A Guide for Science Fair and Engineering Projects

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By

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PREFACE

Children are born with an innate sense of curiosity and an ability to investigate. They utilize their five senses to explore the various surroundings they are exposed to. As they begin speaking, they start asking many questions based on their observations of life around them. This is how the concept of scientific research started. Children are young scientists. Kids with their growing age develop inquisitive minds along with tendencies to unlock the mysteries of nature and seek solutions to the problems occurring in their day-to-day lives. They may adopt certain methods or procedures to test their beliefs (Hypotheses). While testing their hypothesis, they may find the answer to the question or solution to their problem. It is also possible that they will be surprised to find unexpected results. During the scientific process, a scientist may come across facts that will lead their experiment in a different direction with a different conclusion.

In the past four centuries, years of scientific thinking and scientific inquiry have evolved into a scientific procedure called the "Scientific Method". During the 11th century a scientist by the name Al-Hazen (Ibn Al-Haytham) systematically developed this method while conducting research in optics, physics, and mathematics. In Europe, he is called the father of optics (author of Book of Optics) and the inventor of the scientific method, for this reason author Bradley Steffens calls him the first scientist. This book will further explain in detail about various steps required in the scientific method.

In short, the scientific method could simply be described as observation, formulation of a hypothesis, experimentation, collection of data (results), and a conclusion. Such an important topic of scientific research should be the initial part of every science book. In recent times, schools are provided with standards and curricula, designed to help teachers create courses and lesson plans. Some school syllabi emphasize learning through a process of scientific skills, such as observation, classification, measurement, prediction, and inference. Often this type of teaching is completely out of context. For example, what is the point in observing ice melting, classifying types of leaves, and measuring the lunch box without any reason that makes learning meaningless? On the other hand if science is taught with the scientific inquiry in mind while being conscientious of the young curious brain, then it is possible to make scientific research a joyful experience. This is the time when students start thinking beyond limitations and boundaries of academic teachings and eventually it is this type of teaching that will lead to new discoveries, innovative technologies and inventions.

The reason to keep the science fair contest is to bring out the innovative talents of students. They start their science fair experience at the fourth grade level; by then the students are all well versed with basic scientific and mathematical knowledge to conduct independent research studies. In advanced European countries science fairs are held as yearly competitions at the school, regional, state, and national levels. The president of the United States recognizes the importance of the science fair. There

has been an annual science fair held in the White House every year since 2010. The goal behind such an activity is to keep the United States as a leader in innovation, science and technology. I started visiting India every year for past 27 years to promote and popularize science fairs instead of science exhibitions. My intention is to discourage science exhibitions, which deal with exhibits and models of already known scientific facts and knowledge.

Hyderabad was one of the cities that was first motivated by my call for the science fair. Quickly under sponsorship of Mr. Zahid Ali Khan and Zaheeruddin Ali Khan an organization by the name of Science Fair Academy was established. National science fairs were held in Hyderabad for four years under this organization. Currently this annual national competition moved to Chennai, Tamil Nadu where it has been regularly conducted for last seven years. Now, I am glad to know that the Science Fair Academy is planning to rejuvenate and revitalize the regional science fair and publish my handbook "A Guide for Science Fair Projects". Please accept my best wishes for the great cause.

Dr. Qazi Siraj Azher,
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Chairman Scientific Review Committee
Flint Regional Science Fair
Flint, Michigan, USA
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Acknowledgement

We the members of the Science Fair Academy take this opportunity to express our gratitude to the Chief Patron Professor **M.M. Taqui Khan**, Patrons; Professor **Dr. Qazi Siraj Azher**, **Dr. Moin Ansari** and Janab **Zahed Ali Khan** Sahib under whose guidance we are working. We are deeply indebted to them for their useful and valuable suggestions; untiring patience and sincere desire to develop scientific temperament and thought process among the minority students. They are our main source of Inspiration. We are very grateful to them for sacrificing their valuable time to help us in taking up this arduous and noble task.

With sincere pleasure we express our gratitude and acknowledgement to our President Janab **Amir Ali Khan** Sahib for guidance and continuous support in publishing the Science Fair Guide and for organizing regular students and teachers training sessions.

We wish to acknowledge our thanks to the management, head masters/ head mistress of the schools who render their help and co-operation by understanding the need for Science Fairs and allowing us to provide training as well as participation of their schools. And lastly we owe our gratitude towards those students, who are our future hope, the budding scientists of developing India to realize the dream of **"Make in India"**.

***** Science Fair Team *****

Science Fair Academy

The Science Fair Academy, Hyderabad, came into being following a seminar in which (Late) Dr. Afzal Mohammed, Prof. in Economics and Social Science, Ex. V.C. of Dr. Ambedkar University gave a lecture on "Review of Scientific Technology in Medieval India", in December 2005, where number of eminent professors, educationalist & scientists were present and felt a need of forming such an Academy.

Since its inception the Academy has been doing valuable work in developing scientific temper, especially among teachers who teach science at schools & students of city, state & out of state in supervision of an eminent renowned Scientist, Prof. M.M. Taqui Khan, Chief Patron of Academy with few other able Scientists, Academicians etc. as its Patrons like Dr. Qazi Siraj Azher, Director Pathology Division Hurly Medical Centre, Flint, USA, Dr. H.S. Hanafi, Prof. of Botany, Bijapur, Dr. Hameeduddin Siddiqui, Former D.D. CSIR & Mr. Zahid Ali Khan, Chief Editor, "Siasat" Urdu Daily Newspaper from Hyderabad, Mr. Amer Ali Khan, News Editor Siasat Daily, shouldering the responsibility of the President of the Academy.

Dr. Qazi Siraj Azher, has been the driving force behind the Academy with not only his valuable lectures but also in motivating the academy in conducting 3 valuable National Science Fairs, in three consecutive years i.e. 2006-2008, making visits to Hyderabad & other Metros of India.

The Academy is proud to have enjoyed tremendous support by A.P. Council of Science & Technology (APCOST), in the form of collaboration & assistance made possible by kind attention of Prof. Ch. V. Ramana Devi, the then member secretary of APCOST. Academy is indebted to her. During 2008, the academy conducted a Seminar, in Medwin Hospital, in collaboration with APCOST, on, "Planet Earth – is it safe anymore for life", coinciding the Earth Year, in which 5 valuable papers were presented.

The continuous effort of the academy, for 3 years, at last bore fruit as number of schools in city & state have realized the fact that the only successful method for science students to learn it practically, is through "Science Fair Projects", with the conventional teaching of science theoretically, not with the experiments being observed.

A Govt. School "Soundarya Vigyan Bhavan" N'Guda, has thoroughly appreciated this fact, & that the Govt. Schools should come forward first to adopt the system.
Dr. Qazi Siraj Azher & the academy has explained and insisted on the Science Fair Projects, not the Science Exhibition, which is not a Fair Project but only charts, graphs & Models. Always we insisted schools to say **"No to Science Exhibition and Yes to Science Fair".**
The Academy, insists to offer the large share of the effort to young blood. The academy has plans to establish its central office, in near future & also to launch the website on the net.

Organizing Committee

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  Prof. M.M. Taqui Khan
  Distinguished Scientist,
  Ex. Director CSIR

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  Diplomat American Board of Clinical &
  Anatomical Pathalogy
  Prof. of Pathalogy, Hurley Medical Centre, Flint, USA

  Dr. Moin Ansari
  Chairman Board of Nutrition
  Palmer C University, USA

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  Editor, The Siasat Daily, Hyd.

