बच्चों के लिए
राज्य स्तरीय विज्ञान प्रदर्शनियाँ–2011-2012
तथा
39वीं जवाहरलाल नेहरू राष्ट्रीय विज्ञान एवं पर्यावरणीय शिक्षा प्रदर्शनी–2012

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

दिशानिर्देश

STATE LEVEL SCIENCE EXHIBITIONS FOR CHILDREN–2011-2011

AND

39th JAWAHARLAL NEHRU NATIONAL EXHIBITION FOR SCIENCE AND ENVIRONMENTAL EDUCATION FOR CHILDREN–2012

GUIDELINES

For the Preparation of Exhibits and Models
and
Organising Exhibitions

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

CONTENTS

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 interactions 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. The structuring and restructuring of ideas are essential features as children progress in learning. They actively engage with the world around them, exploring, responding, inventing, working things out, and interpreting. In order to stimulate creativity and inventiveness in science, National Curriculum Framework (NCF) 2005 emphasises on activities, experiments, technological modules etc. NCF–2005 also encourages implementation of various curricular activities (even if these are not part of the examination) through a massive expansion of non-formal channels such as organisation of science 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 talent among students. NCF – 2005 further envisages the upgradation of current activity in this regard by many orders of magnitude, through co-ordination of state and central agencies, NGOs, teacher associations etc., financial support and mobilisation of experts in the country. Such a movement should gradually spread to every corner of India and even across South Asia, unleashing a wave of creativity and scientific temper among young students and their teachers.

Science is a powerful way of investigating and understanding the world. Therefore, the teaching of science must enable children to examine and analyse their everyday experiences. Every resource must be explored to enable children to express themselves and to handle objects. 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. Some of the information and understanding, flowing from such activities and projects could contribute to the elaboration of a publicly accessible database, which would in turn become a valuable educational resource. Well-planned student projects may lead to knowledge generation. Such projects may then get a place for display in various science exhibitions.

The National Council of Educational Research and Training (NCERT), New Delhi organises Jawaharlal Nehru National Science Exhibition for Children (JNNSEC) every year for popularising science amongst children, teachers and public in general. This exhibition is now renamed as Jawaharlal Nehru National Exhibition for Science and Environmental Education for Children (JNNESEC). 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 schools 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 2011 - 12 too. These would form the first phase of preparation for the Jawaharlal Nehru National Exhibition for Science and Environmental Education for Children (JNNESEC) to be organised in November 2012. To create a caring community in a well developed society, the main theme for the State Level Science Exhibitions for Children (SLSEC)– 2011-12 would be '**Science, Society and Environment**'.

We confront many crucial issues as a rapidly progressing society, which are directly or indirectly related to science. Among these issues, there are a number of daily and real life situations. There are various problems related to agriculture, global warming, resource depletion, pollution, health, nutrition, disaster management, environment etc. Children need to be aware of such situations, issues and problems that the society is facing. It is aimed to empower them to apply their scientific knowledge and their mathematical understanding to solve them in order to sustain well being of people of modern society. Children should understand how human societies unlimited use of natural resources affects the quality of life and environment. Children need to be encouraged to appreciate and participate in the responsible use of science for the benefit of the society and environment. They should also have a scientific vision about different issues and the ability to acquire and process information about scientific developments and their long term implications on society and environment.

The main objectives of the exhibitions are:

- to provide a forum for children to pursue their natural curiosity and inventiveness to quench their thirst for creativity;
- to make children feel that science is all around us and we can gain knowledge as well as solve many problems also by relating the learning process to the physical and social environment;
- to lay emphasis on the development of science and technology as a major instrument for achieving goals of self-reliance and socio-economic and socio-ecological development;
- to highlight the role of science and technology for producing good quality and environmental friendly materials for the use of society;
- to encourage children to visualise future of the nation and help them become sensitive and responsible citizens;
- to analyse how science has developed and is affected by many diverse individuals, cultures, societies and environment;
- to develop critical thinking about global issues to maintain healthy and sustainable societies in today's environment;
- to apply mathematics to visualise and solve problems pertaining to everyday life etc.
- 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.

It is envisaged that children and teachers would try to analyse all aspects of human endeavor with a view to identify where and how the new researches and developments in science and technology can bring and sustain progress of society leading to improvement for the challenges of life. The organisation of science exhibitions would also provide opportunities to all participating students, teachers and visitors to get acquainted with different kind of equipments, devices and techniques. This exercise would enable the students and teachers to generate scientific ideas for addressing various problems of the society and environment.

In order to facilitate the preparation of exhibits and models for display and the organisation of State Level Science Exhibitions during 2011 -12, six sub-themes have been

identified. These are:

1. Agriculture and Food Security;
2. Energy - Resources and Conservation;
3. Health;
4. Environmental Issues and Concerns;
5. Mathematics and Everyday Life; and
6. Disaster Management.

The importance of each sub-theme in the context of the main theme and a number of ideas for development of exhibits are given below. However, these ideas are only suggestive.* Participants are free to develop exhibits based on other related ideas of their choice.

THEME: SCIENCE, SOCIETY AND ENVIRONMENT

1. Agriculture and Food Security

Agriculture, directly or indirectly has been the main source of livelihood for the majority of Indian population. Initiatives started for an overall agricultural development in the country include the improvement in science and technology capabilities, production and supply of agricultural inputs like seeds and fertilizers, public policy measures like land reforms etc. One of the greatest assets in rural areas could be an intelligent and effective use of emerging technologies such as biotechnology, microbiology, genetic engineering, etc. It is important to emphasize on all fronts like research, education, training and extension to fully realize the agricultural potential of the country by integrating agriculture with other allied areas like horticulture, cash crops and energy crops production, fisheries, agro-forestry etc.

In view of the above, the agricultural activities that lead to food production are no longer a subject of classical farming only. The modern agriculture cannot sustain itself without the support of research work done by scientists in the field of plant breeding; improved variety of seeds; genetic engineering; biotechnology etc.; industries (chemical fertilisers and pasticides, tractors, farming machines and materials); transports (road, rail, waterways); energy (electricity, diesel, petrol, gasoline etc.) ; management (storage, processing, preserving, quality control and maintenance) and many other sectors.

The main aim of this sub-theme is to make our school children and teachers realize the need of studying and removing the constraints responsible for knowledge gap on rural professions and building capacity in food security.

Food resources development is one of the most important areas of human activity. Application of the knowledge of various scientific principles has played as important role in providing new technologies for improving food production. Now, the world is able to grow sufficient food for its 6.6 billion inhabitants. But it is also a reality that many people still do not have enough food to eat and many are malnourished. It is ironical that quite a large number amount of food is grossly wasted by some sections of our global society. Recently our country too is facing this problem related with the food security. This problem needs immediate and appropriate attention. About 15,000 children of the world die daily as a direct or indirect consequence of inadequate nutrition. People can reach their full intellectual and physical potential to contribute to social and econmoical development of a country only when they are well fed and well nourished. Therefore, it is important to achieve food security for all. Food security exists when all people at all times have physical, social and economic access to safe and nutritious food to meet their dietary needs for a productive and healthy life.

With the help of science and terchnology, we can enhance our agricultural knowledge to achieve food security to reduce hunger, malnutrition and poverty, and facilitate equitable, environmentally, socially and economically sustainable development.

