A SOLUTION TO DECIPHER SATL APPROACH FOR TEACHING "SOLUTIONS" IN CHEMISTRY

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ABSTRACT

Solutions are a fundamental unit to be discussed in chemistry. The measurable changes in terms of chemical and physical properties of solutions occur when different interlinking parameters that affect the properties of solutions are altered. It is important to understand this interactive behavior in order to comprehend this basic concept and to develop new applications. Nothing has yet been documented to explain the concept in SATL learning approach. Hence, an easy systemic approach to learn this vital component of chemistry has been devised here. *[African Journal of Chemical Education—AJCE 13(4), December 2023]*

INTRODUCTION

Several strategies are available for enhancing the teaching and learning of scientific subjects in general, and chemistry in particular. These are systemic approaches that make understanding of concept much easier than the traditional system of teaching. There have been many teaching options continued to be reported in literature that points up the chemistry basics to facilitate and enhance its effectiveness in teaching and learning. In the past decade, creative and visionary way of teaching and learning through systemic approach (SATL) has been introduced (1-4) for this end. The basic promising goal of this approach is to make the subject more accessible by providing them the opportunities to explore the concepts, hence change the rote learning path to constructive learning. Amusable defines the meaningful (deep) learning (5) as the formulation of non- arbitrary relationships between thoughts in the learners' mind. Gilbert and Justi states that a**uthentic chemistry education, which mirrors the actual practice of science, is achieved through a meaningful learning approach** (6).

According to Novack (7) meaningful learning means that learners deal with a learning task by attempting to form relationships between newly and previously learned concepts. Michael (8) stated that meaningful learning occurs when the learner interprets, relates, and incorporates new information with existing knowledge and applies the new information to solve novel problems.

In Systemic Approach in Teaching and Learning Chemistry (SATLC) the concepts are positioned in such a way that the relations between a series of ideas and issues are made logical. SATLC emphasizes the interlinking of the various concepts of chemistry and a **number of chemistry-related issues have already been addressed by implementing SATL approach. (9-13).**

It is known for SATL (Systemic Approach in Teaching and Learning) that systemic diagram (SD0) is the initial for pointing out and discussing any issue and is based primarily on the previous knowledge of students. After inclusion of similar systemics with known and unknown relationships (SD1, SD2 and so on) the unit ends at final systemic diagram (SDf) as in Figure 1). In (SDf) students can understand the connectivity of different concepts that how are these related to each other (14-15).

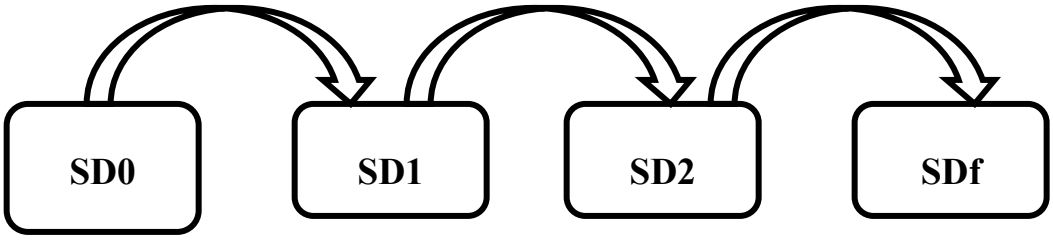

Figure 1: Systemic approach stratagem

Several systemic diagrams on a variety of topics can be developed and finally all of these may be assembled together (Figure 2) (16).

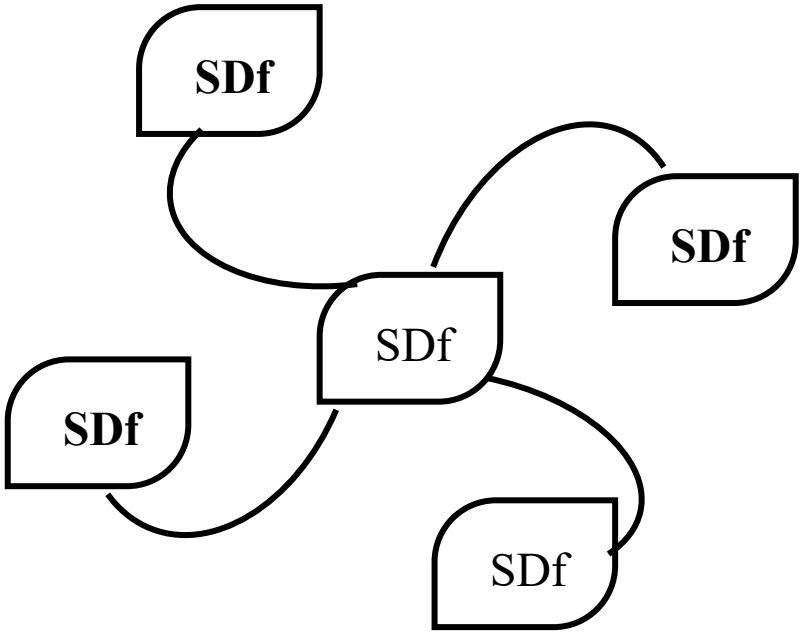

Figure-2: Association of final systemic diagrams (SDf) on various topics.

METHODOLOGY

General chemistry is one of the important branches of Chemistry. It deals with various fundamental concepts to monitor the chemical reaction. This topic has been chosen to enlighten the effectiveness of systemic approach to teaching and learning (SATL) methodology in general chemistry. Generally linear approach has been adopted to convey this subject matter. Figure 3 is

based on the linear relationships among various concepts of chemistry. The relationships (1-6) are sequences of linear associations. Figure 3 can be transformed into systemic diagram SD0 as represented in Figure 4.

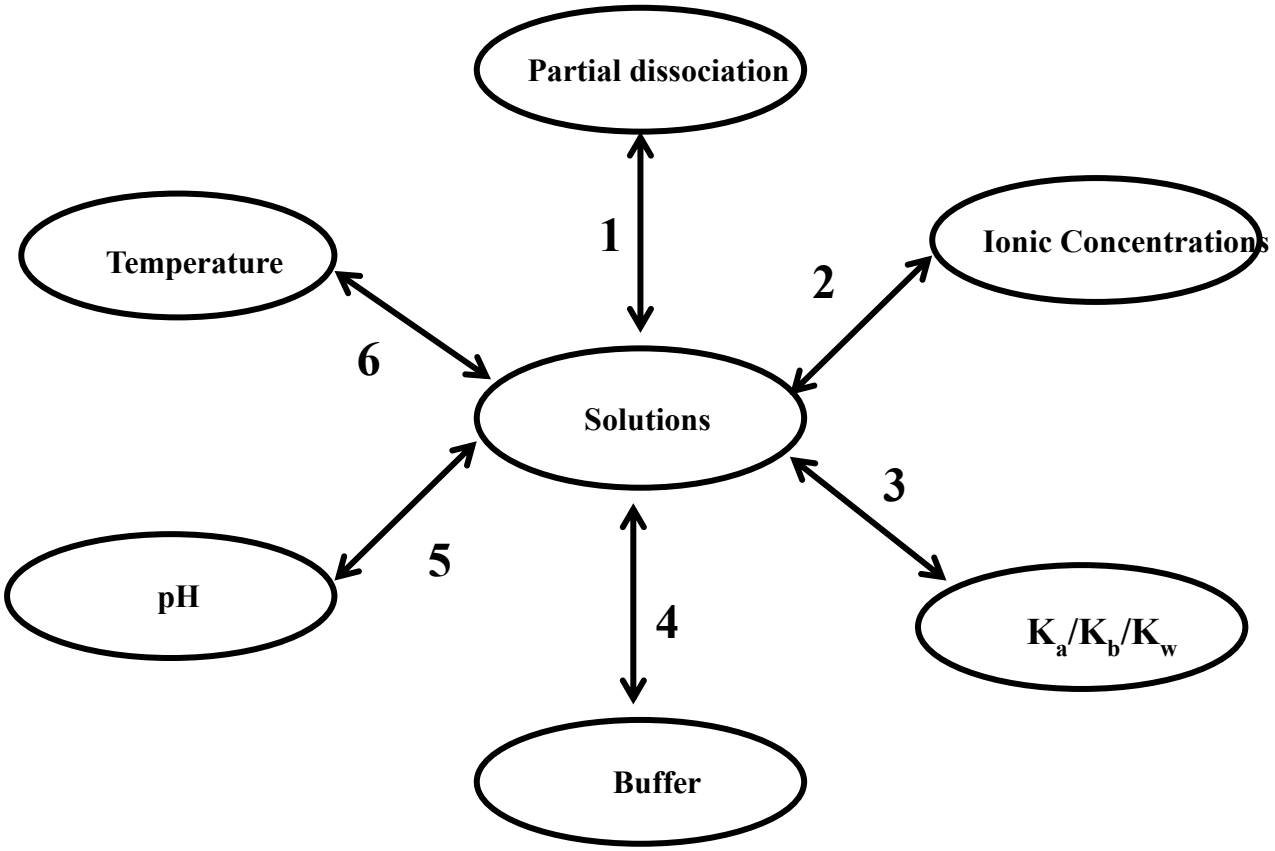

Figure 3: Linear relationships among different concept of chemistry required to study the concept of solution

