EFFECT OF CONCEPT MAPPING IN SCIENCE ON SCIENCE ACHIEVEMENT, COGNITIVE SKILLS AND ATTITUDE OF STUDENTS

ERIC Research Project

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CHAPTER ONE

INTRODUCTION

The first Section of this introductory chapter discusses the theoretical background of Concept mapping which had been used widely in all sectors of education. The section two highlights the nature of science, its changing concept, and status of Science education, followed by the use of concept mapping in science teaching. The latter part of the chapter lays out the objectives and the hypothesis constructed in relation to the project under concern.

1.1.1 Concept mapping – theoretical background

The recent rapid advances in knowledge production in Sciences have led to an interest in 'meta science', or the study of how sciences work to produce new knowledge and this interest has in turn stimulated a renewed interest in and concern with meta knowledge. Concept mapping is seen as a useful tool for helping students learn about the structure of knowledge and the process of knowledge production or meta knowledge. Meta learning refers to learning that deals with the nature of learning or learning about learning. Meta learning and meta knowledge are two different but interconnected knowledge that characterizes human understanding. Learning about the nature and structure of knowledge helps students to understand how they learn and knowledge about learning helps to show them how humans construct new knowledge. In contrast to students who learn by rote, students who employ meaningful learning are expected to retain knowledge over an extensive time span and find new related learning progressively easier. Concept maps use three types of knowledge: facts, concepts and generalization. It is a learning strategy that was developed first as a research tool to represent learner's prior relevant knowledge and later as a tool to enhance meaningful learning.

The use of concept maps as a teaching strategy was first developed by J.D.Novak of Cornell University in the early 1980's. It was derived from Ausubel's learning theory which places central emphasis on the influence of students' prior knowledge on subsequent meaningful learning.

> According to Ausubel, *'the most important single factor influencing learning is what the learner already knows. The meaningful learning results when a person consciously and explicitly ties knew knowledge to relevant concepts they already possess".*

Ausubel suggests that when meaningful learning occurs, it produces a series of changes within our entire cognitive structure, modifying existing concepts and forming new linkages between concepts. This is how meaningful learning is found lasting and powerful when the rote learning is easily forgotten and not easily applied in new learning or problem solving situation in science.

The concept map is a device for representing the Conceptual structure of a subject discipline in a two dimensional form which is analogous to a road map. A concept, as defined by Novak, is regularity in objects or events designated by a specific label. Concepts maps are diagrammatic representations which show meaningful relationships between concepts in the form of propositions. Propositions are two or more concept labels linked by words which provide information on relationships or describing connections between concepts. Concepts are generally isolated by circles and connected by lines. Lines are labelled with 'lining words' which describe how the connected concepts are related to each other. Two connected concepts make up a 'propositional linkage' or a statement about how some piece of the world looks or works. Concepts are arranged hierarchically, i.e., the most general concept (super ordinate) is found at the top of the map, and lower concepts (subordinate) are less inclusive than higher ones. 'Cross links' are propositional linkages that connect different segments of the concepts hierarchy. They may indicate syntheses of related concepts, a new interpretation of old ideas, and some degree of creative thinking.

1.1.2. How is concept mapping supposed to facilitate meaningful learning?

First, concepts are not isolated, but rather connected together, showing interrelationships. Cross-links are particular powerful connections, which form a 'web' of relevant concept, probably enhancing their anchorage and stability in cognitive structure. They not only connect general concepts to specific concepts, but also tend to connect different sub-domains of conceptual structure. Linkages that are made only vertically, would be likely to be forgotten than those that are also made laterally, since vertical linkages, are somewhat more specific instances of concepts, where as cross links relate together concepts in different domains of a concept. Figure 1.1 shows a concept map of a concept map and Figure 1.2 shows the concept map of concepts in a hierarchical organizations. The Concept Mapping demands clarity of meaning and integration of crucial details. The process of constructing a concept map requires one to think in multiple directions and to switch back and forth between different levels of abstraction. In attempting to identify the key and associated concepts of a particular topic or sub-topic, one will usually acquire a deeper understanding of the topic and clarification of any prior misconceptions.

For different learning segments, the superordinate – subordinate relationships of concepts will change (Ref.Fig.1.2 and 1.3). Novak uses the analogy of a rubber sheet for this in which almost any concept on the map can be 'lifted up' to the superordinate positions, but still retains a meaningful prepositional relationship with the other concepts on the map.

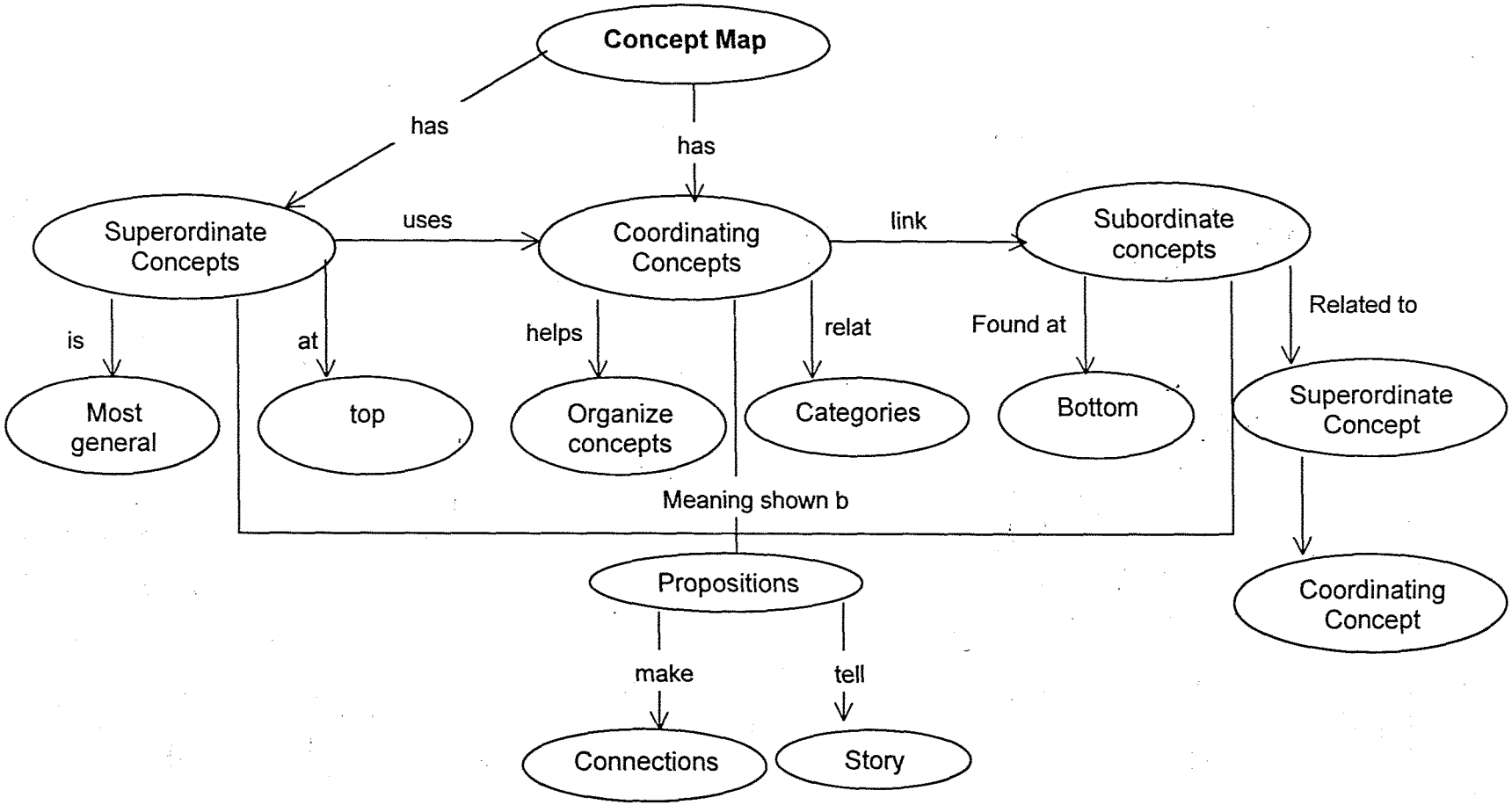


Fig. 1.1 Concept Map for concept Maps

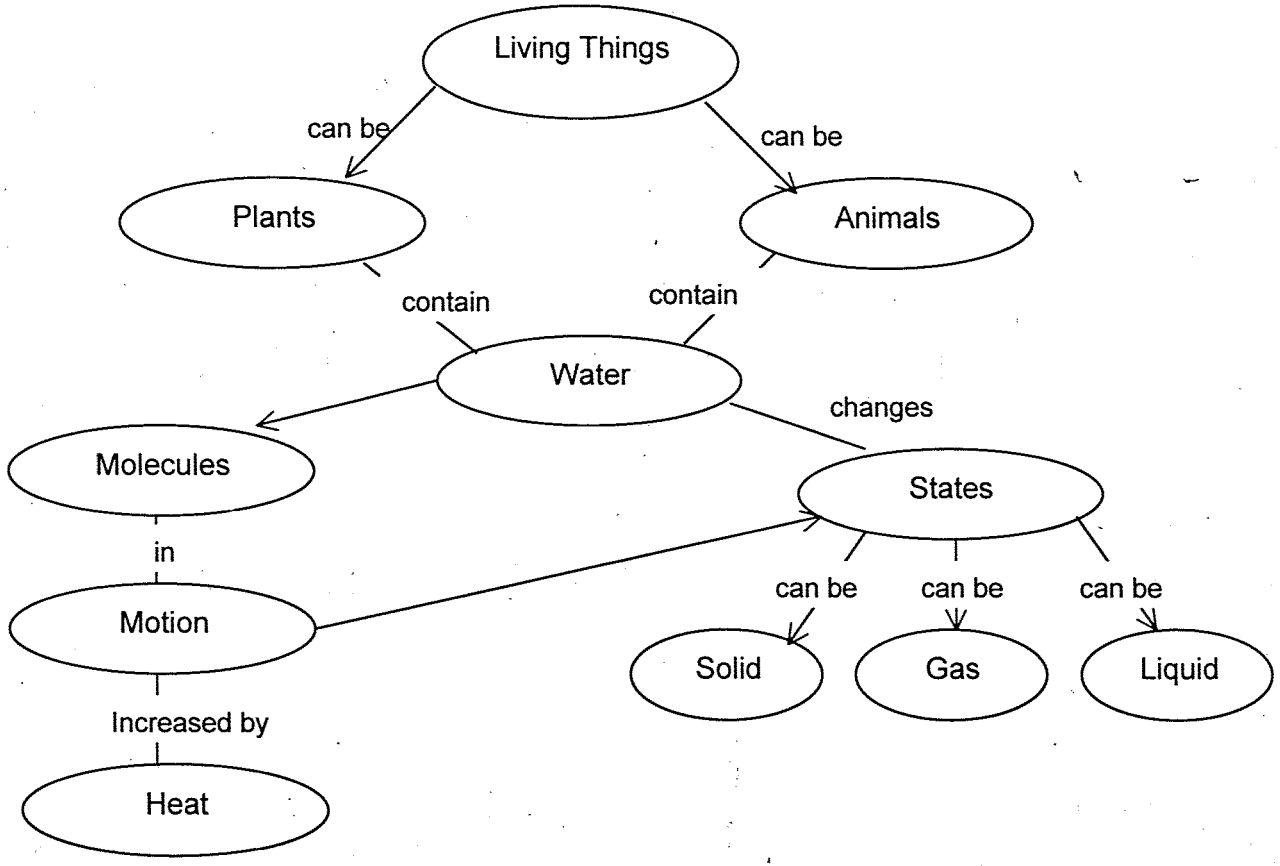


Fig. 1.2 Example (1) of a Concept Map

One big advantage of using Concept Mapping is that it provides a visual image of the concepts under study in a tangible form that can be focused very easily. During the formulation process it consolidates a concrete and precise understanding of the meanings and inter relations of concepts, thus resulting in an active process of learning.

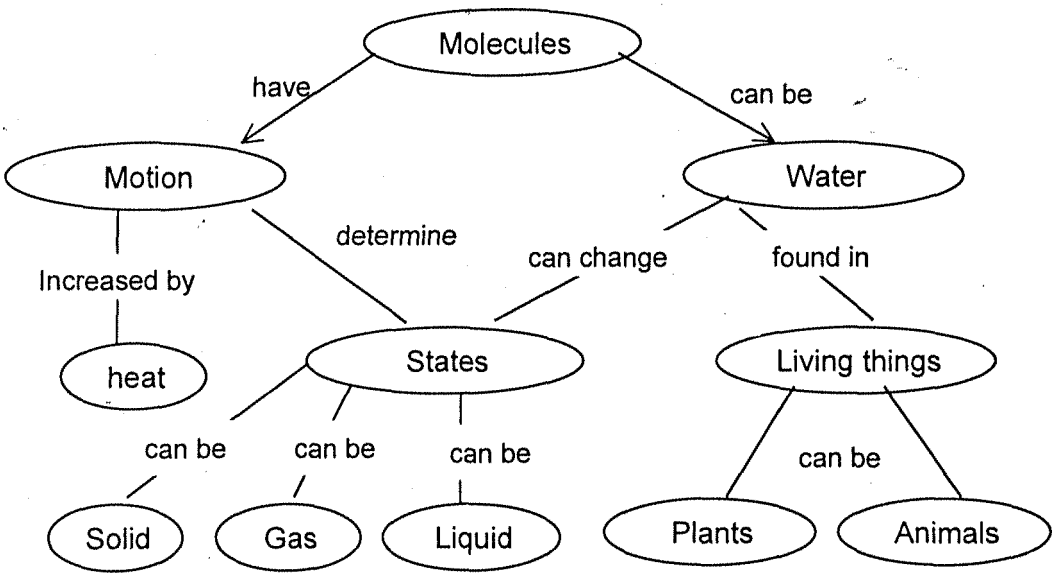
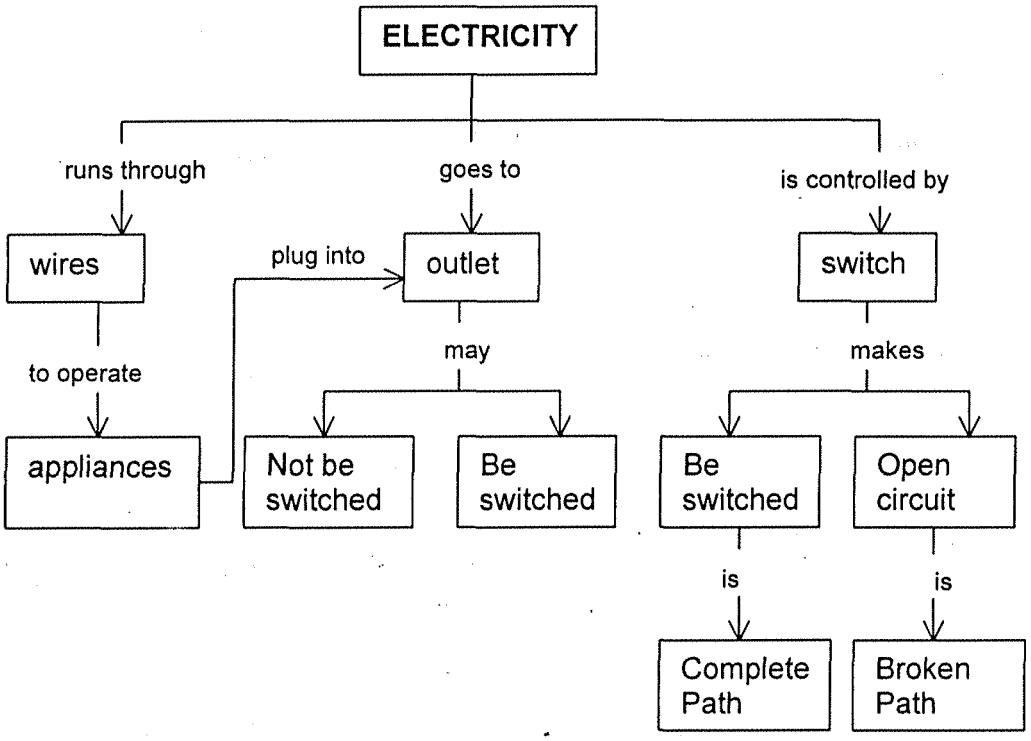


Fig. 1.3 Example (2) of a Concept Map

Concept mapping helps students fulfill high-quality and meaningful learning outcomes in science. As discussed earlier, meaningful learning implies that, as a result of instruction, individuals are able to relate new material to previously acquired learning. If the connections are missing of with the earlier knowledge, learners may regard the ideas they are taught as useless abstractions that only need to be memorized.

> *As an example, learning that electricity flows through a circuit can be meaningful for children if they are able to see with the help of a teacher that this idea applies to their previous understanding about how and where electricity is used. Children may have previously believed that electricity comes from the wall where an electric switch or outlet is located. When someone turns the switch on or plugs an appliance into the outlet, the electricity flows to a lamp or an appliance. A teacher can facilitate learning by helping children*

understand that electricity indeed flows through the switch or comes out of the outlet, but also that there are continuous electric wires between the electric pole outside the house and the switch and between the switch and the appliance (in Science for all children, 1998).



1.1.3. Use of concept maps

In constructing concept maps, difficult concepts can be clarified and can be arranged in a systematic order. Using concept maps in teaching helps teachers to be more aware of the key concepts and relationship among them. It helps in deciding what to include in a curricular, unit or lesson plan. Taking time to identify concepts yield clarity about science topics and helps to determine which topics are worth learning. Mapping concepts suggests specific objectives that teachers must plan for pupils. Not only objectives, but it also helps to seek the breadth and depth of a topic, see logic of relationships and choose proper activities and teaching aids. This understanding improves teachers' planning and instruction.

Since the science knowledge is vast, and most of the teachers have acquired it in pieces at different stages, there is a possibility of not seeing

important connections between different ideas. As an exercise, concept mapping provides an opportunity to express one's understanding about various concepts and to show relationships with other similar and dissimilar concepts.

There is evidence that concept maps can help teachers become more effective (Beyerkach and Smith, 1990; Hozetal, 1990) and can serve as a heuristic for curriculum development (Starr and Krajicik, 1990) . They are essential tools for planning and teaching and can help improve students' concept constructions. Concept mapping is a more recent development that is widely used as constructivist learning models which is accepted in science education. It has been used as an advance organizer to focus pupils' attention and guide them along to seeing bigger picture and for use as a mental scaffolding for organising their thoughts and discoveries. Concept mapping can be used for several purposes like (a) to generate ideas (brain storming), (b) to design complex structures (long texts, hyper media, large web sites); (c) to communicate complex ideas; (d) to aid learning by explicitly integrating new and old learning; and (e) to assess understanding or diagnose misunderstanding of a concept.

Concept maps can also be used for pupil evaluations. They may be used as formative and summative evaluation tools to see whether pupils have understood the concepts, relationships between concepts and the topic as a whole.

Concept maps are not only the ways to represent meanings. Flow charts are often used to represent sequences of activities. Organisational charts, cycles such as water cycle in science, semantic networks and predictability trees that are used in some psychological and linguistic writings are some sort of maps. But they are not based on the theory of learning and theory of knowledge that underlie the concept mapping strategies and their application to education.

1.2. Nature of Science and Science Education

Science as an institutionalized act of inquiry has resulted in rich fund of knowledge. Its currently best publicized products are undoubtedly the technological skills that have been transforming traditional forms of human economy at an accelerating rate. It is also responsible for many other things, like, the achievement of generalized theoretical knowledge concerning fundamental deterring conditions for the occurrence of various types of events and process; the emancipation of minds from age old superstitions; the understanding of the intellectual foundations for moral and religious dogmas; a gradual development of questioning intellectual temper towards traditional beliefs; a development frequently accompanied by the adoption in domains previously closed to systematic critical thought of logical methods for assessing on the basis of reliable data of observation, and merits of alternative assumptions concerning matters of fact or of desirable policy.

The general objective of science is to produce theories which are highly efficient in solving intellectual problems. Other objectives such as the approximation to truth, the development of the technologies or the promotion of social welfare are contingent and depend upon various factors. The substantive structure of the science contains and generates different classes of knowledge, definition, direct-observation, instrumental-observation, law and theory statements. Each class has its unique syntactical structure, a term which is referred to the modes of thinking used to generate and validate statements in the substantive structure. The production of knowledge in science has also psychological, sociological, as well as logical aspects. As world has pointed out,

> *Science is an institutional system with the strength and weakness of a human organizations. For a new result to be accepted in the body of human knowledge it does not suffice that it is correctly derived, be it a logical proposition that fulfils the appropriate*

truth table, or an applied model that satisfies the test of criteria – it must also reach an established status. It has to be accepted in the circle of scientific community to be a valid element in the growing human knowledge.

In short, Science knowledge is also the product of social structure. Although it is the individual Scientist who acts as the creator of new ideas in the discipline, it is the function of groups of scientists to critically assess these idea and decide whether or not to incorporate them into the structure of science.

Despite the growth of science, technology and Science education during the last century, it is only recently that the spirit of science has begun to permeate the practice of science education. In recent years, Scientists, Science educators and Science scholars have called for the development of a more inclusive science education curriculum at the school level, one that makes science interesting, understandable and relevant to all students.

A few decades ago, Science was taught so that pupils would know about the subject and be able to satisfactorily pass examination in it. Little was known of the permanent effect of science teaching. Science was regarded only as a body of knowledge and science teaching was a mere transmit of information.

High level cognitive learning has been an elusive goal of science programmes for many years. Despite the innovations incorporated in Science curricula developed since 1960s, there is an evidence to suggest that traditional teaching methods are still utilized and student outcomes are associated with memorization of science facts and algorithms to solve problems without necessarily understanding how the algorithms work. Research has indicated that sufficient emphasis was not placed on the development of students' understanding and high level cognitive outcomes when the curriculum is implemented. Research also indicates that successful students in science accumulate a great deal of passive knowledge, but often surprisingly little of what Layton (1992) calls "knowledge for

practical action". This calls for quite new and a distinctive type of learning outcome in science.

Fortunately, some curricular projects around the world have generated new perspectives in science teaching by systematically probing what is happening in Science class rooms and laboratories. Science is now seen as a rich field of human enquiry possessing its own unique structure and problem – solving processes. It is seen as a human construct and human activity.

> *Effective science teaching to all students involves the construction of a Comprehension model of the cognitive processes involved in learning science from instruction. These process include not only the learners background knowledge and alternative conceptions, but also sometime neglected processes of attention, motivation, attribution, generation and meta cognition. (Willrock, M.C. 1994).*

This can be done, the Curriculum theorists argue, if the key concepts in science are clearly identified and even more important, if the intellectual operation, used by the researchers in the discipline can be made explicit and transmitted. The students' conceptions represent the knowledge base for building relations between the concepts to be learned and experience summarized in alternative frameworks. The generation of meaningful scientific conceptions clearly involves often unscientific conceptions in the beginning. For example, students' conceptions of the earth (Nussbaum, 1979; Nussbaum and Sharon Dagan, 1983), of the particular nature of gases (Benson, Winrock and Baun, in press) and of gravity (Gumstone and white, 1981) as well as of other science concepts often show great resistance to change through instruction. Osborne (1981) found that elementary school children in several English speaking countries believe that direct current in a simple electrical circuit consisting of a battery, a bulb and their connecting wires flows in these ways:

i) from one side of the battery to the bulb

ii) from each side of the battery to each side of the bulb, and

iii) from one side of the battery through the bulb to the other side of the battery, equal in amplitude through the whole circuit. (These preconceptions firmly resist change).

The identification of these student conceptions implies an advance in the design of science teaching. No longer can science teaching focus only on presenting the Scientists' views of physical events, or on covering the subject matter of science. Science teaching also involves understanding the students' view of science concepts. Teaching involves more than showing students the incorrectness of their beliefs that work quite well for them everyday in realistic concepts. It involves more than setting up dissonance between students' models and teacher controlled demonstrations. It involves leading students to test and develop their models and thought processes in familiar contexts, which they believe are real representatives of every day experience. To learn science with understanding, there is a need to generate a model or an explanation that organizes information into a coherent structure, that relates information to one's knowledge and experience. Comprehension of science concepts involves building two types of relations, (i) among the parts of the new information, and (ii) between the new information and the learner's knowledge and experience. This model of generation learning has been described and empirically tested in the teaching science and mathematics (Wittrocketal, 1974). These meta processes of science learning are important for conceptualization and to reconstruct the knowledge and experience.

1.3 Concept mapping in Science learning:

As stated earlier, Science educators have always been in search for more potential ways of instruction to help students learn science. In recent years, science educators have suggested various directions for the improvement of science education. Beginning from demonstrations, enquiry, discovery method, and problem solving techniques, science educators have suggested constructivism in the classrooms as an interpretative process involving

individual's constructions of meanings relating to specific occurrence and phenomena. New constructions are built through their relations to prior knowledge and it is a pedagogic challenge for teacher to focus on students' learning with understanding. To learn science from a constructivism philosophy implies direct experience with science as a process of knowledge generation in which prior knowledge is elaborated and changed on the basis of fresh meaning negotiated with peers and teacher. Concept mapping stimulates this process by making it explicit. It was considered as an ideal tool to see relationship between concepts and develop enquiring mind and other process skills in students.

In order to develop the attitudes and understanding of Science, teachers need to recognize the relation between the manners by which students initially experience and process information and their subsequent ability to retrieve and transfer that knowledge to novel situation (Minstrell, 1989).

Novak and Gowin (1984) state that concepts play a central role in the acquisition and use of knowledge. They have elaborated saying that 'umbrella' ideas typified by concepts and principles must be established before information can be meaningfully learned. Teachers who view and present science as a list of terms rather than as a concept mapping process perpetuate science class room learning environment which foster negative attitudes and alienate most students. It is important for science teachers to realize that

i) Science concepts are interrelated and hierarchical.

ii) Concepts can be developed from a variety of perspectives, as long as the relationships among concepts are accurate.

iii) Concept maps can be used to identify prior knowledge and misconceptions in both teachers and students.

iv) Students' explanation of the concept map reveals the difference between learning science concepts and memorizing scientific terms.

v) Individuals have different learning styles and interest.

vi) Meaningful learning can be achieved by networks of information together.

vii) Students of Science need to learn how to question and engage in meaningful learning.

As explained in the preceding section, a concept map is a two dimensional, hierarchical node-link diagram that depicts the structure of knowledge within a scientific discipline as viewed by a student, a teacher or an expert in a field. The map is composed of concept labels, each enclosed in a box or oval; a of labeled linking lines, and an inclusive, general to specific organisation.

By assessing the concept maps developed by the students, the teacher can

i) gain insight into the way students view a scientific concept or a topic.

ii) examine the valid understandings and misconceptions students hold; and

iii) assess the structural complexity of the relationships students depict.

Not only for assessing the students understanding of science, the teachers can also use concept maps to organize their ideas in preparation for instruction, as a graphic organizer during class, and as a way to encourage students to reflect on their own knowledge and to work together and share their understanding in collaborative group settings.

1.4 The Present Project

The research in science education has shown that science classes in the schools are predominantly teacher-centered and featuring rote mode of learning without giving much scope for development of certain cognitive skills and understanding of science concepts, facts and generalizations. There is a need to move students away from rote learning towards meaningful learning, since the students who employ meaningful learning are expected to retain

knowledge over an extensive time span and find new related learning progressively easier when compared to students who learn by rote.

The present project approved and funded by ERIC, NCERT was aimed at investigating the use of concept mapping as a strategy to enhance meaningful learning and to improve upon the process skills of students in science. The main objectives of the study are as follows:-

1.5 Objectives of the study:

The objectives of the study are to:

i) develop and implement concept mapping as a strategy in the selected few units of science for VIII standard students.

ii) study the effectiveness of concept mapping on the achievement and process skills of students belonging to different intelligence groups.

iii) study the attitude of students towards concept mapping in science.

iv) study the gender differences in science achievement, process skills and attitude towards concept mapping.

1.6 Hypotheses of the Study:

The following hypotheses were formulated in relation to the objectives of the study:

1.6.1 The concept mapping strategy does have an effect over the achievement of students in Science.

1.6.2 There is no difference in the effect of concept mapping strategy over the achievement of students of different intelligence levels.

1.6.3 There is no difference between boys and girls with respect to their science achievement on pre and post tests.

1.6.4 There is no difference among the students of experimental and control group of different intelligence in their performance on pre and post process skills test.

1.6.5 The concept mapping strategy does have an effect over the process skills of students in science.

1.6.6 There is no difference between boys and girls in their process skills performance on pre and post tests.

1.6.7 There is no difference in the effect of concept mapping strategy over the concept attainment of students in science of different intelligence levels.

1.6.8 The concept mapping strategy does have an effect over the concept attainment of students in Science.

1.6.9 There is no difference between boys and girls in their concept attainment in Science.

1.6.10 There is no difference among the students of different intelligence in their attitude towards concept mapping.

1.6.10 There is no difference between boys and girls in their attitude towards concept mapping.

The related research studies and literature which paved a way for evolving the present project is presented in the following chapter.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

A number of studies have been carried out on concept map by Novak and Gowin who initially germinated with the idea of concept map that enhances meaningful learning. This was followed by innumerable studies which concentrated on various dimensions of concept maps and related variables that played a prominent role in meaningful learning. This Chapter is concerned with empirical studies related to concept mapping and related influencing variables.

2.1 Concept mapping enhances meaningful learning

Science Educators have long sought techniques to integrate the learning of subject matter with learning how to learn. One such technique that has found more and more acceptance during the past decade is the concept map.

As a research and evaluation tool in Science education, Concept mapping is 28 years old. The technique which grew out of work by Novak (1972) and his graduate students at Carnell University (Rowell, 1978) was originally intended as a vehicle for exploring meaningful learning acquired through audio – tutorial instruction in Elementary School science. Since that time it has been adopted by thousands of teachers in the West who have employed it at all levels in instruction, diagnosis and Testing and curricular development and more recently as a metacognitive and in helping students "learn how to learn" (Novak, 1990).

Concept mapping, as claimed by Nowak (1990) shows the potential of helping learners reconceptualise their subject matter knowledge as a conceptually rich tapestry of interrelated ideas and make science conceptually

transparent. It brings about meaningful learning as a result of integrating information into a progressively more complex conceptual framework (Schmid & Stelaro, 1990: Okebukola & jegede, 1991). The concept mapper achieves metacognition which is a general strategy that facilitates learning and understanding of knowledge and which can be used for tackling novel problems. Okebukola (1992) found that the group which was exposed to concept mapping was significantly more successful in solving 3 biological problems than the group which was a control one. This agrees with the finding of Novak, et. al. (1983) who showed the eighth grade students who had concept and vee – mapping experience were better problem solvers of the task in the wine bottle test than control classes who did not have the benefit of this experience.

There is a recent flurry of research activities on concept mapping as a tool for enhancing meaningful learning. Several lines of research within this literature converge to suggest that mapping can assist the learner to go beyond rote learning and achieve metacognition (Al.Aiyemola, Jegede and Okebukola, 1990; Stewart, Vankirk and Rowell, 1979; Moreira, 1979; Novak, 1979; Novak, Gowin and Johansen, 1983; Malona and Dekkers, 1984; Ault, 1985; Fraser and Edwards, 1987; Feldsine, 1987l Fowler and Bou Jaonde, 1987; Barenholz and Tamir, 1987).

In addition, the richness of knowledge (how interlinked the concepts were) was found to be increased by the use of concept maps (Lambiotte and Dansereau 1991). These authors suggested that students who made or viewed concept maps would have a broader knowledge base and therefore be more able to solve problems compared to those students who learnt by rote memorization. The above author's experiments tested the efficacy of different presentation types (concept mapping, text outlines or lists) on learning between students with differing amounts of prior knowledge. They found that students with low prior knowledge learned better with concept

mapping than the other two linear presentations. In conclusion, concept mapping appears to be a good method to promote meaningful learning among students with different academic preparedness – a situation typically found in introductory science classes.

2.2 Concept mapping and achievement

Over the past ten years, research has provided with generally positive findings regarding the facilitating effects of concept mapping on learning, although not all studies showed significant differences in students' achievement when concept mappers were compared with non mappers (Heinze – Fry and Novak, 1994; Jegede et al, Okebukola, 1990; Lehman et.al. 1985; Novak et. al , 1983; Okebukola 1990; Okebukola and Jegede, 1988; Pankratius, 1990; Stewart et. al., 1979). The general facilitating effects of concept mapping are thought to arise from the fact that it assists students in understanding concepts and the hierarchical relationships between them and to organize and reflect upon their own conceptual understanding. Concept mapping is found consistent with the constructivist perspective of learning when it is used to examine changes in the content and organization of students' knowledge by emphasising the process of the construction and the uniqueness of the individual products (Boyer cach and Smith, 1990; Roth, in Press).

However, there are few studies carried out which show a relationship between Concept Mapping and achievement (Bousquet, 1982; Fraser and Edward, 1985). Bousquet (1982) found that skill in concept mapping predicted success on an achievement test among students in a College natural resource class. No significant difference in achievement was found between 3 groups who were taught different versions of concept mapping. Fraser and Edward (1985) found that students who scored at high levels on end-of-unit tests showed high levels of concept mastery.

Novak and Gowin and Johansen (1983) found that students who had been taught concept mapping made more "valid relationships" in a test using a problem solving incident.

Through review it is gathered that there are many studies carried out in West on concept mapping, when compared to Asian countries including India. One of the such studies that are reported in Chinese journal of Science Education was reviewed. The study was carried out by Shwn-Ching Jiang (2001) with an aim to find the influence of concept mapping and illustration on Children's Science knowledge structure, comprehension, and learning response. The findings revealed that the low ability students' knowledge structures and comprehension ability were influenced by reading illustrations and concept mapping than by text, while the middle ability students were more affected by the different material formats and the high ability students were affected by the difficulty of reading different materials.

Coming to studies conducted in India, there are hardly any studies carried out and reported in this area. One study carried out by Raghavan.A (1991) aimed at studying concept mapping in learning physical science and its relation to scholastic performance, cognitive ability, and attitude towards concept mapping and science interest among IX standard students. The findings show that the cognitive ability, attitude towards concept mapping and science interest had both a significant, direct influence on scholastic performance and an indirect influence through concept mapping. Similarly, concept mapping as a teaching-learning strategy had a significant positive influence over scholastic performance.

2.3 Views on Concept mapping and its dimensions

There are few studies carried out not merely exploring the effect of Concept mapping but testing other Variables and dimensions too. For

example, Mc.Murray.M (1999) conducted a study using concept mapping to teach geologic mineralogy for secondary level students. The study aimed at content, affective and literacy outcomes along with dimensions of metacognition and parents involvement.

The study conducted by wolff-michael.Roth (1994) show that the students held positive views regarding concept mapping activity and use of concept maps for learning. According to the study almost 905 students thought that concept mapping is a good way of reviewing a chapter, and it helps to make sense of the many terms in a chapter, and to organize them into a meaningful whole.

Maria et.al (2001) reported the results of a study that compared two concept mapping techniques, one high directed, "fill-in-the map" and one low directed "Construct-a-map-from-scratch". It was examined whether (1) skeleton map scores were sensitive to the sample of nodes or linking lines to be filled in; (2) the types of skeleton maps were equivalent; and (3) the two mapping techniques provided similar information about students' connected understanding. Results indicated that fill-in-the-map scores were not sensitive to the sample of concepts or linking lines to be filled in. It was found that the construct-a-map technique better reflected differences among students' knowledge structure.

Hanna.B. & Pinchas.T. (1992) in their study described the use of concept mapping in design, instruction and assessment related to a microbiology program prepared for high school grades (grades 10 and 11) students in Israel. The study compared two groups, viz., students who studied the new programs using Concept mapping themselves (mappers) and students who studied new program without Concept maps. It was found that Concept mapping (CM) students' over all gain was higher. It was also revealed that students' and teachers' attitudes towards concept mapping were mostly favourable towards the cognitive benefits of Concept mapping. However, it was stated that many students did not like certain aspects of Concept mapping.

Jegede et.al (1990) also showed that besides high achievement, concept mapping was also associated with the reduction of anxiety.

2.4 Concept mapping - individually and Collaboratively in groups

In addition to the cognitive benefits of Concept mapping cited earlier, Okabukola and Jegede (1988) showed that students who collaboratively constructed concept maps "attained meaningful learning better than students working individually". Similarly Anita Roy.C and Wolff. M R (1993) explored the process of the construction of knowledge during the collaborative concept mapping by groups of high school physics students. The concept maps were on topics of "waves and quantum character of light" and found that students attained meaningful construction of knowledge through collaborative concept mapping. Earlier to this, Wolff M in 1992 in his study tried to describe the practice of concept mapping itself; the student-student and student-teacher interactions, and the cognitive ability of the participants.

Similarly, a study by Gladys.O.E. and Kola.S. (1995) on the effect of concept and Vee mapping under three learning modes (Cooperative, cooperative-competitive, and individualistic whole) show that students in the CP-CM condition in all groups achieved significantly better than their counterparts in other two groups.

On the contrary, the studies carried out by Sherman and Others (1989) show that there is no significant difference in achievement of students exposed to pure cooperative, individual or competitive modes of learning.

2.5. Concept mapping and teachers

There are few studies carried out to find the effect of Concept mapping on teachers' teaching skills.

Cheryl L Mason (1992) conducted a two-year study investigating the use of concept mapping as a tool to help potential science teachers rethink their content knowledge, and begin comprehend the nature of scientific concepts. The concept maps were evaluated as a tool for understanding the nature of science, condensing science information, determining the effectiveness of presentations, identifying misconceptions, and recognising different learning styles. The study employed qualitative and quantitative measures to determine a base line profile of the individual subjects, and to monitor the evolution of their understanding of the nature of science, learning and teaching of science. Quantitative measures included gain scores on concept maps. The qualitative aspects involved journal writing, individual assignments, and class presentations and discussions, all of which involved the use of concept mapping. The findings show that latter methodology seemed to have greatest impact on teachers. The students indicated an increasing desire to understand more about science learning.

The study carried out by Wolff.MR (1994) shows that during collaborative concept mapping, teachers take on new roles as coaches, facilitators or guides of learning. The metaphor of coaching implies a teacher who observes students while they carry out a task and offering hints, scaffolding, feedback, modeling, reminders and new tasks carried out bringing the students' performance closer to the experts performance (Collins et.al. (1989). It is inherent in the coach metaphor that learning goals are often specified by the teacher rather than the students thus the goal-directedness. The role of a facilitator implies teachers actions similar to the coach but without the directedness for goal setting by the teachers of constructing specific content or skills. The metaphor of a guide evokes the image of a more experienced learner meanders the same path as the students who have travelled these paths move often (Wolff.M.R., 1994).

Certain studies show that concept mapping can help teachers to become more effective (Beyerback and Smith, 1990; Hozetal, 1990), and can serve as a heuristic for curriculum development (Starr and Krajick, 1990).

Most research on the efficacy of concept maps cover their use as teacher-directed guides (Cilburn 1990; Lambiotte and Dansevean 1991; Morevia 1979; Stewart, Vankirk and Rowell 1979). The idea here is that the expert constructed map (as advance organizer) would provide an anchor on which to attach new knowledge. All of the studies cited above showed that the use of teacher made concept maps increased either learning and/or retention of science knowledge. Student produced maps as learning tools have been studied to a lesser degree (Arnandin, Mintzes, Dunn and Shafter 1984; Okebukola 1992: Wallace, Mintzes and Markham 1992; Wolf and Lopez 1993). While it could be more useful for students to make their own personal and idiosyncratic maps for more meaningful learning, it is also likely that the maps will not be well designed as the teacher made maps. It is felt at large that a good compromise would be a student made map with expert derived lists of concepts.

A meta analysis study was carried out by Horton. P B and Others (1995) which was aimed to study (i) the effect of concept mapping as an instructional tool in improving students' achievement. (ii) students' attitudes towards concept mapping. (iii) difference between teacher prepared versus student prepared concept maps in improving achievement and attitudes. (iv) effect of concept mapping on boys and girls. The study included 19 research reports. The results of the meta analysis carried out revealed that the top-down instructional strategy of concept mapping pioneered by Novak has had generally medium positive effects on students' achievement, and large positive effects on students' attitudes. It was found that achievement and attitude gains were more strongly pronounced in studies conducted in Nigeria. Improved achievement was more evident in studies which used biology as their content-focus, and was also considerably stronger in studies which used conventional instruction rather than a place for their control groups. No evidence was found to show that student-prepared maps were more effective than teacher-made maps.

It may be realized from the above, that a number of studies have been conducted in West on concept mapping, while there are hardly any Indian studies reported in the area. It is, seen through review that the literature contains mixed findings on several aspects of concept mapping, though in general it is proved empirically that it enhances meaningful learning. Taking cues from the aforementioned research findings obtained on the effect of concept mapping, the present study was planned to investigate upon the effectiveness of concept mapping on the science achievement, cognitive skills and attitudes of students. Further, the study intended to investigate the effect of concept mapping on the achievement of different ability groups of students and on the gender. The design of the study, sample characteristics and procedural details are discussed in the following Chapter.

CHAPTER THREE

METHODOLOGY

This Chapter is concerned with the sample, design of the study, the tools that were used to test the variables employed in the study and procedural details of the implementation of the study.

3.1 Sample of the Study

The eighth standard students of two local schools constitute the sample of the study. These two schools are the English medium schools in Mysore City, run by private management. Out of these schools, one (Rotary West High School) served as the experimental group, whereas the other school (Vijaya Vittala high School) served as the control group. The total number of students in experimental group were 47 and students in control group were 42. Since it was not possible to employ randomization which would upset class schedules, the class as a whole in its natural setting was considered for implementing the project.

3.2 Design of the Study

The study is of quasi-experimental in nature wherein non-randomized pretest – posttest design was used. The intact classes of eighth standard as a whole were considered as experimental and control group for the study.

3.3 Tools used in the study

The tools that were used in the study are as follows :

i) **Raven Progressive Matrix** - This intelligence test was used to group the students according to their intelligence gradewise (grade 1 to 4).

ii) **Achievement Test**

The achievement test was developed based on 6 units of eighth standard science syllabus, viz., (i) Microbial World, (ii) Magnetism, (iii)Electric current, (iv) conservation of Natural Resources, (v) Useful plants and animals, and (vi) organic evolution. The test items were of short answer

and objective type in nature falling under the categories of objectives like (i) knowledge (20%), (ii) understanding (71.7%) and application (8.3%). The test also included concept maps on natural resources, electricity and useful plants and animals, magnetism and microbial world. The total number of items were 46 for a total marks of 60. This test was developed in order to find out the improvement in achievement of students in science after the experimental treatment.

(iii) Concept Attainment Test

In order to develop this test, the concept attainment test developed by Anuradha Joshi and Ratnamala Arya (1971) was used as the basis. The framework used in this tool was adopted in the development of Concept Attainment Test (CAT) for the project.

The main objective of the test was to measure the concept attainment ability of students. The whole test was divided into four parts. The Part One had items of matching type which required relating concepts with examples. The Part Two had group of examples related to a particular concept and the students were expected to identify the example that is not related to the concepts. The Part Three had the definition of a concept followed by a group of examples. The students were expected to read and understand the definition of a concept and identify the related example. The part Four consisted of essential attributes and name of the concept. On the whole, the test included 35 items.

(iv) Process Skills Test

This test was developed with an objective to explore the effect of concept mapping strategy over certain process skills in students. The test included items on the following process skills :

i) Observation
ii) Inference
iii) Hypothesis
iv) Interpretation
v) Reasoning

vi) Prediction
vii) Seeing relationship

A total number of 37 items were included in the test representing the aforementioned skills.

(v) Attitude towards Concept Mapping

This scale was developed with an objective of studying students' attitude towards concept mapping after undergoing the experimental treatment in which concept mapping was used as a strategy to teach science. The scale consisted of 30 items on a five-point scale ranging from strongly agree to strongly disagree.

(vi) Reaction Scale

This scale was developed with an objective of knowing the students' reactions about concept mapping strategy used in science. The scale consisted of 4 major parts and 2 open ended questions. The part one had 15 questions related to the concept mapping strategy used to teach science; students' difficulty in mapping and using link words; understanding of concepts better through mapping; see the relationship between subordinate and super ordinate concepts and questions related to the procedure followed during concept mapping.

The part two consisted of 5 questions related to concept mapping used at the end to review the total lesson and students' participation in it.

The part three consisted of 4 questions related to concept mapping used as an evaluation tool during the instructional process.

The part four consisted of 4 questions related to reactions about concept mapping individually and in groups.

The responses from part one to four were to be supplied either on multiple choice or on 3-scale format as required. The questions 5 and 6 were of open ended in nature to elicit reactions about the benefits gained by

students by practicing concept mapping in groups and individually on one's own.

The above tests viz. achievement test, process skills test and concept attainment test were administered as pre and post test to both experimental and control group students. The reaction scale and attitude towards concept mapping scale were administered as post test only to the experimental group. Besides this, 5 unit tests were developed on the respective units and administered intermittently after completion of every unit.

3.4 Procedural Details of the Study

The project was phased into four stages which are as follows :

Phase One : Development and Tryout of tools and lesson Plans

i) During this phase, the aforementioned tools were developed and validated with experts' opinion and comments. Six units were identified from eighth standard science syllabus with the help of science teachers of the schools. Content analysis was carried out to identify necessary concepts, principles and generalizations. Lesson plans were developed for the selected units, viz., (i) microbial world, (ii) magnetism, (iii) Electric current, (iv) Conservation of Natural Resources, (v) Useful plants and animals, and (vi) Organic evolution.

ii) Lesson Planning : The lesson plan was developed using Constructivists' model of planning the lesson. The following steps were considered for planning the lessons.

Step 1 :

a) **Planning of specific behavioural outcomes** for each unit which included knowledge, understanding, application and skill categories.

Step 2 :

b) Planning of student exploration.

This phase was used for determining possible misconceptions, children's awareness of certain concepts and their concrete

experiences which would help them in learning abstract concepts. Teacher uses questions, sometimes pictures and demonstrations resulting in certain enquiries. The process skills of students like, recording observations, making predictions, asking observation questions and so on will be encouraged.

Step 3 : Planning for Explanation

The purpose of this phase was to reach mental equilibrium when a new concept is formed or linked to previously understood and related concepts. The students will focus on their primary findings, exploration and teacher would help them by introducing proper concept labels; lead students through a discussion so that students can discover the concepts on their own. The teacher's task is to question skillfully so that students use the experiences of their exploration to construct scientific meaning and draw concept maps. The following questions provided direction for planning of this phase of the lesson.

