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 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 the year – 2010-11 too. These would form the first phase of preparation for the 38th Jawaharlal Nehru National Science Exhibition for Children to be organised in November 2010. To create a caring community in a well developed society, the main theme for the State Level Science Exhibitions for Children (SLSEC) – 2010 - 11 would be '**Science and Technology for Challenges in Life**'.

We confront many crucial issues as a rapidly progressing society, which are directly or indirectly related to science and technology. Among these issues, there are a number of daily and real life situations. There are various problems related to climate change, global warming, resource depletion, pollution, health, nutrition and environment. 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 and technological knowledge and their mathematical understanding to solve them in order to sustain well being of people of modern society. They should understand how human societies unlimited use of natural resources affects the quality of life and ecosystem. 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 and technological developments and their long term implications on society.

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 and technology have developed and is affected by many diverse individuals, cultures and societies;
- 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 and technology in meeting the challenges of life such as climate change, opening new avenues in the area of agriculture, fertiliser, food processing, biotechnology, green energy, information and communication technology, astronomy, transport, games and sports etc.;

It is envisaged that students 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.

In order to facilitate the preparation of exhibits and models for display and the organisation of State Level Science Exhibitions during 2010 - 11, six sub-themes have been identified. These are:

1. Biodiversity: Conservation and Sustenance;
2. Agriculture and Technology;
3. Green Energy;
4. Transport and Communication;
5. Community Health and Environment; and
6. Mathematical Modelling.

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 AND TECHNOLOGY FOR CHALLENGES IN LIFE

1. Biodiversity: Conservation and Sustenance

Biodiversity (or biological diversity) refers to variability of living organisms of terrestrial, marine and other aquatic ecosystems. Entire aspect of biodiversity can be grouped in three categories i.e., Genetic Diversity (variations of genes within the organisms of a species), Species Diversity (variation of species within a region) and Ecosystem Diversity (variation in the form of vegetation and other wild life in a broad ecosystem). Human has always been the greatest beneficiary of the biodiversity as it provides food, medicines and industrial products. It is estimated that the total number of species variety of different living forms are around 10 millions. Out of such an enormous number, only 1.5 millions have been identified so far. Such a variety of living organisms is important from the point of view of sustenance of life on the earth. All these varieties of various life forms have coevolved over the period of time since the origin of life on earth. The variety of different species, their habitats and ecosystem help maintaining a balance of life forms as well as resources on earth. A drastic change in the habitat or ecosystem leads to depletion in the variety of species and also extinction.

We can understand the importance of large number of varieties from the example of agriculture and livestock production. People have raised a wide variety of crops and different types of livestock over a long period of time for increasing productivity. This experience enabled us in becoming wiser and wiser about the nature and properties of different varieties. This wisdom has not only helped us in growing crops and livestock in different climatic conditions, soil types, resistance to various diseases etc., but also provide a foundation for the successful crop as well as livestock improvement programmes. The modern day's technologies, which have resulted in to the production of Genetically Modified Organisms (GMO) for the purpose of either increasing productivity or treatment of diseases, are

also possible only because of the diversities found in various life forms and their understanding.

Thus protection and conservation of biodiversity is not only important from the point of view of fulfillment of our need, rather it is equally or even more important for the very survival of human and other living organisms on the earth. Also, we need to understand the concept of a strong, safe and secure nation. For this, we must not forget the aspects of a healthy, productive and safe environment besides food, education, economy and national security.

As far as the richness of biodiversity is concerned, the tropical forests are on the top as it is the house for more than 50% varieties of species of living organisms found on earth. It may be noted that the tropical forests constitutes only 7% of the total land area of earth. Such a vast richness of the biodiversity in tropics can be attributed to the optimum conditions of evolution over the period of time coupled with comparatively less extinction in the region besides interaction of organisms' genetic as well as species diversity among themselves and also with climate, topography, nutrient rich soil and many more. But the present day's scenario provides us a gloomy picture, as the tropical forests which was once a crucible of evolution have now turned in to the crucible of mass extinction of biodiversity for the cause of so called development and human prosperity. According to an estimate, about 17 million hectares of tropical forests are cleaned annually, which constitutes an area four times of the area of Switzerland. With this rate of deforestation in the tropics nearly 5-10% of the tropical forest species will become extinct in next three decades.

Main reasons of the loss of biodiversity on the earth can be categorized into:

Habitat destruction: When any naturally evolved vegetation (mainly forests) is cleaned for any human need, it leads to the destruction of living conditions for wide varieties of macro and micro flora as well as fauna (known or unknown). Continued habitat destruction may eventually lead to permanent loss of many of the life varieties in the region.