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  Dr. Syed Ghouse Uddin

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  Chairman, Dawn Group of Schools

  Kishwar Arshad
  Principal IBM High School

  Ghafoor Unnisa
  Meritorious Teacher Awardee by MES Telangana & A.P Unit

  Sadiya Samreen
  Author and Science HOD,
  M.S. Creative School

  M.A. Hameed
  Career Counselor, The Siasat Daily

  Bilquies Farzeen
  Director – Visionary Group of Institutions

  Mubashir Azam
  Physicist

From President's Desk

Science Fair Academy was established in 2005 with an aim to promote Science education and scientific knowledge among the youth and particularly students of High schools and colleges. Mr. Zahid Ali Khan Editor Siasat has been the source of inspiration and he patronizes the organization in all respects. Mr. Zaheer Ali Khan Managing Editor Siasat was the President of the Academy for ten years. Under his able guidance and with valuable cooperation of the distinguished members, we were able to organize various seminars, guest lectures, elocution and essay writing competitions.

The Academy made extensive work to carry on the academic activities like workshops, science exhibitions and group discussions among the students community. We have succeeded in our efforts to promote scientific temperament among teachers and students.

The Academy has conducted workshops on various science inventions, discoveries and created interest in Research on various disciplines of Science. Dr. Syed Ghouseuddin and other distinguished members made efforts in making our programs a grand success. I appreciate their dedicated services and corporation.

We had organized an extension lecture on the Islamic Scientific Technology in the medieval India on 26th December 2005. The eminent scholar and intellectual Prof. Afzal Mohammed the Vice Chancellor of Dr. B.R. Ambedhkar Open University delivered a very thought provoking lecture highlighting the achievements of Muslim Scientists and their contribution in various aspects of science.

On 7th July 2006, a meeting was held in connection with Science Fair Mr. Zaheeruddin Ali Khan, Mr. Abid Siddiqui and Dr. Ghouseuddin and other attended the meeting. It was decided to prepare a list of Muslim Scientists and their contribution in the advancement of Science.

Science Fair Academy had organized Science teachers workshop which was attended by 69 Science Teachers from Telangana, Andhra and Karnataka. Dr. Zia Abidan Punikar, Mr. Shamsuddin, S. Jagirdhar, Mr. Abid Siddiqui, Former News Editor Doordarshan, Dr. H.H.S. Hanafi and many were among the main speakers. The workshop helped the teachers to know the modern techniques of teaching Science.

The Academy invited Dr. Mohd. Samiullah Khan Director Medwin Institute of Medical Science to deliver a lecture on importance of Science Fair in the modern times. Dr. Samiullah delivered a lecture and enlightened the audience with his valuable and most knowledgeable ideas. Mr. Zaheeruddin Ali Khan in his Presidential address advised the Academy to initiate academic activities in the schools and colleges.

I am proud to mention that Dr. Abdul Moin, Dr. Qazi Azhar, Head Dept. of Pathology USA, Prof. M.M. Taqi Khan, Mr. Zahid Ali Khan, Editor Siasat Daily and Dr. H.K.H. Hanafi Professor Alameen College Bijapur Karnataka and many others participated in the seminars and annual function, they underlined the importance of science fairs in the modern world.

Dr. S. Mahmood Naqvi, Scientist NGR, Mrs. Sara Banu Khan Education Officer also spoke before the august gathering of Science Fair.

During the last three years we organized symposium and seminars in which the eminent personalities Dr. Hassanuddin Siddiqui former director NCERT, Mr. Qameruzzaman, Head Dept. of P.G. Unit A.U. College Dr. Akbarudin Siddiqui, Dr. S.S. Jahangir, Dr. Abdul Sattar, Prof. C. Venkata Ramana Devi, Dr. B. Arare Shankar Rao and others underlined the scientific temperament which would help to establish a knowledge society in the country.

Science Fair Academy is actively making lot of efforts to popularize Science in Academic Institutions and also in various Forums; our activities were appreciated by scholars, teachers and the students.

We seek cooperation from all quarters to achieve success in our endeavors. We are leaving no stone unturned to create scientific atmosphere in the society.

Amir Ali Khan
President, National Science Fair Academy
News Editor, Siasat Daily, Hyd.

From General Secretary's Desk

At the outset, I express my sincere gratitude to Almighty and then to all the members of National Science Fair academy for choosing me as a part of making science learning as Factual **F**, Accurate **A**, Innovative **I** and Rationale **R**, process.

When Dr.Qazi Siraj Azher visited our school in 2009 with great enthusiasm, his patriotic beliefs in the future of India and his will to win and desire to succeed, the urge to reach the full potential of a student were the keys that unlocked the doors of scientific temperament among the students.

Thus Neo Rosary became a part of science Fair academy and our students started participating in the National science Fair that is being conducted in Chennai every year.

Neo Rosary is proud to be the winner of National Science Fair award in the academic year 2010-11 and 2013-14. Initially the schools affiliated to Secondary School Certificate were reluctant to take part in Science Fairs as it was not the part of the curriculum. Later with the organizations like **Inspire** and change in SSC curriculum has made us all realize its importance and we are glad to figure out 22 schools with 157 students taking part in our 8th inter school Science fair.

A fundamental challenge facing all Teachers and parents is trying to negotiate a new role for themselves in their relationship with their children. As children grow they change. They expect parents to be idealistic. So the parenting skills and teaching skills need to be polished time to time. Parents and teachers need to be ready upgrading their skills – Teaching techniques that work when a child is 10 will be hopelessly out of sync with a teenager. Your initial teacher's role as a caregiver is natural.

Our new curriculum which is based on Multiple Intelligence supports Science Fair Activity to unlock all the five potentials of an individual.

Linguistic Potential is developed	- Science Fair Presentation skills
Analytical and Logical Potential	- Proving Hypothesis
Personal Potential	- Application and suggestions
Physical and Mechanical Potential	- Consistently & continuously working
Spatial Potential	- Solution to the problem

Throughout the primary grades and middle-school years, parents begin to teach their children to function in the world. In many ways these years are an ideal time for parents, because their children are capable at times of functioning on their own and yet remain totally dependent upon their parents. Later it is the teachers who need to understand a student and ensure to see that a student performs even with various levels of disturbances.

Thus participation in Science Fair activity will help an individual to discover his own inner talents. Every individual child irrespective of his/her individual differences shows a pattern of interest, and ability in a particular area. Once an individual is able to identify his/her ability they will choose subject of their interest for their higher studies and careers. They will be self motivated in doing a job of their interest and will happily give their services to the society.

Nasreen Fatima
Principal - Neo Rosary High School
Organising Secretary COMI and
Rotary Club Charminar
B.Sc, B.Ed, M.A, M.Ed,
B.M.R.C.Sc, P.G.D.C.S (UK)

Scientific Method

Method used by scientists to do research consisting of following steps :

1.1 Observation

Observation is a key to science fair projects.
Observations are based on curiosity and a desire to explore the world around us.
Observations could include all of the human senses.
Observations could also be through technological devices, for example microscope, pH meter, manometer etc.
Observations could be qualitative or quantitative, but scientists usually like quantitative measurements, as they are more precise.

1.2 Question / Problem

Usually an observation leads to a research question or problem that requires further investigation.
Example:
Question: Is the black soil better for the growth of sunflower seeds?
Or
Problem Statement: Do sunflower seeds grow better in black soil?

1.3 Hypothesis

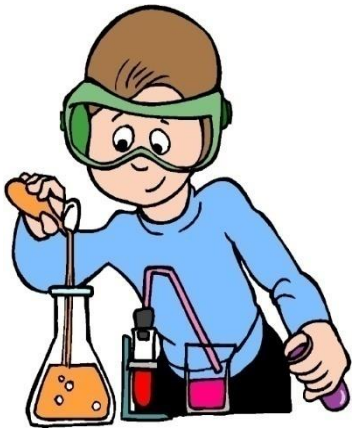
You should write the hypothesis before performing experiment or study.
Based on observation, you may formulate a hypothesis, or possible answer to the question or problem.
Hypothesis is an educated guess or logical explanation that could be tested.
Hypothesis is also a type of prediction that forecasts how one variable (independent or manipulated) can affect a second variable (dependent or responding).
Record your hypothesis in your notebook before you start your project experimentation.
State the fact that you have based your hypothesis on your past experience or observation.
Do not change the hypothesis even if the project results do not support your hypothesis.
***Example**:* *S*unflower seeds grow best in black soil.

