SATL MODEL LESSON IN CHEMICAL KINETICS

Misbah Nazir[1], Iftikhar Imam Naqvi[2] and Rozina Khattak[3]

[1]Department of Chemistry, The Federal Urdu University of Arts, Science and Technology, Gulshan Campus, University Raod, Karachi, Pakistan.
[2]Department of Chemistry, Jinnah University for women, 5-C Nazimabad, Karachi-74600, Pakistan.
[3]National Center of Excellence in Physical Chemistry, University of Peshawar, Peshawar 25120, Pakistan
Email: nazir_misbah@yahoo.com

ABSTRACT

Studies in order to pursue kinetics and mechanism of chemical reactions are a vital component of chemical literature. SATL literature is still not available for promoting this vital aspect of chemistry teaching. A lesson pertaining to this important issue has been developed and various parameters of kinetic studies are explained therein. *[AJCE, 3(1), January 2013]*

INTRODUCTION

There are several strategies, through which teaching and learning of scientific subjects in general, and chemistry in particular may be made much easier to understand. Various teaching options continue to be reported in literature to illustrate the basics of chemistry in order to enhance its teaching and learning. In the past decade an innovative way of teaching and learning through systemic approach (SATL) has been introduced (1-4) for this end.

The basic goal of this approach is the achievement of meaningful (deep) learning by students. Meaningful (deep) learning was described by Amusable (5) as the formulation of non-arbitrary relationships between ideas in the learners' mind. According to Novack (6) meaningful learning means that learners deal with a learning task by attempting to form relationships between newly and previously learned concepts. Michael (7) 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) technique the concepts are positioned in such a way that the relations between a series of ideas and issues are made logical. In various publications it has been stated that systemic approach to teaching and learning (SATL) for discussing any issue initiates with the systemic diagram (SD0), which is based on the previous knowledge of students. After inclusion of similar systemics with known and unknown relationships (SD1, SD2, SD3 and so on) the unit ends at final systemic diagram (SDf) as in Figure 1). In (SDf) all the relationships between different concepts of the unit have been delivered to the students (8-9).

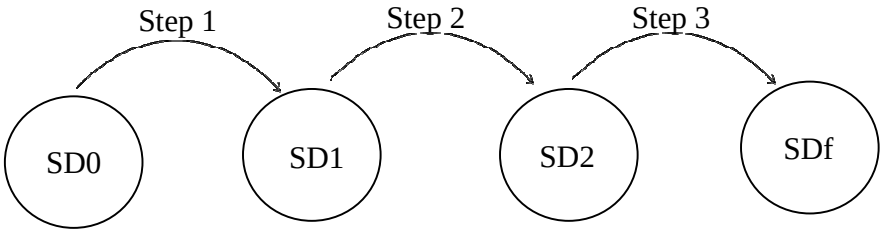

Figure 1: Systemic approach stratagem

Several systemic diagrams on a variety of topics can be developed and finally all of these may be assembled together (Figure 2) (10).

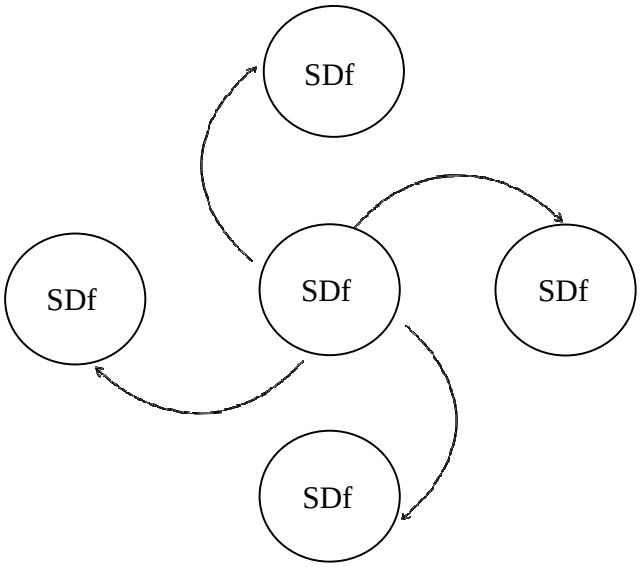

Fig-2: Association of final systemic diagrams (SDf) on various topics.

