CHAPTER-I

Introduction

Background of the Study

We live in the age of science and technology. Scientific inventions and modern day technologies have completely changed the human life and paving the way for our future. Science and Technology has added greatly to our material comforts and quickened the rhythm of our life. It has given man an altogether new social and political outlook. Hence in this age, the study of science is a necessity. Without the study of science, a modern man is like a bullock cart lumbering behind a motorized vehicle (Srivastav,2013).

Science is the systematic observation of natural event and condition in order to investigate fact about them and to formulate laws and principles based on these facts (Sagan**,**1994). Science is crucial to the long term survival of our species. Everybody considers science as a prime factor for the development of human kind. So knowledge of science is necessary for modern living.

The inclusion of science at secondary school level is very necessary to improve the lifestyle and to bring significant changes in the way of thinking, attitudes and outlooks of the school students. Science is related to many aspects of human life. It develops thinking capacity and positive attitudes among the school students. So science subject should be a priority for all the stakeholders. Since the aim of education is not to passively receive knowledge, but it is the educator's role to facilitate the learner's development which involves the active construction of new knowledge..

In context of Nepal, the availability of a qualified instructor, educational materials, a well equipped classes science laboratory and other basic educational needs are lacking which directly effects the educational quality of students. Investment in educational sector is

nominal in comparison to other countries. Out of the total budget, most of the money goes for salary, pension and other things. There is very nominal budget for infrastructure development and training. While other countries are advancing the education system with the use of computer technology, Nepal is facing problems just to fulfill the basic needs of education. It is necessary to make the teacher up to date about the current advancement and educational reforms with the help of effective trainings.

Effective science instruction is an art involving creativity, imagination, and innovation, along with planning, practice, decision making, and evaluation. Teaching is a scholarly activity which involves benefiting from research, collective experience, and critical thinking throughout (Committee on Undergraduate Science Education, 1997). Science is an abstract subject so teacher always face problems to develop conceptual understanding of students.

When teachers provide instruction on concepts in various subjects, they are teaching students who already have some pre-instructional knowledge about the topic. Student knowledge, however, can be erroneous, illogical or misinformed. These erroneous understandings are termed alternative conceptions or misconceptions (or intuitive theories). Misconceptions are preconceived notions, non-scientific beliefs, naive theories, mixed conceptions, or conceptual misunderstandings. Basically, in science these are cases in which something a person knows and believes does not match what is known to be scientifically correct (Newyorkscienceteacher.com,2005-2017).

Basically, alternative conceptions are mental models conceived by individuals to try to explain natural phenomena: “The Moon phases are caused by shadows.” “Density is caused by how tightly packed the molecules in matter are.” “When water appears on the outside of a glass in warm, humid weather, the glass is leaking. “Cold creeps into a house if there are leaks in the structure.” “Metal objects are always cooler than wooden objects, even

when they are in the same room for a long time." These are all examples of alternative conceptions or, as some would call them, misconceptions. They are incomplete theories that people have developed to try to understand their world. Misstating the number of chromosomes in the human cell (which happened in textbooks in the 1950s) is not an alternative conception; it is merely misinformation. For a statement to be an alternative conception, it must be a theory that is used to explain a phenomenon, and is usually self-discovered by a person trying to explain that phenomenon.

Alternative conceptions (misconceptions) are not unusual. In fact, they are a normal part of the learning process. We quite naturally form ideas from our everyday experience, but obviously not all the ideas we develop are correct with respect to the most current evidence. Moreover, some concepts in different content areas are simply very difficult to grasp. They may be very abstract, counterintuitive or quite complex. Hence, our understanding of them is flawed. In this way, even adults, including teachers, can sometimes have misconceptions of material (Burgoon, Heddle, & Duran, 2010). Incorrect understanding of the way the world functions causes the emergence of further misconceptions which are very difficult to eliminate. Therefore, misconceptions emerge through incorrect understanding or total misunderstanding of the information we encounter.

Misconceptions can emerge on the basis of personal experience, imprecise turn of phrase or, possibly, due to errors in the text (Betkowski, 1995) It is therefore, important to not only unmask misconceptions but also eliminate them as effectively as possible.

Every human has their own concept of thinking and understanding the world around them. This concept is affected by all information, knowledge and skills which we encounter. We acquire one part of the knowledge from new curriculum completely, while the other part of new knowledge is interconnected with the original concept. In this way, our worldview is changing, too. However, not every information, skill or knowledge we have is correct. Thus

misconceptions of understanding emerge and they disturb our further learning (Bystrianska, 2013).

Clearly, when students come to class with alternative conceptions of a topic, they will often then make sense of the teacher's explanations in terms of their existing understanding. This can lead to distortions of the teacher's intended meaning, and so compound existing misunderstandings. This raises the question of how such misconceptions arise initially. Research suggests that some derive from intuitive understanding of the world (Taber, 2009). Children are naturally inquiring and our brains have evolved to spot patterns and construct models to make sense of the world. Often the results do not fit with scientific understandings but then of course the history of science offers many examples of ideas which once seemed to explain aspects of the world, but which are now discredited (Burgoon, Heddle, & Duran, 2010).

A familiar example from primary school is students' understanding of the relationship between the earth and the sun. While growing up, children are told by adults that the "sun is rising and setting," giving them an image of a sun that moves about the earth. In school, students are told by teachers (years after they have already formed their own mental model of how things work) that the earth rotates. Students are then faced with the difficult task of deleting a mental image that makes sense to them, based on their own observations, and replacing it with a model that is not as intuitively acceptable (NRC, 1997). This task is not minor, for students must undo a whole mental framework of knowledge that they have used to understand the world. The example of the earth rotating rather than the sun orbiting the earth is one of many that teachers refer to collectively as misconceptions.

As other examples, it is common for students to understand that if an object is stationary, there are no forces acting on it. Also most students believe that if a force acts on an object it most move. Students also believe that when an object runs out of force, it stops

moving. In the topic, electricity and magnetism, students has misconception such as - all metals are attracted to a magnet, all silver colored items are attracted to a magnet, all magnets are made of iron., larger magnets are stronger than smaller magnets, the magnetic and geographic poles of the earth are located at the same place, the magnetic pole of the earth in the northern hemisphere is a north pole and the pole in the southern hemisphere is a south pole. There are other various topics in science text book which students has misconception.

Students acquire science misconceptions from a variety of sources. Inaccurate science concepts come from adults, media, and other educators. If students process the misinformation in order to make better sense of the natural and designed world, it becomes extremely difficult for them to forfeit the resulting misconception (National Research Council [NRC] , 2012). An important source of ideas is other people. Children acquire knowledge from their family and friends, from the magazines and books they read, the programs they see on television (as well as from radio, films, computer games and the internet). These sources are not always scientifically reliable. Students may simply have misunderstood what they heard (Gooding and Metz, 2011). Textbooks also give misleading information either through illustrations or written text (NRC, 2012). For example, an illustration of the planets in our solar system may be inaccurately scaled in order to fit on the page.

Textbooks provide incorrect written information such as water is a “good conductor” of electricity (Gooding & Metz, 2011). In this case, a clarification of distilled water versus tap water needs to be addressed, as the former would not be a good conductor due to the purity of the water. The belief that information in print (including electronic text) must be true is a misconception that should be challenged by teachers (NRC, 1997). There are times when topics are introduced when students are not developmentally or psychologically ready to learn them (Gooding & Metz, 2011). So it is recommend that teachers choose their lessons,

textbooks, and Internet sources wisely by assessing the age and comprehension level of the students.

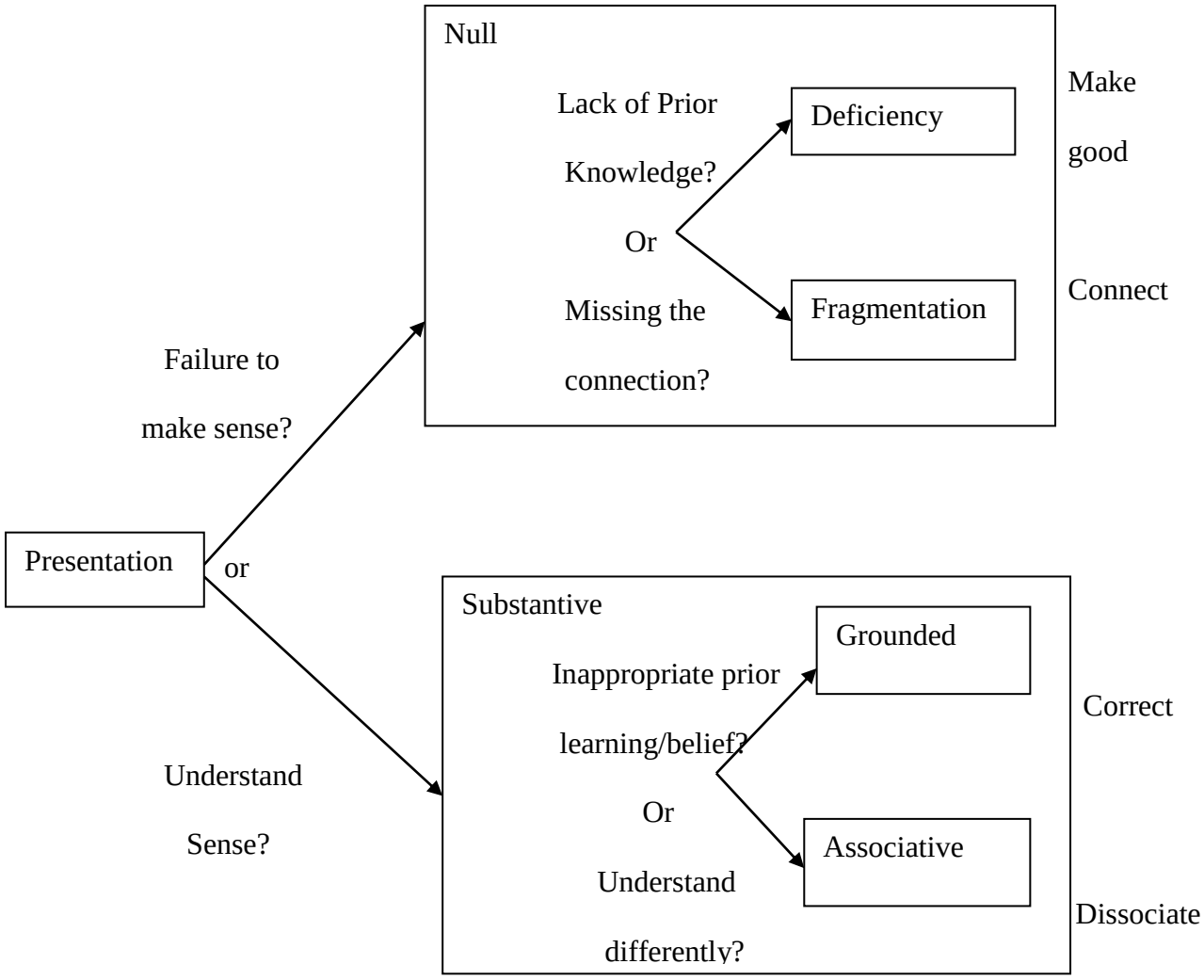

Figure-1, A typology of learning impediments. One way of thinking about how teaching can be misunderstood leading to «learning bugs» such as misconceptions, Source- http://people.pwf.cam.ac.uk/kst24/ScienceLearningDoctors.html.

Misconceptions can have serious impact on student learning. The prevalence of those misconceptions hinder students from learning more advanced concepts, and as they continue to build up knowledge, it becomes more difficult to rectify the misconceptions. If their initial understanding is not engaged, they may fail to grasp new concepts and information presented in the classroom, or they may learn them for purposes of a test but revert to their

preconceptions outside the classroom (Donovan, et. al., 1999). It is then important that the science teacher should find ways to identify and carefully address those misconceptions that students bring to class.

Therefore, this study entitled "Students' Misconception in Science at secondary level : A Quest of Exploration" aimed to find out the common misconceptions of grade 10 students in Science while comparing it with different variables and the sources of misconceptions.

Statement of the Problem

Misconception is an emerging issue especially in the field of science. There is high chance of developing misconception in science even among academically sound students. It has led to different falsified conception which ultimately affects the learning process of students and teachers also. This has become a great problem to the teachers to make their student develop a conceptual understanding of the related topics among students. Not only to the teacher, students are also getting problem to learn those broad scientific concept ultimately developing misconception In context of Nepal research related to misconception in science is neglected till today. Due to which Nepalese students has very poor scientific conceptual understanding. So, to address the problem in some extent, I decided to conduct a research entitled 'Students' Misconception in Science at secondary level : A Quest of Exploration'. This study is deliberately aimed at paving the way for further research on students conceptions as it have serious implications for students' achievement and curriculum development. For this study the underlying issues will be:

- Is there any misconception prevalent in grade X students which has affected the learning of students?
- What can be the possible sources of misconception in conceiving science concepts?

- Is the number of misconceptions correlated with gender and type of school they study?

Objectives of the Study

The main objective of the study is to identify the common misconception and its source of grade X students in Science. The specific objectives of the study are:

- To find out common misconceptions prevalent in grade X students.
- To examine the sources of misconception.
- To compare the level of misconceptions between male and female students.
- To compare the level of misconception between private and public school's students.
- To identify the correlation between the misconceptions in physics ,chemistry and biology.

