SATLC MODEL LESSON FOR TEACHING AND LEARNING COMPLEX ENVIRONMENTAL ISSUES RELATED TO THE THERMODYNAMICS

Atiya Firdous* ,Misbah Nazir** and Iftikhar Imam Naqvi***
*Department of Chemistry, Jinnah University for women, 5C Nazimabad, 74600, Karachi, Pakistan
**Department of Chemistry, Federal Urdu University of Arts, Science and Technology, Gulshan-e-Iqbal Campus, Karachi. Pakistan.
**Institute of Environmental Science, University of Karachi, Pakistan
Corresponding Email: firdous.atiya@live.com

ABSTRACT

Environmental chemistry is one of the disciplines of Science. For the goal of the deep learning of the subject, it is indispensable to present perception and models of chemical behavior explicitly. This can be accomplished by giving careful consideration to the development of concepts such that newer approaches are given contemplation, taking in consideration participation of students. Students, well versed in issues which integrate to enhance vital concepts, are thus able to understand nature and help us to discover means to view the impact of industrialization on the well being of mankind. Understanding environmental chemistry needs quality teaching at undergraduate stage of students learning. In the absence of necessary input of biological sciences, mathematics, statistics, along with the parameters of analytical and physical chemistry, students often find environmental chemistry a difficult subject. It is therefore desirable that the practice of disseminating knowledge related to environmental chemistry must avoid the tradition of presenting the necessary information separated from each other. The lectures should be designed in such a way that they provide the complete description of any issue debated in the class room. The students have not to be encouraged to address the issue in a sphere of limited knowledge. It is suggested that the teachers organize their lectures in such a way that the student get involved in the class. This essential scenario can only develop when the knowledge is transferred through Systemic diagrams. Recently concept based teaching methodology; namely systemic approach to teaching and learning chemistry (SATLC) has been employed to highlight the connectivity between some environmental issues and the disciplines of Physical Chemistry. *[African Journal of Chemical Education—AJCE 5(2), July 2015]*

INTRODUCTION

Numerous strategies have been introduced through which teaching and learning of scientific subjects in general, and chemistry in particular may be made much easier to understand. Several teaching methodologies continue to be reported in literature to illustrate the basics of chemistry in order to enhance its teaching and learning. Recently an inventive way of teaching and learning through systemic approach (SATL) has been familiarized (1-4) for this end. The basic objective of this method is the use of systemic to help students to understand interrelationships of concepts in a greater context, a point of view, once achieved, that ultimately should prove beneficial to the future citizens of a world that is becoming increasingly globalized (3).

Ausable (5) defined meaningful learning as the formulation of non-arbitrary relationships between ideas in the learners' mind. According to Novak (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. Whereas concepts pertaining to teaching of some salient issues in physical chemistry have been published recently (8-10), we undertake to present a model SATL lesson that may help to improve the meaningful understanding of some aspects of environmental chemistry.

Environmental change caused by human influences or natural ecological processes. This change undergoes many complex issues related to the kinetic energy of molecules and various thermodynamic parameters.

Temperature has huge impact on our environment, if temperature goes high we feel warm and when it goes down we feel cold. Warmer temperature can be dangerous causing illness such as heat cramps, heat stokes or even death. It also affects the oceans, weather patterns, snow & ice, plants & animals. The warmer it gets the more severe the impacts on environment will be and it will be effected on entropy. It is an irreversible process which occurs due to irreversible phase changes. Greenhouse-gas-induced temperature increase is one of the main reasons of entropy production. These unpredictable changes in climate have led to an increase rate of entropy. Study of the entropy production of the earth's climate system requires specific regard of the entropy production associated with the irreversible processes of scattering, absorption and emission of radiation. The exchange of radiation between the earth and space define the exchange of entropy between the system and its surroundings. The essence of this exchange is the low-entropy radiation that enters the earth from the sun, and high-entropy radiation that leaves the earth by virtue of the radioactive processes that occur within it.

The relation between altitude and density is a fairly complex exponential that has been determined by measurements in the atmosphere. The heat content or total heat is increasing over time. The increment in total heat of earth atmosphere is causes by energy from sun (which is constant), greenhouse gases which absorb energy and emits radiation to atmosphere and volcanic activity can also cause climate to go hotter. So there is imbalance in energy and heat accumulates on earth's climate system which causes global warming. A warming planet thus leads to a change in climate in many ways such as ocean acidification i.e., CO_2 in the atmosphere dissolves in to ocean by which water becomes acidic also when water is heated it expands and sea level are expected to rise.

