

## Organic Chemistry Crossword Puzzle

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**Abstract:** Since computers have become an integrated part of our daily life, the use of computers in teaching-learning environments has began to be examined to link them with learning process. Various computer-assisted teaching materials have been developed in order to make learning more attractive and to have student-centred approaches to teaching. In this study a crossword puzzle has been developed in relation to the topics included in basic organic chemistry such as alkane and alkynes. It was developed using computer environment and will be accessed through internet. Therefore, this crossword puzzle can be used whenever it is needed by teachers and students. This puzzle is consisted of thirty-two items from left to right and thirty-four items from top to bottom. Students may begin with any item on the puzzle. When the items is not answered correctly, a red sign is given. Therefore, student will have an opportunity to rethink about the answer. Flash CS4 was used in the preparation of the game.

**Key words:** Crossword puzzle • Computer assisted education • Educational games • Chemistry education

### INTRODUCTION

Since computers have become an integrated part of our daily life, the use of computers in teaching-learning environments has began to be examined to link them with learning process. Various computer-assisted teaching materials have been developed in order to make learning more attractive and to have student-centred approaches to teaching. Unlike conventional materials, such materials are mostly based on learners' experience. In working with these materials students may compete with themselves or with peer groups, may visit a chemistry lab or may conduct a chemical experiment. The use of computers dated back to the 1950's. During this period, computers were used for managerial purposes in much more developed US universities such as Stanford and Illinois. The integration of computers into educational activities became possible as a result of the development of cost-effective computers during the 1960's and 1970's. However, computers could not be made a part of teaching design. Because the educational function of computers was not regarded as effective as much as during the current period. Instead, computers were mostly employed for business, medicine and military purposes. Although computers were popular in the USA in the 1960's, the advent of the basic skills movement caused a negative effect on computers [1]. However,

computers are indispensable part of our daily life and most people from different age groups spend much of their time using computers. As a result, the idea that computers may be a part of education process has become common.

Introduction of the computers to the educational process leads to new concepts. One of these concepts is computer-assisted education. Computer-assisted education refers to the use of computers to teach a topic or a concept or to reinforce the previously acquired skills or behaviours through computerized courses [2].

The significant points in computer-assisted education that should be taken into consideration are the availability of hardware and software, the subject to be taught and the type of teaching technique adopted. Based on these points, the topic should be taught to students adopting computer-assisted education [3-6]. Alternations in computer-assisted teaching are as follows;

- The subject is taught based on traditional teaching techniques. Computer-assisted teaching is delivered to those students who cannot attend the course or to those who need extra teaching. In those cases, computers function as "private teacher".
- After the subject is taught in the classroom, evaluation may be realized through computer assistance.

- After the subject is taught in the classroom, computers are employed to carry out exercises, practices and evaluation activities.
- The subject is taught through the computer. If needed, further clarification can be given through in-class discussion and correct the misunderstandings of the students. In such cases the role of teachers is that of “guide” [3, 5, 7, 8].

There are many categories of software that can be used in computer-assisted education. The following software classification is employed in Turkey: software for drill-and-practice; tutorial software; simulation software; problem-solving software and educational games software [9-13].

Increased capacity of computer technologies has led to improvements in computer-assisted teaching. In computer-assisted education, meaningful learning is emphasized. Software used in computer-assisted education provide the students with opportunity to construct their learning based on their pace and to repeat some parts that they need to improve in their learning with fun. Furthermore, the use of such software eliminate the pressure and anxiety on the part of students resulting from classmates and teachers. As stated earlier, software employed in computer-assisted education does not directly shape the teaching process, but is based on learners' experience.

It is argued that students learn better when they are active in learning process, have the control over their learning process and discover the information [14-19]. Therefore, computers that are one of the most attractive devices for children can be used to provide them with an interesting and active environment for learning to improve their achievement levels.

There are some educational game activities in the field of chemistry education. Such activities enable students to reinforce their previously gained behaviour and to make further drills and practices regarding the topics that they need extra assistance. For instance, McClure [20] developed a logical puzzle to teach the concepts related to ionic compounds. The purpose in this puzzle is to improve the students' logical thinking skills concerning these concepts through the discovery of the formulas of multi-atomic ions, mass of molecules, precipitate and ionic compounds. This puzzle is developed for the students of general chemistry courses. Sims [21] similarly developed a crossword puzzle regarding twenty amino acids in biochemistry course. Through the use of this puzzle, learning of metabolisms and catabolic and anabolic ways is supported. Most [22] also developed a

crossword puzzle for general chemistry and organic chemistry courses. This puzzle is consisted of forty-three items from left to right and forty-seven items from top to bottom. Items included are related to general chemistry and organic chemistry. It is argued that such games are designed since they will be useful for students like project activities. Thomas [23] states that the joy of puzzles for students comes from the fact that they regard problem solving as a reward or they like to have bonus after solving the puzzles. Items included are for high-school students and have different levels of difficulty. Specifically, these items are about density, periodic table, volume measurement and acid-base. Crawford [24] developed a crossword puzzle on physico-chemistry that includes sixty-six items from left to right and eighty-two items from top to bottom. In addition to crossword puzzles, there are sudoku puzzles developed for educational purposes in relation to organic chemistry [25], precipitate in general chemistry [26], chemical terms and symbols [27], chemistry of art and color sudoku [28]. All these examples indicate that educational games have become common in teaching-learning process due to their advantages such as offering an environment in which pace of the students' learning is taken into consideration.

