



The Relationship of Chemistry with Physics and Mathematics

Seminar Paper*

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Abstract: The relationship of Chemistry with Mathematics and Physics both are very important because some topics are similar in Chemistry and Physics whereas some problems of Chemistry are solved with the use of Mathematics. Chemistry and Physics are inter-related branches of Science. Both may overlap when the system under study involves matter commonly encounter on earth composed of electron and nuclei made of proton and neutrons. Chemistry and Mathematics are also related to each other because of using Mathematics in Chemistry. For example, Quantum Chemistry is all about solving differential equation, Schrodinger equation describing wave behavior of particle is itself a differential equation. Also in the context of Physical Chemistry, we will need to solve the problems for all sorts of electrical, potential and boundary condition. The concepts of linear algebra are also useful in Chemistry because the behavior and properties in a system can be understood in terms of their Eigen states and Eigen values.

Keywords: Chemistry, Mathematics and Physics, relationship of Chemistry, inter-related branches of Science.

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1. Introduction

Since ancient time people are trying to understand the reason of natural phenomenon as, occurrence of day and night, change of weather, eruption of volcano, etc they are always curious to know the rules of nature and secret of natural occurrence. For that study they always used their senses (eye, ear, nose, skin, tongue). Continuously the development of human brain he developed many apparatus for his convenience. So the knowledge which he is got by the systematic manner is known as a science. The word Science is derived from a Greek word Scientia, which means to know. Gradually the area of science is getting broad so it is divided many branches for the convenience of study, e.g. Physics, Chemistry, Biology, Mathematics, Botany, and Zoology. These branches of science are related to each other in many ways and also they use law and techniques in each other. Physics is the most fundamental and all-inclusive of the sciences, and has had a profound effect on all scientific development. In fact, physics is the present day equivalent of what used to be called natural philosophy, from which most of our modern Sciences arose. Energy and Matter are studied in Physics. Therefore, we need to the basic rules of Physics for studying of Matter in each subject of science. That's why Physics is called as a basic of all Science by all scientists.

The word Physics is derived from a Greek word Physis which means Nature, so Physics means knowledge of nature. Physics is the natural Science that involves the study of matter and its motion through space and time, along with related concepts such as energy and force. We know that all living and nonliving things are made by matter and energy. Physics deals with the basic principles that explain matter and energy.

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The Science which is perhaps the most deeply affected by Physics is Chemistry. There are many theories and techniques of Physics used in Chemistry. The meaning of technique of Physics is the method which is used for the study of matter, energy and its interaction. Physicists used technique to make theory of Physics these methods are used by other branches of Science which is known as scientific method. The interaction between the two Sciences was very great substantiated to a large extent by experiments in Chemistry.

Chemistry is the branch of Science that involves the study of the composition, structure and properties of matter. Often known as the central Science, it is a creative discipline chiefly concerned with atomic and molecular structure and its change, for instance through chemical reactions. Chemistry involves many calculations, and calculations require math. That's pretty much the relationship between the two. We cannot do Chemistry without Math, but we can do Math without Chemistry. Mathematics is a branch of theoretical Science that deals with the study of structure, quantity, change and space. Mathematics is an essential part of every one's life. Mathematics is utilized world-wide as a necessary tool in many sectors such as medicine, engineering, psychology and economics. Applied Mathematics is a part of Mathematics that is concerned with the application of mathematical knowledge to other fields. Physics and Mathematics are closely related with each other. The Relation of Mathematics with Chemistry is very important. It starts with atomic number, mass and ends with nuclear energy. It is useful in rate of chemical equations, precision, speed of atoms, there different type energies. It is dominantly useful in Physical Chemistry e.g. calculating molarity, molality, normality, ppm, osmosis. How can we forget periodic table based on atomic numbers? Thus mathematics is necessary for Chemistry to exist.