Rising sea level also result as glaciers begins to melt and due to increasing heat it is melting at higher rates, this affect the humanity live near the coast or by major areas.

Energy plays an important role in many aspects of our lives. Climate is influenced by natural changes that affect how much solar energy reaches Earth. These changes include changes within the sun and changes in Earth's orbit. Changes occurring in the sun itself can affect the intensity of the sunlight that reaches Earth's surface. The intensity of the sunlight can cause either warming (during periods of stronger solar intensity) or cooling (during periods of weaker solar intensity). The sun follows a natural 11-year cycle of small ups and downs in intensity, but the effect on Earth's climate is small. **(11).**

METHODOLOGY

Understanding environmental chemistry is easier when scientific approach involving chemical and biochemical information is followed. It provides a systemic description of the environment, based upon the energy sources and the involved chemical reactions. Hence transformation of chemical species in the air, soil and water, and the consequence of human activity on these parameters of significant impact on the quality of environment may be easily gauged. Environmental chemistry is an interdisciplinary science that comprises of a systemic approach to atmospheric, aquatic and soil chemistry.

Being a multidisciplinary science, as pointed out earlier, students face obscurity in appreciating correlation between environment and divergent rules that form the basis of current advances in science and technology. In the present lesson we try to highlight environmental issues through systemic diagrams, developed on thermodynamic concepts. These are being presented for developing a deep insight for understanding the relationship between the energy and environment. In order to understand their connection, student must realize a number of multidisciplinary aspects of the contemporary science.

Understanding relationship between energy and environment is important in our global society. Energy provides the driving force that influences the production and consumption of material resources that improve the standard of living of modern human beings. The dependence of environmental health on a variety of biological, chemical and physical parameters cannot be disregarded. Energy is one of the variables that cause the environment to alter itself for an optimistic effect or pessimistic fallout.

About 75 % of the solar energy falling on the earth is absorbed by the earth's surface, which boosts its temperature. The rest of the heat radiates back to the atmosphere. Some of the heat is trapped by gases such as carbon dioxide, methane, ozone, chlorofluorocarbon compounds (CFCs) and water vapor in the atmosphere. Energy controls the availability or lack of this in compounds in the respective atmosphere. In particular fine particles and ozone are the most pervasive health damaging pollutants that are let loose from the prevalent abuse of the energy resources.

The relationship among various parameters that influence the environmental changes can be better presented via systemic diagrams according to the Scenario of systemic building strategy of teaching units (10 - 11).

So, any unit to be taught using SATL methods involves the building of a systemic diagram (SD0) that has been determined as the starting point of the unit; SD0 incorporates the prerequisite concepts. The SD0 of unit assures that all students will have the same starting point as they progress through the entire set of systemic diagrams. The unit ends with a final systemic diagram (SDf) in which all the relationships between concepts in the unit that have been taught to the student are known. From SD0 through SDf we encounter several similar systemic with known and unknown relationships (SD1, SD2, etc.). (4, 10).

According to this scenario we present the unit according to the following steps;

Step-1: We start the unit by presenting the linear relationships among various parameters influence the environmental changes as in the following linear diagram Fig.1.