- What kinds of information or findings are students expected to provide ? (product, process skills).
- How will the students' findings from the exploration phase be reviewed and summarized ? (Teacher questioning, pupil discussion, concept mapping, blackboard work).
- How can the students' findings be used even if they are incorrect or incomplete? (teaching questioning).
- What are the proper concept labels or terms that must be attached to the concept ? (products)
- Providing reasons for the importance of a concept (teacher exposition, lesson expansion).

Step 4 : Planning for expansion

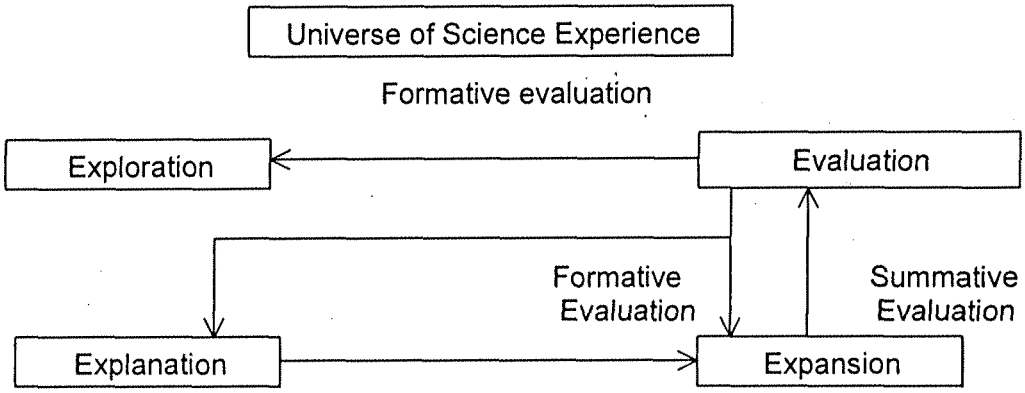
The purpose of this phase was to help students organize their thinking by applying what they have learnt to other ideas or experiences that

relate to the lesson's concept and to help the students to expand their ideas (use of previous experiences related to the concept; examples related to the concept; new experiences related to the concept, subordinate and coordinate concepts related) and draw concept maps.

Step 5 : Planning for evaluation

Evaluation is continuous, and planned in terms of outcomes and pupil performances. Concept mapping was used as a technique to review the whole lesson, and also to test the students' conceptual understanding as well as process skill development.

Fig.3.1 : Planning and Learning Cycle (adopted from SCIS)



The above lesson planning model was the adoption from The Science Curriculum Improvement (SCIS) and was used for focusing on a concept, helping learners to construct meaning, encouraging them to expand understanding of that fundamental meaning, see relationship between concepts and related concepts and evaluate student performance by using concept mapping as a strategy.

The steps followed in constructing the concept maps are as follows:

1. The students are given the material pertaining to the lesson/unit and given instructions, to read the material and select the key concepts. The concepts are listed on the blackboard as they are identified.

Discussion is held with the students as to which concept is more important and most inclusive in the lesson/unit.

2. The most inclusive or super ordinate concept is placed at the top. The most general and inclusive concepts are listed next working through the first list until all concepts are rank ordered.
3. The students are asked to help in choosing good linking words to form the propositions shown by the lines on the map.
4. Cross links between concepts in one section of the map and concept, in another part of the concept tree are made with the help of students. The concepts are either circles or put in small boxes.
5. Maps are reconstructed if they have poor symmetry or poorly clustered.

An illustration of a Concept map is given in the Fig.3.2

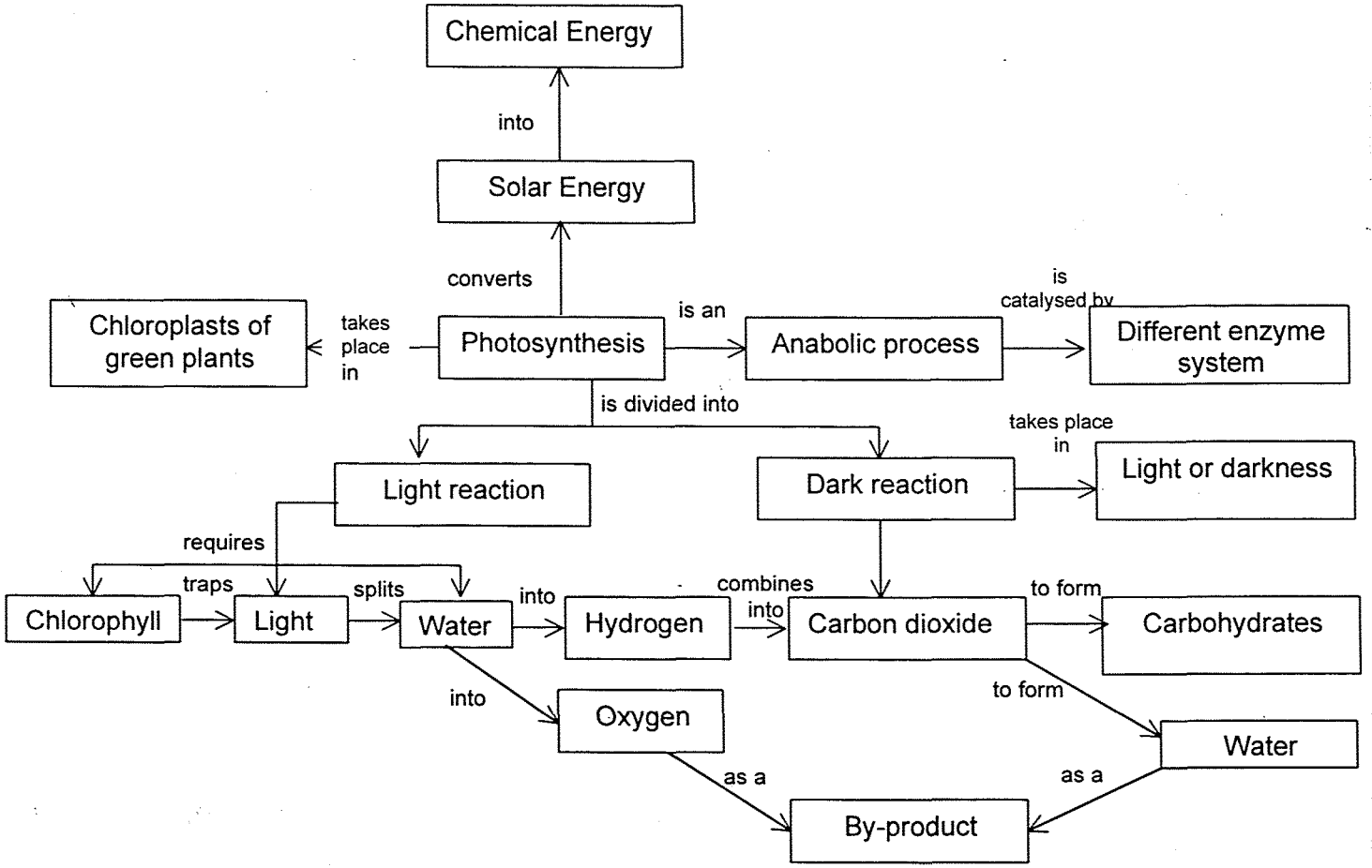


Fig. 3.2 Concept Map on Photosynthesis

Sometimes the Concept maps were drawn along with the explanation, by placing the larger or most inclusive concepts at the top followed by subordinate concepts and examples.

Phase 2 : Pilot Study - Try out of tools and lesson plans

The tools that were developed were tried out on eighth standard students of a local school. Item analysis was carried out in respect of achievement and process skills test. The reliability of process skills was found to be 0.95. Necessary modifications were made in the tools based on experts' comments and feedback obtained from try out.

The lessons that were developed on the units identified were also tried out, and necessary modifications were made wherever required. Some of the observations made were (i) children found difficult to use link words, (ii) to arrange superordinate and subordinate concepts in a hierarchy. From the feedback obtained, it was planned to introduce small exercises on concept mapping using simple concepts at the initial stage of actual implementation of the study.

Phase 3 : Implementation of the Study

As mentioned earlier the two local schools which are run by the private management were selected among which one served as the experimental group. The Intelligence Test (RPM) was administered to both the groups to identify the levels of students. The achievement, process skills and concept attainment tests were administered to both the groups as pretest.

The instructional phase began with the concepts already known to them and drawing simple concept maps as initial exercise. The students were oriented about the steps involved in concept mapping and usage of link words to connect the concepts. This was followed later by the implementation of units selected. Concept maps were evolved during the process of instruction i.e. in explanation and expansion phases.

The concept maps were developed for every single lesson as well as for the entire unit at the end showing the relationship of concepts or network of concepts in the map. The teacher prepares the concept maps as a part of the instructional process along with the explanation by placing the larger or most inclusive concepts at the top followed by subordinate concepts and examples. At the end of the lesson, the concept maps were developed on the blackboard by reviewing the whole lesson with the help of students. The students were made to select a section or small portion of the material given, and construct concept maps either individually or in groups. The student constructed maps were made to be presented on Black Board and discussed by the teacher. Sometimes the concept maps were provided to the students, and they were asked to read the map and write explaining the concepts involved in the map, their relationship with other concepts, subsumed examples and so on.

For assessment purpose, concept maps were used as a tool in all the units. For instance, the concept maps were provided with blanks, without link words, arrows and examples. The students were expected to fill in the gaps. Sometimes the text is given and the students were asked to draw the maps. The illustrations provided in figure 3.3 show how the concept maps were used as an assessment tool.

In certain units, the development of concept maps were a part of the home assignments.

During instruction, some of the lessons were audio recorded. This was used as a feedback in improving upon the lessons that followed later. The total duration of implementation of the study was three months covering 120 periods of instructional hours.

Example 1: Complete the following Concept map using appropriate link words, concepts and examples. (4 marks)

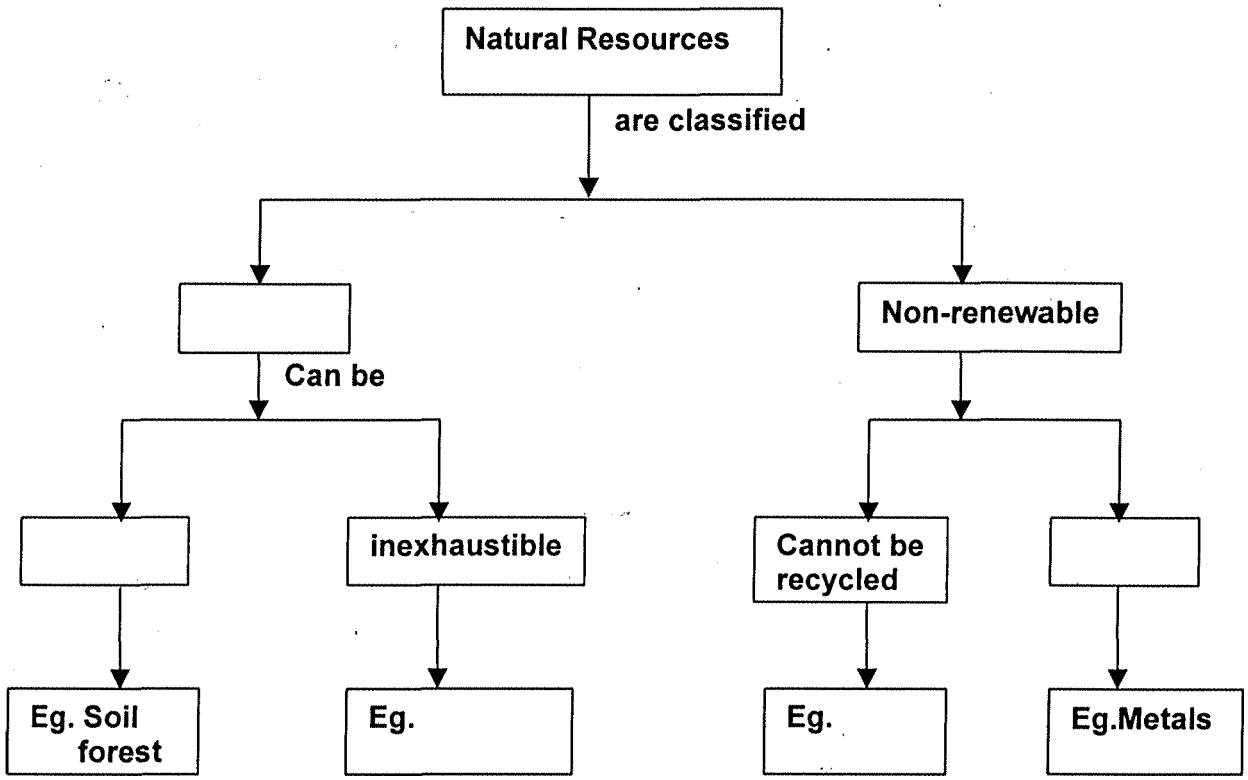


Fig. 3.3 Illustration of a Concept Map that is used for assessment

Example : Draw a Concept map showing the relationship between the following Concepts.

Flora and Fauna
Soil Erosion
Soil fertility
Deforestation
Over grazing
Natural resources
Hunting
Forest fire
Extinction of species

In order to assess the concept maps, Novak has given the following scoring criteria for concept maps which involves propositions.

Scoring criteria for concept maps

1. **Propositions:** Is the meaning relationship between two concepts indicated by the connecting line and linking word(s)? Is the relationship valid? For each meaningful, valid proposition shown, score 1 point. (See scoring model below).

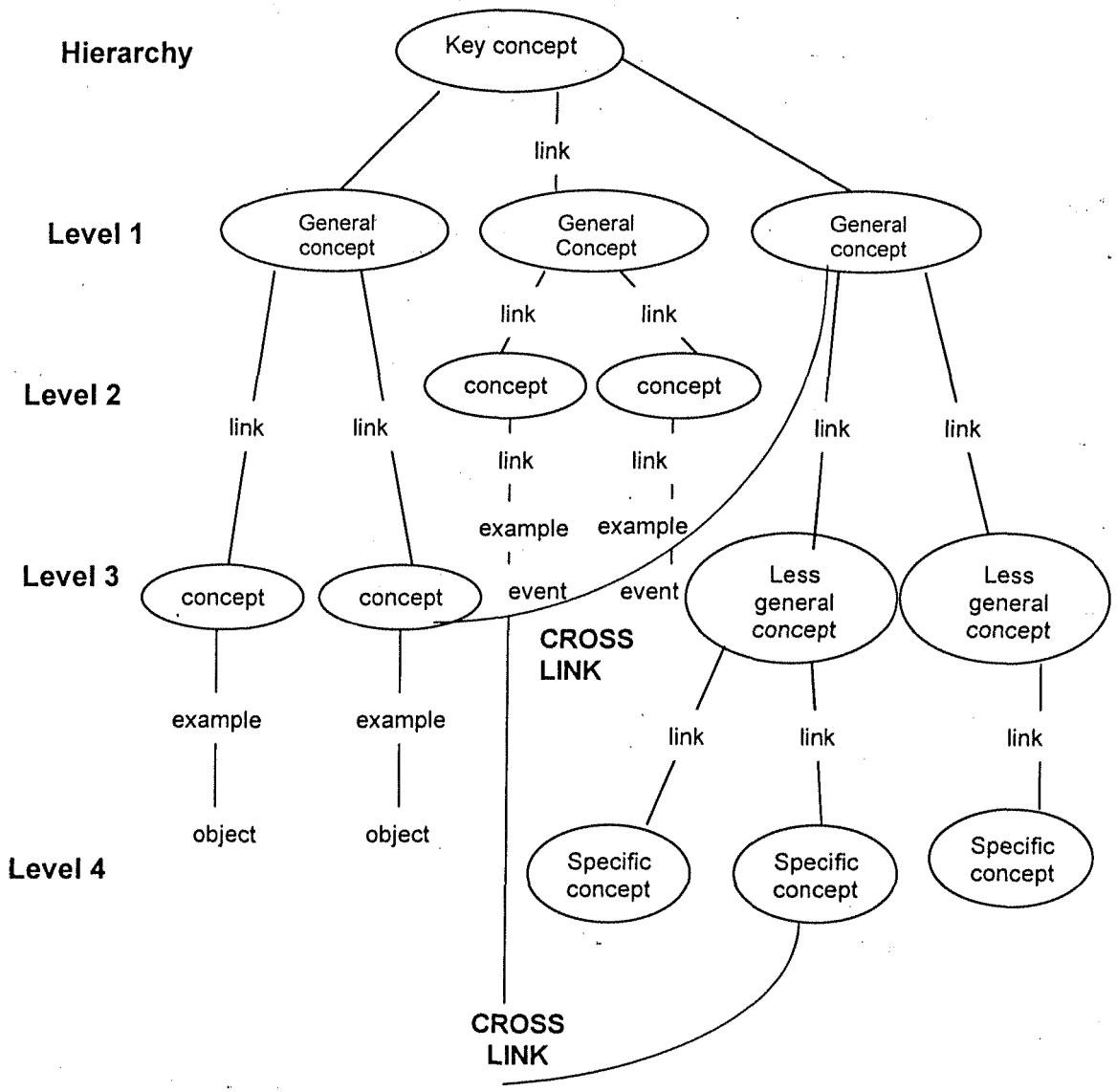
2. **Hierarchy:** Does the map show hierarchy? Is each subordinate concept more specific and less general than the concept drawn above it (in the context of the material being mapped)? Score 5 points for each valid level of the hierarchy.

3. **Cross links:** Does the map show meaningful connections between one segment of the concept hierarchy and another segment? Is the relationship shown significant and valid? Score 10 points for each cross link that is both valid and significant and 2 points for each cross link that is valid but does not illustrate a synthesis between sets of related concepts or propositions. Cross links can indicate creative ability and special care should be given to identifying and rewarding its expression. Unique or creative cross links might receive special recognition, or extra points.

4. **Examples:** Specific events or objects that are valid instances of those designated by the concept label can be scored 1 point each. (These are not circled because they are not concepts).

5. In addition, a criterion concept map may be constructed, and scored, for the material to be mapped, and the students scores divided by the criterion map score to give a percentage for comparison. (Some students may do better than the criterion and receive more than 100% on this basis).

Fig. 3.4 Scoring Model



Scoring for this model:

Relationships (if valid)	**= 14**
Hierarchy (if valid) 4 x 5	**= 20**
Cross links (if valid and significant) 10 x 2	**= 20**
Examples (if valid) 4 x 1	**= 4**
	58 points total

Phase 4 :

After the implementation of the Concept mapping strategy for a period of 3 months, the aforementioned tools were administered as post test to both experimental and control group students. The attitude scale related to concept mapping and reaction scale were administered at the end of the phase to the experimental group.

The analysis of data obtained through above tools along with interpretation is presented in the following chapter.

CHAPTER FOUR

ANALYSIS AND INTERPRETATION OF THE STUDY

The data obtained pertaining to the effectiveness of concept mapping strategy in Science was analysed descriptively and inferentially and interpreted keeping in focus, the objectives and the hypotheses of the study.

The details of the analysis and the interpretation are presented in 5 Sections, viz., effectiveness of concept mapping on achievement of students in science; on process skills of students; on concept attainment of students; attitude of students towards concept mapping and finally, the reactions of students towards the implementation of concept mapping strategy for teaching science.

Section – 1

Effectiveness of Concept Mapping over the Achievement of Students in Science

i) Analysis of students' achievement on pretest in science

The scores obtained by the students on the pre and the post achievement test in science is classified into the range of categories viz., 80% and above (excellent); 70% to less than 80% (very good); 60% to less than 70% (good); 50% to less than 60% (above average); 40% to less than 50% (average); 30% to less than 40% (below average); and below 30% as poor performance.

Table 4.1 : Frequencies and Percentages obtained on Pretest in science by Experimental and Control Groups

Pretest Achievement	Experimental		Control	
	Frequency	Percent	Frequency	Percent
Below 30%	11	23.4	11	24.9
30 and less than 40	20	42.7	10	21.8
40 and less than 50	14	29.9	16	40.5
50 and less than 60	2	4.3	5	12.0
60 and less than 70	-	-	-	-
70 and less than 80	-	-	-	-
80% and above	-	-	-	-
Total	**47**	**100%**	**42**	**100%**

The pre-test performance of experimental and control groups in science showed a low performance of students. The maximum number of students in experimental group and control group falling under the category of average performance were found to be only 29.9% in experimental and 40.5% in control group. Only a small number of students, (4.3% in experimental and 1.2% in control groups) were found to be above average in their performance on pretest in science. The remaining students in both the groups had shown below average (42.7% in experimental; 21.8% in control) and poor performance (23.4% in experimental and 24.9% in control group) in the given pretest.

The minimum and the maximum scores obtained on pretest achievement test in science by the experimental group were 17 and 60 with a mean value of 35.28 and SD value of 9.73. For the control group, the mean value was found to be 36.79 with standard deviation of 11.03, and with a minimum and maximum scores of 17 and 58.

Table 4.2 Mean and SD values obtained on Pre-achievement Test in Science by Experimental and Control Groups

Group	N	Minimum	Maximum	Mean	SD	Std. Error of Mean
Experimental	47	17	60	35.28	9.73	1.42
Control	42	17	58	36.79	11.03	1.70

The descriptive analysis carried out on pre-achievement test of students in science reveal that the performance of students belonging to both experimental and control group was poor.

ii) Analysis of Students' Achievement on Post-test in Science

The scores obtained on the post-achievement test after undergoing the treatment of concept mapping strategy by the experimental group, and the control group which never had without any intervention was analysed.

Table 4.3 Frequencies and Percentages obtained on Post-test in Science by Experimental and Control Groups

Post-test Achievement	Experimental		Control	
	Frequency	Percentage	Frequency	Percentage
Below 30%	1	2.1	8	19.2
30 and less than 40	2	4.3	12	28.8
40 and less than 50	1	2.1	15	36.0
50 and less than 60	17	36.2	7	16.8
60 and less than 70	18	38.3	3	-
70 and less than 80	4	8.5	-	-
80% and above	4	8.5	-	-
Total	**4.7**	**100.0**	**4.2**	**100.0**

The post test performance of students belonging to experimental and control groups in science reveal that the experimental group students have performed better. A good performance on post-test is seen in 55% of the students, while an above average performance is found in 36.2% of the students. Only 6.4% of the students have shown a poor performance on the post achievement test in science.

Considering the scores of students belonging to control group obtained on post test, it is found that 16.8% of the students had shown an above average performance. The average performance was seen in 36% of the students, while the remaining (48%) had shown a poor performance.

The mean value obtained by the experimental group on post achievement test in science was 61.17 with the SD of 12.20. The minimum and the maximum scores were found to be 20 and 87, in the experimental group, while 17 and 53 were found to be the minimum and the maximum scores with the mean and SD values of 38.53 and 9.87 in the control group.

The mean values obtained by the experimental group on post achievement test in science (61.17) show that the concept mapping has had an influence over the science achievement of students.

Table 4.4 Mean and SD values obtained on the Post-Achievement Test in Science by Experimental and Control Groups

Group	N	Minimum score	Maximum score	Mean	SD	Std. Error
Experimental	47	20	87	61.17	12.20	1.78
Control	42	17	53	38.53	9.87	1.52

(iii) Analysis of students belonging to different Intelligence Groups and their Achievement in Science

Based on the intelligence test of Raven Progressive Matrix (RPM) the students belonging to experimental and control groups were classified into 4 categories as follows :

Grade 1 (Superior)
Grade 2 (Above Average)
Grade 3 (Average)
Grade 4 (Below Average)

The frequency and the percentage of students falling under the above grades in both experimental and control groups are given in the Table 4.5.

Table 4.5 Frequencies and Percentage of Students Belonging to different intelligence groups

Grade	Experimental		Control	
	f	%	f	%
1	2	4.3	3	7.1
2	15	31.9	25	59.5
3	13	27.7	8	19.0
4	17	36.2	6	14.3
Total	**47**	**100.0**	**42**	**100.0**

The categories of students belonging to different grades of intelligence classified as above, was considered for analysis, in order to study the effect of concept mapping on students of different intelligence. The descriptive analysis and pre and post-achievement test gradewise is presented in Tables 4.6 and 4.7.

Table 4.6 : Descriptives of Pre and Post Test achievement of Students (Experimental) belonging to different intelligence groups

Grade		Pre-Achievement	Post-Achievement
1.	Mean	42.50	84.17
	N	2	2
	Std. Deviation	3.54	3.54
	Std. Error of Mean	2.50	2.50
2.	Mean	39.67	65.44
	N	15	15
	Standard Deviation	8.02	8.18
	Std. Error of Mean	2.07	2.37
3.	Mean	33.08	60.90
	N	13	13
	Std. Deviation	8.22	4.65
	Std. Error of Mean	2.28	1.29
4.	Mean	32.25	54.90
	N	17	17
	Std. Deviation	8.22	14.56
	Std. Error of Mean	2.28	3.53
	Total Mean	35.28	61.17
	N	47	47
	Std. Deviation	9.73	12.20
	Std. Error of Mean	1.42	1.78

Table 4.7 : Descriptives of pre and post test achievement Of students (control) belonging to different intelligence groups

Grade		Pre-Achievement	Post-Achievement
1.	Mean	41.67	43.89
	N	3	3
	Std. Deviation	13.33	9.18
	Std. Error of Mean	7.70	5.30
2.	Mean	38.80	39.33
	N	25	25
	Std. Deviation	10.52	8.99
	Std. Error of Mean	2.10	1.80
3.	Mean	35.00	38.54
	N	8	8
	Std. Deviation	11.09	12.55
	Std. Error of Mean	3.92	4.44
4.	Mean	28.33	32.50
	N	6	6
	Std. Deviation	9.83	9.65
	Std. Error of Mean	4.01	3.94
5.	Mean	36.79	38.53
	N	42	42
	Std. Deviation	11.03	9.87
	Std. Error of Mean	1.70	1.52

The descriptive analysis of pre and post achievement of experimental group shows that the students have performed better on the post test after undergoing the concept mapping strategy in science. The students belonging to superior intelligence show the mean value of 84.71; above average intelligence students show the mean value of 65.44, while average and below average students show the mean values of 60.90 and 54.90 on post achievement test. The standard error of mean in all four cases seemed to be minimal ranging from 2.07 to 3.53. The below average performance of students belonging to grade 4 have shown an above average performance, while students belonging to grade 2 and 3 have shown a good performance, while students of superior intelligence have shown an excellent performance. The overall mean value obtained for experimental group on the post test shows a good performance with a mean value of 61.17 and SD of 12.20 with the standard error of mean 1.78.

On the contrary, the control group had not shown any difference between pre and post test achievement. Excepting the students of grade 1 who have shown an average performance, the remaining students belonging to grade 2, 3 and 4 had shown a performance which is assessed as below average. The overall mean value for the entire group shows a below average performance on both pre and post test achievement, which indicates that there is no difference in their performance.

In order to determine further, whether the mean values obtained on pre and post-test achievement by experimental group students belonging to different levels of intelligence are significantly different, the following hypothesis was formulated which was tested by using ANOVA.

H_o (4.1) : There is no difference between students of different abilities in their pre and post achievement test in science.

Table 4.8 : ANOVA test on pre achievement test by experimental group students of different abilities

		Sum of Squares	df	Mean Square	F	Sig.
PREACHT*	Between(Combined)	611.566	3	203.855	2.340	
GRADE	Within Groups	3745.763	43	87.111		0.087
	Total	4357.329	46			

The obtained F value of 2.340 on pre-test achievement of students is not found statistically significant at 0.01 level. The significant level of 0.87 is not low enough to reject the null hypothesis. So the hypothesis stating that there is no difference between the experimental group students of different abilities on pre achievement test is retained.

Table 4.9 : ANOVA test on Post Achievement Test by Experimental group Students of different Intelligence Levels

		Sum of Squares	df	Mean Square	F	Sig.
POST	Between(Combined)	2000.624	3	666.875	5.921	.002
ACHT*	Within Groups	4843.348	43	112.636		
GRADE	Total	6843.972	46			

The F value of 5.821 obtained on post achievement test in science is found statistically significant at .01 level. That is, there is less than 1 chance in 100 that the observed differences among the four group means is due to sampling error. Therefore, the null hypothesis (4.1) is rejected and the alternative hypothesis stating that there is a difference between the students of different abilities in post achievement test in science is accepted. In other words, one can say that there is a difference in the effect of concept mapping over the achievement of students belonging to different intelligence groups.

Further to study the difference in the effect of concept mapping over the achievement of experimental group students of different abilities, 't' test was computed gradewise.

Table 4.10 : Mean, SD and 't' values obtained on pre, post test Achievement in Science by Experimental Students Belonging to Different abilities

Intelligence groups	N	Pre test		Post test		't'
		Mean	σ	Mean	σ	
Grade 1	2	42.5	3.54	84.2	3.54	8.33*
Grade 2	15	39.67	8.02	65.44	9.18	12.34*
Grade 3	13	33.08	8.22	60.89	4.65	10.91*
Grade 4	17	32.25	11.24	54.9	14.56	7.39*
Total	47	35.28	9.73	61.17	12.20	16.30*

* Significant at 0.01 level

The findings reveal that the concept mapping has had an effect over the achievement of students of different abilities which can be evidenced through the difference in the mean values obtained on pre and post test occasions and the 't' values which were found significant at 0.01 level. The overall analysis of both pre and post test also reveals that there is a significant difference in the mean values between pre and post achievement test which is reflected in the obtained 't' value of 16.30 that exceeds the critical value of 2.02 at 0.01 level. Therefore, the above stated hypotheses is rejected and the alternative hypothesis stating that there is a difference in the effect of concept mapping over the achievement of experimental group students of different abilities due to the effect of concept mapping strategy in science is accepted.

iv) Difference between the experimental and the control group students in their pre and post test achievement in science

As stated in the objective (1) in chapter one, it was intended to compare the achievement of students in science belonging to experimental and control groups on pre and post test performance. This objective is realized through the testing of null and directional hypotheses which are as follows:

H_o (4.2) There is no difference between the experimental and control group students in their pre test achievement in science.

H_1 (4.3) The experimental group students perform better than the control group students on post achievement test in science.

Table 4.11 : Mean, SD and 't' values obtained on pre-test and Post-test achievement in science by experimental and control groups

Group	N	Pre-test			Post-test		
		Mean	SD	't'	Mean	SD	't'
Experimental	47	35.28	9.73	0.67	61.17	12.20	9.66*
Control	42	36.79	11.03		38.53	9.87	

* Significant at 0.01 level.

Looking into the values obtained on pretest achievement in science, it is found that the mean values of both experimental and control groups are almost similar. The 't' value obtained is not found significant, thereby implying that there is no difference in the pretest achievement in science between the experimental and the control groups. Therefore, the hypothesis (4.2) is retained.

On the post test achievement in science, it is observed that there is a large difference in the mean values obtained by experimental (61.17) and control group (38.53). The 't' value obtained (9.66) was found significant at

0.01 level implying that the difference is due to the experimental treatment of concept mapping in learning science provided to the experimental students. Therefore, the hypothesis stating the experimental group students perform better than the Control group students on post achievement test in science is retained.

v) Difference between boys and girls in their science achievement

In order to study the gender differences in the science achievement, especially in the post test performance after the experimental treatment of concept mapping, the following hypothesis was formulated.

H_o (4.4) There is no difference between boys and girls with respect to their science achievement before and after the experimental treatment of concept mapping in science.

The scores obtained by boys and girls belonging to both experimental and the control group on pre and post tests occasions were considered for testing the above hypothesis.

Table 4.12 : Mean, SD and 't' values obtained by boys and girls belonging to experimental and control groups or both pre and post test achievement tests in science

Group	N	Pre-test						Post-test				
		Boys		N	Girls			Boys		Girls		
		Mean	σ		Mean	σ	't'	Mean	σ	Mean	σ	't'
Experi-mental	29	21.34	5.03	18	21.12	4.5	0.12	38.06	4.3	35.3	5.4	1.08
Control	23	22.09	6.0	19	22.05	5.03	0.02	24	6.1	24.32	5.03	0.14

The 't' values obtained in case of both experimental and control groups were not found statistically significant. Therefore, the null hypothesis stating that there is no difference between boys and girls with respect to their science achievement before or after the treatment of concept mapping in science is retained.

Section - 2

Effect of Concept Mapping on Process Skills

In order to study the effect of concept mapping over the process skills of students in science (Objective 2), the data obtained on process skills administered before and after the experimental treatment to the experimental group and control group was analysed and presented in the following sections.

i) Analysis of Process Skills of Students in Science

The descriptive analysis of each process skills separately and process skills as a whole performed by the students on pre and post test occasions is given in the Table 4.13.

Table 4.13 : Descriptives of Process Skills of Students Belonging to Experimental Group

Process Skills		N	Mean	Std. Dev.	Std. Error	Minimum	Maximum
Observation	(Pre)	47	39.57	21.46	3.13	0	80
	(Post)	47	63.83	13.60	1.98	40	80
Inference	(Pre)	47	40.00	0.00	0.00	40	40
	(Post)	47	74.04	11.73	1.71	40	100
Hypothesis	(Pre)	47	52.49	19.04	2.78	0	100
	(Post)	47	66.68	20.22	2.95	17	100
Interpretation	(Pre)	47	52.53	21.11	3.08	0	83
	(Post)	47	77.30	21.20	3.09	17	100
Reasoning	(Pre)	47	62.00	19.21	2.80	0	83
	(Post)	47	76.57	16.45	2.40	33	100
Prediction	(Pre)	47	48.40	19.09	2.78	0	100
	(Post)	47	64.36	17.09	2.49	25	100
Cause-Effect Relationship	(Pre)	47	40.06	13.48	1.97	0	82
	(Post)	47	58.97	13.63	1.99	27	91
Total	**(Pre)**	**47**	**47.60**	**9.15**	**1.33**	**16**	**67**
	(Post)	**47**	**67.89**	**10.23**	**1.49**	**35**	**91**

The analysis of process skills of students in science indicates high mean values after undergoing the experimental treatment in teaching science through concept mapping. The students seemed to have performed well on

the skills of inference, interpretation, reasoning and hypothesis. When compared to all the skills, it is observed that the students have scored less on the skill of seeing relationships. However, the individual process skills as well as the total scores on process skills as a whole show an increase in mean values, thereby, indicating that the strategy of concept mapping in science has had an effect over the improvement of process skills in students.

Table 4.14: Descriptives of Process Skills of Students Belonging to Control Group

Process Skills		N	Mean	Std. Dev.	Std. Error	Minimum	Maximum
Observation	(Pre)	42	31.43	16.01	2.47	0	60
	(Post)	42	29.05	16.05	2.48	0	60
Inference	(Pre)	42	63.33	20.20	3.12	0	100
	(Post)	42	65.71	16.70	2.58	20	100
Hypothesis	(Pre)	42	53.57	14.05	2.17	33	83
	(Post)	42	57.90	17.40	2.68	33	100
Interpretation	(Pre)	42	56.76	23.82	3.68	0	100
	(Post)	42	61.95	18.21	2.81	33	100
Reasoning	(Pre)	42	65.40	21.55	3.32	17	100
	(Post)	42	72.14	17.44	2.69	33	100
Prediction	(Pre)	42	50.60	17.01	2.62	25	75
	(Post)	42	57.14	23.61	3.64	0	100
Cause-Effect Relationship	(Pre)	42	54.54	17.13	2.64	18	82
	(Post)	42	46.55	14.34	2.21	18	73
Total	**(Pre)**	**42**	**54.21**	**12.78**	**1.97**	**30**	**79**
	(Post)	**42**	**55.04**	**8.89**	**1.37**	**37**	**74**

The descriptive analysis carried out on the process skills of control group does not show any increase in mean values for each process skill on post-test. However, the students seemed to have faired better on the skills like hypothesis, interpretation, reasoning and inference. But, the individual skills analysed separately as well as total analysis reveal that there is no difference between their pre and post performance on process skills test. However, the difference in the mean values between pre and post test on process skills in both experimental and control group is proved statistically through computing 't' test in the sub-section that is followed.

ii) Analysis of Students belonging to different intelligence groups and a study of their process skills in Science

In order to study the effect of concept mapping over the process skills of students belonging to different intelligence groups, the scores obtained on pre and post process skills by the students of different intelligence in both experimental and control groups were analysed descriptively and inferentially.

Table 4.15 : Descriptives of Process Skills of Experimental Students belonging to Different Grade Levels of Intelligence

Process Skills	Grade	N	Mean	Std. Dev.	Std. Error	Minimum	Maximum
Pre-test	1	2	56.98	4.93	3.49	53	60
	2	15	50.85	9.04	2.34	33	67
	3	13	45.97	7.95	2.21	30	58
	4	17	44.87	9.44	2.29	16	53
	Total	**47**	**47.60**	**9.15**	**1.33**	**16**	**67**
Post-Test	1	2	76.74	13.16	9.30	67	86
	2	15	71.01	8.10	2.09	58	91
	3	13	66.55	9.08	2.52	47	79
	4	17	65.12	11.92	2.89	35	81
	Total	**47**	**67.89**	**10.23**	**1.49**	**35**	**91**

From the table 4.15, it is seen that the performance of students belonging to all grade levels had performed better on the process skills in post test occasion. A higher performance is observed especially in grade 1 (superior intelligence) and grade 2 (above average intelligence) students. This is evident through the mean values obtained for each grade levels on pre and post process skills test.

In order to study if there is any difference among the students of experimental group belonging to different grade levels in their performance on process skills test the following hypothesis was formulated and ANOVA test was used.

H_o 4.5: There is no difference among the experimental and control group students of different intelligence in their performance on pre and post process skill test.

Considering the performance of experimental group separately, it is seen that the obtained 'F' value in pre test as well as the post test for experimental group were found below the values of 0.05 and 0.01 levels. Therefore, it is concluded that there is no difference between the students of different grades and within the group of each grade level in their performance on process skills at both pre and post test occasions.

Table 4.16 : ANOVA test on process skills of Experimental Group Students belonging to Different Grades of Intelligence

Process Skills test		Sum of Squares	df	Mean Square	F	Sig.
PRETEST* GRADE	Between Groups	495.574	3	165.191	2.118	0.112
	Within Groups	8353.544	43	77.989		
	Total	3849.119	46			
POSTTEST *GRADE	Between Groups	456.822	3	152.274	1.504	0.227
	Within Groups	4352.678	43	101.225		
	Total	4809.500	46			

The gradewise analysis of students belonging to control group on pre and post process skill is presented in the Table 4.17.

Table 4.17 : Descriptives of Process Skills of Control Group Students belonging to Different Grade Levels of Intelligence

Grade		Pre Process Skills	Post Process Skills
1.	Mean	64.34	65.89
	Std.Deviation	5.85	8.17
	Minimum	58	58
	Maximum	70	74
	Std.Error of Mean	3.38	4.72
2.	Mean	55.07	54.98
	Std.Deviation	13.35	8.98
	Minimum	35	37
	Maximum	79	70
	Std.Error of Mean	2.67	1.80
3.	Mean	51.16	51.74
	Std.Deviation	14.39	9.03
	Minimum	30	37
	Maximum	67	63
	Std.Error of Mean	5.09	3.19
4.	Mean	49.61	54.26
	Std.Deviation	8.66	5.63
	Minimum	37	44
	Maximum	63	60
	Std.Error of Mean	3.54	2.30
Total	Mean	54.21	55.04
	Std.Deviation	12.78	8.89
	Minimum	30	37
	Maximum	79	74
	Std.Error of Mean	1.97	1.37

From the table 4.17 it is seen that there is no difference in the mean values obtained on pre and post process skills by students belonging to different grades. Comparing between the grades, the students belonging to grade 1 seemed to have superceded the students belonging to grade 2, 3 and 4. Though the mean values obtained on pre test (54.21) seemed to be higher when compared to experimental group, it is seen that there is no increase in mean values on post process skills test (55.04).

However, the ANOVA test computed (table 4.18) shows there is no difference between and within the groups of different intelligence on pre and post tests. Therefore, the above hypothesis (4.5) is retained.

Table 4.18 : ANOVA Test on Process Skills of Control Group Students belonging to Different Grades of Intelligence

Process Skills		Sum of Squares	df	Mean Square	F	Sig.
PRE TEST GRADE	Between(Combined)	527.508	3	175.836	1.082	.368
	Within Groups	6173.283	38	162.455		
	Total	6700.790	41			
POST TEST GRADE	Between(Combined)	443.879	3	147.960	2.010	.129
	Within Groups	2797.512	38	73.619		
	Total	3241.392	41			

iii) Difference between pre and post test on process skills of Experimental and Control Groups in Science

In order to study the effect of concept mapping strategy in science over the process skills of students, the following hypothesis was formulated.

H_1(4.6) : The experimental group students perform better on post process skills test after undergoing the concept mapping strategy in science than on pre process skills test.

H_o(4.7) : There is no difference between the pre and post performance of control group students on process skills test.

The scores obtained on each process skill separately, as well as the total score obtained on pre and post tests were analysed in order to test the above hypotheses. The above hypothesis (4.6) is redefined in the null form to be tested statistically for its significance.

Table 4.19: Mean, SD and 't' values obtained on pre And post process skills test by Experimental group

Group (N)	Process Skills	Pre Test		Post Test		't'
		Mean	σ	Mean	σ	
Experimental Group (N=47)	Observation	39.6	21.5	64.0	13.60	7.40*
	Inference	40.0	00	74.2	11.73	20.0*
	Hypothesis	52.0	19.04	67.0	20.22	4.03*
	Interpretation	52.0	21.11	77.0	21.20	5.74*
	Reasoning	62.0	19.21	77.0	16.45	4.11*
	Prediction	48.0	19.9	64.0	17.09	4.76*
	Cause-effect relationships	40.0	13.48	59.2	13.63	9.20*
	Total	**47.6**	**9.15**	**67.89**	**10.23**	**13.52***

* Significant at 0.01 level.

It is observed that on every independent process skill, the mean values obtained on post test were found to be on the higher plane, when compared to the pre test mean values. The 't' values obtained on each process skill as well as on the test as a whole were found to be significant at 0.01 level on one tailed test. This finding indicates that the concept mapping in science has had an effect over the process skills of students in science. Therefore, the above hypothesis stating that the experimental students perform better on post process skills than on pre process skill test is retained which indicates to the effectiveness of concept mapping strategy in science over the process skills of students.

Table 4.20 : Mean, SD and 't' values obtained on Pre and post process skills test by Control Group

Group (N)	Process Skills	Pre Test		Post Test		't'
		Mean	σ	Mean	σ	
Control Group (N=42)	Observation	31.43	16.01	29.05	16.05	0.79
	Inference	63.0	20.2	65.71	16.70	0.62
	Hypothesis	54.1	14.05	58.2	17.40	1.80
	Interpretation	57.2	23.82	62.3	18.21	1.08
	Reasoning	65.2	21.55	72.2	17.44	1.92
	Prediction	50.6	17.01	57.0	23.61	1.71
	Cause-effect relationships	55.2	17.13	47.1	14.34	1.92
	Total	**54.2**	**12.78**	**55.3**	**8.89**	**0.64**

The comparison between the pre and post test on process skills of the students belonging to control group show that there is no difference in their performance. Considering the independent skills also, it is evident that there is no change observed in students on any of the process skills. This finding ensures the effectiveness of concept mapping on process skills in science which was evidenced through the improved performance in experimental group students. Therefore, the hypothesis (4.7) stating that there is no *difference between the pre and post performance of control group students on* process skills test is retained.

iv) Difference between the Experimental and the Control Group students in their pre and post process skills in science

As stated in the objectives in Chapter One, it was intended to compare the process skills of students belonging to experimental and control groups on pre and post process skills test in science. The objective is realized through the testing of null and directional hypotheses which are as follows :

H_o (4.8): *There is no difference between the Experimental and Control Group students in their performance on pre-process skills test in science.*

H_1 (4.9) : *The experimental group students perform better than the control group students on post process skills test in science.*

Table 4.21 : Mean, SD and 't' values obtained on pre and post process skills test in Science by Experimental and Control Groups

Group	N	Pretest			Post-test		
		Mean	SD	't'	Mean	SD	't'
Experimental	47	47.6	9.15	2.77*	67.9	10.23	6.34*
Control	42	54.21	12.78		55.3	8.89	

*Significant at 0.01 level.

Looking into the values obtained on pre-process skills test in science, it is found that the mean values of both experimental and control groups, it is found that the mean values of control group is superior to that of experimental group (Experimental – 9.15; Control – 54.21). The 't' value obtained is found significant, thereby indicating that there is a difference in the pre-process skills in science between experimental and control groups. Therefore, the hypothesis (4.8) is rejected.

On the post process skills test, it is observed that there is a significant difference in the mean values obtained by experimental group (67.9%) and control group (55.3%). The 't' value obtained (6.34) was found significant at 0.01 level implying that the difference is due to the experimental treatment of concept mapping in learning science which has enhanced the mean values of process skills in experimental group. Therefore, the hypothesis (4.9) stating that the experimental group students perform better than the control group on post-process skills test in science is retained.

v) Difference between boys and girls in their process skills

In order to study the difference between boys and girls in their process skills, the following hypotheses was formulated and 't' test was employed to test the hypothesis.

H_o(4.10) : There is no difference between boys and girls of experimental and control groups in their process skill performance on pre and post tests.

Table 4.22a: Mean, SD and 't' values of boys and girls Belonging to experimental group in their process skills

Experimental Group	Pre-Process skills				Post-Process Skills		
	N	Mean	SD	't'	Mean	SD	't'
Boys	29	46.82	10.30	0.79	67.82	10.46	0.05
Girls	18	48.97	8.00		67.98	10.00	
Total	47	47.60	9.15		67.89	10.46	

From the table, it may be seen that the obtained mean difference is not significant which is indicated by the 't' values that are found below the 't' critical values of 2.02 on two-tailed test in both pre and post test situations. This implies that there is no difference between the performance of boys and girls in their process skills in both pre and post test situation. Therefore, the above hypothesis (4.10) in case of experimental group is retained.

Table 4.22b: Mean, SD and 't' values of boys and girls Belonging to control group in their process skills

Control Group	Pre-process skill				Post-Process skill		
	N	Mean	SD	't'	Mean	SD	't'
Boys	23	55.20	12.78	0.53	55.21	8.80	0.13
Girls	19	52.99	12.00		54.83	8.09	
Total	**42**	**1.94**	**12.78**		**55.04**	**8.89**	

As found in the experimental group, even in the control group, it is seen that there is no difference in the performance between boys and girls on pre and post process skill. Therefore, the above hypothesis (4.10) stating there is no difference between boys and girls in their process skills in retained.

Section III

Effect of Concept mapping over the concept attainment of students in Science

In order to study the objective of finding the effect of concept mapping over the concept attainment ability of students in science, the scores obtained on the concept attainment test by both experimental and control group at pre and post occasions were analysed and presented in the following sub sections.

i) Analysis of Concept attainment of students

The descriptive analysis of pre and post performance of students of experimental and control groups on the concept attainment test is given in the Table 4.23. The mean values for experimental group were found to be 46.63 on pre test and 57.57 on post test with the SD values of 9.65 and 9.00. The control group shows the mean values of 48.23 and 54.42 on pre and post concept attainment test with the SD values of 1.13 and 1.48. The minimum and maximum scores in case of experimental group were found to be 23 and 60 on pre test, and 29 and 74 on post test. In case of Control group, 29 and 74 were found to be minimum and maximum scores on pre test, and 31 and 69 on post test.

7Table 4.23: Descriptives of pre and post concept attainment of experimental and control groups

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
PRE CONP						
Experimental	47	46.63	9.65	1.41	23	60
Control	42	48.23	7.31	1.13	26	63
POST CONP						
Experimental	47	57.57	9.00	1.31	29	74
Control	42	54.42	9.57	1.48	31	69

ii) Analysis of Concept attainment of students of different abilities.

The analysis is carried out to study how the students of different levels of intelligence have performed on concept attainment test. The scores obtained by the experimental and Control group on pre and post tests of concept attainment were considered for analysis.

Table 4.24 : Descriptives of Concept attainment of Experimental group

Grade		Pre Concept attainment	Post Concept attainment
1.	Mean	52.86	68.57
	N	2	2
	Std.Deviation	10.10	8.08
	Std.Error of Mean	7.14	5.71
	Minimum	46	63
	Maximum	60	74
2.	Mean	49.33	60.19
	N	15	15
	Std.Deviation	7.90	6.95
	Std.error of Mean	2.04	1.80
	Minimum	31	49
	Maximum	60	74
3.	Mean	49.01	57.80
	N	13	13
	Std.Deviation	7.45	7.11
	Std.error of Mean	2.07	1.87
	Minimum	31	46
	Maximum	57	69

Grade		Pre Concept attainment	Post Concept attainment
4.	Mean	41.68	53.78
	N	17	17
	Std.Deviation	11.07	10.58
	Std.error of mean	2.68	2.56
	Minimum	23	29
	Maximum	60	69
Total:	Mean	46.63	57.57
	N	47	47
	Std.Deviation	9.65	9.00
	Std.error of Mean	1.41	1.31
	Minimum	23	29
	Maximum	60	74

In case of Experimental group (Table 4.24) it is seen that the high mean values are obtained by students belonging to grade 1 and 2 levels of intelligence. Comparing the mean values of pre and post test grade wise, it is seen that the students belonging to all the grades have shown an improvement in their concept attainment on post test which is clearly evident through the increased mean values on post test of all the grades of students.

On the contrary, the descriptive analysis obtained on the performance of students belonging to control group on concept attainment test (Table 4.25) reveal that there is no difference in mean values between the pre and post test performance. The grade wise analysis also reveals that there is no difference in the mean values.

Table 4.25 : Descriptive analysis of Concept attainment of students belonging to Control group

GRADE		PRE CONP	POST CONP
1.	Mean	52.38	49.52
	N	3	3
	Std.Deviation	1.65	8.73
	Std.Error of Mean	95	5.04
	Minimum	51	40
	Maximum	54	57
2.	Mean	49.26	51.09
	N	25	25
	Std.Deviation	7.66	8.62
	Std.Error of Mean	1.53	1.72
	Minimum	26	31
	Maximum	63	66
3.	Mean	46.07	48.57
	N	8	8
	Std.Deviation	6.19	4.83
	Std.Error of Mean	2.19	1.71
	Minimum	37	43
	Maximum	57	57
4.	Mean	44.76	46.67
	N	6	6
	Std.Deviation	8.01	4.30
	Std.Error of Mean	3.27	1.76
	Minimum	34	43
	Maximum	54	51
Total	Mean	48.23	49.86
	N	42	42
	Std.Deviation	7.31	7.50
	Std.Error of Mean	1.13	1.16
	Minimum	26	31
	Maximum	63	66

However to determine the differences between the experimental and the Control groups and the difference within the two groups. The following hypotheses were formulated and analysis of variance was used to the test the hypothesis.

H_0 (4.11) : There is no difference among the students of different abilities belonging to experimental group in their pre and post concept attainment.

H_0 (4.12): There is no difference among the students of different abilities belonging to control group in their pre and post concept attainment.

Table 4.26 : ANOVA for pre and post concept attainment of Experimental group

		Sum of Squares	df	Mean Square	F	Sig.
PRECONP *GRADE (Combined)	Between	677.302	3	225.767	2.699	.05
	Within Groups	3601.986	43	83.767		
	Total	4279.288	46			
POSTCONP*GRADE (Combined)	Between	589.762	3	196.587		
	Within Groups	3132.340	43	72.845		
	Total	3722.102	46			

The F value obtained on pre test (1.185) and post concept attainment test (.649) were not found significant for Control group. This indicates that there is no difference observed within or between the groups of students belonging to different levels of intelligence, and therefore the above hypothesis is retained.

In case of experimental group, the 'F' value of 2.695 was found significant at 0.05 level in case of pre and post concept attainment test. This indicates that there is a difference within and between the students of different intelligence, which is also obvious from the mean values obtained on pre and post concept attainment test by students of different intelligence levels.

Therefore the above hypothesis is rejected and an alternate hypothesis stating that there is a difference among the students of different abilities belonging to experimental group in their pre and post concept attainment is accepted.

iii) Difference between pre and post concept attainment of students

In order to study the difference between the pre and the post concept attainment of Experimental and Control groups, the following hypothesis were formulated and tested by using 't' test.

$H_1(4.13)$: *The experimental group students perform better on post concept attainment than on the pre concept attainment test.*

$H_o(4.14)$: *There is no difference between pre and post concept attainment of control group students.*

Table4.27: Mean, SD and 't' values obtained on pre and post Concept attainment of students

Group	N	Pre test		Post test		't'
		Mean	SD	Mean	SD	
Experimental	47	46	9.64	54.56	8.99	8.98*
Control	42	48	7.31	49.8	7.49	1.62

* significant at 0.01 level.

From the table 4.27 it is seen that there is a difference in the mean values between pre and post concept attainment of experimental group students. The difference is signified by the 't' value of 8.98 which was found significant at 0.01 level. This implies that the given concept mapping strategy in Science has had an effect over the concept attainment of students. Therefore the Hypothesis stated that the experimental group students perform better on post concept attainment than on pre concept attainment test is retained.

In case of Control group, the hypothesis stated is retained, as there was no difference observed in the mean values of pre and post concept attainment tests, which is evidenced through the 't' value of 1.62 that was below the value of 0.01 level of significance.

iv) Difference between Experimental and Control group students in their Concept attainment

In order to study the difference between experimental and Control group in their pre and post Concept attainment to analyse the effectiveness of Concept mapping strategy in Science, the following hypotheses were formulated. The scores obtained by experimental and Control groups on pre and post concept mapping tests were considered for analysis.

$H_0(4.15)$: *There is no difference between the experimental and Control group students in their performance on pre Concept attainment test.*

$H_1(4.16)$: *The experimental group students perform better than the Control group students on post Concept attainment test.*

Table 4.28 : Difference between Experimental and Control Group on Concept attainment

Group	N	Pre Concept attainment			Post Concept attainment		
		Mean	σ	't'	Mean	σ	't'
Experimental	47	46	9.64	0.89	54.56	8.99	4.40*
Control	42	48	7.31		49.8	7.49	

*Significant at 0.01 level.

It is seen from the table 4.16 that there is no difference between experimental and Control groups in their pre concept attainment as 't' value 0.89 is found below the critical value of 2.02. Therefore the above hypothesis (4.15) is retained.

In case of post Concept attainment, there is a difference observed between experimental and Control group which is evidenced through the 't' value of 4.40 that exceeds the critical value of 2.02. This indicates that Concept mapping strategy was effective in improving the Concept attainment ability of experimental group students who underwent the treatment of Concept mapping in Science. Therefore the hypothesis stating that the

experimental group students perform better than the Control group students on post Concept attainment test is retained.

v) Difference between boys and girls in their Concept attainment

The difference between boys and girls in their Concept attainment as an effect of Concept mapping strategy was studied by formulating the following hypothesis which was tested by using 't' test.

H_o (4.17) : *There is no difference between boys and girls in their pre and post Concept attainment.*

The scores obtained by boys and girls in experimental and Control groups on pre and post test occasions was considered for analysis.

Table 4.29 : Difference between boys and girls on Concept attainment

Group	N	Pre Concept Attainment			Post Concept Attainment		
		Mean	σ	't'	Mean	σ	't'
Experimental	Boys(29) Girls (17)	17.03 15.52	9.80 10.48	1.50	20.45 19.71	7.14 10.84	0.69
Control	Boys(23) Girls (19)	17.26 16.42	8.31 6.00	1.07	17.91 16.90	8.00 6.98	1.26

The 't' values obtained on pre and post Concept attainment for boys and girls in both experimental and Control group were found below the critical value of 2.02. Therefore the above hypothesis is stating that there is no difference between boys and girls in their pre and post concept attainment is retained.

Section - 4.V

Analysis of Students' attitude towards Concept Mapping

As stated in Chapter 3, the attitude of students' towards Concept mapping was measured by administering an attitude scale to the students who under went the experimental treatment. The students' attitude towards concept mapping was analysed descriptively and inferentially, the details of which are provided in the following g sub sections.

i) Descriptive analysis of students' attitude towards Concept mapping

For the purpose of analysis, the total scores of attitude is categorized ranging from 'highly positive' to 'highly negative' on a continuum of 5-point scale which is as follows:

121 - 150 (highly positive)
91 - 120 (Positive)
61 - 90 (Neutral)
31 - 60 (Negative)
0 - 30 (highly negative)

From the table 4.30, it is seen that 66.8% of the students have developed a positive attitude, while 34.7% of the students have developed highly positive attitude towards concept mapping. Only 6.5% of the students have shown a neutral attitude towards concept mapping. The findings indicate the students' interest in learning science through concept mapping strategy.

Table 4.30: Frequencies and percentages of students' attitude towards concept mapping

Attitude Categories	Frequency	Percent	Valid Percent
121-150 (highly positive)	16	17.6	34.7
91-120 (positive)	28	30.8	66.8
61-90 (neutral)	3	3.3	6.5
31-60 (negative)	-	-	-
0-30 (highly negative)	-	-	-
Total	**47**	**51.0**	**100.0**

The analysis of attitude of students belong to different intelligence groups is given in the table 4.31.

Table 4.31: Descriptives of attitude of students belonging to Different intelligence groups

Grade	N	Mean	Std. Deviation	Std.Error	Minimum	Maximum
1	2	127.00	5.66	4.00	123	131
2	15	120.33	12.48	3.22	90	141
3	13	111.77	11.57	3.21	91	131
4	17	109.44	14.87	3.72	90	133
Total	**47**	**114.41**	**13.71**	**2.02**	**90**	**141**

It is seen that the mean values of grade 1 (superior intelligence) and grade 2 (above average) students are 127 and 120.33 with the SD value of 5.66 and 12.48 indicating the highly positive attitude towards concept mapping. The students belonging to grade 3 (average) and grade 4 (below average) show the mean values of 112 and 109.44 which indicate the positive attitude towards concept mapping. The over all mean value obtained for the total group of experimental students is found to be 114.41 with the SD value of 13.71 and standard error of mean of 2.02.

In order to know if there are any differences between students of different intelligence group, and difference within the same grade of intelligence group, the following hypothesis was formulated and ANOVA test was used to test the hypothesis.

H_o (4.18) : There is no difference among the students of different intelligence in their attitude towards concept mapping.

Table 4.32: ANOVA test – Difference between students of different intelligence groups in their attitude towards concept mapping

	Sum of Squares	df	Mean Square	F	Sig
ATT*GRADE Between (Combined)	1329.574	3	443.191	2.609	.064
Within Groups	7133.579	42	169.847		
Total	8463.152	45			

From the F value (2.609) obtained from mean squares of groups (between and within) is not found significant at 0.05 level even implying that there is no difference among the students of different grade levels of intelligence in their attitude towards concept mapping. This is also evident from the mean values obtained at each grade level which lean towards positive attitude. Therefore, the above hypothesis stating that there is no difference among the students of different intelligence in their attitude towards concept mapping is retained.

ii) Difference between girls and boys in their attitude towards concept mapping

In order to study if there is any difference between boys and girls in their attitude towards concept mapping, the following hypothesis was formulated and 't' test was used to study the significance of the difference.

$H_o(4,.19)$: *There is no difference between boys and girls in their attitude towards concept mapping.*

Table 4.33: Mean, SD and 't' value obtained on attitude towards concept mapping by boys and girls belonging to Experimental group

Students	N	Mean	σ	't'	Sig
Boys	29	112.6	14.9	1.49	2.04
Girls	18	118.9	12.52		

From the table it is seen that there is no much of difference between the mean value of boys (112.6) and girls (118.9), which is significant. The obtained 't' value of 1.49 is found below the value of 0.05 level, thereby proving that the mean difference in attitude is not significant. Therefore, the hypothesis stating that there is no difference between boys and girls in their attitude towards concept mapping is retained.

Section – V

Concept Map Assignments

Both individual and groups were included in class and home assignment. Individual concept mapping were given maximum as home assignments. As a classroom work, group activities including description of concept maps, drawing a concept map on one's own were given. Among individual and group mapping, it was found that students could do better in groups. The students used to discuss among each other and also sometimes with the teacher and then used to draw concept maps. During discussion, they were able to use appropriate link words which was lacking when students were asked to draw individual maps individually. The students were able to identify superordinate and subordinate concepts and were also able to show

their relationships in the concept maps. But they were unable to use appropriate link words. Apart from this, they used to make use of very long link words and described the concept instead of using concept labels. Some students never used the arrow marks.

Gradually the students improved in drawing concept maps especially using appropriate and short link words, showing relationship between superordinate and subordinate concepts. During the last two lessons, students used to draw the concept maps on their own and found it as a very interesting activity. They also tried in other subjects and found that it is very useful in remembering the concepts easily.

Some examples of concept maps drawn by students individually and in groups are presented in the Appendix.

Section - VI

Analysis of students' reaction about the Concept mapping strategy used for teaching Science

The reactions of students who underwent the experimental treatment on Concept mapping strategy in Science was analysed itemwise descriptively by using frequencies and percentages and qualitatively as well whenever it was required.

1. Use of Concept mapping in understanding the Concepts

It is found that 81% of the students have reacted positively saying that concept mapping strategy has helped them in understanding the concepts in Science, while 15% of the students have said that it has helped them sometimes in understanding the Concepts.

2. To see relationship between the Concepts

Only one student (2.1%) has expressed that concept mapping has not helped in seeing relationship between the concepts, while 77% have said that it has helped them in seeing relationship between various concepts. Around 17% of the students have expressed that the strategy has helped them sometimes to see relationship between various concepts.

3. In remembering the Content for a long time

It is found that 63.8% of the students have expressed that the concept mapping has helped them in remembering the content for a long time, while 27.7% of the students have expressed that it helps sometimes, and 8.5% of the students have expressed that it has not helped them in remembering the content for a long time.

4. Whether regular teacher should teach the same content again?

For this, 75% of the students have responding saying there is no need for regular teacher to teach the same content again, while the remaining students have expressed that sometimes they felt a need that regular teacher should teach the content again.

5. Whether certain questions came to mind while the teaching was going on?

Around 50% of the students had expressed that they had many questions while 30% of the students had said that sometimes they had questions, while 6.45% of the students had expressed negatively.

6. Whether freedom was provided to ask questions ?

It was expressed by 85% of the students that freedom was provided during teaching to ask questions, while 12.8% of the students had felt that sometimes freedom was given to ask questions.

7. Whether concept mapping provided inspiration to learn further?

To this, 68.1% of the students had responded positively, while 21.3% of the students had felt that sometimes the method inspired them to further learning and 10.6% of the students had negatively responded.

8. Whether got distracted when concept maps were developed on the Black Board?

Only 4.3% of the students felt that they got distracted, while 14.9% of the students had felt that sometimes they got distracted. Around 67.4% of the students had expressed that they never got distracted when concept maps were being developed on the blackboard.

9. Whether concept mapping leads to meaningful learning?

Around 80% of the students had felt that concept mapping leads to a meaningful learning, while 15% of the students had expressed that sometimes it leads to meaningful learning and the remaining 5% of the students had expressed negatively.

10. Involvement of students in the development of concept mapping during teaching

It was felt by 66% of the students that they were involved in the development of concept mapping during the lesson, while 28% of the students felt that they were involved sometimes, and 6.4% of the students had expressed that they were not involved.

11. Difficulty in using link words

Regarding this, 75% of the students have expressed that they have no difficulty in using link words, while 25% of the students have felt that sometimes they had difficulty in using link words, and 5% of the students had not responded.

12. Usage of link words in understanding concept maps

For this, 75% of the students had reacted saying that the link words helped them in understanding the concept maps, while 20% said that sometimes it helped them. Only 2.1% of the students had reacted saying it did not help in understanding concept maps.

13. Relationship of subordinate concepts with that of super ordinate concepts

Regarding this, 68% of the students had reacted saying that they could see the relationship, while the remaining said concept maps helped them in seeing relationship between super ordinate and subordinate concepts.

14. Whether drawing concept maps restricted the freedom of expression in other ways?

While 65% of the students had expressed positively saying 'NO' , 20% of the students had felt that sometimes it restricted their freedom, while the remaining felt that it restricted their freedom.

15. Which method is effective in understanding the content – regular teaching method or teaching through concept mapping clubbed with other activities?

To this, 77% of the students had opted for concept mapping, while the remaining students had opted regular teaching method to be the effective method for understanding the content.

II. Concept mapping at the end of the class to review the whole lesson

Concept mapping was used at the end of every lesson and unit to sum up and to review the whole lesson. Certain questions related to this had elicited the following responses from the students,

1. **Whether use of concept mapping helped in getting a complete picture about the content that was taught ?**

To this, 73% of the students had reacted positively, while 21% of the students had reacted saying that sometimes the use of concept mapping at the end helped them in understanding the entire content. Around 6.4% of the students had reacted negatively.

2. ***Involvement in concept mapping during summing up of the lesson***

Around 52% of the students said that they were involved in concept mapping during summing up of the lesson, while 13% of the students said that they were not involved. The remaining students had said that they were involved sometimes.

3. **Whether concept mapping was a boring activity**

Regarding this, 70% of the students had said that it was not boring, while 20% had said that it was boring sometimes. Around 6.4% of the students said that it was a boring activity.

III. Use of Concept mapping for evaluation

Sometimes in the class, concept mapping was used as a tool to evaluate students understanding of the content. A few questions related to this were asked to the students.

1. **Difficulty in answering the questions**

Around 65% of the students had reacted saying that they did not find it difficult in answering the questions asked while developing concept maps related to certain concepts, while 30% of the students felt that they had difficulty sometime in answering the questions, and 5% of the students had said that they had difficulty in answering the questions.

2. Preference for either describing the concept map given by the teacher or draw concept map on ones own

To this, 34% of the students hade expressed that they prefer describing the concept map given by the teacher, while 45% had felt that they prefer drawing the concept maps on their own based on text given. The remaining students had expressed that they prefer doing both.

3. Interest in filling the blanks provided in the concept maps

Around 89.4% of the students had expressed that they were interested in filling the blanks provided in the concept maps, while 6.4% had said that sometimes they were interested, and 4.3% of the students had evinced lack of interest.

4. Whether the discussion in groups helped in drawing better concept maps

To this, 74.5% of the students had expressed that discussion in groups had helped them in drawing better concept maps, while 19.1% had felt that sometimes it helped them. Around 6.4% of the students had expressed that it did not help them.

IV. Drawing concept maps individually and in groups

Sometimes during the instructions, or at the end of the lesson, the students were asked to draw concept maps either in groups or individually. Certain questions were asked to students related to this.

1. Whether they enjoyed drawing concept maps in groups?

To this, 79% of the students had expressed that they enjoyed drawing concept maps in groups, and 12.8% of the students had said that they enjoyed sometimes, while 8.5% of the students had expressed that they did not enjoy drawing concept maps in groups.

2. Which of the following was easier ?

a) Developing concept maps individually.

b) Developing concept maps in groups.

To this 37% of the students had preferred developing concept maps individually, while 63% of the students had felt that developing concept maps in groups was easier.

3. Time consumed

Majority of the students (75%) had felt that drawing concept maps individually consumed more time when compared to drawing maps in groups.

4. In what ways developing concept maps in groups or individually has helped?

The opinions of students for this are categorized as follows:

a) In groups, it was easy to draw concept maps and students enjoyed and learnt together.

b) Working in groups seemed to have helped students in seeing relationship between concepts. For example, one student has expressed, "Doing concept map in groups helped me in different ways like when I knew some points relating to the concept, my friends knew certain other points. Collecting all those points, I could easily draw the concept map. It also helped in many ways like in groups we try to discuss more and more and we try to know more and more information".

"Sometimes if the lessons are taught or difficult to understand, the concept maps helped us by making things short and sweet to understand and the link words used with the subordinate helped us to understand better".

c) Drawing concept maps in groups consumes less time when compared to concept mapping individually.

d) It is boring and confusing to draw concept maps on one's own.

e) Concept mapping in groups helps not only in sharing ideas, but also in getting more information from others. It helps in clearing doubts.

f) A small percentage of students preferred individual concept mapping for the following reasons like - If concept mapping is done individually, one is able to think better and one can also assess one's own understanding of concepts; Individual mapping helps in longer retention of the content and in improving language.

One student had expressed as follows : "It helped me to express my creativity and also show my individuality and express my ideas and attaining perfection".

Another student who expressed negatively about individual mapping is as follows : "When we are providing own concept maps, we require much time. First we have to find the superordinate concept after which we have to find the subordinate concept which is related to the superordinate concept with link words".

Looking into the above reactions, one may conclude that students have reacted positively about concept mapping. Though some students have preferred individual concept mapping, by and large, it is felt that students have preferred concept mapping in groups. This goes very much in hands with those research findings on collaborative concept mapping which showed positive outcomes. However, it was found that those students who preferred individual mapping belonged to the superior intelligence groups.

In short, from the above findings, one can arrive at a conclusion that concept mapping is an effective strategy which can be used to enhance meaningful learning, to develop certain cognitive skills and also as an effective evaluation tool to assess students' understanding.

The major findings of the study are discussed in the following chapter.

CHAPTER FIVE

MAJOR FINDINGS OF THE STUDY

The project was aimed at studying the effectiveness of concept mapping strategy in teaching science to eighth standard students. The effectiveness of the strategy was studied in terms of variables like achievement, process skills and concept attainment ability in science. The analysis was carried out based on the hypotheses formulated by using descriptive and inferential statistical tools. The major findings of the study are as follows :

1. The analysis of students' performance on pre achievement test in both experimental and control groups was found to be poor.
2. The analysis of post test achievement revealed that the experimental group students had performed better after undergoing the experimental treatment of concept mapping in science. This is seen through the maximum numbers of students who had shown a good performance (55%) and above average performance (36.2%). The mean values obtained by experimental and control groups on pre-achievement test were 35.28 and 36.79 while on post achievement test, the mean values were found to be 61.17 (Experimental) and 38.53 (Control group).
3. The analysis of students belonging to different intelligence groups (experimental) revealed that there was an improvement in the mean values of all intelligence levels of students. The students of superior intelligence showed the mean value of 84.71; above average intelligence students showed the mean value of 65.44, while average and below average intelligence students showed the mean values of 60.9 and 54.90 on post achievement test. The 'F' value of 5.921 obtained was found significant at 0.002 and showed that there is a difference between and within the different intelligence groups of the experimental group in their achievement (post) due to the effect of

concept mapping strategy. The mean values and the 't' values obtained gradewise and on the whole(16.3) in case of experimental group proves that the concept mapping strategy used in science had an effect over the achievement of students belonging to experimental group.

4. The mean values and 't' values obtained by experimental and control group on pre-achievement test showed that there is no difference between both the groups.
5. On post-achievement test, the difference in mean values obtained by experimental and control groups was found to be large, and 't' value of 9.66 was found significant at 0.01 level indicating at the effectiveness of concept mapping over the performance of experimental group students in science.
6. There was no gender difference observed with respect to achievement in science in both experimental and control groups.
7. The analysis of process skills individually and the test as a whole revealed that the students of experimental group had performed well after undergoing the concept mapping strategy. This is evidenced through the mean values obtained on post test (67.89) which is fairly high when compared to the mean value on pre process skills test (47.60). It was also found that the students belonging to all grades of intelligence had performed well on post process skills test. The ANOVA test revealed that there was no difference either between or within the different grades of students (intelligence groups) in their performance on process skills.
8. The students of experimental group had performed well on the skills of inference, interpretation, reasoning and hypothesis when compared to other skills.
9. The control group students had performed fairly well on skills like interpretation, inference and reasoning. However, it was found that there is no difference between their performance on pre and post process skills test.

9. Similarly, it was found through ANOVA test that there was no difference either between or within the groups of students belonging to different intelligence.
10. The analysis of each process skill independently obtained through pre and post tests for experimental group showed that there is a difference in the mean values which was found significant. This indicates that concept mapping strategy used in science had an effect over the process skills of students in science.
11. The 't' value of 6.34 obtained on analyzing the difference in the mean values of process skills of experimental and control groups was found significant indicating that there is a difference in process skills between both the groups due to concept mapping strategy used in teaching science.
12. There was no gender difference observed in process skills of both experimental and control groups.
13. The analysis of the concept attainment ability of students revealed that the concept mapping strategy had a good effect upon it which is reflected through the mean values obtained by experimental group (pre = 46.63; post = 57.57). The gradewise analysis in case of experimental group showed that high mean values were obtained by students who belonged to superior intelligence (68.57) and above average intelligence (60.19). On the whole, it was found that the students belonging to all grades of intelligence had shown an improvement in their concept attainment on post test. The 'F' value (2.695) was found significant implying that there is a difference within and between the students of different intelligence in their concept attainment ability.
14. The 'F' value (1.185) obtained in case of control group indicated that there was no difference observed within or between the groups of students belonging to different levels of intelligence.
15. The mean values obtained by experimental group on pre and post concept attainment test were found significantly different which was

evidenced through the 't' value of 8.98. This once again points to the effectiveness of concept mapping strategy over the concept attainment ability of the students.

16. The difference obtained between experimental and control group on post concept attainment test ('t' = 4.40) also revealed that the experimental group students had performed better than the control group students on account of concept mapping strategy.
17. It was found that there was no difference between boys and girls in their concept attainment ability in both experimental and control groups.
18. The analysis of students (experimental) attitude towards concept mapping revealed that 66.8% of the students had a positive attitude while 34.7% of the students showed a highly positive attitude.
19. The gradewise analysis showed that students of superior and above average intelligence had highly positive attitude (mean values of 127 and 120.33) towards concept mapping, while average and below average students showed positive attitude (mean values of 112 and 109.44). The overall mean value was 114.41 indicating positive attitude towards concept mapping. The F value of 2.609 was not found significant thereby indicating that there is no difference between or within different intelligence groups.
20. There was no difference between boys and girls in their attitude towards concept mapping.
21. The analysis of students' reactions about the use of concept mapping strategy in science revealed that (i) concept mapping strategy was useful in understanding the concepts, to see relationship between the concepts, ii) in remembering the content for a long time, iii) concept mapping provided inspiration in learning further.
22. It was felt that use of concept mapping as a teaching strategy is more effective than regular teaching. It was expressed that concept mapping helped in getting a complete picture about the content.

23. Most of the students had expressed that they enjoyed developing concept maps in groups, as being in a group helped them to share their views, discuss and see relationship between concepts in an easier manner and so on. It was felt that drawing concept maps individually consumed more time. A small percentage of students preferred mapping individually as it helps them to think better and be creative in their concept maps.

On the whole, from the analysis carried out to study the effectiveness of concept mapping it is proved that the concept mapping can enhance meaningful learning and improve achievement of students in science. Besides this, the process skills of science and concept attainment ability of students were also found to have improved. From the attitudes and reactions of students, it is evident that concept mapping as a strategy of learning was successful among students.

5.2 Conclusion

The changes taking place in science education and the expectations of new curriculum framework for elementary and secondary education have ushered a new era of exciting learning opportunities for students and new instructional challenges for teachers.

Concept mapping as a tool of learning and assessment is also helpful for making fundamental planning decisions in order to fulfill the outcomes of the content standards. Since success is evident in the significant and substantial gains in students' science achievement, process skills and attitudes, there is a need to include concept mapping with the constructivist basis as one of the approaches to teach science in pre-service teacher training courses. Since the strategy has a solid theoretical foundation and considerable empirical research behind its claims, our purpose should be to provide workable strategies to help students learn how to learn.

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APPENDIX - A

(Tools used in the Study)

Total marks:60

Name : Class:

School : Date:

ACHIEVEMENT TEST

I. Choose any one alternative among the following. Each question carries half mark.

(31 x ½ =15½)

1. Which one of the following is the suitable medium for culturing or growing microorganisms?

   a) water b) gelatin c) agar d) oil

2. Biogas is a mixture of

   a) Carbon dioxide, Methane b) Carbon dioxide, Ethane

   c) Carbon monoxide d) Hydrogen, Carbon monoxide.

3. What happens when a bar magnet is freely suspended in air?

a) It comes to rest in north-south direction.
b) It comes to rest in south-west direction.
c) It comes to rest in north-west direction.
d) It comes to rest in east-west direction.

4. The process of deposition of a metal on the other with the help of electric current is known as

   a) Chrome plating b) Soldering c) Refining d) Electroplating

5. Milk turns into curd due to the presence of

   a) Lacto bacillus b) Salmonella c) Clostridium d) Virus

6. Algae are an important part of the aquatic food chain because they are

   a) consumers b) producers c) small in size d) more in number

7. Why do you take TT injection when you have a cut on your hand by a sharp rusted knife? It is

a) to prevent from tetanus
b) to prevent further infections
c) to avoid bleeding
d) to prevent from hay fever

8. Desert plants are more likely to have

a) large flat leaves
b) short root system
c) reduced leaves
d) a large number of stomata

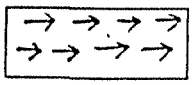
9. Why should we conserve wild life?

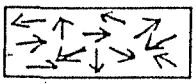
a) as animals have their own rights to live
b) to maintain ecological balance in nature
c) to prevent the animals from becoming extinct.
d) all the above.

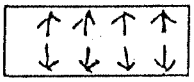
10. Current which changes its direction a number of times during every second is called

a) direct current
b) unidirectional current
c) alternating current
c) non directional current

11. The alignment of magnetic domains in a magnet is arranged as


a


b


c

d. None of the them

12. Which one among the following does not belong to the group?

a) Nictitating membrane
b) Legs of a man
c) Vermiform appendix
d) Caudal vertebra in man.

13. Mechanical energy is converted into electric energy in

a) accumulator b) electric bell c) hand dynamo d) voltmeter

14. Many plants and animals have become extinct due to

a) over exploitation of forests b) forest fires
c) deforestation d) all the above

15. Lines of force of a bar magnet are

a) crowded near the center b) crowded near the poles

c) crowded in the vertical plane d) uniform through out the field.

16. The nuclear reaction which leads to energy production in sun is

a) fusion b) fission c) combination d) decomposition

17. You are given two bulbs and some wires . You have to connect them in such a way that even if one bulb burns out the other should glow. How will you connect it?

a) in series b) in parallel c) either a or b d) neither a or b

18. Which insect among the following transmit the disease sleeping sickness?

a) House fly b) Butter fly c) Tse tse fly d) Bed bug

19. You are given an electric stove and coils of different lengths. Which of these would you use to get more heat?

a) the longest coil b) the shortest coil

c) the medium length coil d) none of the above.

20. At what stage of the life cycle of the moth, silk protein is made?

a) Larva b) Pupa c) Adult d) in all the stages.

21. Which one among the following is the meaning of conservation?

a) Judicious and wise use of natural resources.
b) Un limited usage of natural resources.
c) Rare use of resources.
d) In discriminate usage of natural resources.

22. An electric fuse is a short piece of wire of _____.

a) high melting point b) low melting point

c) either a or b d) both a or b

23. Why plants like bamboos and eucalyptus must be planted? It is because

a) they give shade b) they look beautiful

c) they help as soil binders d) they make the soil fertile.

24. Why a thin sheet of mica is used in iron box?

a) as it is a good conductor of electricity.
b) as it is a insulator.
c) as it has magnetic properties.
d) as it has high melting point.

25. Resources which cannot be produced by man are called

a) unlimited resources b) renewable resources

c) non renewable resources d) limited resources

26. Cutting down of forests and starting industries leads to

a) soil erosion b) erratic climatic changes

c) imbalance in natural environment d) all the above.

27. Why is it necessary to give BCG to infants? It is to prevent the infants from

a) Diphtheria b) Tetanus c) Tuberculosis d) Polio

28. The organs which are structurally similar but functionally different from each other like forelimbs of frog and wings of a bat are called

a) homologous organs b) vestigial organs

c) analogous organs d) none of them

29. Which important features of pigeon's body structure help it to fly in air?

a) light bones b) stream lined body

c) feathers and wings(modified forelimbs) d) all the above.

30. Which one of the following is a renewable source of energy?

a) Petroleum b) Electricity c) Sun d) Coal

31. The continuous process of gradual change from simple forms of life into complex organisms is called

a) variations b) reproduction c) adaptation d) organic evolution

II. Fill in the blanks. Each question carries half a mark. (5 x ½ = 2 ½)

1. _____ is a connecting link between reptiles and birds.
2. The rearing and management of honey bees is called as _____.
3. The natural magnet is known as _____.
4. The development of characteristics which help an organism to survive in a particular environment is known as _____.
5. Bark of Cinchona help in curing _____.

III. Match the following

Name of the disease	Symptoms (3M)
1. Tuberculosis	a. watery stools, repeated vomiting
2. Cholera	b. fever, fatigue, muscular contraction & fear of water
3. Amoebic dysentery	c. high fever, chill & headache and rashes on chest, face, abdomen and limbs.
4. Malaria	d. severe cough, pain in chest and fever
5. Rabies	e. discharge of blood & mucous along with faeces
6. Chicken pox	f. shivering, high fever, profuse sweating

IV. Answer the following questions

1. Here are given few characteristic features of aquatic plants that help in floating . Tick the right ones . (2M)

   a) bulb like structure present in leaf.

   b) Texture (waxy coating) of the leaf.

   c) Poorly developed root system.

   d) Stomata found on both sides of the leaf.

   e) Wavy nature of the stem.

   f) Well developed stout stem.

   g) Storage of water in the leaves.

   h) Well developed root system.

2. Identify the symptoms of the anthrax disease found in the cattle from the following: (2M)

a. The fluid oozes from the eyes.
b. Stomach bulges due to constipation.
c. Blisters in the mouth.
d. Blisters in the cleft of animals hooves.
e. Animal becomes inactive and stops chewing the cud.
f. High fever.

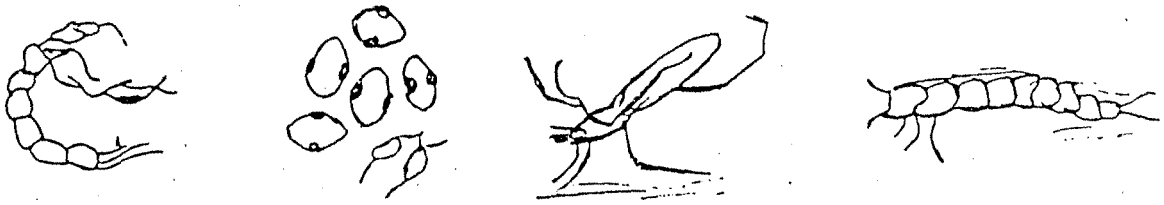
3. Classify the following substances into conductors and insulators. (4M)
Silver, Tap Water, Plastic, Rubber, Ebonite, Pure Water, Acids, Human Body

Conductors	Insulators

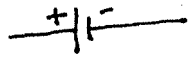
4. Classify the following plants into Xerophytes, Mesophytes and Hydrophytes. (5M)
Rose plant, lotus, cactus, pistia, hydrilla, coriander, asparagus, sunflower, water hyacinth, opuntia

Xerophyte	Mesophyte	Hydrophyte

5. Observe the following diagram representing the life cycle of mosquitoes. Arrange the stages in a sequential order. (1M)

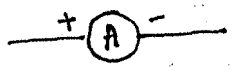


6. Identify and name the following: (3M)

a. 

b. 

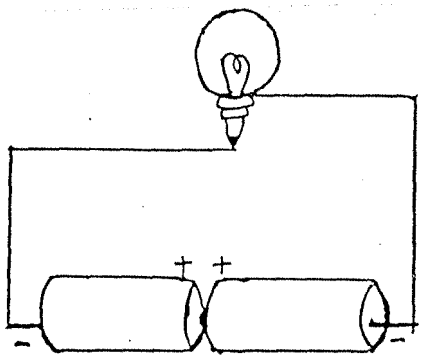
c. 

d. 

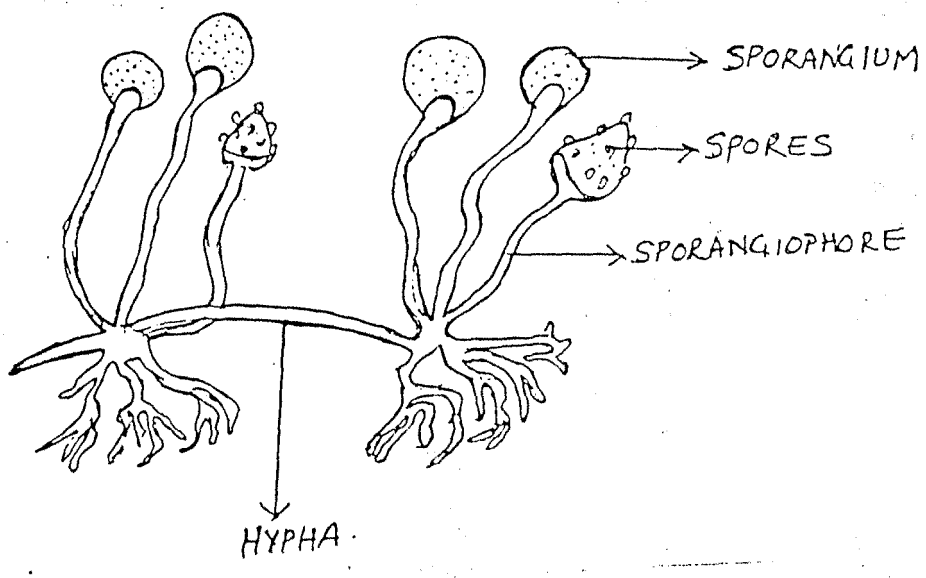
e. 

f. 

7. Below is given a diagram where in the bulb is not glowing. Find out the reason and correct the diagram. (2M)

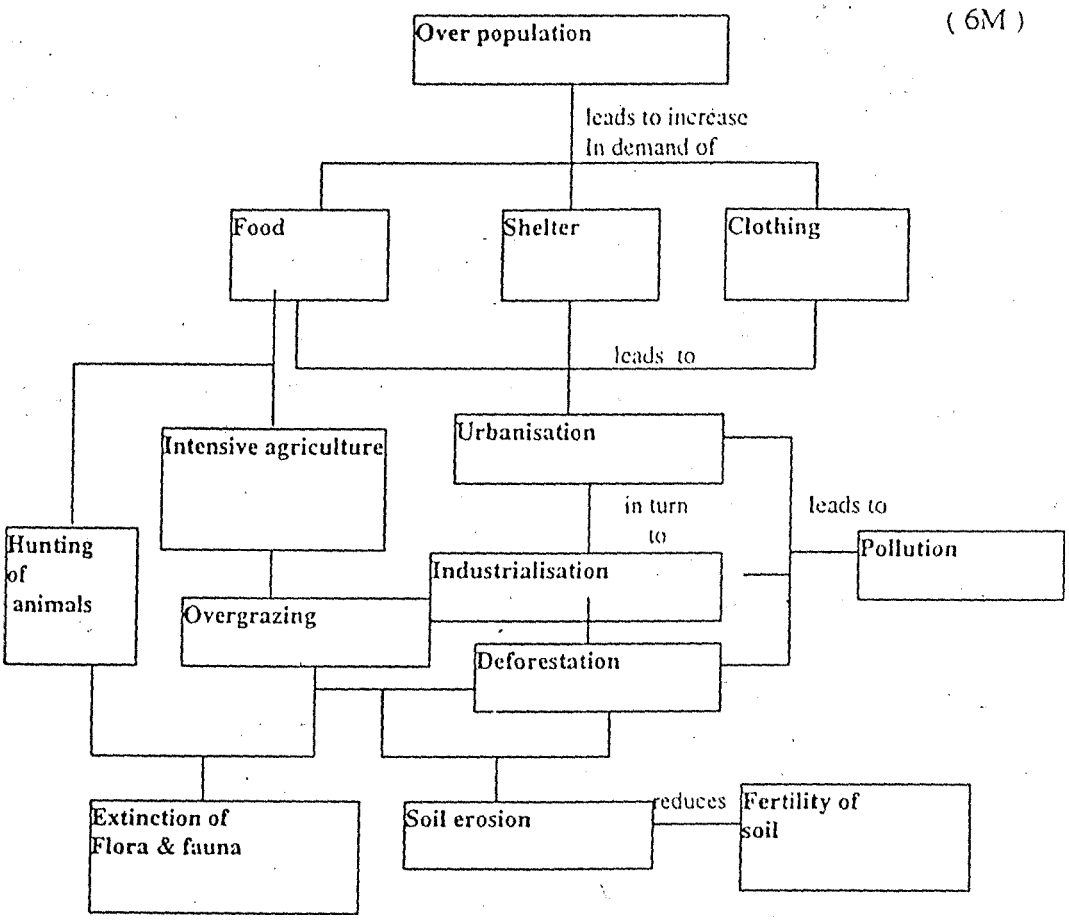


8. Describe the structure of Rhizopus by looking into the following figure. (2M)

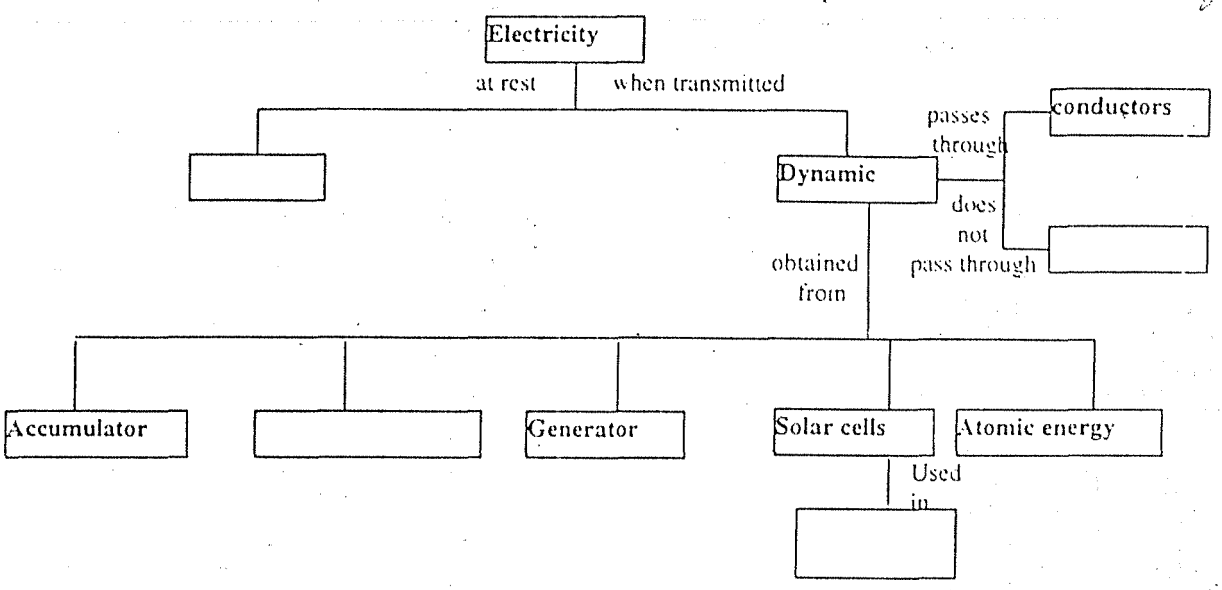


9. Below is given a map showing the depletion of resources. Looking into the map, write the inter relationship between the factors and how they affect the resources.

(6M)



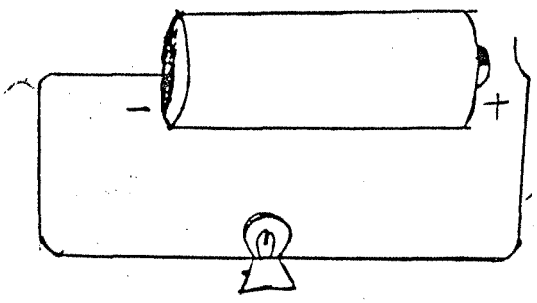
10. Below is given a flow chart, Fill in the gaps with an appropriate answer. (2M)

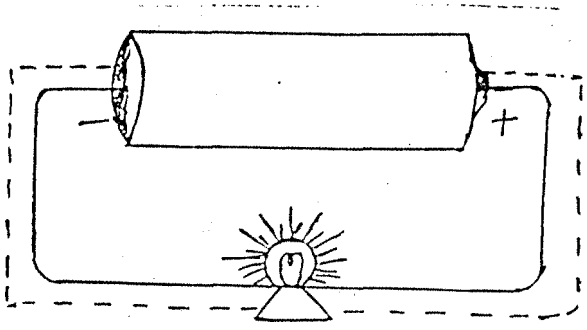


11. Differentiate between natural and artificial magnets. (1M)

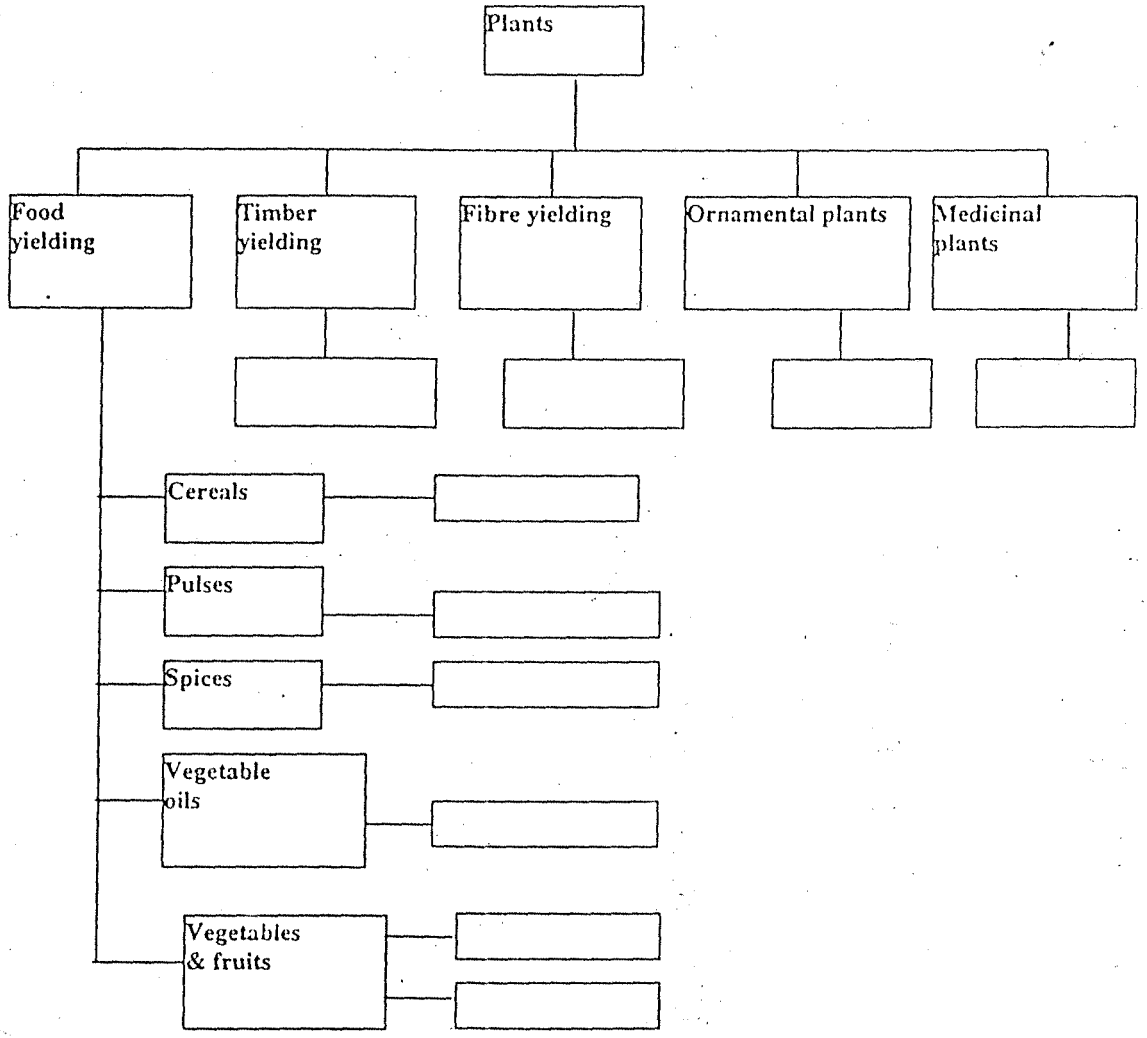
12. Below are given two figures A &B. Observe carefully and explain the differences between both the figures. What terms can be used.

(2M)





13. Give one example each for all the categories in the boxes given. (5M)



14. Suppose you have sown thirty seeds in a very small place, Later you found that only few seeds have germinated and others perished. How is it related to Darwin's Natural selection? Explain it briefly. (2M)

Name:
School:

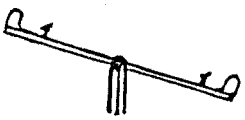
PROCESS SKILLS TEST

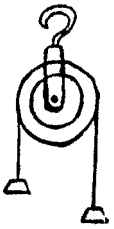
Class:
Date:

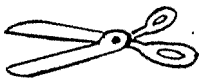
Instructions:

There are 36 items in this test. For each item four responses are given. Read each item carefully and tick the most appropriate response. It is necessary to answer all the items in the test.

1. Which one among the following is a lever of second class?


a) Seesaw


b) Pulley

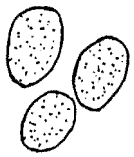

c) Scissors

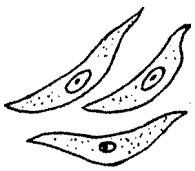

d) Bottle opener

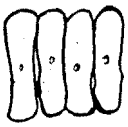
2. Why does euglena comes under both plant and animal kingdom?
a) as it has both chloroplast and flagella.
b) as it has only flagella.
c) as it has only chloroplast.
d) None of the above.

3. Among the following groups, only one group of cells differ from the remaining groups. Find out that group?


a) Nerve cell


b) Red blood cells


c) Muscle cells


d) Columnar cells

4. If you were to hold a piece of paper by each corner and blow across the top of the paper, what would happen to the paper?
a) Paper will fall down.
b) Paper will move downwards.
c) Paper will move upwards.
d) Paper will not move at all.

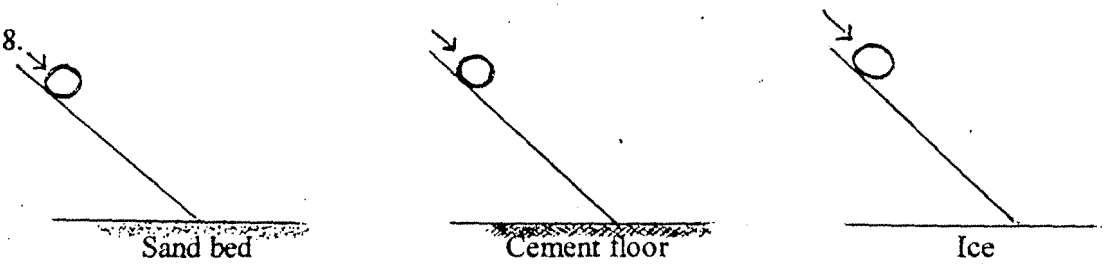
5. In all the climbers there are thread like structures called tendrils. How do they help the plant?

a) They help the plant in climbing.
b) They help the plant in protecting itself from the enemies.
c) They help the plant in storing food.
d) They donot perform any function.

6. Find out the group of dicots from the examples given below
a) Bengal Gram, Beans, Groundnut, Green Gram
b) Maize, Wheat, Rice, Millets
c) Ragi, Mustard, Bengal Gram, Tamarind
d) Tomato, Spinach, Lady's Finger, Peas

7. What do you think will happen if you heat the nail and try to put it through the eye screw again?
a) The nail will not enter the eye of eye screw.
b) The nail will enter the eye screw.
c) The nail will become loose and fall down from the eye screw .
d) None of the above.

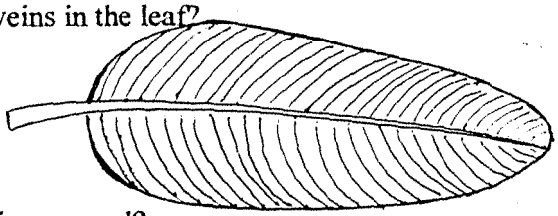
8.



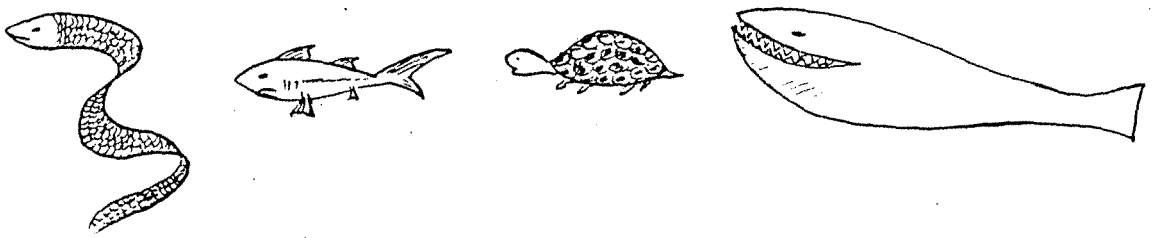
In which case, the ball travels more distance?
a) Sand bed b) Cement floor c) Ice d) both a&c

9. What do you notice about the movement of the smoke, when a newspaper is lighted and held by an open window?
a) The smoke will move out of the window, as the room is warmer.
b) Smoke will spread off in the room.
c) Smoke raises up and touches the roof.
d) Smoke gets accumulated at one place.

10. Observe the structure of a banana leaf. The leaf has a network of veins with a central mid rib. What will happen if there would not have been veins in the leaf?
a) There would not have been proper shape to the leaf.
b) The plant would have stunted growth.
c) The leaf would have been thin and transparent.
d) The leaf would not perform its function properly.

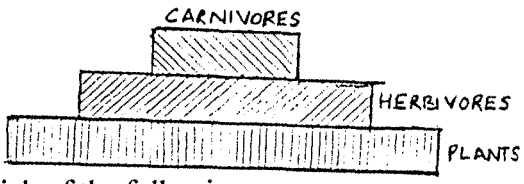


11. Among the following animals which one is an aquatic mammal?
a) Eel b) Shark c) Tortoise d) Whale



12. Here is pyramid, which represents a number of plants, herbivorous and carnivorous animals. What do you infer from this pyramid?

a) Carnivores are more in number than herbivores and plants.
b) Plants are more in number than carnivores and herbivores.
c) Carnivores are less in number than herbivores and plants.
d) Plants are less in number than herbivores and carnivores.



13. Light travels faster than sound. This can be inferred from which of the following statements?

a) Thunder clap and lightening occurs simultaneously.
b) Thunder clap is heard after seeing lightening flash.
c) Lightening flash is seen after hearing thunder clap.
d) Lightening flash is produced near to observer.

14. It is not advisable to sleep under a tree during night because

a) there will be accumulation of oxygen.
b) there will be accumulation of carbon dioxide.
c) branches of the tree may fall.
d) water droplets would fall from the tree.

15. In order to withstand the high temperature and scarcity of water, the desert plants should have

a) a deep rooted system.
b) reduced leaves.
c) very less number of stomata.
d) all of them.

16. What do you think will happen to light rays, if you shine them on a reflecting surface in a manner similar to the way you throw the ball ?

a) Light rays reflect with same angle.
b) Light rays may be absorbed by the reflecting surface.
c) Light rays reflect with different a different angle.
d) Light rays get scattered.

17. When any object is thrown up, it falls down. This may be due to

a) shape of the earth.
b) density of the object.
c) mass and size of the object.
d) earth's gravitation.

18. Bread mould, Mushroom, green mould etc live on the dead and decaying substances as they cannot prepare their own food material. What do you conclude from this?

a) All are autotrophs.
b) All are saprophytes.
c) All are parasites.
d) All are carnivores.

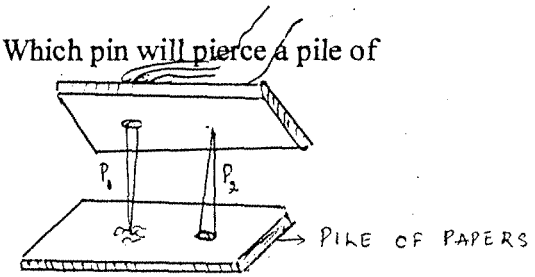
19 .How should the sun, moon and earth be arranged for a solar eclipse to occur?

a) Sun, earth and moon
b)Earth, moon and sun
c) Moon, sun and earth
d)None of the above

20. What would happen if all the people start cutting trees for their domestic purposes?

a) carbon dioxide percentage will increase in the atmosphere.
b) oxygen percentage will decrease in the atmosphere.
c) soil erosion takes place.
d) All of them

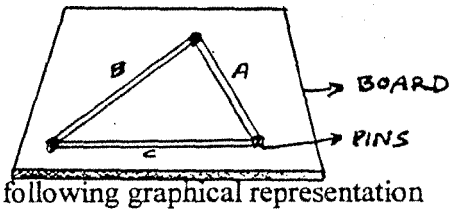
21. A person had pressed two pins P1 and P2 with equal force. Which pin will pierce a pile of papers first?
a) P1
b) P2
c) both the pins pierce at the same time.
d) none of them



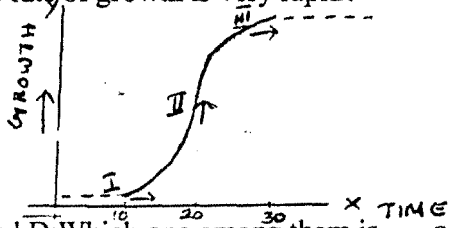
22. Many animals like rats, ants, crabs, etc live inside the burrows and holes because
a) to escape from the enemies .
b)to avoid the heat of the sun.
c) to store the food.
d)all the above.

23. Which one of the following materials is most likely to be corroded?
a) a wooden plank
b) an exposed iron rod
c) a steel chair
d) an iron rod coated with oil

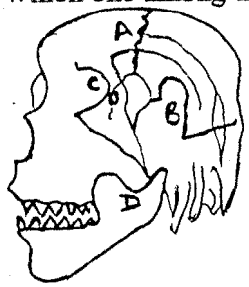
24. Look at the diagram below. There is a board with three rubber bands of different lengths tied to three pins. Which rubber band would you pluck to get lowest note or sound?
a) Rubber band A
b) Rubber band B
c) Rubber band C
d) None of them



25. In plants growth takes place in three phases. Observe the following graphical representation plotted rate of growth versus time . In which phase the rate of growth is very rapid?
a) Phase I
b) Phase II
c) Phase III
d) In all the phases the rate of growth is same



26. In the following figure, joints are labeled as A, B, C and D Which one among them is a movable joint?
a) A
b) B
c) C
d) D



27. Here is a table, which shows the population of human beings per square kilometer in a country in different years. What do you conclude from this table?

Year	Population per Square kilometer
1801	232
1811	221
1821	176
1831	142
1841	117
1851	100
1861	90
1871	81
1881	70
1891	52

a) As the year advances there is an increase in population.
b) As the year advances there is a decrease in population.
c) As the year advances there is no increase or decrease in population.
d) In the beginning and at the end of the year there is increase in population and in between there is a decrease in population.

28. The terminal end of the cow's tail has a bunch of hair. This is to
a) protect its calf.
b) protect its body from insects and birds
c) increase the beauty.
d) attract other cows to follow her.

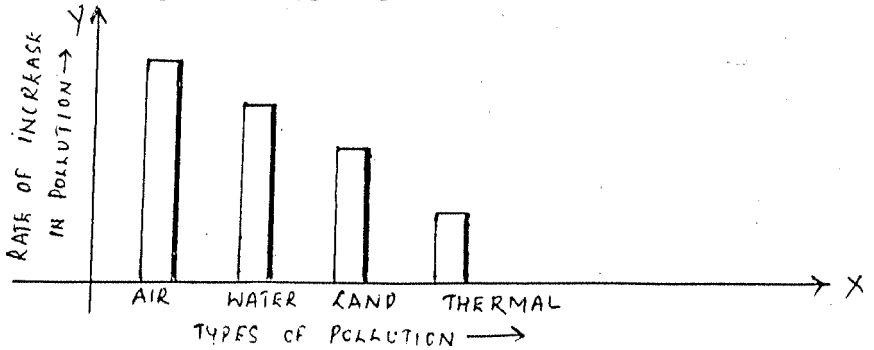
29. What will happen if a burning candle is covered by a glass tumbler? The candle
a) continues to burn.
b) is put off after some time.
c) burns less brightly.
d) burns more brightly.

30. Mohan is looking towards the sun. His shadow falls
a) in front of him.
b) behind him
c) towards left.
d) towards his right.

31. Reptiles are often referred as 'Cold blooded animals'. As their
a) body temperature is always much lower than the external temperature.
b) body temperature varies according to the change in the external temperature.
c) body temperature is always higher than the external temperature.
d) body temperature remains constant.

32. People spray kerosene to stagnant water as it
a) doesn't allow mosquitoes to increase in number.
b) smell is not liked by mosquitoes.
c) makes the mosquitoes unconscious for some time.
d) attracts the mosquitoes.

33. As you know pollution of various kinds have affected and degraded our environment. Below is given a graph showing different type of pollutants and their increasing rate.



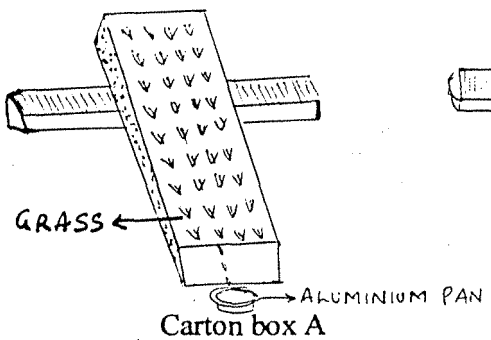
What do you infer from this?

a) the rate of increase in air pollution is higher than the other types of pollution.
b) the rate of increase in thermal pollution is higher than the other types of pollution
c) the rate of increase in air pollution is less than land pollution.
d) The rate of increase in all the types of pollution is same.

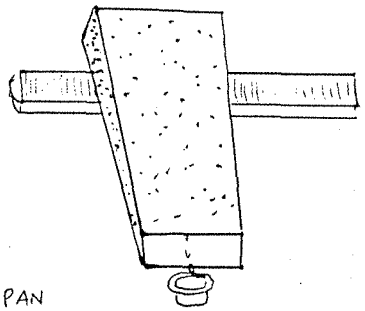
34. Many of the desert plants have reduced leaves. Leaves are modified into spines, thorns etc. This is to

a) increase photosynthetic rate.
b) Decrease transpiration rate.
c) Increase transpiration rate.
d) Increase the beauty of the plant.

35. Here are two carton boxes with grass and without grass respectively. When water is poured to both the carton boxes, which carton box will lose more soil?



Carton box A



Carton box B

a) Carton box A
b) carton box B
c) both carton boxes will lose same amount of soil.
d) both of them do not lose soil.

36. Here is a table showing five small fields of same size are selected and for each field different amounts of fertilizers are supplied. After harvestation , the average crop yield of each field were measured.

Amount of fertilizer(kg)	Average crop yield (tonnes)
125	8
114	7
90	5
81	3
70	2

What do you conclude from the table?

a) as the amount of fertilizer increases, average crop yield increases.
b) as the amount of fertilizer increases, average crop yield decreases.
c) as the amount fertilizer decrease there is no change in the average crop yield.
d) none of them.

37. Below are given few examples which are related to each other. Fill in the blank with the appropriate answer.

Example:

Root : Absorption of water & mineral salts:: Stem : Conduction of water & mineral salts

1. Vegetables : Refrigeration :: Milk : _____

2. Malaria : _____ :: Tuberculosis: Mycobacterium tuberculosis

3. Sodium : Na :: Carbon dioxide : _____

4. Energy giving foods : Carbohydrates :: Body building foods : _____

5. Vitamin C : Scurvy :: Vitamin B_{12} : _____

6. Sedimentary rock : Lime stone :: Metamorphic rock : _____

7. Velocity : Vector :: Speed : _____

8. Soap : Sodium salt of fatty acids :: Detergent : _____

9. Nitrogen, Phosphorous, Pottasium : Primary nutrients :: Magnesium, Zinc, Sulphur : _____

CONCEPT ATTAINMENT TEST

Name : Class:

School: Date :

PART-I

Instructions

Some examples have been presented below in column 'A'. These examples are related with a particular concept. List of four concepts have been given in column 'B'. Read the examples of column 'A' and try to find out the concept from 'B'. Carefully choose an appropriate option from 'B' and put a cross (x) against the cell of that option.

Example

Column A	Column B	
Bhopal	a) State	
Jaipur	b) Capital	X
Bhubaneshwar	c) Union Territory	
Calcutta	d) Division	
Lucknow		

In the above example, the names of Column 'A' come under the concept 'capital'. Hence the correct answer of the item is (b). So put a cross (x) in the cell ( ) against 'b'.

Column A	Column B	
1. Mercury	a) Days	
Venus	b) Satellite	
Mars	c) Nakshatra	
Earth	d) Planet	
Jupiter		
2. Superphosphate	a) Insecticide	
Potash	b) Fertiliser	
Urea	c) Mineral	
Gromor	d) Weed	
Ammonia		
3. Aryabhatt	a) Satellite	
Rohini	b) Space craft	
Bhaskar	c) Constellation	
Aple	d) Nobel Prize	
Insect B		

Column A	Column B	
4. Lead	a) Protective metals	
Mercury	b) Light metals	
Copper	c) Heavy metals	
Platinum	d) Noble metals	
Gold		
5. Polythene	a) Glass	
Bahelite	b) Plastics	
Polysterene	c) Ceramics	
Polyvenyl chloride	d) Nylon	
Celluloid		

PART-II

Instructions:

Five examples have been given below. Four of them are related to a particular concept. But one of them is not the example of that concept. Put a cross (X) on the example which is odd.

Example

a) Dollar [ ] b) Rupee [ ] c) Pound [ ]

d) Cheque [X] e) Yen [ ]

All the four examples are related with currency, except cheque, therefore the right answer will be cheque.

1.

a) Wheat [ ] b) Rice [ ] c) Soyabean [ ]

d) Pulses [ ] e) Rubber [ ]

2.

a) Gold [ ] b) Iron [ ] c) Granite [ ]

d) Manganese [ ] e) Plastic [ ]

3.

a) Sugarcane [ ] b) Groundnut [ ] c) Linseed [ ]

d) Mustard [ ] e) Sunflower [ ]

4.

a) Smallpox ☐ b) Chickenpox ☐ c) Rabies ☐

d) Jaundice ☐ e) Pneumonia ☐

5.

a) Wood ☐ b) Rubber ☐ c) Copper ☐

d) Abonite ☐ e) Plastic ☐

6.

a) Radish ☐ b) Sweat tuber ☐ c) Tomato ☐

d) Carrot ☐ e) Beetroot ☐

7.

a) Charcoal ☐ b) Diamond ☐ c) Graphite ☐

d) Peat ☐ e) Lead ☐

8.

a) Cotton ☐ b) Rayon ☐ c) Terylene ☐

d) Nylon ☐ e) Polysterene ☐

9.

a) Hydrogen ☐ b) Oxygen ☐ c) Nitrogen ☐

d) Chlorine ☐ e) Carbondioxide ☐

10.

a) Tapeworm ☐ b) Hookworm ☐ c) Roundworm ☐

d) Louse ☐ e) Liverfluke ☐

PART-III

Instructions

Definition of a concept has been given below. Read the definition carefully and try to understand the concept. You have to identify the correct example of the concept out of the examples given. Put a cross (X) on the correct answer.

Example

Satellite: The objects which move around the planets

a) Moon	[X]	b) Comet	[ ]
c) Star	[ ]	d) Constellation	[ ]

Here the correct answer is (a) Moon. So put a cross mark against the cell.

1. **Epidemic**: The disease which spread rapidly through injection, due to which large number of people die.

Examples

a) Malaria	[ ]	b) Jaundice	[ ]
c) Plague	[ ]	d) Typhoid	[ ]

2. **Compound**: A compound is formed when two or more elements are mixed with each other in a fixed proportion.

Examples

a) Silver	[ ]	b) Mercury	[ ]
c) Water	[ ]	d) Gold	[ ]

3. **Parasite**: The plant and animal which is dependent on other pants and animals for their livelihood.

Examples

a) Monet plant ☐ b) Rose ☐

c) Plasmodium ☐ d) Boganveiiya ☐

4. **Communicable disease**: A disease caused by the presence of a pathogen and transmitted from one person to another.

Examples

a) Beriberi ☐ b) Cold ☐

c) Anaemia ☐ d) Rickets ☐

5. **Alloy**: A homogeneous mixture of two or more metals or a metal and a non-metal.

Examples

a) Brass ☐ b) Gold ☐

c) Silver ☐ d) Copper ☐

6. **Force**: An external action which makes the object change its place.

Examples

a) a man pushing the cast ☐ b) a swinging doll ☐

c) moving pendulum ☐ d) flying kite ☐

7. **National park**: A secured place where wild animals, natural vegetation and natural beauty can be preserved, under two Government control.

Examples

a) Mughal Garden ☐ b) Kanha Kisli ☐

c) Rose Park ☐ d) Brindawan Garden ☐

8. **Mineral**: Elements and matters which are dugged out of the mines.

Examples

a) Steel ☐ b) Tin ☐

c) Mica ☐ d) Brass ☐

9. **Xerophytes**: Plants which grow in deserts where there is scarcity of water.

Examples

a) Agava ☐ b) Pistia ☐

c) Water hyalinth ☐ d) Hydrilla ☐

10. **Igneous rocks**: Rocks formed from the hot molten rock material that comes out of the earth.

Examples

a) Granite ☐ b) Marble ☐

c) Slate ☐ d) Lime stone ☐

PART-IV

Instructions:

Essential attributes/features and name of the concept are given below. You have to identify the concept on the basis of essential attributes. Put a cross (X) on the correct concept in the response alternatives.

Example

Essential attributes	Concept	
1. Developed from root	a) Root crop	X
2. Provide strength to the plant	b) Stem crop	
3. Storage of food	c) Fibrous crop	

1.

Essential attributes	Concept	
1. Food is prepared by self, partially	a) Symbiotic plants	
2. Some part of food is obtained from insects	b) Insectivirous plants	
3. Parts of plant are modified in order to trap the prey	c) Parasitic plants	

2.

Essential attributes	Concept	
1. Prepared by fungus or microbes	a) Antigens	
2. Used as a medicine	b) Antibiotic	
3. Microbe destroyers	c) Antibodies	

3.

Essential attributes	Concept	
1. Formation of gases and vapours due to internal changes in earth	a) Land sliding	☐
2. Explosion of land due to internal pressure	b) Earth quake	☐
3. Emission and flow of internal matter and gases	c) Volcano	☐

4.

Essential attributes	Concept	
1. have high melting and boiling points	a) Non-metals	☐
2. are ductile and malleable	b) Metals	☐
3. have lustre	c) metalloids	☐

5.

Essential attributes	Concept	
1. non-green, unicellular plants	a) Bacteria	☐
2. have rigid cell wall	b) Virus	☐
3. do not have well developed nucleus	c) Fungus	☐

6.

Essential attributes	Concept	
1. Require less water developed root system	a) Hydrophytes	☐
2. Modification of leaves in spines	b) Xerophytes	☐
3. Food storage by stem	c) Mesophytes	☐

7.

Essential attributes	Concept	
1. Have two convex lenses lengths with different focal lengths	a) Compound microscope	☐
2. Object is placed near the objective lens	b) Telescope	☐
3. The image is the virtual image of real image is formed	c) Simple microscope	☐

8.

Essential attributes	Concept	
1. It helps in synthesis of food	a) Combustion	☐
2. Breaking down of complex substances into simpler ones	b) Respiration	☐
3. Releases energy	c) Photosynthesis	☐

9.

Essential attributes	Concept	
1. It is a pure form of carbon	a) Graphite	☐
2. Hardest natural substance known	b) Coke	☐
3. A non-conductor of heat and electricity	c) Diamond	☐

10.

Essential attributes	Concept	
1. travels in a straight line	a) Sound	☐
2. a form of energy	b) Light	☐
3. its direction alters when it passes from one medium to the other	c) Heat	☐

ATTITUDE TOWARDS CONCEPT MAPPING

Name : School:

Class : Date :

Dear Student,

You have been studying science through concept mapping method since three months. We would like to know how you feel about concept mapping. Please provide your opinion freely and frankly to the questions asked in this sheet. There is no right or wrong answer. Do not leave any items unanswered. Go through the illustration given below before you start. Against each statement is provided five points namely Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (D) and Strongly Disagree (SD). Tick or encircle any one of the point which you feel appropriate.

Illustration:

I do not like going to school. SA A UD (D) SD

Item No.	Statements	SA	A	UD	D	SD
1.	Concept mapping is mere waste of time.					
2.	I found concept mapping as an interesting activity.					
3.	It is difficult to draw concept maps.					
4.	Concept mapping method should be used in learning other subjects.					
5.	Concept mapping helps in developing understanding relationships between the concepts.					
6.	I like to make concept maps on my own.					
7.	It is boring to use concept mapping in learning.					
8.	Concept mapping is a shabby way of representing ones understanding of concepts.					
9.	Concept mapping is an easy way of testing ones understanding.					

10.	I will never use concept mapping in future.					
11.	Concept mapping has no special use in learning subjects other than science.					
12.	One can get a complete picture of a theme while drawing a concept map.					
13.	It is difficult to understand the content through a concept map.					
14.	I wish every teacher follows the technique of concept mapping in teaching all the subjects.					
15.	I find concept mapping helpful in seeing relationship across the subjects.					
16.	Concept mapping makes the class lively and interesting.					
17.	I like to draw concept maps at home also.					
18.	Concept mapping restricts one's freedom of expression.					
19.	Concept mapping does not help in meaningful learning.					
20.	Concept mapping helps in building up confidence in learning the subject.					
21.	Concept mapping is the best method as it helps in remembering the content for a long time.					
22.	I would never prefer to draw concept maps as it occupies much space on the paper.					
23.	Concept mapping method is very irrelevant.					
24.	Concept mapping does not serve any purpose in learning a subject.					
25.	It is quite inspiring to learn the subject through drawing concept maps.					

26.	It is quite exciting to draw concept maps.					
27.	Concept mapping consumes lots of time.					
28.	Concept mapping is more of a fun than learning.					
29.	It is very childish to draw concept maps.					
30.	I don't find concept mapping as a serious activity.					

REACTION SCALE

Name : **School:**
Class : **Date :**

Dear Student,

You have been taught science through concept mapping. You were asked to develop concept maps on your own or in a group. We would like to have your reactions about the programme that you underwent in science for the last three months. There is no right or wrong answer. Therefore, feel free and frank to provide your answers. There are three alternatives given against each statement: "Yes, No, Sometimes". Tick (✓) the one that expresses your reaction about the science teaching through concept mapping.

I. For few lessons the teacher developed concept maps on the blackboard as she was teaching.

1.	Did this technique help you in understanding the concepts ?	Yes/ No / Sometimes
2.	Could you see relationship between the concepts?	Yes/ No / Sometimes
3.	Did this technique help you in remembering the content for a long time ?	Yes/ No / Sometimes
4.	Did you feel a need that the same content should be taught by your regular teacher ?	Yes/ No / Sometimes +24X
5.	Did certain questions come to your mind when the teaching was going on ?	Yes/ No / Sometimes
6.	Were you given freedom to ask questions in class?	Yes/ No / Sometimes
7.	Did this method inspire you to learn further?	Yes/ No / Sometimes
8.	Did you get distracted when the teacher developed a concept map on the board ?	Yes/ No / Sometimes
9.	Did you feel concept mapping as a serious task that leads to meaningful learning ?	Yes/ No / Sometimes
10.	Were you involved in the development of concept map during the lesson ?	Yes/ No / Sometimes
11.	Was it difficult for you to use link words ?	Yes/ No / Sometimes

12. Did the usage of link words helped you in understanding the concept maps ? Yes/ No / Sometimes

13. Were you able to see the relationship of subordinate concepts (concepts at the bottom level) with superordinate concepts (concepts at top level) ? Yes/ No / Sometimes

14. Did the exercise of drawing concept maps restrict your freedom of expression in other ways ? Yes/ No / Sometimes

15. Which method do you think is more effective in understanding the content ?
    a) Regular teaching method.
    b) Teaching through concept mapping clubbed with other activities.

II. At the end of the class, teacher reviewed the whole lesson through concept map.

1. Did concept mapping help you in getting a complete picture about the content that was taught ? **Yes/ No / Sometimes**

2. Were you able to see relationship between different concepts ? **Yes/ No / Sometimes**

3. Were you involved in concept mapping during the summing up of the lesson ? **Yes/ No / Sometimes**

4. Was concept mapping a boring activity for you? **Yes/ No / Sometimes**

5. Did you feel concept mapping as a mere repetition of the content ? **Yes/ No / Sometimes**

III. The teacher used concept mapping in testing what was learnt by you.

1. Did you have any difficulty in answering the questions ? **Yes/ No / Sometimes**

2. Which one of the following do you prefer ?
a) To describe the concept map that is given by the teacher in your own words.
b) To draw the concept map on your own based on the written script by the teacher.

3. Did you find it interesting to fill the blanks provided in the concept map given by the teacher? **Yes/ No / Sometimes**

4. At which stage, did you feel concept mapping as an interesting exercise ?

a) During introduction of the lesson.
b) During teaching (development of the concept map by the teacher).
c) During the review of the lesson (at the end of the lesson)

IV. **During the class, the teacher asked you to draw concept map either individually or in groups.**

1. Did you enjoy drawing concept map in groups? **Yes/ No / Sometimes**

2. Which of the following was easier to you ?

a) Developing concept map individually.
b) Developing concept map in a group.

3. Which one of the following required more time to draw a concept map ?

a) Developing concept map individually.
b) Developing concept map in a group.

4. Was the discussion in a group helped you in drawing a better concept map ? **Yes/ No / Sometimes**

V. In what ways developing concept map in a group helped you? Provide your answer in the given space.

VI. In what ways developing concept map on your own helped you? Provide your answer in the given space.

SCIENCE TEST

ELECTRICITY

Name :
School :

Class :
Max. Marks ;50
Date :

I. Choose any one alternative among the following. Each question carries half mark. (10X1=10marks)

1. The device used for measuring electric current flowing in a circuit is
   a. Voltmeter b. Ammeter c. Galvanometer d. Electric meter

2. An electric fuse is a short piece of wire of
   a. high melting point b. low melting point
   c. either a or b d. neither a nor b

3. The process of deposition of a metal on the other with the help of electricity is known as
   a. chrome plating b. soldering c. refining d. electroplating

4. Current which changes its direction number of times during every second is called
   a. direct current b. alternating current
   c. unidirectional current d. nondirectional current

5. Mechanical energy is converted into electric energy in
   a. accumulator b.hand dynamo c.voltmeter d. electric bell

6. The filament in an electric bulb is made of
   a. bronze b. aluminium c. tungsten d. copper

7. You are given two bulbs and some wires. You are asked to connect them in such a way that even if one bulb burns out, the other one should glow . How will you connect it ?
   a. in series b. in parallel c. either a or b d. neither a nor b

8. Why a thin sheet of mica is used in iron box ?
   a. as it is a good conductor of electricity
   b. as it has magnetic properties
   c. as it has high melting point
   d. as it is an insulator.

9. The path along which the current flows is called
   a. Electric path b. Electric way c. Electric circuit d. Electric wire

10. You are given an electric stove and coils of different lengths. Which one among the following would you choose to get more heat ?

a. medium length coil
b. longest coil
c. shortest coil
d. none of the above

II. **Match the following :** **(4X1=4marks)**

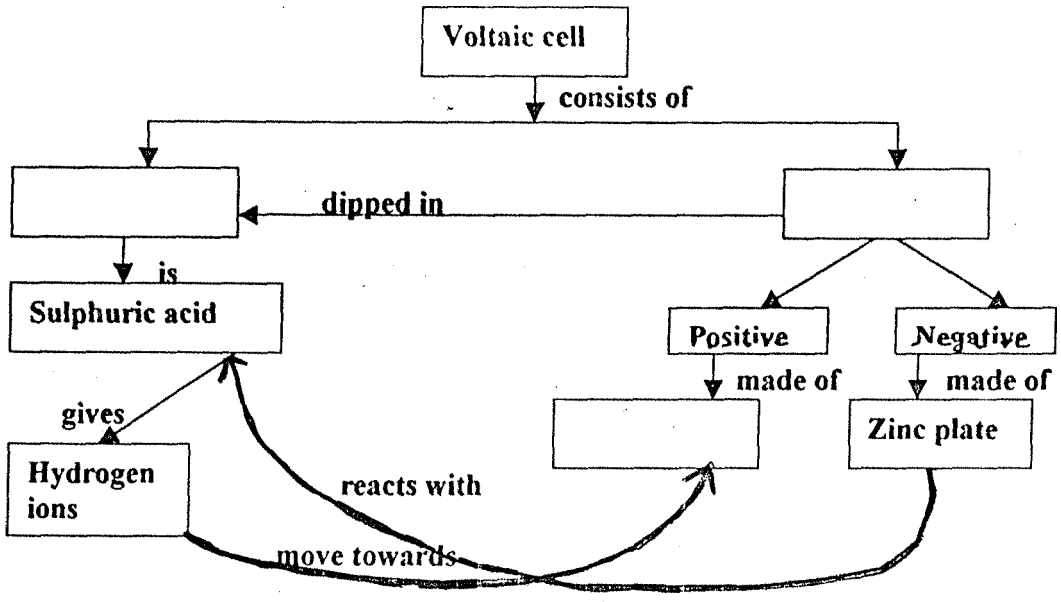
1. Electric iron box	a. magnetic effect ( )
2. Electric bulb	b. chemical effect ( )
3. Gold plating	c. Lighting & heating effect ( )
4. Electric bell	d. heating effect ( )
	e. heating & magnetic effect ( )

III. **Answer the following short answered questions :**

1. Classify the following substances into conductors and insulators. (5 marks)
Silver, Rubber, Mica, Tap Water, Ebonite, Acids, Leather, Glass, Human Charcoal

Conductors	Insulators

2. Fill in the blanks in the following concept map (2marks)



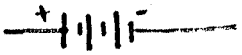
3. Identify the following diagrams. (8X1/2=4 marks)

1. 

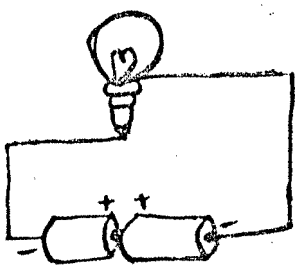
2. 
3. 

4. 

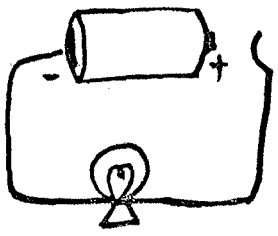
5. 
6. 

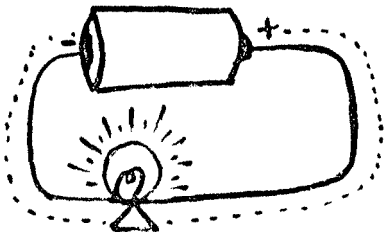
7. 
8. 

4. Below is given a diagram where in the bulb is not glowing. Find out the reason and correct the diagram. (2marks)



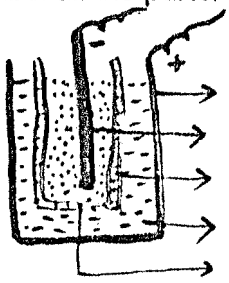
5. Below are given two figures A & B. Observe them carefully and name the circuits (2 marks)



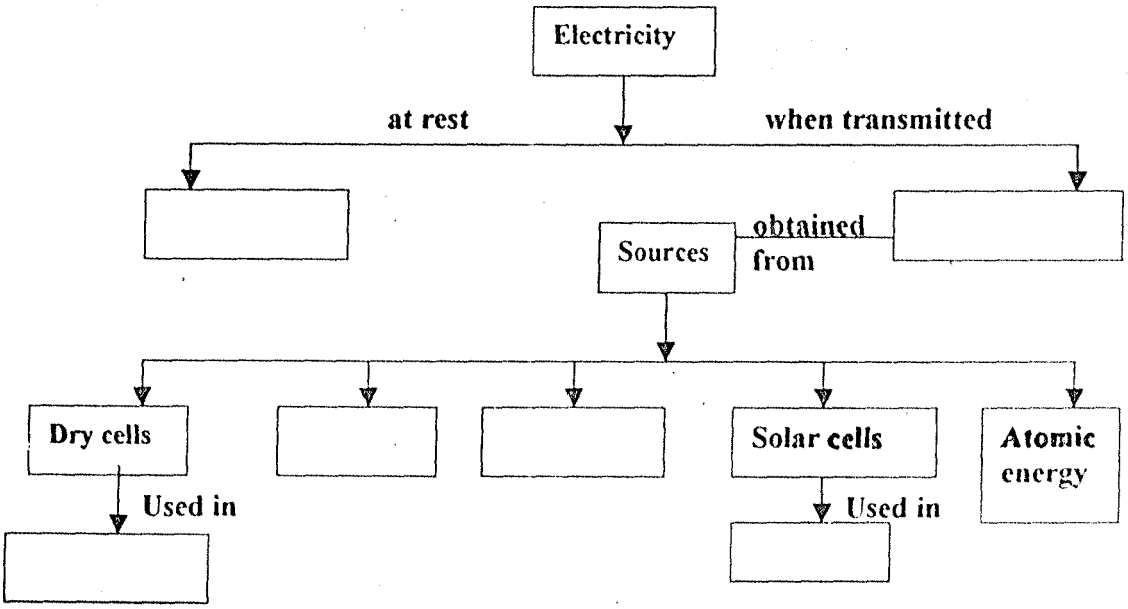


6. Draw a circuit diagram using 3 bulbs, a battery and a key showing connection series. (2marks)

7. Complete the following diagram carefully . Identify the missing part and draw it. Label all the parts. (3marks)



8. Fill in the blanks using appropriate concepts and examples wherever required in the following concept maps. (6marks)



9. Differentiate between (3X2=6marks)

a. Primary cells and Secondary cells

b. Conductors and Insulators

c. Open circuit and Closed circuit

10. How is electricity/electric current produced in Hydro electric power plants? (4 marks)

SCIENCE TEST II

USEFUL ANIMALS AND PLANTS

Name : **Class :**
School : **Date :**
Max.marks : 55

I. Fill in the blanks with an appropriate answer. (7X1=7m)

1. The egg laying bird is called as _____.
2. _____ is obtained from a special breed of sheep found in Kashmir valley.
3. _____ is the botanical name for rubber plant.
4. Dwarf plants are called as _____.
5. The science which deals with study of drug plants is called _____.
6. _____ & _____ help in fixing atmospheric nitrogen in the soil.

II. Choose any one alternative among the following : (5X1 = 5m)

1. Tea, Coffee and Cocoa contain an alkaloid _____ which has a stimulative action on human beings.

   a. Tannin b. Resin c. Cocaine d. Caffeine

2. Which one among the following does not belong to the group?

   a. Aconitum b. Ivy c. Toadstool d. Poison nut

3. What happens when the forests are destroyed ? It leads to

   a. soil erosion b. erratic changes in climate
   c. extinction of flora and fauna d. all the above.

4. Sleeping sickness is transmitted by

   a. mosquito b. sand fly c. tse- tse fly d. rat flea

5. Which one among the following animals is a ruminant ?

a. Frog b. Ass c. Cow d. Lion

III. Answer the following short answered questions.

1. Classify the following examples into cereals, pulses and oil yielding plants. (5m)
Rice, Green Gram, Soya Beans, Coconut, Groundnut, Wheat, Blackgram, Maize, Cotton Seed, Bengal Gram

CEREALS	PULSES	OIL YIELDING PLANTS

2. Classify the following vegetables into three types : (5m)
Potato, Lettuce, Tomato, Sweet Potato, Yam, Pumpkin, Spinach, Cucumber, Coriander, Mint.

Leafy vegetables	Starchy vegetables	Juicy vegetables

3. Identify the medicinal plants among the following and mention their uses: (4m)
Sal, Cinchona, Cotton Seed, Rauwolfia, Neem, Maize, Shisham, Jambul

4. How do leguminous plants help in making the soil fertile ? (2m)

5. How can you test the purity of honey at home ? (2m)

6. What are the health hazards of parthenium plants ? (2m)

7. Define the following terms : (5m)

   a. Domestication:

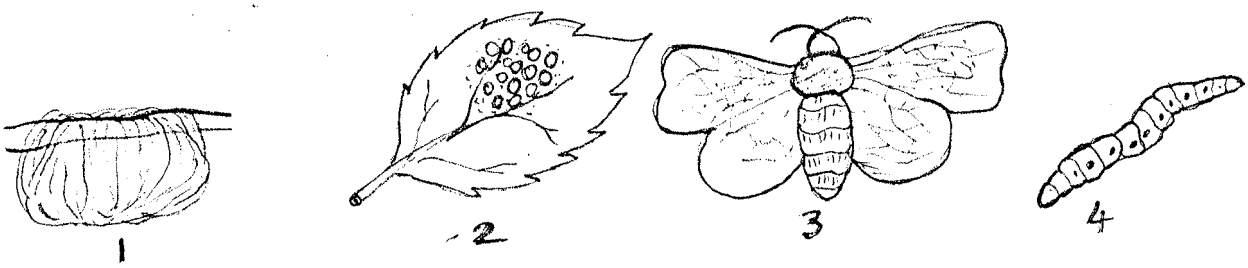
   b. Sericulture :

   c. Hatcheries :

   d. Shearing :

   e. Ornamental plants :

8. Observe the following diagram representing the life cycle of silk moth. Arrange the stages in a sequential order . Answer the given below questions. (5m)



1. Which is the most inactive stage in the life of silk moth ?

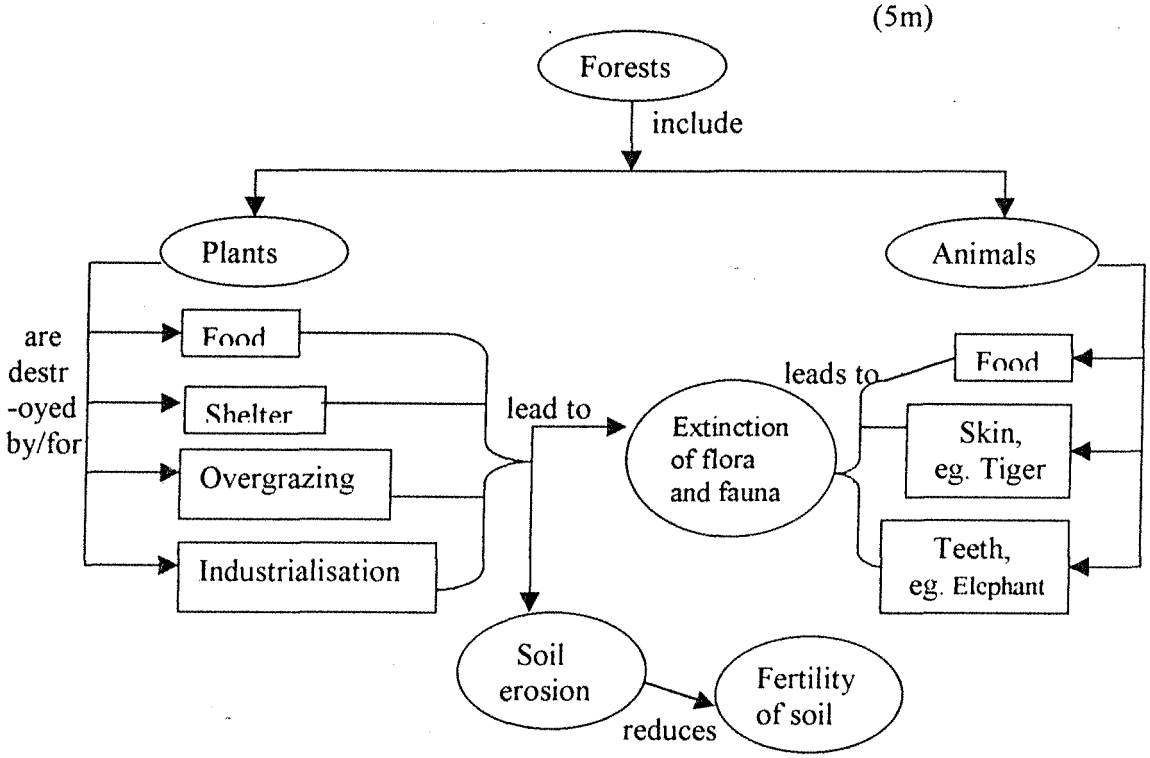
2. Which is the most active stage in the life cycle of silk moth ?