METHODOLOGY

Chemical kinetics is one of the important branches of Physical Chemistry. It helps us to monitor the rate of the chemical reaction. This topic has been chosen to enlighten the effectiveness of systemic approach to teaching and learning (SATL) methodology in physical chemistry. SATL provides a matchless way to have deep understanding of chemical kinetics. Generally linear approach has been adopted to convey this subject matter. Figure 3 is based on the linear relationships among various factors involved in chemical kinetics. The relationships (1-7) are sequences of linear associations. Figure 3 can be transformed into systemic diagram SD0 as represented in Figure 4.

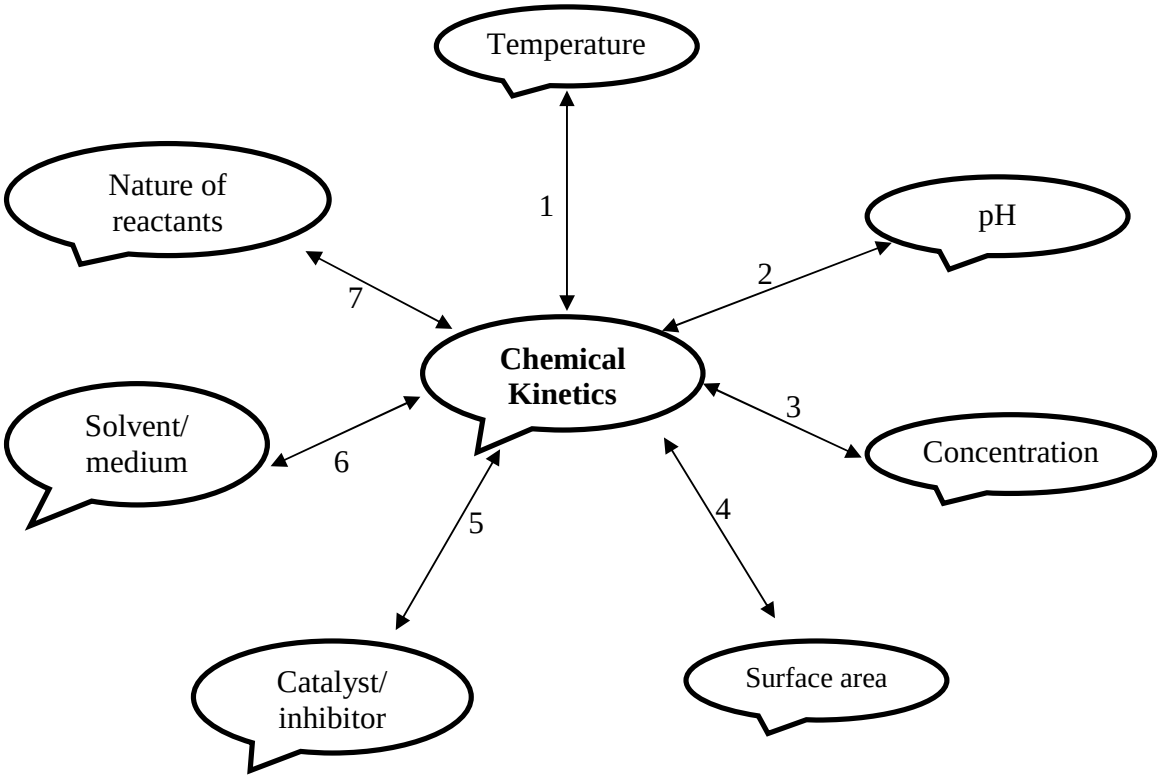

Figure 3: Linear relationships among different parameters occupied in chemical kinetics.