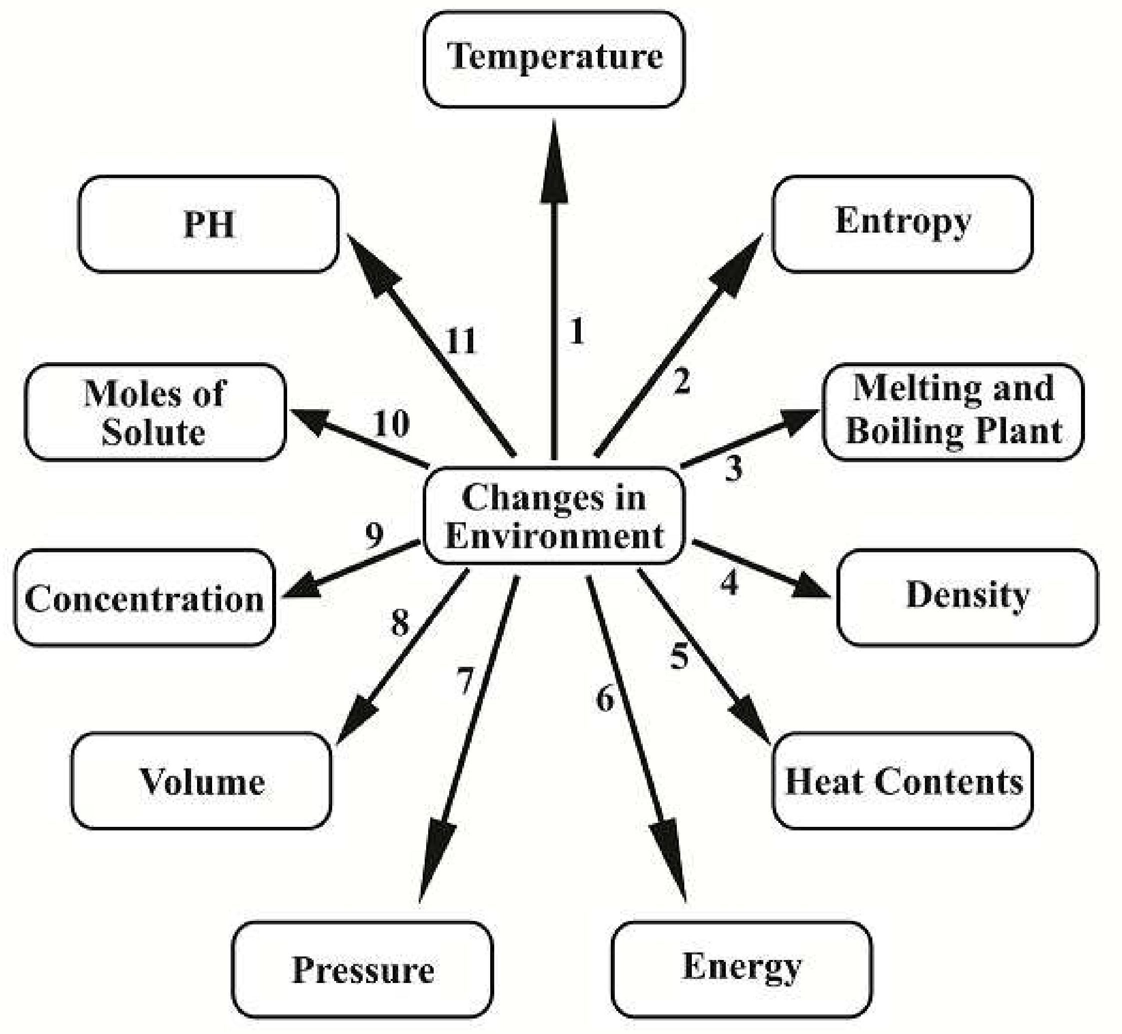

Figure 1: Linear relationship among various parameters influence by the change in environment

Step-2: Students convert linear diagram Fig. 1 into systemic diagram SD0 by connecting factors as represented in Figure 2. In systemic diagram (SD0) (Figure 2) all the systemic relationships between environmental changes and parameters (1-11) and between parameters (12-23) are unknown.

