# WORKSHOP ON PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT (PISA)

# WHAT IS PISA?

Triennial international survey

Participation of over 90 countries since its inception in 2000

Aims to evaluate education systems worldwide

Tests the skills and knowledge of 15-year-old students

# ASSESSMENT GOALS

To evaluate outcomes of learning.

To assess how well students can apply what they learn in school to real-life situations.

To show what 15-year-olds have learnt inside and outside a classroom.

To measure literacy in terms of knowledge, skills and competencies.

# WHAT DOES PISA ASSESSMENT AIM TO ACHIEVE?

Baseline profile of the knowledge and skills of students approaching end of compulsory education.

Understanding of how skills relate to demographic, social, economic and educational variables.

Insights into factors that influence development of knowledge and skills at home and at school and how these factors interact.

Enable policy insights to ensure that students fully participate in knowledge society in future.

# WHAT SETS PISA APART FROM OTHER ASSESSMENTS?

**Policy Orientation-** connects data on student learning outcomes with data on students' backgrounds and attitudes towards learning

**Innovative concept of "literacy"-** students' capacity to apply knowledge and skills in key subjects to interpret and address various real life situations

**Relevance to lifelong learning-** focuses on students' learning in terms of skills and competencies instead of just subject syllabi.

**Regularity-** enables countries to monitor their progress in meeting key learning objectives.

**Breadth of coverage-** 36 OECD countries and 50 non-members will be participating in PISA 2021.

# PISA 2021

India shall be participating in PISA for the second time, the first being in 2009.

36 OECD member countries and over 50 non-members are expected to participate.

The focus will be on Mathematical Literacy.

In addition, students have an option of being tested in an innovative subject - creative thinking.

# WHAT ARE THE DOMAINS OF PISA TESTING?

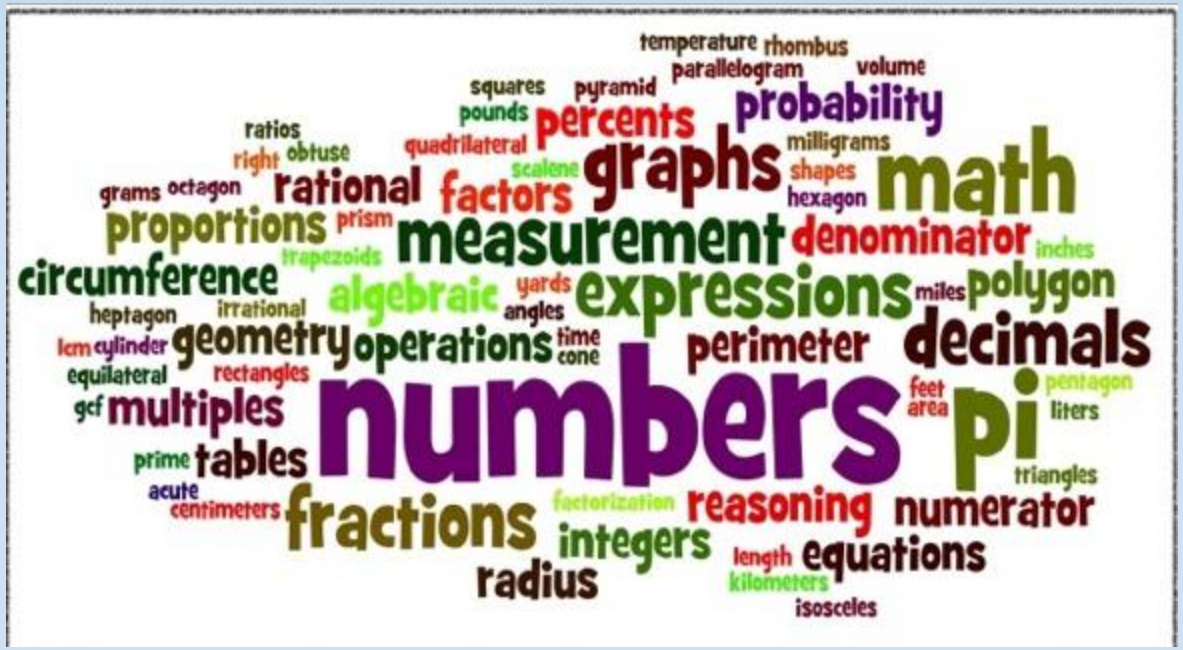
Reading Literacy

Mathematical Literacy

Scientific Literacy

In addition to these three, students are tested in an innovative domain such as collaborative problem solving in 2015 and global competence in 2018.

# Mathematical Literacy



# DEFINING MATHEMATICAL LITERACY

The students' ability to analyse, reason and communicate ideas effectively as they pose, formulate, solve and interpret solutions to mathematical problems in a variety of situations.

It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena.

It assists individuals to recognise the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective citizens.

# RESPONSE FORMATS

- Selected Response
  - Simple multiple-choice (MCQ)
  - Complex multiple-choice (Yes / No)
- Constructed Response
  - Closed constructed-response (one word or digit)
  - Open constructed-response (few lines / paragraph)

# TASK CHARACTERISTICS OF MATHEMATICAL ASSESSMENT

## PROCESSES / COMPETENCIES

- They describe what students do to connect the context of a problem with the mathematics involved and thus solve the problem.