Research Hypothesis

The research hypothesis of the study are as follows

- There is significance difference in the level of misconception in science between male and female students.
- There is significance difference between the level of misconception in science in Private and Public school
- There is strong correlation between the misconception in physics, chemistry and biology.

Research Questions

This research paper tries to answer the following questions;

- What are the common misconceptions among secondary level students in Science?

- What are the prevalent sources of misconception in science ?
- How do secondary level students develop misconceptions while studying science?
- Do the number of students having misconception correlated with gender and type of school?

Significance of the Study

The results of this study is significant in the sense that it will provide data to teachers and curriculum developers on the prevalent misconceptions of the students in science Moreover, the findings will serve as a guide for teachers in planning classroom activities that could address misconceptions, and thus, improve their students' conceptual understanding and facilitate the acquisition of advanced knowledge. Despite of its negative influence in the learning process, misconceptions related research has been neglected in Nepal till today. To fulfill this gap, this research paper attempts to point out some misconception prevalent among grade 10 students. It is expected that the findings of the study "Students' Misconception in Science at Secondary Level : A Quest of Exploration " will be helpful to secondary level science teacher to avoid falsified concept that students may carry. It is significant in the sense that it is helpful to make presumptions about the possible misconceptions that students' might have and acting wisely. This study will be helpful for all the stakeholders who are working in the field of education to get information about the misconception and its affect on learning. This study will also provide valuable information to the concerned policy makers to reform and improve the content which might create misconceptions. It will also provide an insight to the aspirant researcher in the future who desire to study in the field.

Delimitations of the Study

The delimitation of this study were as follows

- This study was delimited to secondary level students.

- This study was delimited to secondary science (Grade IX) text book including physics, chemistry and biology portion.
- The primary data of the study were collected by using a set of conceptual question items.
- The study was delimited to four schools - two public and two private schools of Tanahun district.

Limitations of the Study

The limitation of the study were as follows

- The study was carried out among 59 students only.
- The study consists of 30 set of questions which were constructed from physics, chemistry and biology portion of Grade-IX science text book.
- Questionnaire built in this research were from the text book of Grade-IX while sample students were taken from Grade-X students.

Definition of Terms

Misconception: Alternative conception which is scientifically unacceptable.

Prevalent Misconception: Misconception held by more than 10 % of the students.

Conceptual Understanding: Those understanding learned without having misconception.

Government School : The school run from the fund of government

Private School : The school run by the investment of an individual or a group of individuals on their own fund.

CHAPTER-II

Review of Related Literature

A review of literature is a summary, analysis and interpretation of the theoretical, conceptual and research literature related to a topic or theme (Anderson & Arsenault,1976). It is an effective research based upon past knowledge that is related to the research topic (Best and Kahn, 2000).

During the past years a lot of research studies about misconception has been carried out internationally with the aim to diagnose the common misconception prevalent in different level students. Furthermore, some attempt to remove the existing misconception has also been done to enhance the learning process.

Trowbidge and McDermott (1980) investigated "student understanding of the concept of velocity and acceleration in one dimension". Individual demonstration interviews, conducted with 200 university students, indicated that even after instruction, many students confused position with velocity and velocity with acceleration.

Ivowi (1984) examined the misconceptions in physics of 128 students from two secondary schools in Nigeria. He asked students to find out the explanation of the real situation about the conservation of momentum and approximately half of the sample gave incorrect responses to the question. In that study, Ivowi (1984) revealed that (although the concept of momentum was related to the mass and velocity) students related the conservation of momentum mistakenly only to the concept of velocity.

Halloun and Hestenes (1985) surveyed and analyzed “common sense” beliefs of college students. The researchers used multiple-choice diagnostic pretests and posttests, and conducted interviews. Examples of misconceptions are: that under no net force, an object slows down; that under a constant force, an object moves at constant speed; and, that an

impetus is required to maintain the motion of an object. From the result of the survey, a taxonomy of “common sense” concepts which conflict with Newtonian Theory was developed as a guide to instruction. This is part of a sequence that led to the development of the Force Concept Inventory (FCI).

Lawson and McDermott (1987) examined "Student understanding of the work-energy and impulse-momentum theorems" and found that many students have had difficulties in the interpretation of directly one-dimensional motion of the object to impulse- momentum and work-energy theorem.

Gunstone (1987) , conducted a survey of student understanding in mechanics in Australia. On a multiple-choice test given to 5500 high school students, a majority predicted that two equal masses on an Atwood’s machine would “seek” the same level.

McDermott, et.al.(1987) conducted a long term study entitled "identify student difficulties in relating kinematical concepts, their graphical representations, and the motions of real objects". The result of this study was used as a guide in developing a conceptual approach to teaching kinematics (McDermott & Rosenquist, 1987). Other studies were conducted by McDermott, et.al such as the investigation of student understanding of the work-energy and impulse-momentum theorems (1987), of the Atwood’s machine (1994), of light (1987), and of DC circuits (1992), which led to the development of the “Physics by Inquiry” modules (1996) and “Tutorials in Introductory Physics” (1996). These modules and tutorials have emphasis on the development and application of concepts and scientific reasoning skills.

The Asia-Pacific Physics Teachers and Educators Association (APPTEA) also conducted a survey of students’ conceptions in mechanics in seven Asia-Pacific countries (Gunstone, et.al., 1989). The survey covered 12 qualitative questions on force and gravity. It was found out that students in the countries involved (India, Korea, Malaysia, Philippines,

Thailand, Australia and Singapore) use ideas other than those taught in Physics to interpret situations. These ideas appeared to have been derived from students' interpretation of the world around them and from students' attempts to construct meaning from their everyday experiences. The idea that force is needed for motion was widely held. What was found to differ across some countries was the nature of some commonly misapplied physics principles. These include association of spinning with gravity (Australia), the invoking of an inertial force (Thailand), and the assertion that gravity exists only on earth (Malaysia). The findings may reflect something specific about physics education in the country – curriculum, textbook, or teacher knowledge - which can be determined only by further investigations.

Lee, et.al. (1992) surveyed some of the common misconceptions of force, gravity, heat and electricity among Malaysian pupils. The survey revealed that more than half of the pupils had the misconceptions that if a body is moving, then a force is acting in the direction of the motion, and if a body is stationary then there's no force acting on it. They also associated gravity with the earth's atmosphere, deducing that an object would be weightless on the moon because there is no atmosphere. About one-third of the pupils perceived heat as some form of a substance that can move. They also believed that some electric current is used up after it has flowed through a bulb in a circuit. This study showed that pupils still held certain misconceptions even after receiving classroom instruction

Khang (1995) carried a study entitled "Gender Difference, Misconceptions and Instruction in Science" . The relationship between gender and students' misconceptions in science was analyzed. The study was conducted on two groups of secondary three students (third year high school) from Singapore, both of which consisted of males and females. The two groups were subjected to different teaching strategies for six weeks, namely, teaching strategy 1, which is basically didactic in nature, and teaching strategy 11, which incorporates students' misconceptions and applies the Generative Learning Model. A constructed and

validated diagnostic instrument was used as a means to measure the effectiveness of these two teaching strategies. The findings showed that gender differences did not relate well to students' misconceptions in science.

Graham and Berry (1996) conducted a research " students' understanding on momentum" which examined the development of 549 students' with 20 conceptual questions which involved the relationship of momentum with mass and velocity, vector nature of momentum, impulse in one dimension and the conservation principle of momentum in two dimensions for students at ages 17-18. They explained that according to their results students can be grouped into four categories: first one is those who are confused with the concepts. Second one is those who can understand the basic ideas, recognize relevant situations, and make calculations without knowing the relationships between momentum and impulse and the law of conservation of momentum. Third one is those who are progressing in the hierarchy further and can understand momentum as a vector quantity and apply the impulse-momentum theorem and the law of conservation of momentum in one dimensional problem. The last group is who completely comprehend the concept of momentum.

McDermott (1998) investigated " introductory university mechanics course" where more than 100 students in an introductory university mechanics course were given a short-answer test on concepts of force and motion. The test used a technique abbreviated as D.O.E. (demonstration, observation, explanation). The results revealed that the students, who had previously studied physics, had many incorrect ideas: a force will produce motion; a constant force produces constant velocity; the magnitude of the velocity is proportional to the magnitude of the force; acceleration is due to an increasing force; and in the absence of forces, objects are either at rest or slowing down.

Savinainen and Scott (2002) conducted a research study where the FCI was used to evaluate student learning after Interactive Conceptual Instruction was used in teaching

Mechanics in a Finnish upper secondary school. The most common specific conceptions found after instruction were the ideas that the last force to act determines motion, velocity is proportional to applied force, and greater mass implies greater force. On another occasion, Viiri (1996), as cited by Savinainen and Scott, compared the FCI scores of Finnish and American Students and concluded that the results are very similar.

Singh and Rosengrant (2003) investigated "students' understandings of energy and momentum concepts in an introductory physics course". They constructed and administered a 25-item multiple choice test and also carried out individual interviews. According to the findings of the study, most students had difficulties in conceptually interpreting basic principles related to energy and momentum.

NRC (2008), a document that was written for mid-level teachers, administrators, and parents, emphasizes the practical side of how students best learn science. It includes strategies and instructions for teaching science effectively. This book identifies four strands for developing scientific literacy. These are,understanding science explanations, generating scientific evidence, reflecting on scientific knowledge, and participating productively in science.

DiSpezio (2010) "How to avoid Misconception" noticed that after being provided with multiple opportunities to explore misconceptions, students may proceed to the next step, being able to replace the misconceptions with accurate scientific concepts. Allowing the students to defend their ideas by posing questions that engage them in higher level thinking will help replace the old concepts with the new.

To sum up, various researches have already been conducted to investigate students' misconceptions in science and to test the effectiveness of different teaching strategies in altering those misconceptions. In this study, the researcher wishes to investigate

misconceptions in Science among grade-x, secondary students in public and private school of Myagde-4, Tanahun and compare these with the findings of previous research studies.

Theoretical Framework of the Study

The theoretical framework and philosophical aspect of this research are misconception related theory such as cognitivism, constructivism and conceptual change theory.

Constructivist Theory

This theory assumes that humans construct their own knowledge, using their existing knowledge. The researchers believe that the constructivist theory of learning (Piaget, Dewey, Vygotsky) is useful to explain and predict how learners conceive of scientific ideas including their misconceptions. This theory believes that students construct knowledge by linking with what they already know or believe to be. For example, students are found believing that a negative ion is a electron deficient atom while positive ion to be an electron rich atom. This concept might have occurred due to their preconception. In this way new knowledge is acquired. This type of knowledge can be scientifically unacceptable and hence they develop misconception. So this theory is helpful to explain about the emergence of misconception in students.

According to constructivist theory, Learning occurs when a learner is actively involved in the learning process. Learning outcomes not only depends upon teacher's presentation, but also with the interactive results of the encountered knowledge. Learning is the product of self organization and reorganization of existing ideas. One of the main aims of science education is to make a meaningful understanding of science concepts. Constructivist approach seems to be effective in providing meaningful learning according to which learning take place only when the learner relates the new information to his already existing knowledge. Knowledge cannot be transferred by the teacher. Instead, students construct their

own understanding by making links between their previous ideas and new concepts through experience they acquire in school or daily life. These types of experiences can result in assimilation in which new knowledge is incorporated into existing cognitive structure or they can lead to disequilibrium in which experiences cannot be reconciled within the existing structure and accommodation, where cognitive structure is reorganized, occurs (Mondal, 2012).

Thus, from this point of view, learning is a process of conceptual change. For this reason, effective teaching requires the teacher to consider the wrong conceptions or the learner may fail to make the link between new knowledge and his existing structure (Taber, 2001). Therefore, to avoid misconceptions the cognitive level of the learners and their conceptual development which means the extent of prior knowledge about the topic necessary for learning new knowledge should be considered (Bodner, 1986).

Conceptual Change Theory

"Conceptual Change Approach" has been put forth by Posner, Strike, Hewson and Gertzog (1982). This approach represents a perspective that grounds on Piaget and Zeitgeist's views, yet it has been improved by Posner and his colleagues. The purpose of this approach, which is an alternative strategy based on Piaget's principles of assimilation, regulation and counterbalancing, is to encourage students to remove misconceptions in their minds, and instead learn scientific knowledge (Wang and Andre, 1991; Chambers and Andre, 1997). With conceptions which are particularly deeply rooted in one's cognitive structure, researchers using this theoretical model understand that a kind of conceptual revolution must take place in order for a new idea to replace the old one.

This model is based on constructivist theory in which knowledge acquisition is viewed as a constructive process that involves active generation and testing of alternative propositions (Cobern, 1996). Teaching science focuses on providing students with

opportunities in which they have cognitive conflict and they develop different structures based on their experience. Conceptual change can be accomplished if students are given opportunity to be aware of their ideas, to encounter ideas other than their own and to realize the deficiency in their reasoning. This can be promoted by group discussions which allow students to construct their own knowledge out of exchanges with their friends and the teacher. In this way, students can control their learning and understanding of the content thereby removing misconceptions (Gall and Gall, 1990; Hogan, Nastasi, and Pressley,2000).