The exhibits / models in this sub-theme may pertain to:

**Exhibits that involve curricular areas and low-cost technologies are also welcome to participate.*

- Studies of climatic change on the 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 varities;
- 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 helath and food security;
- Food production and demand of qulaity 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 - Resources and Conservation

After food and water; energy is our most basic need. All activities require energy to perform. The social and economic development of a country and living standard of its inhabitants depends on the availability and proper utilization of energy resources of that country. Energy is an important concern that differentiates the global rich and the global poor and the social and economic inequalities that result.

All conventional sources of energy are exhaustible. Development of conventional forms of energy for meeting the growing needs is the main task. Fossil fuels supply nearly 75 per cent of the world's energy. But fossil fuels are being depleted hundred thousand times faster than they are being formed. At the current rate of consumption, known reserves of petroleum will be exhausted in about 35 years, natural gases in about 50 years and coal some time within 200 years.

In the context of global sustainability, the great concern about energy is not about diminishing supplies. It is rather than our current models of harnessing energy are unsustainable because of environmental, economic, geographical and equity issues. Our current energy models rely on (i) fossil fuels that cause smog and acid rain and are linked with global warming; (ii) traditional biomass fuels that provide about 10 per cent of world energy, but contribute to deforestation, desertification and air pollution; (iii) hydroelectric power stations that provide about 05.5 per cent of energy consumed but linked with environmental refugee; (iv) Nuclear power stations that provide just over 6 per cent of world energy but generated radioactive wastes that require long term safe disposal. Redesigning system of utilization and conservation of energy could not only minimize environmental impacts but also provide tremendous economic opportunities to fast developing country like India.

One of the important and obvious way of redesigning system for harnessing energy is to develop and shift to clean and non-conventional energy resources which are either non exhaustible or renewable as solar energy, wind energy, hydroelectric power, geo-thermal energy, energy from biomass and biogas, ocean thermal energy, wave energy and energy from other emerging technologies. This energy is also called Green Energy. Our country is making efforts in this direction. The technology to exploit such non-conventional sources of energy must have to be efficient and capable of being operation. Another important point is to make efficient use of existing energy resources and their more equitable distribution. As per the data available, two third of energy is currently wasted worldwide.

Our country is endowed with enormous solar energy. It can generate up to 20 MW solar powers per square kilometer land area that can be used for variety of applications. The gross wind power is estimated to be about 45,000 MW, but presently our country is producing only about 15,000 MW wind power. The demand of electric energy is growing at a rate faster than any other form of energy. Its requirement in India is primarily met through a network of thermal (about 70 per cent) hydroelectric (about 14 per cent) and nuclear (about 4 per cent) power station and remaining from other resources. Nuclear electricity holds much greater potential of power supply in future. But the safety and environmental concerns with the nuclear resources are also important.

In this scenario, we need to design, develop and innovate new and economically viable technologies to harness and conserve energy from alternative resources. This sub-theme is expected to make the 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 sub-theme 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 building which 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;
- Improvised 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

Health is an overall state of body, mind and social well being that implies to an individual and people. Our health is continuously under the influence of both endogenous (within) and exogenous (around) environment and therefore a matter of great concern especially in the rapidly growing society to cope up with newer scientific and technological inventions. When people are healthy, they are more efficient at work. This increases productivity and bring economic prosperity. Health also increases longevity of the people and reduces infant and maternal mortality. When the functioning of one or more organs or systems of the body is adversely affected, characterized by various sign and symptoms, a state of disease is reflected.

The health is broadly affected by genetic disorders, infections and lifestyle but multi-factorial causes are more prevalent in case of many diseases. In case of genetic disorders, deficiencies/defects are inherited from parents and the best examples are hemophilia and colour blindness, however, diseases like cancer and diabetes mellitus are also known to have genetic basis, these are non-infectious.

Further, many diseases last for short period of time called acute diseases like common cold but many other ailments last for longer duration and even as much as life time like tuberculosis, they are chronic diseases. The cancer is one of the most dreaded chronic diseases of human beings and is a major cause of death all over the globe. Transformation of normal cells into cancerous neo-plastic cells may be induced by physical, chemical or biological agents. Ionizing radiations like X-rays, gamma rays and non ionizing radiations UV causes DNA damage leading to neo-plastic transformation. Chemical carcinogens present in tobacco smoke have been identified as a major cause of lung cancer. Cancer causing viruses are also known, they possess genes called viral oncogenes.

Infectious agents comprises of a wide group of organisms called pathogens, they are viruses, bacteria, fungi, protozoan and multicellular worms, insects etc. The diseases caused by these organisms include influenza, dengue fever, AIDS, typhoid, cholera, malaria, ringworms, filariasis etc. The pathogens live under different environmental conditions and have great potential to adapt to the environment within the host. For example, the pathogens that enter the gut know the way of surviving in the stomach at low pH and resistance to various digestive enzymes. Pathogenic attack to an individual and spread to someone else takes place through air, water, soil, physical contact and also through other animals. Such animals are thus the intermediaries and are called vectors. In many instances the body is able to defend itself from most of these infectious agents through the immune system. Acquired immunity is pathogen specific; however, we also possess innate immunity from birth.

Our health is adversely affected due to many environmental hazards that lead to several kinds of infection in the body. With increasing population, demand for food, water, home, transport, energy etc are increasing causing tremendous pressure on our natural resources and thereby contributing to pollution of air, water and soil. The lifestyle including food and water we take, tendency for junk/fast food, rest and exercise, habits and drugs and alcohol abuse is another challenge to our health. Increasing level of obesity, early detection of hyperglycemia and hypertension is a great cause of worry from the health point of view. Continuous efforts of scientists, technologists, doctors and naturalist have brought many new ways of safety and security to our life. Major inventions in bio-medical diagnostics, new vaccines and antibiotics, surgical methods and genetic engineering have given relief to the mankind. These efforts are responsible for raising the standard of the personal health and hygiene and in providing both preventive and curative facilities to the community. Mortality age has gone up, infant and maternal mortality gone down and epidemics are much under control. Awareness towards meditation and traditional knowledge of herbal medicines has influenced community health.

The present sub-theme is proposed with the objectives: to bring awareness among the youth about health and factors affecting our health, to explore new scientific, technological and biomedical 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 sub-theme 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, role 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, Homeopath 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. ENVIRONMENTAL ISSUES AND CONCERNS

The spectacular industrial and economical development over the past few decades has led to the replacement of the communities of nature by man-made communities. However, the principles that govern the life of natural communities have to be observed if these man-made communities are to flourish. Deforestation, overgrazing, indiscriminate mining, and tree-felling, faulty tillage practices etc. have led to severe soil erosion. Over irrigation and river-harvesting of agricultural lands has resulted into salinity of water, water-logging and degradation. Over-use of tube-wells has substantially lowered down the underground water table. Destruction of lush tree covers has occurred due to the need of more agricultural and residual lands to meet the challenges due to over-population. Industrial effluents, forest fire and unplanned growth have led to severe water and air pollution. Major current environmental issues include climate change, species extinction, pollution, environmental degradation, and resource depletion etc. Human living has now become unsustainable. However there is an understanding that the sustainability is the key to preventing or reducing the effect of environmental issues. This needs to practice the human use of natural resources to within sustainable limits. Therefore for humans to live sustainably, the Earth's resources must be used at a rate at which they can be replenished.

