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Guidelines for the Preparation of Exhibits and Models

All children are naturally motivated to learn and are capable of learning. The knowledge acquired by them is the outcome of their own activity. Children learn through interaction with people and environment around. They construct knowledge by connecting new ideas to their existing ideas.

In order to stimulate creativity, inventiveness and the attitude for innovation in science and mathematics, National Curriculum Framework (NCF-2005) emphasizes on activities, experiments, technological modules, etc. It also encourages implementation of various activities through a massive expansion of channels such as organisation of science, mathematics and environment exhibition at the national level for school students, with feeder exhibitions at school/block/tehsil/district/region/state levels.

The National Council of Educational Research and Training (NCERT), New Delhi organises National Science, Mathematics and Environment Exhibition for Children every year for popularising science, mathematics and environmental education amongst children, teachers and public in general.

In the year 2022, the advisory committee which advises about the sciene exhibition, in the light of NEP 2020, approved the name of this National Science Exhibition as Rashtriya Bal Vaigyanik Pradarshani (RBVP).

This exhibition is a culmination of various exhibitions organised in the previous year by the States, UTs and other organisations at district, zonal, regional and finally at the state level. Selected entries from all States and Union Territories, the Kendriya Vidyalaya Sangathan, the Navodaya Vidyalaya Samiti, Department of Atomic Energy Central Schools, Central Board of Secondary Education affiliated Public (independent) Schools, Central Tibetan Schools Administration 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 2022-23 too. These would form the first phase of preparation for the RBVP to be organised in November 2023. The objectives of the exhibitions are:

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

games and sports etc.

- to create awareness about environmental issues and concerns and inspire children to devise innovative ideas towards their prevention and mitigation.

Children are naturally inquisitive and innovate in response to a variety of problems confronting society and the world. If today's children get engaged in tackling problems, solving issues, and creating new ideas, we can make our children better prepared for tomorrow's challenges. There is a need to continuously innovate to meet the challenges before us. The rising aspirations of human community for the desire of more comfort and security have put tremendous pressure on the limited resources of the world leading to unequal access and unsustainable exploitation. This is resulting in unsustainable use of resources.

According to United Nations 'Global Resources Outlook 2019', the resource extraction has more than tripled since 1970 in the world, including a five-fold increase in the use of non-metallic minerals and a 45 percent increase in fossil fuel use. Similarly, a very important resource, fresh water is also experiencing acute stress worldwide. According to United Nations World Water Development Report 2019, over 2 billion people live in countries experiencing high water stress, and about 4 billion people experience severe water scarcity during at least one month of the year. Water has to be treated as a limited resource, with a far stronger focus on managing demand. Climate change and bio-energy demands are also expected to amplify the already complex relationship between world development and water demand. It is true that "Jal hi Jeevan Hai", therefore it is the responsibility of everyone to conserve and manage this very important resource. Keeping in view of the importance of water and sanitation the Government of India is increasing the level of investment in this area.

We all are aware that the problems faced by the world today are not confined to a particular city, state or country. Rather, these are global problems and for solving these problems, all the countries of the world need to work in unison. To solve the problems of the world and to bring peace and prosperity for people and the planet, now and into the future, all the member states of United Nations adopted 'The 2030 Agenda for Sustainable Development' which includes 17 different Sustainable Development Goals (SDGs) along with 169 associated targets.

Sustainable development is defined as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This means we cannot continue using the resources at the current level as this will not leave enough for future generations.

Science and Mathematics act as powerful tools for investigating and understanding the nature and the world. They also play a crucial role in solving problems confronting the society and act as a major instrument for achieving goals of self-reliance and socio-economic development in a sustainable manner. To recognize and encourage these powerful tools so that the problems confronting the society can be overcome and a better sustainable future can be built through science and technology led solutions, the theme for the State Level Science, Mathematics and Environment Exhibition (SLSMEE) for Children during 2022-23 has been chosen as Technology and Toy.

