

SATL BASED LESSON FOR TEACHING GRIGNARD REAGENTS IN SYNTHETIC ORGANIC CHEMISTRY

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ABSTRACT

Synthesizing new products from raw materials has been very popular aspects of research in organic chemistry. Traditionally, Grignard reagent has been very vital component of such synthetic procedures. Hence learning of various issues concerning with applications of Grignard reactions in synthetic organic chemistry is vital for enhancing the students creative capability. In this paper we will illustrate the uses of SATL methodology, which is recently getting popular [1-3], in an SATL-based model lesson concerning teaching and learning of synthetic organic reactions related to Grignard reagents. [AJCE 4(4), July 2014]

INTRODUCTION

Traditional literature which is in vogue since the last decade or so, on any academic task, that has been available to the students from very beginning to the higher level, lacks ability to get ingrained in student's mind ^[4]. In order to provide an in depth understanding of scientific knowledge, the systemic methodology of teaching and learning is the key point. Chemistry is a central science and highly interlinked to different scientific disciplines. Therefore it is a vital issue that young students' minds could be prepared to grasp the subject matter in a way that they take the knowledge as a whole and well connected to the problems of their modern world.

SATL is a method to provide deep learning of the subject to the students and enable them to grasp and correlate concepts and ideas that have been gathered from a variety of different disciplines. The method provides a platform to comprehend different diverse phenomena and thus enhances quantum of participation in learning process [4-5].

In organic reactions reagents are very important as they provide road maps for many industrial processes that produce products for human welfare. Synthesizing new products from raw materials, in organic chemistry, has been very popular aspect of research. Traditionally, Grignard reagent has been very vital component in different synthetic procedures. Hence learning of various issues concerning the Grignard reagent in synthetic organic chemistry is vital for acquiring a creative capability. In this paper we present an SATL-based applicable model lesson in which we have tried to highlight salient issues related to teaching of this reagent through SATL model lesson. We believe that this SATL based model lesson will inculcate potential towards new applications of Grignard reagents.

Hydrocarbons are freely available in nature and are the probable raw materials for many products of basic needs. Grignard reagents are indeed vital for synthesizing many hydrocarbon

derivatives. It is used to convert respective raw materials to any desired product. The synthetic pathways for the newer products of these materials can also be identified.

Instead of surface learning that focusing on rote memorizing of Grignard reagent based reactions for synthesizing a specific functional group, one can adapt a systemic way of teaching and learning that intensify deep learning to develop methods and routes for producing products which are feasible in terms of economy, health and that for a friendly environment.

METHODOLOGY

Reactions involving organic reagents are very important as they provide the road maps for many industrial processes that produce products for human welfare. This topic has been chosen in particular to enlighten the students about effectiveness of systemic approach to teaching and learning (SATL) in deep understanding of synthetic organic chemistry.

Traditionally, linear approach (LA) has been adapted for disseminating knowledge about the application of Grignard reagent in synthetic organic chemistry without any connections. So, the student while being taught through a linear approach is asked to apply the Grignard reagents to various types of synthetic chemical reactions without any comprehension or appreciating significance of these relationships representing chemical reactions.

In this presentation we design a model lesson for deep learning of the role of Grignard reagents in synthetic organic chemistry through SATL approach. This model involves developing various SATL diagrams that would help to enhance its comprehension and develop new routes for the target compounds. For designing an SATL-based model lesson, we can make use of number of publications are available in literature [2, 3, 6-9].

Step-1: Linear chemical relations of the uses of Grignard reagents in synthesis of organic compounds

The linear presentation for the uses of Grignard reagents in the synthesis of different classes of organic compounds can be illustrated in the following linear diagram figure 1.

Step 1: is based on the linear relationships for the applications of Grignard reagent towards the synthesis of a number of organic compound.

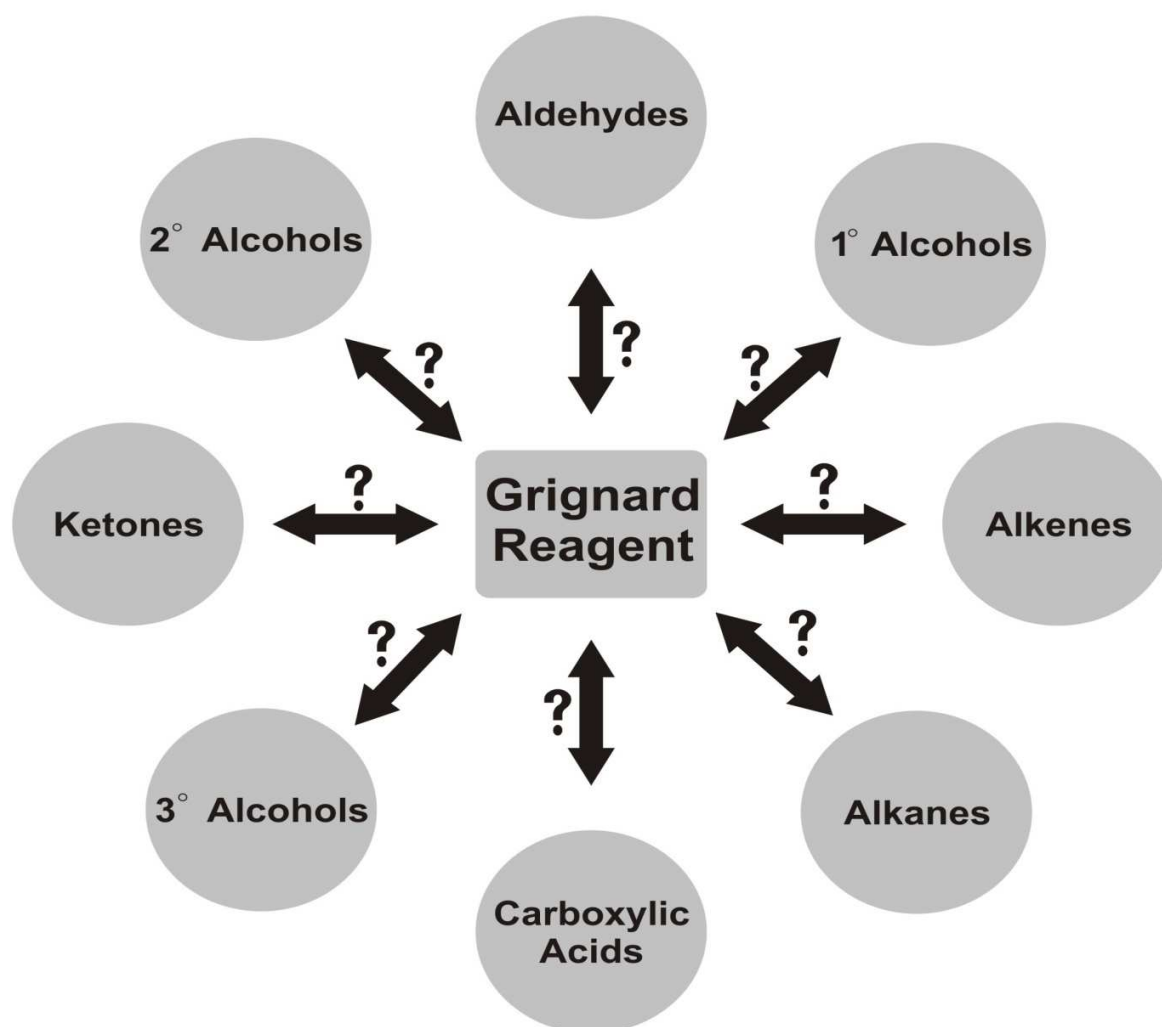


Figure 1: Linear Connections
 Display of Linear Connections

Step-2: Systemic chemical relations related to the uses of Grignard reagents in synthesis of organic compounds

Step-2-1: Build SD₀

The linear diagram Figure 1 can be transformed by students into systemic diagram SD₀ figure 2. This diagram shows that the individual relationships of the compounds suggested to be synthesized through the Grignard reagent in figure 1 can be systemically interconnected. This will develop the students' ability to see the relationships between concepts beside concepts in a pattern of cognition which enhances creativity.

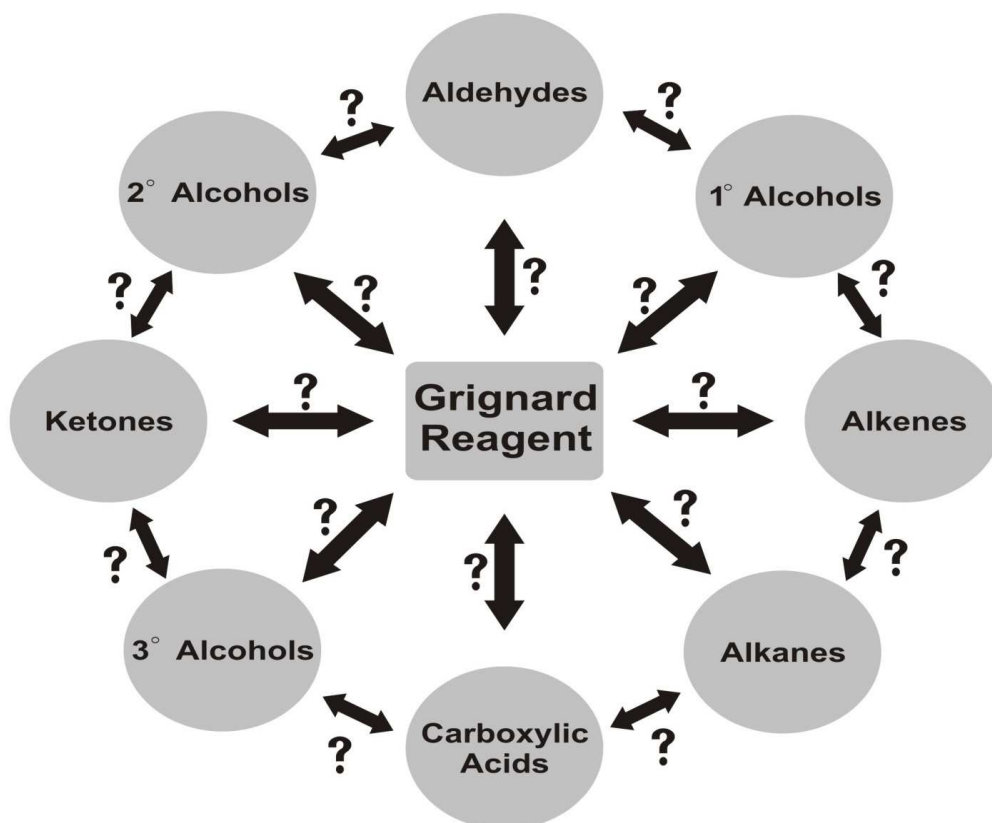


Figure 2: SD-0

Portrayal of Possible interlinkage between various synthetic products prepared by using Grignard Reagent

Step-2-2: Change of SD₀- SD₁

Taking the cognizance of the fact that 1° alcohols, 2° alcohols and aldehydes that are synthesized through Grignard reagents, and hence displayed in SD₀, may even have connections with one and other i.e. 1° alcohol can be converted to aldehyde which can in turn be interlinked with 2° alcohol's synthesis. All the possible synthetic routes are discussed in the class room and after the recognition of various chemical relations systemic diagram SD₀ can be improved by students into another systemic diagram SD₁. In view of discussions SD₀ is altered to SD₁ by placing single headed arrows in place of double headed ones and also bringing tick marks to replace the question marks where ever inter linkages get grasped by the students. Thus some question marks disappear from the display diagram SD₀ as shown in figure 3.

