned the ins and outs of the program. When you start drawing in earnest, save the picture frequently. Then if disaster does strike, you can recover the saved picture.

(iii) The size of drawing which you can create depends on the amount of memory available in the particular computer that you are using. BBC Master and Compacts will allow you to do more than a BBC-B. If you exceed the memory available, the question will not load properly and the program will crash. Do not worry, since you will not have damaged the Program disc. When the program crashes, the picture is incompletely displayed and a ">" appears on the screen.

(iv) The computer does not understand Chemistry! Bonds are drawn between characters on the screen. To achieve the effect you want, you may have to draw the bond between atoms which are not strictly bonded. Try drawing  $\text{CH}_2=\text{CH}_2$ . You will have to draw the double bond from H to C rather than C to C.

(v) We have not included a screen dump program, so you cannot print out your pictures. You can, however, get good print-outs from a BBC Master fitted with a "Smart Cartridge" (Details of these are given in most computing magazines e.g. BBC Micro-User etc.).

(vi) The first question in a game is the first filled question in the Directory. It does not matter if there are unfilled places before it. We therefore suggest that, if you are setting up a long game, you should fill the Directory backwards (ie begin by loading the last question into its correct location). This will enable you to test the questions one by one without going through all of the earlier questions. We have also found that there is a bug in the current version of the program; one question can cause a later question to crash the program (on BBC-B only). If you load the questions backwards, such rogue questions are easy to spot and change.

### **PROGRAM THREE: CHEMISTRY AT NOTTINGHAM**

It is clear that most sixth-formers have little idea of what it is like to study Science at University. The aim of this program is to allow them to choose from a selection of subsidiary subjects and to see the resulting timetable as well as giving them brief background information for each course. The timetable itself can be printed out for the pupil to keep. Apparently, no such program is available to schools and it should be valuable to pupils who are trying to find out more about Universities.

#### **MENU TWO (ADFS); SIDE TWO (DFS):**

##### **PROGRAM 1: ROXY (Oxidation States)**

At the start there is a menu offering Instructions for the game, Rules for establishing Oxidation States and the player is invited to choose the time limit (from 5 to 60 secs) for answering each question. The game begins with a chemical formula appearing on the screen with one element highlighted, eg  $\text{AlCl}_3$ . The player has to type in the oxidation state of this element, eg +3. The score depends not only on getting the right answer but also on the time taken to answer. All answers elicit a jingle and if the answer is wrong, the correct answer is displayed. By pressing the

"Return" key, the student obtains a hint (the sign of the oxidation state). As the score mounts, the examples become progressively harder. There are up to 150 examples, classified into five levels of difficulty. At the end of the game, the player can put his or her name and final score into a "Hall of Fame", already filled with names of famous Chemists. ROXY is relatively easy but it is quite fun, even for experienced chemists, when it is played on the fastest (5 second) level.

## PROGRAM 2: MULTI-ION

Multiple Choice Questions on the Reactions of Inorganic Ions.

The program contains stored formulae of up to 75 assorted cations and anions and a number of chemical tests. Each question in the game consists of a screen display with one test plus four ionic formulae thus:

**"Which ion gives a white precipitate with BaCl<sub>2</sub>?"**  
1. NO<sub>3</sub><sup>-</sup>    2. SO<sub>4</sub><sup>-</sup>    3. ClO<sub>4</sub><sup>-</sup>    4. CrO<sub>4</sub><sup>2-</sup>

The screen display also has a picture of a burette with an empty beaker underneath it. The burette contains a red liquid which "evaporates" until the player gives an answer. If the answer is correct, the remaining red liquid runs into the beaker and a jingle plays. If the answer is wrong, the liquid disappears and the correct answer is displayed. As with ROXY, the questions become harder as the score mounts, with up to 20 questions at each level of difficulty. The game ends with a Hall of Fame and an appropriate jingle. The Utilities (see below) can be used to view or alter the list of 55 ions which are stored in the game at the moment.

## PROGRAM 3: SCHEMER

Identification of Unknown Compounds in a Reaction Scheme.

This game allows a teacher to set up a problem of the type A ----> B ----> C etc., where the pupil is expected to deduce the identity of the unknown species from the information given. Problems of this type apparently cause some difficulty to A-level candidates. SCHEMER gives the teacher the opportunity to guide the students through a scheme, pointing out, for example, the significance of a negative test.

In the game, up to six unknown species can be displayed on the screen with appropriate interconnecting arrows. Each Unknown has a brief description (eg White precipitate) on the screen and further information hidden in a "box". The interconnecting arrows can carry a description of the reagents (eg Aqueous NaOH) or this information can be hidden. The player is presented with the overall scheme and uses a menu to reveal the hidden reagents (for which marks are lost) or to read the extra "boxed" information about each Unknown, which is provided without affecting the score. Points are awarded for guessing the identities of the Unknown.

The main games disc can hold 7 problems and extra discs can be used for up to 17 additional problems per disc. The disc is supplied with four starter schemes:

(a) EXAMPLE, a trivial scheme which contains hints for setting schemes up, correcting errors etc.

**EXAMPLE must not be deleted from the disc, as without it, the Schemer program crashes!!!!**

(b) INORGANIC1 and INORGANIC2 are both taken from schemes provided by a local school. INORGANIC1 is stored in two versions, one of which contains hints for guiding the student through the scheme. INORGANIC2 has hints incorporated into it.

(c) ORGANIC1 is based on the reactions of  $C_2H_4$ , with a second version with hints. SCHEMER is equally applicable to Organic or Inorganic examples but, as can be seen from ORGANIC1, the representation of structural formulae needs some explanation.

It may well turn out that students learn more by using SCHEMER to set up problems for their friends to solve than by solving problems devised by their teachers.

### INSTRUCTIONS FOR SCHEMER

SCHEMER does not have very explicit instructions in the program. This is how to play it.

1. Select Menu option 2 "Load Scheme"
2. Choose one of the stored schemes from the list (e.g type 1 followed by <Return> to choose EXAMPLE)
3. The disc drive will function for a moment and then you will see the main menu again.
4. Before playing the game, check that the "CAPS LOCK" light on the computer is NOT glowing. If the light is glowing, switch it off by pressing the CAPS LOCK key.
5. To play the game now choose Menu option 5 (Play game) and you will see the scheme with the compounds represented by letters A, B, C etc.
6. Each letter represents a box which holds hidden information and you can examine this information by selecting option 2 from the games menu "look in box". Then type in the label on the box (ie A or A+NaOH or HintsII) EXACTLY as it appears in the scheme paying attention to capital and lower case letters (eg HintsII not hintsII or HINTSII).
7. If you guess the identity of a compound correctly, you will be congratulated and the code letter on the scheme will be replaced by the correct formula.
8. When you choose option 4 "Quit" from the games menu, you will find yourself back at the main SCHEMER menu. You can now choose option 3 "Edit scheme". This displays the whole scheme with all of the answers revealed and allows you to change any part of the scheme.

### UTILITIES:

Each game contains a full set of Instructions but in addition there are some Utility programs, reached from the main Menu by typing "0" (i.e. zero). These programs allow the Teacher to examine all of the data and questions in ROXY and MULTI-ION and to change, add or delete compounds or text as required. There is a slight bug in some of the Utility programs, which ignores any text after a comma or a quotation mark. If your alteration is not appearing in the way that you expected, check to see if you have included either of these punctuation marks (ie , or "). No knowledge of computer programming is needed to make these alterations. SCHEMER has its own utility programs incorporated into the game itself.

