Core recommendations of NCF 2005

- Connecting knowledge to life outside the school
- Assuring that the learner is shifted away from rote methods
- Enriching the curriculum to provide for overall development of children rather than remain textbook centric
- Making examination more flexible and integrated into classroom life
- Nurturing an over-riding identity informed by caring concern within the democratic polity of the country.

Basic criteria of validity of a science curriculum

- Cognitive validity
- Content validity
- Process validity
- Historical validity
- Environmental validity
- Ethical validity:

CRITERIA FOR AN IDEAL SCIENCE CURRICULUM

Good science education is true to the child, true to life and true to science.

Thematic approach

Primary Level	Upper Primary Level	Secondary Level	Higher Secondary
Family and friends	Food	Food	Food
Plants	Materials	Materials	Materials
Animals	World of living	World of living	World of living
Food	Moving things, people and ideas	Moving things, people and ideas	Moving things, people and ideas
Shelter	How things work	How things work	How things work
Water	Natural Phenomena	Natural Phenomena	Natural Phenomena
Travel	Natural Resources	Natural Resources	Natural Resources
Things we make and do			

Aims of Science Education

To summarize, science education should enable the learner to

- know the facts and principles of science and its applications, consistent with the stage of cognitive development,
- acquire the skills and understand the methods and processes that lead to generation and validation of scientific knowledge,
- develop a historical and developmental perspective of science and to enable her to view science as a social enterprise,
- relate to the environment (natural environment, artifacts and people), local as well as global, andappreciate the issues at the interface of science, technology and society,
- acquire the requisite theoretical knowledge and practical technological skills to enter the world of work,
- nurture the natural curiosity, aesthetic sense and creativity in science and technology,
- imbibe the values of honesty, integrity, cooperation, concern for life and preservation of environment, and
- cultivate 'scientific temper'-objectivity, critical thinking and freedom from fear and prejudice.

Textbooks at Upper Primary Level

- Child centric
- Activity based content
- Text supporting with illustration and examples
- Question for self and continous assessment.

PAHELI AND BOOJHO

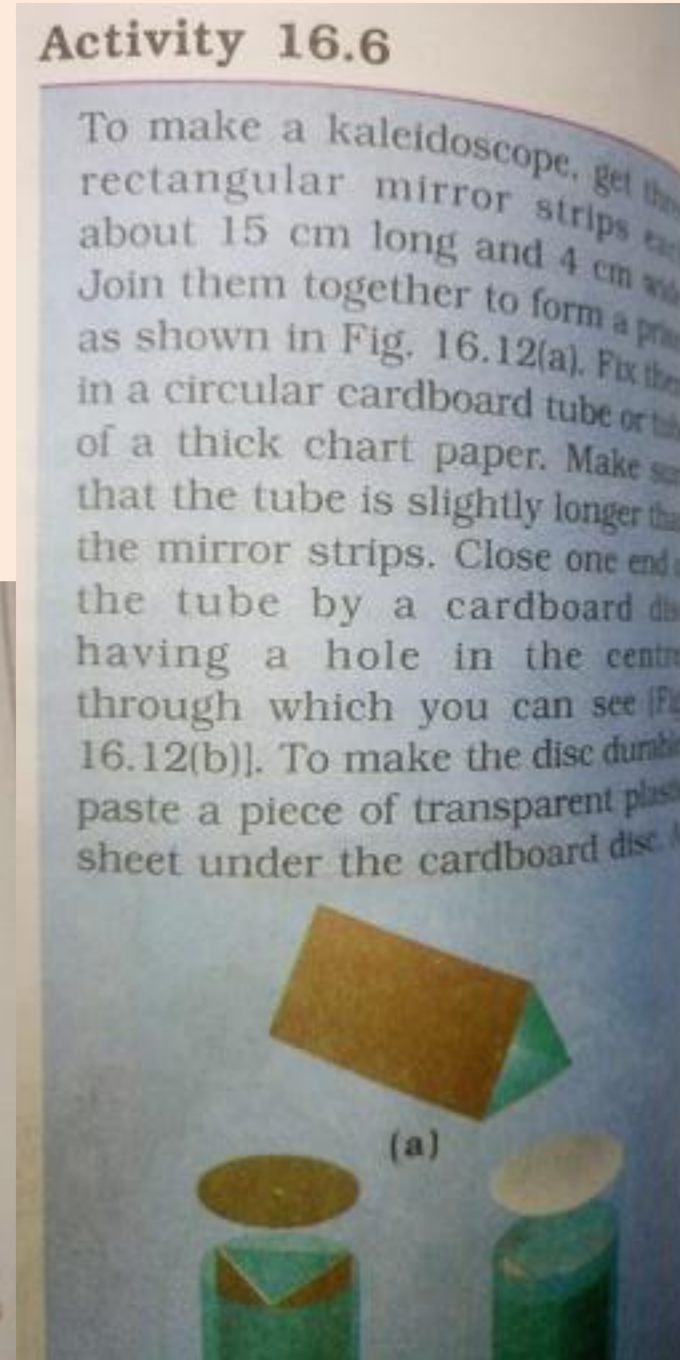
I saw my mother putting some dried neem leaves in an iron drum containing wheat. I wonder why?