Cognitive Theory

Cognitive theory has been described by different philosophers (Piaget, Bloom, Bruner, Ausubel) in different cognitive conditions. Cognitive theory mainly stresses the gaining of knowledge and growth of the mental structure. It tends to focus on conceptualizing the student's learning process: how information is received; how information is processed and organized into existing schema; how information is retrieved upon recall. In other words, cognitive theory seeks to explain the process of knowledge acquirement and the subsequent effects on the mental structures within the mind.

Since learning of student is cognitive in nature, it is therefore helpful to explain the learning of misconception by students in the lens of cognitive theory. Some aspects of thinking may well reflect the structure of the human cognitive apparatus The notion of misconceptions as part of a cognitive framework suggests that an individual’s conceptual structure can account for her productions in the classroom, and that shifts in conceptual structure can account for learning and could be considered ’intuitive’.

Conceptual Framework of the Study

The conceptual framework of the study is as follows:

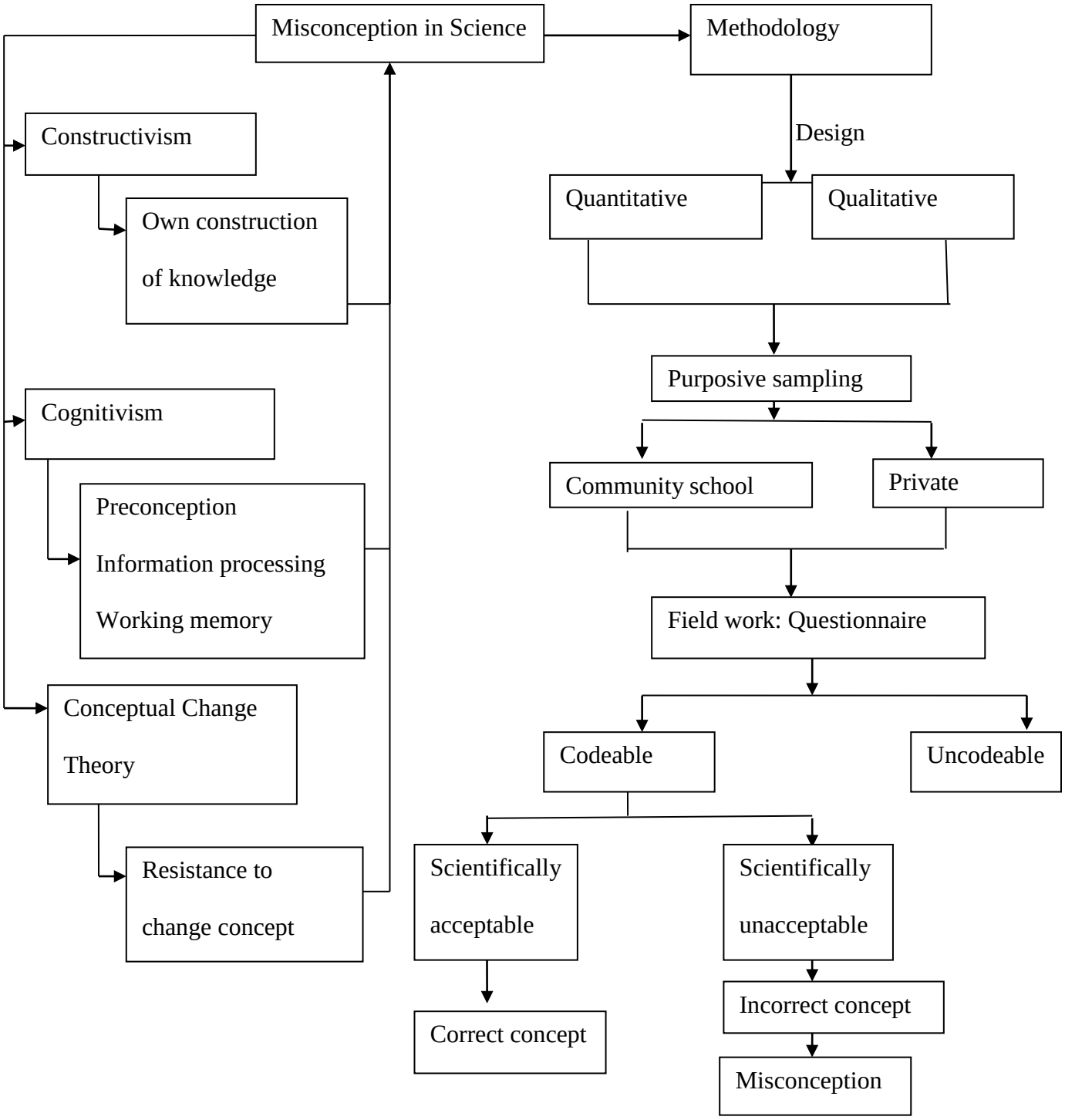

Figure: Conceptual framework of the research "Students' misconception in science at secondary level : A quest of exploration".

CHAPTER-III

Methodology of the Study

This chapter on methodology of the study briefly describes the methods and procedures that was adopted to carry out this study.

Design of the Study

The study is based on the mixed method which involves both quantitative and qualitative research design (Quan-qual) with the use of descriptive, comparative and correlational statistics using the data obtained from the set of conceptual questions.

Sources of Data

Both primary and secondary sources of data have been used in this research.

Primary sources

The primary sources of data were collected from the students of grade X using different sets of conceptual questions which students had to answer with appropriate source of their knowledge from the given options so that the sources of misunderstanding is understood clearly.

Secondary sources

The secondary sources of data for the study were related books, journals articles, website, and result from the previous studies in the related field.

Population and Sample of the Study

The study was intended to find out the common misconception among grade 10 student of Tanahun district. The population of the study were all the secondary school in Tanahun district where Science text book has been used for teaching material for teaching science. The sample of the study were four schools -two government schools and two private

schools of Myagde village council and vyas municipality which was selected by purposive sampling.

Table-1, Sample size of the study in academic year 2074

	Private Schools (N=27)		Community Schools (N=32)	
School Gender	New Vision Public Academy	Damauli Higher Secondary School	Min Higher Secondary School	Shree Janaganapati Secondary School
Male	9	7	7	11
Female	6	5	6	8
Total	15	12	13	19
Grand total	59			

Sampling Procedure

A purposive sampling technique was used in order to select the school from the defined population. The lists of the students from the selected schools were selected by simple random sampling method.

Study Area

The study area for this research is Tanahun District. The researcher has selected this area for her convenience as Tanahun district is her home town .It is located in Gandaki zone of western development region of Nepal. The area of the district is 1546 sq. km. According to the population census 2068, the total population of the district is 3,42,745. The new structure of local government consists of four municipality and seven village council, out of which researcher selected one municipality and one village council. One school from vyas municipality and three schools from myagde village council has been selected.

Tools for Data Collection

The tools used in this study for identifying the misconception was through the questionnaire. A set of 30 conceptual questions were given to the students where student had to give reasons to identify their source of knowledge, with their answers. Each item of the misconception test consisted of

(a) multiple-choice question with common or suspected misconceptions used as the distracters of the question so that the misconceptions could in some sense be summarized

(b) multiple-choice reasons to identify the source of misconception which required students to give their reasons for the answer which they had chosen in order to analyze their misconceptions; and

(c) an open option for students to respond to, if their answers were none of the options given for the purpose of identifying more possible sources of misconceptions held by the students.

Validation of the Tools

The developed tools were presented among teachers, supervisor and experts. The valuable suggestions from the above personnel was acknowledged and the tools were modified accordingly. The test items were piloted in a school named Pragya Jyoti Secondary School, located in Banasthali, Kathmandu for further validation.

Item Analysis

The test items were selected by checking the P-value and D- value of each prepared items. Only those items were selected whose P-value were ranging from 30 to 80 percent and D- value 0.20 to 0.80. Very difficult and very easy items were omitted according to p-value and D-value.

Item Difficulty(P)

Item difficulty is simply the percentage of students taking the test who answered the item correctly. The larger the percentage getting an item right, the easier the item. The higher

the difficulty index, the easier the item is understood to be (Wood, 1960).The proportion for the item is usually denoted as p and is called item difficulty (Crocker & Algina, 1986). An item answered correctly by 85% of the examinees would have an item difficulty, or p value, of 0.85, whereas an item answered correctly by 50% of the examinees would have a lower item difficulty, or p .It is calculated by

Item difficulty index(P) = $\frac{R}{T} \times 100\%$

Where,

P = Item difficulty index

R = Number of students giving correct answer

T = Total number of study taken for the study

Difficulty Level	**Remarks**
30% to 80%	Accepted
Below 30% and Above 80%	Rejected

Discriminating Index(D)

Item discrimination refers to the ability of an item to differentiate among students on the basis of how well they know the material being tested. The higher the discrimination index, the better the item because such a value indicates that the item discriminates in favor of the upper group, which should get more items correct value of 0.50. It ranges from +1 to -1. It is calculated by

Index of discrimination(D) = $\frac{R_u - R_L}{T/_2}$

Where,

D = Discrimination Index

R_u = Number of students in upper group giving correct answer

R_L = Number of students in lower group giving correct answer

T = Total number of students in upper and lower group

Discrimination Index	Remarks
0.40 to above	Excellent
0.30 to 0.39	Good
0.20 to 0.29	Normal, Acceptable
0.19 to below	Rejected

Data Collection Procedure

The main aim of this study is to identify the common misconception prevalent in the secondary level student especially based on Grade X students. Therefore this research had adopted the following data collection procedure to complete this study:

- The school to be taken as sample was visited at first and asked the concerned authority for their permission to carry out the research activities.
- The students were informed about the research and they were addressed about what their role was in the research.
- The questionnaire already prepared, was given to the students to express their ideas regarding the subject matter.
- The answer papers were checked and data were collected from the paper and coded accordingly.

Data Analysis and Interpretation

The collected data were coded and they were analyzed by descriptive, logical and statistical devices with the use of SPSS 20 software. Misconception in science and sources of misconception were analyzed according to students' responses with the use of percentage and mean. The comparison of misconception of students according to gender and type of school were analyzed by using statistical tools such as mean, standard deviation, variance and T-test.

The correlations of students' misconceptions in physic, chemistry and biology were separately analyzed using Pearson's Product moment correlation

CHAPTER– IV

Analysis and Interpretation of Data

This chapter, entitled as "Presentation and analysis of data", constitutes the most crucial part of the study. It provides a mechanism for meeting the basic objectives stated earlier in the first chapter in the research. In this chapter, collected data have been analyzed and presented mathematically..

The main objective of this study is to find out the common misconception prevalent among secondary level students and the source of misconception. The survey instrument consisted of 30 questions which were based on the curriculum of Grade IX. Questions were chosen according to researcher's own perception about misconception. Responses from the students studying in Grade X were taken and result were analyzed thoroughly. This chapter emphasizes the detailed analysis and interpretation of misconception of students in physics, chemistry and biology with the use of survey instruments under the following headings

- Common Misconceptions prevalent in Grade X students in physics chemistry and biology.
- Possible Sources of Misconception.
- Comparison of no. of Misconceptions held by students with gender and type of school.
- Correlations between misconception in physics, chemistry and biology

Common Misconceptions Prevalent in Grade X Students

In this research study, there were 59 students selected for the research study for the purpose finding out some common misconception in science. Among them, 32 students were from community school and 27 students were from private school. Likewise, 34 male and 25 female students were participated in this study. Those concepts with possibility of having

misconception were constructed from physics, chemistry and biology portion of Grade IX Science text book. There were 10 items for each discipline i.e. physics, chemistry and biology.

Among 59 students, 26 students had misconception in physics and the remaining 33 students had a correct concept of science in physics discipline Similarly, 29 students had misconception in chemistry while 30 students had a correct concept. Likewise, 21 students had a misconception in biology and the remaining 48 students had a correct concept. The detail of these data is shown in the following bar-graph.

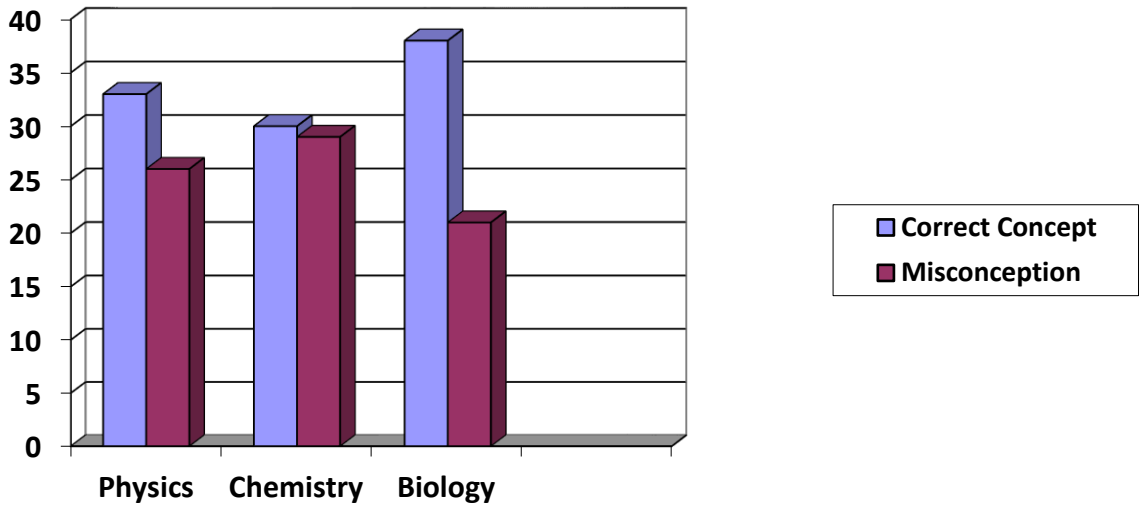

Figure-1, Bar diagram of Students with correct concepts and misconceptions in physics, chemistry and biology.