Over exploitation of plant and animal species: Either for fulfilling the human need or in the name of development we have over utilized the living resources to the extent that many of them have already become extinct and many are facing the danger of extinction.

Pollution: Air, water and soil pollution coupled with deforestation has also put enormous stress on the diversity of living organisms on the earth.

Climate change: Human activities have also led to the change in climatic conditions like rise in global temperature (mainly due to green house gases) and altered rainfall pattern (cause of deforestation) have also adversely affected the biodiversity.

Indiscriminate Industrial growth: A rapid industrial growth has of course fulfilled many of our needs and it has made our life comfortable. But at the same time, Industrial growth is responsible for loss of biodiversity as it has led to habitat destruction by deforestation, over exploitation of living resources on one hand and caused pollution and climate change on the other.

Introduction of Exotic species: Sometimes, a few foreign species are introduced in an area for increasing productivity. But, there are instances when these exotic species become a dominant species over a period of time due to their better adaptability and eventually the population of local species starts dwindling and may even become extinct.

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

- Exhibits showing the methods of measurement of biodiversity;
- Models showing the significance and importance of the biodiversity;
- Strategy for ecological restoration of the micro and macro habitat;
- Impact of climate change on biodiversity and their remedial measures;
- Impact Assessment study of various developmental activities on biodiversity;
- Strategy/methods for the prevention and protection of threatened/rare/ endangered plants and/or animals;
- Assessment of the impact of various human activities on the biodiversity of a region;
- Identification of plants of medicinal value in the biodiversity rich area;
- Report of already known medicinal plants from a new area;
- Impact of overexploitation of forest and forest products;
- Impact of monoculture in forest during afforestation and reforestation;
- Studies on the impact of introduction of exotic species in a natural ecosystem;
- Causes and impact of deforestation due to various river valley projects;
- Causes and impact on biodiversity rich hilly region due to construction of large dams;
- Causes and impact of deforestation due to various industrial activities;
- Inventorization of biological resources in different regions/parts of the country;
- Strategy for sustainable use of genetic resources/germ plasm;
- Reclamation of wasteland and revival of their biological potential through microorganism conservation;
- Understanding of the intricate relationships and linkages between plants and animal species in an ecosystem;
- Role of biological sciences including biotechnology in multiplication of the rare, endangered and endemic species;
- Strategies for *in situ* or *ex situ* conservation of wild life by multiplication and restoration of threatened, rare and endangered species; etc.

2. Agriculture and Technology

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 be integrating agriculture with other allied areas like horticulture, cash crops and energy crops production, fisheries, agro-forestry etc.

Despite technological developments and industrialization, Indian economy is heavily dependent on agricultural progress. Agriculture contributes nearly 30% to the national income and accounts for nearly 20% of the total value of

India's export. It is the main source of food grains and it provides raw materials to many industries. The industrial development of India over the past six decades of planned progress is indeed spectacular. India has abundant natural resources and its economy depends largely on the proper utilization of the resources. The country is now, more or less, self-sufficient in the production of consumer goods and some basic items like iron, steel, and aluminium. Service industries like tourism and banking are also growing. Power generation has been substantially stepped-up to fuel a variety of industries and infrastructure adequately built-up for the future progress. The potential for generating hydroelectric power in north-eastern part of the country has not developed because the region falls within a major earthquake zone. Among India's major large scale industries are: cotton and silk textile industry with over a twelve hundred textile mills; iron and steel industry with six integrated steel plants and over 220 mini-steel plants; jute; sugar; cement; aluminium; electronics; jewellery; heavy machines and electrical equipment; light engineering; glass; leather goods; paper; chemicals and fertilizers; pharmaceuticals; petroleum; shipbuilding; sports; dairy; fisheries and other agricultural products; handicrafts etc. The knowledge-based information technology industry is one of the most promising sectors in India. The IT sector alone accounts for over Rupees Eighty Billion in revenue. Tourism has also emerged as an instrument for employment generation, poverty alleviation and sustainable human development. Presently the direct employment in tourism industry in estimated to be about 1.5 million. The emphasis is not only to accelerate industrial development but also make the Indian industries internationally competitive.

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. Just as the green revolution of the nineteen sixties enhanced our self-confidence about our agriculture and industrial capabilities, a knowledge revolution is now necessary to enhance on agricultural and industrial competitiveness. Technology, training, techno-infrastructure and trade are the four pillars of sustained agricultural and industrial progress and agrarian prosperity.

