

बच्चों के लिए  
राज्य स्तरीय विज्ञान, गणित एवं पर्यावरण प्रदर्शनी-2013-14  
तथा  
41वीं जवाहरलाल नेहरू राष्ट्रीय विज्ञान, गणित एवं पर्यावरण  
प्रदर्शनी-2014

प्रदर्शों तथा मॉडलों को बनाने के लिए एवं  
प्रदर्शनियाँ आयोजित करने हेतु

## दिशानिर्देश

**STATE LEVEL SCIENCE, MATHEMATICS AND ENVIRONMENT EXHIBITION  
FOR CHILDREN-2013-14  
and  
41ST JAWAHARLAL NEHRU NATIONAL SCIENCE, MATHEMATICS AND  
ENVIRONMENT EXHIBITION FOR CHILDREN-2014  
GUIDELINES  
FOR THE PREPARATION OF EXHIBITS AND MODELS, AND  
Organising Exhibitions**

# 1 GUIDELINES FOR THE PREPARATION OF EXHIBITS AND MODELS

## INTRODUCTION

All children are naturally motivated to learn and are capable of learning. They are natural learners and knowledge is the outcome of their own activity.

Children learn through interaction with the environment around, nature, things and people—both through actions and through languages. They construct knowledge by connecting new ideas to their existing ideas based on materials/activities presented to them. In order to stimulate creativity, inventiveness and the attitude for innovation in science and mathematics, National Curriculum Framework-2005 emphasises on activities, experiments, technological modules etc. It also encourages implementation of various activities through a massive expansion of channels such as organisation of science, mathematics and environment exhibition at the national level for school students, with feeder events at school/block/tehsil/district/region/state levels. The objective must be to search and nurture inventive/creative/innovative talent among students. The curriculum framework further envisages the upgradation of current activity in this regard by many orders of magnitude, through coordination of state and central agencies, NGOs, teacher associations etc., financial support and mobilisation of experts in the country.

Science and Mathematics are powerful ways of investigating and understanding the world. Concerns and issues pertaining to the environment should be given importance on all possible occasions through a wide range of activities involving outdoor project works. Such projects may then get a place for display in various science, mathematics and environment exhibitions.

The National Council of Educational Research and Training (NCERT), New Delhi

organises Jawaharlal Nehru National Science, Mathematics and Environment Exhibition (JNNSMEE) for Children every year for popularising science, mathematics and environmental education amongst children, teachers and public in general. This exhibition is a culmination of various exhibitions organised in the previous year by the States, UTs and other organisations at district, zonal, regional and finally at the state level. Selected entries from all States and Union Territories, the Kendriya Vidyalaya Sangathan, the Navodaya Vidyalaya Samiti, Department of Atomic Energy Central Schools, CBSE affiliated Public (independent) Schools and Demonstration Multipurpose Schools of Regional Institutes of Education participate in this national level exhibition. Like in the past several years such exhibitions are to be organised from district to state level during 2013 - 14 too. These would form the first phase of preparation for the JNNSMEE to be organised in November 2014.

Children are naturally inquisitive and innovate in response to a variety of problems in their environment. It is high time that innovations made by children are recognized and encouraged thereby solving problems confronting the nation. To encourage innovations, the Theme for the State Level Science, Mathematics and Environment Exhibition (SLSMEE) for Children – 2013-14 would be **Scientific and Mathematical Innovations**.

Recognizing the importance of innovations, the Government of India has declared the decade 2010-2020 as the **Decade of Innovations** with a focus on inclusive growth. Innovation need not always be a scientific invention or discovery which are based on high input R&D. Innovation in this context may be referred to as renewing, changing or creating more effective processes, products, ways of doing things or development of new values through solutions that meet new requirements..

There are various problems related to agriculture, industry, global warming, resource depletion, energy resources, pollution, health, nutrition, transport and communication, disaster management, environment etc. Children need to be aware of such situations, issues and problems that the society is facing and try to find innovative ways based on their scientific knowledge and mathematical understanding, to tackle them.

Children need to be encouraged to appreciate and participate in the responsible use of science and technology for the benefit of the society. They should also have a scientific vision about different issues and the ability to acquire and process information about scientific developments and innovations.