The flagship programmes of the Government of India such as the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Pradhan Mantri Jan Dhan Yojana (PMJDY), Pradhan Mantri Jan Arogya Yojana (Ayushman Bharat), Skill Development, the Swachh Bharat Abhiyaan (Clean India Campaign),

Pradhan Mantri Ujjwala Yojana, Beti Bachao Beti Padao (Save the Girl Child, Educate the Girl Child) are some of the steps to achieve these sustainable goals.

The theme and sub-themes identified for SLSMEE 2022-23 are directly or indirectly focuses on achieving the sustainable development goals enunciated by the United Nations.

In this context, it is envisaged that children and teachers would try to analyze all aspects of the role of science and technology for sustainable development of the world. This will enable students and teachers to generate scientific and mathematical ideas and prepare models/ exhibits for addressing various problems. Scientific ideas in this context may be regarding innovative ways of doing things, creating simple technologies/tools that meet new requirements; enabling the participation of the lower pyramid of the population in the development process through science and technology, creating an enabling innovation ecosystem in the country for enhancement of science, technology and mathematics.

However, there are instances when children and their teachers think of some ideas that are new and may be applicable in the future. Often such ideas may not be possible to be presented in the form of a model/exhibit. Organizers of exhibitions at all levels may provide opportunities to students and teachers to present such ideas in the form of presentations and discussions.

Children and teachers should identify where and how new processes, researches, and developments in science, technology and mathematics can bring a better future for the world.

Development of creative domain of a learner through teaching- learning process of science is an area which needs to be addressed to make experience of learning stimulating and exciting. For this, there is a need to engage learners in learning of science concepts in innovative ways which may help in all round development of a learner. Toys or games, which may be physical or virtual, are one of the learner friendly tools for learning science. Toys have been used since time immemorial for playing which, in long run, resulted in developing their cognitive, psychomotor and affective domains. Over time the form of toys and the materials used to make toys has evolved, particularly with the growth/ development of technology, however, the importance of toys in learning science continues. With this in view, the theme for the **State Level Science, Mathematics and Environment Exhibition (SLSMEE) for Children– 2022–23 has been chosen as 'Technology and Toys'.**

Toys play an important role in developing different skills of an individual, such as problem solving, conflict resolution, how cause and effect work, etc., and these skills play an important role in their lives. Toys also nurture creativity and imagination and values, such as, cooperation, sharing, respect for others. Toys also play an important role in creating awareness about issues related to health, hygiene and cleanliness. The use of toys for science concepts becomes more relevant considering the declining interest of learners in learning science. On one hand, the traditional toys, which are struggling for their existence among learners in the present era, may be relooked at for use as a tool to transact science concept in an innovative manner. On the other hand, the emerging technologies may be explored to design newer toys, refining existing toys, reviving indigenous extinct toys, made of ecofriendly materials and looking for the possibilities for their use in learning science.

In this context, it is envisaged that students and teachers would try to analyze all aspects of the role of technology and toys in learning of science. This will enable students and teachers to generate ideas

and prepare toys/models/exhibits for addressing various problems.

However, there are instances when children and their teachers think of some ideas that are new and may be applicable in future. Often such ideas may not be possible to be presented in the form of model/ exhibit. Organizers of exhibitions at all levels may provide opportunities to students and teachers to present such ideas in the form of presentations and discussions.

The theme for **SLSMEE–2022-23** and **RBVP–2023**, **'TECHNOLOGY AND TOYS'**, aims to cover sub–themes such as–

1. Advancement in information & Communication Technology;
2. Eco Friendly Material;
3. Health and Cleanliness;
4. Transport & Innovation;
5. Environmental Concerns;
6. Historical Development with Current Innovation
7. Mathematical for Us

(Sub-themes listed above are suggestive. Students may choose any other sub-themes and develop exhibits involving Science and Technology & Toys)

A few exemplar ideas pertaining to the sub-themes listed in the context of the theme, for the development of exhibits are given below.