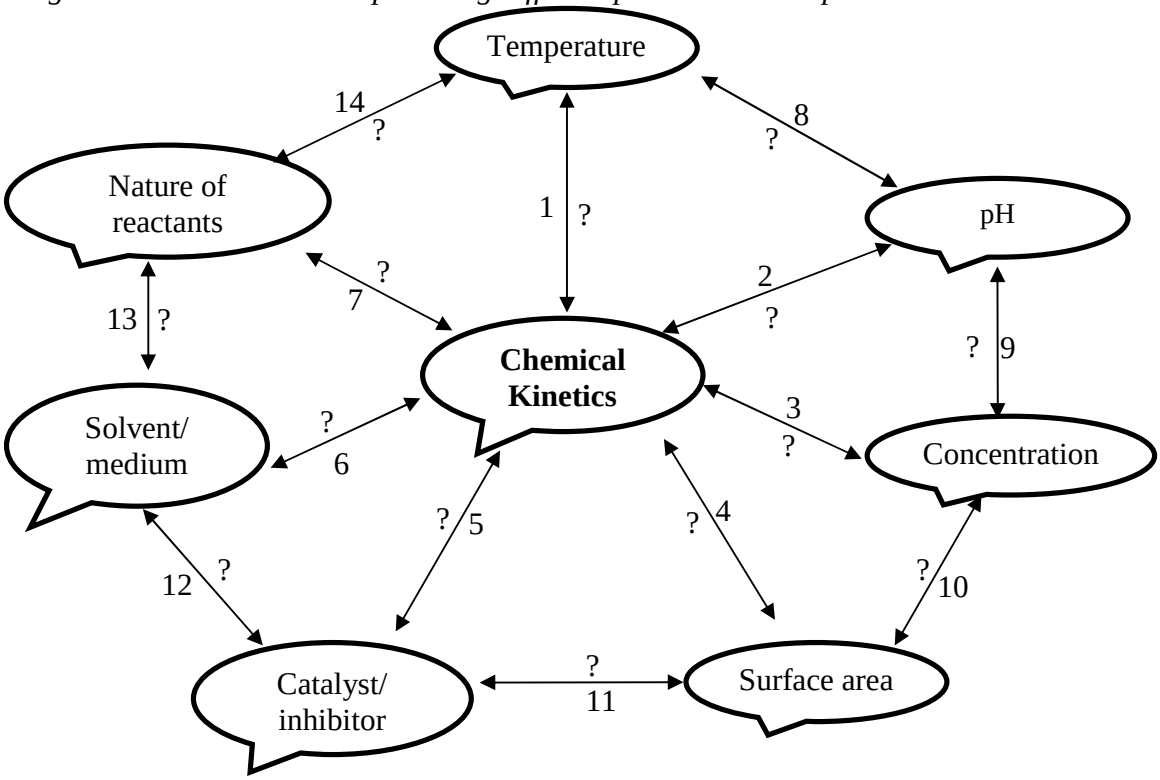

Figure 4: SD0

In systemic diagram (SD0) (Figure4) all the relationships are unknown. Systemic approach will be implemented to interpret these relations. Following the clarification of role of temperature in a chemical reaction (1) and its connection with pH (8), which may also affect the rate of a reaction (2), SD0 can be renewed into another systemic diagram i.e. SD1(Figure 5).