## CONTENT

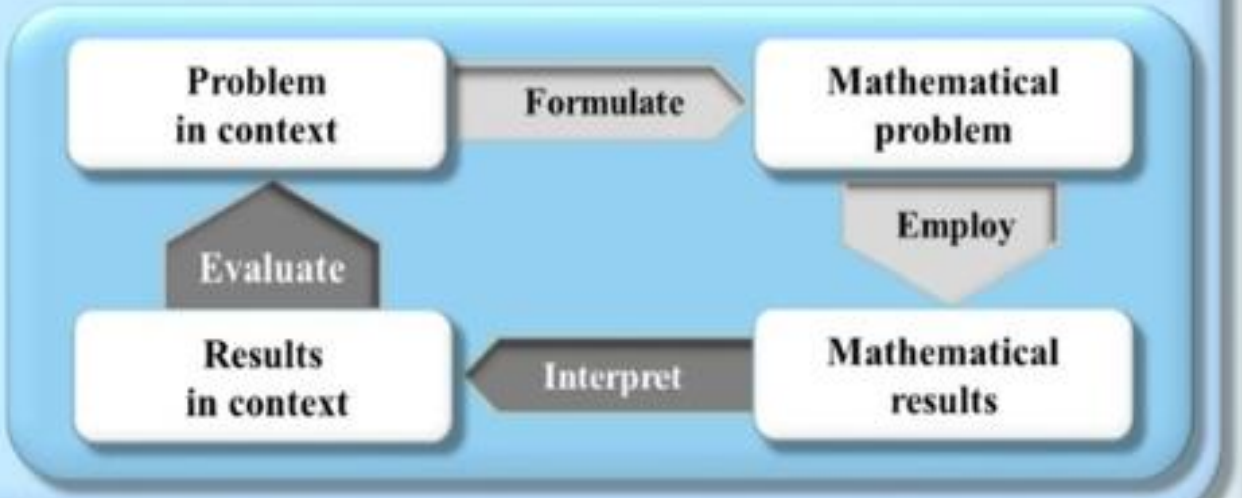
- The ideas (that are related to familiar curricular subjects, such as numbers, algebra and geometry), in overlapping and complex ways.

## CONTEXT / SITUATION

- The settings in a student's world in which the problems are placed.

**Challenge in real world context**
**Mathematical content categories:**
Quantity; Uncertainty and data; Change and relationships; Space and shape
**Real world context categories:** Personal; Societal; Occupational; Scientific

**Mathematical thought and action**
**Mathematical concepts, knowledge and skills**
**Fundamental mathematical capabilities:**
Communication; Representation; Devising strategies; Mathematisation; Reasoning and argument; Using symbolic, formal and technical language and operations; Using mathematical tools
**Processes:** Formulate; Employ; Interpret/Evaluate



# PROCESSES

## Formulating situations mathematically

- Recognise and identify opportunities to use mathematics
- Provide mathematical structure to a problem presented in some contextualised form.

## Employing mathematical concepts, facts, procedures and reasoning

- Apply mathematical concepts, procedures and reasoning to solve mathematically formulated problems to obtain conclusions
- Perform the mathematical procedures needed to derive results and find a mathematical solution

## interpreting, applying and evaluating mathematical outcomes

- Reflect upon mathematical solutions, results, or conclusions and interpret them in the context of real-life problems.
- Construct and communicate explanations and arguments in the context of the problem, reflecting on both the modelling process and its results

# CONTENT

| | |
|---|---|
| **Quantity** | • understanding relative size, recognising numerical patterns and using numbers to represent quantities and quantifiable attributes of real-world objects. |
| **Space and Shape** | • recognising and understanding geometric patterns and identifying such patterns in abstract and real-world representations. |
| **Uncertainty and data** | • solving problems relating to data and chance, which correspond to statistics and probability in school mathematics curricula, respectively. |
| **Change and relationships** | • recognising relationships between variables and thinking in terms of and about relationships in a variety of forms including symbolic, algebraic, graphical, tabular, and geometric. |

# SITUATIONS / CONTEXTS

| | |
|---|---|
| **Personal** | • Problems which focus on activities of one's self, one's family or one's peer group such as food preparation, shopping, games, personal health, personal transportation, sports, travel, personal scheduling and personal finance. |
| **Societal** | • Problems which focus on one's community (whether local, national or global) such as voting systems, public transport, government, public policies, demographics, advertising, national statistics and economics. |
| **Occupational** | • Problems centred on the world of work such as measuring, costing and ordering materials for building, payroll/accounting, quality control, scheduling/inventory, design/architecture and job-related decision making. |
| **Scientific** | • Problems which relate to the application of mathematics to the natural world and issues and topics related to science and technology such as weather or climate, ecology, medicine, space science, genetics and measurement. |

# LEVELS

| PL | Indicators to identify student proficiency levels in Mathematical Literacy |
|---|---|
| 6 | At Level 6 students can conceptualise, generalise and utilise information based on their investigations and modelling of complex problem situations. They can link different information sources and representations and flexibly translate among them. |
| 5 | At Level 5 students can develop and work with models for complex situations, identifying constraints and specifying assumptions. They can select, compare and evaluate appropriate problem-solving strategies for dealing with complex problems related to these models. |
| 4 | At Level 4 students can work effectively with explicit models for complex concrete situations that may involve constraints or call for making assumptions. They can select and integrate different representations, including symbolic, linking them directly to aspects of real-world situations. |
| 3 | At Level 3 students can execute clearly described procedures, including those that require sequential decisions. They can select and apply simple problem-solving strategies. |
| 2 | At Level 2 students can interpret and recognise situations in contexts that require no more than direct inference. They can extract relevant information from a single source and make use of a single representational mode. They are capable of direct reasoning and making literal interpretations of the results. |
| 1a | At Level 1a, students can answer questions involving familiar contexts where all relevant information is present and the questions are clearly defined. They are able to identify information and to carry out routine procedures according to direct instructions in explicit situations. |
| 1b | At Level 1b, students can respond to questions involving easy to understand contexts where all relevant information is clearly given in a simple representation (for example tabular or graphic) and defined in a short syntactically simple text. They are able to follow clearly prescribed instructions. |
| 1 c | At Level 1c, students can respond to questions involving easy to understand contexts where all relevant information is clearly given in a simple, familiar format (for example a small table or picture) and defined in a very short syntactically simple text. They are able to follow a clear instruction describing a single step or operation. |

# Mathematical Literacy Example 1

**You are making your own dressing for a salad.**
**Here is a recipe for 100 millilitres (mL) of dressing.**

| | |
|---|---|
| Salad oil: | 60 mL |
| Vinegar: | 30 mL |
| Soy sauce: | 10 mL |