3. Where are the eggs laid in the case of silk moth ?

4. In which stage the silk is produced ?

9. Look in to the concept map given below and answer the following questions.

(5m)



1. Name some products obtained from forests.

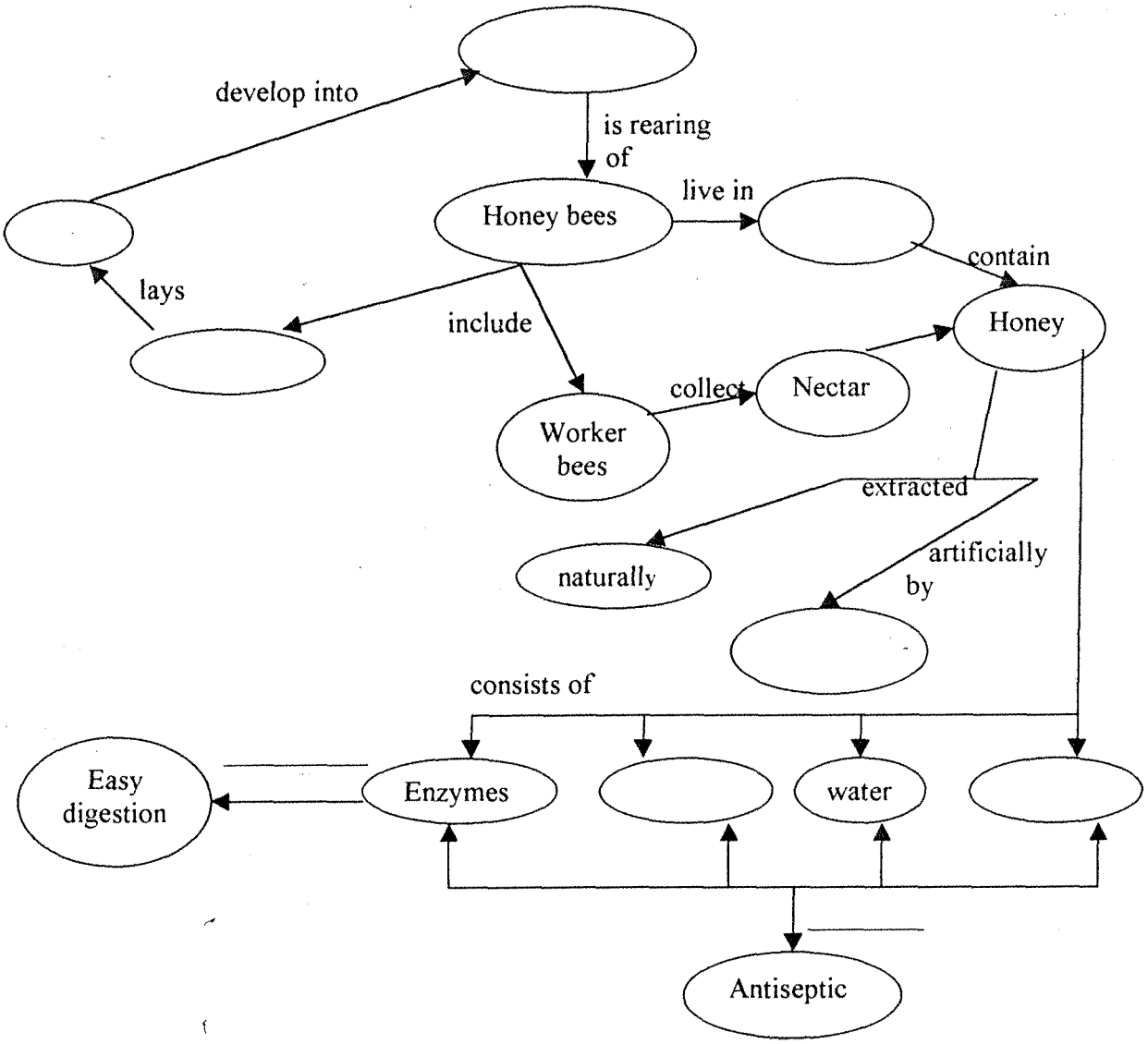
2. What do you mean by soil erosion ?

3. List out the factors that lead to soil erosion.

4. Why do some animals become extinct ?

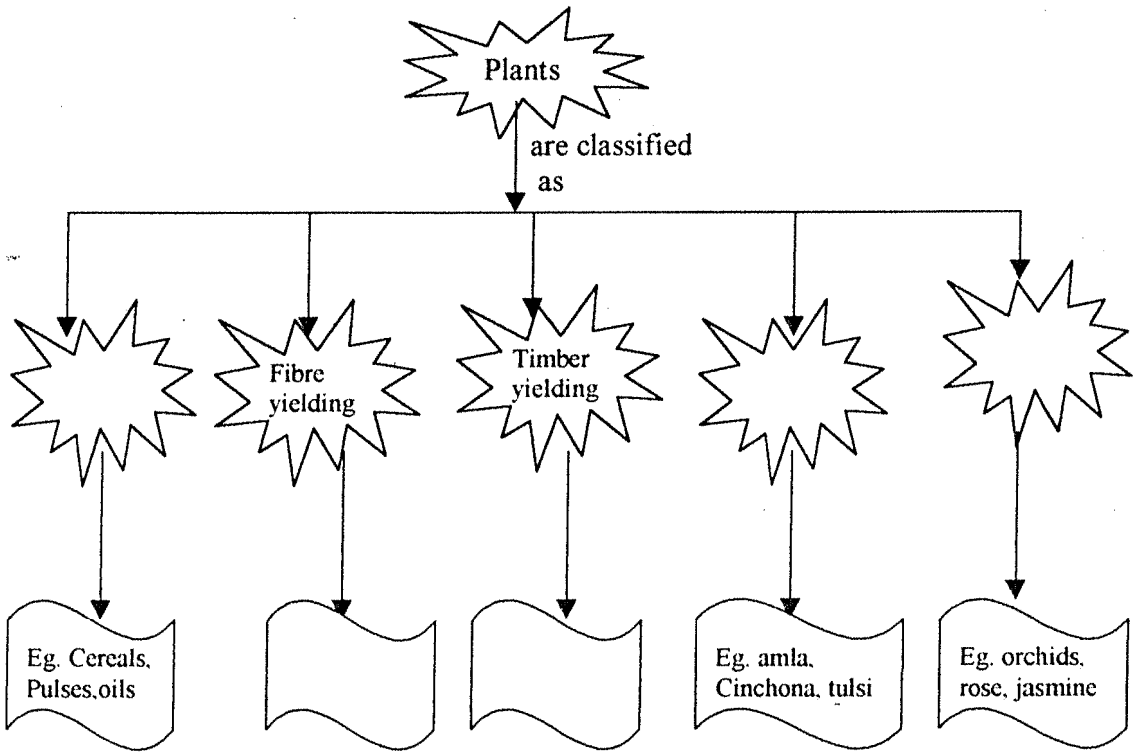
5. How do plants and animals help in maintaining ecological balance ?

10. Look into the below concept map and fill in the blanks with suitable concepts and link words. (4m)



-1-

11. Complete the concept map by filling the blanks with appropriate concepts and examples wherever required. (4 1/2m)



SCIENCE TEST III

Name :
Class :

MAGNETISM

School :
Date :
Max.marks : 50

I. Answer the following short answered questions given below in the space provided.

1. Below are given some substances. Classify them into magnetic substances and non-magnetic substances. (6marks)

Iron, Aluminium, Plastic, Nickel, Wood, Cobalt, Eraser, Stainless Steel, Brass, Copper, post card, paper clip.

Magnetic substances	Non-magnetic substances

2. Suppose you are given a bar and asked to find out whether it is a magnet or not. How will you do it ? (5marks)

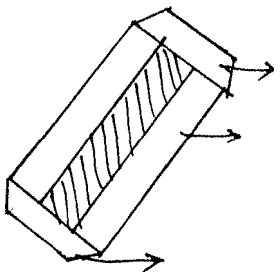
3. Differentiate between (4marks)

a. Natural magnet & Artificial magnet

b. **Temporary magnet & Permanent magnet**

4. **Why do you call earth as a giant magnet ?** **(3marks)**

5. **Here is the arrangement for storage of a magnet. Label the components and their functions.** **(2marks)**



6. **State any four uses of an electromagnet.** **(2marks)**

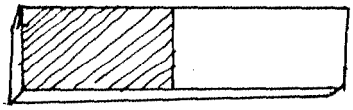
7. **Suppose you are given a bar magnet & a steel needle and are asked to magnetise it ? How will you do it ? Draw the diagrams showing the two methods of magnetization.** **(4marks)**

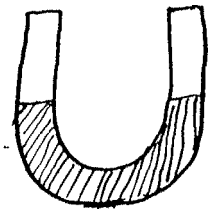
8. How are magnets demagnetized ? (2marks)

9. You are given a iron nail or rod, insulated copper wire and 6V battery, Draw the diagram showing the method of making an electromagnet. Explain the mechanism involved.

(3marks)

10. Below are given the figures of a bar magnet and a U-shaped magnet. Indicate the poles in them. (1mark)





11. What will happen to the domains of an iron piece when it is brought near a magnet ?

(2marks)

12. In what way is magnetic compass useful to the sailor of a ship ?

(2marks)

13. Who used the magnet for the first time and how did they discover it? (2marks)

II. Choose any one alternative among the following. Each question carries one mark. (6X1=6marks)

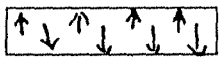
1. Lines of force of a bar magnet are
a. crowded near the vertical plane
b. crowded near the center
c. crowded near the poles
d. uniform throughout the field

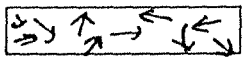
2. Magnetism produced in an electromagnet depends on the
a. amount of the current flowing through the wire
b. length of the iron rod
c. number of turns wound on the soft iron rod
d. both a & c

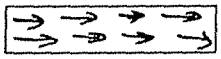
3. When a magnet is suspended freely in air, it rests only in
a. south-west direction
b. east-west direction
c. north-south direction
d. north-west direction

4. What will happen to a magnet if it is broken into pieces ?
a. it loses its magnetic properties
b. each piece act as an iron piece
c. each piece act as a magnet
d. they get united again.

5. The alignment of magnetic domains in a magnet is


a


b


c

None of them
d

6. Which one among the following is the sure test for magnetism ?
a. Attraction
b. bringing an iron piece near it
c. Repulsion
d. Induction

III. Fill in the blanks (6X1=6marks)
a. A horse shoe magnet needs only _____ to store.
b. Alnico magnets are made of Nickel, _____ & _____.
c. The device in which current carrying wire acts like a magnet is _____.
d. _____ is an ore of iron (FeO)
e. Natural magnet is known as _____

Name : Date :

School : Marks :

Science Test

ADAPTATION AND ORGANIC EVOLUTION

I. Choose any one alternative among the following. Each question carries one mark.

1. Desert Plants are most likely to have
   a) Large flat leaves b) Large numbers of stomata
   c) Short root system d) Reduced Leaves

2. Which important features of Pigeons body structure help it to fly in air ?
   a) Light bones b) Stream Lined Body
   c) Feathers & Wings d) All the above

3. The continuous process of gradual change from simple forms of life into complex organisms is called
   a) Variations b) Adaptations
   c) Reproduction d) Organic Evolution

4. In Desert Plants like Cactus, Optunia etc., the stomata are ..... in number
   a) Lesser b) Greater
   c) Limited d) None of the above

5. Which are among the following does not belong to the group ?

a) Nictitating membrane b) Legs of a man

c) No wings of a bird c) Wings of an insect

6. Life Originated first in

a) Water b) Land

c) Air d) All the above

7. Camel is able to with the high temperatures and scarcity of water as it has

a) It as a fat layer under skin

b) Kidneys which retain much water

c) It has four chambered stomach

d) All the above

8. The leaves are modified into thorns in opuntia, it is

a) To add beauty to the plants

b) To protect from other plants

c) To reduce transpiration rate

d) To prepare food for plant

9. Which are among the following does not belong the group

a) Snakes b) Pigeons

c) Bat d) Frog

CONSERVATION OF NATURAL RESOURCES

Name : Marks: 30

Class : Date :

School:

I. Choose any one alternative among the following. Each question carries one mark.

(10x1 = 10 marks)

1. Why conservation of natural resources was not necessary thousands of years ago ?

   (a) As the people were uncivilised.

   (b) As the natural resources were abundant.

   (c) As there was more human population.

   (d) As people never used to waste the resources.

2. What do you think will happen to the snakes if all the rodents in a food chain are killed ?

   (a) Insects will increase in number.

   (b) Snakes will die due to starvation.

   (c) Snakes will migrate from that place.

   (d) Both (a) and (c).

3. What name can you give to the following examples ? ground water, table salt, soil, forests, plants and animals.

   (a) Inexhaustible resource

   (b) Mineral resources

   (c) Exhaustible resources

   (d) Non-renewable resources

4. What do you think will happen if people start cutting all the trees in a forest for starting industries ?

   (a) There will be less oxygen in atmosphere.

   (b) It leads to soil erosion.

   (c) It may lead to decrease in rainfall.

   (d) It may result in increase in temperature.

5. What will happen when farmers start using lots of chemical fertilisers in their fields ?

   (a) It makes the soil more fertile.

   (b) It makes the land worthless.

   (c) The soil organisms will increase in number.

   (d) Soil absorbs more water and minerals.

6. Which one among the following does not belong to the group ?

   (a) Snow Leopard

   (b) Slender Loris

   (c) Golden Langur

   (d) Koala Bear

7. _____ is an example for man-made desert.

   (a) Kalahari desert

   (b) Thar desert

   (c) Sahara desert

   (d) Gobi desert

8. Why should we plant trees in rows ?

   (a) They add beauty to the roads.

   (b) They reduce air pollution.

   (c) They weak the speed of strong winds and reduce wind erosion.

   (d) They give shade to passengers.

9. Which are among the following is the meaning of conservation ?

   (a) Rare use of natural resources.

   (b) Unlimited use of natural resources.

   (c) Indiscriminate use of natural resources.

   (d) Judicious and wise use of natural resources.

10. Which of the following cannot be recycled after they are used ?

(a) Newspaper

(b) Cooking gas

(c) Candle

(d) Empty oil tin

II. Fill in the blanks

(5x1 = 5 marks)

1. _____ farming should be practiced on hills to prevent soil erosion.

2. The substance which are used by man for his sustenance and welfare are called _____.

3. IUCN stands for _____.

4. Chemical fertilisers can be replaced by _____ in the fields.

5. Wild life week is observed from _____ every year.

III. Short answered questions

(15 marks)

1. What kind of human activities make the soil barren ?

2. What is the relationship of deforestation to water cycle?

3. Why are plants like bamboos and eucalyptus must be planted ?

4. What measures would you suggest to conserve water ?

5. What are the main causes of depletion of resources ?

6. Why do farmers adapt crop rotation technique in their fields ?

7. Why is energy from the sun considered to be the most important natural resource ?

8. Name the three different types of nitrogen fixation.

9. Why should we conserve forests ? (3M)

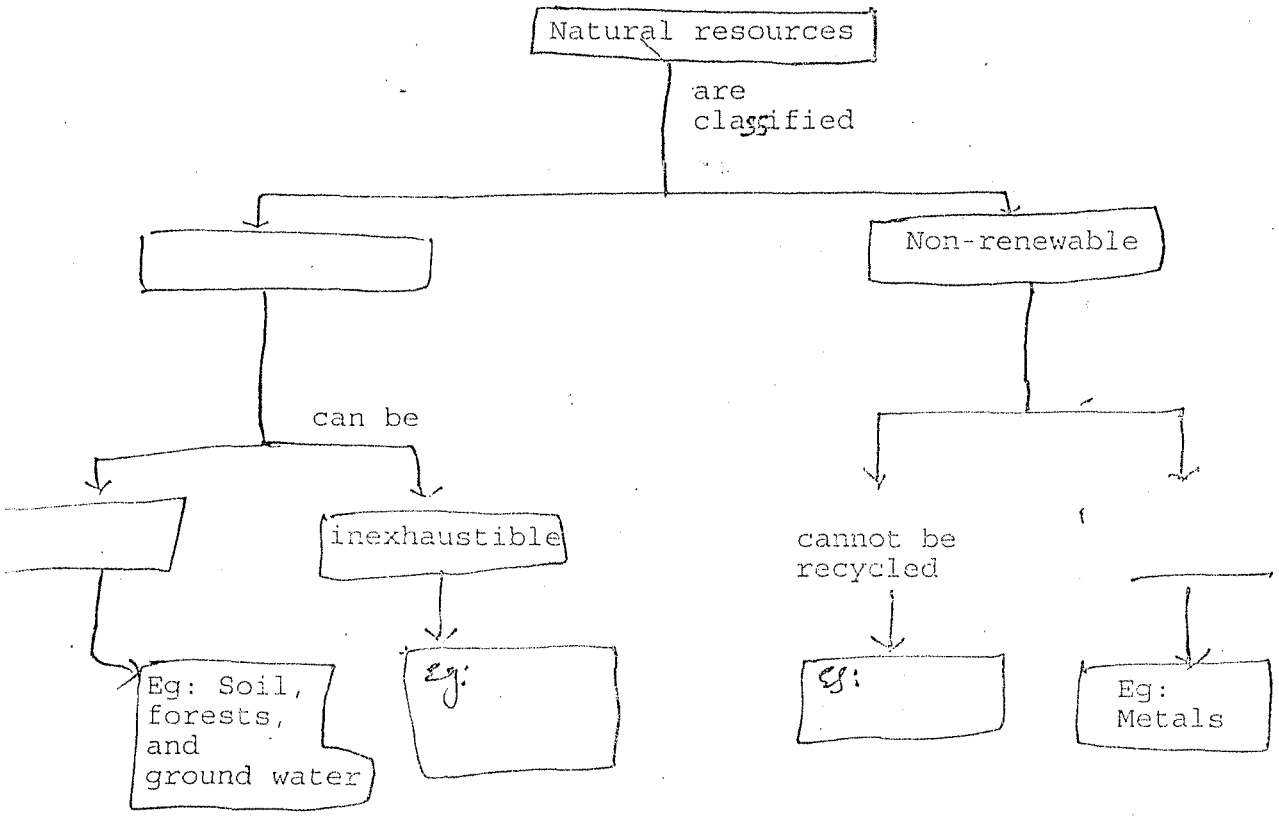
10. How can we prevent ground water from exhaustion ? (2M)

11. Differentiate renewable and non-renewable natural resources. (2M)

12. Explain any four methods of conservation of non-renewable resources. (4M)

13. Draw a concept map showing the relationship between the following concepts. (5M)
flora and fauna, soil erosion, soil fertility, deforestation, over grazing, natural resources, hunting, forest fire, extinction of species

14. Complete the following concept map using appropriate concepts and examples. (4M)



10. Why does a fish due when it is taken out of water ?

a) As it is aquatic in nature

b) As it cannot take atmospheric oxygen

c) As it can take only directly dissolved oxygen

d) Both b and c

II. Fill in the blanks (5 x 1 = 5 Marks)

1. ..... is a link between Reptiles and Birds

2. The development of characteristics which help an organism to survive in a particular environment is known as .....

3. The study of fossils is known as .....

4. ..... is the ancestor of elephant

5. ..... prepares food in cactus plant

III. Answer the following questions

1. Here are given few characteristics features of aquatic plants that help in floating. Tick the right ones (2 Marks)

   a) Wavy nature of the stem

   b) Poorly developed root system

   c) Stomata found on both sides of the leaf

   d) Texture (waxy coating) of the leaf

   e) Stomata are more in number

   f) Well developed woody stem

   g) Bulb like structure present in a leaf

2. Classify the following plants into Xerophytes, Mesophytes, and Hydrophytes, Agave, Hydrilla, Rose, Opuntia, Lotus, Hibiscus, Cactus, Pistia, Coriander, Water Hyacinth

Xerophytes	Mesophytes	Hydrophytes

3. State the main points of Darwin's theory of natural selection (4 Marks)

4. Write down the differences between Analogous organs and Homologous organs. Give examples (2 Marks)

5. How is a fish adapted for its aquatic mode of life ? Explain with the help of a diagram (2 Marks)

6. Name any 4 Vestigial organs found in Human Beings (2 Marks)

7. Who Proposed Law of Use and Disuse? Explain them with examples (4 Marks)

8. List any 4 evidences in favour of evolution. (4 Marks)

9. Define the term fossil (1 Marks)

10. Observe the diagram & list out the Reptilian and Bird Features (4 Marks)

APPENDIX - B

(Lesson Plans)

Unit 1
MAGNETISM

Objectives :

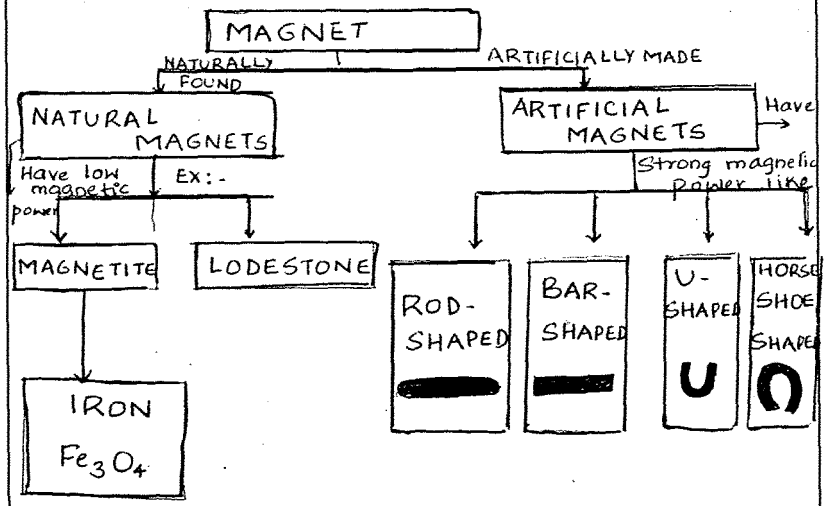
1. Recalls the name of the rock from which magnet was derived.
2. Defines a magnet.
3. Classifies magnetic and non-magnetic substances.
4. Differentiates natural magnet from artificial ones.
5. Given the activity, the student identifies the attractive property of a magnet.
6. Identifies the poles of a magnet.
7. Explains through an activity that like poles repel and unlike poles attract.
8. Proves that magnetic poles exist in pairs.
9. Explains the process of magnetic induction.
10. Develops a concept map showing the properties and types of magnets.
11. Given the materials, student magnetizes an ordinary needle.
12. Explains the two methods of making a magnet by artificial means.
13. Lists out the methods of demagnetization.
14. Recalls the test for magnetism.
15. Reasons out why we should store the magnets when they are not in use.
16. Defines an electromagnet.
17. Explains the process of making an electromagnet.
18. Differentiates between temporary and permanent magnets through a concept map.
19. Lists out the application of electromagnets in our daily life.
20. Describes a magnetic compass.
21. Reasons out why we call earth as a magnet.
22. States the uses of a magnet.

Concepts / Teaching Points

1. Magnetic Substances : Substances which are attracted by a magnet are called Magnetic Substances.
2. Non-Magnetic Substances: Substances which are not attracted by a magnet are called non-magnetic substances.
3. Natural Magnet : The magnets which are found in nature and have low magnetic power.
4. Artificial Magnet : The magnets which are made by man and have high magnetic power.
5. Poles of magnet : The two ends of a magnet where the magnetic force is greatest.
6. Magnetic Induction : the phenomenon by which an ordinary piece of iron acquires magnetic properties temporarily due to the presence of another magnet near it.
7. Self demagnetization : The tendency of magnet to become weaker after some time is called self demagnetization.
8. Electromagnet : The magnets produced with the help of electricity are called as Electromagnets.
9. Magnetic Compass : It is a simple device which has a magnetic needle that is free to rotate and rests in north-south direction.

LESSON PLAN I

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Magnetic and Non-magnetic substances	Exploration	Concept Attainment game	Teacher provides substances/ materials like comb, papers, iron fillings, plastic, fibre, wood, aluminium clips, zinc rod etc. and a magnet to the students and students are asked to classify the materials into groups. S: Classifies them into two groups as magnetic substances and non-magnetic substances.	What are magnetic and non-magnetic substances ?
Natural Magnet	Explanation & Expansion	Story Telling	T: O.K. Students you have used a magnet to identify magnetic substances from non-magnetic substances. Are these magnets actually available ? S: Yes. T: What are they ? S: Magnetite and lode stone. T: Do you know why were they called so ? (the story behind those names). S: No. T: O.K. I will tell you the story of discovery of a magnet. 5000 years ago people of Magnesia (Province in Asia Minor) discovered that particular rock could attract small pieces of iron towards it incidentally. It was named as Magnetite, a wonderful rock which is an ore of iron (Fe_3O_4). Sailors used magnets to navigate their ships especially during cloudy weather. Chinese called them as Leading Stone, presently it is called a Lode Stone. So these two are called as Natural Magnets.	
Natural Magnets			T: Are all magnets naturally available or are there any man made ones ?	What is a natural magnet ?

Artificial magnets		Evaluation	S: Yes they can be artificially made. Like horse shoe magnet. T: Is there any difference between natural and artificial magnets. S: Natural magnets are naturally available and artificial magnets are made by man. Artificial magnets are made by man. T: Which magnet has high magnetic power ?  S: Very good. Teacher draws a concept map showing the types of magnets and their differences and asks certain questions based on the concept map.	Which magnets have low magnetic power ?

Home Assignments / Activities :

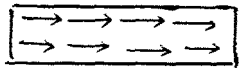
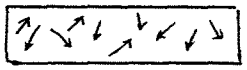
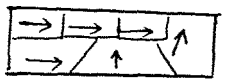
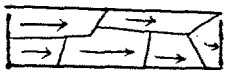
1. Differentiate between (a) Magnetic and Non-Magnetic substances, (b) Natural and Artificial Magnet.
2. Write any 3 examples of Artificial Magnet.

LESSON - 2

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Properties of a Magnet Attractive property of magnets.	Introduction Exploration & Explanation		T: All of you have seen a magnet in the last class and you have also identified magnetic substances from their counterparts. Today we will discuss about its properties. Can you tell the properties of a magnet ? S: It attracts the metal pieces. T: How do you know that it attracts the metallic pieces ? S: Yesterday, it attracted the iron filings. T: Yes, very good. Magnet has an attractive property. It attracts the metallic substances. Teacher places few iron fillings on a white paper and brings a magnet near the filling. Teacher asks the students to observe the result. What do you observe ? S: Iron fillings are attracted towards the two ends of a magnet. Magnets attract the iron fillings. T: What do you call those two ends of a magnet as ? S: Poles – North and South poles. T: In what direction do the magnet rests when it is suspended? S: Experiments and observes that it rests in N-S direction. T: Why does it rest in N-S direction ? (Group Discussion)	What do you infer from this ? How many poles are there in a magnet?
		Experiment		

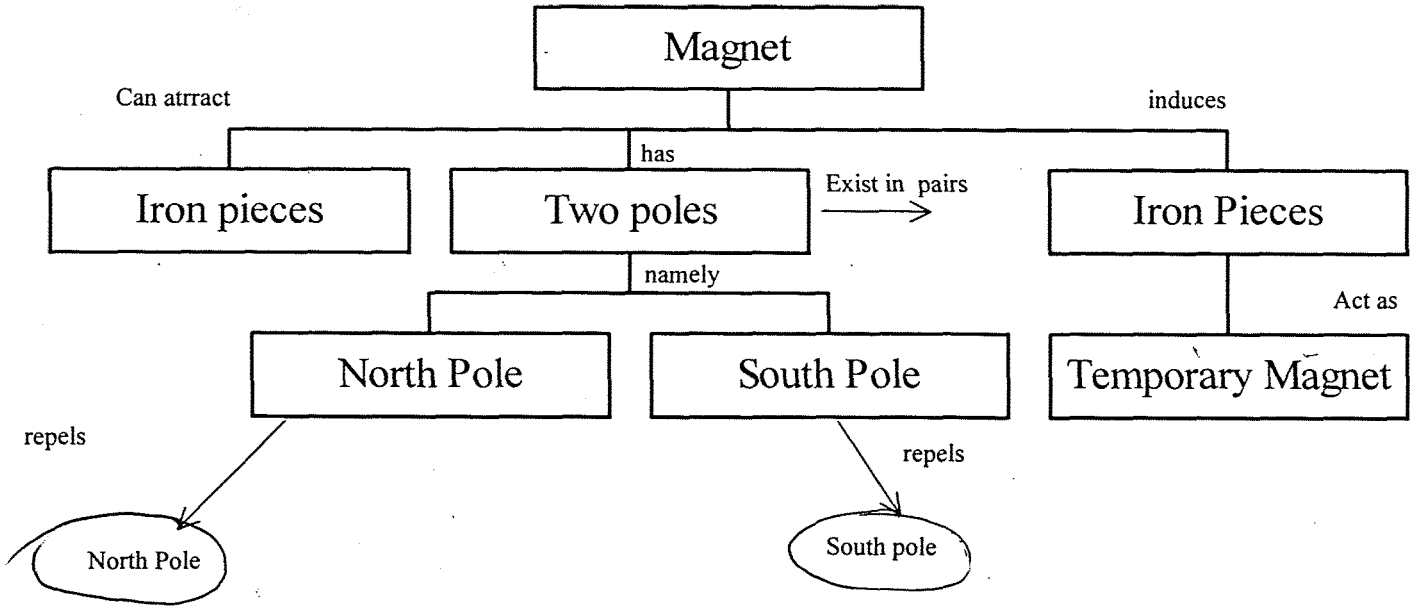
Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Directional property			S: Earth has a large magnetic field around it. It is so with pole points towards geographical North Pole and North pole towards geographical south. That is the reason why the magnet rests in N-S direction. T: Draws the diagram and explains again to the class. T: This property of magnets is called as Directional Property. Where is this property of magnet made use of ? S: In making magnetic compass. T: What is magnetic compass ? Now students you have learnt that a magnet has two poles and it rests in N-S direction. Now let us see what will happen when two magnets are brought near each other ?	
Like poles repel and unlike poles attract.		Experiment	S: Takes two magnets and brings them near each other and observes that North pole repels with North pole of other magnet and North pole attracts with South pole of magnet. S & S repels with each other. T: What do you infer from this ? S: Like poles repel and unlike poles attract each other.	
Poles exist in pairs.			T: What will happen if a magnet is broken in pieces accidentally ? S: Each piece will act as an individual magnet. T: What do you conclude from this ? S: Each magnet has two poles. Magnetic poles always exist in pairs.	How many poles are there in a magnet?

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
	Expansion		T: Day before yesterday when I was collecting the magnets, iron fillings, etc. from the lab, accidentally I had kept an iron nail along with a magnet. Can you guess what must have happened to the iron nail? S: Iron nail started attracted iron fillings. T: What might be the reason for this ? S: Iron nail acquired magnetic properties from the magnet. T: How ? S: ----- T: The magnet has the property of inducing the iron nail. This property is called as Induction. Do you know how this induction takes place ? S: No.	

	Evaluation		T: When we observe a magnet under a microscope, it consists of small regions called as domains. Each of these act as tiny magnet and they point in the same direction (draws on BB). But in case of iron, they are in different directions. When a magnet is brought near the iron nail, slowly the domains turn and align themselves in the same direction. So it acts as a magnet temporarily.  MAGNET  IRON NAIL   Before Induction After Induction T: Now let us try with other objects. Students try with screws, pins, etc. T: What did you observe ? S: Even these materials are acting as magnets. Teacher draws a concept map with the help of the students on blackboard showing the properties of a magnet.	

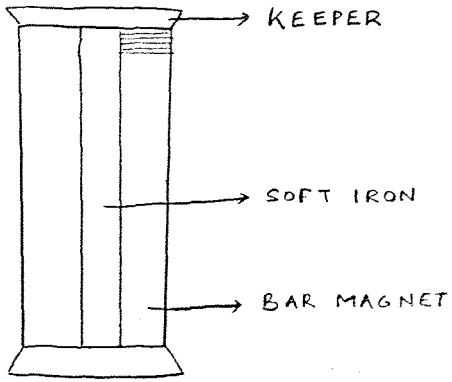
Home Assignments :

1. What will happen to the domains of iron fillings when a magnet is brought near it ?
2. List out the properties of a magnet.


Magnet
Can atrract
induces
has
Iron pieces
Two poles
Exist in pairs
Iron Pieces
namely
Act as
North Pole
South Pole
Temporary Magnet
repels
repels
North Pole
South pole

LESSON – 3

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
	Exploration		T: Yesterday we have seen how a magnet induces an iron nail ? How a temporary magnet is made by the process of magnetic induction ? Can you tell me any other methods of making artificial magnets. S: ------	
	Explanation & Expansion		T: There are 3 more methods of magnet making. (i) Single Touch Method (ii) Double Touch Method (iii) Electromagnet Teacher demonstrates and explains all the three methods one by one on the blackboards and also develops a concept map.	What is single touch method ?
	Evaluation		T: Which one among the three will have lasting magnetic effect ? S: Electromagnet. T: What is an Electromagnet ? S: A magnet produced by electricity. T: How will you make a magnet using electricity ? S: Takes an insulated copper wire and wounds around the iron rod and then connect the two ends to a 6V battery. Then the iron rod attracts the pins, clips, etc. like that of a magnet.	
Temporary and permanent magnets.			T: Is it a temporary magnet or permanent ? S: Temporary. As soon as the supply of electricity is removed, it loses its properties.	What is the difference between temporary and a permanent magnet?

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Magnetic keepers	Evaluation		T: Where do we use Electromagnets ? S: Telephones, bells, microphones, dynamo, etc. T: We must store them in magnetic keepers. Magnets should be kept facing opposite to each other. In between them, a soft iron piece is kept and keepers are kept on the two ends of a magnet.  O.K. Suppose you are given a bar and ..... to find out whether it is a magnet or not ? S: We would check, whether (a) it rests in N-S direction. (b) It attracts iron pieces. (c) Its poles attract each other. T: What do you call the specific test as ? S: Repulsion T: You have seen such a wonderful substance and its properties. Are there any circumstances where a magnet loses its properties or power ?	

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Demagnetisation	Evaluation		S_1: When it has fallen from height forcefully. S_2: When it is heated. S_3: When it is hammered. S_4: When it is stored properly. T: Why does it lose its power ? S: May be hammering etc. destroys the alignment of domains inside. T: Yes, very good. This process of loss of magnetic power of a magnet is called as Demagnetisation. T: How can you overcome the above problem ? S: By storing them properly. T: How ? S: ------ T: O.K. fine. We have learnt so much about the magnets and their properties. Now list out the uses of magnets. S_1: In toys, refrigerator doors. S_2: In loudspeakers. S_3: Telephones, motors. S_4: Memory stores in computers, etc.	What is demagnetisation?

Home Assignment/Activities

1. Draw a concept map showing the different methods of magnetization.
2. Why do we call earth as a magnet ?

UNIT – 2

ELECTRICITY

Objectives :

1. Recalls the concept of Static Electricity.
2. Differentiates between static electricity and dynamic electricity through a concept map.
3. Lists out the appliances that work using electric energy.
4. Lists out the sources of electric current.
5. Gives examples of the devices that work with the help of dry cells, dynamo, generators, solar cells, etc.
6. Defines Accumulator.
7. Explains through an activity that current flowing through the wire is unidirectional (direct current).
8. Differentiates direct current and alternating current through a concept map.
9. Draws and labels a dry cell.
10. Explains the working of a dry cell.
11. Explains the working/process of production of hydroelectricity.
12. Explains the principle of hand dynamo.
13. Lists out the uses of hand dynamo.
14. Differentiates between conductors and non-conductors of electricity.
15. Give n substances, classifies them into conductors and non-conductors of electricity.
16. Draws an electric circuit/diagram using the different symbols.
17. Differentiates between open circuit and closed circuit.
18. Explains the different effects of electric current.
19. Reasons out why mica is used in iron box.
20. Reasons out why tungsten wire is used as filament in bulbs.
21. Sees the relationship between the length of the wire and quantity of heat liberated.
22. Explains the working of electric bell.
23. Draws the diagram of electric bell.
24. Defines the process of electrolysis.
25. Reasons out why wires with low melting point has to be used in electric fuse.
26. Defines electric fuse; electric meter.
27. Defines the unit.
28. Draw an electric circuit diagram in connecting the bulbs in two conditions: (a) parallel, (b) Series
29. Predicts the consequence of disconnection of one of the bulbs when they are connected in parallel.
30. Lists out the devices which convert
    (a) Electrical energy → heat energy
    (b) Electrical energy → light energy

Concepts / Teaching Points

1. Static Electricity : The electricity which do not get transmitted from one place to other.
2. Dynamic Electricity : The electricity which is transmitted from one place to other.
3. Electric current : The directed flow of elections in a conductor.
4. Accumulators : It is a device for storing electricity which is considerably high and the duration of supply will last longer than dry cell.
5. Alternating current : the current which changes its direction a number of times during every second.
6. The current which is unidirectional in nature is called as direct current.
7. Conductors –The objects which allow electric current to pass through them easily.
8. Non-conductors : The objects which do not allow electric current to pass through them easily.
9. Electric Circuit : It consists of a source of current, connecting medium, a bulb, a switch. It is a complete path of the current.
10. Electric meter : The instrument used to measure the quantity of current consumed.
11. Series : In a series circuit, current flows from one device and then enters the other and flows further. If there is any disconnection the flow of current stops in the entire circuit.
12. Parallel circuit, current branches off and flows separately through each of the devices. If there is any device disconnected from the circuit, the current will flow through other devices except the disconnected one.
13. Electric fuse : It is a safety device used to safeguard the circuit against short circuits, power fluctuations, etc. which has wire made from an alloy of lead and tin (low melting point).
14. Ammeter – It is an instrument used for measuring electric current flowing in a circuit (series).
15. Galvanometer – It is used for measuring low currents (series).
16. Voltmeter – It is used to measure the potential difference between two points in an electric circuit in volts (11).
17. Electric generator/dynamo : It is a device for producing electric currents for use in home and industry, which converts mechanical energy into electric energy.
18. Circuit diagram indicates the arrangement of different circuit elements with their conventional symbols.
19. Current – it is the rate of flow of charge . Charge = ± Charge/Time.

LESSON – 1
UNIT - 2

ELECTRICITY

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
	Exploration		Introduction : T: All of us use many electrical appliances and electric current has become a common word for us. Do you know how this current was discovered? And came into being.	
Static Electricity	Explanation		S: It is Jhales who brought out the term electricity. He rubbed Amber and fur cloth. Then both Amber and fur cloth acquired power of attracting small bodies like paper pieces, threads, etc. It was explained that most of the objects around us have an equal number of positive and negative charges i.e. they are electrically neutral. But when we rub them some of the charges are removed from the surface and remained as positively and negatively charged. T: Do these charges get transmitted ? S: No. T: What do you call this type of electricity as ? S: Static Electricity.	What do you mean by Static Electricity?
	Evaluation Exploration		S: Electricity at rest is called Static Electricity. T: Is it the same Electricity which we are using at home ? S: No. T: Then, what is it ?	

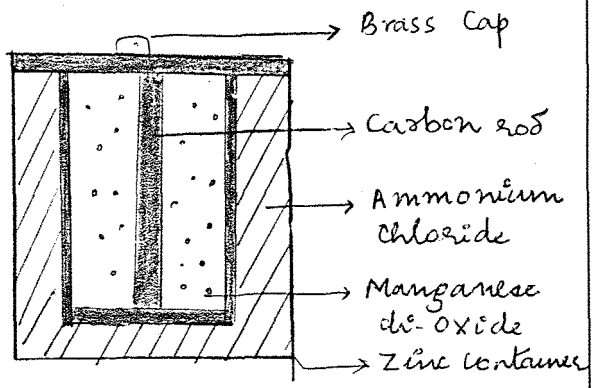
Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Dynamic Electricity	Explanation		S: It is dynamic electricity. T: What is the difference between Static and Dynamic Electricity ? S: Dynamic Electricity is the Electricity Motion. T: It can be transmitted from one place to other. That is why it is called dynamic. T: Can you name some sources of Dynamic Electricity? S: Dry cells, dynamo, generator, solar cells. T: Name some home appliances that work using electrical energy. S: Iron, box, electric fans, etc. T: From which source is the electricity produced ? S: Water (hydro electric power). Teacher summarises the class drawing a concept map on the blackboard taking the help of students.	What do you call the electricity at rest as ?

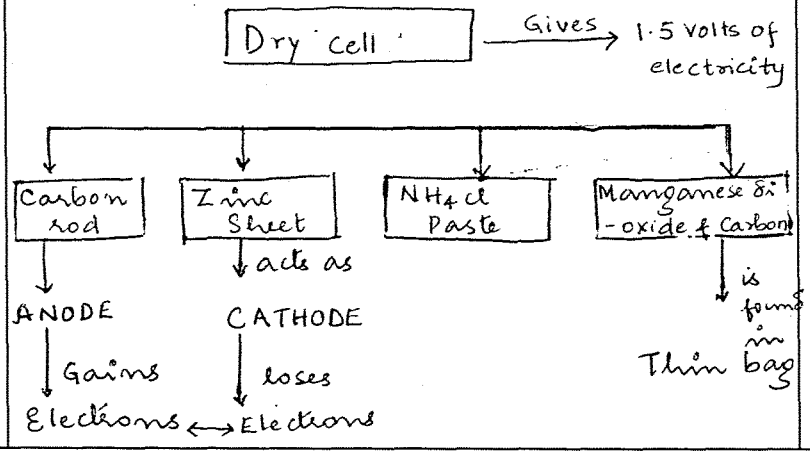
Home Assignment :

1. **What do you mean by Dynamic Electricity ?**
2. **Name any 10 sources of Dynamic Electricity.**

LESSON – 2

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
	Exploration		T: OK Students in the last class, we have learnt two types of Electricity – Static and Dynamic. Can you tell me now in which direction do the electrons move?	
	Explanation/ Expansion		S: They move from +ve to –ve electrodes of a cell.	
			T: Then how is electricity produced ?	
			S: By conversion of different forms of energy into electrical energy.	
Sources of Electricity			T: What are the different forms of energy ?	
			S: Chemical energy, mechanical energy, solar energy, etc.	
			T: Name one example where in Chemical Energy is converted into Electric Energy.	
Dry Cells.			S: Dry Cells.	

			T: Shows a dry cell and cut opens all the components in it, explains the different parts and their functions to the students with the help of diagram.  T: Now I think all of you have understood what a dry cell is and how it functions ?	What is the difference between physical energy and chemical energy ?
	Expansion		T: Where do you use these dry cells? S: Torch, Radio, Walkman, Toys, etc. T: Students, in this cell, from which energy, the electricity is produced?	Which is the anode in dry cell?

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
	Evaluation		S: Chemical energy is converted into Electrical energy. T: Teacher calls one of the students and asks him to draw a concept map showing its components.  	

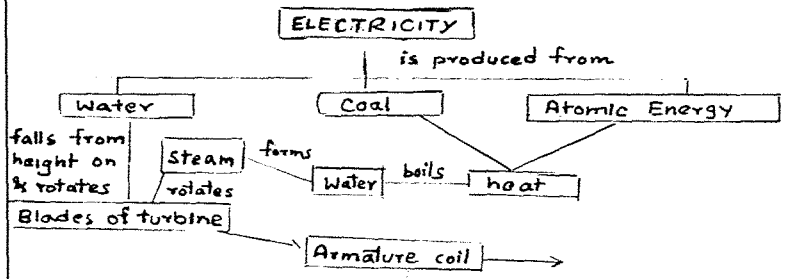
Home Assignment/Activities

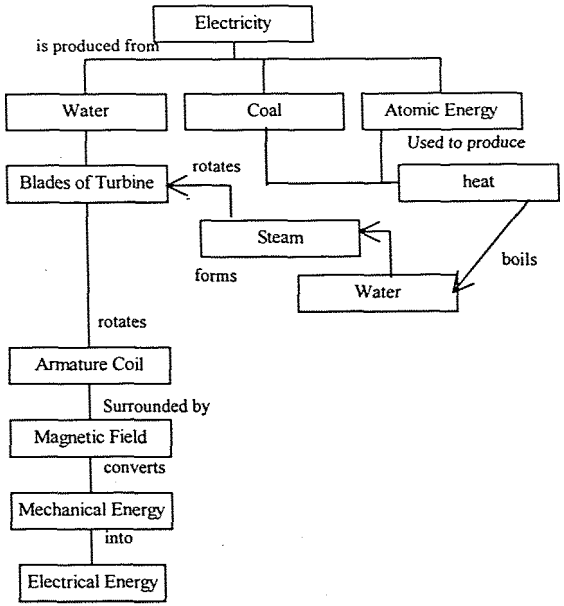
1. Explain the working of Dry Cell.

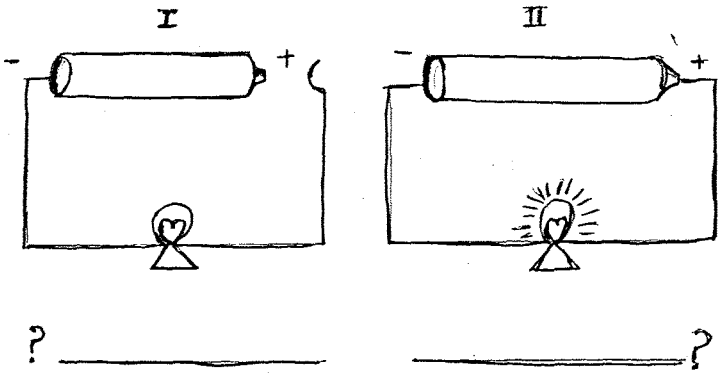
Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Hand dynamo	Exploration		T: Can you tell me an example where mechanical energy is converted into Electrical energy ? S: Hand dynamo. T: Did you see a hand dynamo ? S: Yes, Teacher. It is there in my bicycle. T: What is the purpose of hand dynamo in a cycle ? S: To get light. T: How does it work ? S: I don't know Miss.	