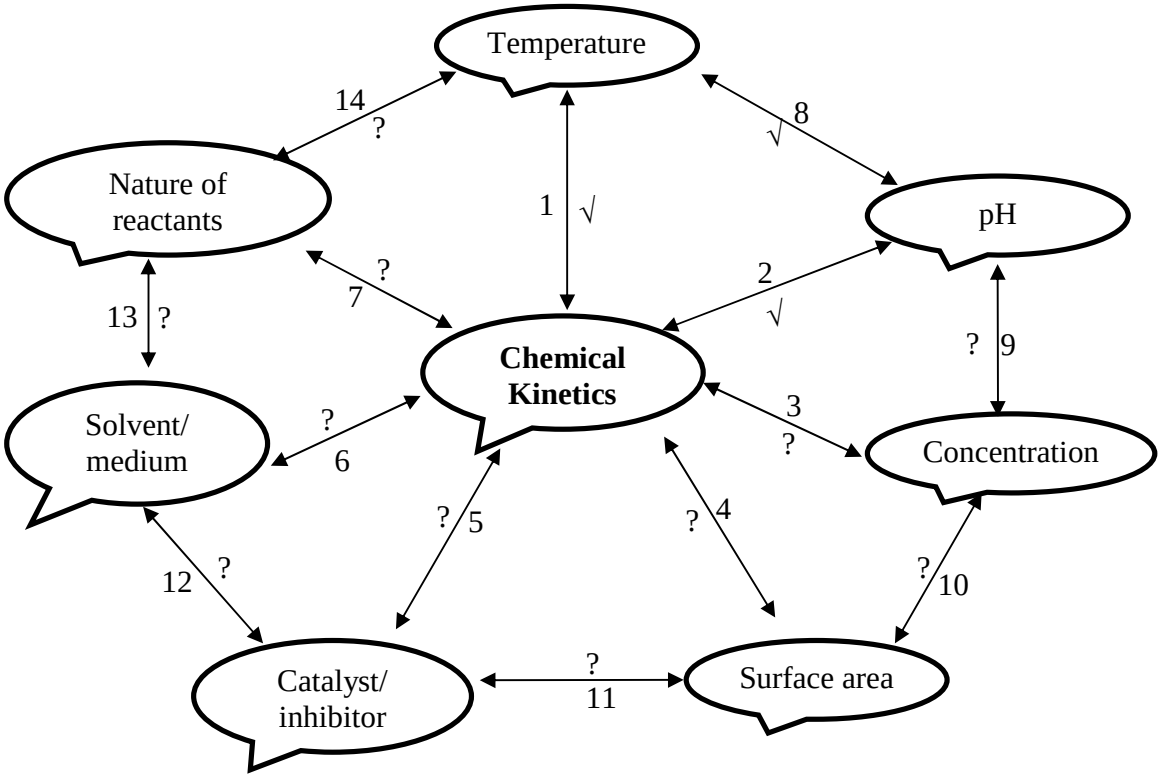

Figure 5: SD1

Still there are some links, in Figure 5 which have to be deciphered. After learning some of these connections Figure 5 will be modified to Figure 6 (SD2).