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

- 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;
- Growing fodders in hydro-ponic environment;
- Indigenous designs of farm machinery, agriculture implements and practices;
- Application of biotechnology and genetic engineering to agriculture for improved and high yielding varieties;
- Application of biotechnology and genetic engineering in improving breeds and production of animal products that are used as food;
- Improved/improvised method of processing, preservation, storage and transport of animal products;
- Application of biotechnology, microbiology, genetic engineering and genomics to agriculture for improved and high yielding varieties;

- Use of biotechnology for economically and ecologically sustainable biofuels;
- Ecologically sustainable farming methods;
- Organic fertilizers versus chemical fertilizers;
- Environment friendly measures of pest control;
- Harnessing of animal products keeping environmental concerns;
- Innovative/inexpensive/improved/indigenous technologies/ methods of storage / preservation/conservation/ transport of agricultural products and food materials;
- Growing plants without seeds;
- Identification of medicinal plants and their applications;
- Effect of radiation, electric and magnetic fields on the growth of plants and protective measures;
- Sugar levels in plant sap at different times and dates;
- Genetic variations among plants;
- Models of improved versions of various types of machines and manufacturing plants;
- Schemes/designs to help reduce production cost and conservation of raw materials;
- Use of eco-friendly innovations that may help in increasing the industrial production;
- Innovative methods of exploration and processing of minerals, crude oil. Etc.;
- Issues related with the service industries like tourism, banking, IT etc.;
- Plans for proper management of natural resources and environment;
- Monitoring the changes in wildlife caused by the human encroachment;
- Devices or methods that control pollution;
- Impact of pollution on living and non-living;
- Devices to control and measurement of the noise, air, soil, water pollution;
- Study of chemical spills in industry;
- Awareness about various aspects of environment and disposal of harmful effluents;
- Preservation, conservation and management of soil;
- Analysis of soil samples for their components;
- Ecological studies of plants and animals;
- Experiments with biodegradability;
- Efficient methods of harvesting and using plankton;
- Effect of lubricants on gears;
- 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.

3. Green Energy

The term 'green energy' is used for those energy sources which are considered to be environment friendly. This term is synonymous with the widely accepted term 'renewable energy'. Renewable energy sources can be renewed, regenerated or replenished over a short period of time through natural processes. These energy sources, therefore, are perennial. These are perceived to produce less pollutents and result in lower environmental pollution and carbon emission. It has already been shown in India and in many other countries that it is possible to reduce the energy consumption without compromising with the quality of required energy services. The most logical way to reduce energy consumption is to use available energy in the most efficient manner and to minimise energy wastage. It is a well documented fact that the

carbon emission per unit of electricity produced from renewable energy technologies and energy efficient cogeneration based power plants are significantly lower than the fossil fuel power plants.

Ever increasing greenhouse gas emission into the atmosphere and related climate change is now recognised to be one of the major challenges for mankind. In order to minimise the perils of climate change, it is therefore necessary to urgently take up measures to reduce carbon footprint. Energy production and its uses contribute much towards carbon emission. Therefore, increasing the use of green energy and enhancing energy efficiency of existing technologies, carbon emission can be mitigated.

Though India has a large reserve of fossil fuels but because of its growing demand of energy, the country is now a net importer of energy. Currently the installed power generating capacity in the country is over 1,57,000 MW; the majority of which (around 64.6 percent) comes from burning of coal, gas and oil. Large hydroplants contribute 24.7 per cent and nuclear energy around 2.9 per cent. The contribution of renewable energy technologies in installed power generating capacity in the country is around 7.7 per cent with contributions from wind, small hydroplants and biomass. Prima-facie, use of renewable energy may appear costlier than the conventional energy, but keeping in mind its benefits, which include assured availability of power and a much lower contribution towards global warming, it is worthwhile that India has evolved an action plan to make judicious use of renewable energy resources. Some of the renewable sources of energy in India are described below.

Solar Energy: This tremendous potential of energy can be harnessed using a variety of devices. With recent developments, solar energy systems are easily available for industrial and domestic use (heating) with the added advantage of minimum maintenance. Most of the developed countries are switching over to solar energy as one of the prime renewable energy sources. The current architectural designs make provision for photovoltaic cells and necessary flow of heat while making building plans.

Wind Energy: It is one of the most efficient alternative energy sources. Globally, use of wind energy is growing at the rate of 30 per cent annually. There has been a good deal of development in wind turbine technology over the last decade with many new companies joining the concern. Wind turbines have become larger. Their efficiencies and availabilities have improved. The concept of wind farm has become very popular. Efforts are being made to combine it with solar energy to provide a total self sustainability to the project. The cost of production of wind energy will reduce with increase in its usage. This is indicated by a boom in wind turbine market. India now ranks as a "wind superpower" having a net potential of about 45,000 MW only from 13 identified states.

Hydroelectric Power: India has a huge hydropower potential, out of which around 20 per cent has been realised so far. The new hydro projects are facing serious resistance from environmentalists. Resettlement of the displaced people with their lands is one of the major issues. The dislocation of human settlements causes physical and psychological stress.