Each questions from 1-30 were tabulated according to the students' responses. The data were derived from the students' responses but only the alternative ideas and beliefs were used to tabulate these data. The below tables represents only the responses from those students who had misconceptions. Answers with no reasons and inconsistent answers that did not provide a logical clue to students' thinking, were not presented in these tables. Correct concept responses were also not mentioned in these tables The following table shows the

detailed analysis of item wise misconception of students based on the questions from physics, chemistry and biology.

Misconception of Science students in Physics

Table-2, Item wise misconception of Science students in Physics

Theme of Questions	No. of students with prevalent Misconception in Physics				
	Community School	Private School	Overall		
	Total	Total	Male	Female	Total
1)Velocity at maximum height	10	8	12	6	18 (31%)
2)Value of 'a' when thrown upward	18	12	16	14	30 (51%)
3)Air resistance on Earth	12	12	12	12	24 (41%)
4)Newton's 2nd law of motion	17	17	19	15	34 (58%)
5)Energy conservation in green plant	8	10	11	7	18 (31%)
6)Echo in small room	7	4	8	3	11 (19%)
7)Refraction of light	16	13	20	9	29 (49%)
8) Effecting factors of resistance	18	17	19	16	35 (59%)
9)Magnetic and Geographical poles on earth	14	10	16	8	24 (41%)
10)Affecting factors of resistance	20	18	24	14	38 (64%)
Mean	14	12.1	15.7	10.4	26
Percentage	44%	45%	46%	42%	44%

Note: Complete questions are given in the appendix.

Table -2 shows that in physics, 26 (44%) students in average had misconception in the given questions. Both community school and private school had almost same level of misconceptions in physics i.e. 44% and 45% respectively. The level of misconception were found greater in male students (46%) than that of female students (42%). The question about affecting factors of resistance had the highest number (64%) of students with misconception.

Both the community school and private school students had maximum no. of misconception from the same question which was - "If the length of a conducting wire increases, the resistance of the wire will: a) decrease b) increase c)no change d)becomes irregular". Out of 59 students, 20 students from community school and 18 from private school had misconception in this question. In addition, most of the male students had misconception in the same question about factors of resistance. Whereas, most of the female students had misconception in the question - " Which of the following factor does not affect resistance? a)thickness of wire b)Type of wire c) pressure on wire d)Temperature of wire". The item with least no (19%) of misconception was about the echo in small room which was.- Echo is not heard in a small room because a) the air inside the room is insufficient b) the temperature is not suitable to cause echo c) light is absence inside the room and d) the source of sound and the reflecting body is less than 17 m apart. For both genders and schools, the least number of students with misconception was found in the question about the echo in small room. It seem that most of the students had weak conceptual understanding in the chapter "current and electricity" and strong conceptual understanding in the chapter "Sound".

The result showed that physics had also some prevalent misconceptions deeply rooted among students. As suggested by the theory of constructivism, students construct the concepts of physics by linking with their own existing knowledge. The conceptual change theory also has revealed that in order to attain a new concepts, the existing schema of thoughts should cooperate with the new thoughts. In context of physics, these theories need to be applied to generate a correct conceptual understanding of students. The cognitive structure also plays an important role to settle the deeply rooted misconceptions as well as correct conceptions. Hence, teacher and educators should engage in discussions to remove misconceptions of students.

Misconception of Science students in Chemistry

Table-3, Item wise misconception of Science students in Chemistry

Theme of Questions	No. of students with prevalent misconception in Chemistry				
	Community School	Private School	Overall		
	Total	Total	Male	Female	Total
11)Definition of Valency	6	12	13	5	18 (31%)
12)Neutrality of atoms	23	19	23	19	42 (71%)
13)Reactivity of K & Ca	20	19	20	19	39 (66%)
14)Saturated solution concept	14	15	12	17	29 (49%)
15)Solubility factors	14	15	14	15	29 (49%)
16)Solute and Solvent	13	12	11	14	25 (42%)
17)Heterogeneous mixture	10	15	17	8	25 (42%)
18)Reactivity of iron	13	9	13	9	22 (45%)
19)Components of Organic compounds	19	13	18	14	32 (54%)
20)States of water	13	15	12	16	28 (47%)
Mean	14.5	14.4	15.3	13.6	29
Percentage	45%	53%	45%	54%	50 %

Note: Complete questions are given in the appendix.

Table - 3 reveal that, in chemistry, 29 (50%) students had misconception in the given question. In average, 53% of private school students were found having misconception whereas only 45% of community school students were found having misconception in chemistry. The situation about neutrality of atom had the greatest number(42%) of students with misconception. Both the community school and private school students had difficulty with the above question. Nevertheless, both genders had the misconception in the same question. The question was- Atoms are electrically neutral because a) they have equal no. of

protons and neutrons b) they have nucleus at the centre of atom c) they have equal no. of positively charged particles and negatively charged particles d) they can react with any other substances. It seem that students had difficulty with the abstract nature of chemistry subject and were having problem to conceptualize atoms and its properties. The question with least number(18%) of misconception was - The definition of valency is a) the no. of valence electrons of an atoms b) the combining capacity of an atom c) the charge held by the atom d) the no. of total electron of an atom. Students may have a clear concept about valency but they may have learned the definition without conceptually understanding the term. The female students had also the same question with least misconception. The least number of male students had misconception about solute and solvent- In a solution containing 1 liter alcohol and 2 liter of water, identify the solute and solvent: a) solute is alcohol and solvent is water b) solute is water and solvent is alcohol c) anyone of them is a solute and another is a solvent d) none of them. They may have clearly understood the concept of solute and solvent because they can relate them with their daily life activities.

Chemistry is a subject based on concepts, many of which are abstract and are therefore hard to grasp and learn especially when the students are put in a position to believe without observing. On the other hand, students are basically familiar with a number of relevant concepts as a result of their previous learning (Roschelle, 1995). The potentially present preconceptions about the world itself can be reflected in the chemistry lessons and can sometimes grow into misconceptions. This might be the reason for having high number of students with misconception in chemistry. Teachers and educators should act as facilitator in helping students to construct a valid concepts and eliminate misconceptions with proper guidance.

Misconception of Science students in Biology

Table-4, Item wise misconception of Science students in Biology

Theme of Questions	No. of students with prevalent Misconception in Biology				
	Community School	Private School	Overall		
	Total	Total	Male	Female	Total
21)Components of NPK fertilizer	7	13	8	12	20 (34%)
22)Classification of dolphin and whale	13	14	15	12	17 (29%)
23)Cold-blooded animals	18	15	17	16	33 (56%)
24)Feeding habits of male mosquito	13	11	16	8	24 (41%)
25)Characteristics of Virus	16	12	18	10	28 (47%)
26)Nature of virus	12	14	14	12	26 (44%)
27)Vestigial organ	6	12	11	7	18 (31%)
28) Top consumers example	4	8	10	2	12 (20%)
29)Abiotic factors of ecosystem	3	10	7	6	13 (22%)
30)Components of artificial green house	2	3	1	4	5 (8%)
Mean	9.4	11.2	11.7	8.9	21
Percentage	29%	41%	34%	36%	35%

Note: Complete questions are given in the appendix.

Table - 4 shows that, in biology, 21 (35%) students had misconceptions in the given questions. 41% of private school students were found having more misconception in biology while 29.3% of community school students were found having misconception . The situation about cold-blooded animals had the greatest number of students having misconception. Both the community school and private school had falsified concept in the same question. Moreover, most of the female students were found having problem with the same concept of cold blooded animals. The question was - Cold blooded animals are those animals: a) whose body temperature is very cold and constant b) whose blood is cold and maintain constant

temperature c) whose body temperature changes with the change of environmental temperature d) whose blood color changes with change in environment. Students were found having poor concept about cold blooded animals. On the other hand, male student had problem about characteristics of virus. They got difficulty in analyzing the character of virus. The question was - Which of the following is the characteristic of virus? a) They can be seen with our naked eye. B) They are multicellular living being c) They do not show response to chemical, heat and temperature. d) They do not respire at all. The question with least misconception was - What is used to make an artificial green house? a) Plastic/glass b) Aluminum foil c) Ozone layer d) All of the above. It seem that students know very well about the materials needed to make green house. Male students had least misconception in the same question whereas female students had misconception about top consumer examples which was - Which of the following is a top consumer? a) jackal b) tiger c) fox d) wolf. Female students were seen having difficulty to conceptualize the top consumers.

The construction of knowledge by students in biology is more easier as they can relate the concepts used in biology with their life experiences. Hence misconceptions in biology is lower in comparison to other disciplines of science. However, there is still some misconceptions prevalent among students. The multiple factors contribute in varying degrees to the acquisition and retention of student misconceptions in biology. It is imperative that we as educators identify sources of student biological related misconceptions, identify or develop strategies to reduce or eliminate such misconceptions, and implement these strategies at the appropriate junctures in students' cognitive development.

Graphical representation of average percentage of misconception in physics, chemistry and biology

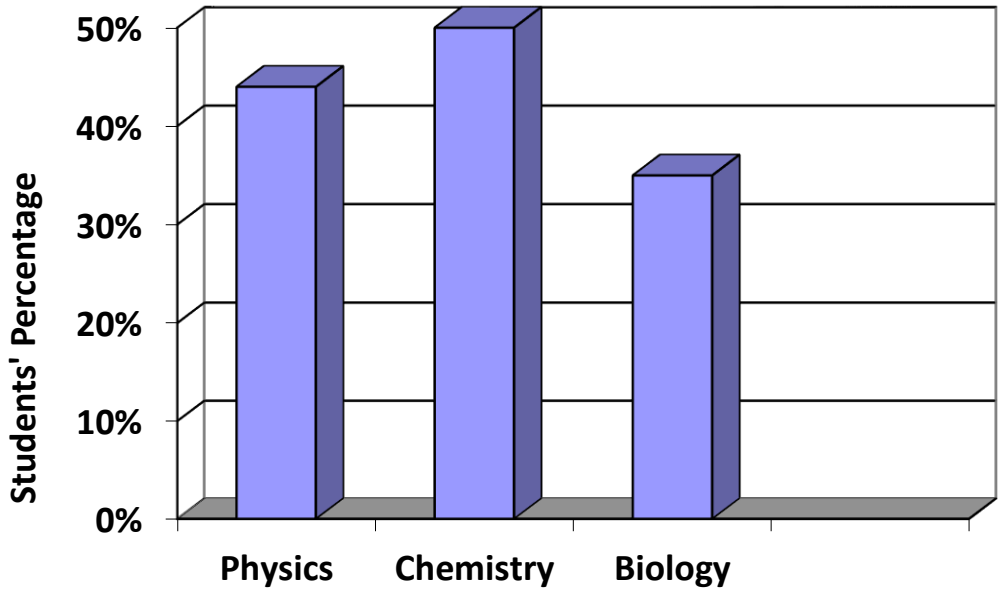

Figure-2, Bar diagram of average percentage of students with misconceptions in physics, chemistry and biology.

Figure-2 shows the level of misconception in science which includes physics, chemistry and biology portion. Among them, the students' developed a more falsified concept in chemistry (50%) than in physics (44%) and biology (35%) . This is more probable if the subject taught are abstract in nature as in chemistry. This can be a main reason for the highest no of students with misconception in chemistry. On the other hand, biology had a lowest no. of students with misconception.

Biology is a subject which students can relate with their life. Most of the contents in biology are relatable and can be conceived without having a great deal. Due to this reason, biology had the lowest no. of students with misconception. Students had moderate level of misconception in physics. This study suggest to accept the null hypothesis that there are some common misconception prevalent among science students.