2. The Relationship of Chemistry with Physics

Chemistry is closely related to several other scientific fields. Chemistry is especially related to the field of Physics, especially in regards to quantum mechanics, thermodynamics and electromagnetism, etc. These overlapping topics are often investigated as Physical Chemistry. Sometimes, Chemistry is even referred to as "Applied Physics" due to the extensive overlap between these fields. Atomic structure was discovered by physicist it helps to understand arrangement of elements in periodic table, nature of valency and chemical bonding. X-ray, diffraction of neutron and magnetic resonance are the gift of Physics. By the application of these method we can easily understand the complicated chemical structure e.g. structure of nucleic acid. Radioactivity is the gift of Physics with the study of these we can find out very small quantity of substance. In physics some chemical techniques of chemistry are used e.g. Madam Curie discovered Radium element by using chemical technique. Chemistry and physics are not strictly separated sciences, and chemists and physicists work in interdisciplinary teams to explore the topic. Quantum chemistry, Spectroscopy, Thermodynamics, Solid state physics, Crystallography, Nanomaterials. There are many theories and laws of Physics are used in Chemistry. Chemistry and Physics both are based on experiment and measurement. Physics is closely related with Mathematics, so we should know Mathematics to understand the theories and law of Physics. In Chemistry several theories and law of Physics are used and also in Physics some techniques of Chemistry are used e.g. Madam Curie discovered "Radium element" by using chemical technique. In Physics, Chemical Physics and in Chemistry, Physical Chemistry is the development of Physics and Chemistry; this is the symbol of co-relation of Physics and Chemistry.

3. The relationship of Chemistry with Mathematics

Chemistry is an experimental science in which we study about state of matter, composition, structure, its properties, use and its reaction which done each other. For these purpose we need to measure volume, mass, temperature, concentration

and density. Measurement is a process in which to find out the physical properties of a substance are to express in arithmetic number and unit. For accurate result it is very important that the measurement done by a chemist is accurate and precise. Mathematics is also used in Chemistry because Chemistry is also based on experiment and measurement. Chemistry practical are based on mathematical calculations because there are many solutions are prepared in lab an exact quantity for this purpose we need mathematical calculations. Many apparatus are used for measurement. Many derivations are solved by using Mathematics in Chemistry. Mathematics is used in most portion of Physical Chemistry. There are many units used for measurement.

Chemistry and Mathematics are also related to each other because of using Mathematics in Chemistry. For example, Quantum Chemistry is all about solving differential equation, Schrodinger equation describing wave behavior of particle is itself a differential equation. Also in the context of Physical Chemistry, we will need to solve the problems for all sorts of electrical, potential and boundary condition. The concepts of linear algebra are also useful in Chemistry because the behavior and properties in a system can be understood in terms of their Eigen states and Eigen values.

4. Conclusion

To sum up, Chemistry, Physics and Mathematics are inter-related branches of Science because they are related to each other in some aspects and also some techniques and theories are used in each other. The three subjects are inter-related actually. Each performs a specific role to each other. Physics is related to Chemistry, in a way that Physics is also concerned about how atoms and molecules react, or in other words, move, when subjected to pressure and another chemical. The fizzing, bubbling, and smoking of substances, we can apply the laws of Physics to these. Physics can be associated practically with everything.

Physics and Chemistry both are branches of science which are based on experiments and measurements. Therefore, to understand the theories and rules of Physics and Chemistry we should have knowledge of Mathematics. Mathematics is proved a powerful tool for the development of theoretical Physics and Chemistry. Mathematics is widely used in quantum mechanics and field theory in both Physics and Chemistry. Thus Chemistry is considered to be strongly related to said Physics and Mathematics.

References

- [1] A.L.Banbela and Y.P.Patel, *Physics*, Ugbohd Publication, Raipur.
- [2] https://en.wikipedia.org/wiki/Comparison_of_chemistry_and_physics
- [3] S.R.Sahu and et.al, *Chemistry*, Ugbohd Publication, Raipur.
- [4] <https://www.ruc.dk/forskning/phd-uddannelse/phd-skoler-og-forskeruddannelsesprogrammer/den-naturvidenskabelige-phd-skole/programmer/didactics-of-mathematics-chemistry-and-physics-with-connections-to-history-and-philosophy-of-science/>
- [5] http://www.answers.com/Q/What_are_other_sciences_related_to_chemistryBottomofFom
- [6] <https://in.answers.yahoo.com/question/index?qid=20090625035411AAadLzH>
- [7] http://www.ucl.ac.uk/sts/staff/chang/Chem_Chap8.pdf
- [8] https://en.wikipedia.org/wiki/Solid_state_physics
- [9] www.thefreedictionary.com/science