Biomass Energy: It can play an important role in reducing India's dependence on fossil fuels (primarily coal) by making use of thermo-chemical conversion technologies. In addition, the increased utilisation of biomass-based fuels will be instrumental in

safeguarding the environment, sustainable development, health improvement in rural areas and creating new job opportunities. Biomass energy could also aid in modernising the agricultural economy. A large amount of energy is expended in the cultivation and processing of crops like sugarcane, food grains, vegetables and fruits which can be recovered by utilising energy-rich residues for energy production. The integration of biomass-fuelled gasifiers and coal-fired energy generation would lower investment. Electrification of villages using biogas is one of the most prestigious programme of the Government of India.

Waste-to-energy: These are the efforts of entrepreneurs to provide environment friendly management and disposal of wastes, as well as the generation of clean electric power from a variety of wastes. Waste-to-energy facilities produce clean, renewable energy through thermo-chemical, biochemical and physicochemical methods.

Micro-generation: The traditional "mega-power" production of electricity is insufficient today because of exponential industrial growth and high living standards. Micro-generation is also called "micro-power". It is the generation of zero or low-carbon electrical power by individuals, small businesses and communities to meet their own needs and can act as a catalyst for cultural changes in consumer attitude. It is both a serious form of clean energy production and also a cultural movement that is gaining momentum worldwide.

Micro-generation technologies include small wind turbines, biomass gasifiers, solar power, micro-hydro, or a combination of these technologies. Hand held solar and wind-power recharging devices for personal electronics, as well as advanced photovoltaic cells, biomass and wind-turbine systems for domestic and industrial power generation are result of technological advances.

The main purpose of this sub-theme is to make children feel the need to study and analyse various aspects of green energy. These include its generation, transmission, distribution and management besides realising its cost effectiveness and positive impact on the environment and society.

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

- Green roof technologies/roof mounted solar technologies such as solar water heater, solar lighting system/heating system of a building by solar heater;
- Devices to make breeze funneling towards your home/natural cooling of the house;
- Designs of insulated bricks for very cold/hot places/methods of heat retention in materials/heat control in the design of house;
- Green bricks using waste materials/different innovative materials for furniture/ construction/road laying;
- Innovative designs of solar cooker/ solar distiller/solar dryer for food processing/solar heated houses;
- Solar thermal electricity/ community solar project;
- Innovative designs for installation of solar tower/ mounting solar panels for electrification in buildings;
- Hybrid solar lighting (solar illumination by routing daylight into the interior part of the building by reflecting a focused beam of sunlight through optical fiber cables);
- Studies of variation in sunshine intensity at a given place for developing indigenous method of its usage;
- Projects for measuring

availability of solar/ wind energy in a given area;
- Wind turbines for domestic use with vertical/horizontal axis;
- Designs of low noise wind farm;
- Innovative/indigenous designs of domestic hydroelectric generator/ wind/water mill for grinding grains/ drawing water from the well and to generate electricity;
- Use of tidal waves/ocean currents/ salinity gradient for generating electricity;
- Wave energy from oscillating water column/ocean thermal energy;
- Tidal barrage generator/ conversion/production of energy from tornadoes/floods/cyclones;
- Innovative designs of geothermal house/green building/environment building which harvest energy, water and various materials/self sufficient, sustainable village/ office/home designs;
- Various ways of harnessing geothermal energy such as energy from hot springs/electricity generated from naturally occurring geological heat sources;
- Geothermal desalinisation/ geothermal power/geothermal heating-controlling heating and cooling of a building using underground heat by vertical/ horizontal loops;
- Production of electrical energy from mechanical energy/nuclear resources;
- Energy from biomass such as seaweeds, human/animal wastes, keeping in view environmental concerns;
- Improvised designs of biogas/ biomass plant/improvised technologies for effective usage of biofuels;
- Fuel farming/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 improving conversion techniques);
- Impact of bio-energy on food security;
- Role of nanotechnology and superconductivity in harnessing energy;
- Innovations in batteries/ inverters/photovoltaic cells to reduce cost;
- Usage of technology for production, storage, transport for using hydrogen/methane/CNG as fuel;
- Designs/models of fuel-efficient automobiles/machines;
- Innovative designs of internal combustion engine which can function on various biofuels;
- Innovations in mechanism of extraction, storage and processing of fossil fuels; etc.

4. Transport and Communication

The Scientific and technological information available today has revolutionized worldwide means of communication, which plays a key-role in the growth and development in all walks of life. Increased production in agriculture and industry also require an efficient transport system for transporting raw materials and finished products from one part of the country of other. Tremendous developments in the field of transport and communication have been made to meet the growing demands due to increasing number of users. The communication network in the world has undergone a sea change with the use of satellite and other communication systems. These global changes have influenced the quality of life in our country.