Graphical representation of students having misconception in physics, chemistry and biology with gender

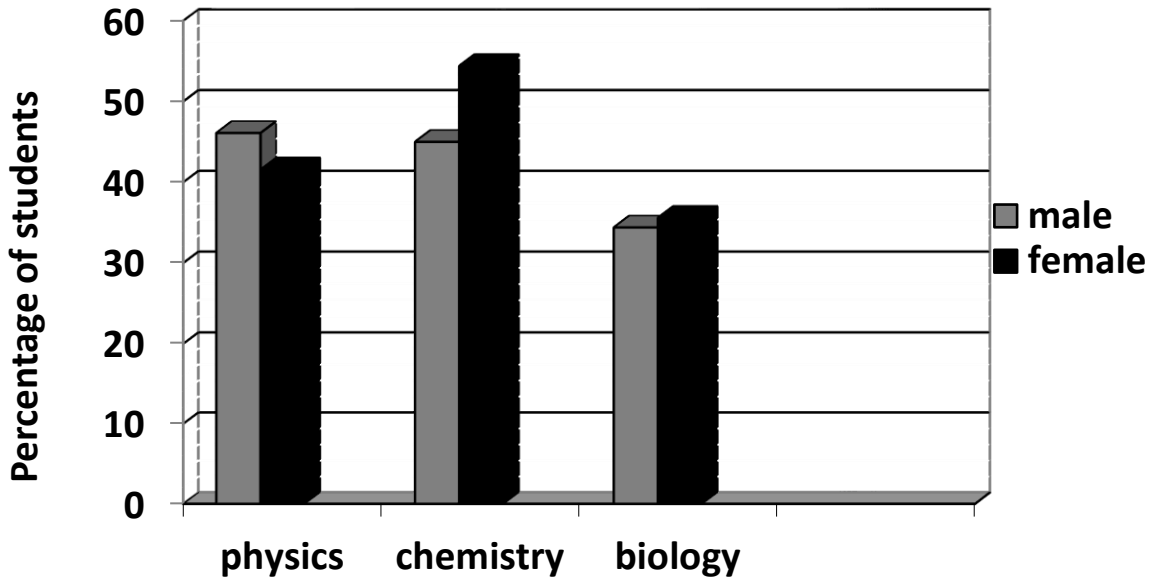

Figure-3, Bar diagram of students' misconception in physics, chemistry and biology with gender

Figure-3 shows the percentage of students having misconception with gender. In physics, male students had more misconception than female students. On the other hand, female students had more misconception than male students in chemistry. Similarly, in biology, female students had a more number of students with misconception than male students but the difference is less. This shows, in average, male students were less prone to misconception in chemistry and biology than female students while in case of physics, female students were less porn to develop misconception.

Graphical representation of students having misconception in physics, chemistry and biology with type of school

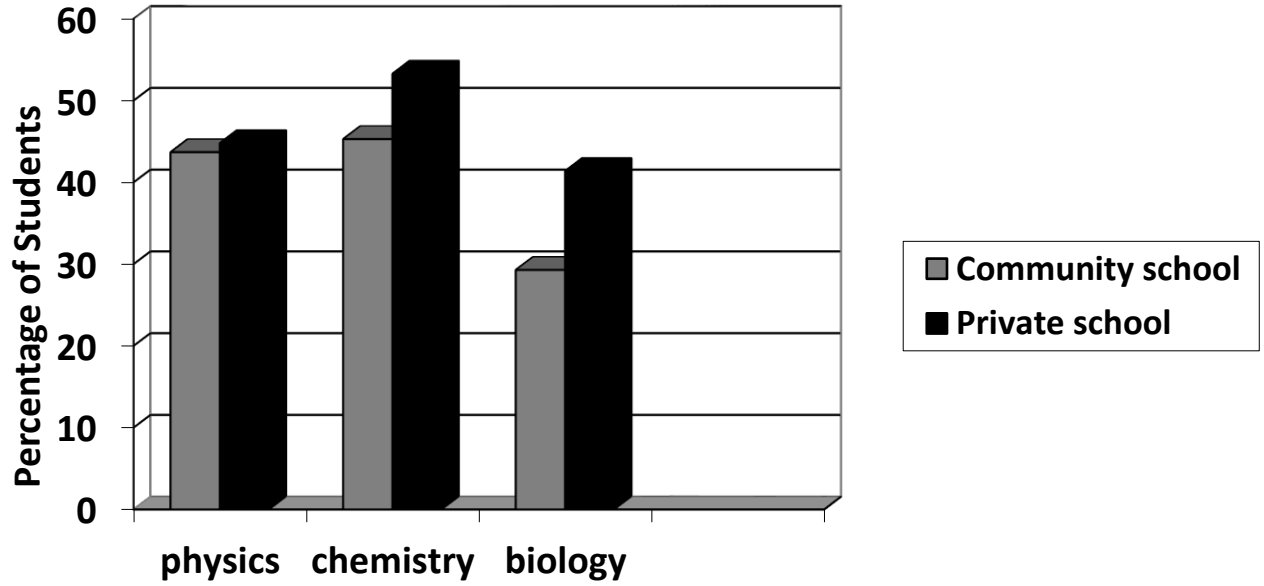

Figure-4, Bar diagram of students' misconception in physics, chemistry and biology with school type

Figure-4 shows the percentage of students having misconception in science with type of school. In context of physics, there was a slight difference in the misconception between community school and private school students. Private school students had more misconception than the community school students. While in chemistry portion, there was a more difference in the level of misconception. Community school students had less misconception than private school students. Similarly, there was a vast difference in the level of misconception between private and public schools' student in biology.

Possible sources of Misconceptions

Students were provided with 5 different options to find their source of misconceptions. Students had to choose from those option about how they learned the answer which developed misconception among students. If they learned the answer from teacher they had to tick the first option. If they had learned the answer from book or other related sources

as book, they had to tick the option second. Similarly, if they had intrinsic knowledge about the answer, they had to tick the option third. However if they did not know the answer and had no source of knowledge at all, then they had to tick the option fourth. The fifth option was for those sources which could not be addressed by the above sources. There was a blank given for this option so that they could mention their source. However, no one has mentioned +any other source then given. The following table shows a detailed analysis of sources of misconceptions in physics, chemistry and biology.

Sources of Misconception in Physics

Table-5, Sources of Misconception in Physics:

Sources of misconceptions	Question No.										
	1	2	3	4	5	6	7	8	9	10	Mean
i) You learned the answer from teacher.	3	4	6	5	3	3	6	3	1	6	4 (15%)
ii) You learned the answer from text book or other sources.	4	7	5	9	7	2	3	5	3	4	4.9 (19%)
iii) You had a intrinsic knowledge about the answer.	7	11	7	13	7	4	14	13	10	17	10.3 (39%)
iv) You selected the answer randomly.	4	8	6	7	1	2	6	14	10	11	6.9 (26%)
v) Other reasons	0	0	0	0	0	0	0	0	0	0	0
Total no. of students	18	30	24	34	18	11	29	35	24	38	26.1

Table-5 shows the sources of misconception in physics. Among the 5 options given to find the source of misconception, 39% of the students with misconception in physic, had chosen the third option. Most of the students source of falsified concept in physics was from their own intrinsic knowledge which they assume to be right. They have some kind of deeply

rooted thinking in their mind for every concepts and it is very hard to replace with the correct scientific knowledge. In average, the least chosen source of misconception was from the teacher. Teacher gives information but they are not found to be wrong source of information. The students may have got very few alternative sources of knowledge from teachers. The greatest no. of students having misconception was found to be in question no.10 which was about the concept of resistance of wire. They have mentioned their source of knowledge in this question to be from their own intrinsic knowledge. This misconception has aroused due to their own preconceived thoughts. The least chosen (15%) source of misconception in question no.10 was knowledge gained from teacher. Students may not read books to understand the concepts but they rely more on teachers or their own source of intrinsic knowledge.

Sources of Misconception in Chemistry

Table-6, Sources of Misconception in Chemistry:

Sources of misconceptions:	Question No.										
	11	12	13	14	15	16	17	18	19	20	Mean
i) You learned the answer from teacher.	5	7	6	3	5	3	2	7	3	2	4.3 (15%)
ii) You learned the answer from text book or other sources.	3	4	7	2	5	4	5	3	6	4	4.3 (15%)
iii) You had a intrinsic knowledge about the answer.	5	19	14	9	8	9	6	7	10	12	9.9 (34%)
iv) You selected the answer randomly.	5	12	12	15	11	9	12	5	13	10	10.4 (36%)
v) Other reasons	0	0	0	0	0	0	0	0	0	0	0
Total no. of students	18	42	39	29	29	25	25	22	32	28	28.9

Table - 6 shows the number of students with their sources of misconception in chemistry. Most of the students(36%) had chosen their source as random selection in. In fact, the 4th option do not really mean any source, but it is an option chosen without having any preconceived knowledge from any source. This might be due to the abstract nature of chemistry. The correct conceptual understanding of student is very hard to construct and hence they answer the questions randomly. Neither the teacher nor the book has sufficient description needed to construct correct concept among students. The least chosen source of misconception(15%) was from teacher and book. It proves student usually do not perceive wrong concept from teacher and books. The greatest no. of students having misconception was found in question no.12. which was about neutrality of atoms. In this question, most of the students had revealed their source of misconception to be their own intrinsic knowledge. Furthermore, the least chosen source of misconception in this question was found to be book i.e. less number of students' had misconception from book

Sources of Misconception in Biology

Table-7, Sources of Misconception in Biology:

Sources of misconceptions:	Question No.										
	21	22	23	24	25	26	27	28	29	30	Mean
i) You learned the answer from teacher.	2	2	3	3	4	3	3	3	5	1	2.9 (14%)
ii) You learned the answer from text book or other sources.	3	7	7	2	3	3	2	1	1	2	3.1 (15%)
iii) You had a intrinsic knowledge about the answer.	9	13	15	13	13	9	3	3	3	2	8.3 (40%)
iv) You selected the answer randomly.	6	5	8	6	8	11	10	5	4	0	6.3 (31%)
v) Other reasons	0	0	0	0	0	0	0	0	0	0	0
Total no. of students	20	27	33	24	28	26	18	12	13	5	20.6

Table-7 shows the sources of misconception in biology according to students' response. Most of the students (40%) had chosen their source of misconception to be from their intrinsic knowledge. It is obvious because biology is a subject which students can relate with their life experiences. Biology is much more systematic in their reasoning for agreeing or disagreeing with the ideas hence biology education itself is reinforcing these intuitive ways of thinking. The least chosen source of misconception (14%) was found to be from teachers. The greatest number of students having misconception in biology was found to be the question about the cold-blooded animals. Most of the students had chosen their source of misconception for this question to be from their own intrinsic knowledge. This proves that students had more misconceptions from their own intrinsic knowledge rather than from teacher and books.

Graphical representation of sources of Misconceptions in Physics, Chemistry and Biology

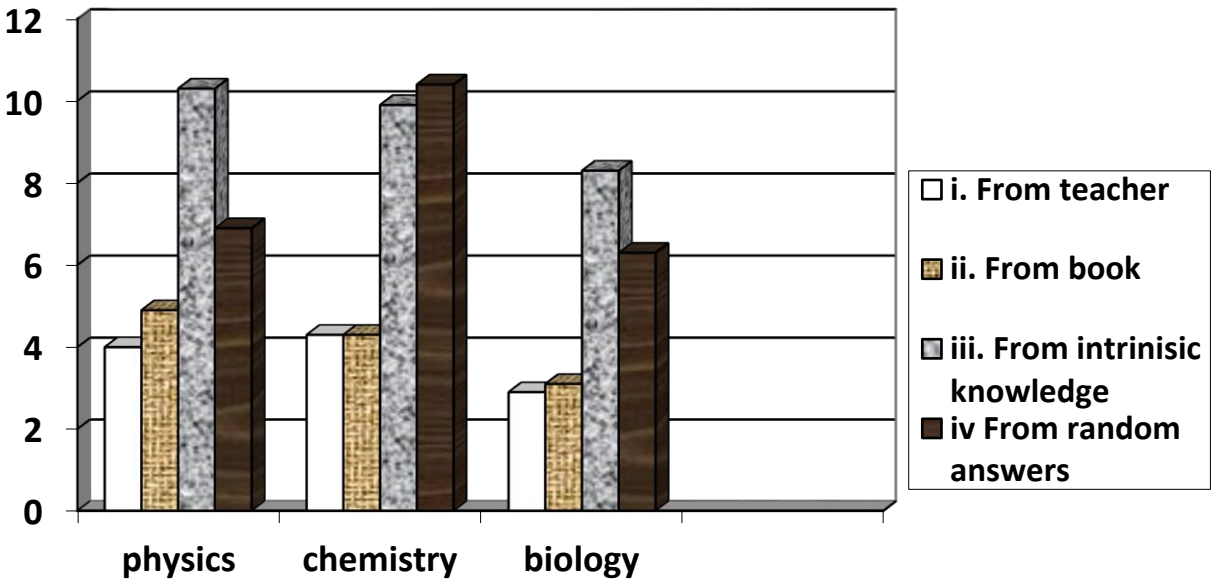

Figure-5, Sources of misconception in physics chemistry and biology.

Figure-5 shows that most of the students in all discipline of science had mentioned their source of misconception from their own intrinsic knowledge. Students enter science classes with many preconceived ideas. These preconceptions are often misconceptions in which students do not provide a correct description of scientific concepts. However, in chemistry the most prevalent source of misconception was found to be fourth option which was a random choice of answer without having preconceived ideas. The least chosen source in all discipline was misconception from teacher. This shows that teacher is a minimal source of misconception.

Comparison of gender wise misconception in physics, chemistry and biology

The number of misconceptions held by students in physics, chemistry and biology from the given set of questions were compared with gender. Statistical tools such as mean,

standard deviation, t-test were used to thoroughly analyze the results. The following tables are the detailed analysis of these statistical tools.