1. Advancement in information & Communication Technology

Information and Communication Technology (ICT) is an ever-evolving discipline. In a relatively quick span of time, ICT has made inroads in all spheres of life, and has largely eased our activities. Today, we see applications of ICT in teaching, learning, assessment; research, explorations; weather monitoring, forecasting, and prediction; healthcare, entertainment; industrial production and manufacturing, etc. With the availability of high-speed yet low-cost network bandwidth coupled with affordable handheld/portable digital devices/gadgets, the technology has a significant contribution in shaping our activities including the way we learn, eat, buy, avail services, communicate, and even socialize. ICT has made significant advancement in the last couple of decades. This is due to the availability of high-speed computing processors, memory, and storage. Thanks to cloud computing, today we can carry out all our computer related activities using a digital device having minimal processing capability also.

Use of toys in education, mainly at the primary stage is considered to be helpful in making the learning fun and joyful as toys keep the learners motivated and engaged. ICT is also used to create various games having toy like characters. The games can be for educational purposes for pure entertainment. In both the cases, programming languages and their advanced libraries and frameworks are used to create games having high resolution graphics in two-dimension (2D) or in three-dimensions (3D). Such games demand a faster computer processor to run. These days, dedicated processor called Graphics Processing Unit (GPU) is used because the GPUs can process different types of data in parallel and thus can accelerate rendering of the graphics used in the games.

These days, the Augmented Reality (AR) and Virtual Reality (VR) based interactive digital content are very popular. VR contents can be created using a specialized camera called VR camera, and a smartphone or a computer. It created a video by capturing a 360-degree view of a situation, which can be viewed using a compatible device that can show the 360-degree content. Wearing a VR

headset, the viewer can move head up, down, left or right and the video also moves accordingly. This creative a completely immersive experience for the viewer as if he/she is actually in that scene.

AR on the other hand is about augmenting the real environment of the user by integrating or adding digital information. For example, we can point our smartphone camera while walking in a city, and the AR app can provide audio, image or video information related to that city, such as its history, culture, etc.

Students can plan to design and create digital games, 360 degree videos, AR or VR contents as exhibit. They can use any existing AR app to visualize their own created contents also.

2. Eco Friendly Material

Technological revolution and environmental degradation go hand-in-hand. While technological revolution leading to industrial revolution in the latter half of the eighteenth century had resulted in the beginning of environmental degradation, we look for technologies that will help us overcome or reverse such impacts on the environment.

Today, degradation and deterioration of the environment is happening in such an unprecedented manner that it has become difficult to live a healthy and sustainable life. Not only human population but all other life forms are also impacted. Air, water and soil are polluted in different ways—piles and piles of waste are dumped in the landfills, there is pollution from different sectors such as transport, industrial, domestic and agriculture; there is unsustainable and overexploitation of natural resources; and today we have the challenge of climate change that needs immediate attention.

All of the above mentioned issues and challenges can be addressed to some extent if we adopt eco-friendly or environment-friendly materials in the production process and in the products. For example, eco-friendly technologies such as machines and raw materials can be used in the manufacture of products and the product can itself be made more eco-friendly. Switching- over to eco-friendly materials, wherever possible, is the need of the hour. The advantage of using eco-friendly materials is that it will not only cause minimal environmental degradation but it will also reduce the negative impacts on all life forms. It is, therefore, encouraged to use eco-friendly materials in the development of different technology and toys. Some examples of eco-friendly materials that can be used in the development of models are provided below. Through such models an awareness can also be generated amongst the masses on the use of eco-friendly materials and their advantages.

- Newspapers and used papers in different forms such as carton boxes, used books, etc., can be used to develop various toys and models.
- Materials made from plants such as cotton cloths, jute products or other plant-based fibres can serve as excellent eco-friendly materials to prepare various models covering wide range of technology and toys.
- Bamboo, wood, cane and other plant-based materials can form the base or frame for many models to represent various technology and toys.
- Although metals are not biodegradable per se, they will be a better option instead of using plastic-based materials such as

polyvinyl chloride (PVC), or polystyrene products such as thermocol sheets, etc.