**How many millilitres (mL) of salad oil do you need to make 150 mL of this dressing?**
**Answer: ..... mL**

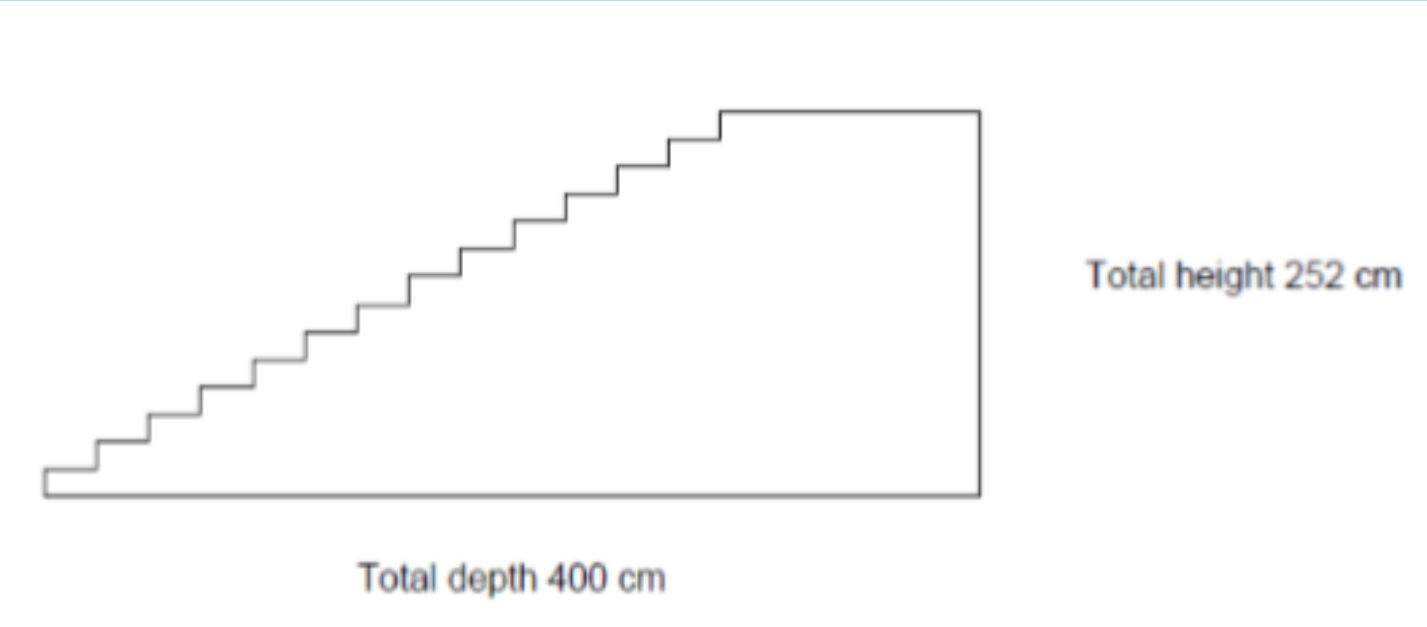
Formulating situations mathematically

**Short open-constructed response item**

Application of the ratio concept in daily life situation to calculate the amount of one ingredient required in a recipe
**Content area: Quantity**
**Context: Personal**