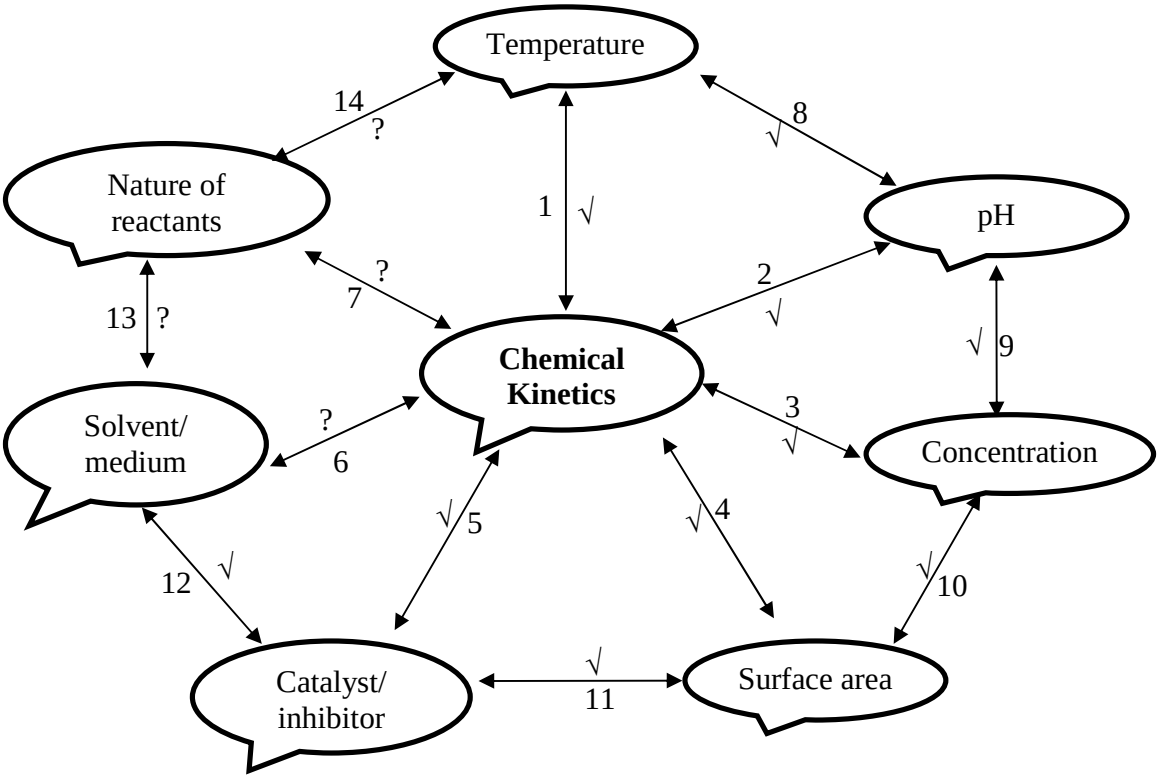

Figure 6: SD2

The remaining linkages of systemic diagram (SD2) relevant to the effect of medium (6) and the nature of reactants (7) in the kinetic study of a reaction and their association with each other (13) and with the temperature (14) can be worked out to attain final systemic diagram (SDf), Figure 7.

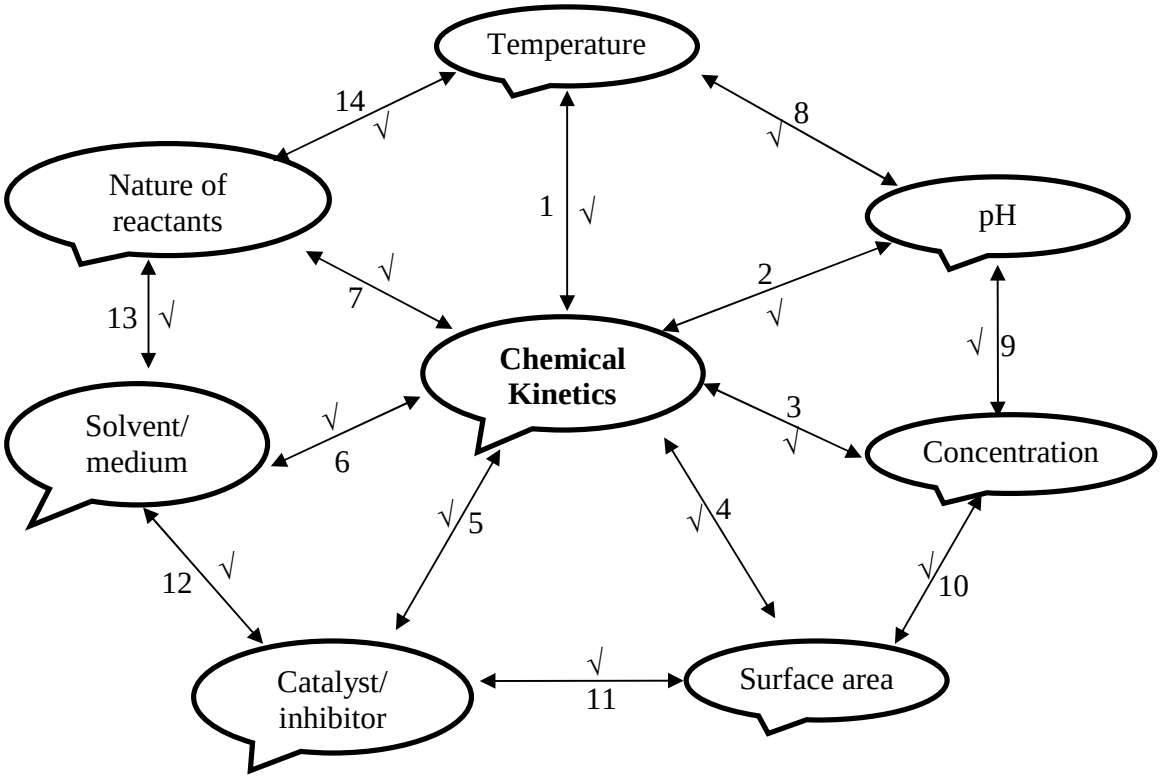

Figure 7: Final Systemic Diagram (SDf)

In the similar way several other systemic diagrams can be developed (Figures 8-11) in 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.