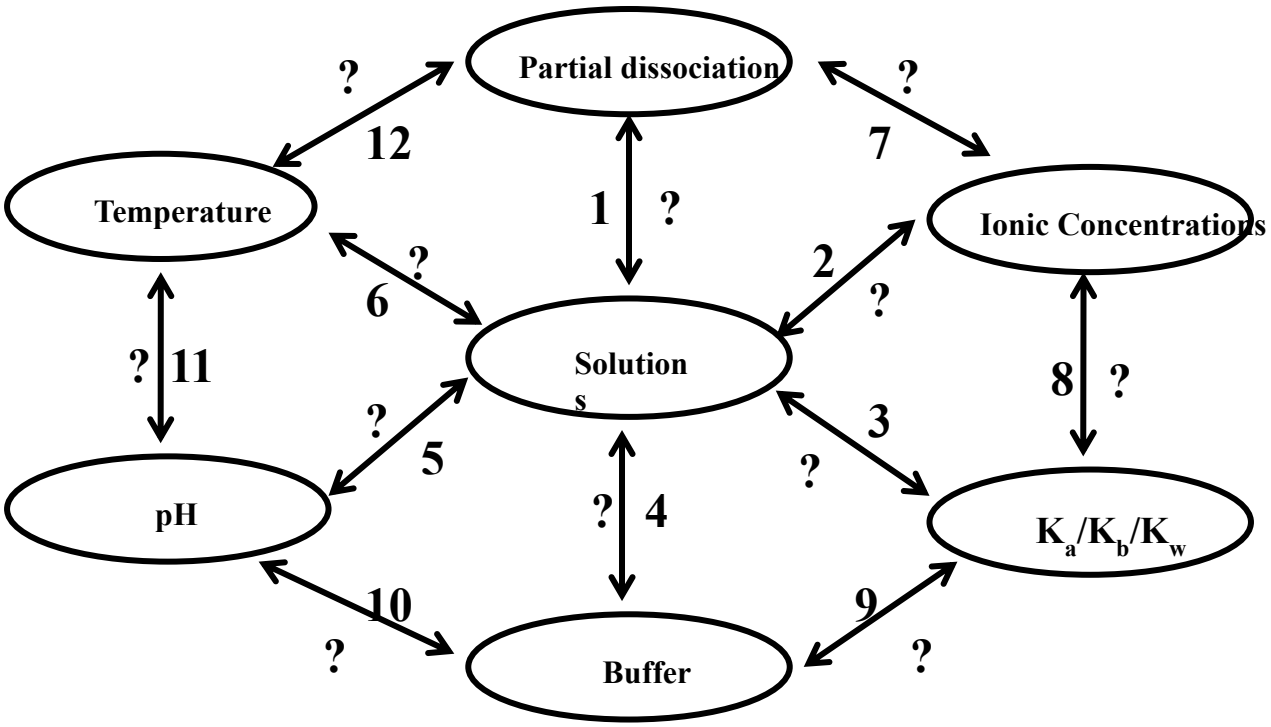

Figure 4: SD0

Systemic diagram (SD0) (Figure 4) sketches that all the relationships are unfamiliar. The interpretation of these relationships can be acquired by applying Systemic approach. Following the clarification of role of partial dissociation of the chemical species in a solution (1) and its connection with ionic concentration (7), which may also affect the various properties of solution (2), SD0 can be renewed into another systemic diagram i.e., SD1(Figure 5).

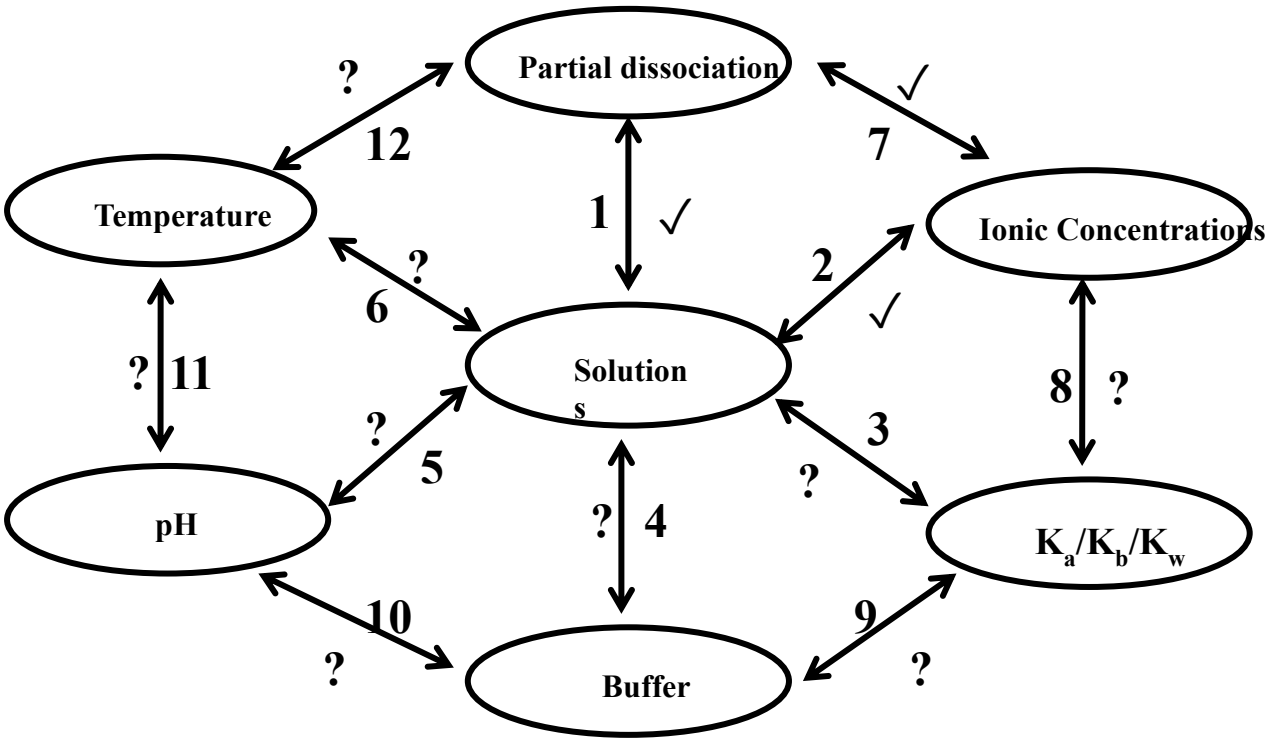

Figure 5: SD1

Figure 5 is not yet fully deciphered and still there are the links need to be figured out. Once decoded, these links will reveal Figure 5 to Figure 6 (SD2)**.**