- Models can also be developed using eco-friendly materials to show the advantages of using eco-friendly materials in various technology and toys.

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

- factors affecting the health and resulting ailments in the body;
- to study as to how the cleanliness influence health;
- foods that improve our immunity to fight against diseases;
- improved methods and innovative ways of sanitation and appropriate technology for disposal of surgical masks, PPE kits, etc. and other biodegradable and non-biodegradable waste;
- the ways to dispose-off the garbage properly to maintain cleanliness;
- methods to improve rural sanitation;
- infectious and non–infectious diseases, relationship with causative factors and their sources with emphasis on Coronavirus;
- mechanisms/ways to control the spread of Coronavirus, Lung infections, Dengue, Malaria, Chikungunya, etc.;
- innovative preventive measures to control diseases at different levels/ roles of various agencies (role of individual to break the infection spread chain);
- demonstration and use of traditional methods of medication;
- demonstration of known facts and findings, and health benefits of physical exercise and Yoga;
- demonstrate importance of balanced diet and nutritional values of various food items;
- ways to raise awareness and sensitize people about the role of social distancing and measures/ innovative techniques to overcome issues in its implementation;
- role of biotechnology to improve nutritional value of crops;
- demonstration of models/projects to show the effect of junk food items, adulterated food items on our body and its preventive measures;
- demonstration of models/projects to create awareness among children about appropriate rules of safety in hazardous situations to avoid accidents and injuries;
- presenting medical assistance and facilities for rural/urban areas and gender aspects;
- ways to raise awareness and sensitise people to be careful in health matters, explore the possibilities and make use of the facilities available;
- innovative ideas for effective implementation of policies/ programmes/ schemes such as Swachh Bharat Abhiyan, National Leprosy Eradication Programm etc. that have significant impact on health;
- innovative ideas for effective implementation of policies/ programmes/ schemes such as Atmanirbhar Bharat (self-reliant India) for making India a bigger part of the global economy;
- development of knowledge–base and understanding new scientific, technological aids in bio–medical areas;
- presentation of known facts and research findings in different medical systems like Traditional, Modern, Homeopathy, Ayurvedic, etc.;
- lifestyle and its relationship with

good and bad health based on known facts and researches;

- common prophylactic measures available for different diseases and advantages of inoculation and vaccination;
- appropriate measures for family planning and welfare;
- ideas for developing low–cost, immunity boosting nutritious food;
- low cost medical diagnostic and therapeutic tools;
- toy/models for sustainable agriculture and health;
- toy/models to demonstrate the impact of chemical residues from fertilizers, pesticides, hormones and food dyes etc., on health;
- new medical diagnostic and therapeutic tools/aids for physically handicapped persons for prevention from Coronavirus;
- innovative control measures at different levels / roles of different agencies;

3. Health and Cleanliess

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, characterised 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 a 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. 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. Ionising radiations like X-rays, gamma rays and non ionising 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 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. 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. In Sustainable Developmental Goals, Goal 3 “Good health and Well Being” established by the United Nations in 2015 is made "to ensure healthy lives and promote well-being for all at all ages."

The main objectives of this sub–theme are: to bring awareness among the children about the factors affecting our health and nutritional needs of the body; to explore new scientific, technological and bio–medical inventions in prevention and cure of diseases like Coronavirus; to explore various scientific and technological interventions for meeting nutritional requirement of human beings and innovative ideas for better management of the crisis created during COVID-19 pandemic. The exhibits/models in this sub– theme may pertain to:

- factors affecting the health and resulting ailments in the body;
- to study as to how the cleanliness influence health;
- foods that improve our immunity to fight against diseases;
- improved methods and innovative ways of sanitation and appropriate technology for disposal of surgical masks, PPE kits, etc. and other biodegradable and non-biodegradable waste;
- innovative ideas for effective implementation of policies/ programmes/ schemes such as Swachh Bharat Abhiyan, National Leprosy Eradication Programm etc. that have significant impact on health;
- innovative ideas for effective implementation of policies/ programmes/ schemes such as Atmanirbhar Bharat (self-reliant India) for making India a bigger part

of the global economy;