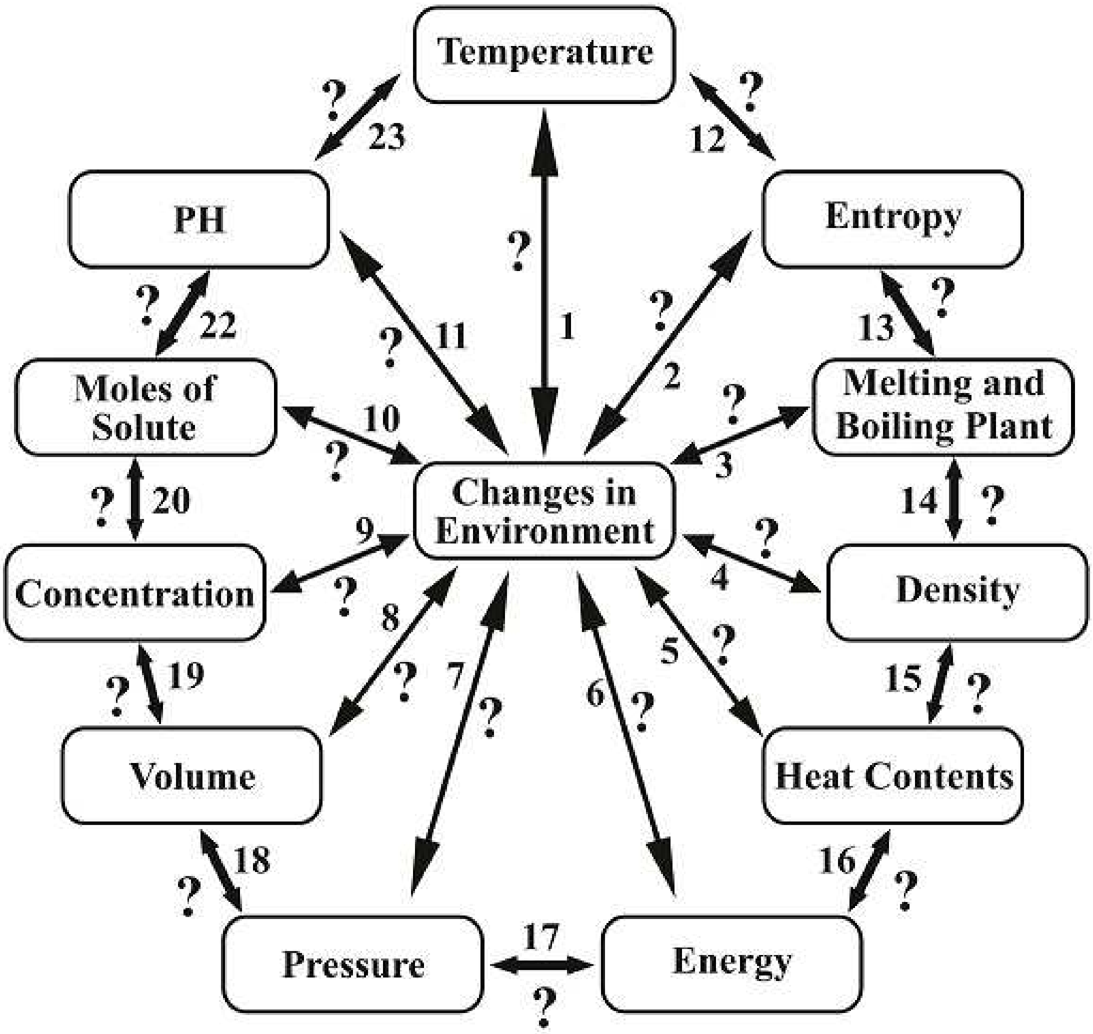

Figure 2: SD 0

Step-3: Systemic approach will be applied to decode the relations in SD0 and the students are able to convert SD0 to another systemic diagram SD1 (Figure 3) in which few of the relations have been clarified by putting a check (√) on relations (1-5& 11—15).