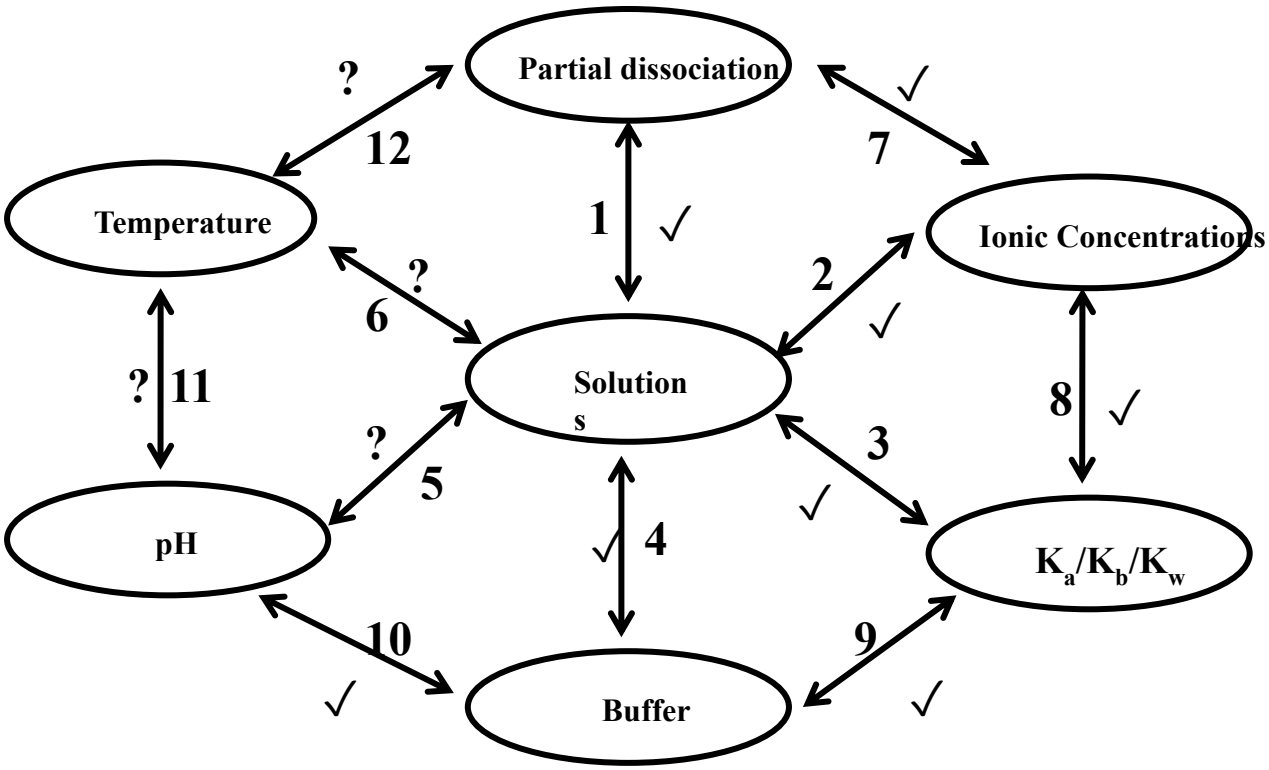

Figure 6: SD2

The remaining connectivity of systemic diagram (SD2) for example: relevance of the pH (5) and the nature of buffer (4), their association with each other such as temperature (11) and with the partial dissociation (12) can be determined to obtain final systemic diagram (SDf), Figure 7.