Oh! Now I understand why my mother never wears polyester clothes while working in the kitchen.

When the free ends of the tester do not touch each other, there is an air gap between them. Paheli knows that air is a poor conductor of electricity. But she has also read that during lightning, an electric current passes through air. She wonders if air is indeed a poor conductor under all conditions. This makes Boojho ask whether other materials classified as poor conductors also allow electricity to pass under certain conditions.

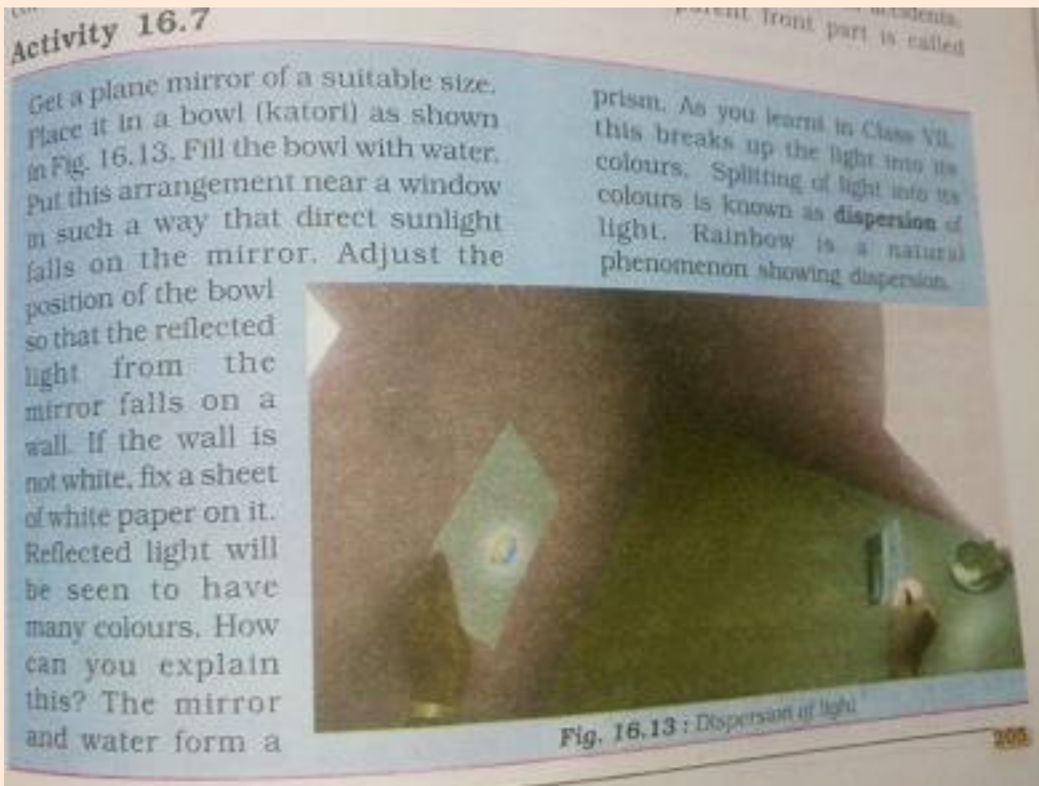
Is nylon fibre really so strong that we can make nylon parachutes and ropes for rock climbing?

Activity based content



Activity 16.6

To make a kaleidoscope, get three rectangular mirror strips each about 15 cm long and 4 cm wide. Join them together to form a prism as shown in Fig. 16.12(a). Fix them in a circular cardboard tube or tube of a thick chart paper. Make sure that the tube is slightly longer than the mirror strips. Close one end of the tube by a cardboard disc having a hole in the centre through which you can see [Fig. 16.12(b)]. To make the disc durable, paste a piece of transparent plastic sheet under the cardboard disc.



Activity 16.7

Get a plane mirror of a suitable size. Place it in a bowl (katori) as shown in Fig. 16.13. Fill the bowl with water. Put this arrangement near a window in such a way that direct sunlight falls on the mirror. Adjust the position of the bowl so that the reflected light from the mirror falls on a wall. If the wall is not white, fix a sheet of white paper on it. Reflected light will be seen to have many colours. How can you explain this? The mirror and water form a prism. As you learnt in Class VII, this breaks up the light into its colours. Splitting of light into its colours is known as **dispersion** of light. Rainbow is a natural phenomenon showing dispersion.