- innovative ideas for effective implementation of policies/ programmes/ schemes such as Namami Gange and National Clean Air programme;
- the ways to dispose-off the garbage properly to maintain cleanliness;
- methods to improve rural sanitation;
- infectious and non–infectious diseases, relationship with causative factors and their sources with emphasis on Coronavirus;
- mechanisms/ways to control the spread of Coronavirus, Lung infections, Dengue, Malaria, Chikungunya, etc.;
- innovative preventive measures to control diseases at different levels/ roles of various agencies (role of individual to break the infection spread chain);
- demonstration and use of traditional methods of medication;
- demonstration of known facts and findings, and health benefits of physical exercise and Yoga;
- demonstrate importance of balanced diet and nutritional values of various food items;
- ways to raise awareness and sensitize people about the role of social distancing and measures/ innovative techniques to overcome issues in its implementation;
- role of biotechnology to improve nutritional value of crops;
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- demonstration of models/projects to create awareness among children about appropriate rules of safety in hazardous situations to avoid accidents and injuries;
- presenting medical assistance and facilities for rural/urban areas and gender aspects;
- ways to raise awareness and sensitize people to be careful in health matters, explore the possibilities and make use of the facilities available;
- development of knowledge–base and understanding new scientific, technological aids in bio–medical areas;
- presentation of known facts and research findings in different medical systems like Traditional, Modern, Homeopathy, Ayurveda, etc.;
- lifestyle and its relationship with good and bad health based on known facts and researches;
- common prophylactic measures available for different diseases and advantages of inoculation and vaccination; appropriate measures for family planning and welfare;
- ideas for developing low–cost, immunity boosting nutritious food;
- low cost medical diagnostic and therapeutic tools;
- toy/models for sustainable agriculture and health;
- toy/models to demonstrate the impact of chemical residues from fertilizers, pesticides, hormones and food dyes etc., on health;
- new medical diagnostic and therapeutic tools/aids for physically handicapped persons for prevention from Coronavirus;
- innovative control measures at different levels / roles of different agencies;
- pollution and its control, innovative and ecofriendly methods;
- innovative ideas for mental health and drug abuse;

4. Transport & Innovation

The Objects of this sub-theme are- to make general public and children understand different modes of transport as well as the importance of transport for Sustainable Development; to make them aware about the issues and concerns of the present transport systems and to promote innovations for efficient systems.

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

- Improvised/ indigenous models for efficient transport
- Working models of fuel efficient/ pollution-free designs of automobiles/ ships, boats, etc.;
- Innovative ideas for efficient management of road, rail, water and air transport systems, e.g., better safety measures, managing traffic jams, etc.;
- Improvised/ improved devices for effective transport between various emergency services, namely medical, police, military and other administrative bodies;
- Use of geo-stationary satellites in providing information pertaining to vehicular movements and transportation, disaster management, etc.;
- Designs for improving existing transport systems;
- Innovative ways of using modern mode of transportation for connecting people.

Learning through play is an important part of child's development. The use of toys can help children learn many different skills they need in their life. Toys can help develop problem solving skills, helps develop their motor skills and also nurtures their creativity and imagination.

Toys have existed in India since ancient times. Traditional Indian toys were simple and could connect to the real life knowledge. Available literature shows that toys have reflected the cultures, society and have played important role in the development of the physique and mind. It has been reported that assemble of toys were found in specific parts of the Indus cities, which could be interpreted as designated play areas. One tenth of all findings in the Indus valley are play-related, which included toys as well as game pieces like Wheel cart, Rattle, dice. A lot needs to be done to recover the lost heritage.