The biophysical environment that comprises the Earth's biosphere is the symbiosis between the physical environment and the biological life. The biophysical environment can be divided into two categories: the natural environment and the man-madeenvironment. The industrial revolutionhas mad the man-made environment an increasingly significant part of the Earth's environment. The scope of the biophysical environment is all that contained in the biosphere, which is that part of the Earth in which all life occurs. A biophysical

environment is the complex of biotic, climatic, and edaphic factors that act upon an organism and determine its form and survival, and morphs itself in the process. Ecosystems, of which there are numerous types and are a defined part of the biosphere, collectively make up the whole of the biosphere. Within an ecosystem there are habitats in which an organism (including human beings) exists. At its most natural state, an environment would lack any effects of human activity, although the scale of this activity is such that all areas of the Earth have had at least some influence by humans. At the other end of the scale is the man-made environment and in some cases it has the biotic component that is virtually absent. Emphasis is now for protection of endangered species and protection of any ecologically valuable natural areas.

The understanding of Earth has remarkably increased in recent times through *Environmental Science* which is a basis for addressing environmental issues. It is now a multi-disciplinary academic study taught and studied at all stages of education including the school education. environmental Science is the study of the interactions within the biophysical environment. Part of this scientific discipline is the investigation of the effect of human activity on the environment. Ecology, a sub-discipline of biology and a part of environmental sciences, is often mistaken as a study of human induced effects on the environment. *Environmental Studies* is a broader academic discipline that is the systematic study of interaction of humans with their environment. It is a broad field of study that includes the natural environment, man-made environments and social environments. Environmentalism is a broad social and philosophical movement that, in a large part, seeks to minimize or eliminate the effect of human activity on the biophysical environment.

Environmental issues and concerns are addressed at a regional, nation or international level by several government and non-government organizations. Ministry of Environment and Forest, Government of India, has established National Green Corps to set up and run eco-clubs in school education. Through the eco-clubs different environment related activities such as greening of school campus, collection of wastes, waste management, water conservation practices etc., and other activities related to spread awareness about the environment such as organizing rallies, painting competition etc. are undertaken. With such initiatives of National Green Corps and school systems, Indian children have finalized Indian Children's Charter of Responsibilities. This Charter "Let's Take Care of India" says: *We, the children of India, resolve to work together to take care of our environment Air, Water, Fire (Energy) and Earth by assuming the Indian Children's Charter of Responsibilities*.

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

- Evironmental issues related with human activities such as agriculture, energy, fishing, foorests, mining, shipping, paper, war, occean deoxygenation, dead zone, paint etc.;
- Environmental issues with conservation — species extinction, pollinator decline, coral bleaching, Holocene extinction, invasive species, poaching, endangered species etc. ean deoxygenation, dead zone, paint 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 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, electromag-

netic 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).

5. Mathematics and Everyday Life

The fascinating world of mathematics provides us with an unlimited scope to perceive problems pertaining to three situations visualized in the form of concrete, abstraction and intuition. The important segment of mathematics—the ability to reason and think clearly is extremely useful in our everyday life. Proofs and deductions are hallmarks of mathematics. Much more than arithmetic and geometry, mathematics today is a diverse discipline. It also deals with data, measurements and observations from science, mathematical models of natural phenomenon including human behavior and social systems. Its domain is not molecules or cells but numbers, chance, forms, pattern and order, algorithms, and change. As a science of abstract objects, mathematics relies on logic rather than on observation, as its standard of truth, yet employs observation, simulation, and even experimentation as means of discovering truth. Mathematics offers distinctive mode of thoughts which are versatile and powerful, including mathematical modeling, optimization, logical analysis, inference from data and use of symbols. Experience with mathematical modes of thought builds mathematical power—a capacity of mind of increasing value in this technological age that enables one of read critically, to identify fallacies, to detect bias, to assess risk, and to suggest alternatives.

From medical technology to economic planning (input/output models of economic behavior), from genetics to geology, mathematics has made an indelible imprint on every part of modern science, even as science itself has stimulated for growth of many branches of mathematics. Applications of one part of mathematics to another-of geometry to analysis, of probability to number theory-unity of mathematics. Despite frequent connections among problems in science and mathematics, the constant discovery of new alliances retains a surprising degree of unpredictability. Whether planned or unplanned, the intimacy between science and mathematics in problem solving, understanding theories and concepts has rarely been greater than it is now, in the last quarter of twentieth century.

Mathematics gives an exactness in thinking and provides a quantitative approach. The special role of mathematics in education is a consequence of its universal applicability. In general, to solve practical problems we follow a set procedure invoving steps related with defining variables; writing equations or inequalities; collecting data and organize into tables; making graphs and illustrations; and calctaulating probabilities.

With the above fragrance of mathematics, let us observe a situation and examine how mathematics is involved in it.

Situation: Suppose our problem is to estimate the number of fish/fishes in a pond. It is not possible to capture each of those fish/fishes and count them. We may capture a sample from the pond and estimate the total number of fish/fishes in it. How can we do this?

For the above situation, let us first take a

sample of fishes. Now, how do we estimate the entire population? We would have to then mark the sampled fishes, allow them to mix with the remaining ones in the pond, again draw a sample from the pond, and see how many of the previously marked ones are present in the new sample. Then, using ratio and proportion, we can come up with an estimate of the total population. For instance, let us take a sample of 20 fishes from the pond and mark them, and then release them in the same pond, so as to mix with the remaining fishes.

We then take another sample (say 50), from the mixed population and see how many are marked. We collect data and analyze it.

One major assumption we are making is that the marked fishes mix uniformly with the remaining fishes, and the sample we take is a good representative of the entire population.

The simplified mathematical problem developed here is then solved using various *mathematical techniques*.

For instance, suppose in the second sample 5 marked fishes are present. So, 5/50, *i.e.* 1/10, of the population is marked. If this is typical of the whole population, then $1/10^{th}$ of the population is equal to 20. So, the whole population = 20 x 10 = 200.

Now, let us go back to the original situation and see if the results of the mathematical work make sense. If not so, we use the model until new information becomes available or assumptions change.

Sometimes, because of the simplification of assumptions we make, we may loose essential aspects of the real problem while giving its mathematics description. In such cases, the solution could very often be off the mark, and not make sense in the real situation. If this happens, we reconsider the assumptions in first step and revise them to be more realistic, possibly by including some factors which were not considered earlier.

For instance, the number may not be the actual number of fishes in the pond. We next see whether this is a good estimate of the population by repeating the above steps a few more times, and taking the mean of the results obtained. This would give a closer estimate of the population.

The importance of mathematics lies in exploring its applications in three different dimensions attributed to its fundamental aspects, *viz*, cultural value, disciplinary value, and utilitarian value.

To encourage and stimulate students' interest in Mathematics, some of the mathematical principles being transacted at school stages with their applications have been indicated below.