Fig. 16.13 : Dispersion of light

Progression

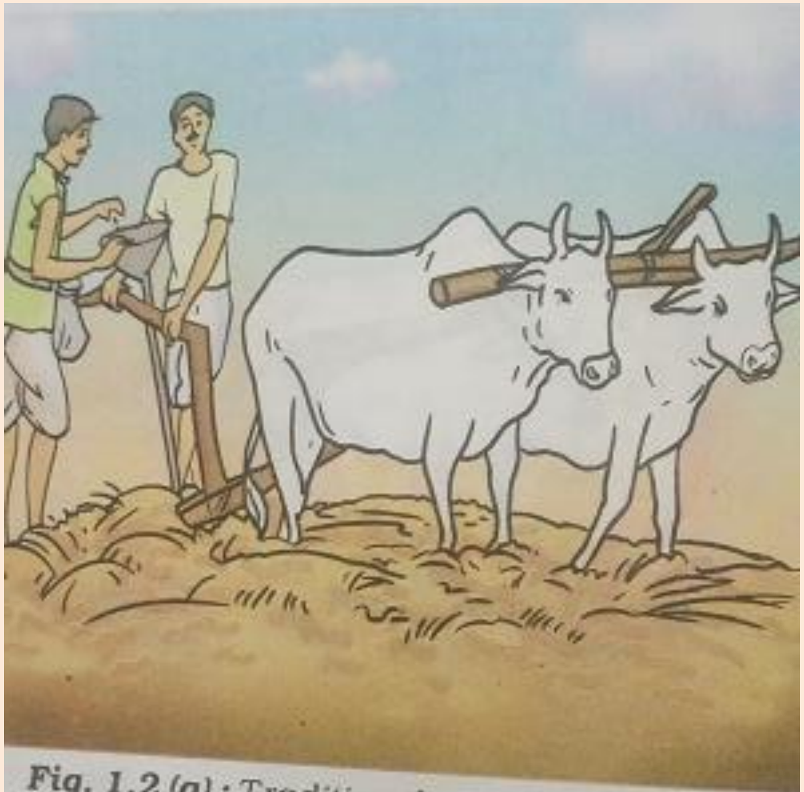


Fig. 1.2 (a) : Traditional method of sowing

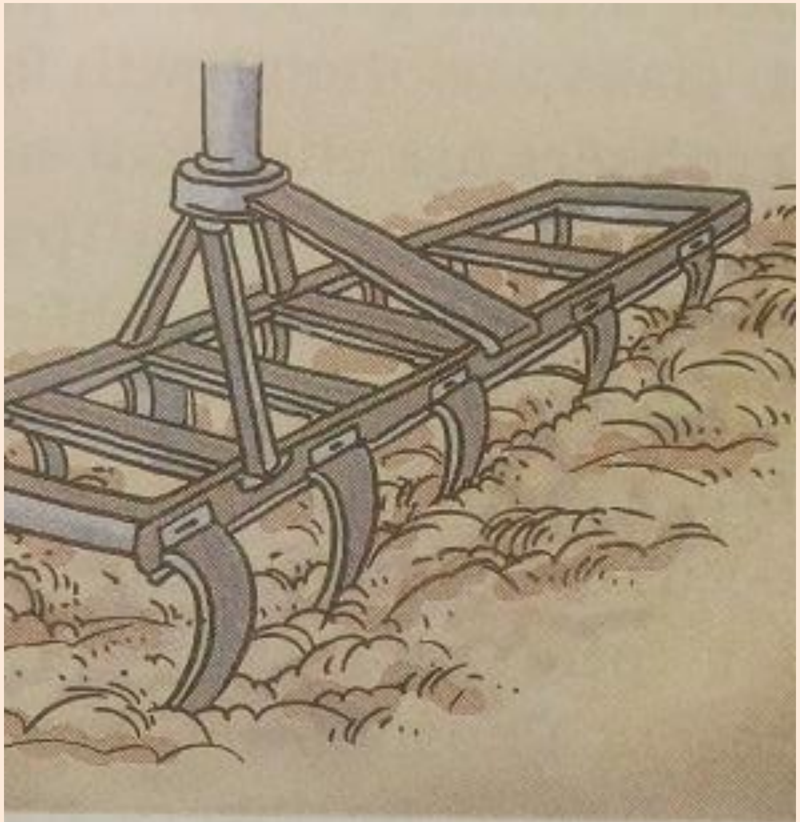
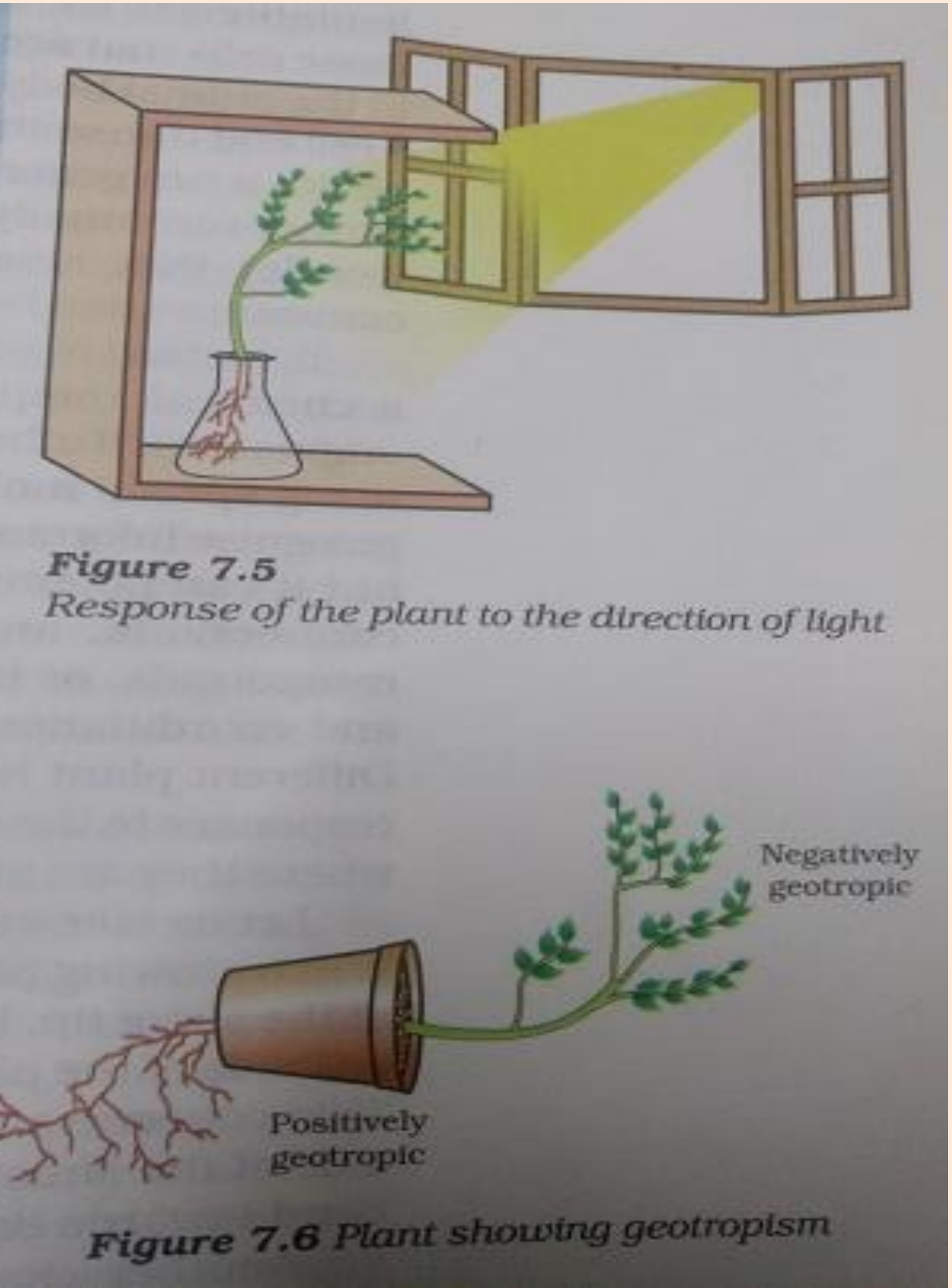


Fig. 1.2 (b) : A seed drill

In 1929, Alexander Fleming was working on a culture of disease-causing bacteria. Suddenly he found the spores of a little green mould in one of his culture plates. He observed that the presence of mould prevented the growth of bacteria. In fact, it also killed many of these bacteria. From this the mould penicillin was prepared.

Textbook at Secondary Stage



encourages learner to

- perform Systematic experimentation as a tool to discover/verify theoretical principles,
- work on locally significant projects involving science and technology.

Systematic Experimentation

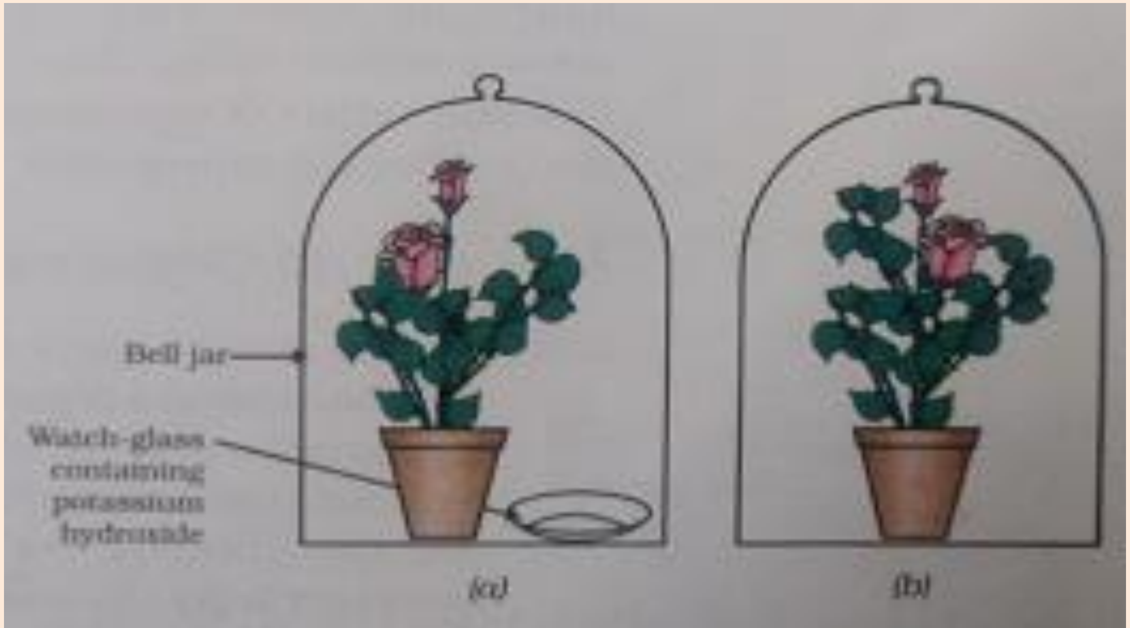


Figure 6.4 *Experimental set-up (a) with potassium hydroxide (b) without potassium hydroxide*

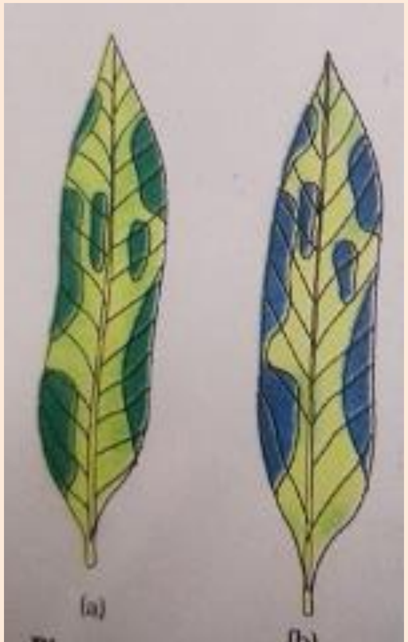


Figure 6.2
Variegated leaf (a) before and (b) after starch test

Progression of concept from Secondary to Higher secondary

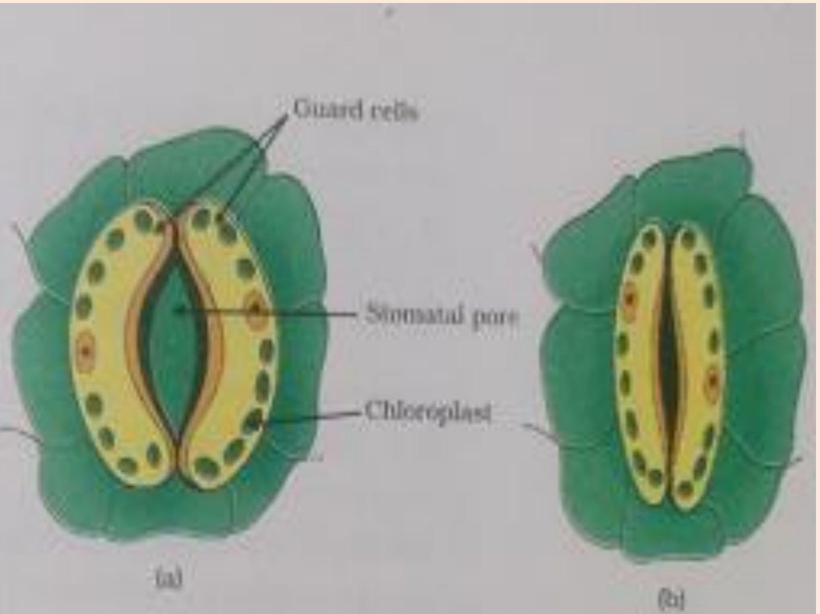


Figure 6.3 *(a) Open and (b) closed stomatal pore*

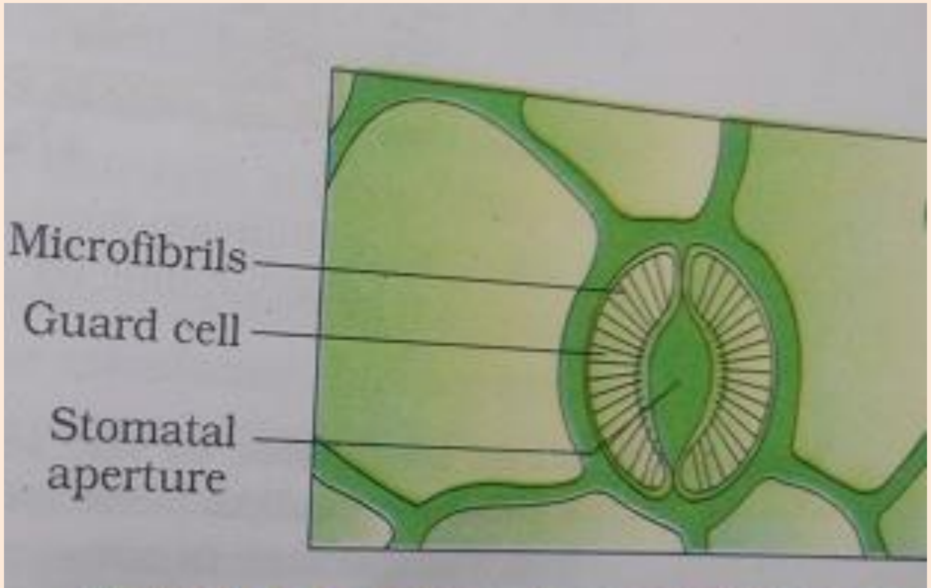


Figure11.8 A stomatal aperture with guard

Continued……

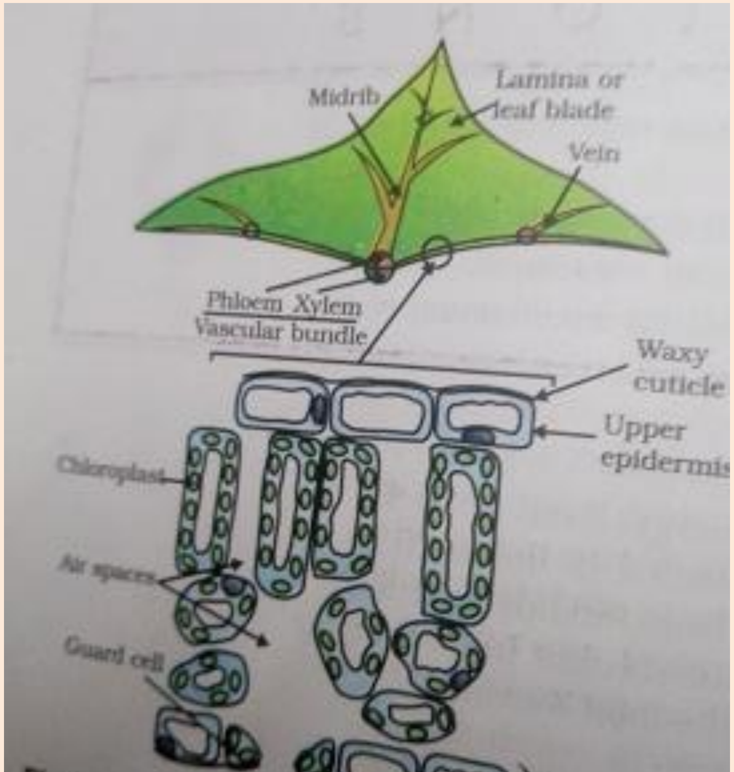


Figure 6.1
Cross section of a leaf

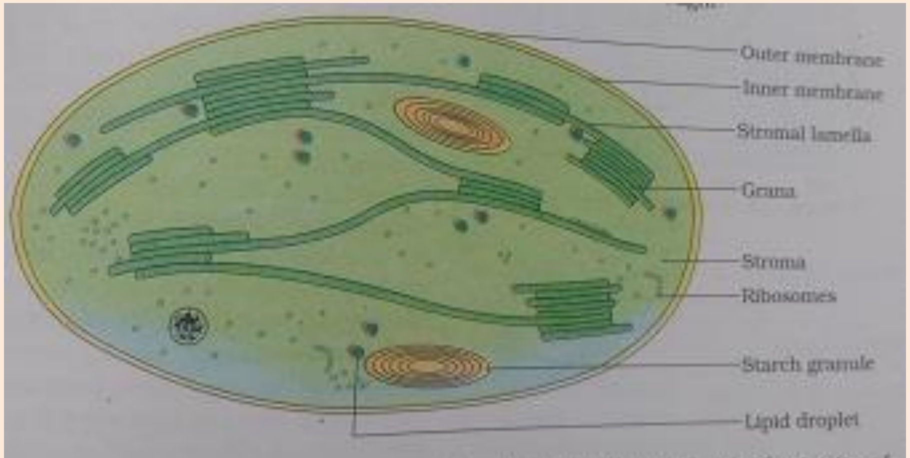
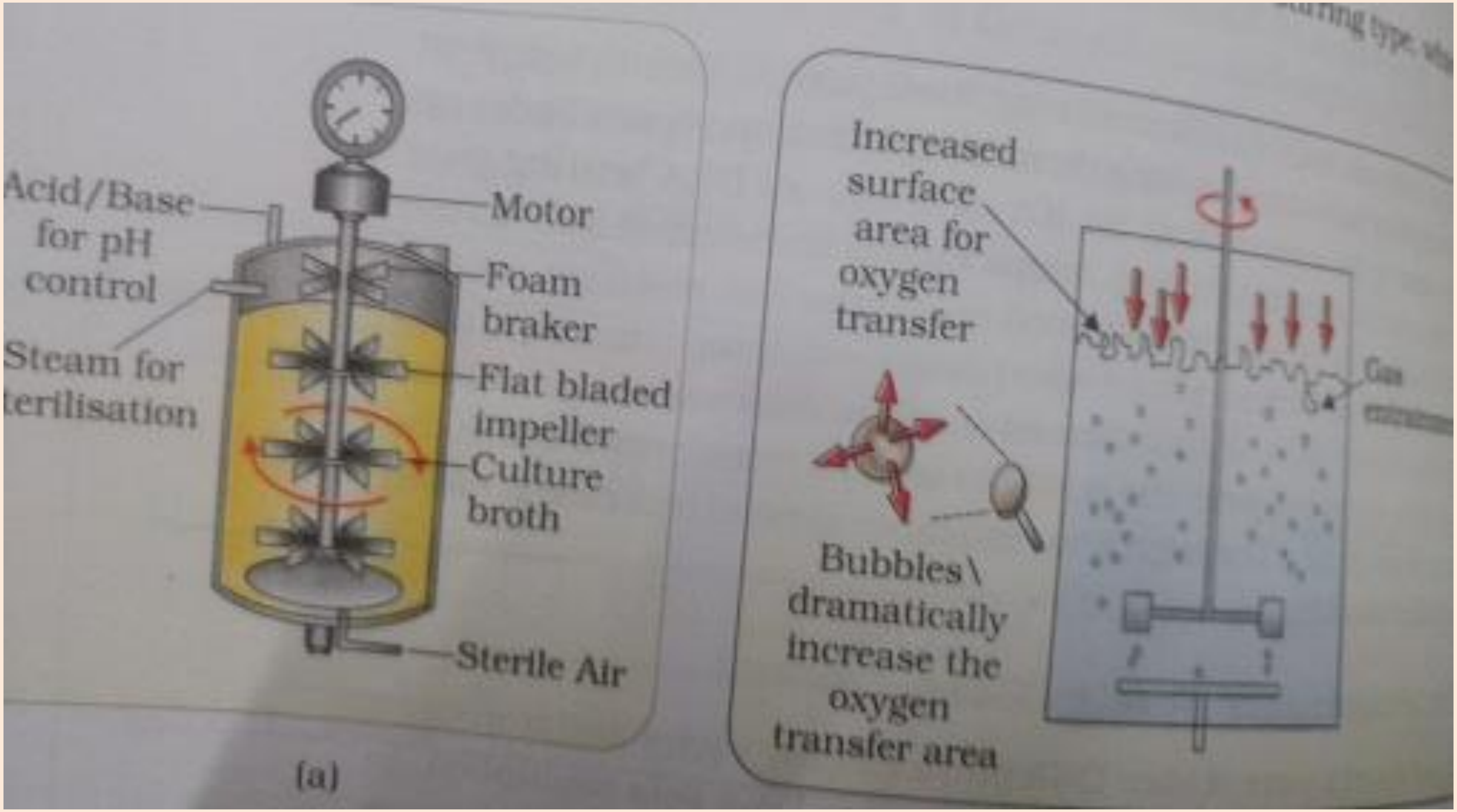


Figure 13.2 Diagrammatic representation of an electron micrograph of a section of chloroplast

Science and Technology



PEDAGOGY

- Role of teacher as facilitator
- Active learner
- Contextualisation

Role of teacher as facilitator

- **In this context, the teacher is a facilitator who encourages learners to reflect, analyse and interpret in the process of knowledge construction.**
- an inclusive and meaningful experience for children, alongwith the effort to move away from a textbook culture
- giving primacy to children's experiences, their voices, and their active participation
- to plan learning in keeping with children's psychological development and interests
- The learning plans therefore must respond to physical, cultural and social preferences within the wide diversity of characteristics and needs

- Our school pedagogic practices, learning tasks, and the texts we create for learners tend to focus on the socialisation of children and on the ‘receptive’ features of children’s learning

Active learner

- **enable children to find their voices, nurture their curiosity—to do things, to ask questions and to pursue investigations, sharing and integrating their experiences with school knowledge**
- Our children need to feel that each one of them, their homes, communities, languages and cultures, are valuable as resources for experience to be analysed and enquired into at school that their diverse capabilities are accepted; that all of them have the ability and the right to learn and to access knowledge and skills; and that adult society regards them as capable of the best.

contextualisation

- A common syllabus (or small variations of it) and common textbooks are certainly not to be expected for the country as a whole. School systems in different states must devise their own curriculum. The larger states particularly need to reflect their diversity in their curricula. Within the broad guidelines of the curriculum framework the syllabi and the textbooks must allow space for contextualizing and variations at the local level for all stages of school education

Supporting material

- Laboratory Manual,
- Exemplar problems for terminal comprehensive evaluation.
- Teacher’s handbook
- digital content and e-learning material.

THANK YOU

- Digital content-e-pathshala audio video programme.
- Science upto class x should be learnt as a composite subject and not as separate disciplines such as physics, chemistry, biology.
- At higher secondary,the requirements of different disciplines of science become important and they need to be learnt in depth and with rigour appropriate at that stage.

SCIENCE CURRICULUM AT DIFFERENT STAGES

- Consistent with the criteria above, the objectives, content, pedagogy and assessment for different stages of the curriculum are summarized below.

- At the primary stage the child should be engaged in joyfully exploring the world around and harmonizing with it. The objectives at this stage are to nurture the curiosity of the child about the world (natural environment, artifacts and people), to have the child engage in exploratory and hands on activities to acquire the basic cognitive and psychomotor skills through observation,
- EXECUTIVE SUMMARY iv classification, inference, etc.; to emphasize design and fabrication, estimation and measurement as a prelude to development of technological and quantitative skills of later stages; and to develop the basic language skills: speaking, reading and writing not only for science but also through science. Science and social science should be integrated as 'Environmental Studies' as at present, with health as an important component. Throughout the primary stage, there should be no formal periodic tests, no awarding of grades or marks, and no detention.

- At the upper primary stage the child should be engaged in learning principles of science through familiar experiences, working with hands to design simple technological units and modules (e.g. designing and making a working model of a windmill to lift weights) and continuing to learn more on environment and health through activities and surveys. Scientific concepts are to be arrived at mainly from activities and experiments. Science content at this stage is not to be regarded as a diluted version of secondary school science. Group activity, discussions with peers and teachers, surveys, organization of data and their display through exhibitions, etc. in schools and neighbourhood are to be an important component of pedagogy. There should be continuous as well as periodic assessment (unit tests, term end tests). The system of 'direct' grades should be adopted. There should be no detention. Every child who attends eight years of school should be eligible to enter Class IX.

- At the higher secondary stage science should be introduced as separate disciplines with emphasis on experiments/technology and problem solving. The current two streams, academic and vocational, being pursued as per NPE 1986 may require a fresh look in the present scenario. The students may be given an option to choose the subjects of their interest freely, though it may not be feasible to offer all the different subjects in every school. The curriculum load should be rationalized to avoid the steep gradient between secondary and higher secondary syllabus. At this stage, core topics of a discipline, taking into account recent advances, should be carefully identified and treated with appropriate rigour and depth. The tendency to superficially cover a large number of topics of the discipline should be avoided.

- First, we must use science curriculum as an instrument of social change to reduce the divide related to economic class, gender, caste, religion and region. We must use the textbook as one of the primary instruments for equity, since for a great majority of school going children, as also for their teachers, it is the only accessible and affordable resource for education. We must encourage alternative textbook writing in the country within the broad guidelines of the national curriculum framework. Information and Communication Technology (ICT) is also an important tool for bridging the social divides. ICT should be used in such a way that it becomes an opportunity equalizer, by providing information, communication and computing resources in remote areas.
- Second, we believe that for any qualitative change from the present situation, science education in India must undergo a paradigm shift. Rote learning should be discouraged. Inquiry skills should be supported and strengthened by language, design and quantitative skills. Schools should give much greater emphasis on co-curricular and extra curricular elements aimed at stimulating investigative ability, inventiveness and creativity, even if these elements are not part of the external examination system. We strongly recommend a massive expansion of non-formal channels (for example, a truly large scale SCIENCE & TECHNOLOGY FAIR with feeder fairs at cluster/ district/state levels) to encourage schools and teachers to implement this paradigm shift.
- Third, we recommend nothing short of declaring examination reform as a National Mission (like other critical missions of the country), supported by funding and high quality human resources that such a mission demands. The mission should bring scientists, technologists, educationists and teachers on a common platform and launch new ways of testing students which would reduce the high level of examination related stress, curb the maddening multiplicity of entrance examinations, and research on ways of testing multiple abilities other than formal scholastic competence.

- In the present scenario, we require an enhanced set of skills that relate to the effective use of computers and communication technology at higher secondary stage (NCF 2005). This can be achieved through a variety of teaching strategies and learning experiences, as these two are the components of an authentic and supportive learning environment. According to Tyler R.W. (1950), “All aspects of the educational program are means to accomplish its goals. So if we are to study an educational program systematically and intelligently we must be sure as to the educational objectives aimed at”. Having worked under Tyler, Bloom (1956) gained deep insights about translating the goals of instruction to concrete general and specific objectives, in cognitive and affective domain.

- The present study has been undertaken with a view of realizing the importance of educational objectives belonging to cognitive and affective domain in computer science education identified by Bloom (1956). Thus it aimed at studying the effect of some positive correlates that promote learning of computer science at higher secondary level such as interest, learning environment and attitude. Very few studies have come to limelight assisting the scholars interested in studying the factors influencing Achievement in Computer Science in Indian context.

In a progressive forward-looking society, science can play a truly liberating role, helping people out of the vicious circle of poverty, ignorance and superstition. In a democratic political framework, the possible aberrations and misuse of science can be checked by the people themselves. Science, tempered with wisdom, is the surest and the only way to human welfare. This conviction provides the basic rationale for science education

POSITION PAPER ON TEACHING OF SCIENCE (p. 2)

- Teacher's Handbook for Class VI
- ScienceQ & A Science and Mathematics in NCF-2005
- Source Book on Assessment for Classes VI-VIII, Science
- Source Book on Assessment for Classes VI-VIII, Mahtematics
- Additional content in Physics based on revised syllabus
- Additional content in Chemistry based on Revised syllabus.
- Additional content in Mahtematics based on Revised syllabus.
- Additional content in Biology based on Revised syllabus.
- Project books on Environmental Education for Classes VI-XII
- Teacher Handbook on Environmental Education for the Higher Secondary Stage
- Four Decades of National Science Exhibition for children.