# Mathematical Literacy Example 2

**The diagram below illustrates a staircase with 14 steps and a total height of 252 cm:**




**What is the height of each of the 14 steps?**

**Height:.....cm.**

Employing mathematical concepts, facts, procedures and reasoning

**Short open-constructed response item h**aving an

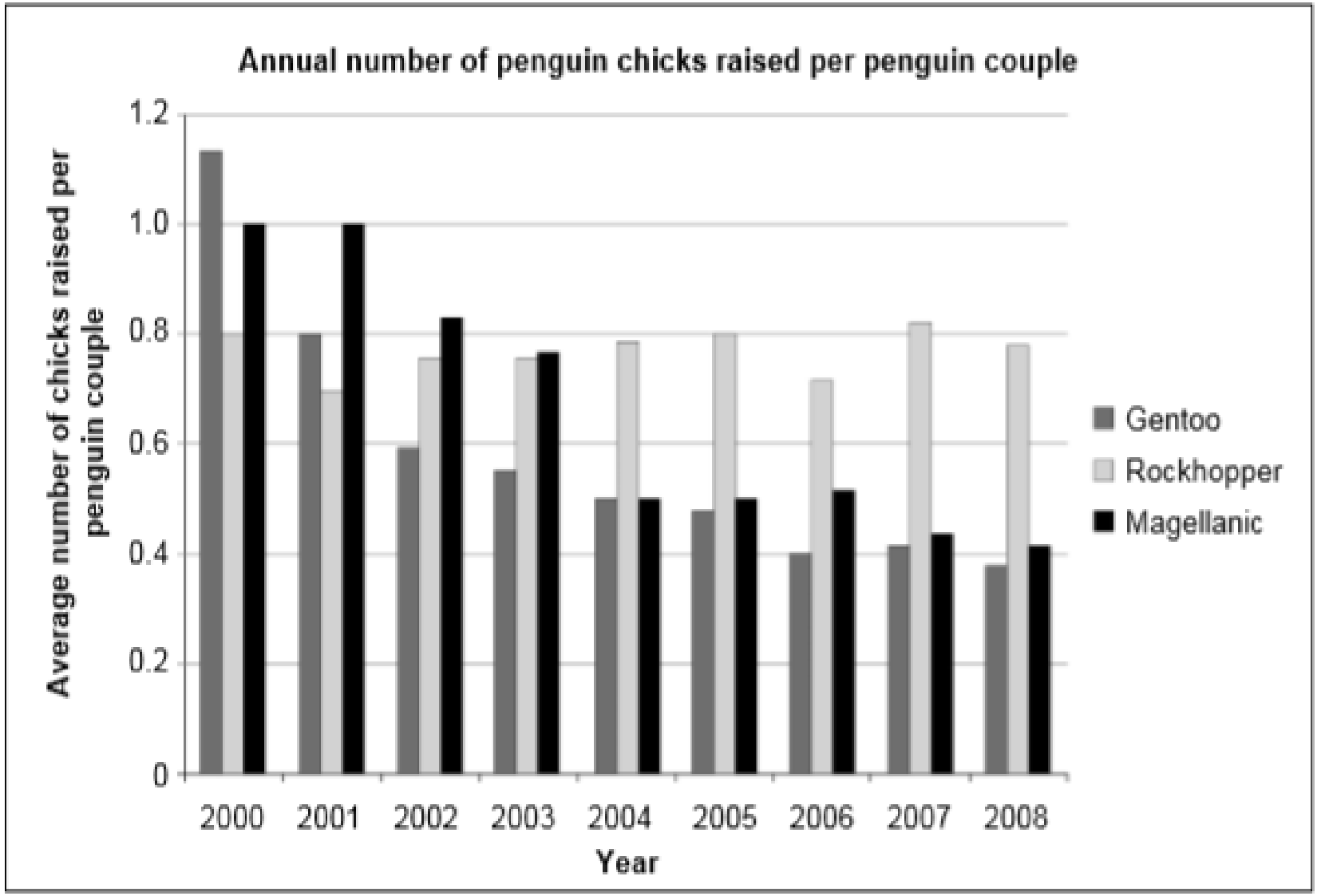
**Context : Occupational**

**Content : Space and shape**

**Level : 2**

# Mathematical Literacy Example 3

**Jean Baptiste had a look on the internet to see how many chicks a penguin couple raise on an average.**

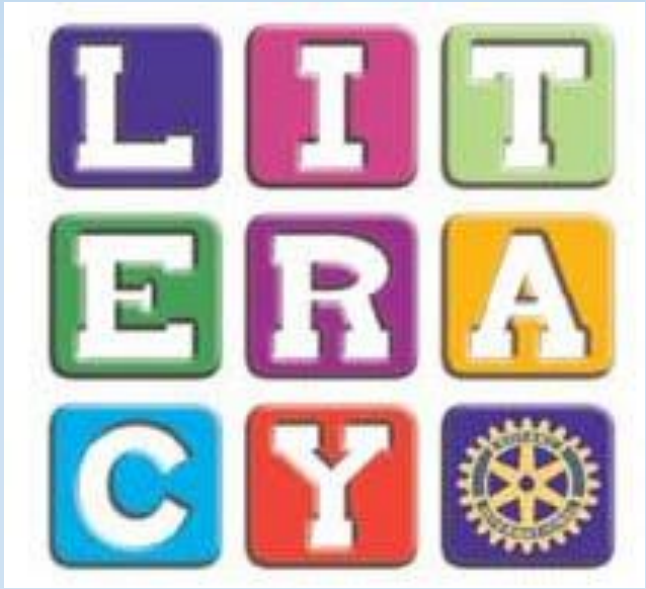


# Mathematical Literacy Example 3

**Based on the chart, check whether the following statements about these three penguin types are true or false. Circle "True" or "False" for each statement.**

| Statement | Is the statement true or false? |
|---|---|
| In 2000, the average number of chicks raised per penguin couple was larger than 0.6. | True / False |
| In 2006, an average , less than 80% of penguin couples raised a chick. | True / False |
| In about 2015 these three penguins types will be extinct. | True / False |
| The average number of Magellanic penguin chicks raised per penguin couple decreased between 2001 and 2004. | True / False |

# Reading Literacy



# DEFINING READING LITERACY

Understanding, using, reflecting on and engaging with written texts in order to achieve one's goals, develop one's knowledge and potential and participate effectively in society.

Includes wide range of cognitive competencies from basic decoding to knowledge of words, grammar, and larger linguistic and textual structures and features, to knowledge about the world.

Acknowledges diversity and complexity of the processes involved in daily reading activities.

Establishes a **baseline level**- proficiency level 2, on a scale with 6 as the highest level and 1b the lowest- at which readers begin to demonstrate the competencies that enable them to participate as continuing students, workers and citizens.

# RESPONSE FORMATS

## Selected Response

- Yes/No
- Choose from alternatives/MCQ

## Constructed Response

- Students generate their own answers
- Could be one word or a paragraph

# TASK CHARACTERISTICS OF READING ASSESSMENT

## PROCESSES

- Cognitive strategies, approaches, or purposes that readers use to negotiate their way into, around, and among texts.

## TEXTS

- The range of material that is read.

## SITUATIONS

- The range of broad contexts or purposes in which reading takes place.

# PROCESSES

## Access and Retrieve

- Locating information

## Integrate and Interpret

- Forming a broad understanding
- Developing an interpretation

## Reflect and Evaluate

- Reflecting on and evaluating the content of text
- Reflecting on evaluating the form of text

# SITUATIONS

| | |
|---|---|
| Personal | • Texts that are intended to satisfy an individual's personal interests, both practical and intellectual. E.g. personal letters, fiction, biography. |
| Public | • Texts that relate to activities and concerns of the larger society. E.g. forum-style blogs, news websites and public notices. |
| Educational | • Designed specifically for the purpose of instruction. E.g. textbooks |
| Occupational | • Involves the accomplishment of some immediate task. E.g. workplace directions, classified advertisements of jobs. |

# TEXT FORMATS

| | |
|---|---|
| Continuous | • Continuous texts are formed by sentences organised into paragraphs. E.g. newspaper reports, essays, novels, short stories, reviews and letters. |
| Non-continuous | • Non-continuous are most frequently organised in matrix format, composed of a number of lists. E.g. lists, tables, graphs, diagrams, advertisements, schedules, catalogues, indexes and forms. |
| Mixed | • Mixed texts are single, coherent artefacts consisting of a set of elements in both a continuous and non-continuous format. E.g. a prose explanation along with a graph or table. |
| Multiple | • Multiple texts are defined as those that have been generated independently, and make sense independently; they are juxtaposed for a particular occasion or may be loosely linked together for the purposes of the assessment. E.g. a list and a play. |

# TEXT TYPE

| | |
|---|---|
| Argumentation | • Presents the relationship among concepts or propositions; is persuasive and opinionative. E.g. letter to the editor, the posts in an online forum and a web-based review of a book or film. |
| Description | • Refers to properties of objects or places. E.g. depiction of a particular place in a travelogue or diary, a catalogue, a geographical map, an online flight schedule. |
| Exposition | • Presents composite concepts or mental constructs, or those elements into which concepts or mental constructs can be analysed. E.g. a diagram showing a model of memory, a graph of population trends, a concept map. |
| Narration | • Refers to properties of objects in time. E.g. a novel, a short story, a play, a biography, a comic strip, fictional texts and a newspaper report of an event. |
| Instruction | • Provides directions on what to do. E.g. a recipe, a series of diagrams showing a procedure for giving first aid, and guidelines for operating digital software. |
| Transaction | • Aims to achieve a specific purpose outlined in the text. E.g. requesting that something is done, organising a meeting or making a social engagement with a friend. |

# PROFICIENCY LEVELS

| PL | Indicators to identify student proficiency levels in RL |
|---|---|
| 6 | • **Make multiple inferences** and comparisons that are both **detailed and precise**; demonstrate full and detailed understanding of one or more texts and may involve integrating information from more than one text.<br>• Hypothesise about or critically evaluates a complex text on an unfamiliar topic, **taking into account multiple criteria or perspectives, and applying sophisticated understandings from beyond the text**; have precision of analysis and fine attention to detail that is inconspicuous in the texts. |
| 5 | • Locate and organise several pieces of deeply embedded information, **inferring which information in the text is relevant**.<br>• **Evaluate critically or hypothesise or draw on previous knowledge**; have a full and detailed understanding of a text whose content or form is unfamiliar. |
| 4 | • Locate and **organise several pieces of embedded information**; interpret the meaning of nuances of language in a section of text by taking into account the text as a whole.<br>• Understand **and apply categories in an unfamiliar context**; use formal or public knowledge to hypothesise about or critically evaluate a text. |
| 3 | • Locate, and in some cases recognise the relationship between, several pieces of information that must meet multiple conditions**; integrate several parts of a text in order to identify a main idea**, understand a relationship or construe the meaning of a word or phrase.<br>• **Demonstrate a fine understanding of the text in relation to familiar, everyday knowledge**. |
| 2 | • Locate one or more pieces of information, which may **need to be inferred and meet several conditions**, recognise the main idea in a text, understand relationships, or construe meaning within a limited part of the text when the information is not prominent.<br>• **Involve comparisons or contrasts based on a single feature in the text**, make a comparison or several connections between the text and outside knowledge. |
| 1a | • Locate one or more independent pieces of explicitly stated information; is able to **recognise the main theme or author's purpose in a text about a familiar topic**, or to make a simple connection between information in the text and common, everyday knowledge. |
| 1b | • **Locate a single piece of explicitly stated information** in a prominent position in a short, syntactically simple text with a familiar context and text type, such as a narrative or a simple list; make simple connections between adjacent pieces of information. |

# READING LITERACY EXAMPLE

## The way of the future

**Just imagine how wonderful it would be to "telecommute"[1] to work on the electronic highway, with all your work done on a computer or by phone! No longer would you have to jam your body into crowded buses or trains or waste hours and hours travelling to and from work. You could work wherever you want to – just think of all the job opportunities this would open up!**

***-Mansi***

# READING LITERACY EXAMPLE

## Disaster in the making

**Cutting down on commuting hours and reducing the energy consumption involved is obviously a good idea. But such a goal should be accomplished by improving public transportation or by ensuring that workplaces are located near where people live. The ambitious idea that telecommuting should be part of everyone's way of life will only lead people to become more and more self-absorbed. Do we really want our sense of being part of a community to deteriorate even further?**

***-Rahul***

*[1] "Telecommuting" is a term coined by Jack Nilles in the early 1970s to describe a situation in which workers work on a computer away from a central office (for example, at home) and transmit data and documents to the central office via telephone lines.*

# READING LITERACY EXAMPLE

**QUESTION 1: TELECOMMUTING**

**Which of the following statements best describes telecommuting?**

a. Telecommuting is when workers commute through an electronic highway.
b. Telecommuting is when workers talk to their friends on telephones.
c. Telecommuting is when workers send data to each other through social media apps.
d. Telecommuting is when workers work on computers and telephones while not being physically present in office.

# READING LITERACY EXAMPLE

**QUESTION 2: TELECOMMUTING**

**Which statement would both Mansi and Rahul agree with?**

a. People should be allowed to work for as many hours as they want to.

b. It is not a good idea for people to spend too much time getting to work.

c. Telecommuting would not work for everyone.

d. Forming social relationships is the most important part of work.

# READING LITERACY EXAMPLE

**QUESTION 3: TELECOMMUTING**

**What is the relationship between “The way of the future” and “Disaster in the making”?**

**a. They use different arguments to reach the same general conclusion.**

**b. They are written in the same style but they are about completely different topics.**

**c. They express the same general point of view, but arrive at different conclusions.**

**d. They express opposing points of view on the same topic.**

**QUESTION 4: TELECOMMUTING**

**List any two jobs that would not be possible with telecommuting and would necessarily physical presence of workers.**

# READING LITERACY EXAMPLE- TASK DISTRIBUTION MATRIX

| | | INTENT | | | | | | FORMAT | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q. No. | Ans | PL | Aspect-Cognitive Process | | | | | Response Format | | Text Format | | | | Text Type | | | | | | Situation | | | |
| | | | Access and Retrieve | Integrate and Interpret | | Reflect and Evaluate | | | | Continuous | Non-continuous | Mixed | Multiple | Exposition | Argumentation | Transaction | Narration | Instruction | Description | Personal | Educational | Occupational | Public |
| | | | (i) Locate Information | (ii) Form a broad understanding | (iii) Develop an interpretation | (iv) Reflect and evaluate content of text | (v) Reflect and evaluate form of text | SR | CR | | | | | | | | | | | | | | |
| 1 | d | 2 | | | | | | | | | | | | | | | | | | | | | |
| 2 | b | 3 | | | | | | | | | | | | | | | | | | | | | |
| 3 | d | 5 | | | | | | | | | | | | | | | | | | | | | |
| 4 | | 6 | | | | | | | | | | | | | | | | | | | | | |

# Scientific Literacy

# DEFINING SCIENTIFIC LITERACY

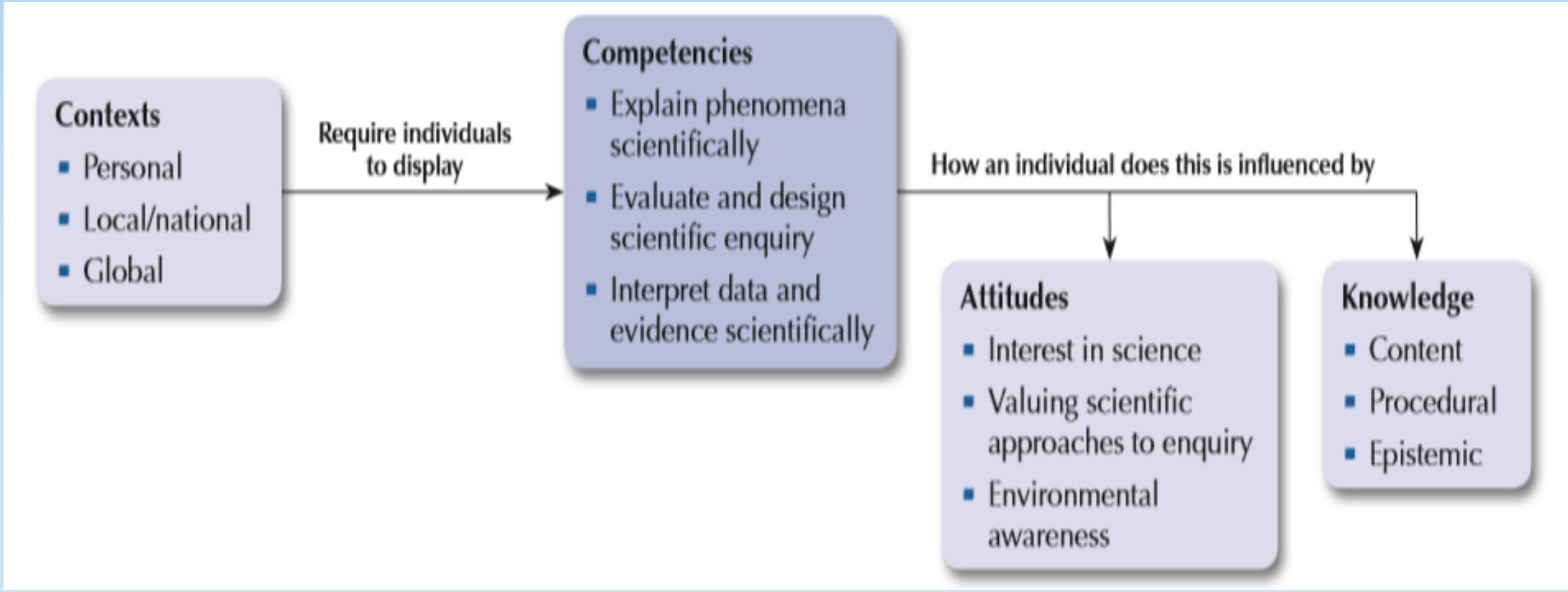
…the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity.

Understanding of the characteristic features of science as a form of human knowledge and enquiry.

Awareness of how science and technology shape our material, intellectual and cultural environments.

Willingness to engage in science-related issues, and with the ideas of science, as a reflective citizen" (OECD, 2006)

# SCIENTIFIC LITERACY



# RESPONSE FORMATS

- Selected Response
  - Simple multiple-choice (MCQ)
  - Complex multiple-choice (Yes / No)
- Constructed Response
  - Closed constructed-response (one word or digit)
  - Open constructed-response (few lines / paragraph)

# TASK CHARACTERISTICS OF SCIENTIFIC ASSESSMENT

PROCESSES

KNOWLEDGE

CONTEXT

CONTENT

# PROCESSES

## Explain Phenomena scientifically

Can 15-year-olds recall appropriate scientific knowledge, identify explanatory models, make and justify predictions and hypotheses, and explain the potential implications of scientific knowledge for society?

## Evaluate and design scientific inquiry

Can students identify the questions explored in a given scientific study, propose and evaluate ways of exploring such questions, and describe and evaluate the methods scientists use to ensure data quality?

## Interpret data and evidence scientifically

Are 15-year-olds able to analyze and interpret data to draw appropriate conclusions, identify the assumptions in science-related texts, recognize when arguments are based on scientific evidence and theory, and evaluate scientific arguments from different sources?

# Content Areas

- Physical systems
- Living Systems
- Earth and Space
- Science and Technology

# KNOWLEDGE

## 1 Content knowledge

- The facts, concepts, ideas and theories that science has established.

Example: How plants synthesise complex molecules using light energy, water and carbon dioxide.

## 2 Procedural knowledge

The practices and concepts on which empirical enquiry is based.
Example: Variables and using standard operating procedures can be used to determine the effect of surface area on reaction rate.

## 3 Epistemic knowledge

Understanding the role that arguments, observations, theories, hypotheses, models, and questions play in science.

# CONTEXTS

# LEVELS

| Level | Lower score limit | Characteristics of tasks |
|---|---|---|
| 6 | 708 | At Level 6, students can draw on a range of interrelated scientific ideas and concepts from the physical, life and earth and space sciences and use content, procedural and epistemic knowledge in order to offer explanatory hypotheses of novel scientific phenomena, events and processes or to make predictions. In interpreting data and evidence, they are able to discriminate between relevant and irrelevant information and can draw on knowledge external to the normal school curriculum. They can distinguish between arguments that are based on scientific evidence and theory and those based on other considerations. Level 6 students can evaluate competing designs of complex experiments, field studies or simulations and justify their choices. |
| 5 | 633 | At Level 5, students can use abstract scientific ideas or concepts to explain unfamiliar and more complex phenomena, events and processes involving multiple causal links. They are able to apply more sophisticated epistemic knowledge to evaluate alternative experimental designs and justify their choices and use theoretical knowledge to interpret information or make predictions. Level 5 students can evaluate ways of exploring a given question scientifically and identify limitations in interpretations of data sets including sources and the effects of uncertainty in scientific data. |
| 4 | 559 | At Level 4, students can use more complex or more abstract content knowledge, which is either provided or recalled, to construct explanations of more complex or less familiar events and processes. They can conduct experiments involving two or more independent variables in a constrained context. They are able to justify an experimental design, drawing on elements of procedural and epistemic knowledge. Level 4 students can interpret data drawn from a moderately complex data set or less familiar context, draw appropriate conclusions that go beyond the data and provide justifications for their choices. |
| 3 | 484 | At Level 3, students can draw upon moderately complex content knowledge to identify or construct explanations of familiar phenomena. In less familiar or more complex situations, they can construct explanations with relevant cueing or support. They can draw on elements of procedural or epistemic knowledge to carry out a simple experiment in a constrained context. Level 3 students are able to distinguish between scientific and non-scientific issues and identify the evidence supporting a scientific claim. |
| 2 | 410 | At Level 2, students are able to draw on everyday content knowledge and basic procedural knowledge to identify an appropriate scientific explanation, interpret data, and identify the question being addressed in a simple experimental design. They can use basic or everyday scientific knowledge to identify a valid conclusion from a simple data set. Level 2 students demonstrate basic epistemic knowledge by being able to identify questions that can be investigated scientifically. |
| 1a | 335 | At Level 1a, students are able to use basic or everyday content and procedural knowledge to recognise or identify explanations of simple scientific phenomenon. With support, they can undertake structured scientific enquiries with no more than two variables. They are able to identify simple causal or correlational relationships and interpret graphical and visual data that require a low level of cognitive demand. Level 1a students can select the best scientific explanation for given data in familiar personal, local and global contexts. |
| 1b | 261 | At Level 1b, students can use basic or everyday scientific knowledge to recognise aspects of familiar or simple phenomenon. They are able to identify simple patterns in data, recognise basic scientific terms and follow explicit instructions to carry out a scientific procedure. |