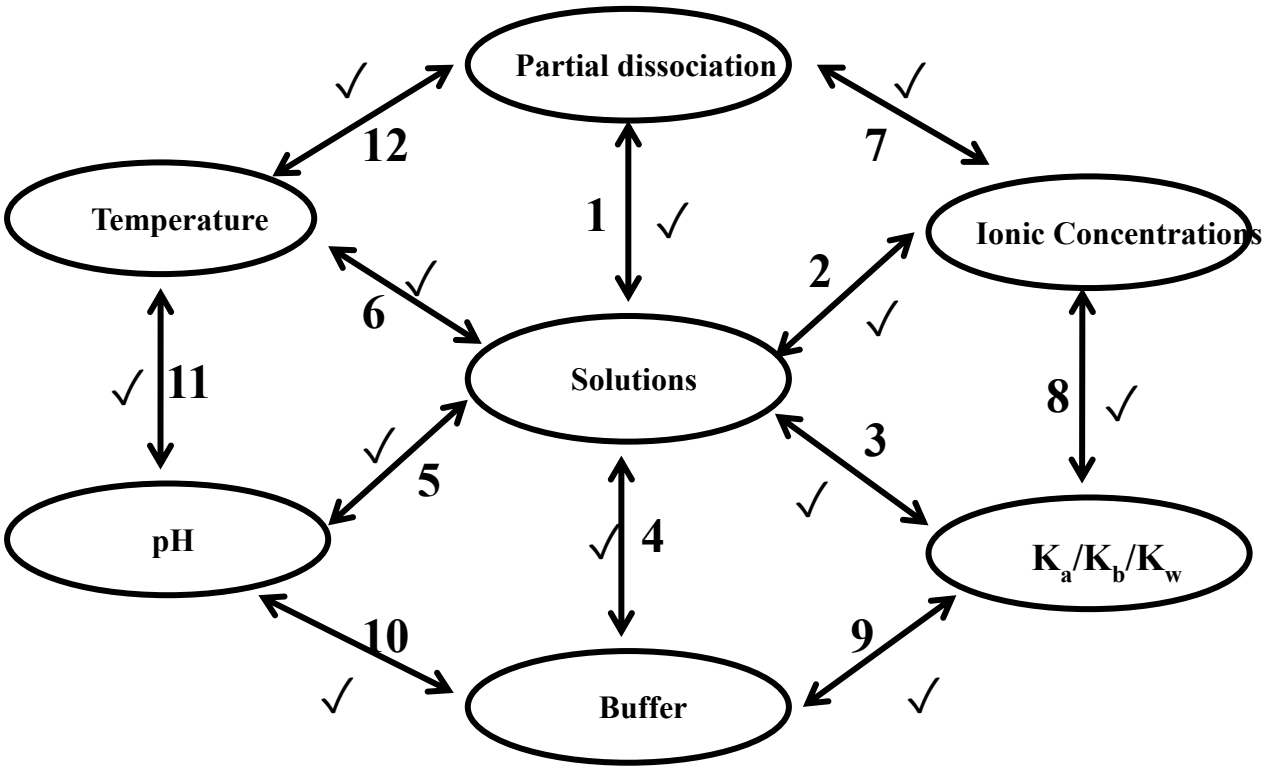

Figure 7: Final Systemic Diagram (SDf)

Similarly, several other systemic diagrams can be developed (Figures 8-13) relating solution relation to the parameters involved in the chemical kinetics. Finally, all these systemic

diagrams can be linked to Figure 7 to provide a wide perceptive of this important field of chemistry.