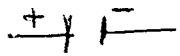
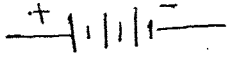
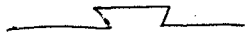
	Explanation & Expansion		T: Today we will see how mechanical energy is converted into electrical energy. Teacher draws the diagram of Hand Dynamo and describes the parts and their functions.	What is the function of a magnet in hand dynamo ?
			Teacher explains : When the bicycle moves, wheels turn, hand dynamos attached to it also rotates, the coil with magnet inside also rotates. So mechanical energy of the wheel is converted into electrical energy.	
	Evaluation		T: When will be the light dim ? S: When the wheels are rotating slowly, when the bicycle moves fast, the light will be bright.	
	Exploration		T: Can you give me one more example wherein Mechanical Energy is converted into Electric Energy as above ? S: Hydroelectric power station.	

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Hydro Electric Power Station	Explanation		T: How is electricity produced in Hydro Power Station ? S: Water falls from height on turbines, the wheels of turbines rotates fastly (mechanical energy) which is connected to armature coil. The armature coil is surrounded by magnetic field. With the spin of armature, electricity is generated.	
Thermal power plant	Expansion		T: The same principle is used in thermal and atomic energy Plants except the source. Instead of water, coal and uranium are used to produce heat which is in turn used to boil the water and the steam drives the engine and rotates armature coil.	

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Electric circuit	Evaluation Explanation		Teacher draws an incomplete concept map showing the Hydro, Thermal, Atomic energy power plants and their working on the blackboard and ask the students to complete them one by one.  T: Have you seen how Electricity is generated in Power Stations ? What do you call the path in which the current flows ? S: Electric circuit. T: What are the essential components of an electric circuit? S: Source, appliance, conductor and a key.	


Electricity
is produced from
Water
Coal
Atomic Energy
Used to produce
Blades of Turbine
rotates
heat
Steam
boils
forms
Water
rotates
Armature Coil
Surrounded by
Magnetic Field
converts
Mechanical Energy
into
Electrical Energy

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Open and closed circuits.			T: I will show you two circuits. Observe them carefully and give you comments on them.  S_1: Connection is not given properly. S_2: Second one is complete. T: What do you call those circuits as ? S: Incomplete and complete circuits. T: Can you give better names ? S: Open and closed circuits.	What is the difference between open and closed circuits?

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
	Expansion		They are called as Open and Closed Circuits. In order to draw a circuit diagram, we need to use the symbols for some elements. Teacher draws symbols on the blackboard and the students copy them in their notebooks. **Symbols of Circuit Elements :** **Name of the Element** — **Symbol Used** 1. A single cell  2. An electric bulb  3. Battery  4. Open Switch  5. Closed Switch  6. A wire joint  7. Ammeter  8. Galvanometer  9. Voltmeter 	

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
	Exploration		Draw a circuit diagram using 1 bulb, 2 cells and wires 1 bulb, 4 cells and wires 1 bulb, 1 cell and wires Students draw circuit diagrams in their notebooks. T: What are the uses/effects of electric Current ? S: Produces light in bulbs, gives heat in iron box and so on. T: There are mainly 3 effects namely (a) Heating Effect, (b) Magnetic Effect, (c) Chemical Effect. What is required for getting heating effect ? S: A conductor. T: Yes. The quantity of heat produced when a current is passed through a conductor depends on length and thickness of conductor. T: Which metals are used for this purpose ? S: Nichrome, tungsten etc. T: In the lesson Magnetism, you have seen how Electricity is made use of in making Electromagnet. What do you call this effect of Electricity as ? S: Magnetic Effect. T: Name the device which is commonly found in all the houses that uses the above effect. S: Electric Bell. T: How does an electric bell work ? S: ----	Differentiate between magnetic effect and chemical effect. How does an electric bell work?

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
			T: Teacher explains the working of an electric bell (showing it). Electric current makes the armature, a magnet and attracts the soft iron piece. Hammer attached to it hits the bell and sound is produced. At the same time, the circuit is broken at the contact point the flow of current in the circuit breaks, armature loses its magnetic property. The bell rings as long as the switch is on. This is how the magnetic effect of current is made use of in electric bell.	
	Evaluation		T: What are the elements in Electric Bell ? S: Battery, Armature, Soft iron piece, hammer, bell.	

Home Assignment/Activities

1. Differentiate open and closed circuits, conductors and insulators.

UNIT – 3 MICRO ORGANISMS

Specific behavioural outcomes:

1. Defines Microbes.
2. Defines Microbiology.
3. Explains the historical growth of Microbiology.
4. List out the various types of microbes.
5. Defines bacteria.
6. Lists out the Characteristics of bacteria.
7. Lists out the places where the bacteria are found.
8. Describes the structure of bacteria and their types.
9. Draws the various bacteria.
10. Reasons out why bacteria are not autotrophic in nature.
11. Differentiates between aerobic bacteria and anaerobic bacteria.
12. Lists out the uses of bacteria in our daily life.
13. Defines Virus, Algae, Fungi, Protozoa.
14. Lists out the Characteristics of the Virus, Algae, Fungi and Protozoa.
15. Explains the nutrition, respiration, reproduction and the economic importance of Virus, Algae, Fungi, Protozoa.
16. Differentiates Antotrophes from heterotrophs.
17. Differentiates the various modes of nutrition.
18. Cites examples of the diseases caused by Virus, Algae, Fungi, Protozoa.
19. Draw labelled diagrams of Virus, Bacteria, algae, Fungi, Protozoa.
20. Explains the process of transmission of microbes from one to another.
21. Lists out the various agents of transmission of diseases.
22. Illustrates the diseases which are transmitted through wind, water, soil, insects.
23. Explain the measures to present the spread of the diseases.
24. Differentiates communicable and non-communicable diseases.
25. Draws and explains the life cycle of mosquito and housefly.

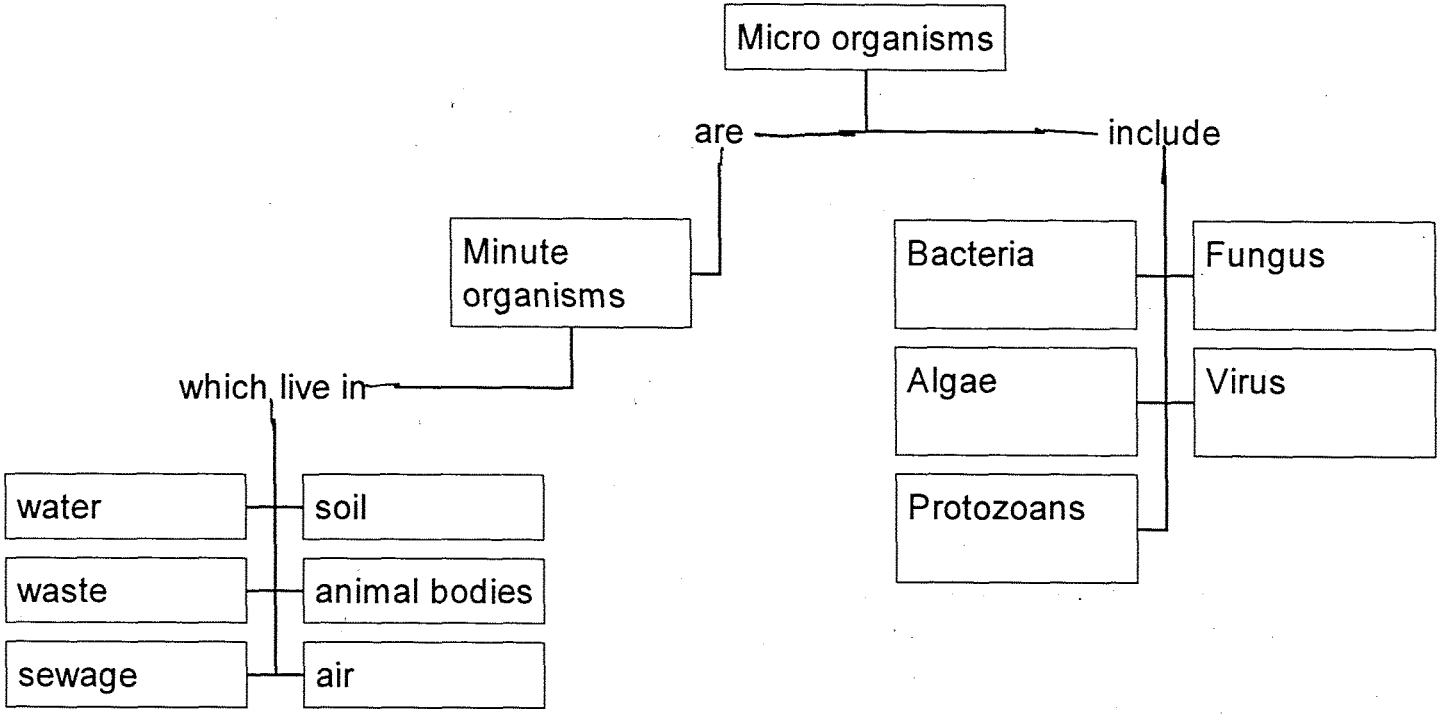
26. Lists out the diseases caused by micro-organisms in animals and plants.
27. Explains the symptoms of Anthrax and Foots and mouth diseases.
28. Explains the various measures to control the spread of diseases.
29. Defines immunization.
30. Explains the methods of immunization Active, Passive, Natural, artificial, etc.
31. Lists out various Vaccines given to Infants.
32. Explains the Ideal immunization schedule.
33. Explains the various methods of Preservation of food, food grains, clothes, leather, wooden materials.
34. Explains the benefits of micro-organisms in field of Agriculture and Medicine.
35. Explains the process of conservation and maintenance of the soil.

Unit 3- Micro Organisms

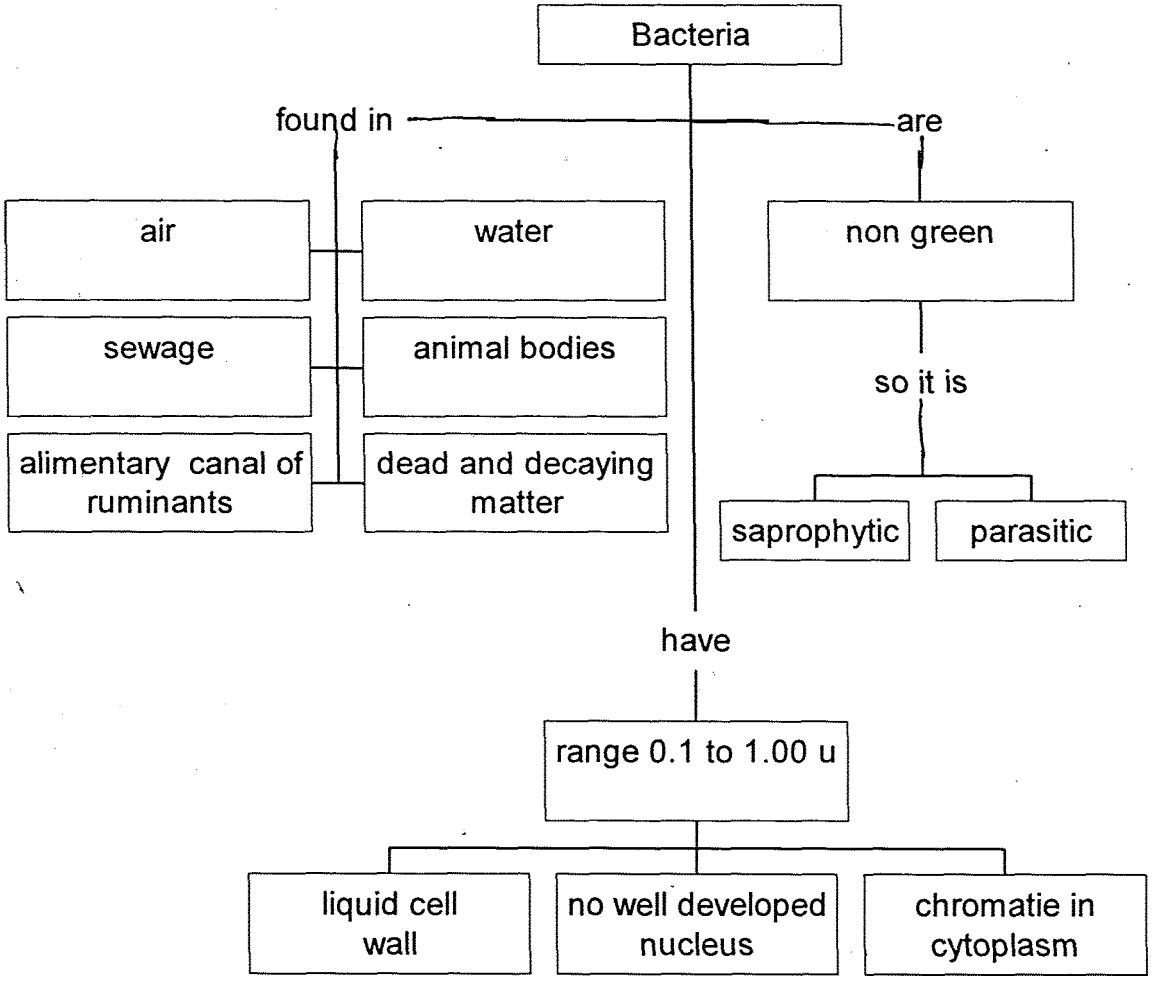
Concept & Related Concepts	Phases of Tg. / Lg.	Activities	Teaching-learning Process	Continuous Evaluation
Microbes	Exploration		Teacher uses concept attainment model & elicits the term Microbes. Tr: Why do you call them as microbes? St: As they are very minute. Tr: Cite some examples of Microbes? St: Bacteria, Fungus, Virus.	What are Microbes?
	Explanation		Tr: How do you know that microbes are all around us? St: Curdling of milk.	
Microbiology			Tr: What do you call the study of microbes as? St: Microbiology. Tr: Can you name few Microbiologists? St: Louis Pasteur, Koch, Iwanoski. Tr: Name few types of Microbes.	

Concept & Related Concepts	Phases of Tg. / Lg.	Activities	Teaching-learning Process	Continuous Evaluation
			St: Virus, Algae, Fungi, Bacteria, Protozoa. Tr: Who discovered the virus? St: Winooski. Tr: Where do we see the microbes? St: Air, water, food stuffs and everywhere.	
		Develops concept map.	Tr: Teacher develops a concept map on the blackboard while discussing with the students. Tr: Where do you find bacteria? St: Everywhere. Tr: How can you say that they are present in air? St: As they cause diseases.	
		Shows slides.	Tr: Today I will show few slides of bacteria. Observe them carefully & draw the diagram in your note books.	

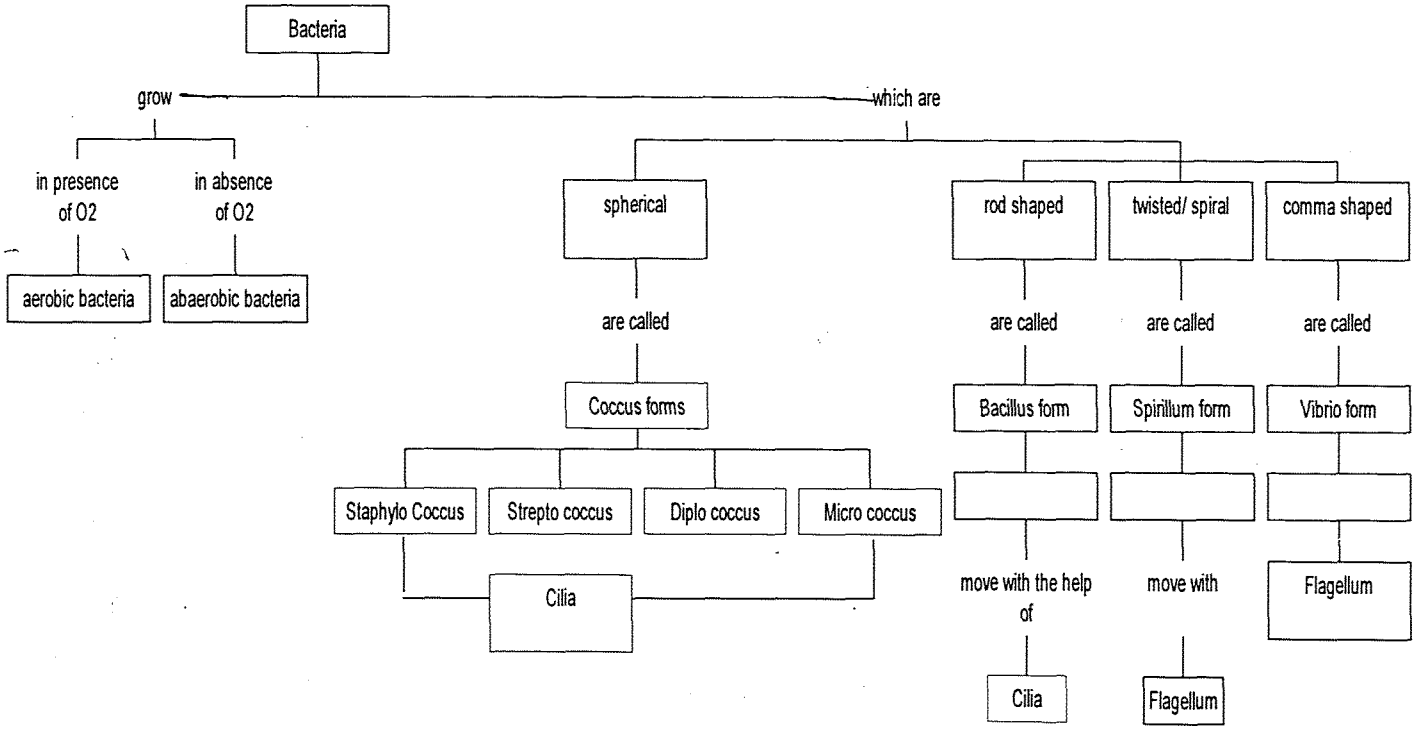
Concept & Related Concepts	Phases of Tg. / Lg.	Activities	Teaching-learning Process	Continuous Evaluation
		Draws different types of bacteria	Tr: What are the characteristic features of bacteria? St: 1. Microscopic in nature 2. Non-green. 3. Do not have well developed nucleus. Tr: Very Good. Tr: How do they get energy for survival.? St: No response Tr: Do they have Chlorophyll? St: No Tr: From where do they derive food? St_1 from dead, organic water. St_2: from other animals. Tr: What do you call such organisms which depend on dead organic matter? St: Saprophytes.	


Micro organisms
are
include
Minute organisms
which live in
water
soil
waste
animal bodies
sewage
air
Bacteria
Fungus
Algae
Virus
Protozoans

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-learning Process	Continuous Evaluation
			Tr: What do you call the organisms that attain food from tissues of other or germisms? St: Parasites. St: They harm the host. Tr: Very good. Tr: You know there are two types of bacteria – anaerobic and aerobic bacterià (which grows in the presence of O_2 and in absence of O_2). Tr: You have said that we are living in the pool of bacteria surrounding us. How are they able to increase their number? How do they reproduce? St: No response Tr: When the conditions are suitable they multiply by binary fission. In Binary fission, the nucleus divides into two, then the mother cell divides into two and form 2 daughter cells. (draws while explaining). Tr: What is endospore?	


Bacteria
found in
are
air
water
sewage
animal bodies
alimentary canal of ruminants
dead and decaying matter
non green
so it is
saprophytic
parasitic
have
range 0.1 to 1.00 u
liquid cell wall
no well developed nucleus
chromatie in cytoplasm

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-learning Process		Continuous Evaluation
			St:	.....	
			Tr:	When the conditions are unfavourable the organisms form a thick wall around it . This conditions is called as Endospore. (draws)	
			Tr:	You have seen slides in the morning. There are different forms of bacteria. Can you tell a few. Forms of bacteria?	
			St_1 :	Rod shaped. called as Coccus.	
			St_2 :	Spiral shaped – Spirillum.	
			St_3 :	Comma shaped- Vibrio.	
	Exploration		Tr:	Yesterday you have learnt about bacteria and its importance. Do you know which is the smallest microbe?	
			St:	Virus.	
Virus	Explanation		Tr:	Can you tell the characteristic features of a Virus?	
			St:	Smallest microbe, simple form, grow and multiply only inside the living cells.	

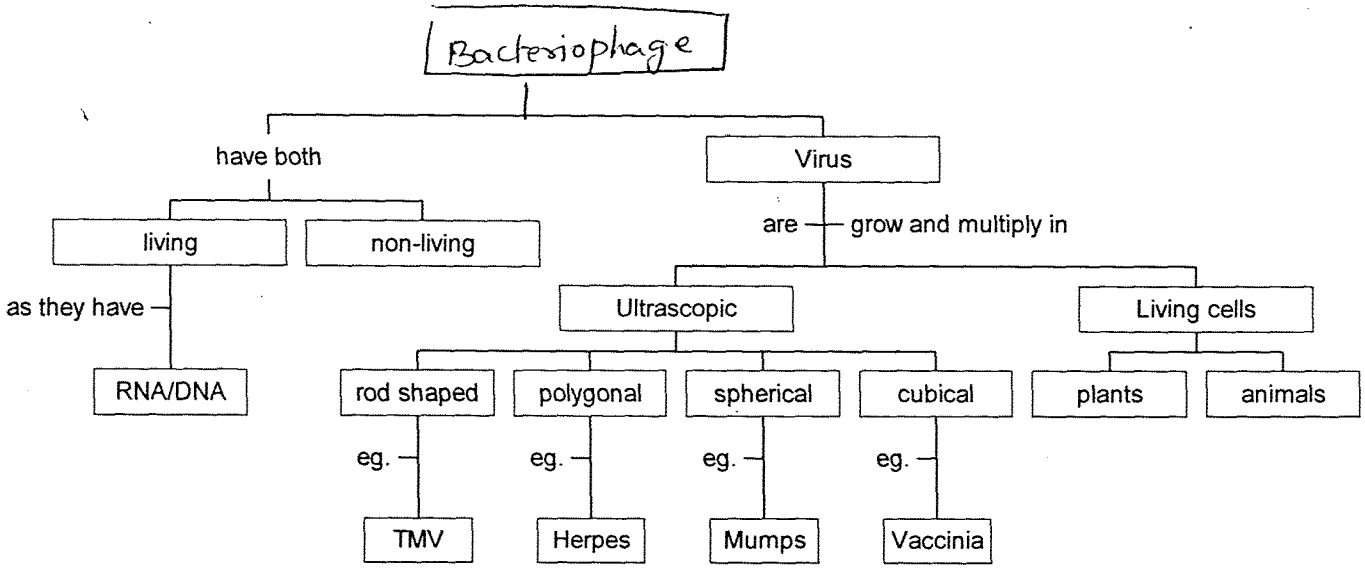

Bacteria
grow
which are
in presence of O2
in absence of O2
aerobic bacteria
abaerobic bacteria
spherical
rod shaped
twisted/ spiral
comma shaped
are called
are called
are called
are called
Coccus forms
Bacillus form
Spirillum form
Vibrio form
Staphylo Coccus
Strepto coccus
Diplo coccus
Micro coccus
Cilia
move with the help of
move with
Flagellum
Cilia
Flagellum

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-learning Process		Continuous Evaluation
			Tr:	Do you know how a Virus look like?	
			St:	No.	
			Tr:	Draws the various shapes of Virus and ask the students to draw them in their note books:	
			Tr:	What are various forms of Virus?	
			St:	They are rod like (TMV), Polygonal (Polio), Spherical (Mumps) Cubical.	
			Tr:	Now Can you describe the structure?	
			St:	Describe the structure of a virus.	
			Tr	RNA / DNA is present inside the cell.	
			Tr:	What is outer covering made of?	
			St:	Protein	
			St:	It has no nucleus, Cytoplasm.	
			Tr:	Where do these Viruses found?	
			St:	In Plants, animals & in bacteria.	

Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
		Draws concept map.	Tr: What do you call the bacteria in which virus lives is called Bacteriophage. Tr: Are they useful to us? St: No. They are harmful. They cause many diseases like Polio, Mumps, etc. Tr: Biologists call this Virus as biological Puzzle. Why? St: As it has both living & non-living matter. Tr: O.K. Students you have learnt about Virus, its characteristics, forms, etc. Now all of you draw a concept map showing the above features in it.	
Home Assignment / Activities List out atleast 10 diseases caused by Virus.				

Unit 3 (Lesson-2)

Concept & Related Concepts	Phases of Tg./Lg.	Acti-vities	Teaching-learning Process	Continuous Evaluation
	Exploration		Tr : O.K. Today we have seen virus which lives inside the living cells of Plants & animals. It cannot prepare food on its own. Can you tell me one of the autotrophic microbe. St: Algae. Tr : Good. St: They are green in colour. Tr : Can we call them as Plants? St: No Tr: Why is it so? St: As they do not have well differentiated roots, stem and leaves. They live in Colonies, few lead a solitary life, eg. Tr Chlamydomoned. They are unicellular and some are multi cellular. Tr: How will you relate number of cells with the type of reproduction?	


Bacteriophage
have both
Virus
living
non-living
are
grow and multiply in
as they have
Ultrascopic
Living cells
RNA/DNA
rod shaped
polygonal
spherical
cubical
plants
animals
eg.
eg.
eg.
eg.
TMV
Herpes
Mumps
Vaccinia

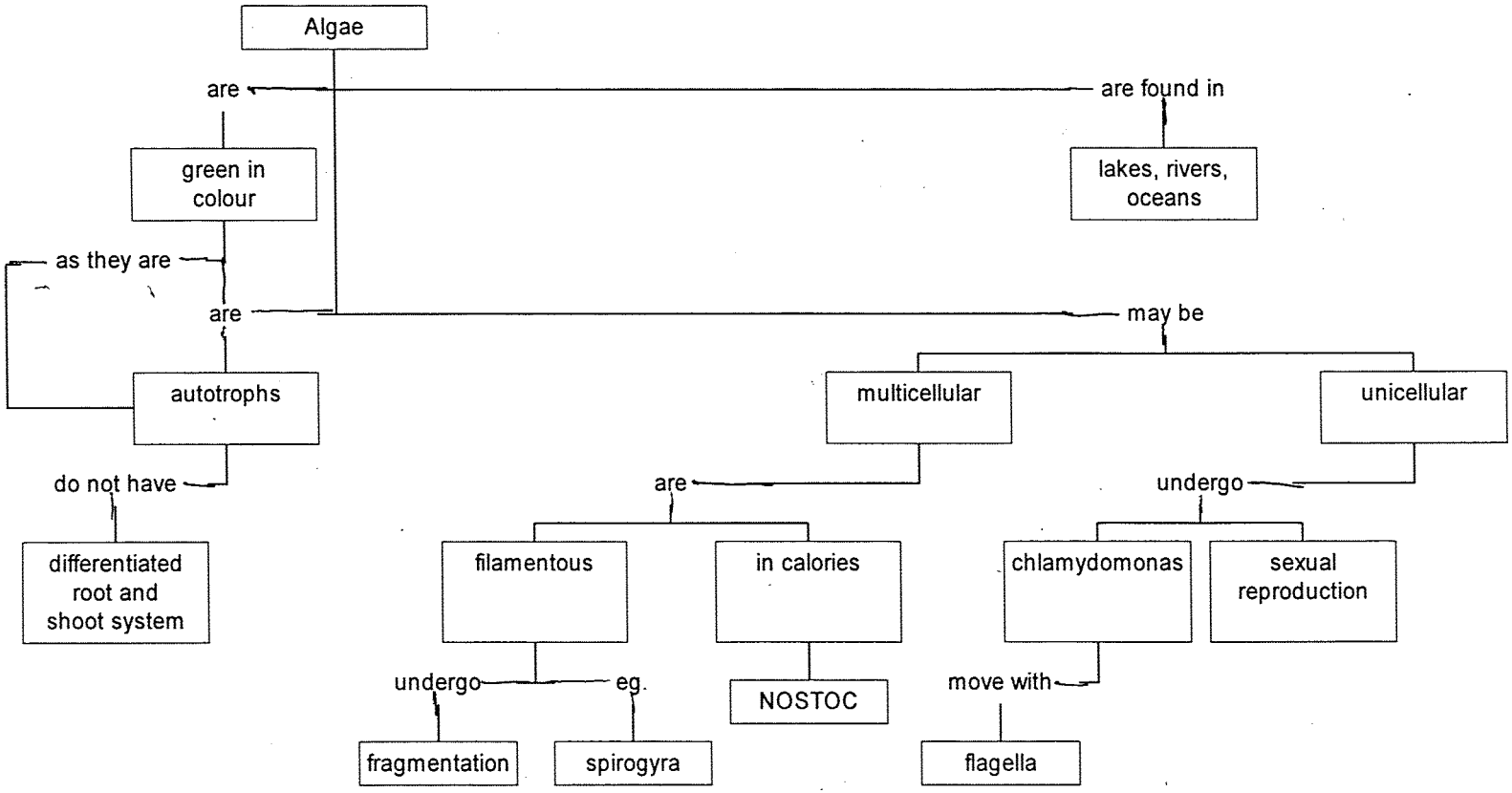
Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-learning Process	Continuous Evaluation
Sexual Reproduction Fragmentation	Exploration Explanation	Draws fragmentation	St: Single Cellular propagates Vegetatively. St: Multicellular propagates sexually. Tr: O.K. Algae are unicellular and multicellular. Tr: What type of Propagation is found in unicellular algae? St: Vegetative and Sexual reproduction. Tr: What do you mean by Sexual reproduction? St: The fusion of male and female gametes and the formation of zygote is called Sexual Reproduction. Tr: What is the other mode of reproduction in Algae. Tr: When an organism is broken into pieces, each piece is called fragment which in turn grows into a free individual. This process is called as Fragmentation.	

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-learning Process	Continuous Evaluation
			Tr: Name one algae which multiplies by this method. St: ..... Tr: Spirogyra. Tr: Any other method? St: Spore formation. Tr: What do you mean by it? St: Spore is a single reproductive cell. It is also a type of vegetative propagation. It is found in Chlamydomones and also found in fungus. Eg. Bread mould. Tr: When it falls on a suitable substance they grow into new individual.	
		Develops concept map on Algae	Tr: With the help of students draw a concept map on algae. Tr: Asks many questions on the importance of Algae. How are they useful to us?	

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-learning Process	Continuous Evaluation
			St: In medicines. Tr: Eg. Chlorethin from Chlorella St: In agriculture as manure, Nitrogen Tr: There are some nitrogen fixing algae for eg; Nostoc, anacena.	
Home Assignment: Draw the diagrams showing their locomotory organs of 3 Algae.				

Unit.3 (Lesson-3)

Concept & Related Concepts	Phases of Tg./Lg.	Activi-ties	Teaching-learning Process	Continuous Evaluation
	Exploration		Tr: Good Morning Students St: Good Morning Miss. Tr: We were discussing about various microbes, their structure & about the diseases caused by them. Name some microbes.	


Algae
are
are found in
green in colour
lakes, rivers, oceans
as they are
are
may be
autotrophs
multicellular
unicellular
do not have
are
undergo
differentiated root and shoot system
filamentous
in calories
chlamydomonas
sexual reproduction
undergo
eg.
NOSTOC
move with
fragmentation
spirogyra
flagella

Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
	Explanation		St: Algae, Bacteria, Virus, Fungus, Protozoa. Tr: Are fungi Unicellular /multicellular St: Both. Some are unicellular & some are multicellular Tr: How do they look like? St: Filamentous. Tr: Good. They are slender filaments called as hyphae. Hyphae is called as Mycelium. Tr: Ok where do you see fungus ? St: On moist things like rotting foods, vegetables, pickles, bread, dead organic matter etc. Tr: How do they get food? St: They depend on others.	

Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
			Tr: They are non green plants. They are either saprophytic or parasitic. St: How do they reproduce? St_1: Sexually when conditions unfavourable & asexually in unfavourable conditions. Tr: Explains the modes of reproduction. Sporulation in rhizopus, Binary fission budding in yeast, regeneration etc. Tr: Are they useful to us? St: Yes. They are used in medicine eg: Penicillin, Brewery & leakery eg: yeast & tahen as food eg: Mushrooms.	What is the difference between scaprophyte and parasite?
	Expansion	Pupils draw concept map in groups	Teacher asks the students to draw concept map in their respective groups by making use of the points they have learnt about fungus.	

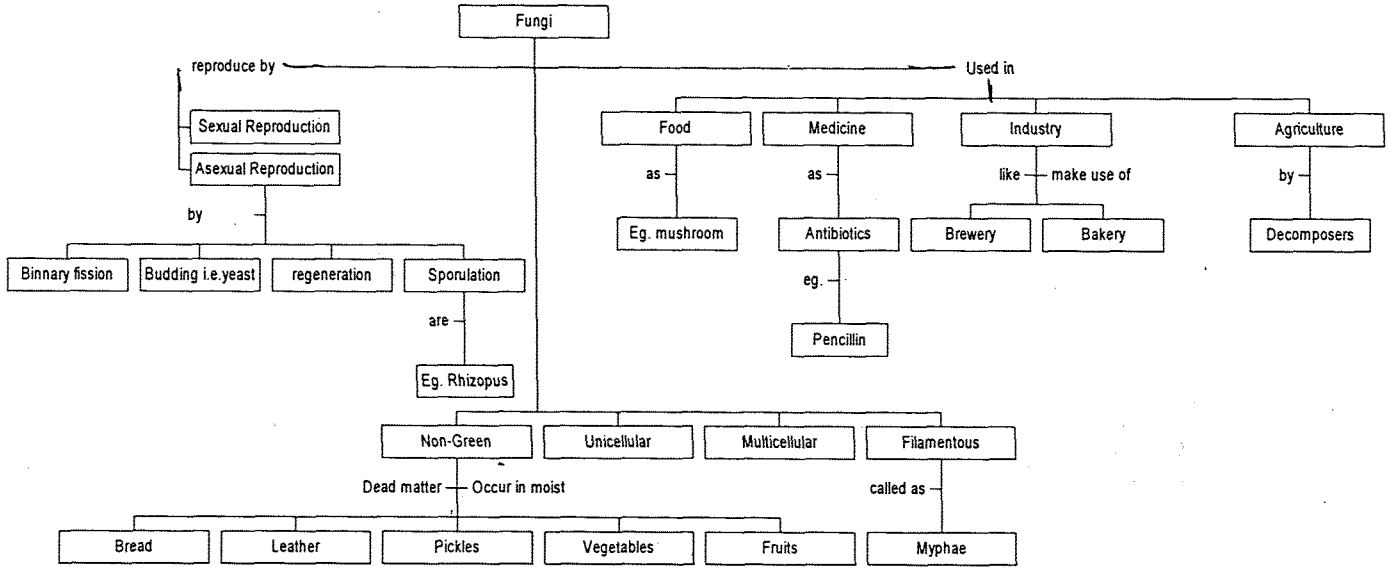
Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
	Evaluation		After discussion with students, the Teacher draws the concept map on the black board taking the help of students.	

Home Assignment / Activities

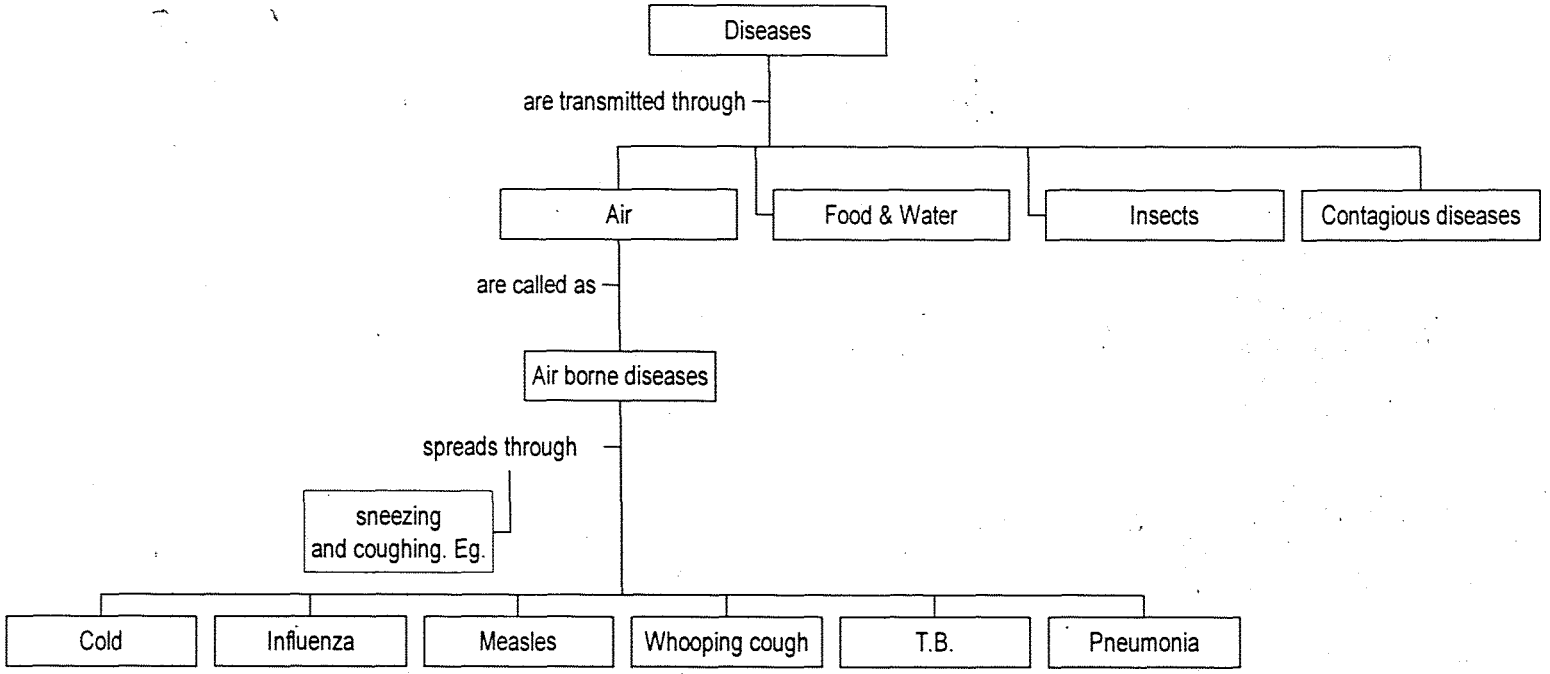
1. Name five examples of Fungus.
2. How are fungi useful to us.
3. Draw a concept map of algae and fungi showing their characteristics,
4. The simple microbe is protozoans. They are single celled organisms which cause many diseases in human beings. Such as Malaria, amoebiasis etc. The teacher gives a write up to then which is self explanatory & ask the students to draw concept map in their notebooks. Students draw & explain it to their teacher. The teacher rectifies the mistakes & summarises it in the class room. Teacher draws & asks number of questions to complete the concept map.

Unit-3 (Lesson-4)

Concepts / Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning process	Continuous Evaluation
	Exploration		We have discussed about types of microbes till now & we know few diseases caused by them. Can you tell me what is meant by disease: St: It is a state of body St_2: The malfunctioning of body is called as Disease. Tr: Very good. Can you name some diseases?	

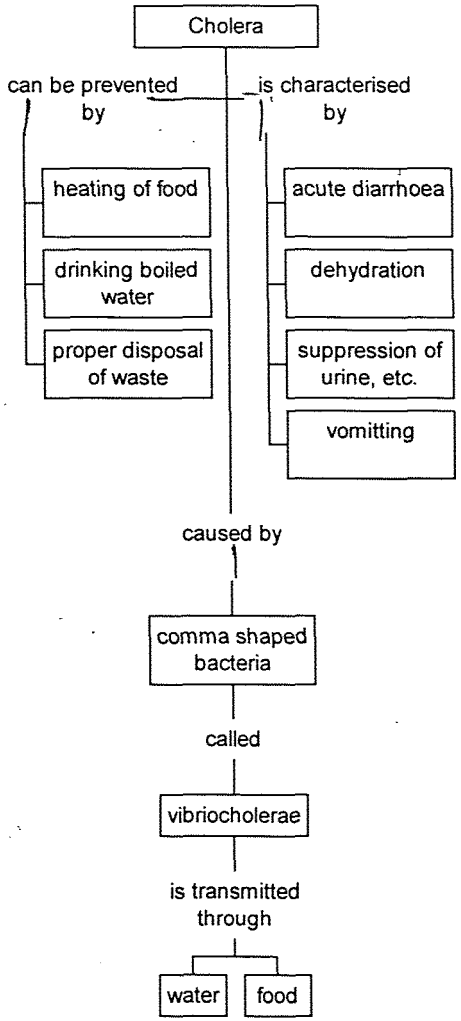

Fungi
reproduce by
Used in
Sexual Reproduction
Asexual Reproduction
by
Binnary fission
Budding i.e.yeast
regeneration
Sporulation
are
Eg. Rhizopus
Food
as
Eg. mushroom
Medicine
as
Antibiotics
eg.
Pencillin
Industry
like
make use of
Brewery
Bakery
Agriculture
by
Decomposers
Non-Green
Unicellular
Multicellular
Filamentous
Dead matter
Occur in moist
called as
Bread
Leather
Pickles
Vegetables
Fruits
Myphae

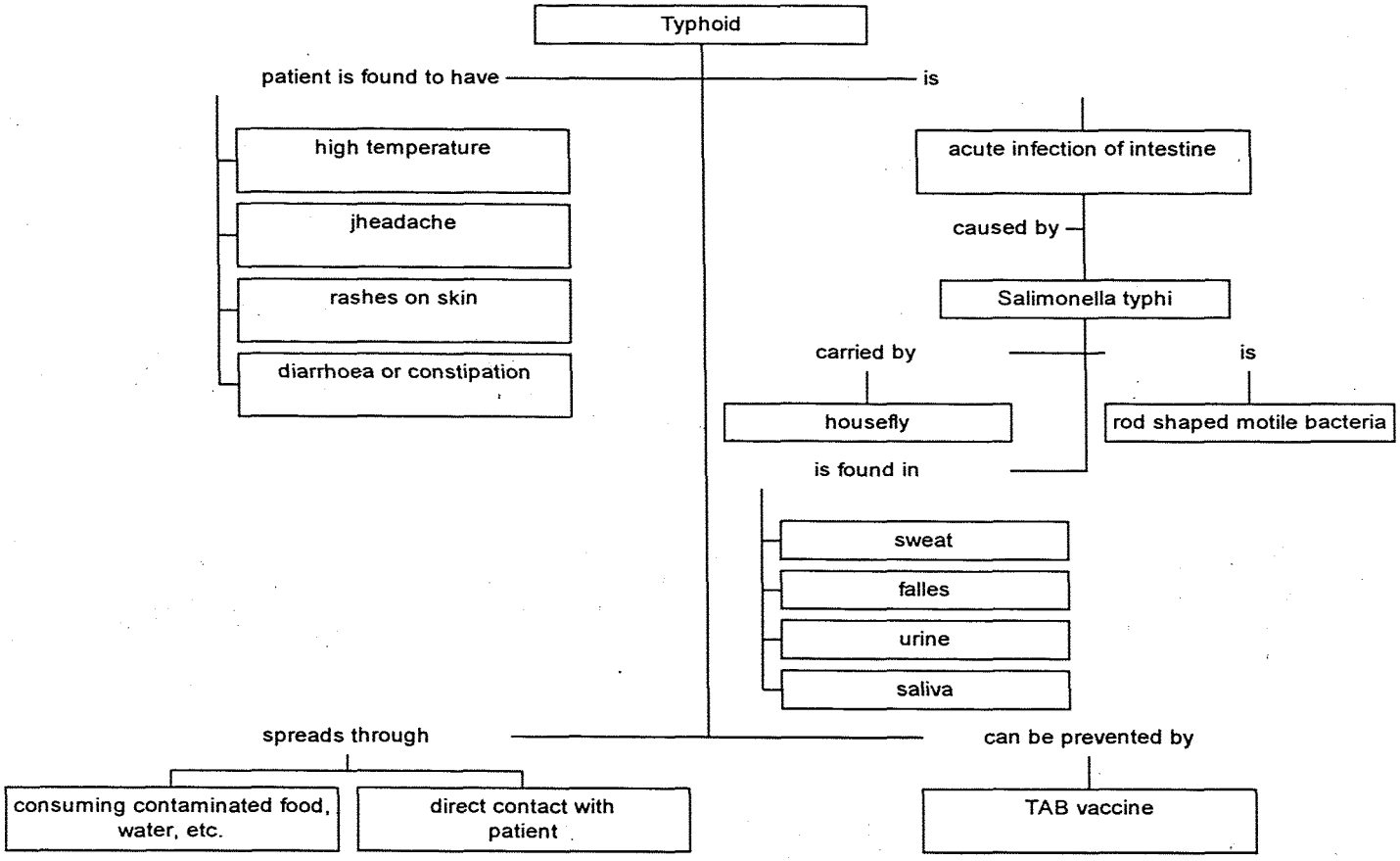
Concepts / Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
Explanation		Develops concept map.	St: Give examples. Tr: How are these diseases caused. St: By microbes, transmitted through heater and Tr: Very good. Tr: Teacher asks students to categories the examples of diseases given by them. (Richets, Cholera, anemia, Typhoid., amoebiasis, scurvy etc.) St: Teacher develops concept map while discussing with students on Black board. Richets, anaemia, scurvy come under group 1 – non-infections. St_2: Cholera, typhoid, ameobiasis in other group- infections diseases Tr: Good. Infections or communicable diseases as you know are caused by Pathogen. Do you know what is a pathogen? St: Disease accusing organisms Tr: Yes. Namel some of them & diseases caused St: Bacteria eg: TB' cholera. St_2: Virus – eg: cold, measles St_7: Protozoans – Malaria	


Diseases
are transmitted through
Air
Food & Water
Insects
Contagious diseases
are called as
Air borne diseases
spreads through
sneezing and coughing. Eg.
Cold
Influenza
Measles
Whooping cough
T.B.
Pneumonia

Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process		Continuous Evaluation
Transmission through wind.	Expansion		St_3:	Parasitic worms – Ascariasis	
			St_4:	Fungus – Skin diseases	
			Tr:	What about non-infections diseases?	
			St:	They are caused due to vitamin deficiency, and malfunctioning of internal organs.	
			Tr:	In case of infections diseases, you have said that, they are spread from one person to other. How are they transmitted?	
			St:	They are transmitted through air, water, food, soil personal contacts.	
			Tr:	Name one disease that is transmitted through wind	
			St:	Tuberculosis, cold.	
			Tr:	How is it transmitted?	
			St:	It spreads through sputum which contains the bacteria i.e. Mycobacterium Tuberculosis. It affects lungs, bones, brain, joints.	
			Tr:	What are symptoms found in the patient?	
			St:	Fever, cough, pain in chest, sputum with blood.	

