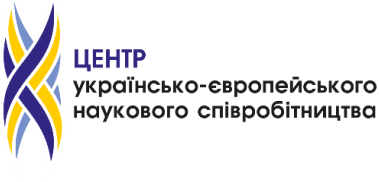

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ЗМІСТ

CRACKING THE ORGANIC CHEMISTRY: UNLEASHING PRECISION LEARNING WITH SMART QUESTIONS IN CHATGPT

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The path to mastering any subject becomes an exciting adventure to strategically unravel its complexities through a variety of thought-provoking questions. In Organic Chemistry education, the art of questioning becomes a key strategy for gaining accurate knowledge. Each request is a conscious step towards embracing the unknown from different angles, revealing its secrets, and expanding understanding of this fascinating and complex field.

Chat GPT 3.5's capabilities as a large language model (LLM) focus on processing and generating text based on information available until January 2022 [1]. This innovative informational source marks a significant departure from traditional educational models in a new era of personalized learning. Using sophisticated data processing capabilities, these models offer personalized feedback and dynamically adapting to students' unique cognitive processes. This integration of artificial intelligence and education goes beyond conventional boundaries, promoting not only efficiency but also increased engagement. Here are a few of its ***strengths***:

1. *Explanation and Clarification*: It can help explain concepts, reactions, and principles in Organic Chemistry, providing clarity from different angles.
2. *Problem-Solving Assistance:* It can assist with solving theoretical and conceptual problems, guiding students through the complex process.
3. *Conceptual Overviews:* It can provide overviews of Organic Chemistry topics, offering a comprehensive understanding of key principles.

Hence, by asking ChatGPT Organic Chemistry questions, students get benefits like personalized and interactive answers, real-time help, concept

clarification, learning about a variety of topics, problem solving support, and easy access. It complements traditional methods by providing immediate, tailored information that goes beyond textbooks or Google searches. Whether thinking about the development of complex drug molecules or unravelling the mechanisms of organic reactions, students are encouraged not just to absorb information, but to actively participate in the dynamic processes that define the field. Emphasizing the importance of active application of knowledge through problem-solving exercises, true mastery of Organic Chemistry is achieved through hands-on exploration.

The following examples illustrate the effectiveness of ***ChatGPT questioning*** to provide a comprehensive and detailed understanding of Organic Chemistry:

1. *Conceptual Understanding:*

- What is the difference between a nucleophile and an electrophile? Give some examples.
- How do electron movements contribute to the stability of organic molecules?
- How do resonance structures contribute to the stability of molecules?
- How does the electronegativity of an atom influence its nucleophilic or electrophilic character?

2. *Reaction Mechanisms:*

- Walk me through the steps of an elimination reaction.
- Can you elaborate on the factors that influence the regioselectivity of an organic reaction?
- Can you give examples of reactions where stereochemistry is crucial, and why?
- How do reaction mechanisms provide insights into chemical transformations?

3. *Functional Groups:*

- Identify and explain the functional groups present in a compound.
- How does the presence of a carbonyl group impact the properties of a compound?
- What distinguishes one functional group from another in terms of chemical behaviour?
- How does the presence of functional groups affect the physical and chemical properties of organic compounds?

4. *Nomenclature:*

- How do you name a compound with multiple substituents using IUPAC rules?
- What is the naming convention for cyclic compounds?

- What is the systematic name for a bicyclic compound with two alkene groups?

5. *Stereochemistry:*

- How does the configuration of stereocenters influence the designation of a compound as optically active?
- Explain the difference between enantiomers and diastereomers.
- Elaborate on the concept of meso compounds in stereochemistry.
- What strategies are employed to control regioselectivity in synthesis?

6. *Synthesis and Retrosynthesis:*

- What are some recent advancements in the field of asymmetric catalysis?
- Given a starting material, suggest a retrosynthetic analysis.
- How has technology influenced the efficiency of organic synthesis processes?

7. *Spectroscopy and Analysis:*

- How can you distinguish between isomers using NMR spectroscopy?
- What information can infrared spectroscopy provide about a compound?
- How does mass spectrometry help in determining the molecular weight and structure of a compound?

8. *Organic Reactions:*

- Describe the types of reactions involved in the Grignard reaction.
- What are the key characteristics of a Diels-Alder reaction?
- Discuss the application of the Wittig reaction in synthesizing alkenes.
- How do transition metal catalysts influence the selectivity of organic reactions?

9. *Biological and Medicinal Chemistry:*

- In what ways is Organic Chemistry crucial to understanding biological systems?
- How does the structure of a drug impact its biological activity?
- In drug design, how are molecular docking studies used to predict the binding of a drug to its target?
- Can you explain the mechanism of action of a specific drug?

10. *Problem-Solving:*

- Work through a synthesis problem involving multiple reactions.
- Explore the relationship between lipophilicity and drug absorption?
- In pharmaceuticals, how is the design of prodrugs influenced by Organic Chemistry concepts?
- Describe how a specific drug targets enzyme in a metabolic pathway.

These questions not only scratch the surface, but also delve into the intricacies of the subject, developing students' curiosity, critical thinking, and problem-solving skills. By asking questions ranging from basic differences between organic and inorganic compounds to complex strategies used in organic synthesis, students are encouraged to seek deeper understanding. These thought-provoking requests act as catalysts, sparking curiosity and igniting the flame of inquiry among students. As students try to understand the differences between different functional groups or reflect on the meaning of stereochemistry in reactions, they move toward a deep understanding of the multifaceted nature of Organic Chemistry. They go beyond mere memorization and encourage exploration of the fundamental principles governing the behaviour, reactivity, and structural complexities of organic compounds.

Nevertheless, up-to-date ChatGpt should be used only as an additional resource to complement traditional teaching methods. It is important to acknowledge ***ChatGPT limitations*** [2, 3]:

a) lack of contextual understanding: it may struggle with contextual understanding of chemical concepts, leading to potentially inaccurate or incomplete responses;

b) inability to interpret various visual information: it has limitations in interpreting and responding to such information, which is essential in chemistry education;

c) insufficient domain-specific training data: it may require more chemistry-specific training data to enhance its accuracy and relevance in generating responses related to chemistry concepts and applications, so cannot replace the depth of knowledge contained in specialized textbooks or peer-reviewed literature.

Tasks such as conducting experiments, performing laboratory work, or using specialized molecular modelling software in laboratory or educational settings also require hands-on experience and specialized tools.

Summing up, this approach aims to develop a holistic understanding of Organic Chemistry by transforming the learning experience into a vibrant and dynamic exploration. The questions serve as beacons, leading students to a deep conceptual understanding of Organic Chemistry by instilling a sense of curiosity, and challenging them to unravel the intricacies of the subject. And ChatGPT can surely enhance their conceptual understanding, problem-solving skills, and engagement in the subject.

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3D VIRTUAL REALITY FOR ENHANCED VISUALIZATION IN ORGANIC AND BIOORGANIC CHEMISTRY EDUCATION: ADVANTAGES, DISADVANTAGES, CHALLENGES AND SOLUTIONS

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The convergence of 3D virtual reality (VR, a simulated experience that uses pose tracking and near-eye 3D mapping to give the user a sense of immersion in the virtual world), and augmented reality (AR, interactive experience when a real-world environment is enhanced with computer-generated stimuli) in the educational landscape of Organic and Bioorganic Chemistry holds the promise of revolutionizing the learning experience, offering students a robust platform to explore and comprehend molecules and chemical reactions [1]. This symbiosis includes a variety of **benefits**: