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## UNIT 9 ASSESSMENT IN SCIENCE

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### 9.1 INTRODUCTION

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When we talk about assessment, we talk about it with a purpose. As a science teacher, you should be agreeing that purpose of assessment in science is to facilitate the learners in developing scientific attitude and acquiring process skills. A science teacher has to plan and execute the assessment as an integrated part of his/her teaching-learning process. Present unit will help you in planning and designing your assessment strategies so that you can assess various aspects of learners' progress and facilitate them accordingly. A teacher has to devise various tools and adopt different techniques for assessment depending upon nature of content, type of skills, level of learner, etc. In means, one can not use similar kind of tool for assessing variety of process skill, for different kind of content and activities. The unit will discuss various tools and techniques, which are being used for assessment in science at secondary level. Unit will not only talk about classroom assessment but also give you an idea about various schemes, which are being used to promote the development of scientific temper and attitude among learners. Unit will also help to design your plan for recording and reporting of learners' progress in science.

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### 9.2 OBJECTIVES

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After going through this unit, you will be able to:

- understand the need of different types of assessment strategies in sciences;

- develop assessment indicators for various process skills;
- design various tools for scholastic assessment in science;
- develop a unit-test as a tool for formative assessment in science;
- justify the need and importance of diagnosis and remediation in science; and
- motivate your learners to participate in various schemes for promoting scientific attitude.

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### **9.3 NATURE OF ASSESSMENT IN SCIENCE**

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Nature of assessment in science is not something entirely different from other subjects but it has certain distinctive characteristics, which have been drawn from the objectives of teaching-learning in science.

#### **Assessment in science promotes scientific enquiry**

When a teacher plans assessment activities in science, its key focus is that it should promote scientific enquiry. Assessment in science should not be based on rote memory. Mere memorization of facts, principles or theories will not serve the purpose of science teaching-learning. If as a teacher, you plan and use such tools and techniques, which involve problem solving, investigation, active thinking and reasoning, your assessment will promote scientific enquiry.

#### **Assessment is linked with cognitive levels of learner**

In unit 5, we have discussed levels of cognitive learning, which are based on Anderson's taxonomy i.e. remembering, understanding, applying, analyzing, evaluating and creating. When as a science teacher, you are planning your assessment strategy, you should keep in mind that your assessment tool should be linked with every level of cognitive learning. You have to identify, decide and plan that which content is related to what level and what should be appropriate tool or technique for its assessment.

#### **Assessment in science is comprehensive in nature**

Comprehensiveness is the key characteristic of assessment in science. A science teacher never assesses only one dimension, rather it assess many dimensions during one assessment. For example, s/he has to assess the comprehension of the concept, its linkages with examples from immediate environment, applications to solve problems, development of values and role of assessment activity in facilitating development of scientific temper. When you plan an assessment activity, you should keep in mind many dimensions.

#### **Assessment in science facilitates development of process skills**

Major role of assessment is not grading or promoting. Its role is facilitating development of scientific process skills. Critical pedagogues also advocate development of process skills among science learners, which is major focal point in present days teaching-learning. Your assessment activities should be in sync with process skills associated with the content.

## 9.4 ASSESSMENT INDICATORS IN SCIENCE

While teaching science, our focus remains on the development of science process skills. When we plan assessment, we have to identify criteria on which any skill is to be assessed. The criterion, on which development of any skill is being assessed, is known as assessment indicators. In documents like the *Source Book on Assessment in Science* (NCERT, 2102), *Formative Assessment Manuals for Teachers (IX-X)*, (CBSE, 2010, 2016) various learning indicators have been suggested to assess various science process skills. We suggest you to go through these documents to arrive at a deeper understanding of assessment in science. In order to understand various skills to be developed and assessed, let us discuss some learning indicators associated with various skills, which form the basis for assessment in science.

Skills	Indicators	Examples
Observation	Children observe critical characteristics of a thing, an event or a phenomenon. Can differentiate between two similar things based on their observation.	Different shapes of Leaves Parts of a flower Shadow of an object, etc.
Enquiry	Children ask questions starting with why, when, how and what about various phenomenon, things, etc., which they observe.	Why does the Sun rise in morning? Why are the stars twinkling at night? How do snakes move?
Experimentation	They are able to perform experiments systematically under guidance. They follow the correct procedure during the experiment. They handle equipment with care.	Test of starch or protein in food Conduction of water through stem in plants. Measuring length of an object with a scale. Experimenting with electric circuit.
Classification	Children are able to identify similarities in two objects / phenomenon. They are able to point out the differences. They are able to group certain objects on the basis of any similar characteristic.	Similarities in common salt and sand. Difference when they are being dissolved in water. Enlisting of wild animals into herbivore and carnivore animals.
Planning	Children are able to list the different steps of an experiment, enquiry or observation. They are able to define their role in a group activity.	Role of different children during the visit to a garden, pond or a zoo.
Organization	Children can organize group activities on their own. Children cooperate in group performance.	Suggestion of activities related to their life experience. Assigning individual tasks in a group activity on the visit to a zoo.

	They are able to manage the activity in the desired manner.	
Collection and Presentation of data	Children are able to collect relevant data with precision.	Collection of pictures of wild animals, edible things, sources of protein, etc. Presentation of collected materials according to classification.
Recording of data	They record information in suitable forms, gathered through observation during visits, experimentation, demonstration, etc.	Record of the heights of classmates Record of the change in temperature. Record of the amount and the time taken by the solvent to dissolve.
Reporting	Children are able to narrate an event or process orally or through writing. Children are able to deliver the information in the desired manner.	Writing the description of a table or a graph on increasing cost of fuels. Explaining the pictures of handicrafts of different States on basis of logic, relevance and importance.
Communication skills	Children are able to express their views in clear words. Children respond and reflect on others' views after listening to them carefully. Children participate in activities like debates, elocution with comfort and confidence. Children argue with logical facts. Children are eager to respond and participate in discussions frequently.	Giving description of components of food in their afternoon meal. Participation in debates on topics like 'Importance of Nutrients in Food'. Communication of observations during an experiment.
Explanation skill	Children communicate their life experiences and events happening around them in relation to the content being explained. Children are able to explain any incident or situation in their own words.	Explanation of variety of flowers in their garden. Explanation of possible causes of sudden thunderstorm last night.
Conclusion/ Inferences	Children are able to draw inferences from the observation/ experimentation. They use logical arguments to justify their results. They are ready to argue on the results of the experiment using their ideas or in their own words.	Comparison of lengths of objects while measuring through a scale. Reflection of light through mirrors and image formation. Identification of conductors and insulators on the basis of their observation and experimentation.
Analyzing/ applications from daily life	Children are able to correlate their life experiences with the knowledge generated.	Giving examples of hot days and colder nights during discussion on radiation

experiences	Children give examples from their experiences in everyday lives. They understand the logic/principle/theory behind any incident or event.	Examples of various means of separation of substances. Explaining the causes of sweating and high rate of breathing after long walks or running.
Values/attitudes/ Concerns	Children are able to correlate their scientific knowledge with environmental concerns. They participate in events on pollution, wastage, conservation, etc. Children believe in group tasks and respect and value the contribution of others in the group. They believe in their own and others' capabilities and are aware of their limitations. They are ready to help others in the group during group tasks to overcome their limitations. They are comfortable in seeking help from the others in the groups.	They cite examples of air pollution due to vehicles and the role of factories in river pollution. Enthusiastically participate in awareness campaigns on various environmental concerns. Generate new slogans and make attractive placards. Take help of group members during any group activity. Help other group members in recording, performing or completing any task.

Source: BES-019, IGNOU, 2013

**Table 9.1: Science Process Skills and their Assessment indicators**

The discussion in above table clarifies that every skills has a different set of indicators. Without identifying and planning right kind of indicator, it is very difficult for a science teacher to plan the assessment strategy or to identify a tool.

<b>ACTIVITY 1</b>		
Select a topic from Science textbook of class IX or X, make a table in following manner:		
<b>Topic/sub-topic</b>	<b>Process Skill to be developed</b>	<b>Assessment indicators</b>

**Check Your Progress**

**Notes:** a) Write your answers in the space given below.  
 b) Compare your answers with those given at the end of the unit.

1) Why is it important to identify the assessment indicators in science?  
 .....  
 .....  
 .....  
 .....  
 .....

**9.5 TOOLS AND TECHNIQUES FOR ASSESSMENT**

With the introduction of Continuous Comprehensive Evaluation (CCE), assessment has changed a lot in schools. There is a fundamental shift from testing to learning as assessment is perceived as integral part of teaching-learning process. This shift has also brought a shift in traditional ways (tools and techniques) of assessment. Tasks like Role Plays, Crossword Puzzle, Flow Charts, Popular Science, Book Review, Field Trips, Class Work/Home Work Assignments, Group Work, Survey, Project Work, Worksheets, Games, etc. became tools for assessment. Let us discuss some tools and techniques, which can be used by you in your science classroom.

**9.5.1 Tools for Scholastic Assessment in Science**

Under the domain of scholastics assessment, formative and summative assessments are two dimensions. Formative assessment is used by the teacher in the classroom to monitor the progress of learners and to provide them appropriate support for enhancing their learning. Summative assessment is generally carried out at the end to assess how much learner has learnt. We can say, focus of formative assessment is more on ‘assessment for learning’ whereas focus of summative assessment is more on ‘assessment of learning’.

Following tools and techniques have been suggested for scholastic assessment as secondary level in science.

**Scholastic Assessment**

<b>Formative Assessment (Flexible Timing)</b>		<b>Summative Assessment (Written-End of term)</b>
<b>Tools</b>	<b>Techniques</b>	
Objective type	Tests	Objective type
Short Answer	Assignments	Short Answer
Long Answers	Quizzes and Competitions	Long Answers
Questions	Projects	
Observation schedule	Debates	
Interview schedule	Elocution	

Checklist	Group discussions	
Rating scale	Club activities	
Anecdotal records		
Document Analysis		
Tests and inventories		
Portfolio analysis		

**Table 9.2: Tools and Techniques for Scholastic Assessment**

When we talk about scholastic assessment in science, we should keep in mind that nature of content, process skills and objectives are the key determinants of the tool to be used for assessment.

It is being suggested by CBSE (2010), that in Science tools like Experiments, Information gathering and deducing, Presentations on science concepts/experiments, Investigations for stated problems, MCQs and Science Quiz, Simple and interesting assignments, Group assignments and projects, Model Making, Science symposium/seminar, Preparation of various compounds/salts, explanation of different natural phenomenon using scientific principles should be used for assessment. It is also suggested that for science, at least one out of four formative assessments in the year are experiments.

Here we are taking few examples of tools and techniques, which have been suggested in various manuals published by NCERT and CBSE, for assessment in science. These examples will help you understand the comprehensiveness of assessment as well as facilitate to choose and design your assessment strategy accordingly.

#### **A) DEBATE**

Debate can be used for scholastic as well as co-scholastic assessment. Debate provides an opportunity to children to communicate their view point about any issue with logical arguments. The objective of debate should not be to highlight the negative aspects only or to criticize, but to provide an opportunity of balanced evaluation by highlighting both dimensions of the issue/topic.

Debates are a useful tool for development of a collaborative and cooperative learning environment as well as for motivating children to search, collect, arrange, share and discuss new information related to any issue being debated. In Science, you can use debate for various topics like balanced diet and deficiency diseases, wastage and conservation of water, industrial growth vs. pollution, effect of deforestation on wildlife, etc.

Debates provide an opportunity for healthy competition among children. Children also learn and sharpen their skills to evaluate the problem/issue with two different sets of opinions. Their higher order thinking skills, communication skills, critical analysis improve through such activities.

Let us explain the steps you can adapt to plan using debate as a learning and assessment tool in your class.

**1) Selection of a Topic: “Wastewater Management: Role of an Individual”**

- After selection of a topic, give a justification about its need and explain its importance as a topic for debate to children. This will develop readiness among the children.

**2) Specifying the topic for discussion**

- The selected topic may have many subthemes. You can ask them to identify few sub themes/topics. Some of the topics may be, wastage of water at home, in industries, in construction work, in irrigation, etc. Methods of wastewater management, e.g., household measures, rainwater harvesting, modern irrigation techniques, holding rainwater in big ponds/dams, sewage treatment of contaminated water, etc.

**3) Assigning the role**

- Ask children to choose a sub-theme or a topic of their interest. This can be done in a group of 2-3 or individually.
- Assign the roles in management and execution of the debate like, anchoring of the event, collection of score sheets from judges, time management, etc. such practices will help in developing event management skills in children.

**4) Pre-debate preparation**

At this stage, ask children to go through the relevant material for collecting information and provide them guidance in organizing of their presentation.

**5) Expected Learning Outcomes**

You are advised to plan some expected learning outcomes, which will be the base for assessment, e.g., Children will be able to

- Comprehend various causes of wastage of water,
- Link their day-to-day experiences and observations about wastage of water,
- Collect relevant information from various sources and compile them in a s regarding the topological sequence
- Communicate logically their view point.

**6) Assessment Table**

You should develop an assessment table for the event to ensure comprehensiveness and objectivity in assessment. One such table is given below as an example.



Sl No.	Indicator of Learning	Activity specific Indicator	Assessment
1	Planning for the Debate	<ul style="list-style-type: none"> <li>• Selection of specific roles in organizing the debate by children</li> <li>• Choosing the sub-theme</li> <li>• Assigning/choosing specific task in a group dealing with a particular sub-theme</li> </ul>	<p>Willingness to participate in the organization of the event</p> <p>Selection of relevant sub-themes</p> <p>Assigning responsibilities to all members of the group with their consent</p>
2	Organization of facts/ information	<ul style="list-style-type: none"> <li>• Selection of the source of information</li> <li>• Collection of relevant information from various sources</li> <li>• Logical arrangement of sub-themes</li> <li>• Sequencing of the information to be presented</li> </ul>	<p>Knowledge of relevant resources</p> <p>Selection and screening of relevant information</p> <p>Decision about sequencing of sub-themes</p> <p>Linking the previous sub-theme and next subtheme</p>
3	Presentation of data	<ul style="list-style-type: none"> <li>• Introduction of the sub-theme</li> <li>• Rationale of discussion</li> <li>• Issues/aspects raised</li> <li>• Logical sequencing in presentation</li> <li>• Supportive data/facts to justify the logic</li> </ul>	<p>Relevant background of the subtheme</p> <p>Linkage of issues with sub-theme</p> <p>Contextualization of the issue</p> <p>New information, which is not commonly known to all</p>
4	Communication skill	<ul style="list-style-type: none"> <li>• Expression of views</li> <li>• Confidence and clarity of thoughts</li> <li>• Acceptance of other's view point</li> <li>• Describing important details</li> </ul>	<p>Use of vocabulary and command over language</p> <p>Confidence and logic</p> <p>Considering and countering other's view point during deliberation</p> <p>Including all finer details</p>
5	Linkage with daily life	<ul style="list-style-type: none"> <li>• Citing examples from their day-to-day lives</li> <li>• Giving solutions from their everyday observations routine</li> <li>• Giving examples on the basis of their life experiences or observations</li> </ul>	<p>Examples from household wastage of water like in kitchen, garden, washing the road, etc.</p> <p>Small initiative to taken care at home</p> <p>Examples from wastage or conservation at large scale, if they have observed anywhere</p>
6	Values/ attitude	<ul style="list-style-type: none"> <li>• Respect other view points</li> <li>• Cooperating in group dealing with a particular sub-theme</li> <li>• Cooperating in organizing the event</li> <li>• Showing a responsible attitude towards the tasks chosen</li> <li>• Avoiding wastage of material</li> <li>• Showing concern for the issue</li> <li>• Sensitivity towards the issue being debated.</li> </ul>	<p>To what extent have other views been considered</p> <p>The degree of cooperation among all children</p> <p>Concentration and effectiveness of task chosen by children in organizing of the event</p> <p>Cooperating with others in group for providing supportive data and encouragement</p>

## B) ROLE PLAY

*(Following Example has been taken from CBSE Formative Assessment Manual, Class IX)*

**Objectives:** To enable the learners to:

- get familiarized with the states of matter,
- compare the properties of the three states of matter at the particle level, and
- visualise the effect of heat and pressure on the states of matter.

**Task: Groups of five**

**Approximate Time:** 3-5 minutes to every group

**Procedure:**

The teacher may:

- Make three groups of five learners (so fifteen learners would be involved in this activity, rest of the learners will observe, do peer assessment and get involved in other role plays during the academic year)
- Assign each team a task to act like the 'state of matter' assigned to them. The use of verbal mode, bodily kinesthetic mode and props is on the discretion of the group.
- Guide them as to depict the—
  - a) Inter-particle distances
  - b) Inter-particle forces of attraction
  - c) Kinetic energy possessed by the particles.
  - d) Effect of heat and pressure on the state.

**Assessment parameters:**

One mark for each of the following indicators:

- 1) Does the child understand the task given?  
*Yes /No*
- 2) Is the child able to work in a team? *Yes /No*
- 3) Is the child inquisitive about different phenomena? *Yes /No*
- 4) Can the child think logically and rationally? *Yes /No*
- 5) Is the child able to apply theoretical knowledge in practical situation? *Yes /No*
- 6) Does the child have good understanding of the following concepts? *Yes /No*

(1 mark for each of the following)

- Inter-particle distance
- Inter-particle forces of attraction
- Kinetic energy possessed by the particles
- Effect of heat on state of matter
- Effect of pressure on state of matter

**Total marks: 10**

**Suggestive Remediation:**

- A few learners may find it difficult to understand the correspondence between observing themselves as particles and the particles of matter. The teacher may explain it to them.
- Since it is an exercise for promotion of self-learning, encouragement may be given to those who take more time to understand and are shy of performing.

**C) DEMONSTRATION BASED WORKSHEET**

*(Following Example has been taken from CBSE Formative Assessment Manual, Class IX)*

**Chapter-9: Force & Laws of Motion**

**Objectives:** To enable the learners to:

- get into the habit of ‘careful observation’,
- state their observations,
- draw conclusions based on their observations, and
- arrive at a ‘general result’ based on their observations and conclusions.

**Procedure:**

- Arrange a card board/plyboard at some angle to the ground to a place where a longstretch of floor is ‘clear’.
- Make provision for holding the board in its inclined position and for adjusting its angle of inclination.
- Make provision for fixing two different surfaces – One smooth and one rough – on the board.
- Have two different balls – say a smooth rubber ball and a used cricket/tennis ball.
- Let each ball roll down, from each of the two surfaces, for a given angle of inclination.
- Measure the distance (from the lower edge of the inclined surface) the balls travel on the floor before coming to rest.
- Write the results of your observations on the black board or notebook.

**Assessment parameters:**

1 mark for the three correct answers.

1 mark for a ‘tabular presentation’ of the observations.

1 mark for ‘conclusion’ arrived at.

**Learner Worksheet****Instructions:**

Observe the ‘demonstration’ and the data written on the black board carefully and answer the following questions:

- 1) In each case, is the distance moved by the cricket ball less/more than that moved by the rubber ball?
- 2) For which of the two surfaces does the rubber ball travel a longer distance?
- 3) Why do the balls come to rest after travelling different distances?

- 4) Write the written results of the demonstration in a 'tabular form'.
- 5) State your 'general conclusion', if any, based on your observations.

**Suggestive Remediation:**

- Make the learners understand the role of friction in bringing the balls to rest.
- Explain why the force of friction is different for different surfaces in contact.
- Help the learners understand how 'observations' and 'data' can be used to arrive at some 'general conclusion.'

**D) INDIVIDUAL WORKSHEET (FLOW-CHART BASED)**

*(Following Example has been taken from CBSE Formative Assessment Manual, Class IX)*

**Objectives:** To enable the learners to:

- learn the common methods of transmission of diseases,
- identify the various modes by which a disease may spread from an infected person to a healthy person, and
- understand how some diseases may be prevented

**Task: Individual Work**

**Approximate Time:** 20 Minutes

**Feedback and Follow-up:**

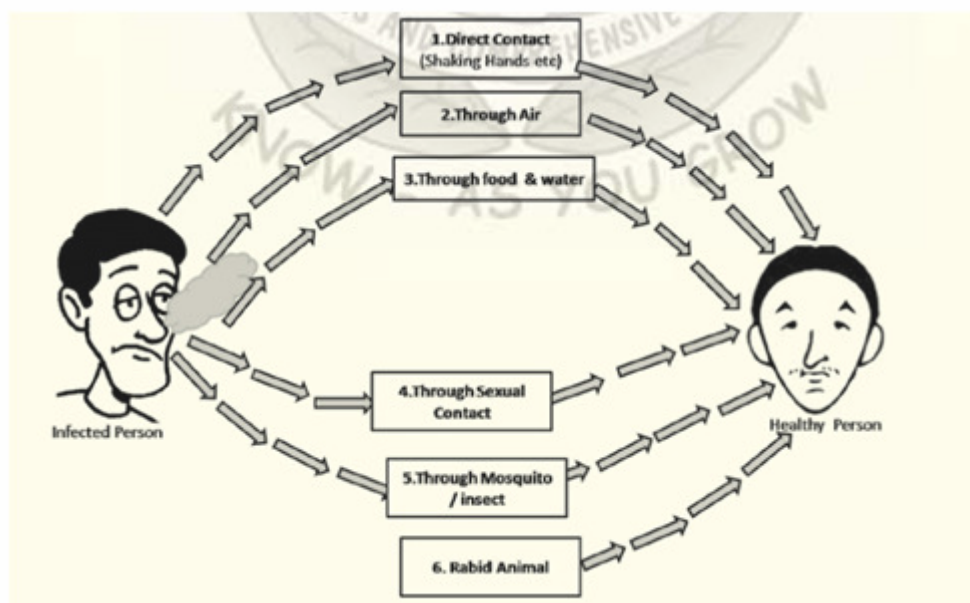
- 1) The worksheet with a **Flow chart of Common methods of Transmission of Diseases** is given to the learners.
- 2) The learner answers the questions after observing the Flow chart.

**Learner Worksheet**

**Time:** 20 minutes

**Instructions:** Given below is a **Flow chart of Common methods of Transmission of Diseases**. Six modes of transmission of diseases have been mentioned and numbered. Answer the questions given below after observing the flow chart.

**Common methods of Transmission of Diseases**



Answer the following questions:

- 1) Name one disease spread by mode -1.
- 2) How can you protect yourself from this disease?
- 3) How could a person transmit disease causing organisms through air?
- 4) Name a bacterial disease spread by mode-3.
- 5) Name a disease that may be spread by a rabid animal.
- 6) Name a disease that can be spread by animals.
- 7) Name one disease spread by mode-4.
- 8) How can mosquitoes spread a disease from an infected person to a healthy person?
- 9) Name a disease spread by mosquitoes. (other than malaria)
- 10) Can you protect yourself from diseases that are transmitted through air?

**Criteria for Assessment:** Marks for each correct answer =  $\frac{1}{2}$ ,

Total Marks:  $\frac{1}{2} \times 10 = 5$

**Suggestive Remediation:**

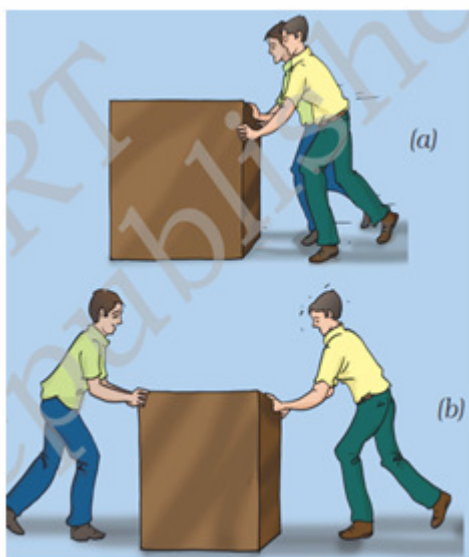
- A few learners may not be able to answer the questions. The teacher may explain the topic again or provide pictures that can be used as hints, for learners.
- If the number of learners who have not answered the questions is more, then the worksheet may be modified by adding more pictures and situations.

**E) ACTIVITIES**

In science, pedagogy is experiential in nature. A number of activities have been suggested in science text books. Many times teachers got confused about teaching learning and they misconceived the textbooks as activity books only. Activities are the tool of learning as well as assessment for scientific process skills. These activities may be individual activities or group activities. Let us discuss one example.

Choose a heavy object like a table or a box, which children can move by pushing hard. Ask them to try to push it all by themselves. Can any of them move it individually? Now ask one another child to help him in pushing it in the same direction [Fig. 9.1]. Is it easier to move it now? Ask them to explain why?

Next ask them to push the same object, but ask one child to push it from the opposite side [Fig. 9.1]. Does the object move? If it does, ask them to note the direction in which it moves. Can they guess which one of them is applying a larger force?



**Fig. 9.1:** Two friends pushing a heavy load (a) in the same direction, (b) in opposite direction.

Adopted from NCERT TEXTBOOK of Science, Class VIII

In the above activity, you have to plan what kind of learning indicators you will use to assess various scientific process skills.

First you have to identify the skills to assessed, activity associated with those skills and check list/or assessment indicator of that particular skill. You have to develop an assessment table for that activity which will help you in assessing the child's performance and learning electively. Going back to the above example, you can develop a table of the following type.

Sl No.	Skill	Specific learning Indicator	Assessment of Learner
1	Observation	Observing the size of box Discussion on the possibility of moving it by one learner	Initiatives taken (Yes/No) Hypothesis formation
2	Planning	Who will move first? Who will be the second child to help? From which direction the force will be applied?	Willingness to participate in activity (Yes/No) Identification of proper direction to apply force (precision and estimation)
3	Reporting	How will the process be narrated to the whole class? Who will narrate?	Are they communicating in simple language )Yes/No) Is the narration understandable (Yes/No) All the important facts/ events part of narration (Yes/No)
4	Communication/ Explanation	Why can a single person not move the box? Why did two children move it? What happens when force was applied from opposite directions?	Is the explanation is satisfactory? (Yes/No) Are they using logic to explain it? (Yes/No)
5	Conclusion/ Inference	Forces applied on an object in the same direction add to one another. If two forces act in the opposite directions on an object, the net force acting on it is the difference between the two forces. The net force on an object is zero if the two forces acting on it in opposite directions are equal.	Are they able to arrive at a conclusion? (Yes/No) Are their conclusions complete? (Yes/No) Is anyone giving extra explanation? (Yes/No)
6	Application	a game of tug-of war Fixing a lamp-post on roadside and using ropes to keep it straight Tugging of tent ropes	Examples are given by children (Yes/No) Examples are explained by Children (Yes/No)

On a similar pattern, you can develop an assessment table for any individual or group activity which will help you to assess the children's learning during the activity and you can use it further for grading in formative assessment too.

These are few examples of tools and techniques, which can be used for assessment. Other tools are also equally important.

You are advised to go through the NCERT Source Book on Assessment for Class VI-VIII Science, and Teachers' Manual on Formative Assessment, Science Class IX-X, published by CBSE.

## 9.5.2 Unit Test Development in Science

### Unit test

Mr. Mohan, a science teacher, taught a topic "Fun with Magnet" to learners of class VI. During the teaching-learning process, he introduced the concept of magnet with the help of examples of Crain, door of refrigerator etc. He explained magnetite ore and discussed various types of magnet. He performed some activities to differentiate between magnetic and non-magnetic substances. He explained properties of magnet and its use in daily life like finding directions. After completion of his teaching in 3 periods, he planned to assess the understanding of his learners about magnet.

Let us see what he did.

He prepared a question paper comprising of fill in the blanks questions, short answer type questions, true false type questions, one word answer type questions and distributed among the learners of his class without any prior announcement about it. He asked learners to attempt all these questions during his class.

### An Example of a Unit Test

<b>Class VI</b>	<b>Subject: SCIENCE</b>	<b>Max. Marks: 20</b>
<b>FUN WITH MAGNETS</b>		
<b>Note: Attempt all the questions.</b>		
<b>I) Fill in the blanks:</b>		<b>(1 × 5 = 5 marks)</b>
1) A freely suspended _____ always points to the north-south direction.		
2) Similar poles of two magnets always _____ each other.		
3) A magnetic _____ is used for finding geographic direction.		
4) A material which attracts pieces of iron or steel is called _____.		
5) _____ is the world's first magnet.		
<b>II) Write true or false against the statements given below: (1 × 4 = 4 marks)</b>		
1) Bar magnet is more powerful than natural magnet.		
2) Magnetic attraction is maximum in the middle of a bar magnet.		

- 3) Magnetic Compass is used for finding magnetic directions.
- 4) A magnet can separate iron nails from a mixture of iron filings and iron nails.

**III) Name the following: (1 × 5 = 5 marks)**

- 1) Name the substances from which artificial magnets are made.
- 2) Name the method to magnetize a piece of iron.
- 3) Force felt when two unlike poles of magnet are brought closer to each other
- 4) Magnet that retains magnetism for short period of time
- 5) Name given to U shaped magnet

**IV) Answer the following questions: (2 × 3 = 6 marks)**

- 1) Distinguish between magnetic and non-magnetic substances.
- 2) What would happen to a pole of magnet if we go on breaking it into pieces?
- 3) Write any four uses of magnet?

He collected the answer sheets after learners had completed their answers. He evaluated their answer sheets and came to know that most learners had answered his questions but there were a few questions which were answered wrongly by many learners. He realized that he had to re-teach those concepts which were not clear to all learners before moving on to the next topic.

What is this exercise? This is called **Unit test**.

Unit test is the simplest way to assess learners' progress in subject areas. Teachers generally take an oral test or a written test of 10-20 marks as unit test just after completion of a unit. In most schools, unit test is used to assess the progress made by learners in a particular content. It also plays an important role of diagnostic testing, to some extent.

In CCE, unit testing has become the formal part of total evaluation process, and due credit is given to it in the whole evaluation scheme. This initiative will increase the effectiveness and utility of unit testing in the whole evaluation process. Moreover, learners will also take it seriously.

Unit test should be based on learning objectives formulated for the unit. A teacher can use short answer type questions, one word answer type questions or objective type questions to evaluate the learners' progress in a unit.

**Activity 2**

Select a unit from Science textbook of Class IX or X. Prepare a unit test of twenty marks based on learning objectives of the unit.



**Check Your Progress**

**Note:** a) Write your answers in the space given below.  
 b) Compare your answers with those given at the end of the unit.

2) Why is it important to use variety of assessment tools for scholastics assessment in science?

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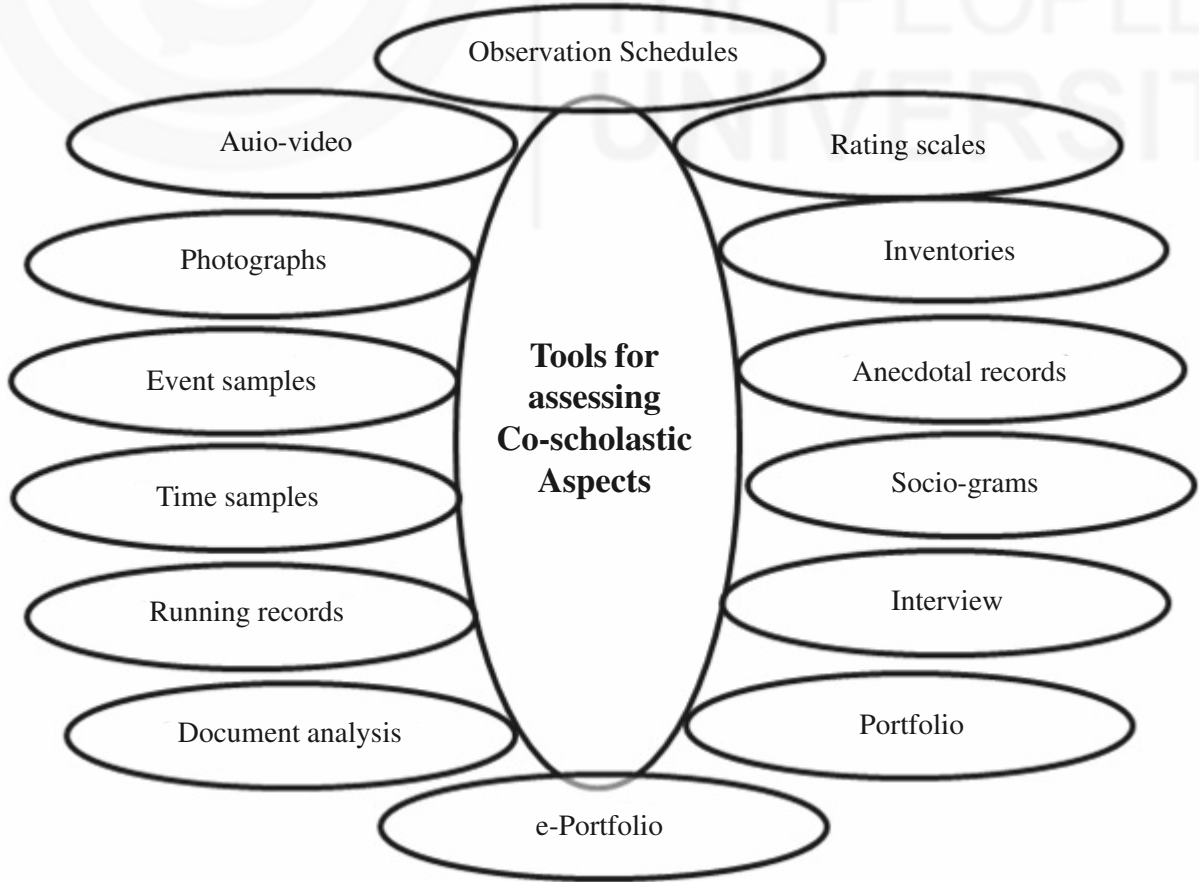
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**9.5.3 Tools for Co-scholastic Assessment in Science**

In previous section, we have discussed about various tools and techniques which you can use for assessing scholastic aspects of learner’s achievement. There are various tools and techniques, which can be used for assessing co-scholastic aspects.



**Fig.11.10: Tools for Assessing Co-Scholastic Aspects**

Now, we will discuss some tools, which can help you in assessment of co-scholastic aspects with objectivity.

### A) OBSERVATION SCHEDULE

Observation is one of the most frequently used ways to gather information and get a picture of what's happening in your school or classroom. You can also use it to assess learners' performance in various co-curricular activities. Systematic classroom observation is a quantitative method of measuring classroom behaviours. Information about a child (his/her behaviour) can be collected in and outside the class through observation. Observation can be used as a tool of assessment in a variety of situations like debates, elocution, group work, practical and laboratory activities, projects, play fields and school prayers, clubs and festivals. Observation can be biased and subjective. However, such errors and risks can be substantially reduced by using an observation schedule.

Observation schedule is used to collect information systematically and with objectivity. Here is one example of using observation schedule for debate competition.

**Table.9.5: An example of an Observation Schedule**

Sl.No.	Descriptors	Score out of 5
1	Depth of knowledge of the content	
2	Strength of the argument to conceive	
3	Fluency, diction and pronunciation	
4	Ability to contradict a given point of view	
5	Respectful to the opponent	
6	Ability to take criticism positively	
7	Body language while arguing	

\*Source: CBSE Manual (2010)

#### Activity 3

Prepare an observation schedule for assessing learners' performance in group discussion.

### B) RATING SCALE

Rating scale is a technique, through which an assessor categorizes the objects, events or persons on a scale, represented by a series of continuous numerals or letters. This technique is a subjective method. Rating is basically a term applied to an expression of opinion or judgment regarding some situation, object, character or an attribute. Rating scale refers to a scale with a set of points which describe varying degrees of dimension of an attribute being observed. In a typical numerical scale, a sequence of definite numbers is supplied to the rater or to the observer. The observer assigns, to each stimulus to be rated, an appropriate number corresponding to those definitions or descriptions. In a rating scale, you can use *three points, five points, seven points* or *nine points* scale. In a three point scale, you can have rating of 3 for most pleasant; rating of 2 for indifferent and a rating of 1 for most unpleasant.

It is always useful to have an odd number of points in a scale like 3, 5 and 7, so that there could be a middle (neutral) one, a favorable one and an unfavourable one. Numerical rating scales are the easiest to construct and to apply. They are also the simplest in terms of handling the results.

### An Example of a Rating Scale

Task Criteria	Ratings			
	Exceeds Goals	Meets Goals	Approaches Goal	Goal Not Yet Met
1) Correctly state the problem and identify the information needed to solve it and the steps needed to arrive at a solution.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) Produce reasonable estimates of data values not identified but needed for the solution.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) Apply concepts and formulas related to motion (velocity, acceleration, average speed).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) Make accurate conversions as needed to solve the problem.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5) Communicate conclusions clearly, using examples as needed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Source:** Adapted from Davery & Rindone (1990). "Anatomy of a Performance Task." Presented at the American Educational Research Association meeting, Boston, MA., from materials developed by the Bureau of Evaluation and Student Assessment, Connecticut State Department of Education.

### C) INVENTORIES

Inventories are used to assess personality of learners. An inventory is constructed in the form of a questionnaire. It consists of a series of questions or statements to which the subjects respond by answering 'Yes' or 'No', 'agree' or 'disagree'. While preparing an inventory, you have to keep in your mind that the statements are put in the first person i.e. "I think I am more anxious about the examination than others". That's why, sometimes, inventories are also termed as self-reporting tools. Inventories are used for measuring personality traits, interests, values, adjustment etc.

Here is an example of an inventory to assess interpersonal skills of learners.

**Table.9.6: An Example of an Inventory**

Read the following statements carefully and mark tick (√) in appropriate box.

S.No.	Statement	Yes	No
1	I shake hands if other person offers.		
2	I can identify relationships that may be hurtful or dangerous.		
3	I can identify my personal strengths and needs.		
4	I make arrangements with peers for social activities.		

5	I know who can help me when I am unable to resolve interpersonal conflicts alone.		
6	I can find out the relationship between actions and consequences.		
7	I can develop and carry out a personal plan for achievement of goal without supervision.		
8	I can close a relationship or say “good bye” in a healthy manner.		

**Activity 3**  
**Prepare an inventory for identifying learners’ areas of interests.**

**D) ANECDOTAL RECORDS**

Anecdotal records are informal observational notes in the form of a story. A teacher records what learners are learning, their academic performance, learning behaviour, their achievements and social interaction.

Though it is an informal note but with its help, you can keep a record of each and every learner of your class in a comprehensive manner. While taking the note, you have to ensure that you only record what you observe and hear without any interpretation. For example, while preparing an anecdotal note on reading habit of your learners, you can consider many issues like:

- Does a learner show a positive attitude towards reading books?
- Does a learner choose his/her favourite books?
- Does a learner read books for pleasure/information?
- Does a learner read them silently?
- Does a learner reflect on his/her reading?
- Does a learner share his/her ideas with others during literature discussions?

Anecdotal records are the **written observations** – word for word, action for action – of exactly what a child is doing and saying. You can use these notes to create a complete developmental picture of young children.

Anecdotal notes should be used to record the day-to-day development of learners, as well as their specific behaviours, especially those that are a cause for concern, speech patterns, language development, social/emotional development, peer interactions, etc.

Here is one sample anecdotal record form.

**Table.9.7: An Example of an Anecdotal Record**

<p><b>XYZ PUBLIC SCHOOL, NEW DELHI</b>  <b>ANECDOTAL RECORDING FORM</b></p>	
<p><b>Observer:</b> .....</p>	<p><b>Observation date:</b> .....</p>
<p><b>Learner name:</b> .....</p>	<p><b>Observation time:</b> .....</p>
<p><b>Description of the incident:</b></p> <p>.....</p> <p>.....</p> <p>.....</p>	
<p><b>Description of the location/settings:</b></p> <p>.....</p> <p>.....</p>	
<p><b>Recommendations/Action:</b></p> <p>.....</p> <p>.....</p> <p>.....</p>	
<p><b>Signature</b></p>	

**E) PORTFOLIO**

It is the collection of evidences of learners’ works over a period of time. It could be day-to-day works or selection of learner’s best piece of work. Painters and commercial artists often use portfolios to demonstrate their skills and quality work before the selection committees. Portfolios encourage teachers and schools to focus on important learner outcomes, provide parents and the community with credible evidence of learner achievement. Portfolio provides a cumulative record of growth and development of a skill or competence in an area over a period of time. It also enables a learner to demonstrate to others, his/her learning and progress. Care should be taken that only selected works having specific purpose need to be put into the portfolio.

**Portfolio can include:**

- **Photographs:** Provides an insight into child’s emotional, social and psychological development
- **Paintings and other examples of artistic endeavor:** Provides evidences of a learner’s abilities, thoughts and attitudes
- **Audio-Video Recordings:** Important processes and events that can be recorded and analyzed later
- **Self Assessment Sheets:** Provides evidence of learner’s self-evaluation
- **Peer Assessment Sheets:** Excellent for assessing team based activities, social projects and peer related behaviour.
- **Parent Assessment Sheets:** Provides evidences of evaluation carried out by the parents.

**Check Your Progress**

**Notes:** a) Write your answers in the space given below.  
b) Compare your answers with those given at the end of the unit.

3) Why is co-scholastics assessment essential in Science?

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### 9.6 DIAGNOSTICS ASSESSMENT IN SCIENCE

Diagnostic assessment is a kind of assessment, which helps teachers to determine what learners know and where s/he is lacking behind. Generally, diagnostic assessment is used to know about learners’ strengths, weaknesses, level of their existing knowledge and the skills, they possess. It helps teachers to design and plan their instructions accordingly.

As a science teacher, you can use it before starting your instructions as pre-assessment activity. You can also use it in between to diagnose the difficulties learners are facing in comprehending any particular concept or topic and adopt remedial measures.

A diagnostic test helps teachers to plan their instructions effectively. Because it helps in understanding what the learners know and what they do not know. If a teacher finds that a particular learner or a small group of learners is lacking behind the rest of the class on a particular topic or theme, s/he can organize remedial classes or adopt some other strategies to facilitate learners.

Let us understand with an example:

Ms. Anjali, a physics teacher in a secondary school of Bhopal, taught the unit of “Light” to her class. She helped learners in comprehending the concept of Mirrors, Lenses, Laws of Reflection and Refraction, drawing the ray diagram to depict image formation, structure and function of Human eye, etc.

She administered a unit test on it. While going through the assessment sheets of learners, she found that few learners have made some common mistakes while drawing the ray diagrams and few are confused between refraction and reflection.

When teachers find themselves in the situation like Ms. Anjali, they generally re-teach the concept or give some more exercises to learners to practice. Do you think it is a right approach? Let us see what Ms. Anjali did in this situation.

Ms. Anjali thought and reflected on possible reasons for the mistakes done by learners. She again went through their answer scripts/assessment sheets and identified few common minor errors, due to which learners committed those mistakes.

She prepared a separate test only on the concept of Refraction, Reflection and Drawing of Ray Diagrams. She administered it on those identified learners and found that learners are having difficulty in distinguishing between the use of mirrors or lenses while explaining refraction and reflection. She also identified that learners are confused between focal length, principle axis and optical center.

She came to know the exact reason of mistakes committed by learners. She planned certain activities and exercises to give hands-on practice to learners on identified concept and helped learners to overcome their difficulties.

Hope the above example will help you understand the concept of diagnosis and remediation. It is expected from you as a science teacher that you will facilitate your learners in overcoming their problems and use diagnostic testing as a facilitating tool for learners in your class. You can use many modern assessment tools discussed above as well as concept map also as diagnostic test.

#### Activity 4

Identify few topics/concepts with help of a unit test in your science class, where your learners are facing difficulty to comprehend these concepts. Analyze their difficulties with help of a diagnostic assessment tool and provide remediation. Prepare a report on your experiences during this exercise highlighting the benefits you observed.

## 9.7 SCHEMES FOR PROMOTING SCIENTIFIC ATTITUDE

As a science teacher, you need to be aware of the schemes which are promoting development of scientific attitude among learners upto senior secondary level. Such schemes/initiatives help in attracting young minds towards science. There are many such scheme, few important one have been discussed here in brief.

### 9.7.1 National Talent Search Examination (NTSE)

National Talent Search Scheme (NTSE) was launched in 1963 as National Science Talent Search Scheme (NSTSS). Initially, this scheme was awarding fellowships to learners of Class XI based on a written examination, a project report and interview. In 1976, this scheme was extended to social sciences too and renamed as National Talent Search Scheme (NTSE). Scheme started separate examination for class X, XI and XII learners. Scheme of examination also changed. The learners have to appear in two objective type written tests namely the Mental Ability Test (MAT) and the Scholastic Aptitude Test (SAT). Based on performance in written test, a selected group of learners was facing a face-to-face interview and scholarship was awarded based on the final awards in both components.