There has been a global expansion of electronic information in recent times. This has greatly helped in improving

upon the quality of life. Millions of computers in this world are connected through the Internet, facilitating the accessibility to information within a ultra short time. Use of fax, mobile phone, e-mail, have become a common day affair in all walks of life. The convergence of multiple communication systems have revolutionised learning and knowledge sharing. The ability to access and manage these information and knowledge repositories is important in the development of both the individual as well as the society.

Children should be exposed to communication technology and to appreciate its role in human affairs. They need to adapt/adopt new technologies to collect, process, analyse, synthesise, evaluate and share knowledge with others.

The objective of this sub-theme is promoting innovations in knowledge networks involving transport and communication technology in all segments of the society. Children need to reason and communicate to solve problems and to understand effective use of information and communication technology for a variety of purposes.

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

- Indigenous/improvised/Improved devices for world-wide communication of verbal/printed/pictorial information;
- Improvised/Indigenous models for efficient transport and fast communication especially Internet for communication in rural areas;
- Working models of fuel efficient/ pollution-free designs of automobiles/other vehicles;
- Models showing use of innovative/ inexpensive/locally available materials/designs for construction/ maintenance of roads/railway tracks of vehicles;
- Innovative ideas for efficient management of road, rail, water and air transport systems, e.g. better safely measure, especially unmanned railway crossings checking/control of pollution, providing immediate relief to accident victims, etc;
- Models showing preparedness for disaster-both natural and man-made management;
- Working models of devices for recording and reproduction of audio-visual material for entertainment and recreation, use of computers in motion pictures including cartoons, animation, graphics and television;
- Working models of printing technology - communication with graphics and multi-media and low-cost methods.
- Working model of efficient transport system in metropolitan/ urban and rural areas;
- Working model/charts of GPRS enabled vehicular movement;
- Demonstrating the principle and functioning of modern devices of communication;
- Designs for making existing operation of communication more efficient;
- Showing the use of information technology for preservation and conservation of soil/water management and maping of water resources;
- Showing the use of information technology for developing improved designs of machineries for textiles, engineering goods, machines, tools, chemicals, drugs and pharmaceuticals, plastics and ecofriendly materials;
- Demonstrating the use of information technology in developing improved designs/

indigenous designs/devices, which may be used on a small scale for production/manufacturing of utility items of daily use;

- Showing applications of communication technology in making innovative designs of weaving, pottery, metal and leather wares, dyeing, printing and other crafts practiced in cottage industry;
- Developing innovative designs/ models of multimedia equipments/ materials and packages for the children with special needs, especially with visual and audio impairment;
- Exploring uses/applications of transport and communication technology in generating employment/eradicating illiteracy;
- Technologies of emerging web designs/effective use of bookmark sharing;
- Projects against attack aimed on information services/cyber security.
- Technologies in forecasting and warning of cyclones, floods and storms;
- Improvised/improved devices for effective transport and communication between various emergency services, namely medical, police, military and other administrative bodies/ committees;
- Information management from ships and oceans buoys - use of radars in cyclone detection/information management and early warning system for flash floods;
- Use of geo-stationary satellites in providing information pertaining to meteorological processes; etc.
- Emergency mechanisms and mobilization centers/improvement in communication and transportation systems; etc.

5. Community Health and Environment

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 multi-cellular 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. 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 helath.

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 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 subtheme may pertain to:

- Demonstration of health and differentiation from the state of ill health. Health and disease;
- 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 maters, 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.

6. Mathematical Modelling

Mathematical modelling is the process of transformation of a physical situation into mathematical analogies with appropriate conditions. Physical situations need some physical insight into the problem. Then it is solved by using various mathematical tools like percentage, area, surface area, volume, time and work, profit and loss, differential equations, probability, statistics, linear, nonlinear programming, etc. It is a multi-step process involving identifying the problem, constructing or selecting appropriate models, fighting out what data need to be collected, deciding number of variables and predictors to be chosen for greater accuracy, testing validity of models, calculating solution and implementing the models. It may be an iterative process where we start from a crude model and gradually refine it until it is suitable for solving the problem and enables us to gain insight and understanding of the original situation. It is an art, as there can be a variety of distinct approaches to the modeling, as well as science, for being tentative in nature.