Concepts / Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
Tuberculosis			Tr: Is there any way to prevent us from this disease?	
			St: BCG. Vaccine can be taken & maintaining proper health & hygiene.	
	Con map-1	Students draw concept map.	Tr: So the diseases like cold, TB, transits through wind when the patient, Coughs, Sneezes or spits. Teacher asks the students to draw con map in the note books	
	Con map-2	To draws concept map on	Teacher draws a concept map on the black board on transmission of diseases through water & asks the student to explain in their own words.	
Transmission through water.		Transmission of diseases and asks students to explain.		
			Tr: Name some more examples of diseases, which are transmitted through water.	
			St: Cholera, Typhoid, amoeleiasis	
			Tr: What are the symptoms commonly found in cholera patients?	


Cholera
can be prevented by
is characterised by
heating of food
drinking boiled water
proper disposal of waste
acute diarrhoea
dehydration
suppression of urine, etc.
vomitting
caused by
comma shaped bacteria
called
vibriocholerae
is transmitted through
water
food


Typhoid
patient is found to have
high temperature
jheadache
rashes on skin
diarrhoea or constipation
is
acute infection of intestine
caused by
Salimonella typhi
carried by
housefly
is
rod shaped motile bacteria
is found in
sweat
falles
urine
saliva
spreads through
consuming contaminated food, water, etc.
direct contact with patient
can be prevented by
TAB vaccine

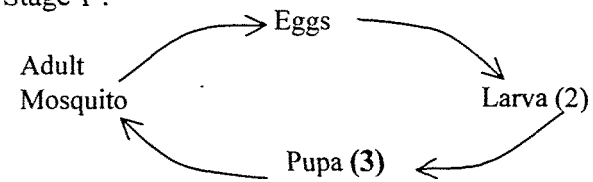
Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
Cholera Typhoid	Explanation		St: Vomiting,, diarrhea, dehydrations. Tr: Which is the causative organism? St: Vibrio cholerae Tr: How can we prevent this disease? St: By drinking boiled water. St_2 By disposing waste properly. : Tr: Why should we boil water ? St: Boling kills the bacteria inside the water. Tr: Which is the causative microbe in case of typhoid? St: Sahmonella Typhi – bacteria rod shaped. St: It is carried by housefly. Tr: List out the symptoms of the disease. St: High temp, headache, diarrhoea, rashes on skin. Tr: Yes. Both cholera and typhoid are spread through bacteria. They are transmitted through food and water.	

Concepts/ Related Concepts	Phases of Tg/Lag	Activities	Teaching – Learning Process	Continuous Evaluation
			Tr: So what do you understand from this ? St: We should not eat or drink uncovered, contaminated food and water. St_2 We should wash raw foods before consuming them. : St_3 We must drink clean and safe water. :	
			Home Assignment: 1. Explain how cholera is caused ? 2. List out the symptoms found in typhoid.	

Unit-3 (Lesson-5)

Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
Transmission through soil.			In the last class, you have studied how diseases are transmitted through wind and water. Today we will discuss about transmission of diseases through soil and insects. Tr Name one disease that is transmitted through soil? : St: Tetanus, it is caused by clostridium tetain.	

Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
Transmission through insects.			Tr: What happens to the person affected by tetamis? St_1: Muscles get stiffened St_2: It spreads from Joints ⟶ face ⟶ neck & at last to the throat. Swallowing become difficult and person dies. Tr: So in order to avoid this disease what are we supposed to do? St: We should wash the wound with clean water St_2: We should get vaccinated against tetanus. Tr: Good. Tr: Apart water, air, food & soil there is one more important transmistting agent- insects. Do you know the diseases that are spread by insects? St: Yes Malaria, amoebiasis. Tr: How is malaria caused? St: Csused by a protozoan called plasmodium St_2: It is carried by female anapheles mosquitoes.	

Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching Learning Process	Continuous Evaluation
	Con map -6	**(Teacher develops a concept map on malaria on Black board)**	Tr: What are the symptoms of this disease? St: Shivering, high fever, nausea St_2: Sweating, head ache. Tr: Yes. Do you know how it is prevented? St_1: By spraying insecticides like DDT. St_2: Using mosquito coils / mats St_3: It can be controlled by antimalarial drug like quinine, chloroquine etc. Tr: Very good. Do you know various stages in life cycle of mosquito? St: Stage 1 :  Tr: Good, The same is the case with that of housefly. St: In case of amoebiases, it is spread through containated food & water.	What is the name of the parasite that causes malaria? State the symptoms of malaria?

Concepts/ Related Concepts	Phases of Tg/Lg	Activities`	Teaching – Learning Process	Continuous Evaluation
Amoebiasis			Tr: Amoebeasis is caused by a protozoan known as entamoeba histolytica. Tr: What happens to the person suffering from this disease? St: Profuse diarrhoea St_2: Discharge of blood & mueous along with the faecal matter. Tr: Tr: Good one more important thing is lesians are formed in the patients intestine & liver. Tr: What are the presentive measures for this disease? St: Avoid unclean, uncover food & water St_2: Eat & drink safe & clean food & water. Tr: Not only the above transmitting agents but even animals also tramints diseases, can you give some example?	What are the symptoms of amoebiasis? How it is caused?

Concepts/ Related concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
Rabies			St: Rabies Tr: Very good. It is a viral disease which is caused due to the bite of a mad dog. The victim sufers from fever, head ache, fatigue, develops unreasonable anger, fear. Especially fear of water (hydrophotica), even leads to death. Tr: Any other disease? St: Tr: Japanese enclophalitis- Viral diseases hosted by domestic animals & birds causes brain fever in humans. So we should take all the pre cautions to avoid these problems. Take all the vaccinations in time & maintain health & hygiene to keep our surroundins clean.	
Home Assignment: Explain the below concept map in your own words.				
	Exploration		Tr: How are microhes transmitted? St: Microbes are transmitted through wind, water, soil, insects animals. Tr: You have seen various diseases caused by micaobes in human beings. Can you tell me whether microbes attack plants and animals.	

Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
Anthrax disease	Explanation		St: Yes Tr: Name few diseases caused by microbes in Animals St: Anthrax & foot & mouth diseases St: Which is the causative microbes in these two cases? Tr: Anthrax is caused byn Bacillus anothrosis Tr: In which animals, this disease is seen? St: Goat, sheep, pig, cattle suffer from this disease Tr: What are the symptons of the disease? St_1: Fluid oozes from the eye. St_2: Animal becomes inactive St_3: Food intake comes down. St_4: Stomach bulges Tr: Why? St: Due to constipation Tr: What should we do to the animal? That is dead?	

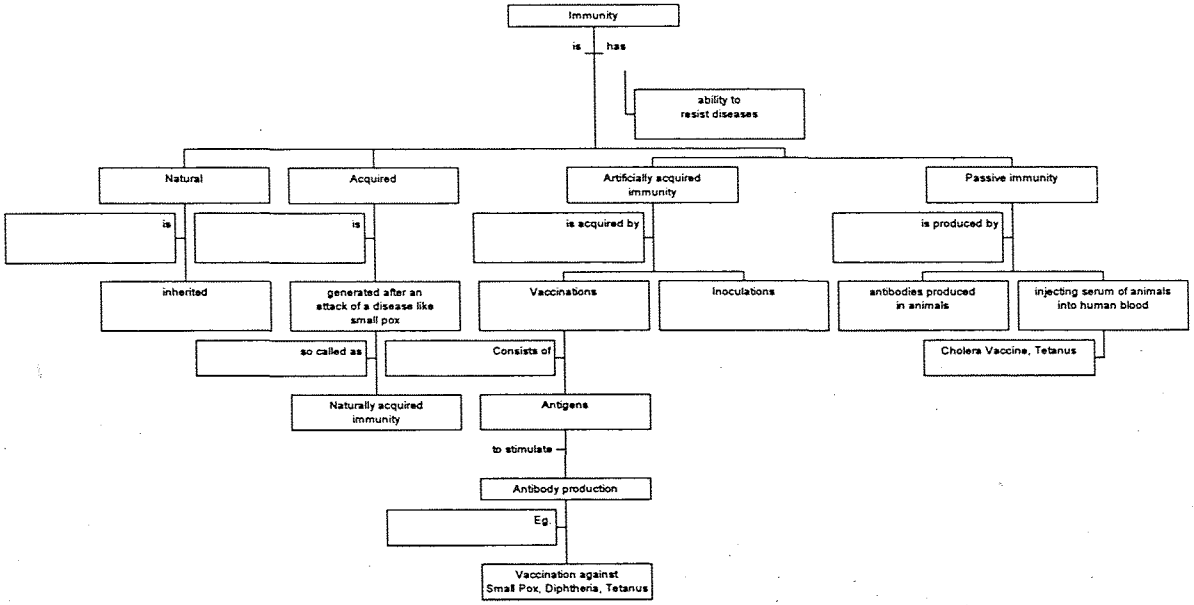
Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
Foot & Mouth disease	Expansion		St: They should be burnt or burried in a deep pit. Tr: Yes. Very good. Tr: What about foot & mouth disease St: It is caused by a virus St: It is a most common disease among cattle. Tr: What are the symptons of this disease? St: Lack of appetite. St_2: Blisters appear in the left of the animals hooves. St_3: Sore ness of mouth St_4: More saliva formation	
	Evaluation		Tr: How does it spread? St: Spreads through contact, manure, hay, pasture. Tr: Very good. These two diseases are contagious. We should take precautions by vaccinating the animals in time.	
Home Assignment / Activities				

Unit-3 (Lesson-6)

Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
	Exploration		Tr: Good morning students St: Good morning miss. Tr: Today we will have small group discussions in our class You have seen how microbes attack and the various disease caused by them. Why is that only few people are attacked by diseases? & why not others? St: They are immune to disease St: They have high immunity power Tr: What do you mean by immunity? St: It is the ability to resist diseases.	

Concepts/ Related concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
	Explanation & Expansion		Tr: Good. Ok now you are going to discuss about immunity, types of immunity with your group members & draw a concept map by reading the material givien. Students discuss among themselves & draws the concepts maps in thier note books. Teacher asks them to present the map to the class. Students representing their group draw the concept maps on the black board & explain them. Teacher at last corrects the concept map & add certain points & improves it & help the students in defining the terms. Tr: What is natural immunity. St: Immunity which is inherited & is passed on from generation to generation. Tr: Which is other stype of immunity? St: Artificial / acquired immunity Tr: What does it mean? St: By vaccinations & inoculations Tr: Can you name some examples of vaccines?	

Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
	Evaluation		St: Small pox, ddiptheria (DPT), BCG etc. Tr: There is one more type of immunigy. That is called as Passive immunity. It is first produced in animals. The serum contains antibodies This serum is injected into the blood of human being and immunity lasts for a short time. Now try to name of one such vaccine. St: Cholera, T.T. Tr: Why should we take vaccination? St: To prevent ourself from diseases. Tr: Did you get vaccinated any time? St: Yes. Tr: Which vaccine? St: BCG,DPT,Tetamus vaccines , polio, Hepatitis B. Do you know at what age they are given? St: Yes. Tr: BCG is given soon after birth.	


Immunity
is
has
ability to resist diseases
Natural
Acquired
Artificially acquired immunity
Passive immunity
is
is
is acquired by
is produced by
inherited
generated after an attack of a disease like small pox
Vaccinations
Inoculations
antibodies produced in animals
injecting serum of animals into human blood
so called as
Consists of
Cholera Vaccine, Tetanus
Naturally acquired immunity
Antigens
to stimulate
Antibody production
Eg.
Vaccination against Small Pox, Diphtheria, Tetanus

<table>
<tr><th>Concepts/ Related Concepts</th><th>Phases of Tg/Lg</th><th>Activities</th><th>Teaching – Learning Process</th><th>Continuous Evaluation</th></tr>
<tr><td></td><td></td><td></td><td>Tr: It prevents from small pox.

St: DPT is given when the child is 4-9 months

Tr: What does DPT stand for?

St: Diptheria, Pertussis, Tetamus.

Tr: How many doses are given ?

St: - - - - - -

Tr: 3 doses with intervals of 4 to 6 weeks.

St: Polio vaccine, pulse polio till the child attains the age of five.</td><td></td></tr>
<tr><td colspan="5">Home Assignments: Fill in this table :
<table><tr><td>Age</td><td>Vaccination</td></tr><tr><td></td><td></td></tr></table></td></tr>
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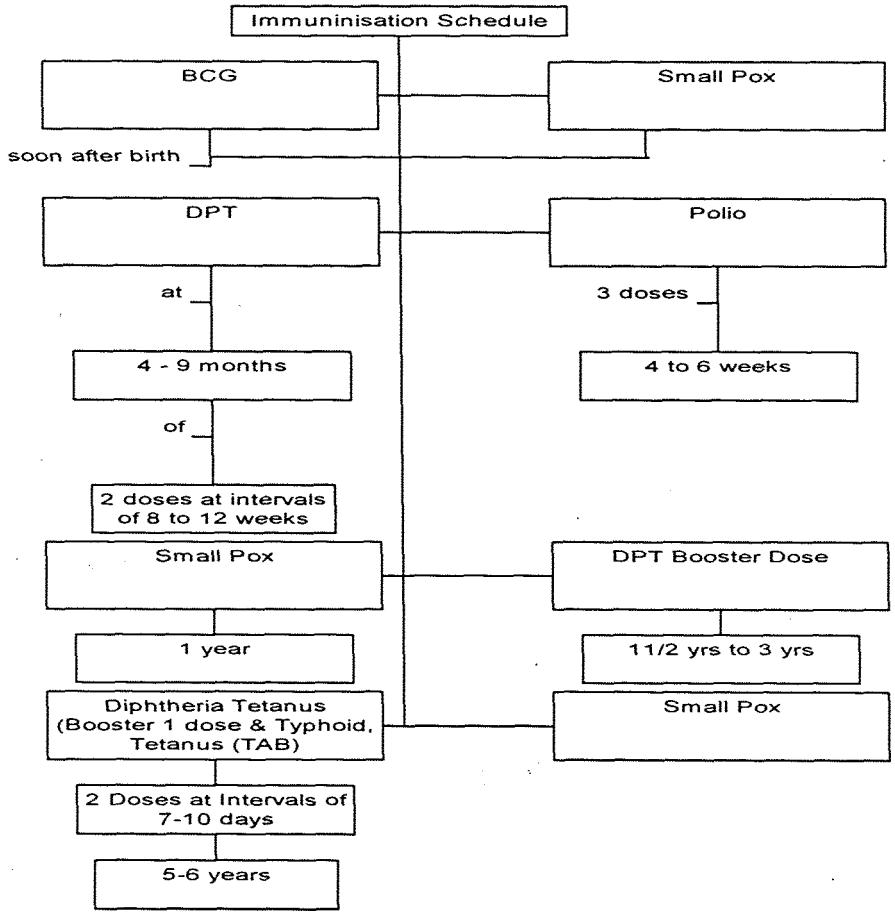
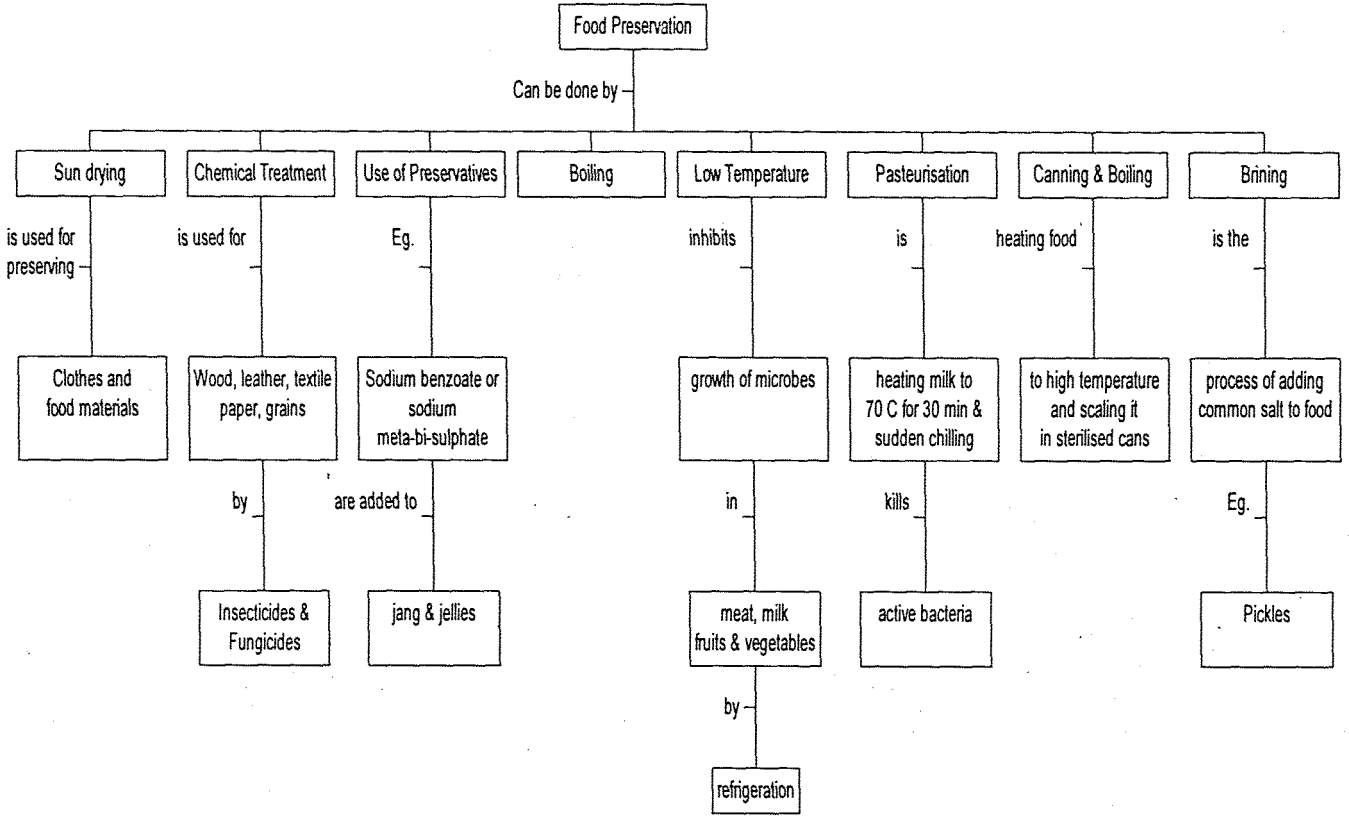

Immuninisation Schedule
BCG
Small Pox
soon after birth
DPT
Polio
at
3 doses
4 - 9 months
4 to 6 weeks
of
2 doses at intervals of 8 to 12 weeks
Small Pox
DPT Booster Dose
1 year
11/2 yrs to 3 yrs
Diphtheria Tetanus (Booster 1 dose & Typhoid, Tetanus (TAB)
Small Pox
2 Doses at Intervals of 7-10 days
5-6 years

UNIT 3 (LESSON No 7)

Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
Food preservation	Exploration	Introduction	Till now we have seen how the diseases are spread what should we do to avoid all the above? St: We should preserve the food. Tr: What are the methods of food preservation? St: Sun drying. Tr: Give examples. St: Pickles, food materials are dried in the sun. Tr: Then what other methods? St: Using salt to food stuffs especially while making pickles. Tr: What do you call that process as ? St: Tr: It is called as Brining St: Keeping the food stuffs in refrigerator. Tr: Give examples. St: Vegetables, fruits Tr: What happens when they are kept in low temperature.	

Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
Pasteurization	Explanation & Expansion		St: Low temperature inhibits growth of microbes. Tr: How can we preserve milk? St: By heating the milk & after it cools downs we have to keep in refrigerator Tr: What do you call this process as? St: Pasteurisation Tr: Have you seen this word on the milk packets? St: Yes miss. Pasteurised milk is written Tr: Very good. Tr: Preservatives such as sodium benzoate are added to jams & jellies. Tr: Even canning is done. St: What is canning?	

Concepts/ Related Concepts	Phases of Tg/Lg	Activities	Teaching – Learning Process	Continuous Evaluation
Canning	Expansion		Tr: It is the process where in food is heated to high temperature & then sealed in sterilized cans. St: Sweets.	Name few foods stuffs which are canned.
	Evaluation		Tr: With the help of students draws the concept map showing the various methods of preservation of food. (con map.14) Students explain the concept map.	
Home Assignment / Activities Explain the various methods of food preservation.				


Food Preservation
Can be done by
Sun drying
Chemical Treatment
Use of Preservatives
Boiling
Low Temperature
Pasteurisation
Canning & Boiling
Brining
is used for preserving
is used for
Eg.
inhibits
is
heating food
is the
Clothes and food materials
Wood, leather, textile paper, grains
Sodium benzoate or sodium meta-bi-sulphate
growth of microbes
heating milk to 70 C for 30 min & sudden chilling
to high temperature and scaling it in sterilised cans
process of adding common salt to food
by
are added to
in
kills
Eg.
Insecticides & Fungicides
jang & jellies
meat, milk fruits & vegetables
active bacteria
Pickles
by
refrigeration

USEFUL PLANTS AND ANIMALS

Objectives :

1. Classifies the useful plants into food yielding, timber, fibre, ornamental plants.
2. Give examples for different categories of plants.
3. Differentiates cultivated and wild plants.
4. Names the different varieties of food yielding plants.
5. Gives examples for cereals, pulses, etc.
6. Explains the importance of leguminous crops.
7. Classifies the vegetables into starchy, juicy and leafy vegetables.
8. Lists out the oil yielding plants.
9. Lists out the edible fruits; fruits which can be eaten raw and cooked.
10. lists out the spices used commonly at home.
11. Appreciates the herbal medicines.
12. Lists out some commonly used herbs/plant products at home for curing common diseases.
13. Explains the importance of plants like Neem, Amla, Cinchone etc.
14. Gives examples of ornamental plants.
15. Lists out various plant products obtained from forests.
16. Explaining the process of maintaining ecological balance in nature by plants.
17. Lists out some harmful plants.
18. Defines domestication.
19. Lists out some useful animals.
20. Lists out some useful products from animals.
21. Explains the process of shearing in sheep.
22. Differentiates between a cock and a hen.
23. Explains the process of hatching in hatcheries.
24. Explains the importance of fishes.
25. Draws the life cycle of silk moth.
26. Explains the method of testing for purity of honey bees.
27. Explains the development of silk moth from the egg stage → adult stage.
28. Lists out the 3 kinds of silk.
29. Appreciates the process of pearl formation in oyster.
30. Lists out the other uses of animals such as transport, pets, soil fertility, pollinating agents, etc.
31. Lists out certain harmful animals.
32. Lists out certain diseases caused by micro organisms.

Concepts/Teaching Points :

1. Food yielding plants
2. Timber yielding plants
3. Fibre yielding plants
4. Medicinal plants
5. Ornamental Plants
6. Domestication
7. Domestic and wild animals
8. Apiculture : The rearing and management of honey bees on large scale.
9. Sericulture : The rearing and management of silk moth.
10. Pisciculture : Rearing and management of fishes
11. Hatcheries : The place where the eggs are artificially hatched in incubators.
12. Piggery – the management of pigs.

LESSON PLAN I

USEFUL PLANTS

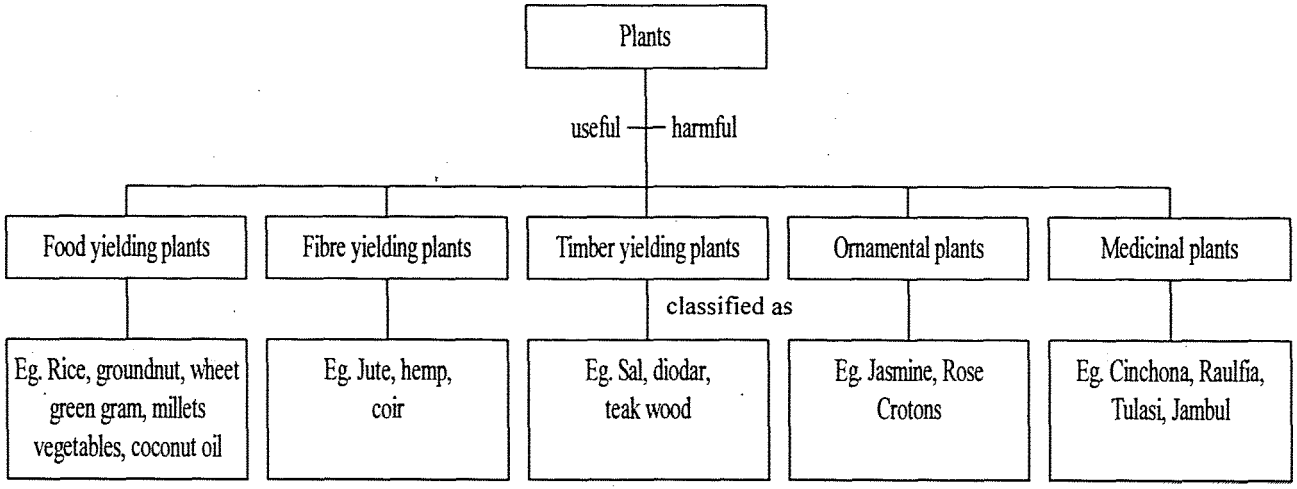
Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Useful Plants Food yielding plants: Timber yielding plants Fibre yielding plants, Ornamental	Introduction	Concept Attainment Model (Given specimens of different plants)	Introduction: T: Students, all of you had breakfast in the morning? and you are all energetic now. Where did you get this food from ? S_1: Plants and animals. T: Are all plants and animals useful to us ? S_2: Not all. Some of them are useful. T: Give some examples of useful plants. S_1: Wheat, Rice, etc. (Teacher writes on blackboard showing the specimens. Rice, Jute, Teak Wood, Jasmine, Rose, Groundnuts, Green Gram, Wheat, millets, coconut oil, vegetables, sal, hemp, cinchone, crotons, raulfia, deodar, tulasi, jambul, coir. Students start grouping the examples into categories. Category I : Rice, groundnut, wheat, green gram, millets, coconut oils, vegetables. Category II : Sal, deodar, teak wood. Category III : Jute, hemp, coir Category IV : jasmine, rose, croton. Category V : Cinchona, Raulfia, Tulasi, Jambul.	

yielding plants, Medicinal yielding plants. Timber yielding plants Fibre yielding plants. Ornamental plants			T: What do you call the I category of plants as ? S: Food producing plants. T: Why do you call them so ? S: As all of them produce food. T : Why did you keep sal, deodar and teak wood in one group? S: As all of them give us wood. T : So what do you call them as ? S : Wood yielding plants. T : You can call them as timber yielding plants. T: What name could you suggest for Category III ? S : Thread yielding. T : Try for a better word. S : Fibre yielding plants. T : What are they used for ? S: Ropes etc. T: What about IV Category ? S: Decorative plants. T : Which is the other name for decorative plants ? S: Ornamental plants.	Tell some more examples of food yielding plants. Give one more example for timber yielding plants.

Medicinal plants.			T : S: T : S : T: S:	Give some more ornamental plants. Hibiscus, bougenvelia. What does the V group consist of ? All the plants are of medicinal use. What do you call them as ? Medicinal plants. Teacher draws the concept map on useful plants by taking the help of the students. – Next page	

Home assignments :

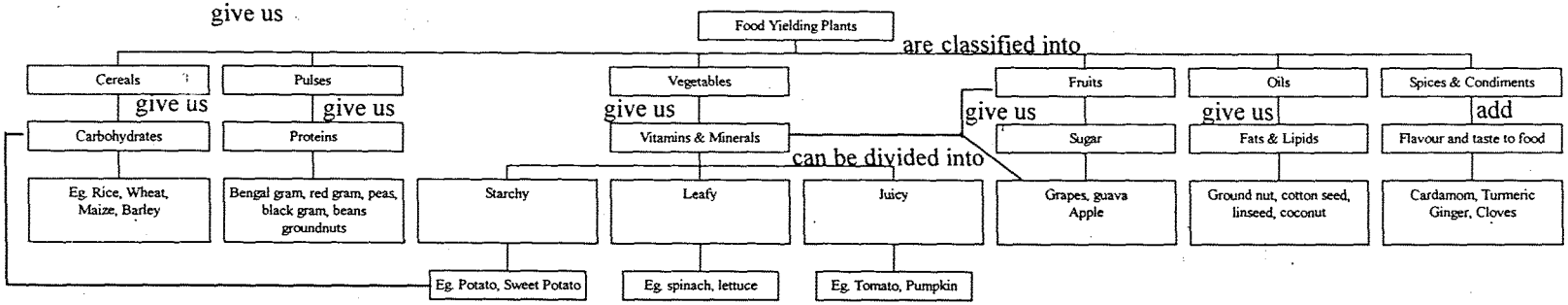
Name 5 (i) Food yielding plants; (ii) timber yielding plants; (iii) Fibre yielding plants; (iv) Ornamental plants; (v) Medicinal plants.


Plants
useful
harmful
Food yielding plants
Fibre yielding plants
Timber yielding plants
Ornamental plants
Medicinal plants
classified as
Eg. Rice, groundnut, wheet green gram, millets vegetables, coconut oil
Eg. Jute, hemp, coir
Eg. Sal, diodar, teak wood
Eg. Jasmine, Rose Crotons
Eg. Cinchona, Raulfia, Tulasi, Jambul

LESSON PLAN II

FOOD PRODUCING PLANTS

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Food producing plants		**Exploration**	Students try to group rice, green gram, ground nuts, coconut, cotton seeds, thill, wheat, millets, grapes, mango, spinach, lady's finger, potato, peas, sweet potato, tomato, pumpkin.	
		Group Activity 6 groups	**T:** Draw a concept map using the above examples.	
			Refer next page.	
		Expansion	**T :** What is the main purpose of planting leguminous crop in between wheat crop ? **S_2:** As its root nodules have N_2 fixing bacteria, which fixes atmospheric nitrogen and make the soil more fertile. **T :** Vegetables can be still categorized into 3 groups. Would you like to try ?	Give two examples of leafy vegetables.


Food Yielding Plants
are classified into
Cereals
Pulses
Vegetables
Fruits
Oils
Spices & Condiments
give us
give us
give us
give us
give us
add
Carbohydrates
Proteins
Vitamins & Minerals
Sugar
Fats & Lipids
Flavour and taste to food
can be divided into
Eg. Rice, Wheat, Maize, Barley
Bengal gram, red gram, peas, black gram, beans groundnuts
Starchy
Leafy
Juicy
Grapes, guava Apple
Ground nut, cotton seed, linseed, coconut
Cardamom, Turmeric Ginger, Cloves
Eg. Potato, Sweet Potato
Eg. spinach, lettuce
Eg. Tomato, Pumpkin

Vegetables are classified into (i) leafy, (ii)juicy, (iii)starchy	**Group Activity**	**Evaluation**	**S:** May be tomato or pumpkin group. **T:** Why do you think that these two can be grouped? **S:** As they are juicy in nature. **T:** So what do you call them as ? **S:** Juicy vegetables. **T:** What do you call the other groups as ? **S:** II group – Spinach and lettuce. We can call them as leafy vegetables . **T:** Why ? **S:** As leaf is the part which is used as food. **T:** Group II can be called as starchy vegetables as potato and sweet potato have starch in them. **T:** What do we add to the vegetables while cooking to add flavour and taste to it ? **S:** Spices. **T:** Can you name some of them ? **S:** Cloves, tamarind, etc. Teacher provides a worksheet which includes name of the plant, part used, nutrients present in it, its uses. Students discuss among themselves and fill the work sheet accordingly.	Name few spices and condiments.

Teacher and Students discuss about the above work.

Sl. No.	Name of the Plant	Part used	Nutrients present in it.	Its uses
1.				
2.				
3.				
4.				
5.				
.....				
20.				

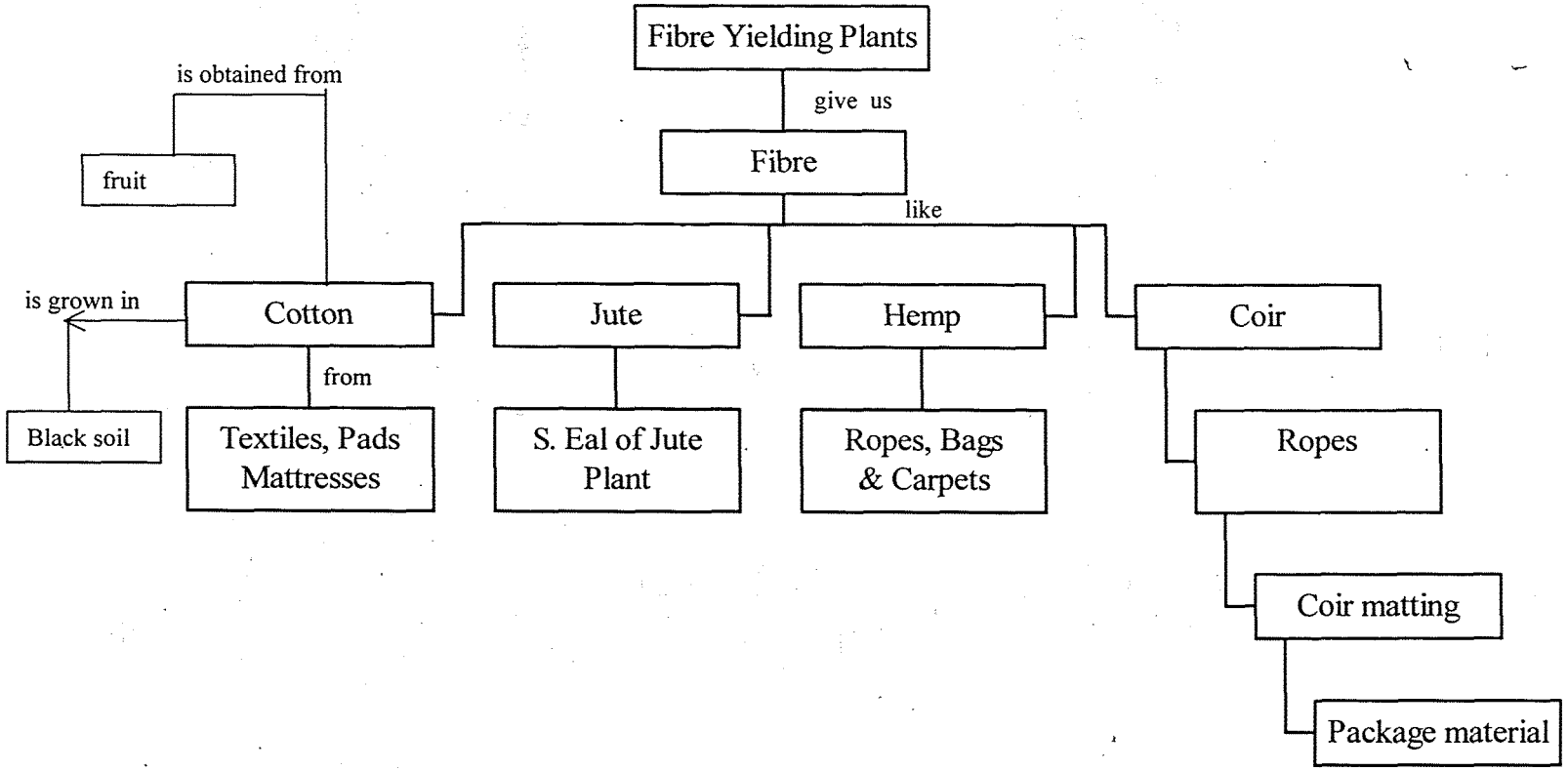
Home Assignments : Collect the different groups of food yielding plant products and fill them in satchets and stick them onto a chart.

1. Cereals
2. Pulses
3. Oil yielding plants
4. Vegetables
5. Fruits

LESSON PLAN III

FIBRE YIELDING PLANTS

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Student identifies and names the products are made of coir, jute and cotton.	**Exploration**		Which is the second category under plants ? **S:** Fibre yielding plants. **T:** Can you name some fibre yielding plants ? **S:** Jute, cotton, coconut. Teacher shows the articles made up of fibres like ropes, bags, clothes, etc. and ask the students to find out, which plant has given it. **T:** Draws a concept map (taking the ideas of students) showing the characteristics, part used and their uses on the blackboard. (Refer next page)	
		Expansion	Why do we say that cotton clothes are good in summer? **S:** As they do not absorb sunlight. **T:** Why do most people like cotton ? **S:** They are made from natural products/substances. They leave no rashes on skin. **T:** In summer, I think all of you might have seen we use curtains made of jute fibres ? Do you know why jute is used ?	Which clothes would you like to wear in winter? State the uses of fibre-yielding plants.
		Evaluation	**S:** As it absorbs water and leaves the cool air into the rooms. **T:** Do you know where the coconut coir is used ?	


Fibre Yielding Plants
give us
Fibre
like
is obtained from
fruit
is grown in
Cotton
Jute
Hemp
Coir
from
Black soil
Textiles, Pads
Mattresses
S. Eal of Jute
Plant
Ropes, Bags
& Carpets
Ropes
Coir matting
Package material

			S: In stuffing the sofa sets, etc. **T:** What about your mattresses ? **S:** Yes, coir is used in mattresses. **T:** Why ? **S:** In summer, it is comfortable and cool to sleep on it.	

Collect any 10 articles/materials made of fibres and stick/stitch them on a cardboard sheet and name them.

LESSON PLAN IV : MEDICINAL PLANTS AND OTHER USES OF PLANTS

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Medicinal plants **Pharmacology is the study of drug plants.**	**Exploration**		**T:** What are the different types of medicines ? **S:** Allopathy, Homeopathy, Ayurveda, Sidda and Unani. **T:** What do you call the type of medicine from plants as ? Can you name some medicinal plants ? **S:** Tulasi, ginger, etc. **T:** What do you call the science which deals with the study of drug plants as ? **S:** ? **T:** Pharmacology	
		Explanation	Teacher lists out the names of different plants which are used in preparation of medicines and their medicinal value. Teacher explains the importance of medicinal plants and their uses.	
		Expansion	**T:** Do you know the uses of garlic ? **S:** It helps in digestion, cures gastric problems etc. **T:** Can you name some commonly used substances for curing/preventing diseases ? **S:** Ginger, Tulasi, cloves, etc.	
		Evaluation	Draw a concept map showing medicinal plants and their uses.	

Home Assignment : Collect some specimens/products of the plants which help in curing/preventing diseases.

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Ornamental plants : Plants which are cultivated in gardens, parks, flower pots for their beauty.	**Exploration**		During this Dasara festival, there is a competition in and around Mysore. Do you know what it is ? **S:** Flower exhibition. **T:** What do you call the plants which help in decoration of house, buildings, etc. **S:** Decorative plants. **T:** Any other name for it ? **S:** Ornamental plants. **T:** Name some of the ornamental plants. **S:** Roses, jasmine, champa, croton, money plants, etc.	Differentiate between fibre-yielding and medicinal plants.
		Explanation/ Expansion	O.K. We have learnt about the major category of plants till now. What are the other useful plants ? **S:** Tea, coffee. **T:** What do you call them as ? **S:**	
Beverages			**T:** Beverages. **T:** What do they contain ? **S:** Caffeine. **T:** Is caffeine useful to us ? **S:** No. **T:** That is why we should not get addicted to tea and coffee. **T:** How are plants useful to us? **S1:** They regulate temperature. **S2:** Maintains Soil fertility. **T:** How do they maintain soil fertility?	

			S: By producing humous and by preventing soil erosion. **T:** How do you get rubber? **S:** From rubber plant. **T :** Do you know the scientific name of Rubber tree? **S:** No **T:** Howea brasiliensis. **T:** Which part of the tree gives rubber? **S:** When we tap the bark of the tree, latex oozes out. Which is processed Chemically. **T:** Name some products made by rubber. **S:** Erasers, tyres, rubber bands, etc. **T:** Are all of them similar in quality? **S:** No, Some are soft and some are hard. **T:** Good.	

Evaluation: Draw a concept map including the uses of plants.

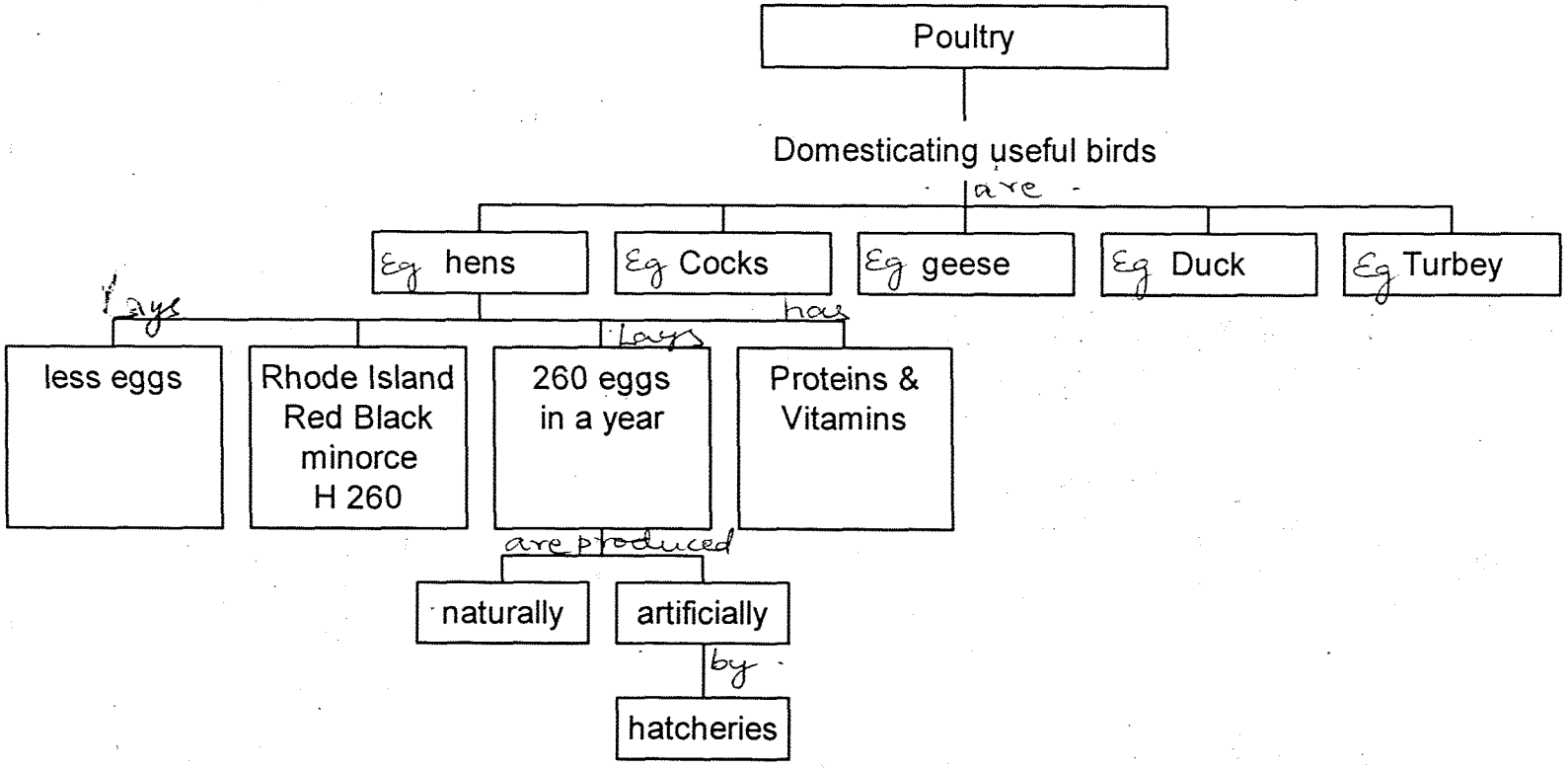
			T: All of you have learnt about useful Plants till now. Are there any harmful Plant? **S:** Yes **T:** Name some harmful Plants: **S1:** Congress Plant or parthenium – the Pollen grains of it cause respiratory problems. **S2:** Cocaine etc. are very harmful drugs which effect nervous system. **S3:** Ivy, Curare, Poison nut, monkshood, toadstools are poisonous Plants. **S4:** Some lower plants like fungi and bacteria cause damage to food clothes, etc. **T:** In Kerala, the workers who work in cashew nut field, were proved to have ulcers on hands, due to the shells of cashew nut (as it contains powerful skin irritant.	

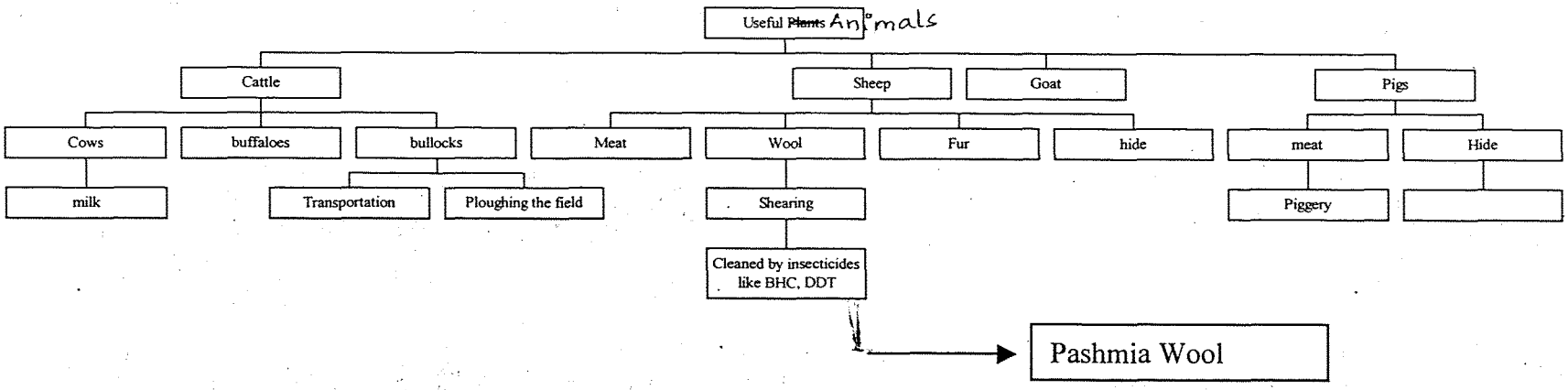
Domestication Cattle	Exploration	Explanation/ Expansion	**T:** How are animals useful to us? **S:** They give us milk, meat & Skin., domesticate. **T:** What do you mean by domestication? **S:** Keeping animals for specific use. **T:** What is the other name for it? **S:** Taming. **T:** Name some useful animals. **S:** Cattle, Sheep, goat, pigs, poultry, fish, honey bees, silk worm, pearls oyster etc. **T:** Which are the milk yielding animals? **S:** Cattle, Cows, Buffaloes. **T:** What do they feed on? **S:** Plants, seeds, flour etc., herbivorous animals. **T:** Why do we call milk as Complete food? **S:** As it contains the essential nutrients required for our growth and development. **T:** Is there any other use of cattle animals? **S:** Bullocks are used for ploughing the fields and for transportation. **S2:** The Cowdung, etc. is used for producing manure and biogas. **S3:** Their skin is used for making items such as shoes, purses, gloves,etc. **S4:** Many people kill animals to get their skin which is inhuman. **T:** Yes, we should not exploit animals for satisfying our desires. Govt. had banned killing the animals in the name of sacrifice, etc. but still it is going on. O.K. coming back to the lesson. Do you know how gobar gas is produced ?	

Piggery – Management of Pigs		Expansion	**S:** Yes Mam. Dung is kept 3-4 days in a closed container. Container gets filled by the gas produced in it. This gas is used for cooking etc. **T:** Good. **T:** Why do people rear sheep and goal ? **S:** As they give wool, meat, etc. **T:** How do these animals move ? **S:** They move in groups. **T:** What do you call the group of goats and sheep as ? **S:** Flocks and herd. **T:** How do they remove the skin of animals ? **S:** They remove the skin of animals and dip it in DDT/BHC. **T:** Why do they dip it in DDT ? **S:** To prevent infection by lice and ticks. **T:** What are these lice and ticks called as ? **S:** Parasites. **T:** Ectoparasites, as they live on the bodies of animals. **T:** Do you know the special breed of sheep ? **S:** No. **T :** Pashina wool of Kashmir valley. **T:** What are the other animals which are domesticated for their meat ? **S:** Pig. **T:** What do you call the management of pigs as ? **S:** Piggery. **T:** What is the name given to the birds which lay eggs ? Teacher develops a concept map on board on useful animals while teaching. **S:** Broiler hen. **T:** Name some domesticated birds for their meat and eggs.	Give some examples of animals which are useful to mankind.

Poultry : Keeping a group of useful birds which provide meat and eggs.			**S:**	Hen, cock, geese, turkey, ducks.	
			T:	Why do hens lay less eggs in winter ?	What are the nutrients present in an egg ?
			S:	As the days are shorter and they do not go out for good.	
			T:	How many eggs does a hen lay in a year ?	How are they useful for the body ?
			S:	----	
			T:	Breeds like Rhode Island, Black minor etc. lay 240-260 eggs in a year.	
			T:	How do hens hatch their eggs ?	
			S:	By sitting on them.	
			T:	What about the artificial method of hatching ?	
			S:	Keeping the eggs in incubators.	
			T:	What do you call the place where the eggs are hatched artificially in incubators ?	
			S:	Hatcheries	
			T:	What do you call the rearing and management of fish as ?	
			S:	Pisciculture.	
			T:	Name some common edible fishes.	Name the nutrients present in fish.
			S:	Rohu, catla, etc.	
			T:	How are fishes useful to us apart from their meat ?	
			S:	They kill harmful insects, give us oil. Eg. Cod liver oil, which is rich in Vitamin A and D.	How is it useful for the body?

Home Assignments : Draw a concept map on Poultry.


Poultry
Domesticating useful birds
are
Eg hens
Eg Cocks
Eg geese
Eg Duck
Eg Turbey
lays
has
Lays
less eggs
Rhode Island Red Black minorce H 260
260 eggs in a year
Proteins & Vitamins
are produced
naturally
artificially
by
hatcheries


Useful ~~Plants~~ Animals
Cattle
Sheep
Goat
Pigs
Cows
buffaloes
bullocks
Meat
Wool
Fur
hide
meat
Hide
milk
Transportation
Ploughing the field
Shearing
Piggery
Cleaned by insecticides like BHC, DDT
Pashmia Wool

LESSON PLAN VI : APICULTURE AND SERICULTURE

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
	Exploration		**T:** How do we get honey ? **S:** Honey bees. **T:** What do you call rearing of honey bees as ?	
Apiculture			**S:** Apiculture/Apiaries	Define Apiculture.
			T: What are the different types of bees ? **S:** Queen bees, worker bee. **T:** How is honey produced in honey bees ?	
	Explanation/ Expansion		**S:** They collect honey (nectar) from different flowers.	
			T: What does honey contain ? **S:** Water, sugar, minerals and enzymes. **T:** What else is produced by honey bees ? **S:** Wax (mon) used in making candles, moulds and ointments.	Give an example from your daily life where you use honey as home remedy?
Honey			**T:** What are the uses of honey ? **S:** Is an antiseptic, in medicines, and an appetizer, etc. **T:** How do you test for its purity ? **S:** ----- **T:** When you add 2 or 3 drops of honey in water, if it gets dissolved – then it is impure. When it settles down as it is, then it is a pure one.	
	Evaluation		Draw a concept map showing apiculture, honey, its constituents and types of bees.	

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Sericulture	**Exploration** **Explanation/ Expansion** **Evaluation**		Students, all of you know that we use different types of clothes which are made from natural fibres and artificial ones. **T:** Name certain natural threads used in making clothes. **S:** Wool, silk, cotton. **T:** Do you know how silk is produced ? **S:** Silk moth **T:** At which stage, silk is produced ? **S:** Pupa stage What do you call the process of rearing and management of silk worms as ? **S:** Sericulture. Teacher draws the diagrams/arranges the specimens in wrong order on the table and asks the students to arrange them in a proper way. **S:** They arrange them in a sequence. Egg → larva → pupa → adult. **T:** Explains the different stages of life-cycle for silk worm. **S:** Draws and labels the diagram in their notebooks. **T:** Why is the silk worm called as voracious eater ? **S:** As it eats large amount of food (mulberry leaves). **T:** What do you call the stage where silk is produced ? **S:** Pupa/cocoon. **T:** How is silk produced ? **S:** -----	Explain the life cycle of silk moth.

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
			Teacher explains that larvae has special glands known as silk glands. It produces a substance (called Fibroin) which the larvae use to spin thread like structure around its body and forms a cocoon. **T:** Then what happens to the worm inside the cocoon in sericulture farms? **S:** When the cocoons are boiled, the worms die inside and then silk threads are extracted from the cocoon.	

Home Assignments : Draw a well labeled diagram of life cycle of silk moth in a concept map.

LESSON PLAN VII – HARMFUL ANIMALS

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
			Teacher shows pearls and ask how they are produced ? **S:** They are obtained from oyster. **T:** How is it secreted ? **S:** --- **T:** Explains that oyster secretes liquid around any foreign particles which enters in between its shell and the mantle. **T:** O.K. What are the other uses of animals ? **S:** In Transportation, ivory, pets, decoration (shells), etc. **T:** You have said that some of the animals are harmful. Can you tell some of the names of animals which are harmful? **S:** Insects which damage the crops.	

			T: Diseases are caused by microbes. **S:** Certain Poisonous animals like snakes, scorpions. **S:** Spoils food – Ants, flies, moths, etc.	

Home Assignments : Name some useful animals.

CONSERVATION OF NATURAL RESOURCES

Objectives:

1. Recalls the term natural resources.
2. Lists out the natural resources.
3. Differentiates renewable and non-renewable resources.
4. Gives examples for renewable and non-renewable resources.
5. Explains the importance of natural resources.
6. Reasons out why we have to conserve natural resources.
7. Explains various methods to conserve the natural resources.
8. Lists out the incidents and accidents, which causes dangerous effects in the ecosystem.
9. Lists out the causes for pollution of air, water and soil.
10. Explains various methods to conserve wild life.
11. Develops concept maps showing the classification of natural resources and their examples.

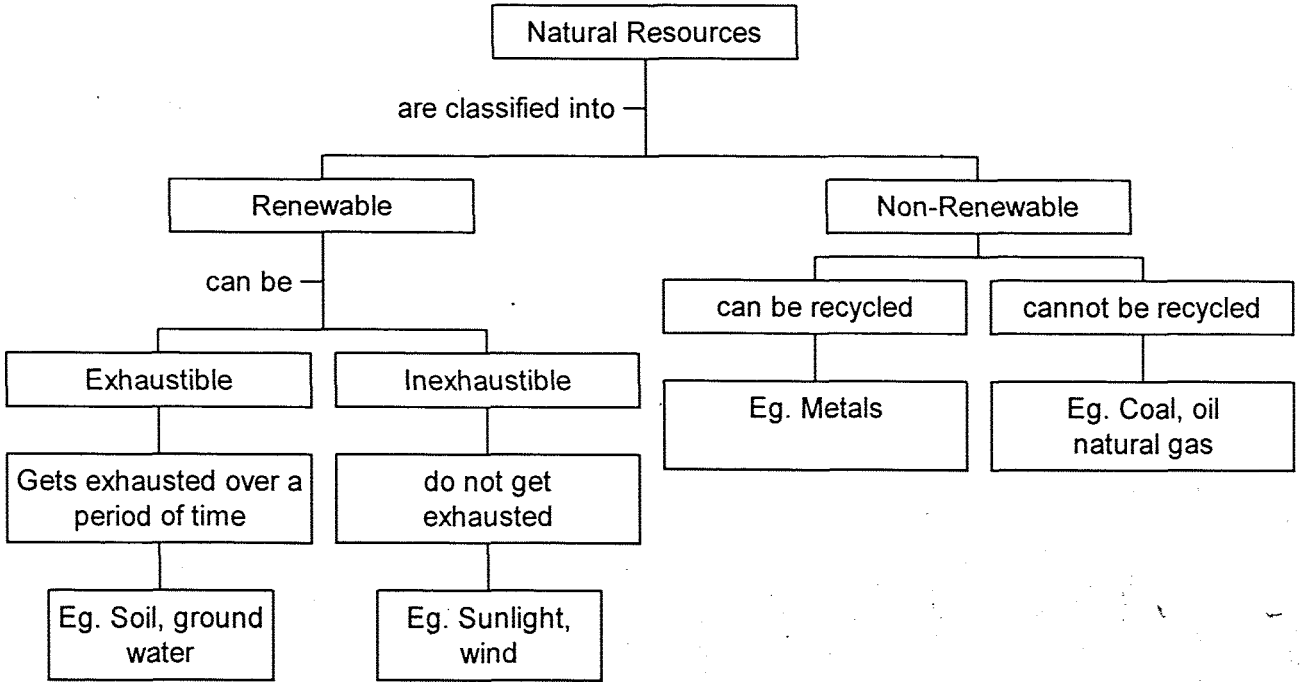
LESSON – 1

UNIT – 4
Conservation of Natural resources

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Natural Resources	Exploration	Introduction:	Good Morning Students. St: Good Morning Miss. Tr: What do you call the substances, which are used by man in nature as? St: Natural Substances. St: Natural resources. Tr: Why do you call so? St: As they are found in nature freely. Tr: Can you name some of the natural resources? St: Soil, ground water, metals coal, wind sun light, water etc. Tr: Can you classify then based on their commonalities?	What do you mean by natural resource

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Renewable resources Non renewable resources	Explanation		St: Yes. Teacher. Tr: Along with the student's categories the examples into two groups. St: Group 1: Soils, ground water , Sunlight, water Group 2: Metals, coal, oil, petroleum. Tr. Name the firs & second groups. St_3: Group 1: Renewable Group 2: None renewable. Tr: What do you mean by Renewable resources? St: Group 1 has all the resources which are regenerated through natural cycles. So they are called as Renewable resources. St_2: Group 2 are those, which are not replaced in the environment. They are called as non-renewable resources.	

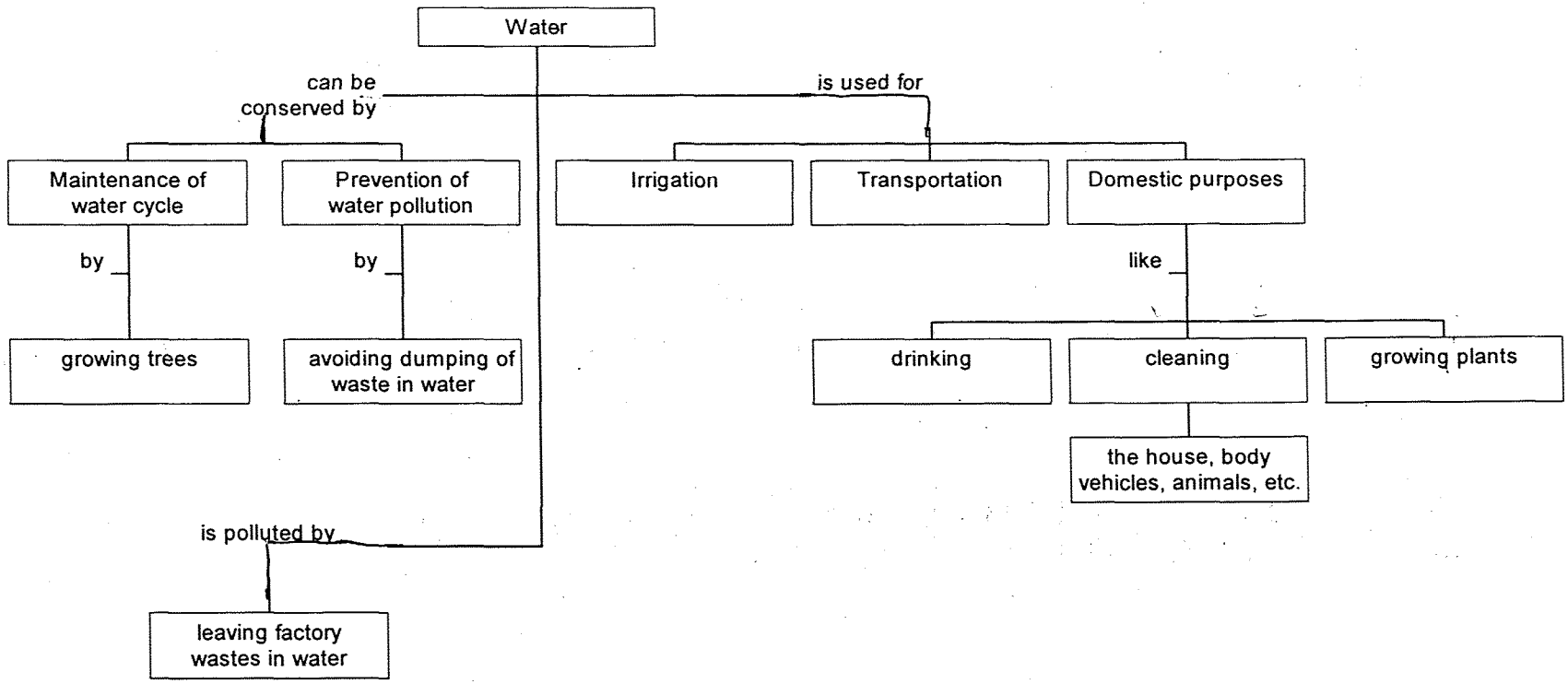
Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process		Continuous Evaluation
		Expansion	Tr.	Develops a concept map showing the types & the examples of natural resources & explains that renewable resources can be exhaustible & inexhaustible and some of non renewable resources can be recycled & some cannot be recycled.	Gives some examples of renewable and non-renewable substances.
		Evaluation		Why is ground water kept under exhaustible natural resources?	Differentiate between renewable and non-renewable resources.
			St.	As it gets exhausted over a period of time or if it is overused.	
Home Assignment / Activities Define: Natural resources, Renewable, Non-renewable, Exhaustible, Inexhaustible Natural resources.					


Natural Resources
are classified into
Renewable
Non-Renewable
can be
can be recycled
cannot be recycled
Exhaustible
Inexhaustible
Eg. Metals
Eg. Coal, oil
natural gas
Gets exhausted over a
period of time
do not get
exhausted
Eg. Soil, ground
water
Eg. Sunlight,
wind

UNIT – 2

LESSON NO - 2

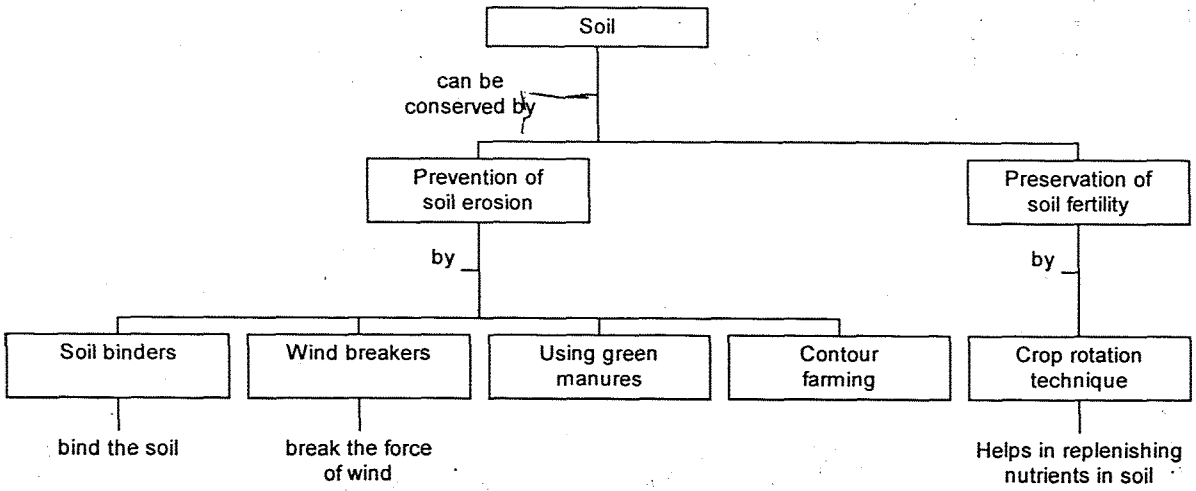
Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
		Exploration	Today we will see the causes for depletion of natural resources and the methods used for their conservation. You have listed out many renewable resources. One of the important one is water.	
		Imp. Work	What are the various uses of water, show it in the form of a concept map.	
			St: Discuss among their group mates & draws the concept map showing uses of water.	
			Tr: Also draws concept map after correcting the group works on the black board & explains the concept of conservation of water, the uses, factors leading to depletion of water & the methods of its conservation by using Questioning technique such as. In what way are we responsible for pollution of water? water, the uses, factors leading to depletion of water & the methods of its conservation by using Questioning technique such as. In what way are we responsible for pollution of water?	


Water
can be conserved by
is used for
Maintenance of water cycle
Prevention of water pollution
Irrigation
Transportation
Domestic purposes
by
by
like
growing trees
avoiding dumping of waste in water
drinking
cleaning
growing plants
the house, body vehicles, animals, etc.
is polluted by
leaving factory wastes in water

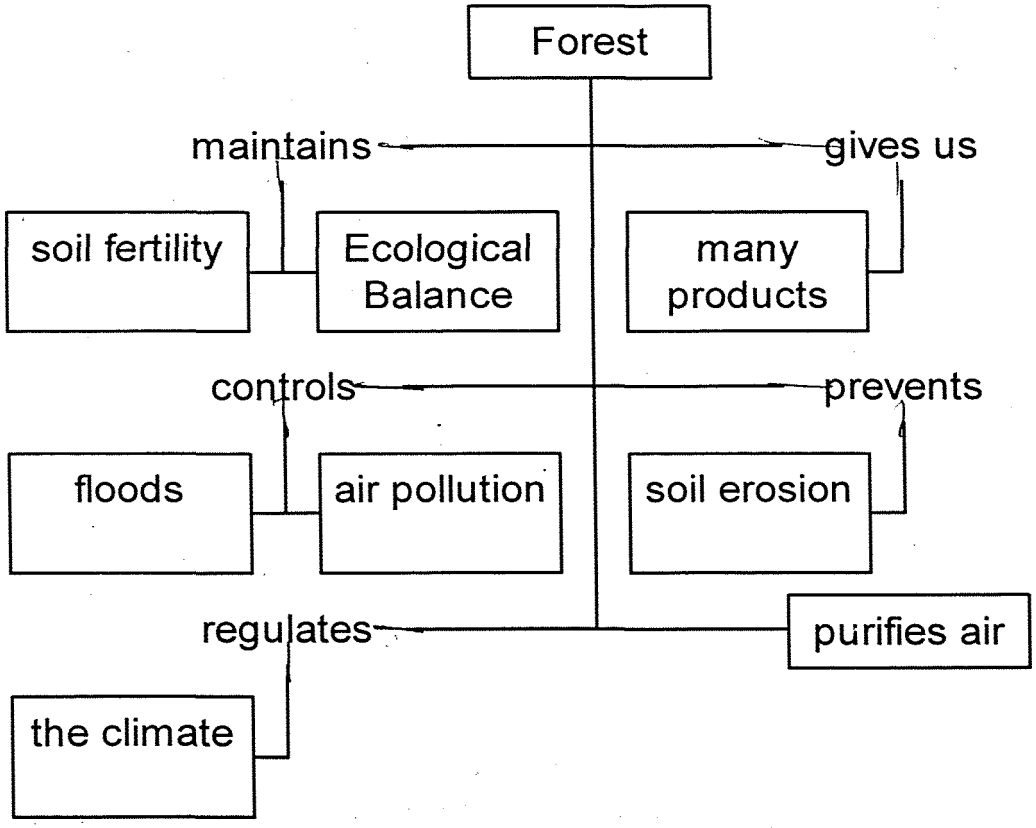
Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Conservation of water.	Explanation & Expansion		St: Wastage is thrown into water. Tr: What will happen if the wastage, sewage is left in water? St: Aquatic life gets disturbed. Tr. Then what will you do to prevent water pollution. St: Will not allow to pour sewage in water. St: We will try to maintain water cycle. Tr: How will you do it? St: By planting trees. Tr: Good. We should conserve water by planting trees & by presenting pollution.	What is water pollution ? How can we prevent water pollution?
	Exploration		Tr. What about soil? St: It is very important for us in many ways. St: For growing plant, i.e. Agriculture	

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
Conservation of soil			Tr: Very good. Man depends on agriculture for clothing, medicine, etc. It is also used in industrialization & urbanization. Can you tell me measures to conserve soil? St: Soil can be conserved by presenting soil erosion & preserving soil fertility. Tr: What do you mean by soil erosion? Tr: How can you prevent soil form erosion? St: By planting soil binders, which do not allow the top soil to run down along with flow of water. Tr: Name few examples of soil binders. St: Bamboos, eucalyptus.	What is soil erosion? How can we conserve soil?
	Expansion		Tr: Adds information & explains how the soil is conserved by soil binders, wind weathers contour farming with the help of black board. St: (Notes down the points in their notebooks).	
	Evaluation		Tr: What do you mean by wind breaches?	

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
			St: Trees are planted in rows they act as wind breathers to beat the force of wind & prevent soil erosion	
			Tr: How is soil fertility maintained?	What is crop rotation? Give an example.
			St: By using crop rotation method	
			Tr: What do you mean by crop rotation?	
			St: Rotation of leguminous crop along with cereals to replenish the soil fertility year after year.	
			St: Nitrogen fixing bacterial are present in the root nodules of leguminous crop, there bacterial help in fixing atmospheric nitrogen.	What is nitrogen fixation?
			Tr: Very good . Rhizobiun is one of the bacterial which fixed Atmospheric Nitrogen in the soil & replenishes the fertility.	
	Evaluation		Tr: Draws concept map taking the help of students.	How does it help soil fertility ?


Soil
can be conserved by
Prevention of soil erosion
Preservation of soil fertility
by
by
Soil binders
Wind breakers
Using green manures
Contour farming
Crop rotation technique
bind the soil
break the force of wind
Helps in replenishing nutrients in soil

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
	Exploration		Till now we have seen various methods of conservation of water & soil. Plants & animals are also a part of Eco system. St: Lists out various uses of forests such as purifies air, plant & animal products etc.	
	Explanation: & Expansion:		Tr: Explains the importance of forests with the help of this diagram. (Refer next page) You haven seen that forest do a lot for us? Now tell me the methods to conserve forests & wild life. St: Afforestation, establishing, sanctuaries, Zoo parleys, prohibiting, hunting, precautions to avoid forest fires etc. Tr: Name some programs which were taken up by the government to conserve wild life & forests. St: Vanamahotsava, project Tiger etc. Tr: Good. Can you tell me the names of the organizations engaged in conservation of wild life?	What do you mean by afforestation.


Forest
maintains
gives us
soil fertility
Ecological Balance
many products
controls
prevents
floods
air pollution
soil erosion
regulates
purifies air
the climate

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
			St: WWF-world wild life fund. IUCN- International Union for conservation of nature & Natural resources.	
	Expansion		Tr: Many organizations are also established to take care of animals. Do you know when is wild like week celebrated?	
	Evaluation		St: 1st to 8th October every year children were shown a film named "Beauty without cruelty"' & were asked to answer few question and their comments. Till now we have seen various renewable resources., & their conservation. Tomorrow we will discuss about conservation of Non renewable natural resources.	
Home Assignment / Activities 1. Why should we conserve renewable resources. 2. What are the methods used to conserve soil?				

UNIT 2 (LESSON NO 3)

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
			Tr: Till last class we have seen how renewable resources are conserved. Today we will discuss about non-renewable resources. What are non-renewable resources ? St: The resources, which are not regenerated in the environment. Tr: Give few examples of Non renewable resources. St: Metals, coil oil, petroleum, natural gas. Tr: Why do we call so? St: We cannot get hen back. Tr: Good. These resources can be regenerated again once used up. We classified again the non-renewable resources into the one, which can be recycled. Other which cannot be recycled. Tr: Name few examples of non-renewable resources, which can be recycled.	What is the difference between renewable and non-renewable resources?
	Exploration			

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
	Explanation		St: Metals, paper. Tr: Name few non renewable resource which cannot be recycled: St: Petrol, oil, natural gas, coal, Tr: Good. Petrol, coal etc cannot be recycled. This type of resources is called as non-recycled non-renewable resources. Paper can be recycled where as polythene, plastic cannot be recycled. They are non-degradable substances & they cannot be decomposed & they make the soil less fertile. So such substances should be used in lesser quality. Tr: So. Today we will see the conservation of non-renewable natural resources. Can you try few methods? St: Using less, limited use. Tr: Good. Judicious & wise use of resources. We are not supposed to waste the natural resources & use them properly as they are very precious. St: By making use of solar energy.	Give some examples for non-cycled non-renewable resources. What is energy?

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
	Expansion		Tr: Can you tell me where is this solar energy used? St: For streetlights, in calculators, cookers. Tr: What is principle of the function of solar cooker? St: Black color absorbs heat, heat helps in cooling food. Tr: Any other method to conserve non-renewable resources? St: Wind energy. Tr: Where is wind energy used? St: It is used in production of Electricity, for grinding corn. Tr: What do you call these resources (solar energy, wind energy, nuclear energy) etc as ? St: They are called as alternative sources of energy. Tr: Good. We can make use of alternative sources of energy in the place of Hydro Electric Power.	What is solar energy? How is wind energy used? How is solar energy used?

Concept & Related Concepts	Phases of Tg./Lg.	Activities	Teaching-Learning Process	Continuous Evaluation
			St: We can recycle the metals, paper etc. Tr: Recycling is one of the method used commonly for paper & metals. Tr: Suppose your watch is not working. What will you do? St: I will get it repaired & then use it. Tr: Good. So repair & use is one of the important methods of conservation of non-renewable resources. It also helps in minimizing economy. How does this help in minimizing the economy. St: Helps in saving money, giving livelihood to people. Tr: These are the 4 main methods of conservation of non-renewable resources.	
Home Assignment: - Explain the various methods of conservation of renewable & non-renewable Natural resources.				

APPENDIX - C

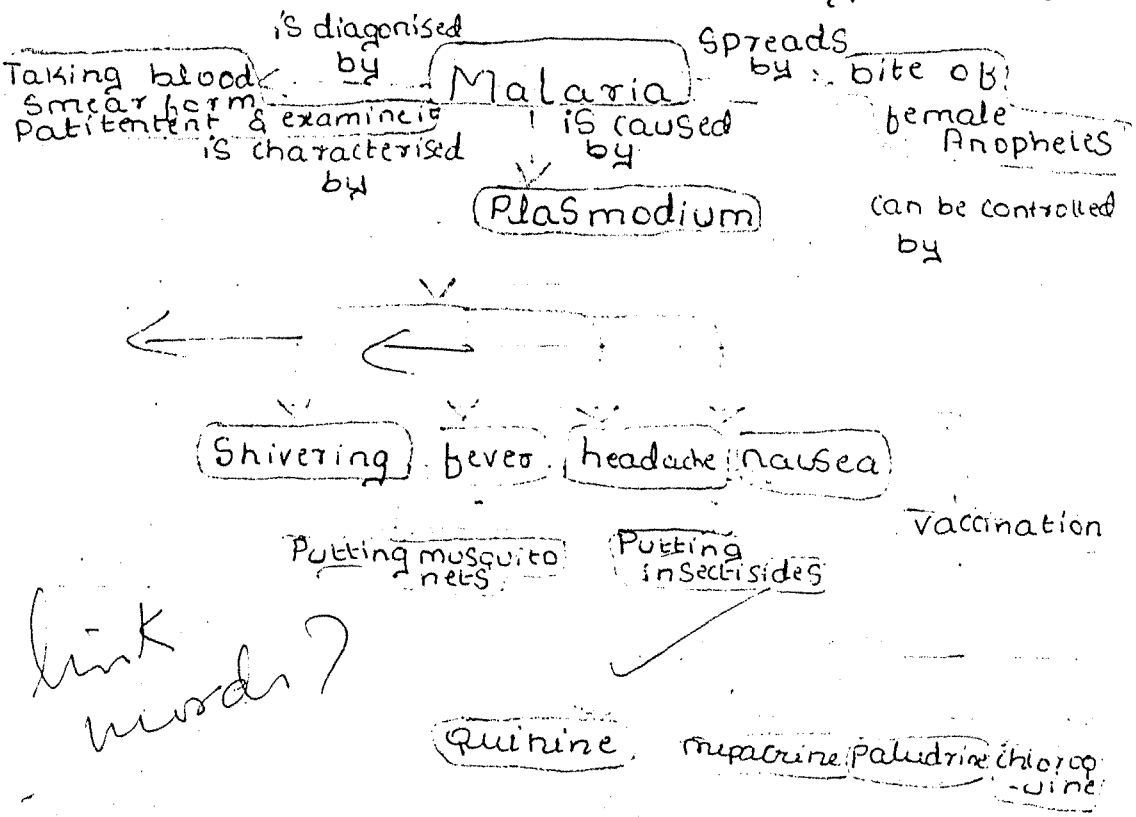
(Sample of Student made Concept Maps)

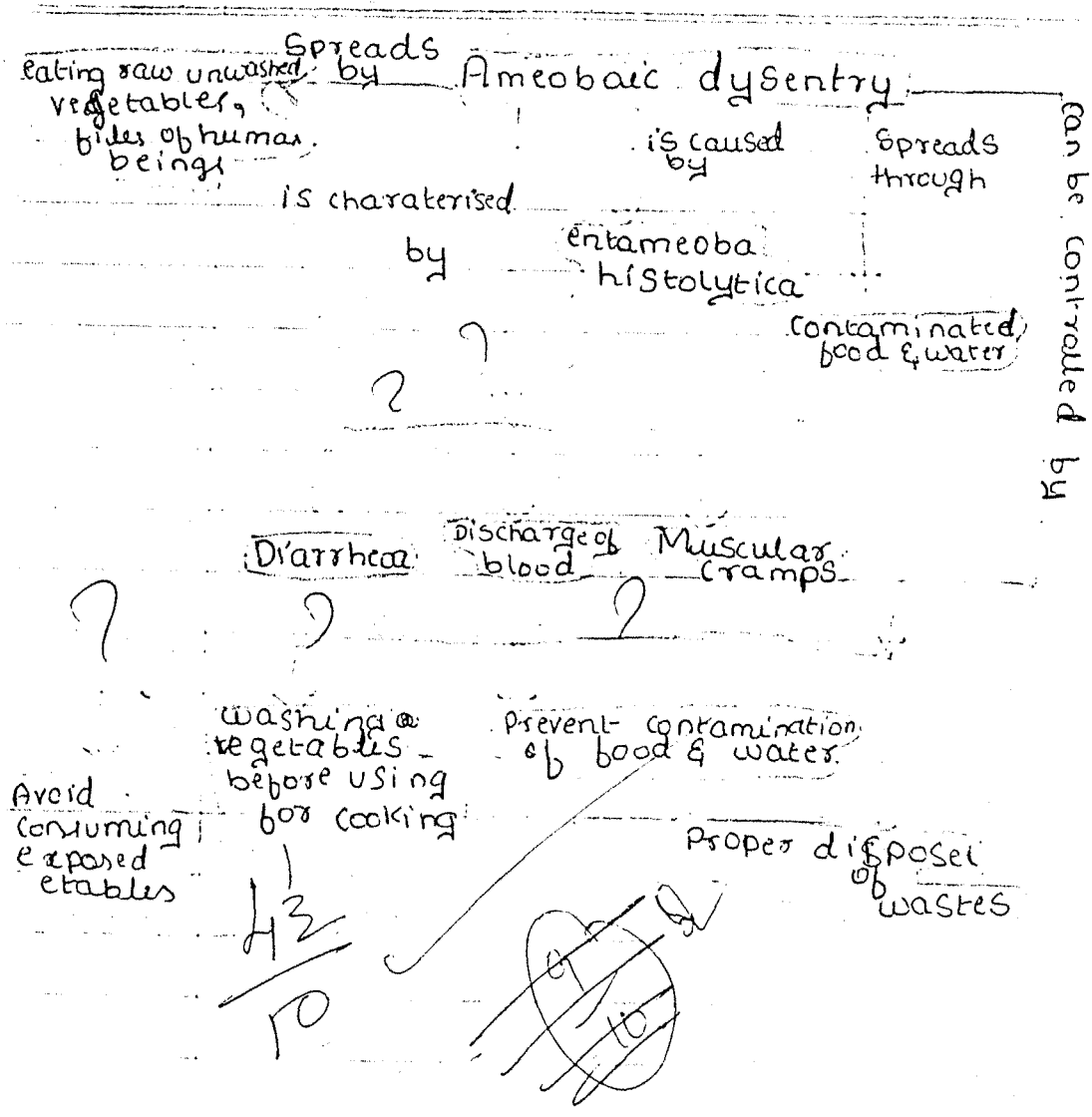
Individual

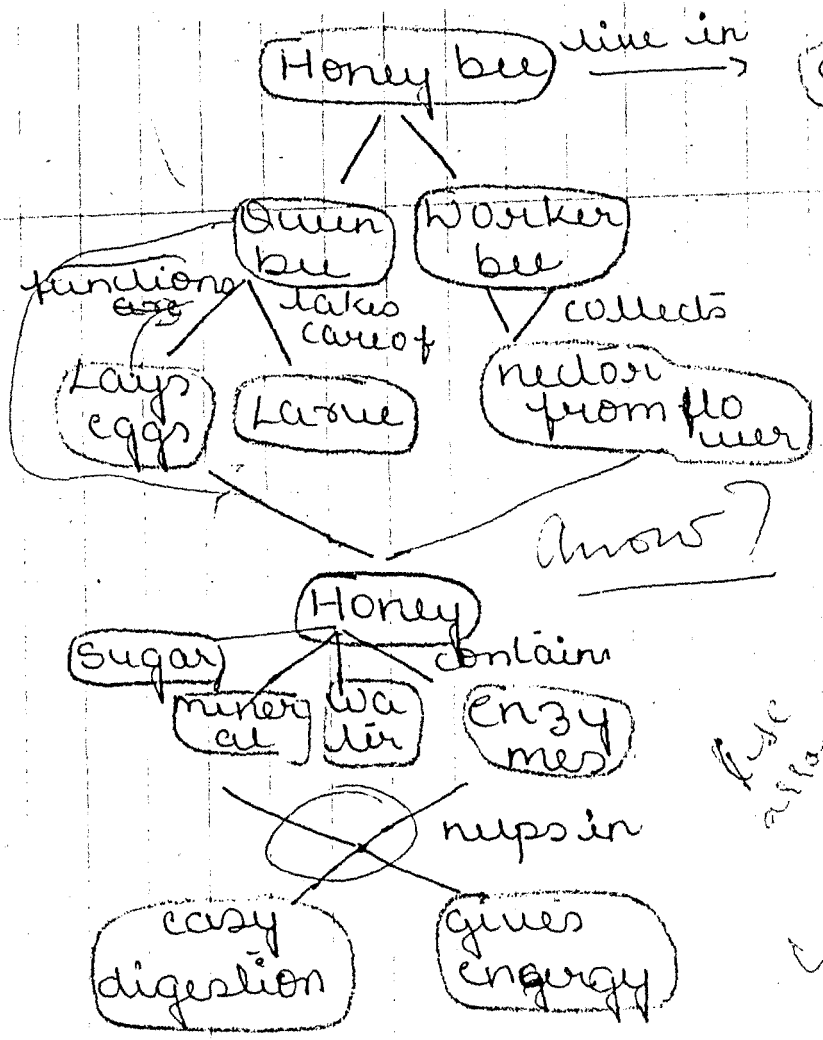
Pramod .P. Kumar

8th Standard

Diseases caused by protozoa




Spreads by
eating raw unwashed vegetables, bites of humans beings
Amoebaic dysentry
is caused by
Entameoba histolytica
Spreads through
Contaminated food & water
Can be controlled by
is charaterised by
Diarrhoea
Discharge of blood
Muscular cramps
Avoid consuming exposed etables
Washing of vegetables before using for cooking
Prevent contamination of food & water
Proper disposel of wastes



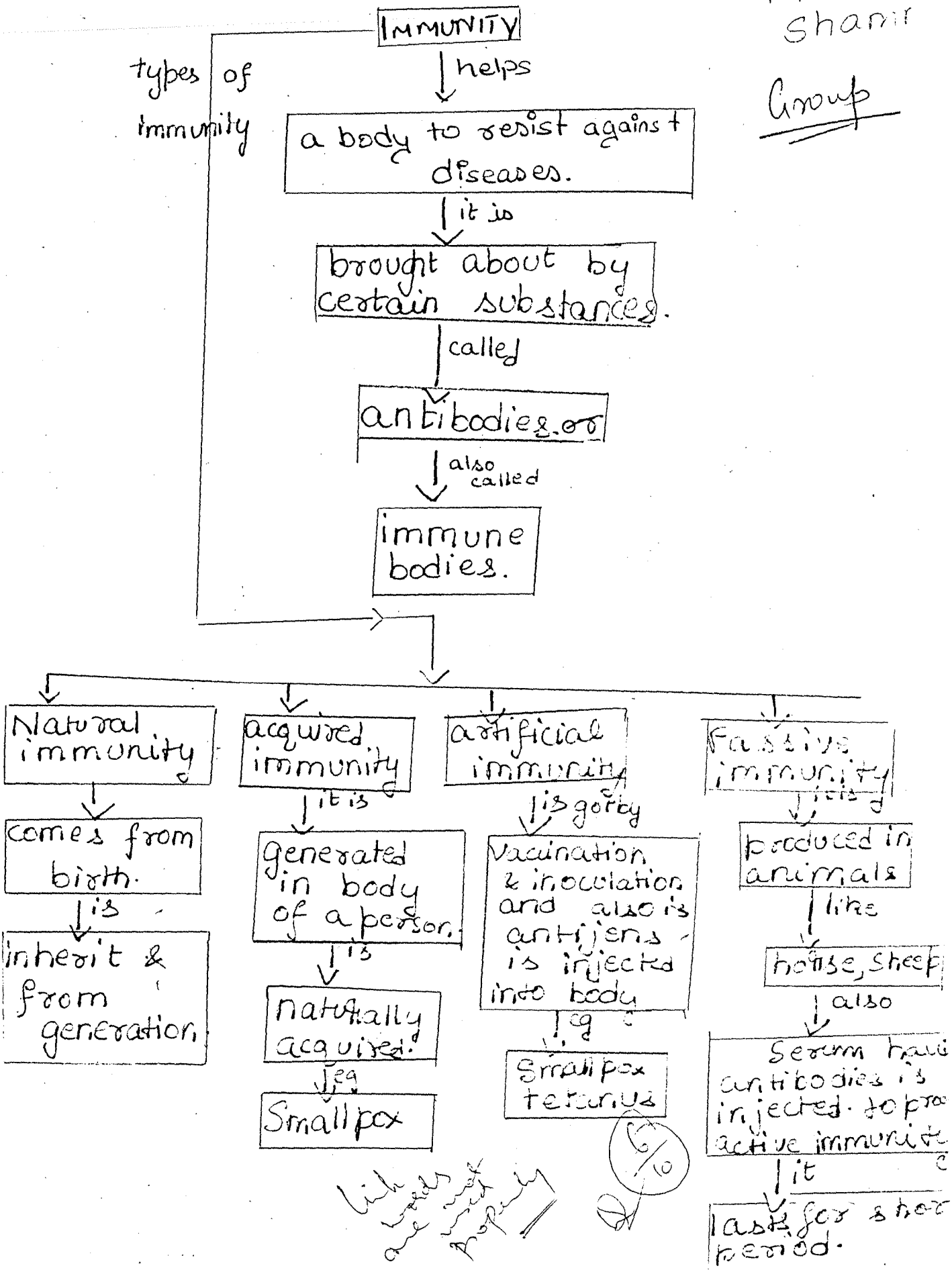
Group Names :-

PRAMOD
PRAVEEN
RAGHAVENDRI
SAURAB
SATHYAVRATI
JNANESH.

science

by - Suma, Namratha, Sheetal, Mounika, Shanir

Group



IMMUNITY

is brought by

Antibodies

also called as

Immune bodies

the ability of a person to resist the disease.

Group

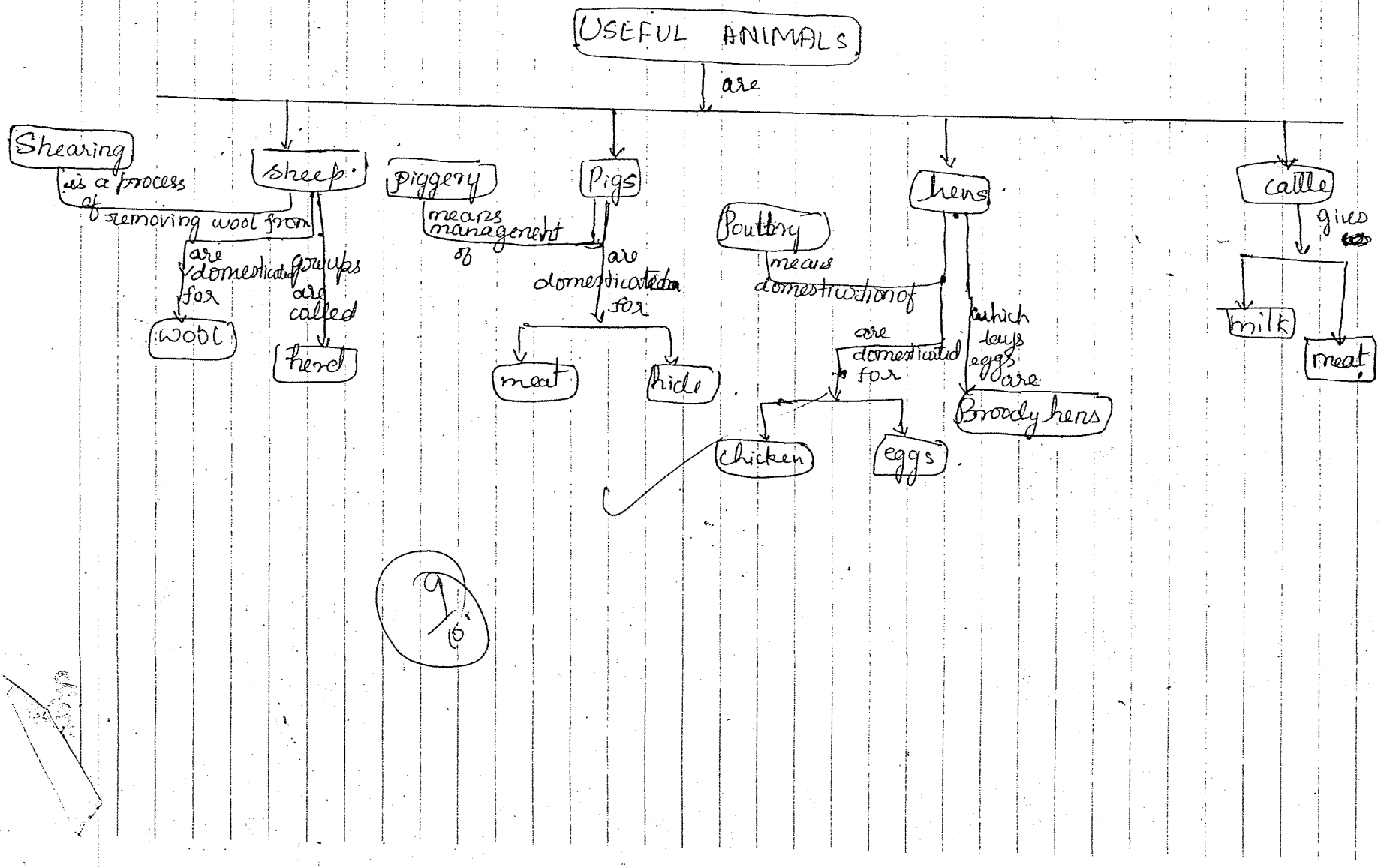
Can be

- Natural immunity
  - and from birth
  - is passed from Generation to generation
- Acquired immunity
  - generates in the body of a person who is attacked by the disease like Small pox
  - said to be naturally aquired immunity
- Artificially aquired immunity
  - is aquired by
    - Vaccination
      - consists antigens
        - is injected to the blood stream of a person which produces antibodies
        - eg:- Vaccination against smallpox, diphtheria, tetanes
    - Inoculations
- Passive Immunity
  - is produced in body of animals as antibodies
    - eg:- Horse sheath.
    - Cholera vaccine to be injected each year

by :- Megha. K.S.
Chaithra. P.P.
Bhavana.
Shilpashree
Nikila.

9/16

Individual


USEFUL ANIMALS
are
Shearing
is a process of removing wool from
sheep
are domesticated for
wool
groups are called
herd
Piggery
means management of
Pigs
are domesticated for
meat
hide
Poultry
means domestication of
hens
are domesticated for
chicken
eggs
which lays eggs are
Broody hens
cattle
gives
milk
meat