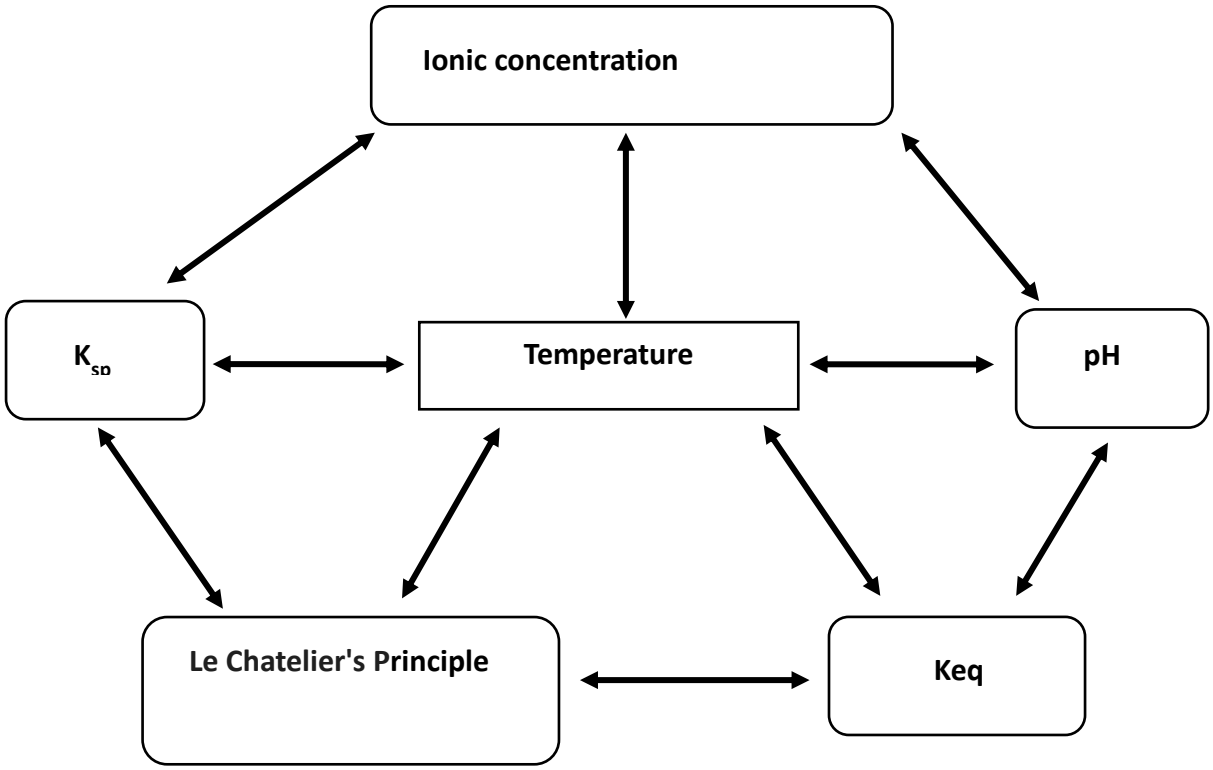

Figure 8: Systemic diagram to explain the temperature

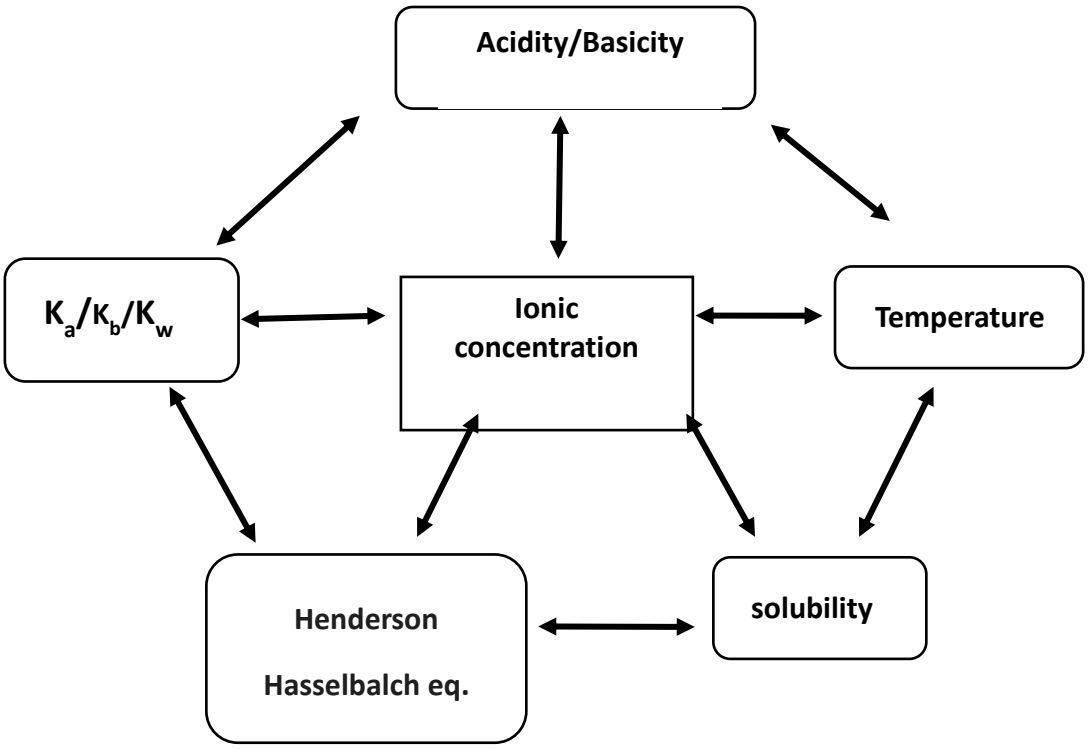

Figure 9: Systemic diagram to explain the ionic concentration

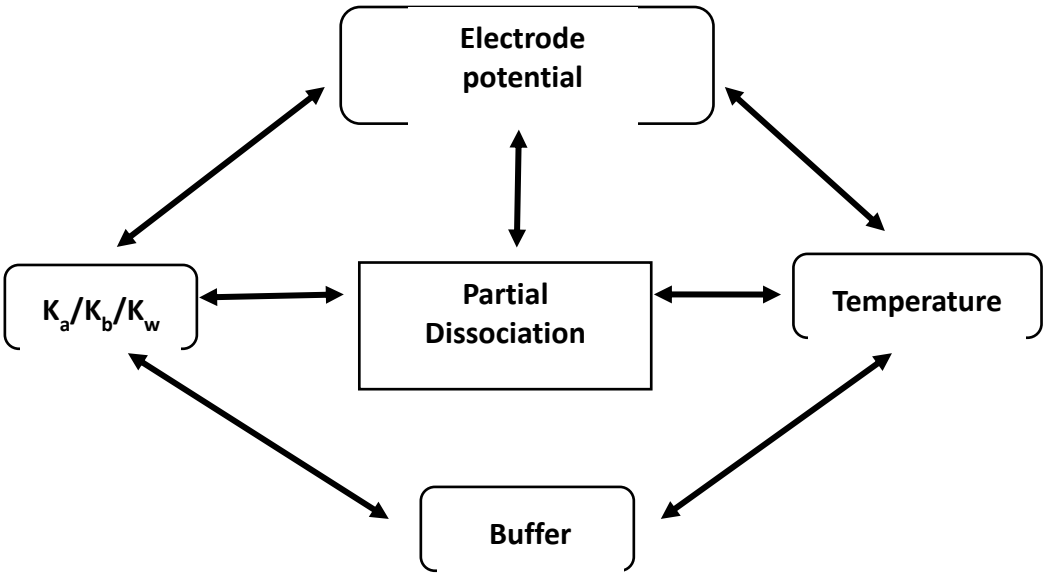