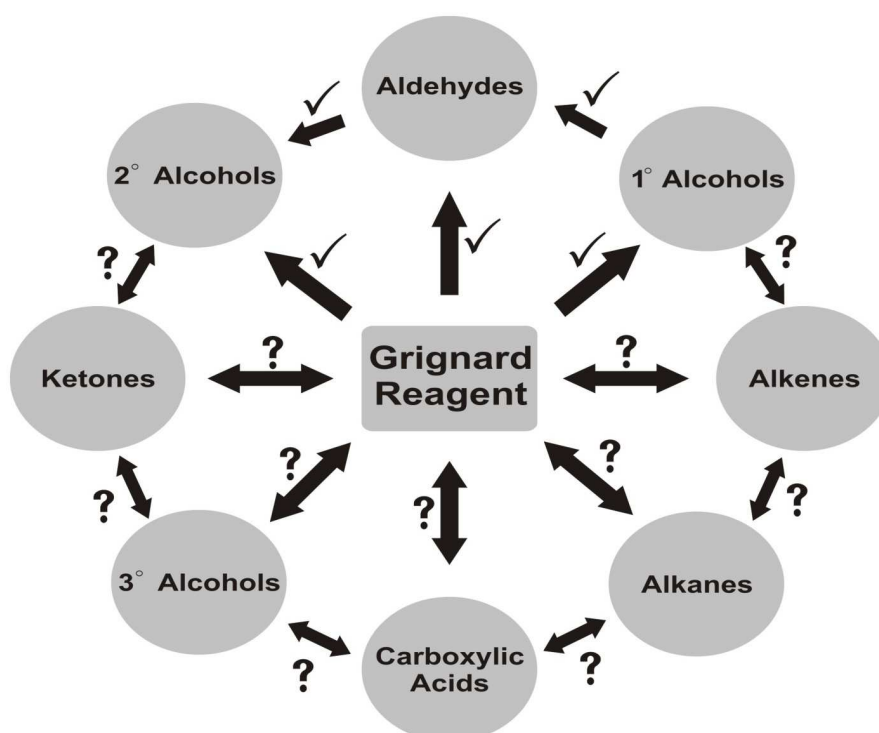


Figure 3: SD-1

Pictorial Presentation of possible linkage involving Grignard Reagent

Step-2-3: Change of SD₁- SD₀

Still there are some unknown chemical relations (questionable links), in figure 3, which have to be debated further as the students are able to explain some of the remaining connections, and explore the different synthetic routes in step by step mode and hence new avenues for synthetic creativity get opened up and SD₁ figure 3 can be modified by students to SD₂ figure 4.