The exhibits/models in this sub-themes may pertain to:

- Principles of sequence and series in several spheres of human activities viz, calculating the amount of money over certain period of time under given rate of simple interest or compound interest/ finding depreciated or increased value of a certain commodity over a period of time;
- Determining expenditures needed for manufacturing water tank/rectangular box/cylindrical/cone- shaped objects of a certain material provided cost of material per square/cube/unit are known;
- Using principles of permutations and combinations to count the number of arrangements and selections (for example, determining how many routes are there from City A to City C via City B provided there are five routes from City A to City B and seven routes from City B to City C);
- Determining perimeter, area of a region bounded by polygons/the circumference and area of a circular region/surface area and volume of cube/cuboid/cylinder/ cone/sphere/hemisphere of solid when two basic solids are joined together;
- Construction of sphere by revolving circle about its diameter/right circular cylinder by revolving rectangle/right circular cone by revolving right angled triangle/ construction of conics, parabola, ellipse and hyperbola by cutting double napped cones by planes;
- Analytical tools such as conics used in designing parabolic reflectors in automobile head light/suspension of cable bridges/loud speakers in radio;
- Principles of symmetry for indirect mea-

surement for the height of certain object;

- Finding the ratio of area of quantities of substances in the formation of compounds or mixtures;
- Application of semi-elliptic springs and elliptic shaped gears in engineering and industry;
- Constructing an open water tank of maximum capacity by cutting squares of same size at each corner of the sheet and folding up the sides by using given rectangular sheet of metal/finding when the reservoir will overflow by knowing the depth of water at various instants of time;
- Designs of parking area for maximum utilization of space;
- Predicting the changes in value of a particular stock by knowing its present value through financial institutions;
- Predicting the population of species over certain period of time under given constraints;
- Estimating/calculating size of windows/doors/rooms in our school or home/estimating number of plants lying in a particular flower bed/calculating height of a building or a tree;
- Estimating the degree of uncertainty regarding the happening of a given phenomenon such as a candidate appearing for an interview for a post may be selected or may not be selected/it may or may not rain today;
- Applications of linear programming in solving problems pertaining to manufacturing of goods/transport/diet issues;
- Study of rotational symmetry in plants and animals/role of repeated symmetrical patterns in making fabric designs, wallpaper etc.;
- Applications of mathematics in decorating home e.g. how many rolls of wallpaper/number of tiles are needed to cover the wall;
- Use of triangles/making geometrical designs on a table of certain radius, a design is formed leaving an equilateral triangle in the middle and finding the area of the design);
- Using mathematics in cooking and nutrition/estimating number of calories and quantity of nutrients (carbohydrates, proteins, fats, minerals etc.) in a sample portion of various food items;
- Estimating quantity of seeds needed for a crop/estimating crop yields in a particular field without cutting or weighing/estimating/calculating length of wire needed to fence our field/estimating life span of an electric bulb/estimating the volume of blood inside the body of a person/estimating amount of water needed to fill a swimming pool;
- Establishing a mathematical relation by considering all possible parameters to have maximum profit in producing certain items by a factory;
- Helping to decide/determine premium on insurance policies/to make important decisions in business;
- Finding instantaneous speed of a piston in a cylinder of an automobile engine;
- Application of mathematical tools and computer techniques in biology. For example, naration of story of evolution through computer mediated assembly of phylogenic trees and dendograms; etc.

6. Disaster Management

Disasters have significant relationship with natural resource management, poverty allevaiation and sustainable development. Various disasters can cause damage to human life, environment, infrastructure, lowering the quality of life, loss of different bio-organisms, political instability and conflicts, demographic imbalance, unemployment etc.

There is chaos and disorganisation in the event of any natural or manmade disaster. People are affected and disturbed. The issue of disaster can be managed by making all possible preparedness to facilitate proper coordination among different components of the system such as communication, medical, fire fighting agencies, police, social workers,

media, electric supply agencies, armed forces, scientists, engineers and technologists, and other agencies. The whole system including the general public altogether must know what to do and at what time to do. Preparedness, coordination anongst different agencies including the government agencies, planning and clear vision of action to be taken are the keys to any disaster management.

Geoclimatic conditions of our country are prone to certain natural disasters like drought, flood, cyclone and earthquake. Around 60 % of Indian landmass is prone to earthquake of varying degree; 8 per cent of total area to cyclone; 68 per cent to drought; 0.5 million hectare to flood. Seventy five per cent of the annual rainfall occurs during monsoon months. As a result, almost all the rivers carry heavy discharge with them during those months. In the current decade, the damage in terms of human sufferings, loss of life, agricultural productivity and economic losses have been astronomical. Forecasting, warning and communicating using advanced technologies: setting up, maintaining reviewing and upgrading of preparedness measures: sensitization: training: exercise and behavioral change programmes of the community; effective enforcement of building safety codes and information management are some of the issues related with disaster management.

In our country, the issue is also about the need for effective resource mobilization and speedy action. What should we do when faced with a flood, cyclone, quake or any other disaster when we are at home, school or at work? Trained local teams should be equipped to deal swiftly and efficiently in any emergency. Science and technology can be of great help as in most disasters response time is crucial to prevent further loss.

The objective of this sub-theme is to increase awareness of the dangers posed by disasters and to help children find measures for effective mitigation of those dangers. The exhibits/ models in this sub-theme may pertain to:

- Better information and public address systems in the event of disaster to prevent chaos and confusion;
- Access of clean and safe drinking water in the event of disaster;
- Extending logistic supports during various calamities, undertaking rescue and rehabilitation measures during calamities;
- Improvised/improved devices for effective communication between various emergency services-medical, police, military and other administrative bodies/committees;
- Various measures/models for planning, preparedness and coordination of different agencies in the even of disaster/community level preparedness for the various man-made disasters such as gas leakage, nuclear accidents, battery/bomb explosions, etc.;
- Use of geo-stationary satellites in providing information pertaining to meteorological processes;
- Technologies in forecasting and warning of cyclones, floods and storms;
- Innovative designs of flood alarm/flood forecasting and cyclone warning networks;
- Information management from ships and oceans buoys- use of radars in cyclone detection;
- Various flood preventing measures such as construction of raised platforms, embankment of rivers, maintenance of mangroves and other mitigation measures;
- To ensure the effectiveness of drainage system for clearance of sewage before monsoon season/to carry off storm water;
- Emergency mechanisms and mobilization centers/improvement in communication and transportation system;
- Information management and early warning systems for flash floods;
- Studies of the impact of global warming on human health (spread of epidemic like dengue, malaria, yellow fever etc.;
- Reconstruction of riverbanks in flood affected areas for agricultural and rehabilitation of landless people;
- Studies of the changes in animal behavior as a warming to natural disaster;
- Designs and development of automatic weather recording devices etc.

2 GUIDELINES FOR ORGANISING ONE-DAY SEMINAR ON POPULARISATION OF SCIENCE

INTERNATIONAL YEAR OF CHEMISTRY – 2011

NOTE: *The One-Day Seminar on Popularisation of Science should preferably be organised one day before the organisation of State Level Science Exhibition for Children.*

The United Nations declared year 2011 as the International Year of Chemistry (IYC). The activities to be carried out internationally and nationally in this year 2011 will emphasize on the importance of chemistry in sustaining natural resources. In addition, the year will also draw attention to the UN decade of Education for Sustainable Development 2005 – 2014.

The year 2011 is the 100th anniversary of the award of Nobel Prize in Chemistry to Mme Maria Sklodowske Curie. Thus IYC – 2011 also provide an opportunity to celebrate the contribution of women to science. This year is also the 100th anniversary of the foundation of the International Association of Chemical Sciences (IACS) to address the needs for international scientific communication and cooperation among chemists by standardizing nomenclature and terminology (together with the International Union of Pure and Applied Chemistry which was established in 1919 by chemists and academia).

Chemistry is fundamental to our understanding of the world and the cosmos. All known matter is composed of the chemical elements. This is the knowledge of chemistry that makes us to understand the material nature. The molecular transformations are central to the production of food, medicines, fuel, and countless manufactured and extracted products. Indeed all living processes are controlled by chemical reactions. It is also certain that chemistry will play a major role in developing alternative energy sources and in feeding the world's growing population. During IYC – 2011, the achievements of chemistry and its contributions to the well-being of humanity will be celebrated. Through the Year, the world will celebrate the art and science of chemistry, and its essential contributions to knowledge, to environmental protection and to economic development. The IYC will give a global boost to chemical science in which our life and our future are grounded. During the IYC, activities woiuld be planned to (i) Increase the public appreciation of chemistry in meeting world needs; (ii) Increase interest of young people in chemistry; (iii) Increase the public appreciation and understanding of chemistry; (iv) Generate enthusiasm for the creative future of chemistry; (v) Raising public awareness about chemistry is all the more important in view of the challenges of sustainable development; (vi) Promote the role of chemistry in contributing to solutions to global challenges; and (vii) Celebrate the 100the anniversary of the Mme Curie Nobel Prize and the 100th anniversary of the founding of the International Association of Chemical Socities (IACS).