In the year 2000, the number of scholarships was raised up to 1000 with the provision of reservation for SC and ST candidates based on the national norms of 15 per cent and 7½ per cent respectively. From the year 2006 onwards, the NTS examination was held at the end of Class VIII. From the year 2008 examination, a provision of 3 per cent reservation has been made for physically challenged learners.

From the year 2012-13, NTSE is being conducted for Class X learners. Now it consists of Mental Ability Test(MAT) and Scholastic Ability Test(SAT). The amount of scholarship is Rs. 500/- per month for all the learners studying in Class XI onwards(irrespective of class/course) except for Ph.D., wherein it is paid as per UGC norms.

The scholarships are being awarded to learners for pursuing courses in sciences and social sciences up to doctoral level and in professional courses like medicine and engineering up to second-degree level subject.

### 9.7.2 Kishore Vaigyanik Protsahan Yojna (KVPY)

The Kishore Vaigyanik Protsahan Yojana (KVPY) is a very popular National Program of Fellowship in Basic Sciences, initiated and funded by the Department of Science and Technology, Government of India in the year 1999, to attract exceptionally highly motivated learners for pursuing basic science courses and research career in science.

The objective of the program is to identify learners with talent and aptitude for research; help them realize their academic potential; encourage them to take up research careers in Science, and ensure the growth of the best scientific minds for research and development in the country.

Under this scheme, learners are selected from those studying in XI standard to 1st year of any undergraduate Program in Basic Sciences namely B.Sc./B.S./B.Stat./B.Math./Int. M.Sc./M.S. in Mathematics, Physics, Chemistry and Biology having aptitude for scientific research.

Based on the performance in the aptitude test, short-listed learners are called for an interview which is the final stage of the selection procedure. For receiving a fellowship, both aptitude test and interview marks are considered. The KVPY Fellowships are given to Indian Nationals only to Study in India.

It is being given in three streams.

- **Stream SA:** Learners enrolled in XI Standard (Science Subjects). The fellowship of the learners selected under this stream will be given only if they join an undergraduate course in Basic Sciences.
- **Stream SX:** Learners who are enrolled in XII Standard/ (+2) (Science subjects) and aspiring to join undergraduate programme in Basic Sciences.
- **Stream SB:** Learners enrolled in the 1st year of undergraduate program in Basic Sciences.



<b>Basic Sciences</b>	<b>Monthly Fellowship</b>	<b>Annual Contingency Grant</b>
<b>SA/SX/SB</b> - during 1st to 3rd years of - B.Sc./B.S./B.Stat./B.Math./Integrated M.Sc./ M.S.	Rs. 5000	Rs. 20000
<b>SA/SX/SB</b> - during M. Sc. / 4th to 5th years of Integrated M.Sc. /M.S./M.Math./M.Stat.	Rs. 7000	Rs. 28000

### 9.7.3 Rashtriya Avishkar Abhiyan

In pursuance of the focus on connecting school based knowledge to life outside the school and making learning of Science and Mathematics a joyful and meaningful activity and to bring focus on innovation and use of technology, the Ministry of Human Resource Development has set up the Rashtriya Avishkar Abhiyan(RAA). It is a convergent framework that aims at nurturing a spirit of inquiry and creativity, love for Science and Mathematics and effective use of technology amongst children and encourage those who show an inclination and talent for these subjects to be encouraged and supported to heights of academic excellence and research.

Rashtriya Avishkar Abhiyan is targeting learners in the age group of 6-18 years and in turn the execution of RAA will span across MHRD's schematic interventions of Sarva Shiksha Abhiyan, Rashtriya Madhyamik Shiksha Abhiyan in the Department of School Education & Literacy and programmes and schemes of Department of Higher Education to encourage Science, Mathematics & Technology.

### 9.7.4 Science Olympiads

Science Olympiad Foundation (SOF) is a Registered Not-For-Profit Organization popularizing Computer, Science, Mathematics, English, Sports Knowledge and Company Secretaries' Education among school children.

It is working for over two decades to promote scientific attitude and temperament through innovative activities and use of IT in learning process that involve school learners across the country.

The foundation conducts the following Olympiads:

- National Cyber Olympiad
- National Science Olympiad
- International Mathematics Olympiad
- International English Olympiad
- International Company Secretaries Olympiad
- International Sports Knowledge Olympiad

Learners of classes 1 to 12th are eligible to appear for the 1st level Olympiads. There is no other eligibility criterion like minimum marks. Learners who qualify for the 2<sup>nd</sup> level exam include:

- a) Top 5% of learners' class wise, who appear for the 1st level exam,
- b) State wise top 25 rank holders class wise, and
- c) Class toppers from each participating school where at least 10 learners from a class appear in the exam & scores 50% qualifying marks. Learners from classes 1 and 2 are not required to appear for the 2<sup>nd</sup> level exam and are ranked based on their performance in the first level exam. IEO is a single level exam.

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## 9.8 LET US SUM UP

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Assessment is viewed as an integral part of teaching-learning process. Its primary role is not to grade or promote learners to next class but to facilitate learning upto maximum extent. Discussion on nature of assessment in science will help you understand its role more effectively. It is important for you as a science teacher that you are able to identify and design appropriate assessment tool which is facilitating in acquiring desired process skills. Discussion on various assessment tools for scholastic and co-scholastic assessment will help you in it. Diagnosis and remediation is an important part of science teaching-learning; you should use it frequently in your class. Information about various schemes to promote scientific temper among learners will help you to motivate your learners in engaging few of such activities.

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## 9.9 UNIT END EXERCISES

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- 1) Why is identification of assessment indicators important for selecting an assessment tool?
- 2) What precautions you will keep in mind while designing an assessment tool for scholastic assessment?
- 3) Why is the co-scholastic assessment necessary in science teaching-learning?
- 4) Discuss importance of diagnostics testing?

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## 9.10 SUGGESTED READINGS AND REFERENCES

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NCERT (2013) Pedagogy of Science, Textbook for B.Ed. Part-II

NCERT (2012) Source Book on assessment for Classes VI-VIII Science

CBSE (2016) Revised Formative Assessment Manual for Teachers Class-IX (Science),

CBSE (2010) Formative Assessment Manual for Teachers Class-X (Science)

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## 9.11 ANSWERS TO CHECK YOUR PROGRESS

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- 1) In order to assess the development of process skills in science, you have to identify on what criteria any skill is to be assessed. The criterion, on which development of any skill is being assessed, is known as assessment indicators.
- 2) During teaching-learning of science, variety of skills is to be developed along with development of scientific temper and attitude and inculcation of values. Everyone cannot be assessed with one or two kind of tools; hence it is necessary to use variety of tools for assessment.
- 3) Write on the basis of your understanding.