In mathematical modelling, we neither perform any practical activity nor interact with the situation directly, e.g. we do not take any sample of blood from the body to know the physiology, and still our mathematical tools reveal the actual situations. The rapid de-

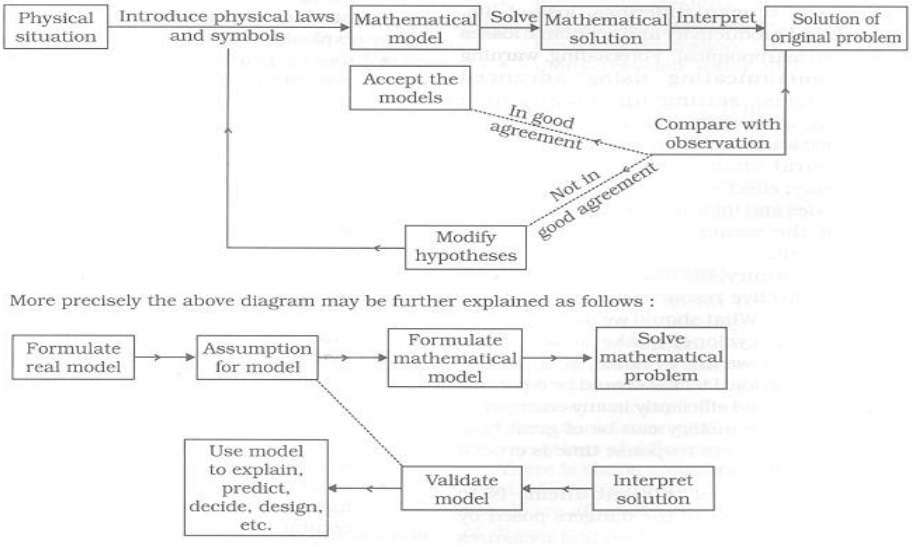

Fig. 1: A Mathematical Model

velopment of high speed computers with the increasing desire for the answers of everyday life problems have led to enhanced demands of modelling almost every area. The objective of this sub-theme is to help children to analyse how mathematical modelling can be used to investigate objects, events, systems and processes. It can be visualized by Fig. 1.

An example is given below for a mathematical modelling for estimating the profitability of a company which sells its products at a fixed price.

Step 1: Understanding the problem: We need to know the profitability of a company under some restrictions/constraints.

Step 2: Mathematical description: Here we suppose the costs are of two types: fixed and variable. The fixed costs are independent of number of units produced (e.g. rent and rates), while the variable costs increase owith the number produced (e.g. materials).

Initially we assume that the variable costs are directly proportional to the number of units produced – this should simplify our model. The company has a certain amount of money coming in form of sales and wants to ensure that it is maximum.For convenience, we assume that all units produced are sold immediately.

Step 3: Solving the mathematical problems: Let x be the number of units produced and sold, C be the total cost of product (in Rs), I be the income from sales (in Rs) and P be the profit (in Rs). Our assumptions above states that C consists of two parts - fixed cost a (in Rs) and variable cost b (in Rs)

$$\text{Then } C = a + bx \qquad (1)$$

Also income I depends on selling prices a (Rs per unit).

$$\text{Thus } I = sx \qquad (2)$$

The profit P is then the difference between income and costs, i.e..

$$P = I - C = sx - (a + bx)$$
$$= (s - b)x - a \qquad (3)$$

Now, we have a mathematical model of the relationship (1) - (3) between the variables x, C, I, P, a, b and s. These variables may be classified as: (i) Dependent C, I and P; and (ii) Parameters a, b and s.

Step 4: solving the mathematical problem: The manufacturer, knowing x, a, b and s can determine P. He/she can also see that to break-even (i.e. no loss and no profit), he/she must produce

$$[a/(s - b)] \text{ units} \qquad \text{(how?)}$$

The model is best summarized as follows:

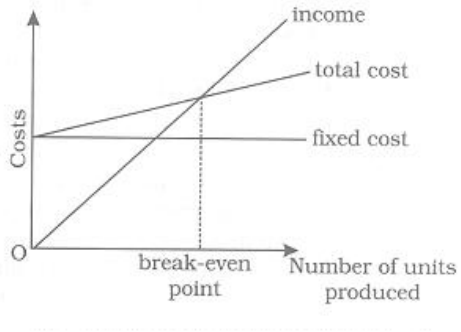

Fig. 2: *Graph between number of units produced and costs*

Step 5: Interpreting the solution: The model agrees without intuition in that if few units are sold a loss will result, but if lots of units are sold a profit will result. If the break-even point proves to be unrealistic, then a non-linear model could be tried out or our simplifying assumptions about cash flow (resources from earning and investment) can be amended.

Step 6: Validiting the model: Taking the relationships (1) - (3) and data from various firms, the profit may be estimated and verified.