During this One-Day Seminar on Popularization of Science, children, teachers, parents and all concerned are invited to generate ideas. The activities in this seminar may include:

- Organising hands-on activities and demonstrations to help children in understanding working in chemistry-related areas, such as periodic table, molecules that have led to revolution in human life, atomic models, use of mathematical modelling etc.
- Promoting designing projects to promote and stimulate modern developments in chemistry and chemical research at all levels of school education.
- Organization of visits to industrial sites including manufactures, chemical producers, plants, metal and petroleum refineries,. science express train etc.
- Publicizing the contributions that chemistry makes to human kind by arranging lectures or by publications etc.
- Organizing poster exhibition-cum-competitions highlighting usefulness and wonders of chemistry.
- Inviting professionals to schools to show how chemistry is applied and used in their jobs.
- Dispaly of low-cost exhibits and models conveying curricular topics.
- Screening of slide shows, demonstrations experiments etc.

3 Guidelines for Organising the State Level Science Exhibitions for Children – 2011-2012

Objectives

The purpose of science exhibitions is to develop scientific attitude in the young generation of our country to make them realise the interdependence of science, technology and society and the responsibility of the scientists of tomorrow. These objectives may be achieved by presenting the exhibits as an exciting experience of creativity of children, innovations through improvisations of science kits, and various devices and models for providing solutions to many present and future socio-economic problems particularly those confronted in the rural areas, using available materials and local resources.

The exhibition will help children and teachers to learn from each other experiences and motivate them to design and develop something new and novel. It will also provide a medium for popularising science and increasing awareness among the public towards it. The objectives of organising science exhibitions may briefly be put as follows:

- stimulating interest in science and technology and inculcating scientific spirit in younger generation;
- exploring and encouraging scientific and technological talent among children;
- inculcating in them a sense of pride in their talent;
- making children realise the relationship between science and technology and society;
- understanding the need for proper management for the optimum utilisation of resources and prevailing technologies;
- providing exploratory experiences, encouraging creative thinking and promoting psychomotor and manipulative skills among children through self devised exhibits or models or simple apparatus;
- encouraging problem solving approach and developing the appropriate technologies, especially for rural areas and integrating scientific ideas with daily life situations;
- inculcating intellectual honesty, team spirit and aesthetic sense among the participants;
- popularising science among masses and creating an awareness regarding the role of science and technology in socio-economic and sustainable growth of the country;
- developing appropriate techniques for communication of science, technology and its management.

Call for Entries

The main theme for the State Level Science Exhibitions for Children – 2011-2012 and for the 39th Jawaharlal Nehru National Exhibition for Science and Environmental Education for Children (JNNESEC – 2012) would be '**Science, Society and Environment**'. The identified six sub-themes are:

1. Agriculture and Food Security;
2. Energy – Resources and Conservation;
3. Health;
4. Environmental Issues and Concerns
5. Mathematics and Everyday Life; and
6. Disaster Management

In order to facilitate the preparation of exhibits and models for display in district to state level science exhibitions during 2011-2012, *Guidelines for the Preparation of Exhibits and Models* are also being communicated.

i. Children from all schools [including government, government-aided, public and private, catholic, mission, armed-forces (Army, Air Force, Navy, Sainik, BSF, ITBP, Assam-Rifles, CRPF, Police etc.), DAV

management, Maharshi Vidya Mandir, Saraswati Vidya Mandir, Navyug, Municipality, Bhartiya Vidya Bhavan, Science Clubs etc.] are eligible to participate in State Level Science Exhibitions. Preference may be given for students in senior classes (i.e. in secondary and higher secondary stages).

Note for all State Level Science Exhibitions coordinators belonging to state/UT governments:

Following organisations conduct their own science exhibitions separately:

- Kendriya Vidyalaya Sangathan;
- Navodaya Vidyalaya Samiti;
- Department of Atomic Energy Central Schools;
- CBSE affiliated Public Schools (independent schools); and
- Demonstration Multipurpose Schools of Regional Institutes of Education.

These organisations send their selected entries for consideration for participation in Jawaharlal Nehru National Exhibition for Science and Environmental Education for Children (JNNESEC) - 2012 to the NCERT directly. Therefore, it may please be ensured that entries belonging to these organisations are not forwarded to NCERT.

ii. Wide publicity should be given for inviting entries. *Guidelines for the Preparation of Exhibits and Models for display in district to state level science exhibitions during 2011-2012 should be provided to all schools*. These guidelines may also be translated in local languages, if possible, and be given wide publicity. This may also be given on the Internet website(s) of the respective states/union territories and other participating organisations. It is also envisaged that guidelines be printed in local language(s), Hindi, and English in the form of a booklet for their dissemination among all the schools for generating the ideas for developing the exhibits and models. These guidelines can also be viewed on NCERT website (*www.ncert.nic.in*).

iii. Public Sector Undertakings, Industries, and other Non-government Organisations working in the areas (where these science exhibitions are organised) may also be invited to participate as the exhibits displayed by them would be of instructional value for the children and teachers.

Screening, Evaluation and Monitoring of Entries

1. A screening committee should be set up to finalise the selection of entries from the various institutions for participation in the State Level Science Exhibition for Children in case Districts/Regional Level Science Exhibitions are not being organised by the state/UT.
2. The Screening Committee may consist of representatives of SISE/SIE and some selected representative institution(s). All records about the meeting of the committee should be maintained. The selection procedure adopted should lay more emphasis on the quality of the exhibits rather than quantity. *It should be ensured that the exhibits are not crude and hazardous* and have good finish and are presentable.
3. The above mentioned Screening Committee or a separate panel of judges should evaluate the exhibits according to the criteria of evaluation attached herewith. Best three exhibits in each sub-theme from each category, viz., higher secondary and others must also be selected by the said panel of judges.
4. A separate list of the selected entries of the exhibits and models under each sub-theme (to be displayed in the state level science exhibition) must be prepared. This must contain the name of the exhibit/model, names of the student(s) and guiding teacher(s), name of the school and a brief information about the exhibit (may be in two sentences only). This list may also be distributed among all participating children and teachers. A copy of this list should be forwarded to NCERT together with the formal report of the exhibition.