The main objectives of the exhibitions are:

- to provide a forum for children to pursue their natural curiosity, innovation and inventiveness to quench their thirst for creativity;
- to make children feel that science and mathematics are all around us and we can gain knowledge as well as solve many problems by relating the learning process to the physical and social environment;
- to lay emphasis on the development of science and mathematics as a major instrument for achieving goals of self-reliance and socio-economic and socio-ecological development;
- to analyse how science and mathematics have developed and are affected by many diverse individuals, cultures, societies and environment;
- to appreciate the role of science in meeting the challenges of life such as climate change, opening new avenues in the area of agriculture, fertiliser, food processing, biotechnology, green energy, disaster management, information and communication technology, astronomy, transport, games and sports etc.
- to create awareness about

environmental issues and concerns and inspire children to devise innovative ideas towards their mitigation.

In order to facilitate the preparation of exhibits and models for display in SLSMEE-2013 -14 and JNNSMEE-2014 , The theme for SLSMEE-2013-14 will be **Scientific and mathematical Innovations** pertaining to the areas such as-

1. Agriculture;
2. Energy;
3. Health;
4. Environment;
5. Resources;

**( Areas listed above are suggestive, students are free to choose any other areas and develop exhibit involving scientific and mathematical innovations)**

A few exemplar ideas pertaining to some of the areas in the context of the theme for the development of exhibits are given below.

## **THEME: SCIENTIFIC AND MATHEMATICAL INNOVATIONS.**

### **1. Agriculture**

The main aim of this area is to make our school children and teachers realize the need of studying and removing constraints responsible for inadequate knowledge about rural professions and building capacity and an attitude for innovation for achieving food security.

The exhibits/models in this area may pertain to:

- Studies of climatic change on agriculture;
- Managing crop yield due to climatic change arising from global warming;
- Eco-forestry to protect and restore ecosystem for sustainable forest practices/preserving and enhancing forest biodiversity;
- Preservation and conservation of soil and judicious use of water;
- Conventional biotechnology practices e.g., application of biotechnology,

microbiology, genetic engineering and genomics to agriculture for improved and high yielding varieties;

- Organic farming/organic fertilisers versus chemical fertilisers; biodynamic liquid manure/green manure;
- Planning and managing energy crops (Salix, poplar, Jatropha, Jojoba etc.);
- Use of biotechnology for economically and ecologically sustainable biofuels;
- Environmental friendly measures of pest control;
- Application of biotechnology and genetic engineering in improving animal breeds and production of animal products that are used as food;
- Growing fodders in hydro-ponic environment;
- Innovative/inexpensive/improved/indigenous technologies/ methods of storage/preservation/conservation/transport of agricultural products and food materials;
- Innovative/improved practices for reducing cost of cultivation;
- Growing plants without seeds;
- Identification of medicinal plants and their applications;
- Effect of electric and magnetic fields on the growth of plants and protective measures;
- Sugar levels in plant sep at different times and dates;
- Gentic variations among plants;
- Factors affecting seed germination;
- Best conditions for mushroom production and growth of ferns;
- Tropisms in plants and growth hormones etc.;
- Indigenous designs of farm machinery, agriculture implements and practices;
- Impact of pollution on food;
- Application of biotechnology and genetic engineering to agriculture for improved and high yielding varieties;
- Improved/improvised method of processing, preservation, storage and transport of animal products;
- Organic fertilizers versus chemical

fertilizers;

- Ecologically sustainable farming methods;
- Environment friendly measures of pest control;
- Harnessing of animal products keeping environmental concerns;
- Identification of medicinal plants and their applications;
- Schemes/designs to help reduce production cost and conservation of raw materials;
- Plans for proper management of natural resources and environment;
- Strategies to eliminate food insecurity;
- Issues related with the animal health and food security;
- Food production and demand of quality food and food security;
- Advantages and disadvantages of genetically modified (GM) food;
- Nutrition education/healthy eating habits and food utilisation by body;
- Pepping/mulching for weed management and root development in soil; etc.
- Devices to control and measurement of the noise, air, soil, water pollution;
- Preservation, conservation and management of soil;
- Analysis of soil samples for their components;
- Ecological studies of plants and animals;
- Experiments with biodegradability;
- Study and record varying water levels, over the year, in the water body, surrounding environment;
- Design and development of an automatic weather recording device;
- Ozone destruction experiments; etc.

