CBSE Guidelines to Prepare a Good Project

CBSE organises science exhibition every year with the vision to develop scientific temper and 21st century skills that are mandatory is today's world. CBSE is a stepping-stone to the JNNSMEE organised by NCERT as well as to the Intel Science Exhibitions.

This is an exhibition organised at national Level and hence it is essential that the projects submitted by students adhere to certain standards, and have global benchmarks. It is expected that projects prepared by students must reflect quality and be innovative, original and follow scientific methodology.

It is important to prepare project under the guidance of a guide - He/she could be a teacher or parent/guardian or may even be a research scholar / scientist.

While working on a model / project each student / team is requested to follow these guidelines:

- How to select a topic
- 10 steps to a Prepare a Prize Winning Research Based Project
- What is NOT accepted as a CBSE Project?
- Important Do's and Don'ts
- Project set up and display
- How to present your exhibit for judgement?
- Tips on writing a Synopsis
- Tips for teachers / Guides / Parents / Project Mentors
- What should be the essential elements of your project?

How to Select a Topic

Choosing a sub – theme for your project

Select a sub-theme based on CBSE's circular. Choose a topic for your project which completely justifies / maps with the sub – theme under which the project will be presented. Never select a topic which cannot be completely mapped to any sub-theme.

Research-based projects qualify to participate at the National Fair. Hence, your project must be original in content and should be substantiated with data collected from experimentation, if appropriate. As far as possible it should be a working model.

10 steps to prepare a Research Based Project:

Choose your topic carefully and start working on it as early as possible. Do not change sub - themes or topic selected under a sub - theme. This will enable you to organize your project in the correct format, with sufficient data and results of the experiment. Follow the steps mentioned below to prepare your research based project.

1. **Select your topic under a sub – theme which completely maps with the sub– theme:**

   The first step, selecting a project idea, is the most important. This is the first question or dilemma a student faces when starting a science project, because it can make a big difference between a good and an excellent project. Keep three important things in mind while selecting your topic.

   First, choose a topic that interests you;

Second, while you are choosing a topic, check all the resources around you. This will help you in doing your project with ease. e.g. - If you are working on medicinal plants, make sure that you have access to at least some medicinal plants in the surrounding region;

Third, have conviction in the project idea selected and don't change it half way through.

2. Source information on your project:

It is important to source information very carefully. After selecting the project topic, try to learn everything about it. Search for good books in your school library and other libraries in your city. Become member of some local library in your city and try to buy some good books on your topic from the bookstore. You can access Internet and visit various search engines available to find information. You may also try various science related sites on the internet, however be careful with the information available on Internet. You must learn to collect only meaningful data from Internet and also try to check its validity and authenticity of its source. Internet is flooded with information, and hence, filter the information as per your requirement. Do not put anything and everything available on various website while recoding your observation. Also try to source any related work done before, so that you may take that as background and may start from there.

3. Work plan:

Make a complete work plan as to how you will conduct your experiment or prepare your model. Your plan should include the following:

- The purpose, aim of your experiment and the scientific principle involved;
- The variable or the things that you are going to change during the experiment to evolve a new concept;
- Outcome of the project;
- Detailed procedure outlining as how you will conduct the experiment;
- Material you will require at each stage.

Prepare a Time frame and allot sufficient time for all stages. Also make sure that time allotted is realistic and deadlines strictly adhered.

With the assistance of your guide/ teacher prepare a work flow / flowchart for preparing the complete project, allocate work and fix responsibilities within team.

4. Make and test your hypothesis - design experiments to test your hypothesis:

As in any research based experiment it is most important to think, identify and determine the variables that may be involved, think about ways to change one at a time. Never change more than one at a time, as you will not know what variable is causing your observation. Sometimes variables are linked and work together hence, first, try to choose variables that you think act independent of each other.

Hypothesis is a tentative theory that can be proved or disproved through further investigation and analysis. Once you are able to determine variables you will be able to formulate questions. You can now formulate hypothesis. There is usually one hypothesis for each question. You must at least design one experiment to test each hypothesis.

Design experiments to test your hypothesis

Define a complete procedure for each experiment. To draw a conclusion from any experiment, it is mandatory to have a neutral "reference point" for comparison. This neutral "reference point" allows you to see what changing a variable does by comparing it to not changing anything. Experiments are usually conducted in all research laboratories in this way and they are called "controlled experiments".

Experiments are usually repeated to validate results and to make sure they are reproducible. Reproducibility is a crucial requirement as without it, you cannot trust your

results. It is desirous in any experiment to think of possible errors and record them, and as far as possible correct them. Your results should be predictable, i.e. the same results should be obtained when the experiment is repeated. This will ensure that your results are not due to mere chance but are scientific in nature.

5. Recording your data and observations:

In any experiment recording the observations is the most important part of the experiment. You must measure to what extent the variable affects the system under study and what different responses this change produces in the system. It is mandatory for any experiment that this data is recorded very carefully may be in a tabular form so that it can be retrieved as and when required. This is called "raw data" since it has not yet interpreted. When raw data is processed it becomes result.

Observations can be written descriptions of what you noticed during an experiment or problems encountered. These observations are valuable when drawing conclusions and useful for locating experimental errors and therefore should carefully note in a data-log book. You may also take photographs at various stages or video record an experimental procedure performed.

6. Consult your guide (teacher / parent/ research scholar):

As a first step, even before you select a topic appoint a guide. Your science teacher or your parent or any research scholar you might know may be selected as a guide. It is a good practice to discuss everything and anything related to your project with your guide and should be an ongoing activity. The guidance will ensure that you are working in the right direction and the methodology being used by is correct besides you will also get a complete clarity about several concepts which you might study in senior classes at later stage of your life. However don't feel shy in getting your queries solved and listen to their suggestions. Be inquisitive!!

7. Calculations to draw conclusions:

Use your raw data to calculate and arrive at conclusions. It is very important to process raw data carefully else you may arrive at a wrong conclusion.

For example, you weighed a container. This weight is recorded in your raw data table as 'wt. of container'. You then added some liquid to the container and weighed it again. This would be entered as 'wt. of container + wt. of liquid'.

In the calculation section, do the calculations to find out how much liquid was used in this experimental run:
(**wt. of container + wt. of liquid**) **-** (**wt. of container**) = **wt. of liquid.**

Each calculated answer is entered into a table in a 'Results' section using proper units.

8. Summarize results and derive conclusions:

Summarization of result is very important. Summarisation may be written paragraph or can be in the form of a table of processed numerical data or graphs. Mathematical equations can be made from graphs. These equations allow you to predict how a change will affect the system without the need to do additional experiments. Based on summary, you can draw conclusions about the system under study. These conclusions help to confirm or deny the original hypothesis.

Based on summary and your experimental data and your experimental observations, try to answer your initial questions. Is your hypothesis correct? This is the time to reflect and access your experiment. It is possible that your observations lead you to conclude something different from your starting hypothesis. Never ever alter results to fit a theory. If your results do not support your hypothesis, it does not matter. You still have done successful scientific research. *The spirit of scientific inquiry requires an open mind.*

9. Define utility and further scope of Project

It is very important to determine utility of the project. Utility and further scope also determines cost viability and encourages inventors to explore further. Investors are willing to invest money in any project if it has futuristic value. Whenever you decide to take up a project it's very important to determine its future prospects.

10. Cost feasibility:

It is very important to put down the actual cost incurred in preparing the dummy model as well as calculating and arriving at the estimated cost of the actual device. You must do a cost comparison with the existing products, if applicable. You should also state the source from which these components can be obtained.

What is NOT accepted as a CBSE Project?

Any project that you take up must follow the *scientific method* and should be a *research project*. It is very important that it should be as per the sub-theme under which it is presented.

Thousands of exhibits are displayed at regional level but only few make it to national level. Typical examples of projects that are not selected are:

- Merely repeating an experiment in your science textbook, e.g. germination of seeds, forest farming etc.
- Making a wild hypothesis without personally doing any experiment or showing proof to support the concept, e.g. generating electricity from speed breakers, feeding animals in forest.
- Making unsubstantiated claims that violate known laws and principles of science, e.g. generating energy out of nothing.
- Simple posters, thermocol or wood models explaining science/technology principles, e.g. model of digestive system, model illustrating soil erosion, model of a hydroelectric power station, models illustrating pollution control etc.
- Merely presenting ideas and concepts which are already well established and used or were used in various countries without doing proper research about its viability and applicability in current situation e.g. generation of electricity using sea water.
- Presenting an idea based on information available on websites without doing any proper research.
- Presenting an idea which cannot be presented in class room conditions hence adapting unfair means to make it work.

Important Do's and Don'ts

- **Follow the Mentor / Guide:** You may take guidance from your teachers, parents, research scholars or any qualified person who is capable of guiding your research project.
- Follow the **display rules for displaying the project.** Make sure your project's dimensions are as per specifications given by the Board.
- **Using unfair means:** Do not adapt unfair means while presenting the project.
- Follow display rules and do not display prohibited banned objects.

Project set up and display

Main objective of presenting the project is to attract and inform judges and visitors hence it is important that your project should be easy to access.

Display of Exhibit

- Make the effective use of the space provided by using clear and concise displays. The display is what shows the judges and public what you did. It should look organized, neat and attractive.

- Do not distract with a lot of decoration or distracting features. The prime focus is the work; the display board is just to display the work.

- Think carefully what should go on display Board or charts. Do not put everything and anything on the display. Do not clutter information as it will confuse your target audience.

- Make sure your display is logically presented, well organised and easy to read. A glance should enable anyone (particularly the judges) to locate the title, experiments, results, and conclusions quickly. When you arrange your display, imagine that you are seeing it for the first time.

- Make sure your display stands out. Use neat, colourful headings, charts, and graphs to present your project. Pay special attention to the labelling of charts and diagrams. Each item must have a clear descriptive and distinctive title. As far as possible all items on chart may be typed or should be written in very neat and legible handwriting.

- Languages are an important means of communication, and hence, present your project using good language. Watch your grammar, spelling and wording. Again, all sections should be TYPED and computer generated.

- You must make sure that your exhibit should not require more than **6'X3' of space** for display. Maximum project sizes include all project materials, supports, and demonstrations for public and judges.

- Strictly adhere to the **size limitations and safety rules** while preparing your display.

- Make sure your display is **portable and sturdy**, as it will need to remain intact for quite a while.

- **Select a good and simple title for your exhibit.** Your title must accurately represent your exhibit.

- **Take photographs, make videos** of the supporting activities undertaken by you while working on this project. You may take photographs/videos of important parts/ phases of your experiment to use in your display.

Display / Safety Rules

Following item are prohibited for display and should not be used while working on project:

- Living organisms.

- Specimens / Preserved vertebrate or invertebrate animals.

- Human / animal parts or body fluids (e.g., blood, urine). For the purpose of student research, all body fluids, including saliva and urine (excluding hair), are not to be considered tissues. (Exceptions: teeth, hair, nails, dried animal bones, histological dry mount sections and completely sealed wet mount tissue slides).

- Laboratory / household chemicals.

- Poisons, drugs, controlled substances, hazardous substances, or devices (e.g., firearms, weapons, ammunition, reloading devices)

- Flames or highly flammable display materials.

- Gas cylinders, Generators.
- Batteries with open top cells.
- Dry ice or other sublimating solids.
- Pressurized tanks that contain non-combustibles may be allowed if properly secured.
- Sharp items (for example syringes, saw blades, needles, pipettes, knives etc.)
- Any apparatus with unshielded belts, pulleys, chains, or moving parts with tension or pinch points may not be operated.
- Any apparatus producing temperatures that will cause physical burns must be properly insulated.
- Heavy electrical machinery such as large compressors, electric hot plates etc. may not be used.
- Any Banned object if displayed will be removed by the authorities and the project will be summarily disqualified.

Electrical power

- 220 Volt single-phase AC power will be available at the supply hence all gadgets should be compatible (especially for international participants).
- All open ends of electrical wires, sharp objects, edges to be properly insulated/sealed.
- It may be noted that wire connectivity without proper plug at power source is not permitted

Computer facilities

You need to bring your own laptop.

Explaining exhibit to the visitors and at the time of Judgement?

Well explained exhibit makes all the difference. Presentation of exhibit to judges as well as to visitors is most important and crucial part of exhibition. You should keep following points in mind while presenting your exhibit:

a) Make sure you are audible and clear.
b) Speak in clear language and do not use accent.
c) Explain in language in which you are most comfortable. You may use your native language if judges are comfortable with it.
d) Speak confidently! Rehearse in front of your family, friends and classmates.
e) Do not feel offended with cross-questioning.
f) Do not merely collect and mug up data and information but try to understand the concept.
g) Make sure you are explaining the concept which you completely understands and comfortable with. Ask you guide to explain the details.
h) Explaining with a cheerful smile and good body language is a good gesture.
i) Do show respect to all visitors as well as judges.
j) Listening to others view points, suggestions and ideas is a good option. A scientist should be open to ideas.
k) It is very important to present your exhibit in allotted time span. As per rule each team will be given 10 minutes for explanation.
l) Rehearsing explanation within stipulated time limit will help you in including essential points. Do not include everything and anything in your explanation. Explanation should be to the point.

m) Do not try to influence judges with your knowledge.
n) Do not argue with your visitors.
o) Exhibitions provide good platform to learn and exchange ideas. Do take time to visit all exhibits and learn from others. Do not make fun of their exhibit or be judgemental.