   Such a list may be prepared in accordance with the NCERT un-priced publication on "List of Exhibits", to be displayed in Jawaharlal Nehru National Science Exhibition for Children (now renamed as Jawaharlal Nehru National Exhibition for Science and Environmental Education for Children). It is published every year and distributed to all participating children, teachers, and visitors during the exhibition. *A copy of this may be obtained from the Head, Department of Education in Science and Mathematics, National Council of Educational Research and Training, Sri Aurobindo Marg, New Delhi 110 016.*
5. A formal report of the State Level Science Exhibition and Seminar on Popularisation of Science should reach NCERT **within one month** after the conclusion of the exhibition. It should include the following:
   - i Dates and venue of exhibition.
   - ii Proformas I - V duly filled up.
   - iii List of schools participating and the number of students/teachers participating as per the proforma attached. Break-up of the male and female participants should also be given. It should also reflect on the number of rural and urban schools, that participated in the exhibition.
   - iv List of entries of the exhibits and models being displayed in the state level science exhibition, as explained in paragraph-4 above. Number of exhibits displayed under each sub-theme should also be mentioned separately.
   - v Highlights of the exhibition including other activities such as lectures, film shows, book exhibition etc. and participation of other scientific/industrial organisations.

vi Panel of judges for evaluating the exhibits/models displayed in the exhibition (in accordance with the Criteria for Evaluation of Exhibits).

vii List of selected exhibits being sent for consideration for display in 39th JNNESEC - 2012 bearing the name of student, teacher, school, etc. and their write ups for consideration for participation in JNNESEC -2012.
(A proforma for information about the exhibit/model is also attached for this purpose).

viii Number of visitors to the exhibition.

The Report

and

Proformas I-V

Should strictly follow the above format and be forwarded

within one month

after the conclusion of the exhibition to :

Dr. Gagan Gupta
Co-ordinator

State Level Science Exhibitions for Children - 2011-12
and
Jawaharlal Nehru National Exhibition for Science and Environmental Education for Children - 2011

Department of Education in Science and Mathematics
National Council of Educational Research and Training
Sri Aurobindo Marg, New Delhi 110 016

Telefax: 011-26561742

e-mail: *desm.ncert@nic.in*; *jnnesec2011@yahoo.com*

Website: www.ncert.nic.in

Criteria for Evaluation of Exhibits

The Jawaharlal Nehru National Exhibition for Science and Environmental Education for Children - JNNESEC (earlier called Jawaharlal Nehru National Science Exhibition for Children - JNNSEC) is organised every year by the NCERT. It receives entries for consideration for participation from States/UTs selected from the State Level Science Exhibitions held in the preceding year. In order to keep a uniform criteria for evaluating the exhibits in all States/UTs and on the basis of the feedback received from different agencies, the following criteria for judging the exhibits is suggested (the percentage given in bracket are suggestive weightages):

1. Involvement of children's own creativity and imagination (20 per cent);
2. Originality and innovations in the exhibit/model (15 per cent);
3. Scientific thought/ principle/ approach (15 per cent);
4. Technical skill, workmanship and craftsmanship (15 per cent);
5. Utility/educational value for layman, children, etc.; (15 per cent)
6. Economic (low cost), portability, durability, etc. (10 per cent); and
7. Presentation - aspects like demonstration, explanation, and display (10 per cent).

It is further advised to divide the entries into two categories, viz., (i) upto secondary level; and (ii) higher secondary level. On the basis of the criteria suggested above, three entries from each sub-theme may be selected and forwarded to NCERT for consideration for participation in JNNESEC-2012. Besides the popularisation of science, the objective of this activity is to search and nurture inventive or creative talent among children. Judges are requested to evaluate the entries on the basis of pupils' involvement. Imagination and innovations made by the child in designing the exhibit/model should be assessed. They should also judge whether the model is traditional or an improvement over the traditional model or it is innovative. Various skills involved in constructing the exhibit and model, the degree of neatness and craftsmanship may also be taken into account. *Every effort must be made to rule out the tendency of procuring the ready-made exhibits/models.*

General layout of the exhibit, relevance, clarity of charts accompanying the exhibit and overall attractiveness to the layman and children should also be assessed. Working models should be encouraged.

State _____ Duration_____

STATE LEVEL SCIENCE EXHIBITIONS FOR CHILDRE - 2011-2012

THEME: SCIENCE, SOCIETY AND ENVIRONMENT

VENUE: .....

JUDGES' PROFORMA FOR EVALUATION OF PARTICIPATING ENTRIES–SUB-THEME-WISE

Sub-theme

(Please tick mark on the sub-theme being evaluated)

Agriculture and Food Security / Energy – Resources and Conservation / Health / Environmental Issues and Concerns / Mathematics and Everyday Life / Disaster Mangamnet

Sl. No.	Code of the Exhibit	Involvement of Children's Own Creativity and Imagination 20 %	Originality / Innovations in the Exhibit / Model 15 %	Scientific Thought / Principle / Approach 15 %	Technical Skills / Workmanship / Craftsmanship 15 %	Utility / Education Values for Layman and Children 15 %	Economic (low cost) / Portability / Durability 10 %	Presentation 10%	Total 100 %
1.	...	...	...	...	...	...	...	...	...
2.	...	...	...	...	...	...	...	...	...
3.	...	...	...	...	...	...	...	...	...
4.	...	...	...	...	...	...	...	...	...
5.	...	...	...	...	...	...	...	...	...
6.	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...

Date: _____

Signature .....

Name :

Designation and Affiliation:

EXPENDITURE NORMS

The 'Grant-in-Aid' provided by the NCERT to respective states/UTs is a **catalytic grant** for organising the State Level Science Exhibitions and Seminar on 'Popularisation of Science'. States and UTs are expected to spend the additional expenditure, if any, from the state funds. The funds given to the States/UTs are to be utilised *exclusively for meeting the travel and boarding costs of participating students and their teachers and experts*. It is suggested that the following norms of payment may be followed:

1. For Organising the Seminar on Popularisation of Science

(i) The seminar should be organised during the days of exhibition in morning/evening hours.

(ii) Honorarium to **four** (**two** outstation and two local) experts/scientists may be disbursed at the rate of Rs 500.00 each.

Note : The expert/scientist should be preferably from a research institute/ laboratory/ university.

(iii) Travelling allowance to two outstation experts/scientists from a maximum distance of 500 km may be disbursed as per the state/central government rules.

(iv) Daily allowance and incidental charges to **two** outstation experts/scientists for a maximum of three days may be disbursed as per state/central government rules.

(v) Conveyance charges to **two** local experts/scientists may be disbursed as per state/central government rules.

(vi) Contingency grant for tea/coffee with light snacks: typing/photocopying/ cost of transparencies/transparency pens/CDs etc: Rs. 2,500.00.

1. For Organising the State Level Science Exhibitions

(i) Honorarium to **four** (local) judges may be disbursed at the rate of Rs. 500.00 each. **NCERT faculty members should not be provided any Honorarium from this head, if invited as a judge in the exhibition.**

(ii) Only one student and one teacher may be permitted to participate with each exhibit. However, for more than one teacher may be permitted to participate.

(iii) Travelling allowance: actual second class sleeper rail/bus (non-AC) fare.

(iv) Incidental charges: Rs. 50.00 each way for outward and inward journeys subject to a maximum of Rs. 100.00 provided the journey time by rail or bus is more than 6 hours. For journeys less than 6 hours no incidental charges should be paid.

(v) Boarding expenses: Rs.80.00 per head per day for each participant for a maximum of 4 days. *In case if the boarding facilities are not provided by the organisers then a sum of Rs.120.00 per person may be provided as daily allowance (DA).*

(vi) Local conveyance charges may be disbursed as per state/central government rules.

(vii) contingency grant for typing/ photocopying etc. Rs. 2,500/-

It is necessary to **maintain a separate account** for the expenditure of the grants-in-aid provided by the NCERT and the same should be forwarded to the NCERT, along

with all relevant vouchers and receipts, in original **WITHIN ONE MONTH OF THE CLOSE OF THE EXHIBITION** for adjustment in the NCERT account. Proforma I is given for convenience. All vouchers may be signed by the Coordinator/In-charge of the exhibition. All those vouchers/receipts that are in regional language should accompany with a translated copy in English certified by the Coordinator/In-charge of the State Level Science Exhibition to facilitate audit and settlement of accounts. Only those Vouchers/Receipts against such items of expenditure, which are covered under the expenditure norms, may please be sent to this department for adjustment/settlement of accounts. All payments exceeding Rs 5000/- should be supported by payee's receipt with a revenue stamp.