Figure 10: Systemic diagram to explain the partial dissociation

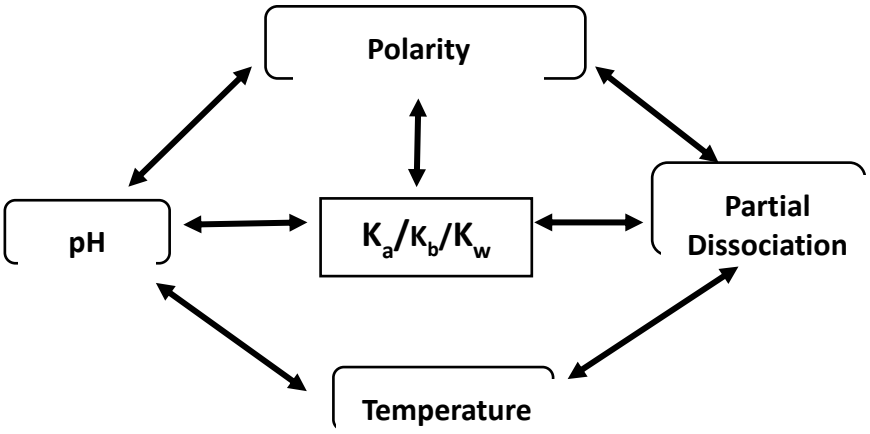

Figure 11: Systemic diagram to explain the $K_a/K_b/K_w$

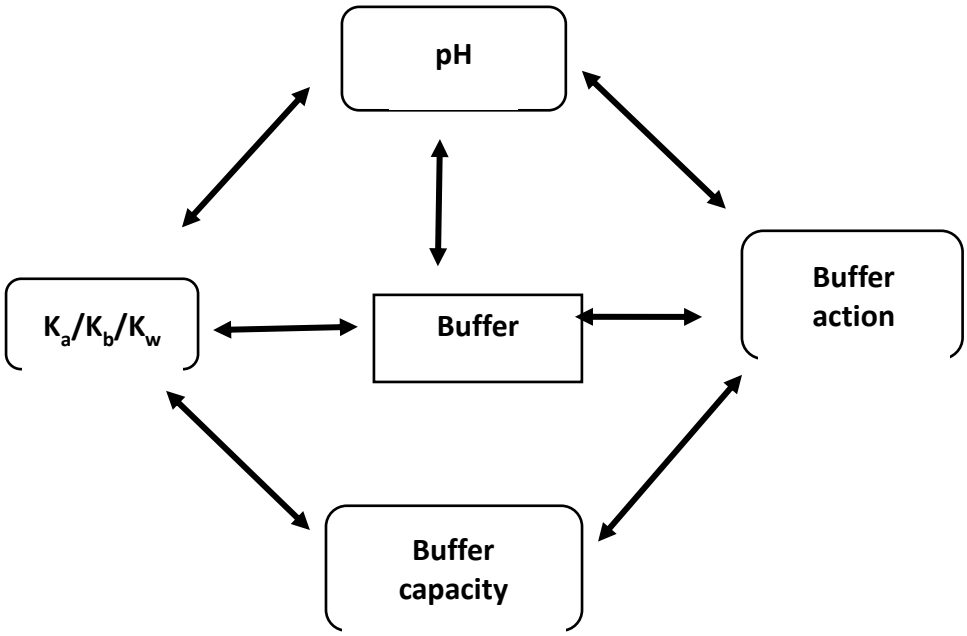

Figure 12: Systemic diagram to explain the buffer at its relation with other factors