It is essential to create a platform where young generation can showcase their innovative toys. Awareness among young generation needs to be initiated regarding the unhealthy manufacturing practices in the industry, waste control by rejecting plastic and electronic toys. Our society needs to be sensitized to the importance of organic toys. Toys can be used by children of all ages to see and recognize science embedded in their daily lives..

Students can design and develop two kinds of toys:

(a) Static and (b) Dynamic

Static toys, such as kites, dolls, animals, birds, etc., can be made of clay, bamboo, metals, paper or any locally available materials.

In dynamic category, moving or/ and sound, light producing toys such as, *Damaru* or drum rattle, spinning top or *lattu*, *Gulel*, moving vehicles, dolls, robots etc., can be made. These toys would be useful in understanding the various concepts of science. Students can design advanced science toys, or prepare science projects, based on the simple toys they have played with as children Toys can also be used as teaching aid for transacting many concepts of science. These contribute in overall development of the child.

5. Environmental Concerns

Every aspect of our lives today is impacted by the unprecedented environmental issues and problems that we have caused as a result of our haphazard and unsustainable practices and decisions. It is not just human lives but the impact is equally, if not to a greater extent, felt by other life forms as well. Our production of coal-based thermal energy, ever-increasing use of fossil fuel for transportation, and other practices such as burning of stubble, waste, etc., is pumping poisonous gases and other greenhouse gases such as carbon dioxide into the atmosphere. Our soil and water are polluted by various sources such as untreated domestic and industrial discharges, chemical pesticides, fertilizers, biomedical wastes, etc. We are losing our wetlands which are the natural sponge as they trap and slowly release surface water thereby controlling flood. Besides they also store carbon instead of releasing them in the atmosphere. Yet such ecologically and environmentally crucial sites are being converted into commercial or residential areas. Our forests are shrinking. There are issues of habitat loss due to various human activities and thereby resulting in biodiversity loss and human-animal conflict as animals move out as their natural habitats shrink in area. We see the impact of climate change everywhere—changing rainfall patterns affecting agriculture, sea level rise, increasing heat waves, more frequent and intense cyclones, forest fires, increase or spread of vector-borne diseases due to changing temperature, etc. To make matters worse, our changing lifestyles also contribute to a huge extent to environmental problems such as our dependence on packaged food, increased consumption of processed food, food transported from far off places, use of disposable items, irresponsible use of technology in the form of devices, appliances, and other technologies, fossil fuel-intensive means of transportation, consumerism, increase in wastes production, etc.

With all such environmental problems and concerns facing us, the need of the hour is to find ways to address them by devising appropriate solutions towards alleviating or reducing the problems. The solutions could be in terms of using biodegradable or eco-friendly raw material or in terms of improving its efficiency in terms of minimizing consumption of energy, wastage, etc. Keeping this in view, students can come up with their innovative strategies by applying their scientific knowledge. They can identify an issue and suggest their innovative ways to solve the problem through a model/ project. Students are encouraged to choose an issue which are locally relevant. There is a wide range of projects which students may consider. Some areas on which students can develop their projects are listed below:

- Green or renewable energy from solar, wind, water, etc.
- Reducing air, water and soil pollution in rural and urban environment; agriculture, industries, manufacturing and transport sectors, etc.
- Reclamation of riverbanks and flood affected areas for the rehabilitation of landless people
- Automatic weather-recording devices
- Innovative designs and technologies for solid waste management
- Water harvesting and ground water recharging
- Management coastal areas Reducing carbon and ecological footprint