**The Study:** In this study a crossword puzzle has been developed in relation to the topics included in basic organic chemistry such as alkane and alkynes. It was developed using computer environment and will be accessed through Internet. Therefore, this crossword puzzle can be used whenever it is needed by teachers and students. This puzzle is consisted of thirty-two items from left to right and thirty-four items from top to bottom. Students may begin with any item on the puzzle. When the items is not answered correctly, a red sign is given. Therefore, student will have an opportunity to rethink about the answer. Flash CS4 was used in the preparation of the game.

The purpose of the puzzle is not to teach a specific topic. Instead, it aims at providing the students with opportunity to make drills and practices about the topic just taught in the class. Furthermore, teachers may use it to evaluate the student learning. On the other hand, it is designed to reinforce the students' knowledge about the related concepts and to practice it. Therefore, the ultimate aim of this puzzle is not to teach but to provide the students with the opportunity to practice their previously acquired knowledge. In the puzzle, items are designed to improve the students' skills of taking decisions, making practice and self-evaluation. Such puzzles may be developed for different topics in chemistry as well as for

other fields. This puzzle is thought to contribute to reinforce the topics included in organic chemistry that is both a new and a challenging subfield of chemistry for students (Appendix1).

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# Appendix 1

☒ ACROSS    ☐ DOWN

ANSWER:

1. A series of related chemical compounds differ in formula by a fixed group of atoms are called \_\_\_\_ series  
 2. The compounds consist of only carbon and hydrogen atoms are called \_\_\_\_  
 3. Saturated hydrocarbons are also called as \_\_\_\_ which means inactive  
 5. Alkynes which are a member of unsaturated hydrocarbons are also known as \_\_\_\_  
 8. Alkynes are found naturally in \_\_\_\_  
 10. Reduction of \_\_\_\_ with  $\text{LiAlH}_4$  produces the alkanes  
 11. \_\_\_\_ can only be used to obtain even-carbon-numbered and symmetric alkanes  
 13. The halogenation of alkanes with the catalytic effect of heat and light is \_\_\_\_  
 14. Radical formation from a hydrocarbon by any effort is an \_\_\_\_ reaction  
 16. The fragmentation reaction of alkanes with very high temperatures is called \_\_\_\_  
 19. Organic compounds are named according to the \_\_\_\_ system  
 22. Removing a molecule of water from alcohols is called \_\_\_\_ reaction  
 24.  $\text{CH}_2 = \text{CH}-$  is an alkyl group which is obtained from ethane and referred as \_\_\_\_  
 25. While the addition of hydrogen acid to an alkene, the hydrogen is joined to the carbon which has the hydrogen at most. This rule is called as \_\_\_\_ rule  
 28. Polymers formed from ethylene are \_\_\_\_  
 30. The reaction of alkenes with  $\text{KMnO}_4$  is an \_\_\_\_ reaction  
 31. Molecules which have two double bonds are called \_\_\_\_  
 32. Organic compounds containing a triple bond in its molecule are called \_\_\_\_

KEYWORD:

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☐ ACROSS    ☒ DOWN

ANSWER:

4. Alkenes which are a member of unsaturated hydrocarbons are also called \_\_\_\_  
 6. The molecules which have the same empirical formulas but different molecular structures are called \_\_\_\_  
 7. When the straight-chain hydrocarbons are branched with two methyl groups on the second carbon atom named by the prefix \_\_\_\_  
 9. Alkanes were obtained by the catalytic hydrogenation of \_\_\_\_  
 12. Alkyl magnesium halide compounds are also called as \_\_\_\_  
 15. The reaction between two radicals to produce a molecule is an \_\_\_\_ reaction  
 17. The oxidation reaction of an organic compound with \_\_\_\_ to produce  $\text{CO}_2$  and  $\text{H}_2\text{O}$  is called combustion  
 18. Mono-chlorination of ethane produces \_\_\_\_  
 20. The reaction in which two atom or group removed from molecules to produce an unsaturated molecule is called \_\_\_\_ reaction  
 21. Heating ethyl bromide with  $\text{KOH}$  produces \_\_\_\_  
 23. \_\_\_\_ is obtained by the acid catalyzed water elimination from the t-butyl alcohol  
 26. Isomers differ in space are called \_\_\_\_  
 27. (+) and (-) stereoisomers are \_\_\_\_ of each other's  
 29. Ethylene generates \_\_\_\_ in cold and dilute solution of  $\text{KMnO}_4$   
 33. Compounds containing a triple bond have two \_\_\_\_ bonds  
 34. Acetylene the smallest member of alkynes can be obtained by the reaction of \_\_\_\_ with water

KEYWORD:

<http://yunus.hacettepe.edu.tr/~nsecken/wordpress/wp-content/uploads/2012/04/puzzle1.swf>