1.4 Plan an experiment

Do the background research and review the published materials related to your question or problem.

Design a project-experimentation to test the hypothesis.
Design an experiment that will permit an appropriate evaluation of a given hypothesis.
It is important that only one variable (independent variable or manipulated variable) is changed, while keeping the other constant. This makes an experiment "controlled".
Include a precise way of measuring the results.
Collect more than one set of data to verify your results.
Write down the steps you will follow to do your experiment.

1.5 Conducting an experiment

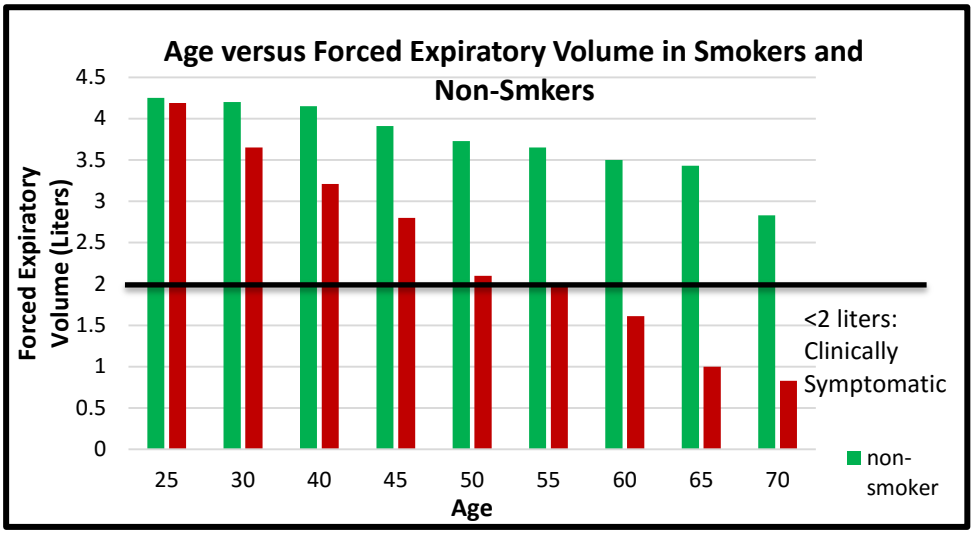


Follow the steps you wrote down in planning the experiment.
Make a list of items or materials that are required to conduct the experiment.
Observe and measure the variables carefully with control.
Keep all the data recorded in a notebook or project journal. It is important proof that you actually did the project. During the presentation and interview, the judges will want to see this work.
Test your hypothesis through your procedure of experimentation (data collection) and analysis of your data.
Always use metric measurements [e.g. centimeters (cm), grams (gm), and milliliters (ml)].
Collect more than one set of data to verify your results.
Repeating the experiment, collecting the data multiple times, randomization of sample and test, increasing the sample size reduces margin of error and improves the confidence interval.
Example: Sample size
If testing the lung capacities in the groups of smokers and non-smokers; it is essential to collect the data by testing large number of people in both the groups. This will improve precision and accuracy with better outcome of the experiment.
Note: This is also called a "procedure" or "material and method".

1.6 Results

Results include data and analysis.
Organize the data in the form of charts or tables or graphs so that it gives quick and easy interpretation.
Example: In the graph below, when forced expiratory volume has been measured in the population, between nonsmokers and smokers, there is

marked drop in the lung capacity of smokers with increasing age. In bar graph the results become self evident and clear.



1.7 Conclusion

This is a brief summary of what you have discovered based on your experimental results.

State your findings in relationships of one variable with the other.

It indicates whether or not the data support your hypothesis. You will be accepting or rejecting your hypothesis based on the results of your investigation.

Do not change the hypothesis, if your results are not what you expected.

You may find the results of your project inconclusive. If this is the case, try to find why. Give reasons why you think the results did not support your hypothesis.

Research Paper

2.0 Research paper should be available along with the project data book and an abstract at the time of project presentation and judging. A good paper includes following sections.

2.1 Project Title

Select a title that summarizes your project.

Keep it short and simple.

It should be attention grabber and intriguing to the casual observer.

It should stand out visually.

2.2 Table of Contents

This allows the reader to quickly go through different parts of your project.
Make sure to list the different sections of your paper by page numbers

2.3 Abstract

Abstract is important, as it is a representation and brief overview of the project.
It should be no longer than one page, containing a maximum of 250 words according to Intel International Science and Engineering Fair (ISEF).
It should include the project title, your name, and school on top. Starting on the next line, purpose (hypothesis) of the project, method of research, pertinent data, conclusion, and application.
Use short sentences and do not abbreviate. Use 'past tense' in your descriptions. Appropriate scientific terminologies should be used. Remember to correct your spelling, grammar, and punctuation.
Discussion, acknowledgements, and unnecessary details should not be included in the abstract.
Most science fairs will require a copy of your abstract to display at the exhibit and the other copies to handout to judges and visitors on the day of public-visitation.

2.4 Introduction

This section will introduce the topic of the project.
It should state what information or knowledge led you to your hypothesis.
Include what prompted you to do this research and what you hoped to achieve.
It is a statement of your purpose along with the background information that led you to do the study.
If you are going to state references in your report, this is where more citations are likely to be given.
The introduction is written before starting the project and collecting the data, therefore results should not be included under this heading.

2.5 Materials and Method (or procedure)

This part of the report contains information about the project experiment.
It should include procedural steps with materials used, calculations, amounts, and measurements.
Describe in detail the methodology you have used to collect the data.
If you have designed an apparatus or equipment, then include a detailed design or diagram.
It is important to follow the same procedure every time the experiment is repeated to get consistency in results.

The purpose of writing a procedure is to provide detail method of your experiment, so that if someone else wants to follow your procedure, then that person should be able to achieve the same data.

2.6 Results

Results include data and analysis.
Present the data in the form of charts, tables, or graphs.

2.7 Discussion

This is the heart or the essence of your paper.
Discussion of your experimental results is a principal part of your project report. Therefore, begin by presenting all your observations and data.

In this section, interpret and critically evaluate your results in light of what is already known, and explain your new understanding to the problem.
Develop your argument for and against your hypothesis.
Explain whether the data you have obtained support your hypothesis.
Acknowledge any anomalous data or deviation from what you expected.
Do not make generalized statements that are not based on your data, known facts, or reason.
Be sure to relate your findings to earlier work in similar studies and cite those studies.
Derive conclusions based on your findings about the process you are studying
Explore the theoretical and/or practical implications of study or findings.

2.8 Conclusion

Draw your conclusion based on the analysis of your data. You should conclude whether or not results support your hypothesis.
This is the final outcome of your project or experiment. May prove or disprove your hypothesis.
This is in addition to what has already been described in section **2.6

2.9 Acknowledgement

Give credit to the institutions or people who have assisted you in your project.

2.10 References or Bibliography

These are the list of citations used in your research paper.
Your references should include any documentation that is not your own.
Please adopt standard citation format of references (CSE or MLA).

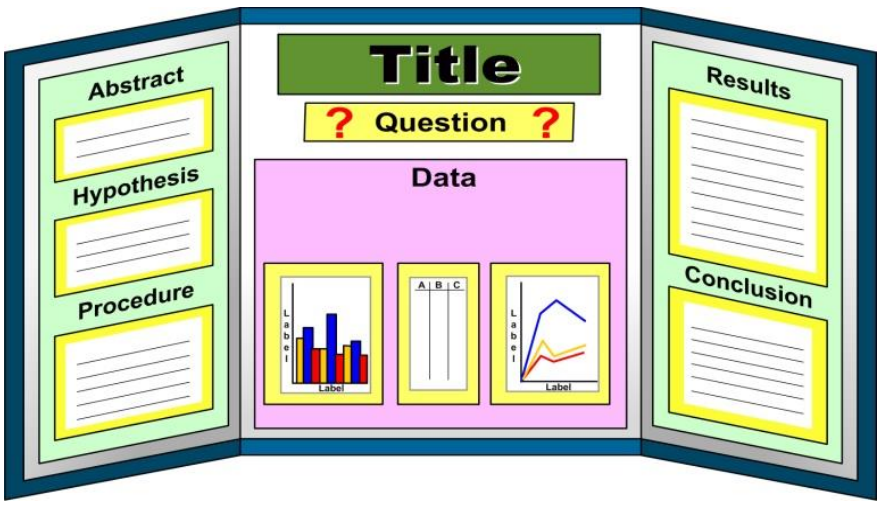
Example from a journal article: Meise CJ, Johnson DL, Stehlik LL, Manderson J, Shaheen P. 2003. Growth rates of juvenile Winter Flounder under varying environmental conditions. Trans Am Fish Soc 132(2):225-345.

Example from a book chapter: McDaniel TK, Valdivia RH. 2005. New tools for virulence gene discovery. In: Cossart P, Boquet P, Normark S, Rappuoli R, editors. Cellular microbiology. 2nd ed. Washington (DC): ASM Press. p. 473-488.

Example from an electronic article:
Hong P, Wong W. 2005. GeneNotes: a novel information management software for biologists. BMC Bioinformatics [Internet]. [cited 2007 July 24]; 6:20. Available from: HYPERLINK "http://www.biomedcentral.com/1471-2105/6/20 "http://www.biomedcentral.com/1471-2105/6/20

Project Display Board

3.0 Displaying your project in science fair is the most important tool for the presentation of your research. Therefore, it should be clearly visible, neat, and should have all the information required at the time of judging.



3.1 Title

Your title should be the largest text on the display. It should be readable from minimum of six feet or from across the room.

3.2 Display Board

Usually standard display boards are tabletop and of three-panel (tri-fold) type, but freestanding type and commercially available role-able laminated poster boards could also be used. According to the rules of International Science and Engineering Fair (ISEF), project display should fit into the following configuration.

Dimensions: 122 cm (48”) in width or side to side and 76 cm (30”) in depth or front to back. The permitted height from floor to the top should be not more than 274 cm (108”).

Science Fair Board Layout: This is not the same as your written report. The objective of a display board is to present your research in a way that others can easily understand.

Title should go on the top of the central panel.

People have a tendency to read the project board like reading a book, from top to bottom and left to right. Therefore, when setting up the board, start putting the earlier work of your research on the left panel and the right panel should be used for the work done at the end of the project.

Presentation on the left panel will show research question or problem, hypothesis, introduction, materials and method or procedure.

The right panel should display result, conclusion, and acknowledgements, at the end your name and school.

Intel ISEF also requires an abstract that should be displayed at the bottom of this panel.

The central panel is the most significant part of the entire board as this part is most eye catching. It should carry data, graphs and pictures as these illustrations will make the project easy to comprehend.

On the other hand, cluttering of the central panel with unnecessary pictures and graphs confuse and distract the viewers from the main research of your project. Similar effect is produced by too much texting of the display board.

Graphs, tables and pictures should be neatly labeled and numbered for citation in the text. As far as pictures are concerned please follow the rules and regulations of ISEF.

Writing Format:

- All the text material should be typed or printed in black only on white paper.
- Letters for the title should be 3 to 4 inch high.
- Subtitles (e.g. Hypothesis, Introduction, Material and Method etc.) should be in font size 36.
- Use number 16 or 18 font for the text.
- Use I” margin.
- Use only 8 1/2 x 11 paper.
- Put a blank line between paragraphs.
- Titles and subtitles should have dark colors so that they standout.
- Use computer to generate labels in appealing

colors. You must not use more than three contrasting colors.
Never use neon colors as they do not look professional and would distract the onlooker.

- All the graphs, figures and diagrams should be appropriately numbered and labeled.
- **Display Materials or Demonstration Equipment:** Apart from displaying scientific report, logbook and abstract, the following items should be considered to be displayed:
- Mock-ups of three dimensional design used in the research.
- Laptop illustrations of the procedure. PowerPoint and videos could be excellent complements to the text and graphics on the board.
- Display demonstration equipment in engineering projects.
- Items that are not allowed to display are living organisms, chemicals, drugs, human or animal parts, food, body fluids, preserved vertebrates or invertebrates.

For further rules and regulations please brows through Intel ISEF website. (https://student.societyforscience.org/intel-isef-forms).

Oral Presentation

Now it is time to be judged and to impress the judges with your project, knowledge, and enthusiasm. Oral presentation is also an important part of the science fair project. Remember you are in competition, better the judges understand and appreciate your work, higher the scores you will get. People are affected not only by your knowledge but by the way you look, the way you talk, and the way you act.

- Dress up professionally and appropriately with descent cloths.
- Be polite, pleasant and cheerful.
- Speak loud and clear (not too loud or not too soft).
- Avoid verbal clutter (Um, Ah, like, you know etc)
- Do not chew gum or candy.
- Stand at the side of your display board.
- Introduce yourself with your grade and your school.
- During presentation, keep your eye contact with the judges.
- Open your presentation with an interesting statement or question about your project.
- Explain a little bit how the idea of your project originated.
- Make sure to research your subject of research thoroughly for background information.
- Be organized in your presentation and follow the steps of scientific method.
- Try not to read from the script or the board.
- Emphasize particularly the area of the project where you were creative and innovative.

- Mentioned briefly if you had any problems during experimentation and how did you rectify them.
- Let the judges get involved during your presentation by showing and handing over to them designs or research equipments or gadgets.
- Use your charts and graphs to present the data along with illustrations and pictures.
- Sometime memorized speech becomes problematic as it becomes emotionless, flat, and boring therefore *avoid memorization but remember the points* to be said. But could make some cards with hints and points to look while talking.
- Time yourself to be sure that you finish in the allotted time.
- Give some time for questions and answers.
- Think questions that the judges may ask and be sure that you can answer them completely and concisely. If you are not aware of the answer then be honest. Judges like the honesty. Do not fake the answer.
- If you disagree, explain the way you understood, but do not argue with the judge.
- Finally, what is the significance of your research and its application? Bring up to judges' attention if you have got any new ideas or developed any questions by doing this project, as we know one project leads to another project.
- At the end thank the judges.

Judging Criteria for Intel ISEF (International Science & Engineering Fair)

The following evaluation criteria are used for judging at the Intel ISEF. As shown below, science and engineering have different criteria, each with five sections as well as suggested scoring for each section. Each section includes key items to consider for evaluation both before and after the interview.
Students are encouraged to design their posters in a clear and informative manner to allow pre-interview evaluation and to enable the interview to become an in-depth discussion. Judges should examine the student notebook and, if present, any special forms. Considerable emphasis is placed on two areas: *Creativity* and *Presentation,* especially in the *Interview* section, and are discussed in more detail below.

Creativity: A creative project demonstrates imagination and inventiveness. Such projects often offer different perspectives that open up new possibilities or new alternatives. Judges should place emphasis on research outcomes in evaluating creativity.

Presentation/Interview: The interview provides the opportunity to interact with the finalists and evaluate their understanding of the project's basic science, interpretation and limitations of the results and conclusions.