- Drainage systems
- Green buildings
- Sustainable farming practices—organic farming, permaculture, traditional and indigenous practices, etc.
- Sustainable, biodegradable and innovative ways of packaging
- Sustainable and eco-friendly cooling and heating systems in appliances, buildings, etc.
- Biodegradable and cost-effective products
- Restoration and conservation of biodiversity—terrestrial and aquatic (freshwater and marine)
- Human susceptibility to infectious diseases through malnutrition due to climate stress and ways to controlling them/ studies of the impact of global warming on human health (spread of epidemic like dengue, malaria, zika virus, SARS CoV-2, etc.)
- Circular economy
- Innovations to reduce waste in extraction and processing of minerals
- Innovative designs to address human-animal conflict
- Social conflicts resulting from environment and climate change and their resolution (if possible, using case studies)
- Innovative designs/ methods of waste water recycling/ reclamation/ using recycled water in industries/ homes
- Innovative technologies/ designs of sanitation/ hygiene related issues
- Innovative designs for enhancing efficiencies of existing lighting system/ automobiles/ machines/ stoves/ *chulhas*
- Innovative devices for various purposes—measurement of pollutants, detecting forest fires, recording weather, diseases, etc.
- Conservation and management strategies of biodiversity
- Conservation and management strategies for forests, lakes, rivers, mangroves, wetlands, peatlands, etc.
- Technologies for forecasting and warning of cyclones, floods and storms
- Mathematical modeling to show impact of environment and climate change on biodiversity
- Mathematical modeling to show impact of increase in population one environment and climate
- Mathematical modeling to show spread of forest fire depending on the types of trees, weather and nature of the ground surface, etc.

6. Historical Development with Current Innovation

Learning while playing helps children in developing different important life skills unconsciously. Hence, role of toys in the life of children is very important. Toys can help develop problem solving skills, develop their motor skills and also nurtures their creativity and imagination.

History of toys is as old as human civilization. In ancient times Toys were handmade by using stone, wood, clay etc. Development of new materials and innovations in technology have led to the development of variety of types of Toys with many new features, such; as Toys with attractive colours, Toys made of new materials like paper, plastic, ceramics etc.

Developments in the field of Electricity and Electronics opened up new dimensions in the field of Toys. The electrical and electronic devices have added new features to the existing Toys by powering them up by battery

and using motors for giving the Toys different types of motions. It has created the Toys which can move, dance or produce different types of lights etc.

With the emergence of modern digital technologies and microcontrollers, a new category of Toys have been developed which were more interactive and can even be controlled from a distance.

These days Innovative Toys with Artificial Intelligence (AI) are being developed, which can be coded by the users such; as a AI based Doll can do friendly conversations with users. Similarly programmable Robots which are capable of performing numerous entertainment features which children can watch or interact with.

For example, a user can program the robot to shout or dance whenever it sees a certain person or it can be programmed to move on a particular predefined path etc.

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

- Toys depicting the journey of toys from Ancient times to the present time;
- Working models of Toys with modifications in existing Toys;
- Working models of Toys which can help mankind in different ways;
- Toys based on Scientific Principles and Mathematical concepts;
- Toys from locally available material.
- Toys from waste material.

7. Mathematics for Us

The present life demands to have good mathematical knowledge. Mathematics is important for life and supports all-round personal development. Mathematics significantly influences students' education both in mathematical knowledge and in terms of moral education. We can find mathematical application in the nature around us, technology, architecture, machinery, building industry, banking sector, in research, cartography etc. There are very interesting applications in genetics. Statistical methods are used in hypothesis testing in genetics. By using mathematics, we can create statistical descriptions of quantitative relations. When we process research data, we need arithmetical diameter, scattering, standard deviation etc. We can develop pupils' interest in mathematics with the help of quality school education, because mathematics is a part of our daily routine and influences the quality of our life and the quality of our professional orientation.

In our day-to-day life whatever role we play, be it a cook or a farmer, a carpenter or a banker, a shopkeeper or a doctor, an engineer or a scientist, a musician or a magician, every one of us needs mathematics. It is quite impossible to summarize the applications of mathematics in a single field.

According to NEP 2020 'It is recognized that mathematics and mathematical thinking will be very important for India 's future and India's leadership role in the numerous upcoming fields and professions that will involve artificial intelligence, machine learning, and data science, etc.' Encouraging students to make models based on mathematical themes is one of the attempts to engage students in mathematics thinking.