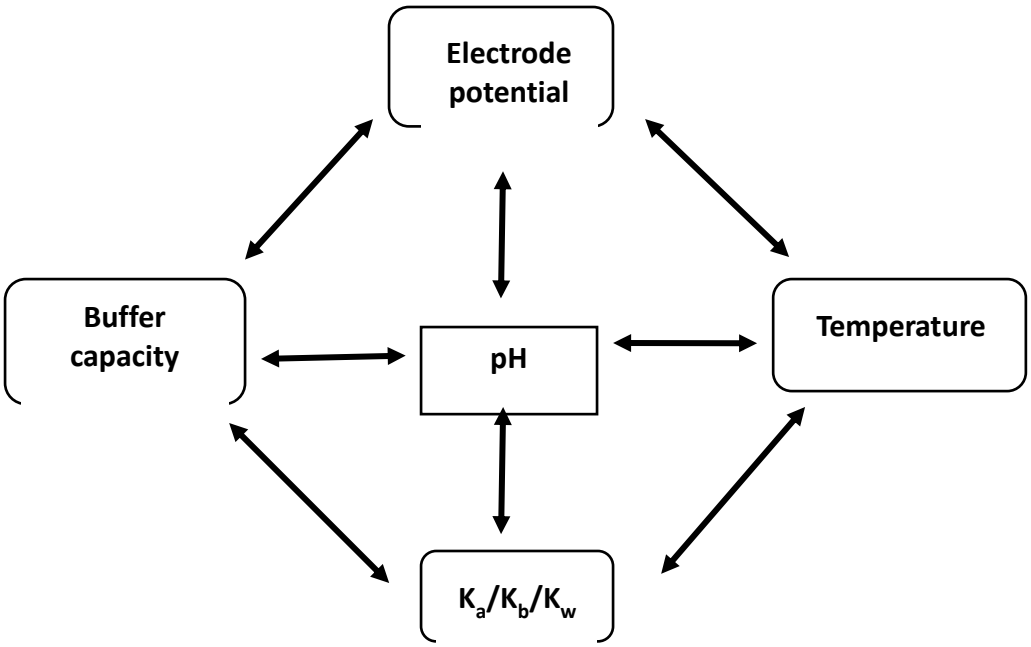

Figure 13: Systemic diagram to explain the pH

SUMMARY

The need of systemic method approach is necessary for better and deep-interactive discussion of the general chemistry concepts. Through the understanding of various linkages in SD0 stepwise, SDf can be achieved. The interconnection of different systemic diagrams (figure 11) gives justification to the topic. In this model lesson connectivity of various general chemistry concepts to the solution have been deciphered (Figure 14). Hence, this model lesson will pave the more meaningful way to understand about the fundamental concept of chemistry i.e., “solutions”.

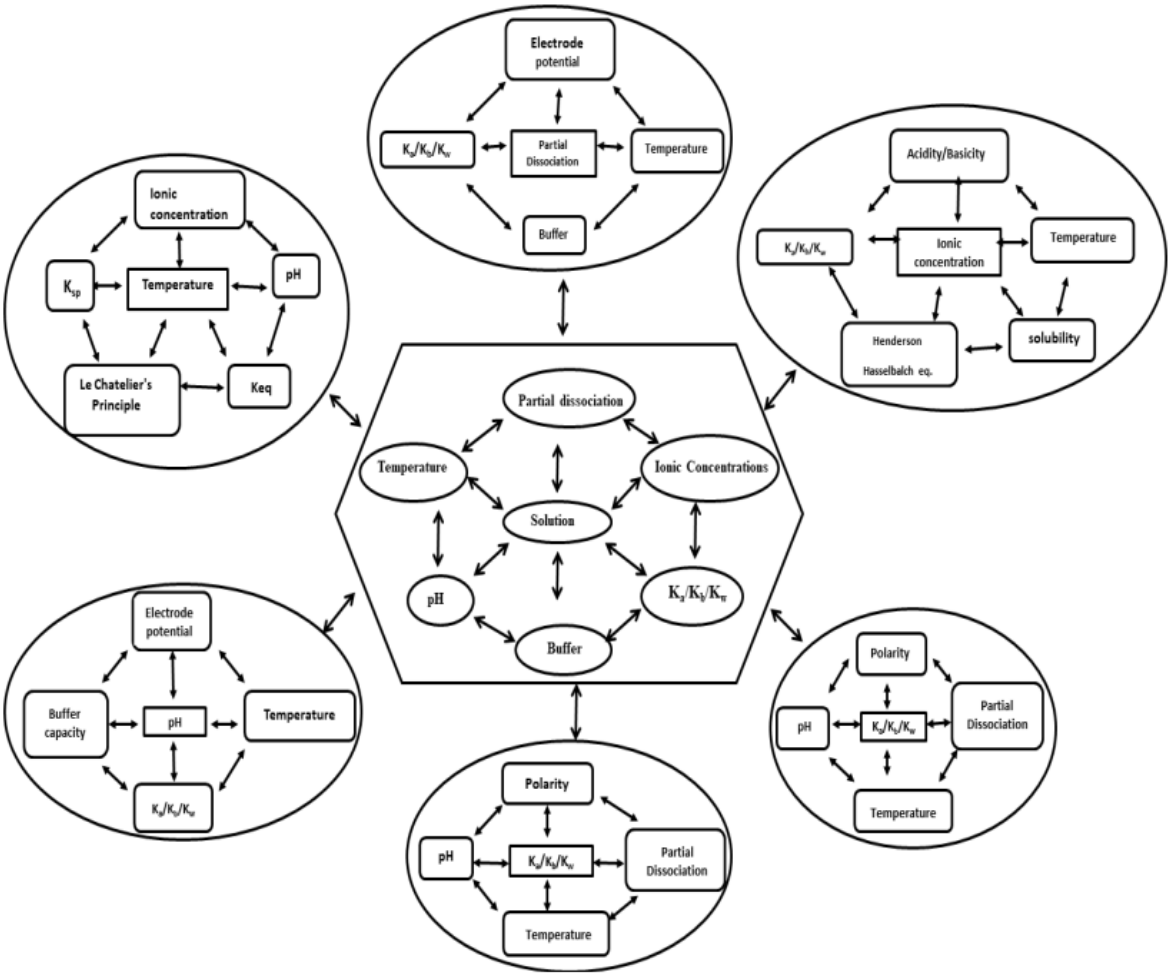

Figure 14: Single display of final systemic diagram and various concepts

This model lesson has been designed considering the importance of *conceptual knowledge*. For instance, the concept of pH will elaborate the chemical condition of the solution, behavior of species during a chemical reaction, and then if the pH is the requirement, the application and importance of buffer will be revealed to learner.

Selection of specific pH- buffer helps the learner to learn about the world of buffers, in terms of types, buffer action, buffer capacity, conjugate acid, conjugate base, and other physical factors that affect the buffer solutions and so on. This pH and buffer essentials will be helpful not only in chemistry, but the learner will be able to apply these in various other fields of sciences too, such as in biological systems, in agriculture, food science and pharmaceutical sciences etc.

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