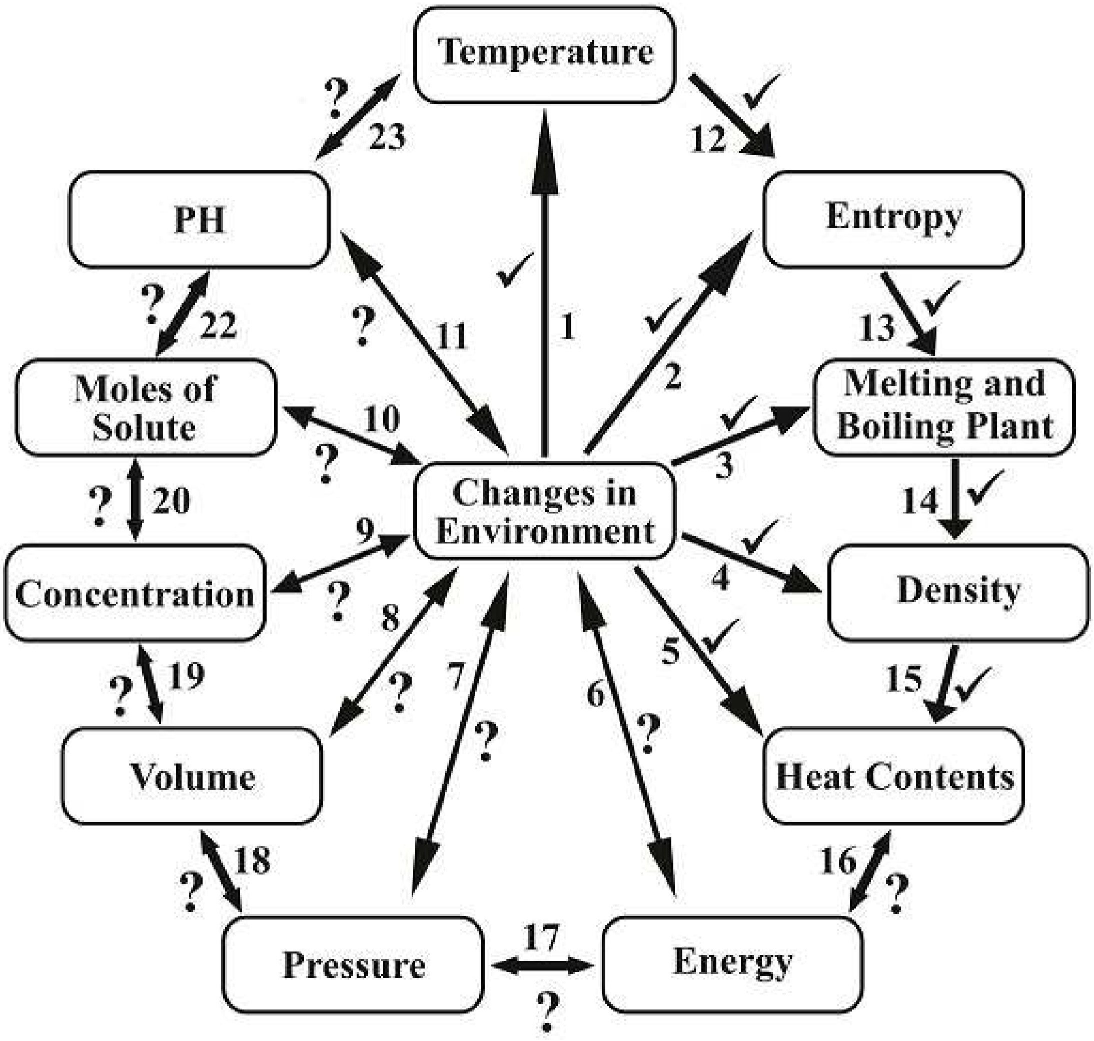

Figure 3: SD 1

Step-4: After clearing up some more invironmental relations students are able to convert systemic diagram SD1 into SD2 (Fig.4) in which more invironmental relations have been clarified by putting a check (√) on relations (6-8 & 16—19).