Comparison of gender wise misconception of students in Physics

Table-8, Group Statistic

Gender	N	Mean	Std. Deviation	Std. Error Mean
Male	34	4.62	2.060	0.353
Female	25	4.16	1.818	0.364

Table-9, Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Equal variances assumed	1.400	0.242	0.885	57	0.380	0.458
Equal variances not assumed			0.903	55.028	0.371	0.458

Table-8 and Table-9 reveal the comparison of gender wise misconception of students in physics. analyzed through the use of independent sample t-test. The difference in the misconception of male students (M=4.62, SD=2.060) and female students (M=4.16, SD=1.818) with conditions; t (57)=0.885, p = 0.38> 0.05 was found. Since the calculated P-value is greater than the standard p-value 0.05, it indicates that there is no significant association between gender and the number of misconceptions held. It also implies that the number of misconceptions held by the male students in physics does not significantly differ from the number of misconceptions held by the female students.

Comparison of gender wise misconceptions of students in Chemistry

Table-10, Group Statistics

Gender	N	Mean	Std. Deviation	Std. Error Mean
Male	34	4.50	1.656	0.284
Female	25	5.44	1.685	0.337

Table-11, Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Equal variances assumed	0.118	0.732	-2.139	57	0.037	-0.940
Equal variances not assumed			-2.133	51.353	0.038	-0.940

Table-10 and Table-11 shows the comparison of gender wise misconception of students in chemistry, analyzed through the use of independent sample t-test The difference in the misconception of male students (M=4.50, SD=1.656) and female students (M=5.44, SD=1.685) with conditions; t (57)=-2.139, p = 0.037 < 0.05 was found. Since the calculated P-value is less than the standard P-value 0.05, it indicates that there is significant association between gender and the number of misconceptions held in chemistry. It also implies that the number of misconceptions held by the male students significantly differ from the number of misconceptions held by the female students.

Comparison of gender wise misconceptions of students in Biology

Table-12, Group Statistics

Gender	N	Mean	Std. Deviation	Std. Error Mean
Male	34	3.44	2.063	0.354
Female	25	3.56	1.850	0.370

Table-13 , Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Equal variances assumed	0.318	0.575	-0.228	57	0.820	-0.119
Equal variances not assumed			-0.232	54.689	0.817	-0.119

Table-12 and Table-13 shows the comparison of gender wise misconception of students in biology, analyzed through the use of independent sample t-test . The difference in the misconception of male students (M=3.44, SD=2.063) and female students (M=3.56, SD=1.850) with conditions; t (57)=-0.228, p = 0.820 > 0.05 was found. Since the calculated P-value is greater than the standard P-value, it indicates that there is no significant association between gender and the number of misconceptions held in biology. It also implies that the number of misconceptions held by the male students does not significantly differ from the number of misconceptions held by the females.

Overall comparison of students' misconception in science with gender

Table-14, Group statistics

Gender	N	Mean	Std. Deviation	Std. Error Mean
Male	34	12.3529	4.15519	0.71261
Female	25	13.1200	3.59768	0.71954

Table-15, Independent sample Test

	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Equal variances assumed	0.001	0.971	-0.741	57	0.462	-0.76
Equal variances not assumed			-0.757	55.40	0.452	-0.76

Table-14 and Table-15 shows the comparison of gender wise misconception of students in science including physics, chemistry and biology, analyzed through the use of independent sample t-test. The difference in the misconception of male students (M=12.35, SD= 4.15) and female students (M=13.12, SD=3.59) with conditions; t (57)= - 0.754, p = 0.462 > 0.05 was found. Since the calculate P-value is greater than the standard P-value 0.05, it indicates that there is no significant association between gender and the number of misconceptions held in science. It also implies that the number of misconceptions held by the male students does not significantly differ from the number of misconceptions held by the females in science including physics, chemistry and biology. The null hypothesis is rejected

and the alternative hypothesis is accepted as there is no significant difference in the misconceptions of male and female students in science.

Comparison of the students' misconception on the basis of type of School

The numbers of misconceptions held by students in the given set of question were compared with type of school. The results obtained from the analysis of misconceptions from physics, chemistry and biology were separately analyzed. Statistical tools such as mean, standard deviation, t-test were used to thoroughly analyze the results. The following tables are the detailed analysis of these statistical tools

Comparison of the students' misconception in physics on the basis of type of school

Table-16,Group Statistics

Type of School	N	Mean	Std. Deviation	Std. Error Mean
Community School	32	4.38	1.897	0.335
Private School	27	4.48	2.064	0.397

Table-17, Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Equal variances assumed	0.005	0.942	-0.206	57	0.837	-0.106
Equal variances not assumed			-0.205	53.47	0.838	-0.106

Table-16 and Table-17 shows the comparison of students' misconception in physics on the basis of type of school analyzed through the use of independent sample t-test. The difference in the misconception of community school (M=4.38, SD=1.897) and private school (M=4.48, SD=2.064) with conditions; t (57)= - 0.206, p = 0.837> 0.05 was found. Since the calculated p- value 0.837 is greater than the standard p-value 0.05, it indicates that there is no significant association between community school students' misconception and private school students' misconception. It also implies that the number of misconceptions held by the community school students in physics does not significantly differ from the number of misconceptions held by the private school students.

Comparison of the students' misconception in chemistry on the basis of type of school

Table 18,Group Statistics

Type of School	N	Mean	Std. Deviation	Std. Error Mean
Community School	32	4.53	1.626	0.287
Private School	27	5.33	1.754	0.338

Table 19, Independent samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Equal variances assumed	0.237	0.628	-1.821	57	0.074	-0.802
Equal variances not assumed			-1.809	53.696	0.076	-0.802

Table-18 and Table-19 shows the comparison of students' misconception in chemistry on the basis of type of school analyzed through the use of independent sample t-test. The difference in the misconception of community school (M=4.53, SD=1.626) and private school (M=5.33, SD=1.754) with conditions; t (57)= - 1.821, p = 0.074 > 0.05 was found. Since the calculated p- value 0.074 is greater than the standard p-value 0.05, it indicates that there is no significant association between community school students' misconception and private school students' misconception. It also implies that the number of misconceptions held by the community school students in chemistry does not significantly differ from the number of misconceptions held by the private school students.

Comparison of the students' misconception in biology on the basis of type of school

Table-20,Group Statistics

Type of School	N	Mean	Std. Deviation	Std. Error Mean
Community School	32	2.94	1.585	0.280
Private School	27	4.15	2.179	0.419

Table-21, Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Equal variances assumed	4.636	0.036	-2.465	57	0.017	-1.211
Equal variances not assumed			-2.401	46.610	0.020	-1.211

Table-20 and Table-21 reveal the comparison of students' misconception in biology on the basis of type of school analyzed through the use of independent sample t-test. The difference in the misconception of community school (M=2.94, SD=1.585) and private school (M=4.15, SD=2.179) with conditions; t (57)= - 2.65, p = 0.017< 0.05 was found. Since the calculated p- value 0.017 is smaller than the standard p-value 0.05, it indicates that there is significant association between community school students' misconception and private school students' misconception. It also implies that the number of misconceptions held by the community school students in biology significantly differ from the number of misconceptions held by the private school students.

Overall Comparison of students' misconception in science on the basis of type of school

Table-22, Group statistics

Type of School	N	Mean	Std. Deviation	Std. Error Mean
Community School	32	11.6563	3.12750	0.55287
Private School	27	13.8889	4.44049	0.85457

Table-23, Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Equal variances assumed	5.723	0.020	-2.258	57	0.028	-2.23264
Equal variances not assumed			-2.194	45.61	0.033	-2.23264

Table-22 and Table-23 reveal the comparison of students' misconception in science on the basis of type of school through the use of independent sample t-test. The difference in the misconception of community school (M=11.65, SD=3.127) and private school (M=13.88, SD=4.44) with conditions; $t(57) = -2.258$, $p = 0.028 < 0.05$ was found. Since the calculated p- value 0.028 is smaller than the standard p-value 0.05, this suggest the conclusion that indeed, there is significant association between community school students' misconception and private school students' misconception. It also implies that the number of misconceptions held by the community school students in science significantly differ from the number of misconceptions held by the private school students. This gives a conclusion to reject the null

hypothesis and accept the alternative hypothesis that there is significant difference between the misconceptions held by community school students and private school students.

Correlation between students' misconception in Physics, Chemistry and Biology

Correlation between Physics and Chemistry

Table-24, Pearson's Product Moment coefficient of Correlation between physics and chemistry

Correlation between Physics and Chemistry			
		Misconception in Physics	Misconception in Chemistry
Misconception in Physics	Pearson Correlation	1	0.090
	Sig. (2-tailed)		0.499
	N	59	59
Misconception in Chemistry	Pearson Correlation	.090	1
	Sig. (2-tailed)	.499	
	N	59	59

Table-24 shows the correlation between misconception in physics and chemistry. A Pearson product-moment correlation coefficient was computed to assess the relationship. The value was computed as r = 0.090, n = 59, p = 0.499.Since the pearson's correlation value (r) was 0.090, there was a very small positive correlation between these two variables. A scatter plot below summarizes the results (Figure 6). Overall, there was a very small, positive correlation between number of misconception in physics and number of misconception in chemistry. Increase in misconception in physics does not significantly increases the number of misconception in chemistry.

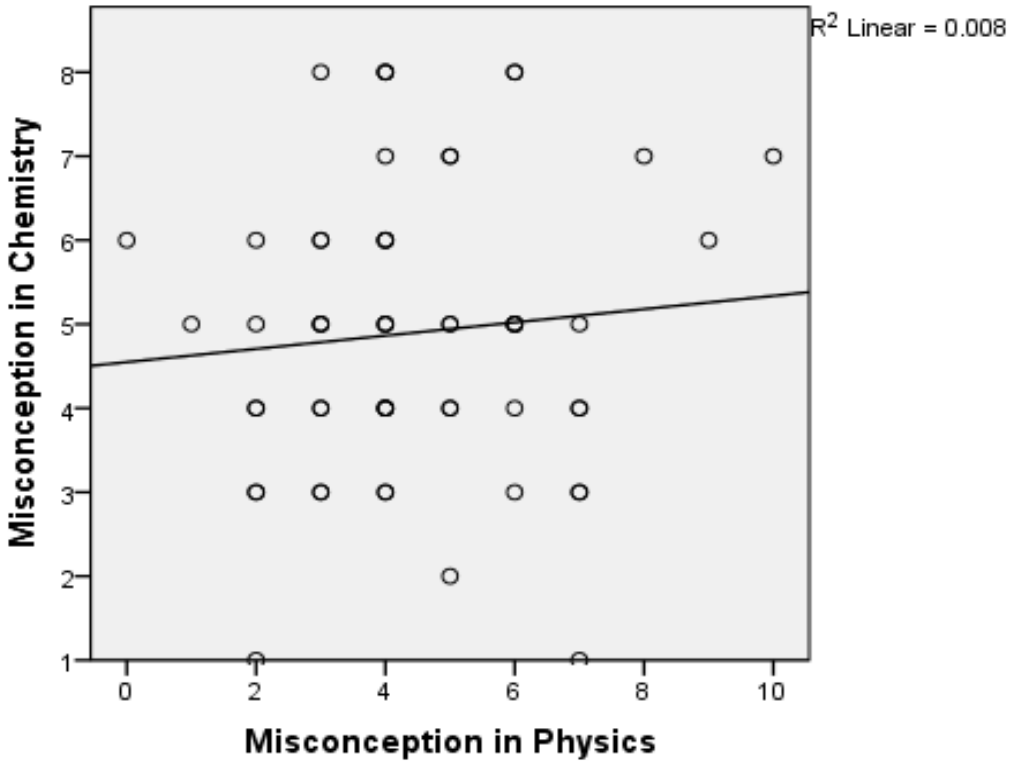

Figure-6, Scatter plot showing a very small positive correlation between misconception in Physics and Chemistry

Correlation between Chemistry and Biology

Table-25, Pearson's Product Moment Coefficient of Correlation between chemistry and biology

Correlation between Chemistry and Biology			
		Misconception in Chemistry	Misconception in Biology
Misconception in Chemistry	Pearson Correlation	1	0.547**
	Sig. (2-tailed)		0.01
	N	59	59
Misconception in Biology	Pearson Correlation	0.547**	1
	Sig. (2-tailed)	0.01	
	N	59	59

Table -25 shows the correlation between misconception in chemistry and biology. A Pearson product-moment correlation of coefficient was computed to assess the relationship. The value was computed as r = 0.547, n = 59, p = 0.01. Since the pearson's correlation value (r) was 0.547, there was a medium positive correlation between these two variables A scatter plot below, summarizes the results (Figure 7). Overall, there was a moderate, positive correlation between number of misconception in chemistry and number of misconception in biology. Increase in misconception in chemistry increases the number of misconception in biology.