- If the project was done at a research or industrial facility, the judge should determine the degree of independence of the finalist in conducting the project, which is documented.
- If the project was completed at home or in a school laboratory, the judge should determine if the finalist received any mentoring or professional guidance.
- If the project is a multi-year effort, the interview should focus ONLY on the current year's work. Judges should review the project's abstract to clarify what progress was completed this year.
- Please note that both team and individual projects are judged together, and projects should be judged only on the basis of their quality. However, all team members should demonstrate significant contributions to and an understanding of the project.

Judging Criteria for Science Projects:

I. Research Question (10 points)

- Clear and focused purpose
- Identifies contribution to field of study
- Testable using scientific methods

II. Design and Methodology (15 points)

- Well designed plan and data collection methods
- Variables and controls defined, appropriate and complete

III. Execution: Data Collection, Analysis and Interpretation(20 points)

- Systematic data collection and analysis
- Reproducibility of results
- Appropriate application of mathematical and statistical methods
- Sufficient data collected to support interpretation and conclusions

IV. Creativity (20 points)

- Project demonstrates significant creativity in one or more of the above criteria

V. Presentation (35 points)

a. Poster 10 points)

- Logical organization of material
- Clarity of graphics and legends
- Supporting documentation displayed

b. Interview (25 points)

- Clear, concise, thoughtful responses to questions
- Understanding of basic science relevant to project

- Understanding interpretation and limitations of results and conclusions
- Degree of independence in conducting project
- Recognition of potential impact in science, society and/or economics
- Quality of ideas for further research
- For team projects, contributions to and understanding of project by all members

Judging Criteria for Engineering Projects:

I. Research Problem (10 points)

- Description of a practical need or problem to be solved
- Definition of criteria for proposed solution
- Explanation of constraints

II. Design and Methodology (15 points)

- Exploration of alternatives to answer need or problem
- Identification of a solution
- Development of a prototype/model

III. Execution: Construction and Testing(20 points)

- Prototype demonstrates intended design
- Prototype has been tested in multiple conditions/trials
- Prototype demonstrates engineering skill and completeness

IV. Creativity (20 points)

- Project demonstrates significant creativity in one or more of the above criteria

V. Presentation (35 points)

a. Poster (10 points)

- Logical organization of material
- Clarity of graphics and legends
- Supporting documentation displayed

b. Interview (25 points)

- Clear, concise, thoughtful responses to questions
- Understanding of basic science relevant to project
- Understanding interpretation and limitations of results and conclusions
- Degree of independence in conducting project
- Recognition of potential impact in science, society and/or economics
- Quality of ideas for further research
- For team projects, contributions to and understanding of project by all members

Note: Science fair projects and engineering projects have different evaluation scores but both will add up to 100 points.

Difference between Science Fair and Science Exhibition

Science Fair Project	Science Exhibition Project
1. Students think and work like scientists	1. Students do not think like scientists
2. Original innovative concept, publishable	2. Not an original or novel concept, not publishable
3. Planning and designing their own experiment plays an important role	3. Cook-book science experiments copied from text books
4. Observation play an important role	4. Observation is not a factor
5. Curiosity and inquiry driven	5. Curiosity does not play any role
6. Creativity and critical thinking plays an important role	6. Creativity and critical thinking has no role to play
7. Data is collected to find the results, which are not known before	7. Display already established facts and published data with results
8. Use their own creative scientific techniques and procedures	7. Just follow others methods, procedures and instructions
9. Research base activity	9. Do not have any element of research
10. Follow scientific method or engineering methods	10. Do not use scientific method or engineering method
11. A science fair project starts with a question or a problem	11. Question, and problem are not part of this activity
12. Not part of science syllabus in school	12. Part of science syllabus in school
13. Develop the ability to do independent research study	13. Unable to do an independent research study
14. Students show lot of interest in doing science fair projects as those are their own research work	14. Students think science exhibition projects are part of school work, do not show much interest
15. Require days, months or years to do one project	15. These projects require short duration, sometime this could be done overnight
16. Students do lot of research prior to starting their projects beyond their text book contents	16. Building models and demonstrations do not require any extra research or scientific information
17. Both students and teachers get benefited with new scientific knowledge and information	17. No new information and scientific knowledge is gained
18. Very often science fair participants find their future careers in science	18. Most of the students do not select science as their future career

Difference and Similarities Between Scientific Method and Engineering Method

Scientific Method	Engineering Method
1. Based on observation ask a question	1. Define the problem
2. Perform a background research	2. Perform a background research
3. Construct a hypothesis	3. Design criteria and constraints
4. Materials and method/procedure	4. Develop prototype solution
5. Analyze data and draw conclusion that may favor the hypothesis or not	5. Test solution that meet the requirement or redesign the prototype

Engineering Method or Engineering Design Process

Engineers who are also scientists adopt engineering method or engineering design process for their scientific research.
Engineers use the engineering method or design process to create solutions to problems.

3.1 Define need; express a goal.
Identifying a problem or need starts an engineering project.
Therefore, start the project by defining the need or problem.

3.2 Do the background research.
Gather background information and research on the project you would like to start.

3.3 Design criteria and constraints.
Design criteria, are requirements you specify that will be used to make decisions about how to build and evaluate the product.
Criteria are the product's physical and functional characteristics. Some examples of criteria are shape, size, weight, speed, ruggedness, and ease of manufacture.
Determine how you will solve the problem.
Brain storm and choose a solution to solve the problem and make a prototype.

Constraints are factors that limit the engineer's flexibility. Some typical constraints are cost, time, and knowledge; legal issues; natural factors such as, climate, raw materials etc.

3.4 Requirements and preparations for the preliminary design.
Basically these are materials that are required to build the prototype.

3.5 Test and evaluate the prototype using the design criteria.
Test solution by building and testing the prototype.
Collect the data after testing the prototype.
A prototype is the first full scale and usually functional form of a new type or design.

3.6 Analyze test results, make design changes, and retest
Analyze the test results, verify and draw a conclusion.
If testing does not meet the requirement redesign the prototype. Then, go back and reevaluate the solution and prototype.
Redesign, test again and review new data.

3.7 **Summary of the Engineering Design Process :**

1. Define a need; express as a goal
2. Establish design criteria and constraints
3. Evaluate alternative designs
4. Build a prototype of best design
5. Test and evaluate the prototype using the design criteria
6. Analyze test results, make design changes, and retest, communicate the design.

3.8 **Example:**

I would like to give an example of a water-reservoir-dam that is not only used in storing water, but also generating hydraulic electricity.

Define need: How water reservoir height in a dam affects in production of spinning force of turbine to generate electricity. In simpler way, where should we keep the water pipe opening in relation to the dam's height that will result in more water pressure on turbine to move them faster and generate more electricity by transformer?

Background research:

Hydroelectricity means generating electricity from water through waterfall or flowing water. Usually by constructing a dam across a fast flowing river, the height of the water level increases behind the dam to create more water pressure. This pressure in flowing or falling water is used to move the water-turbines to generate electricity by an electric generator (Figure -1).