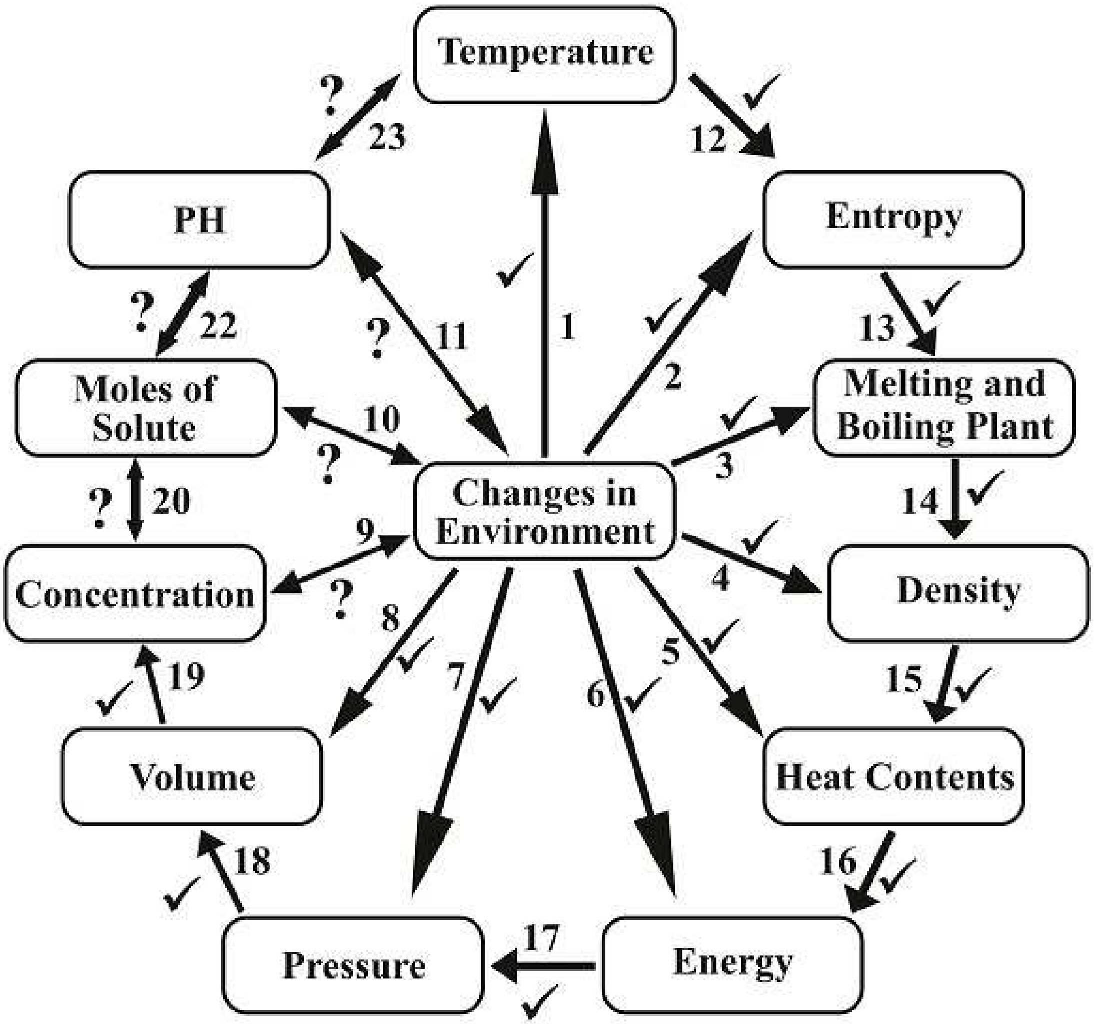

Figure 4: SD 2

Step-5: After presentation of remaining environmental relations (9-11&20-23) the students are able to convert systemic diagram SD2 (Figure 4) to attain the final systemic diagram SDf, (Figure 5) in which all the relations are clarified by putting a check (√) on relations and the unit ends.

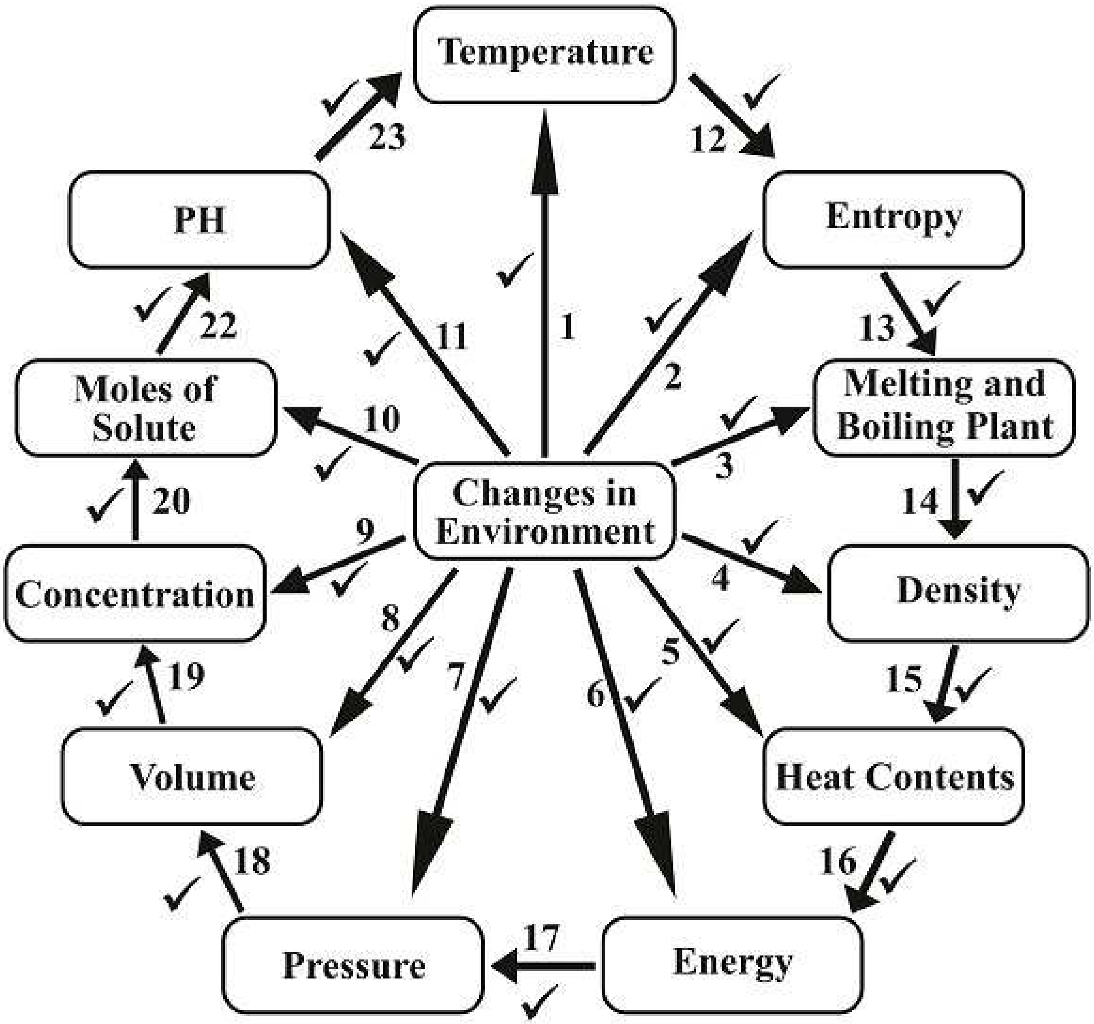
Temperature
Entropy
Melting and Boiling Plant
Density
Heat Contents
Energy
Pressure
Volume
Concentration
Moles of Solute
PH
Changes in Environment
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Figure 5: Sdf