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

- Mathematical modelling to solve various problems of our everyday life/environment related problems;
- Mathematical modelling and computer simulation of climate dy-

namics/ production of weather phenomena based on a number of predictors;
- Mathematical modeling in physical geography such as rotation and revolution of earth, precession and equinoes etc.;
- Mathematical modelling to predict orbital path of comets, meteors and other minor planets;
- Mathematical modelling to show how disease might spread in human in the event of epidemics/ bioterrorism;
- Mathematical modelling to predict the devastating effects of wars/ nuclear explosions;
- Mathematical modelling to show spread of forest fire depending on the types of trees, weather and nature of the ground surface;
- Mathematical modelling to demonstrate the action of medicines in human system;
- Mathematical modelling of the working of heart, brain, lungs, kidneys, bones and endocrine system;
- Computer diagnosis of human diseases;
- Mathematical modelling of fluid flow in drain, spillways, rivers, etc.;
- Using mathematical modelling and computer simulation to improve cancer therapy/wound healing/tissues formation/corneal wound healing;
- Mathematical modelling of intracelular biochemical reactions and metabolisms;
- Mathematical modelling to describe traffic flow/stock market options;
- Studies of storage and retrieval techniques for computer systems;
- Data manipulation and information management techniques;
- Statistics and random number problems;
- Developing video games;
- Mathematical modelling on social insects such as honeybees, termites etc. to know how they use local information to generate complex and functional patterns of communication;
- Mathematical modelling of maximum speed in fibre optic links;
- Mathematical modelling of highly abstract problems arising from control and communication processes in the brain;
- Mathematical modelling of urban city planning;
- Mathematical modelling to prevent an unwanted future/to understand various natural and unnatural phenomena;
- Mathematical modelling to show the effect of climate changes/ global warming;
- Mathematical modelling on balance of carbon cycle, etc.
- Mathematical modelling for predicting future population and knowing the impact of population;
- Mathematical modelling for increasing production of crops.

2 GUIDELINES FOR ORGANISING ONE-DAY SEMINAR ON POPULARISATION OF SCIENCE
INTERNATIONAL YEAR OF BIODIVERSITY – 2010

The United Nations declared 2010 to be the International Year of Biodiversity. It is a celebration of biodiversity (or biological diversity)––the variety of life on earth––and boosting awareness of how important it is for our lives. It refers to the wide variety of ecosystems and living organisms: animals, plants, their habitats and their genes. Biodiversity is the foundation of life on Earth. It is crucial for the functioning of ecosystems which provide us with products and services without which we couldn't live. Oxygen, food, fresh water, fertile soil, medicines, shelter, protection from storms and floods, stable climate and recreation - all have their source in nature and healthy ecosystems. Biodiversity is extremely complex, dynamic and varied like no other feature of the Earth. Its innumerable plants, animals and microbes physically and chemically unite the atmosphere (the mixture of gases around the Earth), geosphere (the solid part of the Earth), and hydrosphere (the Earth's water, ice and water vapour) into one environmental system which makes it possible for millions of species, including people, to exist.

Most people appreciate the beauty of the natural world, but awareness of biodiversity, how seriously it is threatened, and the implications for human wellbeing, is alarmingly low. Biodiversity is the most influenced feature of the Earth by man's activities. By changing biodiversity, we strongly affect human well-being and the well-being of every other living creature.

It is therefore important to organise One-Day Seminar on issues related with the Biodiversity. The objective of the seminar is to facilitate interactions among children, academicians, institutions, industries etc. to enhance public awareness about the preservation and sustenance of biodiversity. The common aim includes: (i) To present innovative ideas and search for new ways of how to increase public appreciation and understanding of biodiversity; (ii) To create enthusiasm, interest, and participation in biodiversity features among young people; (iii) To create excitement concerning advances in biodiversity; (iv) To encourage intelligent debate on related developmental issues. The organisation of this One-Day Seminar on Popularisation of Science in year 2010 may include the following activities.

Suggested Activities

- Organisation of lecture and demonstration programme that provides an interaction of eminent scientists with general public and students.
- Demonstration of some model exhibits and experiments from science centers, science clubs and scientists from universities, research organizations and other institutions.
- Screening of films, video programmes, slide shows, publications etc. on issues related with biodiversity.
- Organisation of Poster Competition, Quiz Programme, Debate, Drama etc.

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.

3 GUIDELINES FOR ORGANISING THE STATE LEVEL SCIENCE EXHIBITIONS FOR CHILDREN – 2010-2011

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 – 2010-2011 and for the 38th Jawaharlal Nehru National Science Exhibition for Children – 2011 would be 'Science and Technology for Challenges in Life'. The identified six sub-themes are:

1. Biodiversity: Conservation and Sustenance;
2. Agriculture and Technology;

3. Green Energy;
4. Transport and Communication;
5. Community Health and Environment; and
6. Mathematical Modelling.

In order to facilitate the preparation of exhibits and models for display in district to state level science exhibitions during 2010-2011, *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:

   It may please be ensured that entries from the following organisations are not forwarded to NCERT:

   - 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.