## **2. Energy**

This area is expected to make children think of various ways and means for making efficient use of available energy resources and also new techniques/methods of using and conserving energy from both conventional and non-conventional sources. The exhibits/models in this area may pertain to:

- Various ways of harnessing geothermal energy such as energy from hot springs/geothermal desalinization/geothermal heating – controlling heating and cooling of a building using underground heat by vertical/horizontal loops/geothermal power/electricity generated from naturally occurring geological heat sources;
- Models of green building/environment friendly building which can harvest energy, water and materials;
- Green roof technologies/roof mounted solar technologies such as solar water heater, solar lighting system;
- Heating system of a building by solar heater;
- Models/innovative designs of domestic hydroelectric generator;
- Devices to make breeze funneling towards your home;
- Methods of heat retention in materials/heat control in the design of house;
- Solar cooker/solar distiller/solar dryer for food processing/solar heated houses;
- Solar thermal electricity/community solar project;
- Innovative designs and installation of solar tower;
- Hybrid solar lighting (solar illumination by routing daylight into the interior part of the building by reflecting a focused beam of sunlight on the end of optical fiber cables);
- Studies of variation in sunshine intensity at a given place for developing indigenous method of its usage etc;
- Projects for measuring availability of solar/wind energy in a given area;
- Model of wind turbine for domestic use with vertical/horizontal axis;
- Designs of low noise wind farm;
- Wind mill/water mill for grinding grains/drawing water from the well and to generate electricity;
- Water sensitive urban design to mitigate water shortage;
- Water crisis management;
- Use of tidal waves/ocean currents/salinity gradient for generating electricity;
- Wave energy from oscillating water conversion/tidal barrage generator etc;
- Energy from biomass such as seaweeds, human/animal wastes, keeping in view environmental concerns;
- Improved technologies for effective usage of bio-fuels;
- Innovative designs of bio gas/bio mass plant;
- Bio diesel from plant oils (obtained from canola, palm oil, micro algae oil, waste vegetable oil etc);
- Low cost liquid fuel (bio-ethanol, bio-methanol from cellulose biomass by improvising conversion techniques);
- Bio energy for poverty alleviation;
- Impact of bio-energy on food security;
- Models/designs of fuel-efficient automobiles/machines;
- Innovative designs of internal combustion engine which can function on various bio fuels;
- Production of electrical energy from mechanical energy/nuclear resources;
- Mechanism of extraction, storage and processing of fossil fuels,
- Study of air tides;
- Effects of landscaping and architecture on energy consumption etc.

### 3. Health

The main objectives of this area are: to bring awareness among the youth about health and factors affecting our health, to explore new scientific, technological and bio-medical interventions in prevention and cure, to analyze the role of self and society in keeping our environment healthy in order to maintain good health and promote innovative ideas for better management.

The exhibits and models in this area may pertain to:

- Demonstration of health and differentiation from the state of ill health;
- Demonstration of factors affecting the health, different ailments in the body;
- Showing and designing activities on

infectious and non-infectious diseases, relationship with causative factors and their sources;

- Innovation to develop control measures at different levels/roles of various agencies;
- Presenting medical assistance and facilities, rural/urban and gender aspects;
- Sensitising people to be careful in health matters, explore the possibilities and make use of the facilities available;
- Development of knowledge-base and understand new scientific, technological aids in bio-medical area;
- Demonstration of means and ways to adopt methods for self concentration and meditation and their uses;
- Demonstration of known facts and research findings in different medical systems like Indian, Modern, Homeopathy etc.;
- Demonstration of lifestyle and relationship with good and bad health based on known facts and researches;
- Demonstration of the role of traditional knowledge of herbal products for community health; etc.
- Improved methods of sanitation and appropriate technology for waste disposal, both biodegradable and non-biodegradable;
- Common prophylactic measures available and advantages of inoculation and vaccination;
- Need for appropriate measures for family welfare;
- Need for developing low-cost nutritious food;
- General awareness about occupational hazards and innovative techniques to overcome them;
- General awareness about community medicine;
- New medical diagnostic and therapeutic tools;
- Improved aids to visually impaired and physically handicapped persons;
- Need to curb menace of alcohol consumption, drug addiction and smoking;
- Genetic studies;

- Studies of memory span and memory retention; and
- Factors affecting the enzymes' reaction rates etc.
- Simple technologies for developing diagnostics and environmental monitoring.