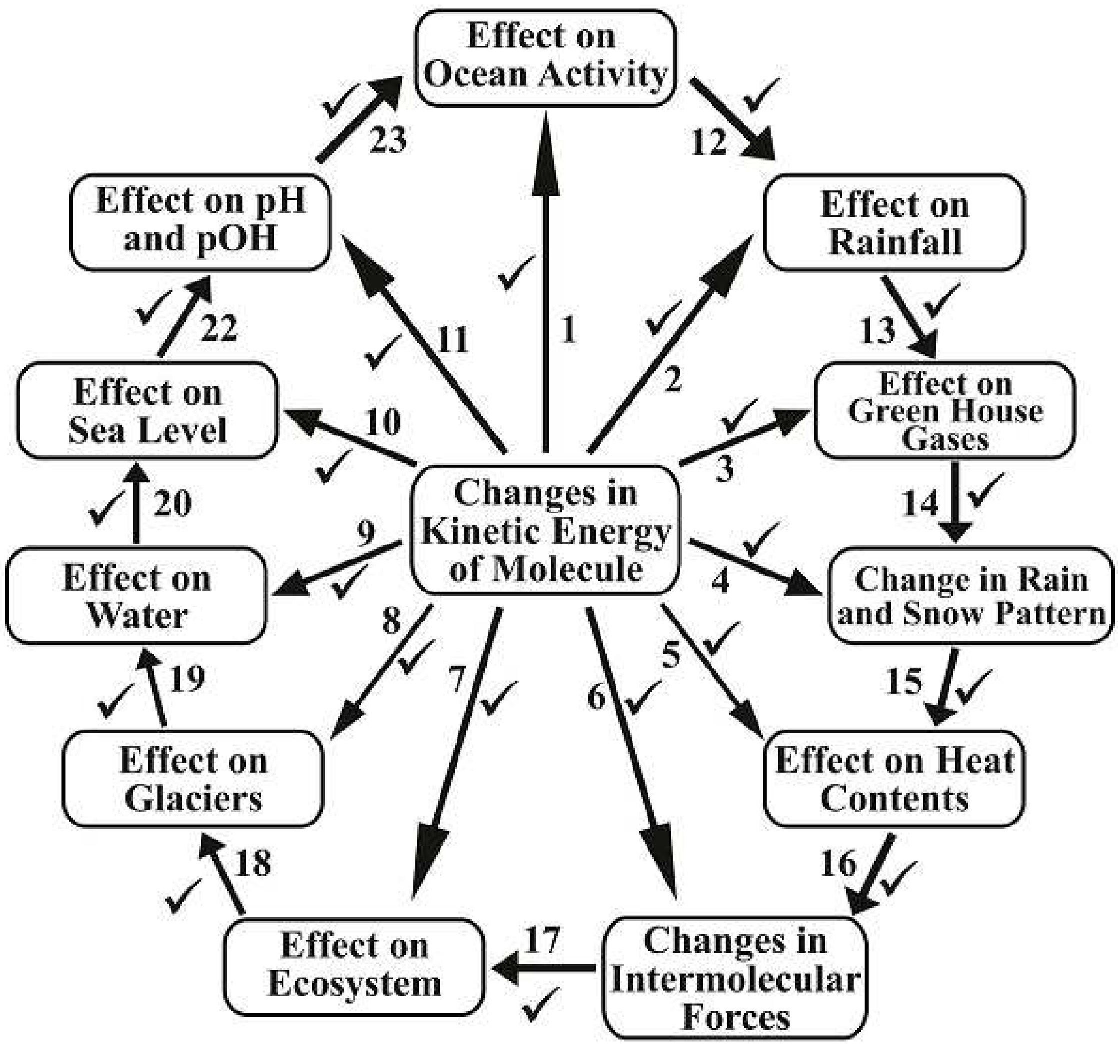

Figure 6: SDf, showing the connections between molecular kinetic energy and other factors.