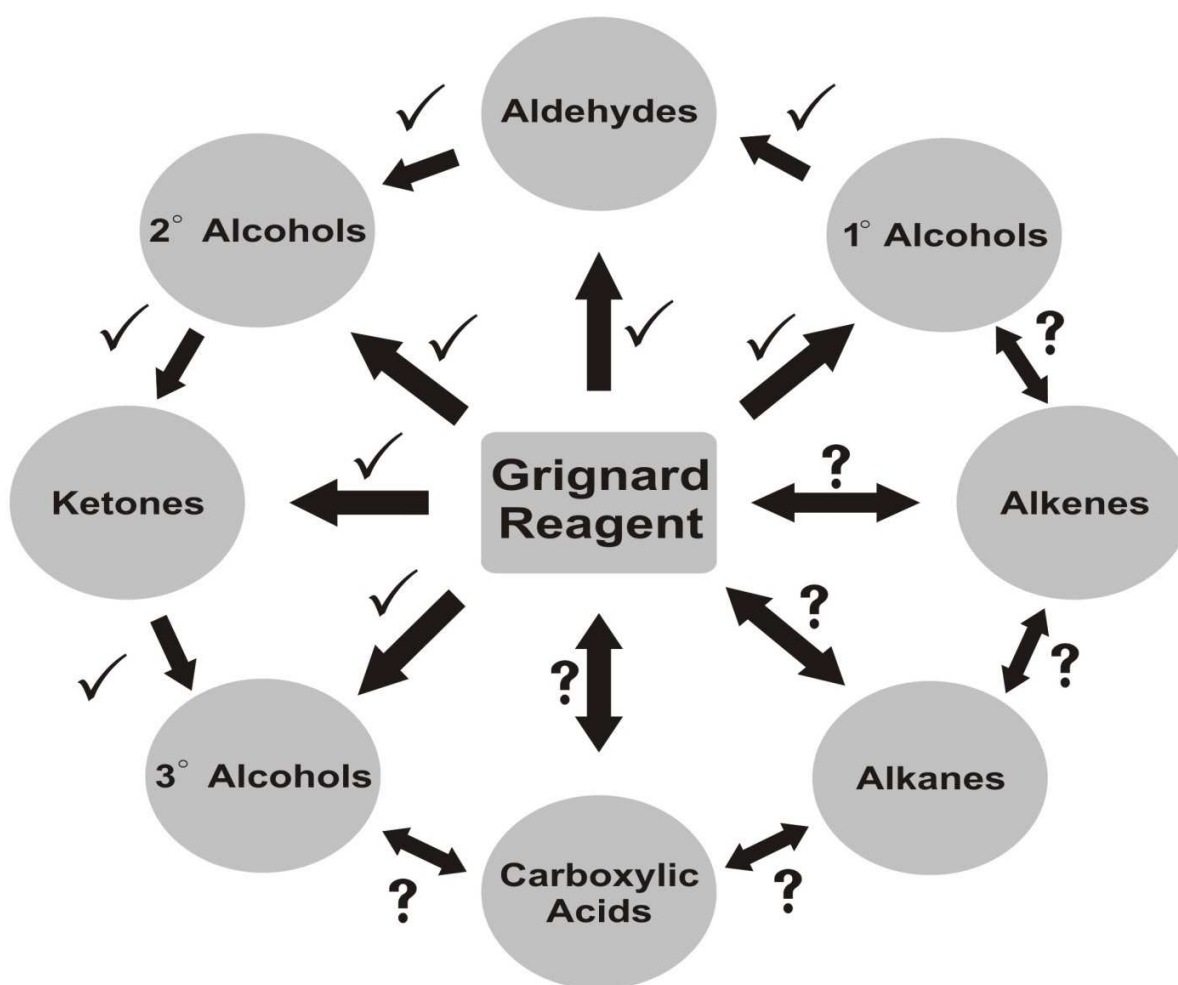


Figure 4: SD-2

Advanced linkage diagram for connecting Grignard Reagent towards the various synthetic routes

Step-2-4: change of SD₂- SD_f

As the rigorous arguments, discussions and hence insight of the subject strengthen the remaining chemical relations of systemic the diagram (SD₂) relevant to the synthesis of hydrocarbons and carboxylic acids, and their chemical relations. The students can be changed SD₂ to the final systemic diagram (SD_f), figure 5. At this stage, new ideas and connections begin to arise in students' minds. This opens the door for a new approach towards synthetic applications of Grignard reagent. For instance when the connection of ketone with 3⁰ alcohol is drawn, at the same time one can figure out that this 3⁰ alcohol could be connected to carboxylic acid synthesis and when connection gets validated, a new door towards creativity opens up to transform this acid to hydrocarbons such as alkanes and alkenes.

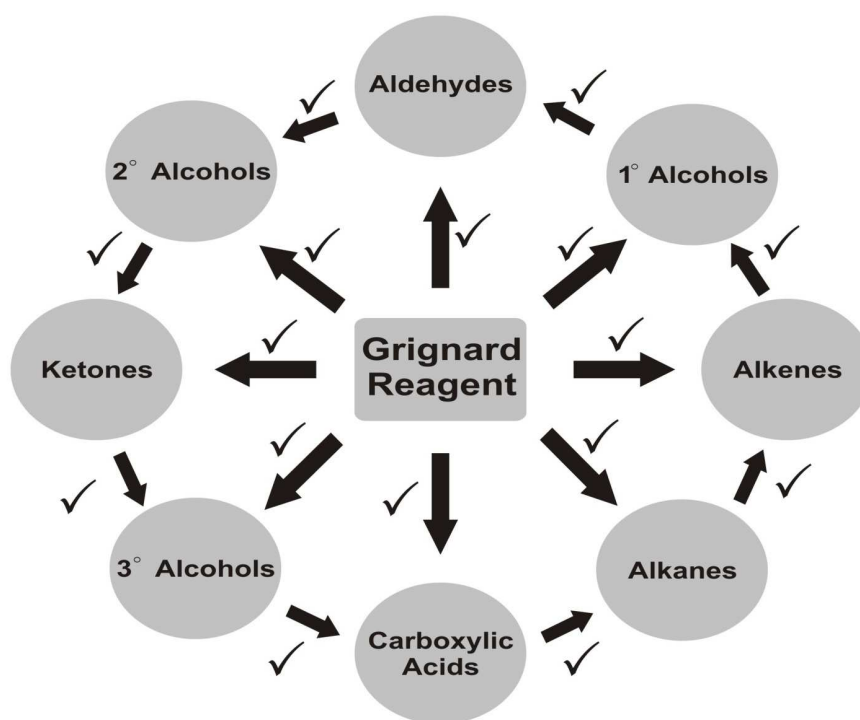


Figure 5: SD-Final

Systemic diagram with the complete mapping of synthetic routes involving Grignard Reagent

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