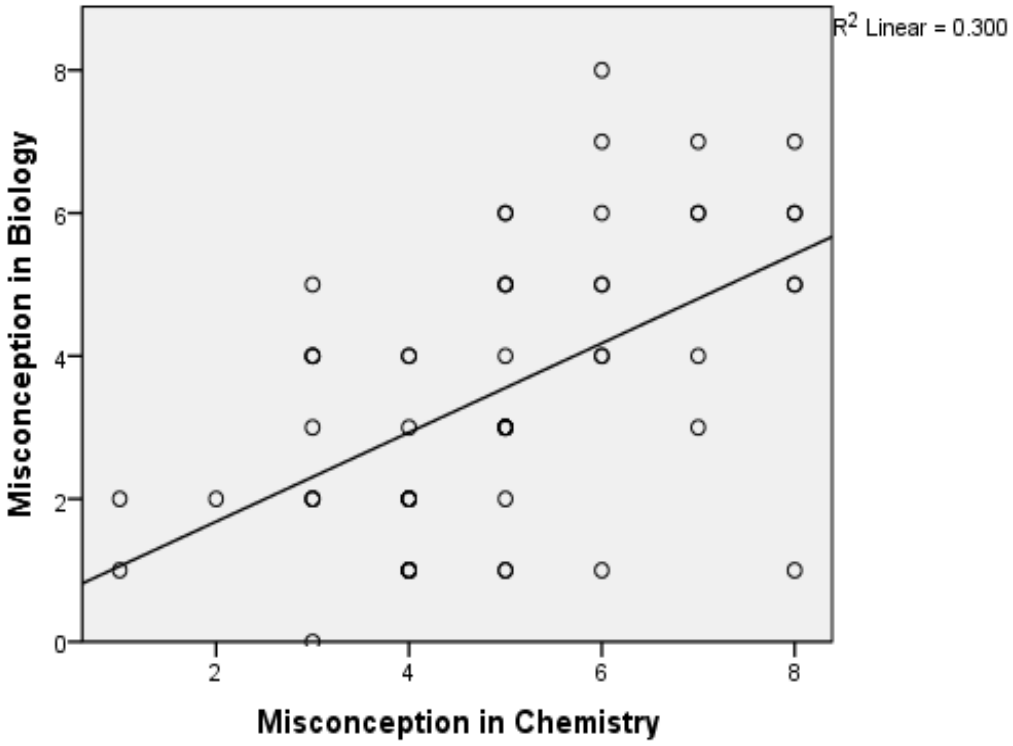

Figure-7, Scatter plot showing a moderate positive correlation between the misconception in Chemistry and Biology

Correlation between Physics and Biology

Table-22, Pearson's Product Moment Coefficient of Correlation between physics and biology

Correlation between Biology and Physics			
		Misconception in Biology	Misconception in Physics
Misconception in Biology	Pearson Correlation	1	0.026
	Sig. (2-tailed)		0.847
	N	59	59
Misconception in Physics	Pearson Correlation	0.026	1
	Sig. (2-tailed)	0.847	
	N	59	59

Table -25 shows the correlation between misconception in physics and biology. A Pearson product-moment correlation of coefficient was computed to assess the relationship. The value was computed as, r = 0.026, n = 59, p = 0.847. Since the pearson's correlation value (r) was 0.026, there was a negligible correlation between these two variables. A scatter plot below summarizes the results (Figure 8). Overall, there was a very negligible correlation between number of misconception in physics and number of misconception in biology. Increase in misconception in physics does not significantly increases the number of misconception in biology.

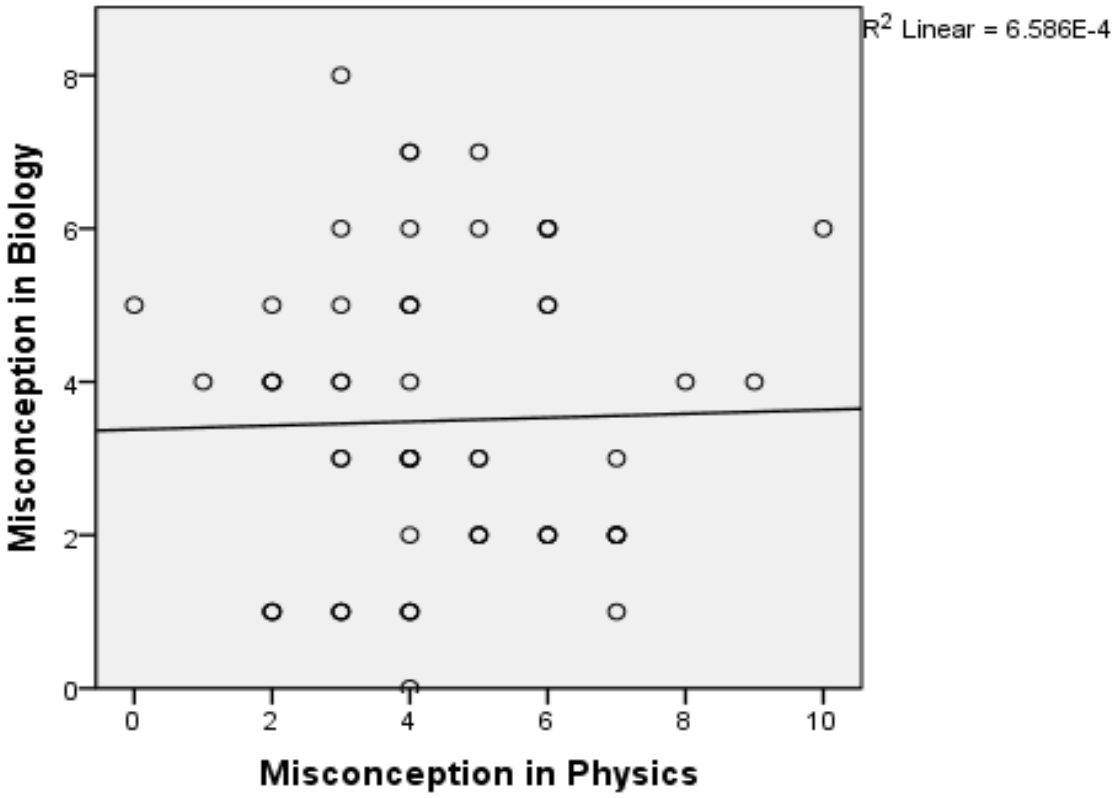

Figure-8, Scatter plot showing negligible correlation between the misconception in Physics and Biology

CHAPTER -V

Findings, Conclusions and Recommendations

Summary of findings

After the analysis and interpretation of the collected data an attempt has been made to summarize and enlist the findings and some recommendations for further study. The first section presents the findings of the study. The second section includes its conclusion and the last section provides the suitable recommendations based on the findings of the study.

Findings of the study

The main findings of the study are

- Out of 59 students, in average, 26 (44%) students had misconception in physics, 29 (50%) students had misconception in chemistry and 21 (35%) students had misconception in biology.
- In physics, both community school students and private school students had almost same level of misconception i.e. 44% and 45% respectively while most of the male students were found having misconception than female students i.e. 46% and 42% respectively..
- In physics, most of the students had misconception regarding the factors effecting the resistance while the least number of students had misconception in the question about the echo in a small room.
- In chemistry, community school students were found having less misconception than private school students i.e. 45% and 53% respectively. Furthermore, female students were found having more misconception than male students i.e. 54% and 45% respectively.
- In chemistry, the maximum number of students with misconception was in the question about neutrality of atom while the least number of students with misconception was in the question about the definition of valency.

- In biology, more students from private school were found having misconception than community school students i.e. 41% and 29% respectively while male and female students had nearly same level of misconception with a difference of only 2% i.e. 34% and 36% respectively
- In biology, the question with more number of students having misconception was in the question about the nature of cold blooded animals while the least number of students with misconception was in the question about the example of top consumer.
- In average, out of 26 students with misconception in physics, most of the students (10) had chosen their source of knowledge from their intrinsic knowledge while least number of students (4) had chosen their source of knowledge from teacher.
- In average, out of 29 students with misconception in chemistry, most of the students (10) had chosen their source of knowledge to be fourth option which was in fact a random choice while the least chosen (4) source of knowledge was from the teacher and from the book.
- In average, out of 21 students with misconception in biology, most of the students (8) had chosen their source of knowledge to be their own intrinsic knowledge while least number of students(3) had chosen their source of knowledge from teacher.
- Comparison of number of misconception with gender using t-test revealed that, there was no significant association between genders and the number of misconceptions in physics with conditions; $t(57)=0.885$, $p = 0.38 > 0.05$.
- Comparison of number of misconception with gender using t-test revealed that, there was significant association between gender and the number of misconceptions in chemistry with conditions; $t(57)=-2.139$, $p = 0.037 < 0.05$
- Comparison of number of misconception with gender using t-test revealed that, there was no significant association between genders and the number of misconceptions in biology with conditions; ; $t(57)=-0.228$, $p = 0.820 > 0.05$

- The overall comparison of number of misconception with gender using t-test revealed that, there was no significant association between genders and the number of misconceptions in science with conditions ; $t(57) = -0.754$, $p = 0.462 > 0.05$.
- An independent-samples t-test was conducted to compare no. of misconceptions in Physics with type of school which revealed that there was no significant association between the type of school and number of misconceptions held in physics with conditions; $t(57) = -0.206$, $p = 0.837 > 0.05$
- An independent-samples t-test was conducted to compare no. of misconceptions in Chemistry with type of school which revealed that there was no significant association between the type of school and number of misconceptions in physics with conditions; $t(57) = -1.821$, $p = 0.074 > 0.05$
- An independent-samples t-test was conducted to compare no. of misconceptions in Biology with type of school which revealed that there was no significant association between the type of school and number of misconceptions held in physics with conditions; ; $t(57) = -2.465$, $p = 0.017 < 0.05$
- The overall comparison of number of misconceptions in Science with type of school revealed that there was significant association between the type of school and number of misconceptions in physics with conditions; $t(57) = -2.258$, $p = 0.028 < 0.05$.
- A Pearson product-moment correlation coefficient was computed to assess the relationship between the misconception in physics and chemistry which showed a very small correlation between the two variables with conditions, $r = 0.090$, $n = 59$, $p = 0.499$.
- A Pearson product-moment correlation coefficient was computed to assess the relationship between the misconception in chemistry and biology which showed a medium correlation between the two variables with conditions, $r = 0.547$, $n = 59$, $p = 0.001$

- A Pearson product-moment correlation coefficient was computed to assess the relationship between the misconception in physics and biology which showed a negligible correlation between the two variables with conditions, $r = 0.026$, $n = 59$, $p = 0.847$

Conclusions

From the above findings, some important conclusions can be drawn. Most of the students in science has misconception which has affected the learning of students. This suggests the conclusion that there is some common misconception in science among secondary level science students.

The maximum number of students developed the falsified concept in chemistry portion which is followed by physics and biology. Most of the students' source of misconception in science was found to be from their own intrinsic knowledge.

The overall comparison of students' misconception with gender revealed that there was no significant difference in the misconception of male and female students. This suggests rejecting the null hypothesis that there is significant difference between the misconception among male and female students and accepting the alternative hypothesis. The overall comparison of students' misconception with type of school revealed that there was significant difference in the misconception of government school students and private school students. This indicates that there is significant difference between the misconception among community school students and private school students. The computation of correlation coefficient revealed that the correlation between physics and chemistry were not strong while chemistry and biology were at medium level and the correlation between biology and physics were negligible.

Recommendations

On the basis of the findings and conclusions, following recommendations are put forward for the betterment of the teaching science without misconceptions.

- The findings of this study can be used by teachers and curriculum developers in designing classroom activities and teaching strategies that could address the students' misconceptions found.
- Teachers can find ways of identifying students' misconceptions, such as the use of probes or formative assessment, to motivate students and to guide in the teaching process
- The special attention should be given for the development and refinement of tools used.
- Future research could investigate the effectiveness of a teaching method aimed to remove misconceptions that were identified in this study.
- Variables like student background, environmental factors, creativity e.t.c can be studied in relation of level of misconception among the students.
- It would be better to use conceptual questions asking students to give their reason for their answer so that more specific misconceptions in science can be identified.
- This study was limited only to certain area of grade ten students hence the researcher cannot generalize the findings of this study to all schools. So Similar researches be conducted, with emphasis on testing teaching strategies that could effectively alter students' misconceptions
- This study was conducted at four schools of Tanahun district. So to get a more valid and reliable result, it would be better to extend the research to nationwide.

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Appendix-A

A list of sample schools

1. New Vision public Academy, Myagde-4, Tanahun
2. Janaganapati Secondary school, Myagde-4, Tanahun
3. Shree Min higher secondary school, Myagde-4, Tanahun
4. Damauli Higher Secondary School, Vyas-4, Tanahun

Appendix-B

Statistical Formulae Used in the Analysis

1. Level of difficulty $P = \frac{R}{T} \times 100\%$

2. Discrimination Index (D) = $\frac{R_u - R_L}{T/2}$

3**. Mean (X) =** $\frac{\Sigma fx}{N}$

4. Standard Deviation (σ) $= \sqrt{\frac{\Sigma(X-X)2}{N}}$

5. Coefficient of varience = $\frac{\sigma}{x} \times 100\%$

6. Coefficient of correlation (r) = $\frac{n\Sigma XY - \Sigma X \Sigma Y}{\sqrt{n\Sigma X2 - (\Sigma X)2}\sqrt{n\Sigma Y2 - (\Sigma Y)2}}$

7. Independent Sample T-test (T) = $\frac{\left(\overline{X}_1 - \overline{X}_2\right) - \left(\mu_1 - \mu_2\right)}{S_{\overline{X}_1 - \overline{X}_2}}$

Where, $S_{\overline{X}_1 - \overline{X}_2} = \sqrt{\frac{S^2_{pooled}}{n_1} + \frac{S^2_{pooled}}{n_2}}$

Appendix-C

Co-relational Values and Description

Coefficient of correlation	Description
0.00 to 0.20	Negligible
0.20 to 0.40	Low
0.40 to 0.60	Moderate
0.60 to 0.80	Substantial
0.80 to 1.00	High or very high

Appendix-D

Questionnaire for Students' Misconception in Science at Secondary Level: A Quest of Exploration

Name: …… **Time: 1 hour**

School: Community ( ) Private ( )

Gender: Male ( ) Female ( )

Tick (✓) the best answer in the given questions. Also, tick (✓) the reason about why you chose the answer. If the given options do not match your reason, you can give your own response in the blank space in option (V) .