# SCIENTIFIC LITERACY EXAMPLE 1

**Many people believe that wind should replace oil and coal as a source of energy for producing electricity. The structures in the picture are windmills with blades that are rotated by the wind. These rotations cause electricity to be produced by generators that are turned by the windmills.**

# SCIENTIFIC LITERACY EXAMPLE 1

## Question 1 Explain phenomena scientifically

**The higher the altitude the more slowly windmills rotate at the same wind speed.**

**Which one of the following is the best reason why the blades of windmills rotate more slowly in higher places at the same wind speed?**

**A. The air is less dense as altitude increases.**
**B. The temperature is lower as altitude increases.**
**C. Gravity becomes less as altitude increases.**
**D. It rains more often as altitude increases**

## Question 2 Explain phenomena scientifically

**Describe one specific advantage of using wind to generate electricity compared with using fossil fuels like coal and oil.**

# SCIENTIFIC LITERACY EXAMPLE 2

**Read the following newspaper article and answer the questions that follow:**

A team of British scientists is developing "intelligent" clothes that will give disabled children the power of "speech". Children wearing waistcoats made of a unique electrotextile, linked to a speech synthesiser, will be able to make themselves understood simply by tapping on the touch-sensitive material.

The material is made up of normal cloth and an ingenious mesh of carbonimpregnated fibres that can conduct electricity. When pressure is applied to the fabric, the pattern of signals that passes through the conducting fibres is altered and a computer chip can work out where the cloth has been touched. It then can trigger whatever electronic device is attached to it, which could be no bigger than two boxes of matches.

"The smart bit is in how we weave the fabric and how we send signals through it – and we can weave it into existing fabric designs so you cannot see it's in there," says one of the scientists.

Without being damaged, the material can be washed, wrapped around objects or scrunched up. The scientist also claims it can be mass-produced cheaply.

*Source: Steve Farrer, `Interactive fabric promises a material gift of the garb', The Australian, 10 August 1998.*

# SCIENTIFIC LITERACY EXAMPLE 2

**Question 3 ： Interpret data and evidence scientifically**

**Can these claims made in the article be tested through scientific investigation in the laboratory? Circle either “Yes” or “No” for each.**

| The material can be | Can the claim be tested through scientific investigation in the laboratory? |
|---|---|
| **washed without being damaged.** | Yes /No |
| **wrapped around objects without being damaged.** | Yes / No |
| **scrunched up without being damaged.** | Yes / No |
| **mass-produced cheaply.** | Yes / No |

# SCIENTIFIC LITERACY EXAMPLE 3

**Read the following section of an article about the ozone layer:**

**The atmosphere is an ocean of air and a precious natural resource for sustaining life on the Earth. Unfortunately, human activities based on national/personal interests are causing harm to this common resource, notably by depleting the fragile ozone layer, which acts as a protective shield for life on the Earth.**

**Ozone molecules consist of three oxygen atoms, as opposed to oxygen molecules which consist of two oxygen atoms. Ozone molecules are exceedingly rare: fewer than ten in every million molecules of air. However, for nearly a billion years, their presence in the atmosphere has played a vital role in safeguarding life on Earth. Depending on where it is located, ozone can either protect or harm life on Earth. The ozone in the troposphere (up to 10 kilometres above the Earth's surface) is "bad" ozone which can damage lung tissues and plants. But about 90 percent of ozone found in the stratosphere (between 10 and 40 kilometres above the Earth's surface) is "good" ozone which plays a beneficial role by absorbing dangerous ultraviolet (UV-B) radiation from the Sun.**

# SCIENTIFIC LITERACY EXAMPLE 3

**Question 4**

**Ozone is also formed during thunderstorms.**

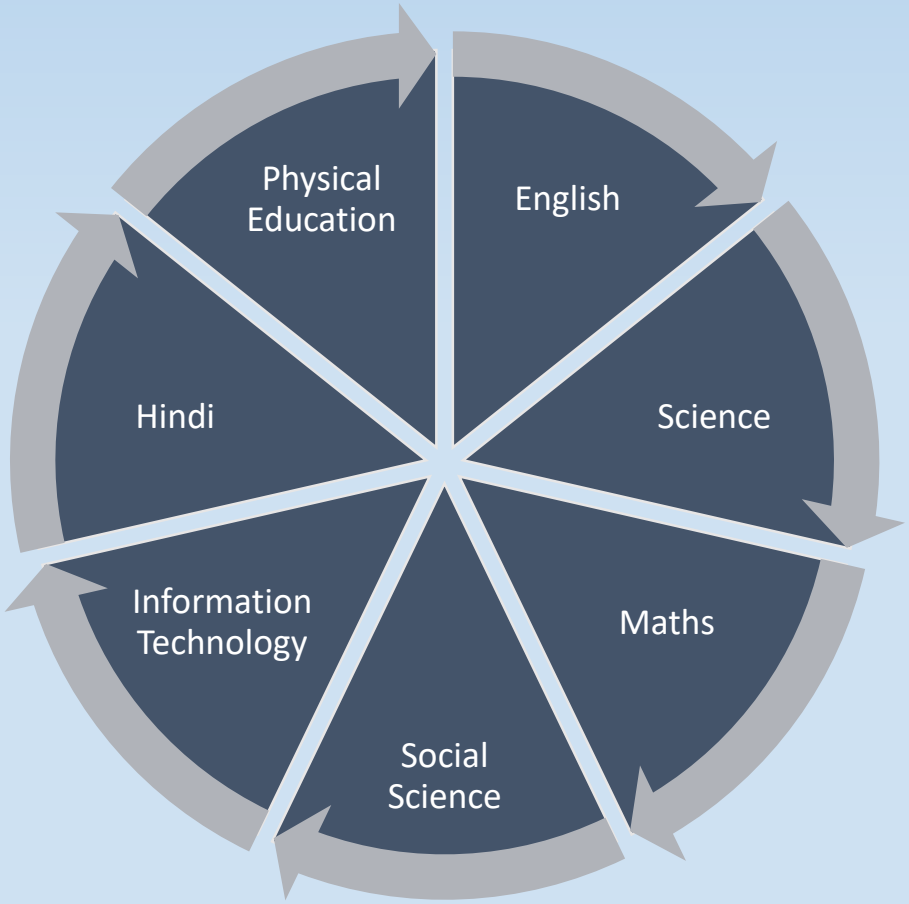
**It causes the typical smell after such a storm.**