HYDROELECTRIC DAM

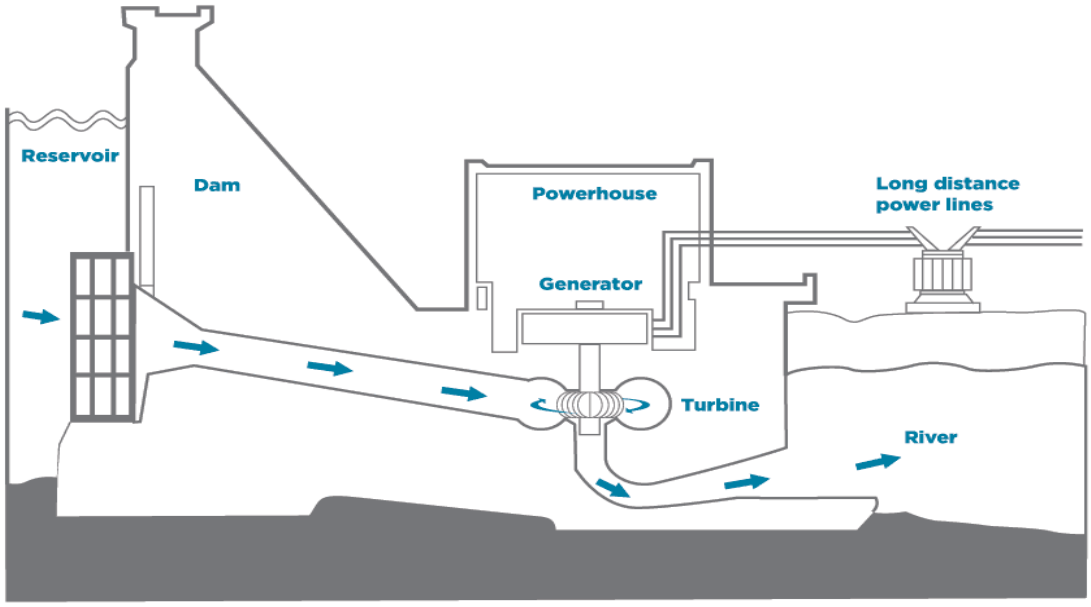


Figure - 1

Establish design criteria and constraints:

A container filled with water will act as water reservoir or dam. It could be a one-gallon plastic jug or a tin can.

Requirements and preparations for preliminary design:

- Plastic jug, 1-gallon
- Permanent marker
- Ruler, metric
- Small nail, 2 cm long
- Duct sticky tape
- Measuring tape metric
- Stepping stool, or bricks or blocks of wood
- Timer
- Lab notebook
- Graph paper

Testing and evaluation of prototype:

Take a one-gallon plastic jug and make three holes 6 cm apart one above the other. When conducting experiment, fill the jug with water, release the tape from one hole at a time and measure the length of the stream and record the measurements over different time by using a stopwatch (Figure - 2). Similarly, measure the streams from other holes by uncovering one hole at a time. Record the data in table-1. Do not forget to take off the lid cap from the bottle.

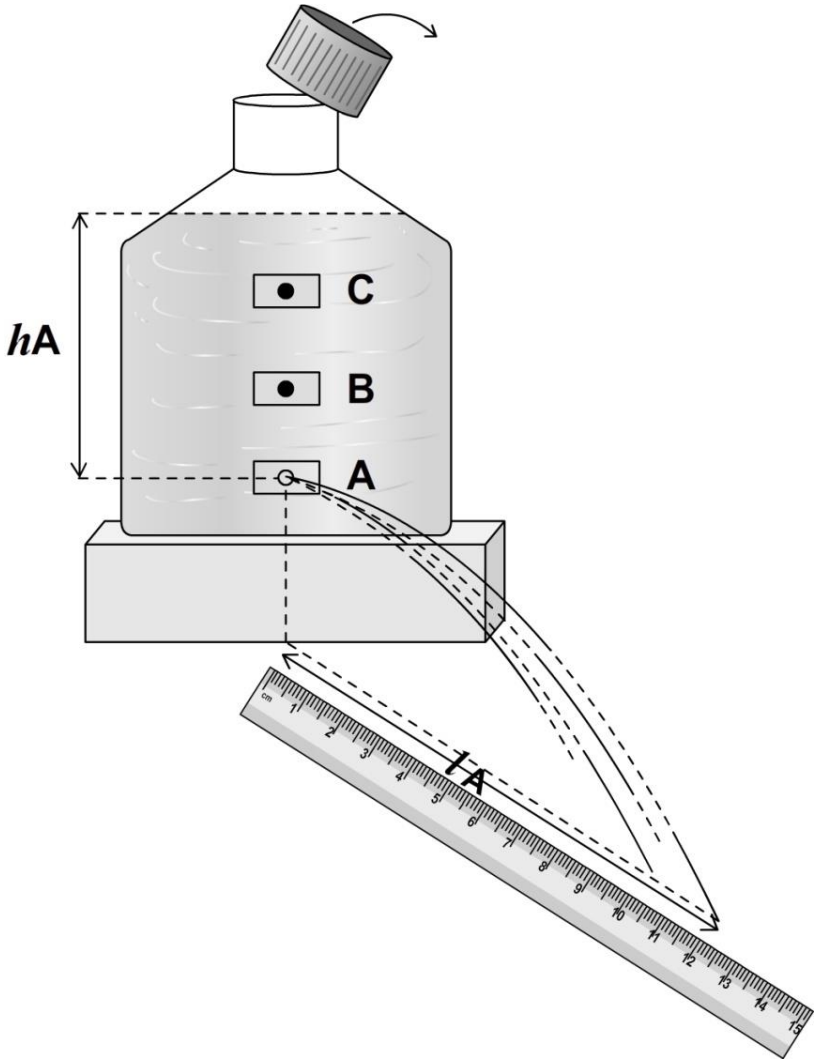


Figure – 2

Table 1

TIME Minutes	Lowest hole Stream Length (cm)	Middle hole Stream Length (cm)	Highest Hole Stream length (cm)	Reservoir Height (cm)
1				
2				
3				
4				
5				

Analyze Test Results:

Which hole has the longest stream?

What happens to the length of the streams over time?

Make three line graphs and visualize the change in the three streams with change in time.

Measure the water level in reservoir height from the hole each time you are recording the length of the stream, until the stream length becomes zero. Calculate whether the difference is the same for all the holes?

Based on your experiment which hole in the water reservoir has the highest pressure and which hole will produce more electricity?

Make design Changes and retest:

Instead of milk can, which has a narrow top opening, take a cylindrical, rectangular or conical reservoir and see the difference in water pressure or stream length in different holes.

What will be the effect of bigger holes (diameter) in relation to the length and pressure of the streams?

Does the density of water affect the stream length or water pressure?

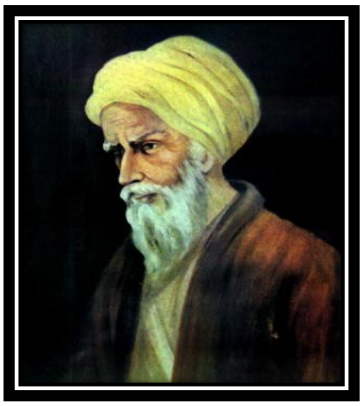
Note: you could measure pressure of liquid including water by a following formula:

$$P=Dgh$$

Where **'P'** is pressure of water or liquid. '**D'** is the density of water ($1x10^3$ kg/m^3) liquid. Whereas '**g'** is the gravity (9.8 m/sec^2) and '**h'** is the height of the water or liquid column.

Muslim Scientists

The Golden Islamic Age, is traditionally dated from the 700 AD to 1200 AD, but has been extended to the 15th and 16th centuries by some scholars. During this period, artists, engineers, scholars, poets, philosophers, geographers, mathematicians and traders in the Islamic world contributed to the various fields.



Al-Hassan Ibn Al Haytham
(965-1040 AD)

He developed scientific method, therefore is called first scientist. He is known as father of Optics and written book of Optics (Kitabul Manazer). Inventor of the pin-hole camera (Camera Obscura). Described detail structure of eye and optic nerve path in the brain. Developed analytical geometry, linking it to algebra.