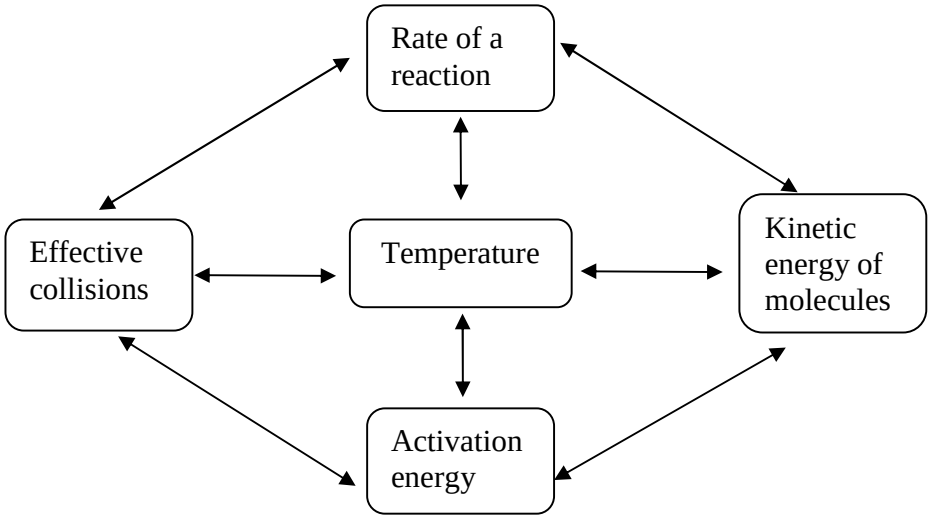

Figure 8: Systemic diagram to explain the temperature in kinetics of a reaction

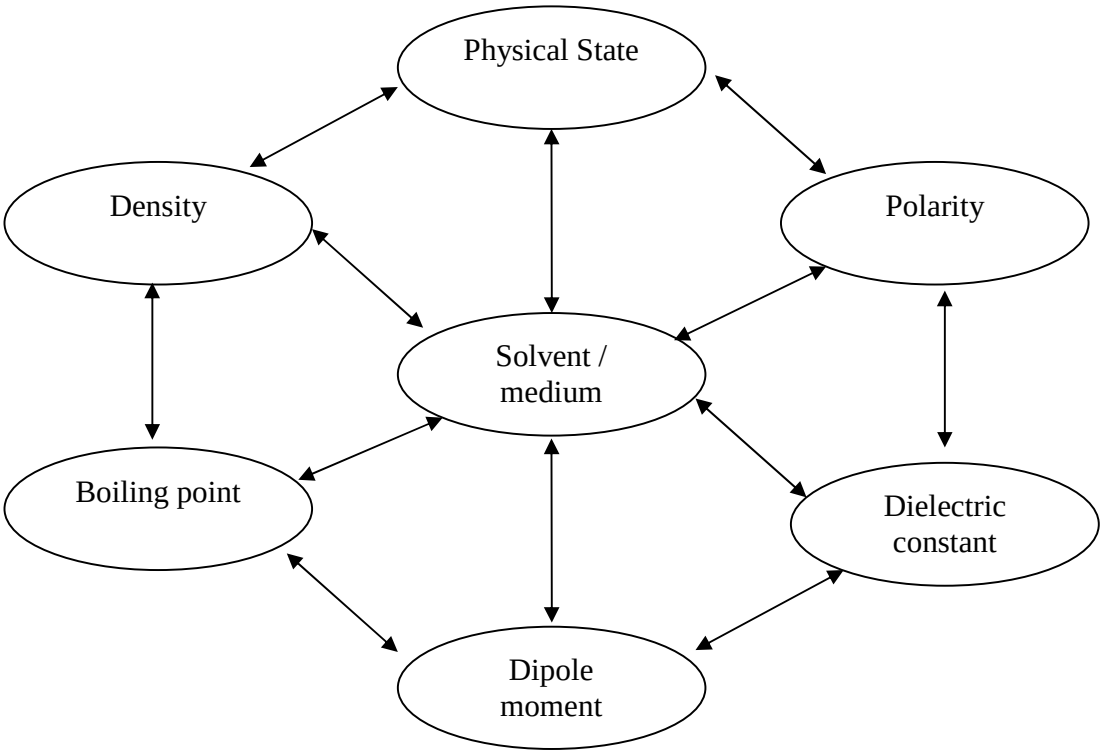

Figure 9: Systemic linkages among the various properties of solvent or medium

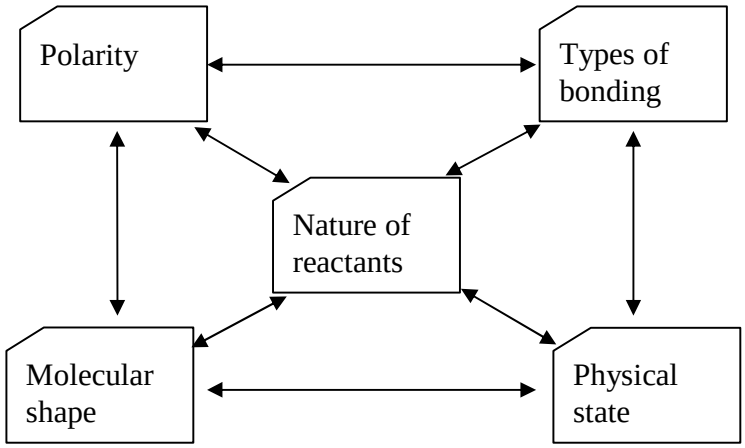

Figure 10: Systemic diagram of various parameters of a reactant

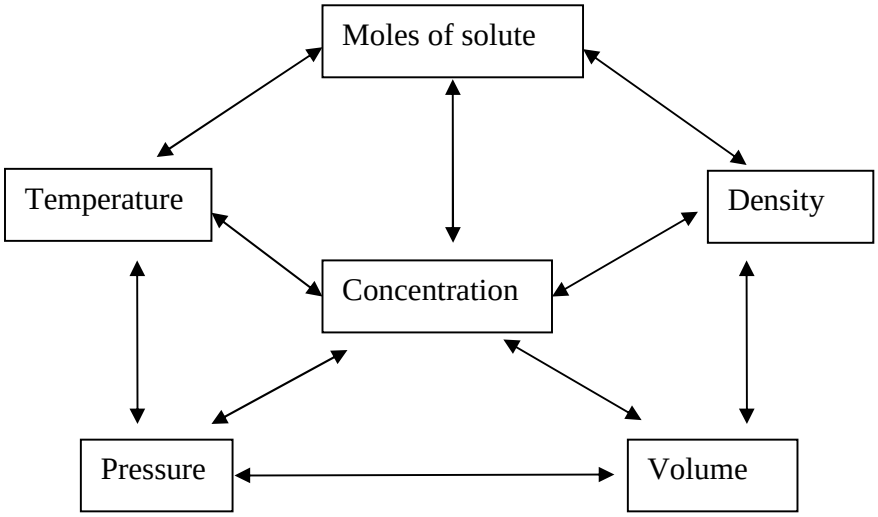

Figure 11: Systemic diagram connecting various factors related to the concentration

SUMMARY

The implementation of systemic method assists to discuss the issue of chemical kinetics with SD0 as an initial point. Through the understanding of various linkages in SD0 stepwise, SDf can be acquired. Connecting different systemic diagrams (Figure 12) further clarify the topic.