**In terms of the article, is the ozone that is formed during thunderstorms "bad ozone" or "good ozone"?**

**A. Bad - it is formed during bad weather.**
**B. Bad - it is formed in the troposphere.**
**C. Good - it is formed in the stratosphere.**
**D. Good - it smells good.**

# CROSS-CURRICULAR LINKAGES

## Integrating Classroom Learning Across Subjects



## WHAT?

Sensitivity towards and a synthesis of knowledge, skills, and understanding from various subject areas.

## WHY?

Inter-disciplinary teaching can increase students' motivation for learning and their level of engagement.

Students will be able to make meaningful and relevant connections between disciplines.

## HOW?

Disciplines may be related or integrated through a central **theme, issue, problem, process, topic, or experience.**

# EXAMPLES OF CROSS-CURRICULAR LINKAGES IN NCERT TEXTBOOKS– 1/2

## ENGLISH & MATHS

**Question 3:** How is a cricket bat different from a hockey stick?

**NCERT CLASS 7 MATHS- VISUALISING SOLID SHAPES**

**NCERT CLASS 7 ENGLISH - HONEY COMB: THE STORY OF CRICKET**

## ENGLISH & INFORMATION TECHNOLOGY

**Question 9:** How have advances in technology affected the game of cricket?

## ENGLISH & SCIENCE

17 Forests: Our Lifeline

One evening Boojho entered the park with an elderly person. He introduced him to his friends. Prof Ahmad was a scientist working in the university. The children started playing while Prof Ahmad sat on a bench in the corner. He was tired as he had participated in the golden jubilee celebrations of the town. After a while, the children also came and sat around him. They wanted to know about the celebrations. Prof Ahmad told them that after the cultural programme, the senior people discussed the town's unemployment problem. A plan was proposed to put up a factory by clearing an area of the forest just outside the town. This would give the increasing population of the town a chance to get jobs. The children were very surprised when Prof Ahmad told them that many people had objected to this idea.

"This is because the forests serve as green lungs and water purifying systems in nature", Prof Ahmad explained. The children were confused. Prof Ahmad realised that the children had not visited a forest. The children also wanted to know more about the forest, so they decided to visit it with Prof Ahmad.

17.1 Visit to a Forest

One Sunday morning, the children packed a few things like a knife, a hand lens, a stick, a notebook and walked together through a forest trail near a village. On their way, they met Tibu, a young boy of their age group, of nearby village, who was taking cattle for grazing along with his aunt. He was very agile, running here and there to keep the herd together. When he saw the children, Tibu also started walking along with them, while his aunt went on a different path. As soon as they entered the forest Tibu raised his hand and signalled them to keep quiet because noise could disturb the animals living in the forest.

Tibu then took them to a place at a height to show them the broad view of the forest. Children were surprised

**Activity 17.1**

Observe the various things in your home and make a list of those which are made from material which may have been obtained from the forest.

You might have many wooden items on your list like plywood, fuel wood, boxes, paper, matchsticks, and furniture. Do you know that gum, oils, spices, fodder for animals and medicinal plants are also some of the products which we get from the forest (Fig. 17.5).

Science

**NCERT CLASS 7 SCIENCE- FORESTS:OUR LIFELINE**

# EXAMPLES OF CROSS-CURRICULAR LINKAGES IN NCERT TEXTBOOKS- 2/2

## ENGLISH & SCIENCE

**NCERT CLASS 8 ENGLISH- HONEY DEW: THE TSUNAMI**

**Question 6:**

What are the two different ideas about why so few animals were killed in the tsunami? Which idea do you find more believable?

**KEYWORDS**

- CRUST
- DISCHARGE
- EARTH'S PLATES
- EARTHQUAKE
- ELECTROSCOPE
- LIGHTNING
- LIGHTNING CONDUCTOR
- NEGATIVE CHARGE
- POSITIVE CHARGE
- RICHTER SCALE
- SEISMOGRAPH
- THUNDER
- THUNDERSTORM
- TRANSFER OF CHARGE
- TSUNAMI
- TREMOR

**NCERT CLASS 8 SCIENCE- SOME NATURAL PHENOMENA**

**WHAT YOU HAVE LEARNT**

- Some objects can be charged by rubbing with other objects.
- There are two kinds of charges — positive charge and negative charge
- Like charges repel and unlike charges attract each other.
- The electrical charges produced by rubbing are called static charges.
- When charges move, they constitute an electric current.
- An electroscope may be used to detect whether a body is charged or not.
- The process of transfer of charge from a charged object to the earth is called earthing.
- The process of electric discharge between clouds and the earth or between different clouds causes lightning.
- Lightning strike could destroy life and property.
- Lightning conductors can protect buildings from the effects of lightning.
- An earthquake is a sudden shaking or trembling of the earth.
- Earthquake is caused by a disturbance deep inside the earth's crust.
- It is not possible to predict the occurrence of an earthquake.
- Earthquakes tend to occur at the boundaries of earth's plates. These boundaries are known as fault zones.
- Destructive energy of an earthquake is measured on the Richter scale. The earthquake measuring 7 or more on Richter scale can cause severe damage to life and property.
- We should take necessary precautions to protect ourselves from earthquakes.