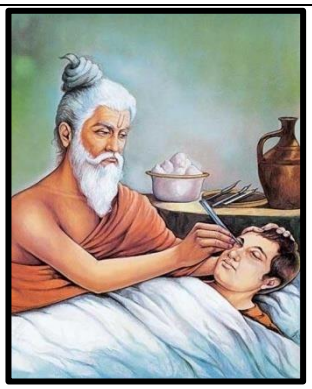
Ibn Sina
(980-1037 AD)
Writer of the Islamic Golden Age.
He is the writer of famous medical books

- **The Book of Healing**
- **The Canon of Medicine**

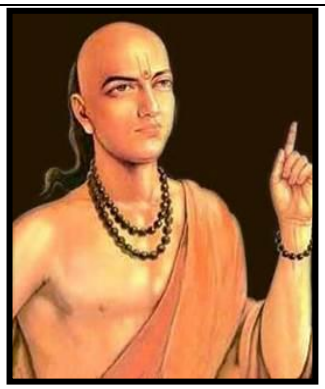
Al Biruni
(973-1048 AD)
Greatest scholar of the medieval Islamic era. Well versed in Physics, Mathematics, Astronomy and Natural Sciences.

Muhammad ibn Musa alKhwarizmi
(780-850 AD)
Persian Mathematician, Astronomer and Geographer. He is considered one of the fathers of Algebra.

Indian Scientists



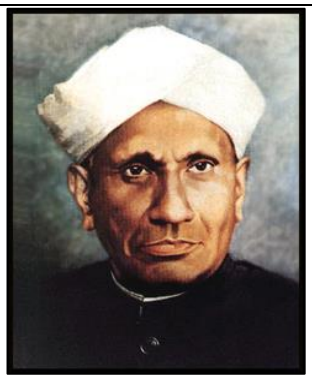
Sushruta
(600 BCE)
Father of Indian Surgery. He is also known as "the first plastic surgeon". He had conducted the variety of complex surgeries such as caesareans, artificial limbs, cataract, urinary stones, fractures, and most specially the plastic surgery.



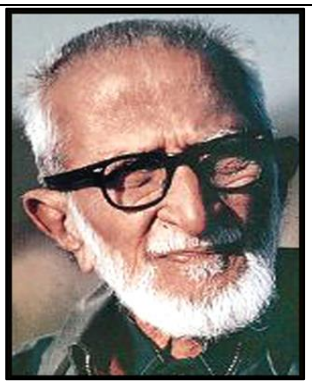
Aryabhatta
(476-550 CE)
Eminent Mathematician and Astronomer. He is the first Mathematician to calculate the value of pi. Calculated the circumference of Earth to 99.8% accuracy. Explained Lunar and Solar Eclipse. Rotation of Earth on its axis.

Sir Ronald Ross
(1857-1932)
He was a British medical doctor who discovered that the malaria parasite is transmitted by mosquitoes. He worked in the Indian Medical Service for 25 years in Calcutta. He received the Nobel prize for physiology or Medicine in 1902.

Sir Jagadish Chandra Bose (1858-1937)
Invented first Wireless detection device. He invented crescograph. He demonstrated that Plants are also sensitive to heat, cold, light, noise and various other external stimuli.



C.V. Raman
(1888-1970)
Indian Physicist who discovered Raman Effect Light Scattering. Won Nobel prize in 1930. He received Bharat Ratna in 1954.



Salim Moizuddin Abdul Ali
(1896-1987)
Indian Naturalist who developed Ornithology. Known as the "Birdman of India". He was awarded Padma Bhushan and Padma Vibhushan.

How to write an abstract?

Abstract is a brief or abbreviated version of your final report of the science fair project. Usually it is limited to 250 words. It should contain five important following points in both engineering and science fair projects.

1. Introduction: Start with why you did this science project or invention and what is the purpose? Is this new procedure or gadget better than the old? How it is going to help people?
2. Problem statement: Identify the hypothesis you have investigated in scientific method and problem you solved in engieneering method.
3. Procedure: Described your approach, how you solved the problem or investigated by experimentation. Do not go in details by mentioning materials used etc. You could describe most important variables.
4. Results: What was the outcome of the experimentation? Describe briefly the results by using numbers of percentages.
5. Conclusion: Finally, state how your new procedure or invention will help or contribute in the area of science you have worked. In case of engineering project, mention whether you met your design criteria.

Some Don'ts in the abstract:

1. Do not use vague terms such as some, probably, possibly, and most.
2. Do not use abbreviated terms or acronyms, unless you have initially used its full form such as AC (Air Condition) or LCM (Least Common Multiple).
3. Abstracts do not have references and citations.
4. Abstracts do not have graphs, charts or tables.
5. Do not put acknowledgement to anyone in the abstract.

Abstract is the creme of your project, which quickly gives an idea about the important research you have performed. Hence judges or scientists in scientific competitions would love to read abstract first.

Some Examples of Abstract

The Effect of Acid Exposure on Dental Amalgam Restorations
Aarzoo Mahajan
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Dental amalgam is a common material used to fill cavities. Filling made with amalgam are known as silver fillings. Over the years concerns have been raised about the use of amalgam because it contains mercury. The objective of this experiment is to see if dental amalgam will leach mercury when placed in an acidic environment for a set amount of time. A 48-hour exposure time was selected because the greatest leaching of mercury from an amalgam restoration takes place during the first 24 hours. Allowing 48 hours of exposure time ensures sufficient time to dissolve the available

mercury. The three acids being used are Sulfuric, Nitric and Phosphoric. These acids are present in a variety of foods; therefore, teeth are exposed to these acids. The three acids were standardized using a standardized Sodium Hydroxide Solution. This insured that the acid concentration was accurately represented on the labels. An atomic absorption instrument was used to obtain data. The level of mercury detected in the acid solutions was compared to the safe human consumption level. The mercury level found in all of the acids was above the safe human consumption level (<0.085 ppm). The hypothesis was not supported and a higher concentration than expected was leached from the amalgam restorations. Further testing is indicated to determine if dental amalgam restorations pose a danger to patients.

THE EFFECTS OF ELECTRICITY ON PLANT GROWTH

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The purpose of this experiment was to determine the effects of Electricity on Plant Growth. Sixty bush bean plants of similar height was selected out of one hundred bush bean plants and the sixty bush bean plants of similar height were divided into four groups of fifteen. Three of the four groups received different voltages, ranging from 1.5 to 9 volts. The fourth group served as the control group and received no electric treatment. In general, plants receiving lower voltages (1.5 and 3 volts) grew taller and greener than those receiving a higher voltage (9 volts). In the end, the plants in the control group grew slightly taller than those in the higher voltage group, but lower than those in the lower voltage groups (1.5 and 3 volts). The results of this experiment indicated that lower voltages of electricity were beneficial to plant growth and that higher voltages of electricity were not beneficial to plant growth.

GRASS AS FUEL : FINDING THE ENERGY OF GRASS

Jeff K. Bean
American Fork High School, American Fork, UT

Each year millions of tons of grass clippings end up in landfills. My experiment was to measure the energy that could be extracted from this biomass resource.
Two varieties of grass were grown to provide our biomass. The varieties chosen were types common in the area I live.
A calorimeter was not accessible so one was constructed. A design was drawn in which an insulated outer box held a specific amount of water. Inside the water was a combustion chamber made from an electrical heating coil inside a small paint can. The coil was designed to ignite and hold the burning grass. A current flowing through the coil triggered the combustion. A stirring rod was made with a small fan and a wooden dowel. This helped the water to heat uniformly. The entire system was carefully insulated from the environment.

When running the experiment a temperature probe was inserted in the system and connected to graphing software on a computer. The initial and final temperature was used in the equation Q = mcAt. This gave the total system energy increase in joules. The control run energy was subtracted from this value and the new value was then divided by the mass of grass. From this data, a value in kJ/g was obtained.
It was found that tall fescue grass releases 12.9 kJ/g of energy and Kentucky blue grass releases 10.8 kJ/g. Estimating an average lawn size and number mowing about 4000 kJ per lawn could be extracted.