Tips on writing a Synopsis

A synopsis gives the essence of the project in brief. Ideally, a synopsis should not exceed 250 words. It is important that synopsis must provide fairly accurate idea of the project. While writing a synopsis one must focus on the current research and previous work should be given minimal reference. Acknowledgement should not be included in the synopsis.

The following should be the elements of synopsis:

- **Aim of the experiment** - An introductory statement which clearly and completely defines the objective of taking up the experiment. Aim may be defined as a statement of the problem and/or the hypothesis being studied.
- **Procedures used -** A summary of the key points and an overview of how the investigation was conducted. A synopsis does not give details about the materials used unless they greatly influenced the procedure or had to be developed to conduct the investigation. A synopsis should only include procedures done by the student.
- **Data -** This section should provide key results that lead directly to the conclusions you have drawn. It should not give too many details about the results nor include tables or graphs.
- **Logbook -** The calculations made during experiments, other rough work done along with date and place details are recorded in a logbook, which could be a rough booklet.
- **Conclusion -** Conclusions from the investigation should be described briefly. The summary paragraph should reflect on the process and possibly state some applications and extensions of the investigation.

Tips for Guides / Teachers / Parents

- Encourage, support, and guide your student
- He / She should be encouraged to research on the topic selected
- Students should be motivated to work independently as well as team
- Make them realize the main goal of Science Exhibition. Science exhibition is a platform to strengthen the skills he/she has learned and develop higher-level skills besides exchange of ideas. The main goal should never be wining the prize
- As a school provide transportation to libraries, research laboratories , or universities that can help your child find project information
- Provide Internet access, either at home or at a school or library
- Supervise the project and guide/ mentor them as and when required
- Keep all safety norms in mind and also adhere to all rules so that no rework is required
- Work on mutually agreed timeline to prevent a last minute project. Also start early
- It is suggested you allow at least 12 weeks conducting an experiment and preparing the presentation
- Try to inculcate scientific skills
- Discourage any mal-practices such as copying data from net
- Teach the process of observation, recording of results, drawing conclusion during experimentation
- Teach the art of surfing internet to collect data. Students must be guided to learn to check the authenticity and relevance of data collected
- Most important, guide them not to worry or get upset if they are not able to win a prize at the Science Exhibition. The skills they have gained are worth all the effort
- Discourage all unfair means and practices. Inculcate values a scientist should be honest and fair to his findings.

What should be the essential elements of your project?

Ideally, your project should have the following elements:

- **Synopsis -** This is a summary of your idea and should include the purpose of the experiment, procedure used, data, and conclusion
- **Research paper -** A research paper should be prepared and must be available along with the project data book with relevant written material. A research paper helps organize data as well as thoughts. A good paper includes the following sections:
- **Title page:** Centre the project title, and put your name, address and school
- **Aim / Objective:** The introduction sets the stage for your report. The aim includes your hypothesis, an explanation of what prompted your research and what you hoped to achieve.
- **Scientific Principle Involved:** In this section describe the principal involved.
- **Material Used:** List all the items used here this will help you in working out the final cost.
- **Method:** This section describes how you did the study. Describe in detail the methodology used to collect your data or make your observations. Your report should be detailed enough for someone to be able to repeat the experiment. Include photographs or drawings of self-designed equipment. The research work conducted by you may have taken more than a year. In such case, include this year's work only.
- **Discussion**: This is the essence of your paper. The results and conclusions should flow smoothly and logically from your data. Be thorough. This should let the reader know exactly what you did, compare your results with theoretical values, published data and expected results. Include a section of possible errors. How did the data vary between repeated observations of a similar event? How were your results affected by uncontrolled events? What would you do differently if you were to repeat this project? What other experiments should be conducted?
- **Conclusion**: This section describes the findings and conclusion of the project. Briefly summarize your results. Be specific, do not generalize. Never introduce anything in the conclusion that has not been discussed.
- **Further scope of project**: This is a step further; here you describe the future scope of your experiment.
- **Acknowledgement**: You should always give credit to those who assisted you; they may be individuals, educational or research institutions.
- **Reference list:** Your reference list should include any documentation that is not your own (i.e. books, journal articles, include specific internet url’s).