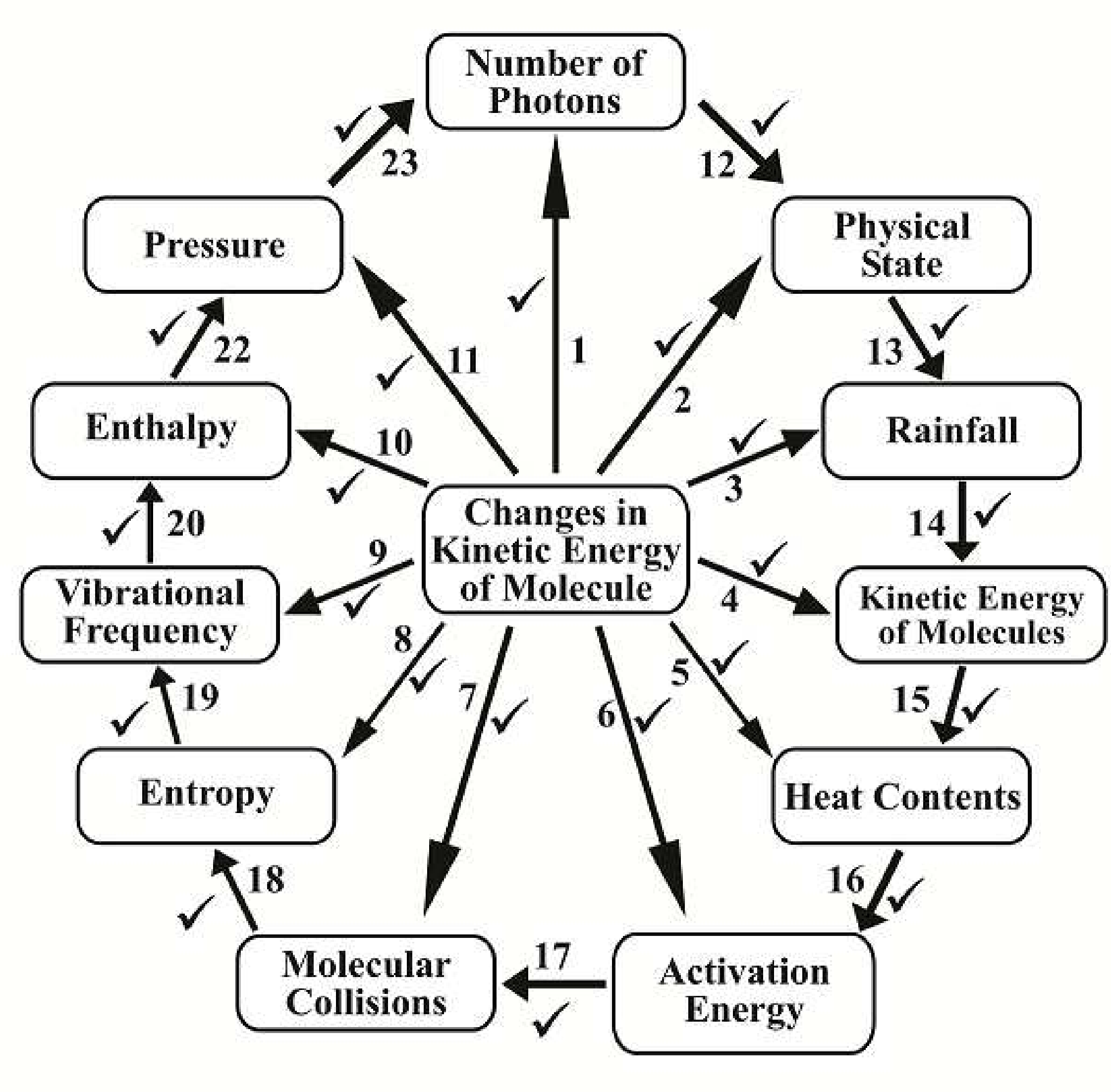

Figure 7: SDf, demonstrating the influence of changes in temperature on various parameters.

CONCLUSION

A model lesson for teaching and learning the concepts underlying environmental chemistry has been developed on the basis of systemic building strategy. We feel that a lecture delivered through this SATL Scenario is going to be a vital route to deep understanding of the complex environmental issues.

This mode of teaching and learning is likely to open new avenues for appreciating the interconnectivity between thermodynamics and environment.

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