It may please be ensured that each Voucher/Receipt against the expenditure is duly verified for the amount and then passed for payment. The specimen of this certificate is indicated below for convenience:

Verified and passed for payment of Rs .....

(Rupees ..... only).

Signature of the Co-ordinator/In-charge
STATE LEVEL SCIENCE EXHIBITION

4 PROFORMAS

STATE LEVEL SCIENCE EXHIBITION FOR CHILDREN - 2011-2012

Proforma I

MAINTENANCE OF ACCOUNTS

State/Union Territory: _____

Dates of Exhibition: _____

Venue of Exhibition: _____

Voucher No.	Receipt			Expenditure				Signature of Coordinating Officer
	Date of Receipt	Particulars of Grant	Amount Received	Voucher No.	Date of Expenditure	Particulars (Head-wise)	Amount Spent	
		Draft No. Date						
		Other income, if any						
					Balance Refunded to NCERT, if any, vide			
		Total				**Total**		

Certified that the expenditures have been made in accordance with the norms and Guidelines as given by the NCERT for organising the State Level Science Exhibition for Children. It is also certified that no other voucher is included.

Date

Signature of the In-Charge (Controlling Officer)
Official Seal

STATE LEVEL SCIENCE EXHIBITIONS FOR CHILDREN - 2011-2012

Proforma II

INFORMATION ABOUT PARTICIPATING SCHOOLS

State/Union Territory: _____

Dates of Exhibition: _____

Venue of Exhibition: _____

Type of School*	No. of Schools	Tribal/ Rural/ Urban	Number of Exhibits/ Models	Participants from the School						
				Teachers			Students			
				Male	Female	Total	Boys	Girls	Total	SC/ST
G	T									
	R									
	U									
LB	T									
	R									
	U									
PA	T									
	R									
	U									
PU	T									
	R									
	U									
Total										

* **G. Government**: A Government School is that which is run by the State Government or Central Government or Public Sector Undertaking or an Autonomous Organisation completely financed by the Government;

L.B. Local Body: A Local Body School is that which is run by Panchayati Raj and Local Body Institutions such as Zila Parishad, Municipal Corporation, Municipal Committee or Cantonment Board;

P.A. Private Aided: A Private Aided School is that which is run by an individual or a private organisation and receives grants from the Government or Local Body;

P.U. Private Unaided: A Private Unaided School is that which is managed by an individual or a private organisation and does not receive any grant from the Government or Local Body.

STATE LEVEL SCIENCE EXHIBITIONS FOR CHILDREN—2011-2012

Proforma III

INFORMATION ABOUT NATURE AND NUMBER OF EXHIBITS DISPLAYED

THEME: SCIENCE, SOCIETY AND ENVIRONMENT

State/Union Territory: _____

Dates of Exhibition: _____

Venue of Exhibition: _____

Sub-themes	Natural and Number of Exhibits Displayed				Total No. of Exhibits
	Innovative/Improvised Apparatus/Working Model	Static Model	Study/Survey Report	Any other	
Agriculture and Food Security					
Energy – Resources and Conservation					
Health					
Environmental Issues and Concerns					
Mathematics and Everyday Life					
Disaster Management					
Grand Total					

State _____ Duration _____

STATE LEVEL SCIENCE EXHIBITIONS FOR CHILDREN - 2011 - 2012

Proforma IV

PANEL OF JUDGES - SUB-THEME-WISE*

VENUE ....

THEME : SCIENCE, SOCIETY AND ENIRONMENT

Sub-theme:
(Please tick mark on the sub-theme being evaluated)

Agriculture and Food Security / Energy – Resources and Conservation /Health/ Environmental Issues and Concerns / Mathematics and Everyday Life / Disaster Management

Sl. No.	Name(s) of the Judge(s)	Designation	Official Address, Phone Fax, e-mail	Residential Address Phone, Mobile
1.				
2.				
3.				
4.				

* Respective judges may have their opinions, suggestions and comments about the organisation of science exhibition. NCERT welcomes all such opinions. Kindly enclose them on separate sheets.

39TH JAWAHARLAL NEHRU NATIONAL EXHIBITION FOR SCIENCE AND ENVIRONMENTAL EDUCATION FOR CHILDREN (JNNESEC) - 2012

Theme : Science, Society and Environment

Proforma V

INFORMATION ABOUT THE EXHIBIT/MODEL

1.	Title of the Exhibit/model (in block letters)	_____ _____
2.	Sub-theme: (Tick only one or strike out all others)	Agriculture and Food Security/Energy – Resources and Conservation/Health/ Environmental Issues and Concerns/ Mathematics and Everyday Life/Disaster Management
3.	Name(s) of the Student(s) (in block letters)	_____ (M/F) _____ (M/F) _____ (M/F) _____ (M/F)
4.	Name(s) of the Teacher(s) (in block letters)	_____ (M/F) _____ (M/F)
5.	Name and complete address of the school (in block letters) :	....Pin .....
6.	Type of school*	Government/Local Body/Private Aided/Private Unaided/Any other (Please Specify) _____ _____
7.	Affiliation of the School	State Board/ICSE/CBSE Any other (Please Specify) _____
8.	Location of the School	Tribal/Rural/Urban
9.	Nature of the Exhibit/Model	Innovative/Improvised Apparatus/Working/Static Model/Study Report Any Other (Please Specify) _____
10.	Approximate Cost of the Exhibit/Model	Rs _____
11.	Requirement for Display	
	(i) Shamiana/Open Space/Dark room	_____
	(ii) Table Size	Length: _____ m; width: _____ m.
	(iii) Water Supply	Yes/No
	(iv) Number of Electrical Points	No.: _____ (5 A); No.: _____ (15 A)

* **G.** **Government:** A Government School is that which is run by the State Government or Central Government or Public Sector Undertaking or an Autonomous Organisation completely financed by the Government;

L.B. **Local Body:** A Local Body School is that which is run by Panchayati Raj and Local Body Institutions such as Zila Parishad, Municipal Corporation, Municipal Committee or Cantonment Board;

P.A. **Private Aided:** A Private Aided School is that which is run by an individual or a private organisation and receives grants from the Government or Local Body;

P.U. **Private Unaided:** Private Unaided School is that which is managed by an individual or a private organisation and does not receive any grant from the Government or Local Body.

12. Source of inspiration / help for preparing the exhibit / model:
(Please explain briefly about the nature and form of help received from the following):

(i) From Teachers / School

_____

_____

(ii) From Parents

_____

_____

(iii) From Peer Group

_____

_____

(iv) Any other

_____

_____

13. Brief Summary (Please explain the purpose and the scientific principle involved in the exhibit / model in not more than three lines).

_____

_____

14. Write-up of the Exhibit / Model **(not more than 1,000 words) in the following format.** (Note: *Proper submission of the write-up will ensure that if selected for participation in the 39^{h} Jawaharlal Nehru National Exhibition for Science and Environmental Exhibition for Children (JNNESEC) – 2012, it will be considered for publication in* the booklet *entitled: Structure and Working of Science Models*. For convenience an exemplary write-up is also given here.):

I. *Introduction*
   (i) Rationale behind construction of the exhibit; and
   (ii) The scientific principle involved.

II. *Description*
   (i) Materials used for the construction;
   (ii) Construction and working of the exhibit / model; and
   (iii) Applications, if any.