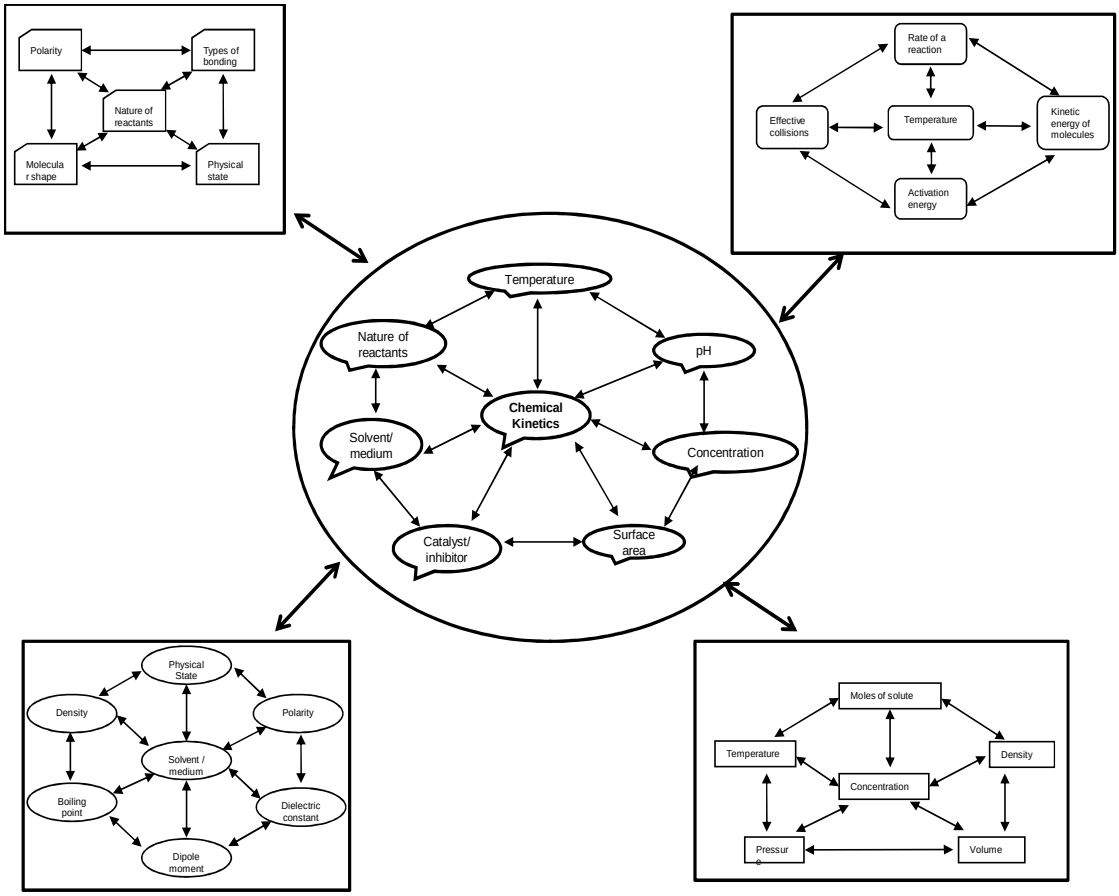

Figure 12: Representation of a variety of subject matter in single display

REFERENCES

1. Fahmy A. F M. and Lagowski J. J. (2001). Chemical Education International, 3 (1).
2. Fahmy, A. F. M., Lagowski, J. J. (2003). Systemic Reform in Chemical Education an International Perspective, J. Chem. Edu., 80 (9), 1078.
3. Fahmy, A. F. M., Lagowski, J. J. (2011). The systemic approach to teaching and learning (SATL): A 10-year review, AJCE, 1(1) 29-47.
4. Fahmy, A. F. M.,Lagowski, J.J. (2011). The systemic approach to teaching and learning (SATL): Operational steps for building teaching units, AJCE, 1(1)62-80.
5. Ausubel, D. P. (1963) The Psychology of Meaningful Verbal Learning;Grune and Stratton: New York.
6. Novak, J. D. (2002). Sci. Educ. 86, 548–571.
7. Michael, J. (2001). Adv. Physiol. Educ. 25, 145–158.
8. Nazir, M and Naqvi, I. (2011). Instruction Manual of Systemic Approach to Teaching and Learning (SATL) Pak. J. Chem. 1(4) 168-175.
9. Nazir, M. and Naqvi, I (2011). Systemic Approach to Teaching and Learning Chemistry as Integrated Approach towards Teaching Physical Chemistry AJCE, 1(2), 59-71
10. Nazir, M and Naqvi, I. (2012). Lectures through Systemic Approach to Teaching and Learning a Model for SATL Methodology Pak. J. Chem. 2(1) 46-57.