The objective of this sub-theme is to help children to analyse how mathematics can be used to investigate objects, events, systems and processes around us. Using mathematics, the exhibits/models in this subtheme may

pertain to:

- suggesting solutions for various problems of our everyday life/ environment related problem;
- examples around us like formation of various mathematical patterns in nature's fabrication such as birds flying patterns, animals' movements, and formation of roots, mathematical relationships in trunks, twigs and leaves of trees;
- display of physical geography such as rotation and revolution of earth, precession and equinoxes etc.;
- mathematical model to predict orbital path of comets, meteors and other minor planets;
- show how disease might spread in human in the event of epidemics/ bioterrorism;
- to predict the devastating effects of wars/ nuclear explosions/ pandemics;
- show spread of forest fire depending on the types of trees, weather and nature of the ground surface;
- demonstrate the action of medicines in human system;
- show the working of heart, brain, lungs, kidneys, bones and endocrine system;
- computer diagnosis of human diseases;
- fluid flow in drain, spillways, rivers, etc;
- describe traffic flow/stock market options;
- increasing production of crops;
- social insects such as honeybees, termites, etc. to know how they use local information generate complex and functional patterns of communication;
- urban city planning;
- the effect of climate changes/global warming;

Guidelines for Organising One–Day Seminar

Topic: Scientific Innovations for a Sustainable Future

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

Humans, directly or indirectly, impact the environment in several ways. Different human activities have resulted in deterioration of environment at global scale in a variety of ways, such as, irreversible changes to the composition of the atmosphere which ultimately affects the earth's climate; destruction of the ozone layer which consequently affects the life of living organisms on earth; removal of top soil which causes desertification; loss of biological diversity; extensive pollution of air, rivers, soil, and ocean, decline in air quality and climate change due to greenhouse gases.

All these factors can cause irreversible damage to the environment if urgent steps are not taken. Scientific community has been warning about the threat to sustainability, particularly environmental sustainability. There is a great need to preserve the environment for our present generation as well as for future generations. This has led to the need for sustainable development and as we are moving towards the future, the need for sustainable development keeps on growing. Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs. Sustainability improves the quality of our lives, protects our ecosystem and preserves natural resources for future generations. Going green and sustainable maximizes the benefits from an environmental focus in the long-term.

The Sustainable Development Goals (SDGs) were adopted by United Nations in 2015. The Sustainable Development Goals cover a huge variety of social and economic development matters. To fulfil the sustainable development goals would require actions on some fronts, which include harnessing and capitalising on the ability of scientific and technological innovations. Examples of such technology include carbon capture and storage systems, extra efficient irrigation methods, essential medicines, household water purification devices, reducing exposure to hazardous chemicals by switching from solvent-based paints to high-performance water-based alternatives, powering most household appliances from farm waste, use of energy pellets made up of biomass such as wood chips and bio-crops as a clean and renewable alternative to coal, recycling plastic waste to preserve our oceans; and production strategies that minimise waste and pollution.

The role of scientific innovations in enhancing sustainability cannot be neglected as these can help in reducing the effects of human activities on planet Earth. Scientific innovations are the key elements through which organizations, institutions, regions, and countries implement sustainability constantly. Therefore, sustainability can be achieved when it is based on innovation-centered approaches. National Education Policy (NEP) 2020 also cited the Sustainable Development Goals. One of the recommendations of NEP 2020 is making environment education an integral

part of school curricula for appropriate integration of environmental awareness and sensitivity towards its conservation and sustainable development.

The critical thinking that originates with science education is important in understanding the world and making sustainable choices. We have seen that science plays a crucial role in sustainable development. It does this by providing solutions to many of the challenges faced by many countries across the world nowadays.

Achieving sustainability in development requires innovations, which science and technology must deliver. Research and innovation are essential to improving our abilities to confront sustainable development challenges. Building a sustainable world demands interdisciplinary cooperation based on disciplinary excellence. Therefore, the biological and physical sciences and engineering must work closely with the social and behavioural sciences to rapidly improve the application of innovations and develop insights to the needs of society.