III. *References*
   Books, journals or magazines referred for preparation of the exhibit / model.

IV. *Illustrations*
   (i) Black and white line diagram of the model, illustrating the working of the exhibit.
   (ii) Close-up photographs of the exhibit.

Note: (i) Please neither pin nor paste the photographs of the exhibits. Enclose them in a separate envelope. Description of the photograph may be written on its back.
(ii) Please do not enclose the photographs of participating student(s) and their guide teacher(s).

(Signatures of all students and teachers)

5 An Exemplary Write-up of an Exhibit "Toilet Modification in Indian Trains" Displayed in the 35th Jawaharlal Nehru National Science Exhibition for Children—2008 (Solan)

Students
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Kochi
Kerala

Teacher
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Introduction

When it comes to disposal of human excreta and other wastes the country's largest public sector undertaking, the Indian Railways, has been groping in the dark for many years. Untreated excreta and sewerage are discharged into the open, leaving railway tracks a repulsive sight.

Most of the passenger coaches have four toilets, two on both ends of each coach. The human waste from these toilets is directly discharged onto the open tracks. Unhindered dumping of such waste is resulting in unhygienic conditions that may also cause spread of diseases.

Human waste, especially of sick passengers, may contain a large number of germs of many diseases like diarrhoea, cholera, typhoid, hepatitis, other water-borne diseases besides parasitic infections. Parasites like hookworm, roundworm and pinworm are spread mainly through human waste that results in the spread of communicable diseases. The seemingly innocent action of the railways contaminates the environment and promotes unsanitary conditions, negating the very small strides made in sanitation and community health.

Toilet discharge is another major source of corrosion of rails and fastenings. Large amount of water used in the toilets at present needs to be minimised in order to conserve water. Waste water can be treated and recycled so that the problems of corrosion of the tracks as well as spread of diseases can be checked.

Rationale behind Construction of the Exhibit

This project is an attempt to solve the problems arising due to the present mode of disposal of human waste in Indian trains with additional benefit of recycling the water after proper treatment. In the present model the water used in the toilet is filtered and chemically treated and recirculated so that water usage can be minimised as well as the release of untreated water into the tracks can be avoided. After separating water the human excreta is stored separately and can be used to produce biogas

Scientific Principle Involved

Collection: Human waste flushed from toilets is collected in a tank.

Filtration: Filters used in the proposed system filters water from the human wastes flushed from the toilet. The filtered water is collected in a separate tank.

Disinfection: The filtered water is treated chemically using chlorine solution and 1per cent phenol.

Recirculation of Water Using Sensor Controlled Pump: The pump automatically switches ON to pump up water to the overhead tank. This pump is auto controlled with an IC and sensor circuit and switches ON when the water has been treated and switches OFF when water has been pumped up to an overhead tank.

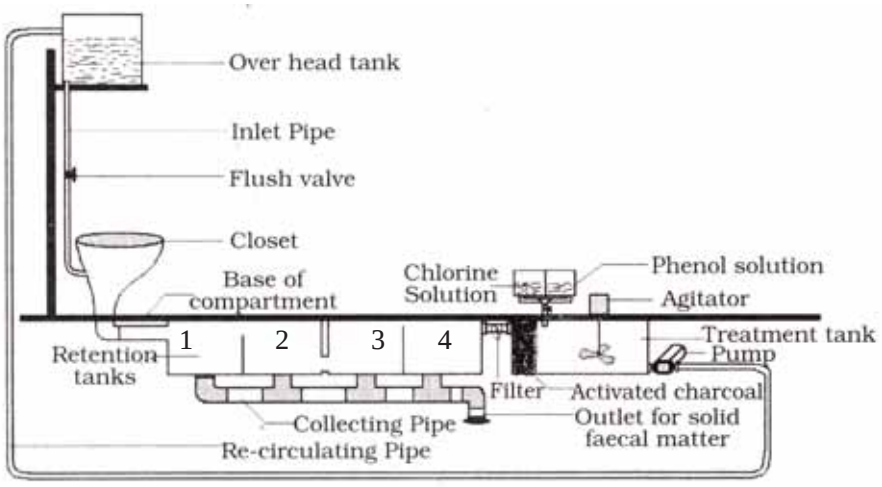
MATERIALS REQUIRED FOR THE CONSTRUCTION

Plywood, transparent plastic boxes, transparent pipes, water pump (washing machine), fevibond, phenol, bleaching powder, metal clamps, screws and nails, wooden stand and activated charcoal.

CONSTRUCTION AND WORKING

The present working model consists of the following major components in the given figure.

(i) Toilet and overhead tank;
(ii) Faecal storing tanks;
(iii) Chemical treatment tank;
(iv) Pipes for water circulation; and
(v) Pump with sensor.



Water from the overhead tank flushes into the toilet after use and the human waste with water gets collected in tank 1 after passing through a tube bent in U-shape. This U-bent tube always holds some water which acts as a seal (to prevent spread of odour). In tank 1 the heavy matter of the excreta is allowed to settle. A pipe has been attached to this tank in order to prevent air blockage. This tank has another pipe near its top through which, water and the light weight matter overflows to tank 2. Tank 2 is connected to tank 3 through a pipe fixed near its base. Water reaching tank 3 may contain some particles, which may settle down after some time.

When tank 3 gets filled up, water from it overflows to tank 4 where it gets filtered. Filters remove tiny particles and the water is then transferred to the treatment tank. Chemical treatment is done with the help of two chemicals, 10 per cent bleaching powder solution and 1 per cent

phenol solution. Both chemicals are kept in two separate tanks, fixed over the treatment tank, and are connected to the treatment tank through pipes, with valves to control the flow of chemicals.

An agitator is provided in the treatment tank, for the proper mixing of chemicals with the water. The treated water is then sent to the adsorption tank where unwanted chemicals get adsorbed by activated charcoal. Charcoal removes foul odour as well as chemicals such as phenol by the process of adsorption and makes the water clean. The treated water is then pumped into the overhead tank with the help of a sensor-operated pump. Whenever the water level reaches a particular level (maximum), through a relay system and IC, the pump gets switched ON and water is pumped to the overhead tank. The same process is repeated again and again.

The water in the overhead tank is only meant for use in toilets for flushing, not for washing and other purposes. For this, another tank has to be provided adjacent to the overhead tank.

The solid component of human excreta stored in the retention tanks is sucked out by a motor when the train reaches the destination station. This can then be transferred to the digester tank of biogas plant which are to be installed in the yard near the main stations.

APPLICATIONS

1. The present model ensures safe disposal of human waste in running trains and helps in minimising use of water by recycling it.
2. The suggested system would also help in preventing spread of diseases causing germs and parasitic infections.
3. Anaerobic fermentation of human waste produces biogas. Hence, the biogas plant set up in the railway yards could meet some of the energy needs of the railway station.
4. This model ensures that railway stations and tracks are kept clean besides, preventing corrosion of rails and fastenings.
5. The biogas produced can minimise energy consumption of the railways. Besides, slurry can be used as manure for plants along the railway lines and at railway stations.

REFERENCES

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2. PIB Press Release: pib.nic.in/archive/lreleng/lyr2003
3. Indian Railways:www.indianrailways.gov.in/deptts/safety
4. Department of Transport, www.dft.gov.uk/transportforyou/access/rail/