   The above-mentioned organisations conduct their own science exhibitions separately. They would send their selected entries for consideration for participation in JNNSEC-2011 to the NCERT directly.

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 2010-2011 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. It is published every year and distributed to all participating children, teachers, and visitors during the JNNSEC. *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 JNNSEC - 2011 bearing the name of student, teacher, school, etc. and their write ups for consideration for participation in JNNSEC - 2011. (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 - 2010-2011

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

Website: *www.ncert.nic.in*

CRITERIA FOR EVALUATION OF EXHIBITS

The Jawaharlal Nehru National Science Exhibition for Children, organised every year by the NCERT, 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 JNNSEC-2011. 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 - 2010-2011

THEME: SCIENCE AND TECHNOLOGY FOR CHALLENGES IN LIFE

VENUE: .....

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

Sub-theme

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

Biodiversity: Conservation and Sustenanc/Agriculture and Technology/ Green Energy / Transport and Communication / Community Health and Environment / Mathematical Modelling

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

2. 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 employees should not be provided any Honorarium if invited for this purpose.

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

(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 EXHIBITIONS FOR CHILDREN - 2010-2011

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. It is also certified that no other voucher is included.

Date

Signature of the In-Charge (Controlling Officer)
Seal

STATE LEVEL SCIENCE EXHIBITIONS FOR CHILDREN - 2010-2011

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—2009-2010

Proforma III

INFORMATION ABOUT NATURE AND NUMBER OF EXHIBITS DISPLAYED

THEME: SCIENCE AND TECHNOLOGY FOR CHALLENGES IN LIFE

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	
Biodiversity: Conservation and Sustenance					
Agriculture and Technolgy					
Green Energy					
Transport and Communication					
Community Health and Environment					
Mathematical Modelling					
Grand Total					

State _____ Duration _____

State Level Science Exhibitions For Children - 2010 - 2011

Proforma IV

Panel of Judges - sub-theme-wise*

Venue .....

Theme : Science and Technologyfor Challenges in Life

Sub-theme: Biodiversity: Conservation and Sustenance/

Agriculture and Technology / Green Energy / Transport and Communication / Community Health and Environment / Mathematical Modelling

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

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

* Respectively 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.

38TH JAWAHARLAL NEHRU NATIONAL SCIENCE EXHIBITION FOR CHILDREN - 2011

Theme : Science and Technology for Challenges in Life

Proforma V

INFORMATION ABOUT THE EXHIBIT/MODEL

1.	Title of the Exhibit/model (in block letters)	_____ _____
2.	Sub-theme:	Biodiversity: Conservation and Sustenance/ Agriculture and Technology/Green energy/ Transport and Communication/Community Health and Environment/Mathematical Modelling (Tick only one)
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 37th Jawaharlal Nehru National* Science Exhibition *for Children – 2010, 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)

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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.

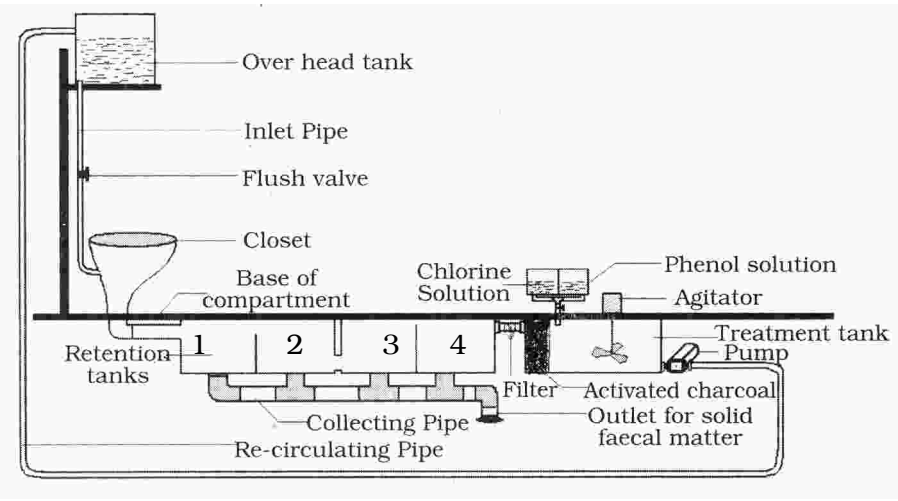
MATERIALS REQUIRED FOR THE CONSTRUCTION

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

1. ACCIDENTS civilaviation.nic.in/ccrs/accidents
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/