1. When a body is thrown vertically upwards, the final velocity at maximum height is :

   a) -10 m/s
   b) 9.78 ms
   c) 0 m/s
   d) 0.01 m/s

   ❖ Tick the reason ,why you choose the answer?

   i. You learned the answer from teacher.
   ii. You learned the answer from text book or other sources.
   iii. You had a intrinsic knowledge about the answer.
   iv. You selected the answer randomly.
   v. Other reason. (Please mention the reason)……

2. When a body is thrown vertically upwards, the acceleration will be equal to :

   a) +g
   b) -g
   c) g*h
   d) -a

   ❖ Tick the reason why you choose the answer:

   i. You learned the answer from teacher.
   ii. You learned the answer from text book or other sources.
   iii. You had a intrinsic knowledge about the answer.
   iv. You selected the answer randomly.
   v. Other reason. (Please mention the reason)……

3. A feather and a coin released at the same time from the same height do not reach the ground at the same time because of the

   a) Resistance of the air
   b) Force of gravitation
   c) Force of gravity
   d) Difference in mass

   - ❖ Tick the reason why you choose the answer:
     i. You learned the answer from teacher.
     ii. You learned the answer from text book or other sources.
     iii. You had a intrinsic knowledge about the answer.
     iv. You selected the answer randomly.
     v. Other reason. (Please mention the reason)……
     vi.

4. When a blanket is given a sudden jerk, the dust particles fall off because :

   a) Dust particles move along with the blanket
   b) It is natural process, so no particular reason to explain it
   c) Dust particles remain as it is whereas blanket moves from its position
   d) Due to the effect of gravity

   - ❖ Tick the reason why you choose the answer:
     i. You learned the answer from teacher.
     ii. You learned the answer from text book or other sources.
     iii. You had a intrinsic knowledge about the answer.
     iv. You selected the answer randomly.
     v. Other reason. (Please mention the reason)……

5. In a green plant which of the following conservation of energy takes place?

   a) Chemical into heat energy
   b) Light into chemical energy
   c) Light into heat energy
   d) Chemical into light energy

   - ❖ Tick the reason why you choose the answer:
     i. You learned the answer from teacher.
     ii. You learned the answer from text book or other sources.
     iii. You had a intrinsic knowledge about the answer.
     iv. You selected the answer randomly.

v. Other reason. (Please mention the reason)……

6. Echo is not heard in a small room because :
   a) the air inside the room is insufficient.
   a) the temperature is not suitable to cause echo
   b) light is absence inside the room.
   c) the source of sound and the reflecting body is less than 17 m apart.
      - ❖ Tick the reason why you choose the answer:
        i. You learned the answer from teacher.
        ii. You learned the answer from text book or other sources.
        iii. You had a intrinsic knowledge about the answer.
        iv. You selected the answer randomly.
        v. Other reason. (Please mention the reason)……

7. A swimming pool appears shallower than it really is because of the effect of:
   a) reflection of light
   b) refraction of light
   c) total internal reflection of light
   d) dispersion of light
      - ❖ Tick the reason why you choose the answer:
        i. You learned the answer from teacher.
        ii. You learned the answer from text book or other sources.
        iii. You had a intrinsic knowledge about the answer.
        iv. You selected the answer randomly.
        v. Other reason. (Please mention the reason)……

8. Which of the following factor does not affect resistance?
   a) thickness of wire
   b) type of wire
   c) pressure of wire
   d) temperature of wire
      - ❖ Tick the reason why you choose the answer:
        i. You learned the answer from teacher.
        ii. You learned the answer from text book or other sources.
        iii. You had a intrinsic knowledge about the answer.

iv. You selected the answer randomly.

v. Other reason. (Please mention the reason)……

9. The magnetic pole and geographical poles of the earth are located at the:

a) Opposite place to each other.

b) Same place to each other.

c) Centre of the earth.

d) None of the above

❖ Tick the reason why you choose the answer:

i. You learned the answer from teacher.

ii. You learned the answer from text book or other sources.

iii. You had a intrinsic knowledge about the answer.

iv. You selected the answer randomly.

v. Other reason. (Please mention the reason)……

10. If the length of a conducting wire increases, the resistance of the wire will:

a) decrease

b) no change

c) increase

d) become irregular

❖ Tick the reason why you choose the answer:

i. You learned the answer from teacher.

ii. You learned the answer from text book or other sources.

iii. You had a intrinsic knowledge about the answer.

iv. You selected the answer randomly.

v. Other reason. (Please mention the reason)……

11. The definition of valency is :

ii. You learned the answer from text book or other sources.

iii. You had a intrinsic knowledge about the answer.

iv. You selected the answer randomly.

v. Other reason. (Please mention the reason)……

12. Atoms are electrically neutral because :

a) they have equal no. of protons and neutrons.
b) they have nucleus at the centre of atom.
c) they have equal no. of positively charged particles and negatively charged particles
d) they can react with any other substances.

- ❖ Tick the reason why you choose the answer:
  - i. You learned the answer from teacher.
  - ii. You learned the answer from text book or other sources.
  - iii. You had a intrinsic knowledge about the answer.
  - iv. You selected the answer randomly.
  - v. Other reason. (Please mention the reason)……

13. Potassium is more reactive than calcium because

a) it has high nuclear power and smaller size.
b) it has high nuclear power and bigger size.
c) it has less nuclear power and bigger size.
d) its valency is higher than calcium.

- ❖ Tick the reason why you choose the answer:
  - i. You learned the answer from teacher.
  - ii. You learned the answer from text book or other sources.
  - iii. You had a intrinsic knowledge about the answer.
  - iv. You selected the answer randomly.
  - v. Other reason. (Please mention the reason)……

14. When a saturated solution is heated further, it becomes :

a) saturated
b) unsaturated
c) supersaturated
d) concentrated

- ❖ Tick the reason why you choose the answer:
  - i. You learned the answer from teacher.
  - ii. You learned the answer from text book or other sources.

iii. You had a intrinsic knowledge about the answer.
iv. You selected the answer randomly.
v. Other reason. (Please mention the reason)……

15. Which of the following does not affect solubility?

a) temperature
b) pressure
c) nature of solute and solvent
d) state of matter

❖ Tick the reason why you choose the answer:

i. You learned the answer from teacher.
ii. You learned the answer from text book or other sources.
iii. You had a intrinsic knowledge about the answer.
iv. You selected the answer randomly.
v. Other reason. (Please mention the reason)……

16. In a solution containing 1 liter alcohol and 2 liter of water, identify the solute and solvent:

a) solute is alcohol and solvent is water
b) solute is water and solvent is alcohol
c) anyone of them is a solute and another is a solvent
d) none of them

❖ Tick the reason why you choose the answer:

i. You learned the answer from teacher.
ii. You learned the answer from text book or other sources.
iii. You had a intrinsic knowledge about the answer.
iv. You selected the answer randomly.
v. Other reason. (Please mention the reason)……

17. Which of the following is a heterogeneous mixture?

a) salt solution
b) tincture of iodine
c) water and alcohol
d) muddy water

❖ Tick the reason why you choose the answer:

i. You learned the answer from teacher.
ii. You learned the answer from text book or other sources.
iii. You had a intrinsic knowledge about the answer.
iv. You selected the answer randomly.
v. Other reason. (Please mention the reason)……

18. Iron reacts with oxygen and moisture to form:

a) Hydrogen oxide
b) rust
c) steel
d) alloy

❖ Tick the reason why you choose the answer:

i. You learned the answer from teacher.
ii. You learned the answer from text book or other sources.
iii. You had a intrinsic knowledge about the answer.
iv. You selected the answer randomly.
v. Other reason. (Please mention the reason)……

19. Which element is present in all organic compounds?

a) Carbon
b) Nitrogen
c) Oxygen
d) Phosphorous

❖ Tick the reason why you choose the answer:

i. You learned the answer from teacher.
ii. You learned the answer from text book or other sources.
iii. You had a intrinsic knowledge about the answer.
iv. You selected the answer randomly.
v. Other reason. (Please mention the reason)……

20. The three states of water are :

a) Lake water, pond water, bath water
b) Solid, liquid, gas
c) Rain, cloud, ice
d) Hard water, soft water, cold water

- ❖ Tick the reason why you choose the answer:
  - i. You learned the answer from teacher.
  - ii. You learned the answer from text book or other sources.
  - iii. You had a intrinsic knowledge about the answer.
  - iv. You selected the answer randomly.
  - v. Other reason. (Please mention the reason)……

21. NPK fertilizers are a mixture of :

a) Nitrogen, potassium and phosphorous
b) Nitrogen and phosphorous
c) Nickel, Potassium and Krypton
d) Potassium and nitrogen

- ❖ Tick the reason why you choose the answer:
  - i. You learned the answer from teacher.
  - ii. You learned the answer from text book or other sources.
  - iii. You had a intrinsic knowledge about the answer.
  - iv. You selected the answer randomly.
  - v. Other reason. (Please mention the reason)……

22. Of the following classes, dolphin and whale lie in which class?

a) Pisces
b) Amphibia
c) Reptilia
d) Mammalia

- ❖ Tick the reason why you choose the answer:
  - i. You learned the answer from teacher.
  - ii. You learned the answer from text book or other sources.
  - iii. You had a intrinsic knowledge about the answer.
  - iv. You selected the answer randomly.
  - v. Other reason. (Please mention the reason)……

23. Cold blooded animals are those animals :

a) Whose body temperature is very cold and constant

b) Whose blood is cold and maintain constant temperature
c) Whose body temperature changes with the change of environmental temperature
d) Whose blood colour changes with change in environment.

- ❖ Tick the reason why you choose the answer:
  - i. You learned the answer from teacher.
  - ii. You learned the answer from text book or other sources.
  - iii. You had a intrinsic knowledge about the answer.
  - iv. You selected the answer randomly.
  - v. Other reason. (Please mention the reason)……

24. Male mosquitoes do not bite us because :

a) they don't need food for living
b) they are afraid of biting living beings
c) they are adopted for sucking on the sap of plants.
d) they cannot digest blood properly

- ❖ Tick the reason why you choose the answer:
  - i. You learned the answer from teacher.
  - ii. You learned the answer from text book or other sources.
  - iii. You had a intrinsic knowledge about the answer.
  - iv. You selected the answer randomly.
  - v. Other reason. (Please mention the reason)……

25. Which of the following is the characteristic of virus?

a) They can be seen with our naked eye.
b) They are multicellular living being.
c) They do not show response to chemical, heat and temperature.
d) They do not respire at all.

- ❖ Tick the reason why you choose the answer:
  - i. You learned the answer from teacher.
  - ii. You learned the answer from text book or other sources.
  - iii. You had a intrinsic knowledge about the answer.

iv. You selected the answer randomly.

v. Other reason. (Please mention the reason)……

26. Viruses are:

a) a chain between living and non-living
b) animals
c) plants
d) all of the above

❖ Tick the reason why you choose the answer:

i. You learned the answer from teacher.
ii. You learned the answer from text book or other sources.
iii. You had a intrinsic knowledge about the answer.
iv. You selected the answer randomly.
v. Other reason. (Please mention the reason)……

27. Vestigial organs are those organs which :

a) are no longer present now.
b) are very useful in human beings.
c) are evolving now and can have some function in future.
d) are functionless and present as reduced structure in the body

❖ . Tick the reason why you choose the answer:

i. You learned the answer from teacher.
ii. You learned the answer from text book or other sources.
iii. You had a intrinsic knowledge about the answer.
iv. You selected the answer randomly.
v. Other reason. (Please mention the reason)…….

28. Which of the following is a top consumer?

a) jackle
b) fox
c) tiger
d) wolf

❖ Tick the reason why you choose the answer:

i. You learned the answer from teacher.
ii. You learned the answer from text book or other sources.
iii. You had a intrinsic knowledge about the answer.

iv. You selected the answer randomly.

v. Other reason. (Please mention the reason)……..

29. Which of the following is the abiotic factor of the ecosystem?

a) bacteria
b) fungus
c) algae
d) soil

❖ Tick the reason why you choose the answer:

i. You learned the answer from teacher.

ii. You learned the answer from text book or other sources.

iii. You had a intrinsic knowledge about the answer.

iv. You selected the answer randomly.

v. Other reason. (Please mention the reason)……

30. What is used to make an artificial green house?

a) Plastic/glass
b) Ozone layer
c) Aluminum foil
d) All of the above

❖ Tick the reason why you choose the answer:

i. You learned the answer from teacher.

ii. You learned the answer from text book or other source

iii. You had a intrinsic knowledge about the answer.

iv. You selected the answer randomly.

v. Other reason. (Please mention the reason)……

Best of luck!!