#### **4. Environment**

The main objective of this area is to make general public and children in particular aware about the current environmental issues and concerns for achieving sustainability to prevent the effect of environmental issues. The models and exhibits in this area may pertain to:

- Environmental issues related with human activities such as agriculture, energy, fishing, forests, mining, shipping, paper, war, ocean deoxygenation, dead zone, paint etc.;
- Environmental issues with conservation — species extinction, pollinator decline, coral bleaching, Holocene extinction, invasive species, poaching, endangered species etc.
- Environmental issues with energy conservation, renewable energy, efficient energy use, renewable energy commercialization etc;
- Environmental controversies such as dam controversies, genetically modified organisms/food controversy, sealing, dioxin controversy, water fluoridation controversy, Endosulfan controversy, POP etc.;
- Environmental disasters such as Bhopal disaster, oil spills, nuclear accidents etc.
- Endocrine disruptors;
- Climate change — global warming, greenhouse gases, fossil fuels, sea level rise, ocean acidification etc.;
- Issues related with environmental health such as air quality, asthma, electromagnetic radiations and fields, lead poisoning, indoor air quality, sick building syndrome etc;
- Ozone depletion – CFC;
- Environmental effects of intensive farming such as overgrazing, irrigation, plasticulture, pesticides etc.;

- Water pollution — acid rain, marine pollution, Ocean dumping, eutrophication, marine debris, thermal pollution, algal boom, micro-plastics, etc;
- Air pollution — smog, ozone, particulate matter, sulphur oxide etc;
- Light, noise, visual, point source and extended source pollution;
- Urban sprawl, habitat fragmentation, habitat destruction;
- Soil erosion, soil contamination and salination, and Waste;
- Aviation and environment;
- Environmental impacts of irrigation, dams and reservoirs;
- GAIA hypothesis and environment protection;
- Environmental implications of nanotechnology (nano-toxiology and nano-pollution).

## **2** GUIDELINES FOR ORGANISING ONE-DAY SEMINAR ON

### **Mathematics of Planet Earth – 2013**

**NOTE:** *The One-Day Seminar should preferably be organised one day before the organisation of State Level Science, Mathematics and Environment Exhibition (SLSMEE) for Children.*

The importance of Mathematics has been realized since ancient time. Mathematics not only helps in day-to-day situations but also develops logical reasoning, abstract thinking and imagination. It enriches life and provides new dimensions to thinking. The struggle to learn abstract principles develops the power to formulate and understand arguments and the capacity to see inter-relations among concepts. From Medical Technology to Economic Planning, from Genetics to Geology, mathematics has left an indelible mark on every part of modern Science. It can thus be seen that mathematics is a powerful way of understanding the world.

Having realized this the international mathematics community decided to dedicate the year 2013 as the 'Year of Mathematics' and mooted the idea of Mathematics of Planet Earth (MPE)-2013. More than a hundred scientific societies, universities, research institutes and organisations all over the world have come together to make attempts to explore the mathematical framework in Nature and to see how with the help of other disciplines mathematics can provide solutions to the challenging problems on the planet earth. The ideas generated and the initiatives thought during MPE-2013 are likely to make an impact on the society in such a way that a new generation of motivated researchers will grow up to explore the mathematics in the scientific problems that relate to sustainability of planet earth.

MPE-2013 intends to create awareness among teachers, teacher educators, researchers and students about looking for mathematics in all possible situations on the planet earth. It may also motivate the community to appreciate and join interdisciplinary courses in future.

During the Year of Mathematics of Planet Earth activities are planned to (i) increase the public appreciation and understanding of Mathematics; (ii) generate awareness among the masses about the power of mathematics; (iii) motivate people to think about using mathematics for solving challenging problems surrounding them; and (iv) make people aware of the aesthetic sense and beauty of mathematics.

As a part of this endeavour, to reach out to the public through children, a one day seminar may be organised in the SLSMEE for children. During this One-Day Seminar on Mathematics of Planet Earth, children, teachers, parents and all concerned may be invited to generate ideas. The activities in this seminar may include:

- Encouraging the designing of projects in mathematics to generate enthusiasm in the recent trends of development and research in mathematics;
- Making people aware of contributions of mathematics in the development of other subject areas;
- Publicising the usefulness of mathematics in the development of mankind in bringing it to the present stage;
- Organising poster exhibition-cum-competitions highlighting usefulness of mathematics, especially when it is worked out with other disciplines, in solving the problems on planet earth;
- Organising invited talks by experts in mathematics, particularly motivating the audience to look for mathematics in the nature;
- Arranging a Quiz competition in which questions may be based on the interdisciplinary approach to learn mathematics;
- Arranging a group discussion among different groups, to create awareness about the usefulness of mathematics in different spheres of life.