DEVELOPING A COST-EFFECTIVE PROSTHETIC HAND
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Saginaw Arts and Science Academy. Saginaw, MI, United States

A major issue facing people in developing countries is a lack of resources to pay for trauma care. One of the most expensive components of trauma care lies in prosthetics. In fact, a single prosthetic hand is too cost-prohibitive for many Americans. A hand-socket combination costs roughly $60,000. The goal of this research project was to design a simple, inexpensive, and modular prosthetic hand to bring prosthetics and their benefits to less-affluent areas.
The goals of this project included building a simple electromyography-controlled (EMG) prosthetic hand with at least two fingers and an opposite digit, with a total material cost of less than $100. The design for the hand was created using a combination of 3-D Autodesk Inventor modeling and 2-D AutoCAD modeling. The metacarpus was created using 3-D printing, and the phalanges were created by using laser-cut pieces of acrylic. The EMG sensor was calibrated to the test wearer's arm and the digits were attached to servos. The electronics were controlled using an Adriuno UNO development board.
At the end of the project, the engineering goals were met. The hand in its current state has the ability to read EMG signals from the wearer's arm and actuate the fingers based upon the amplitude of these signals. With more research and development, 3-D printed prosthetics might eventually become a viable option for those in developing nations.

Investigating Shear Thickening Fluid Applications to Decrease Linear and Rotational Mean Peak Acceleration as measured by Dual Axis Acceleration in hockey headgear and a Hybrid 3 Head Form
Clara Wagner
Saginaw Arts and Science Academy, Saginaw MI, USA

Recently a new emphasis has been placed on protection headgear in hockey and other sports as the importance concussion and sub-concussive brain injury has been better understood. A summation of Tests for the Analysis of Risk (STAR) formula has been previously described by mapping on ice exposure impact data to laboratory test

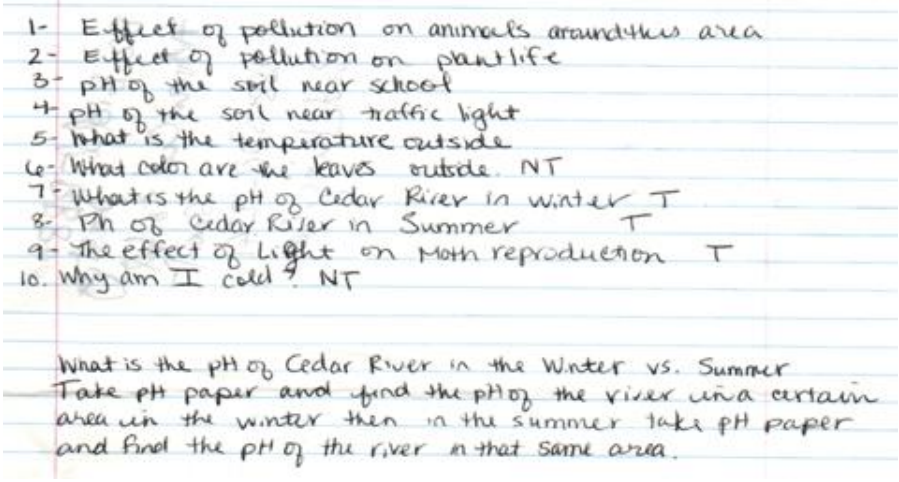
conditions as expressed in the equation. Linear(a) and rotation () head acceleration are potentially modifiable risks in this equation. A four meter pendulum was carefully designed and constructed to closely replicate the testing conditions of the STAR paper. Using this pendulum testing system, sheer thickening fluids and materials containing cornstarch and silica/PEG and nano particle sized Mica suspensions were tested for their potential to decrease mean peak acceleration and rotational acceleration. Externally applied engineered sheer thickening fluids and materials tested in this experiment significantly ($p<.05$) reduced risk (R) of concussion as a function of linear (a) and rotational head acceleration.

Building a Prototype Device to Relieve Tension Neck Syndrome
Kaylie Barton

Tension Neck Syndrome is a debilitating pain in the neck that affects numerous assembly line workers and especially dental care workers that spent a large portion of their day working with their neck bent supporting the weight of their head. This project included determining the best material to support neck of someone at the appropriate angle while taking off a large portion of the force to hold their head up. The material chose was the aluminum bar because it has the appropriate modulus of elasticity to provide the correct support and it is a material that can be easily mounted on the backpack holder. The head support was made so that it mounts to the aluminum bar with a string so that the head can turn to look back and forth with the neck still supported. The device was tested on five people and all said that it was comfortable to wear and did indeed support their head. The important part of the design is that the tension rod is adjustable for the different people. Depending on the size of the person it was found that they desired different amount of support.

"How to plan or initiate a science fair project"

How a student think about science fair Environmental project, putting down some questions or problems.


1- Effect of pollution on animals around this area
2- Effect of pollution on plant life
3- pH of the soil near school
4- pH of the soil near traffic light
5- What is the temperature outside
6- What color are the leaves outside NT
7- What is the pH of Cedar River in winter T
8- Ph of Cedar River in Summer T
9- The effect of Light on Moth reproduction T
10. Why am I cold? NT

What is the pH of Cedar River in the Winter vs. Summer
Take pH paper and find the pH of the river in a certain area in the winter then in the summer take pH paper and find the pH of the river in that same area.

Sample Project – 1 "Hands On From Now On"

Elementary Division (4th Grade)

Question: What helps you remember the best?

Hypothesis: I believe a hands-on experience is the best way to remember.

Introduction: I have always enjoyed science classes because there are lots of hands-on activities to do. I also found out that hands-on activities have always helped me to remember better. I wanted to know whether the same is true for other kids. Hence, I started this project. Before I started the project I found out that the picture memory is better in five seconds through reading books and articles (1,2, 3 and 4).

In my project, I tested 50 students from ages 6-12 to see whether remembering objects is better using hands-on technique rather than just reading the object's name off of a screen. The hands-on technique of remembering certain object is by taking the object in his / her hand, and allow the student to look, to feel, to smell, to hear, and taste (using the five senses).
At the end, I compared word memory, with memory related with hands-on activities. My study has shown that the hands-on activities are very helpful in remembering things better.

Materials:
Laptop / Computer
20 hand held objects (These were given to the students)
2 black bags
Paper & Pencil

Procedure-1:

1. Power point computer program is used to show twenty names of objects in a typed format. Each word is shown on one side, which is automatically replaced by new slide that means a new word.
2. The words selected are : Birds, Glasses, Pine Tree, Clock, Pears, Dog, Pizza, House, Salt, Model car, Piano, Table. Book, Bed, Bicycle, Tooth, Boat, Pocket, Vase and Orange.
3. Each word is shown for five seconds.
4. After the computer scrolls through the twenty words, the students are given a paper and pencil to write down all the words they remember.
5. The data is then recorded in a note book.

Procedure-2:

1. Twenty small objects are collected and placed in a black plastic bag.
2. The objects selected are : Goggles, Watch, Candle, Calculator, Cassette, Bottle cap, Light bulb, Large bouncy ball, Chap stick, Candy bar, Model car, Butterfly,

Small bouncy ball, Pencil, Ring, Penny, GI Joe figure, Rock, Lego block and Battery.

3. One object at a time is given to the students to examine the item by using the five senses.
4. A timer is set to beep every five seconds.
5. At the end of every five seconds, a new object is given and the old object is dropped in another black plastic bag.
6. The purpose of using a black plastic bag is to keep the students from seeing the objects again.
7. After the students examine all the objects, a paper and pencil is given to the students to write out the names of the objects that they remember.
8. When they are done with writing the names, data is collected and compared with Procedure 1.

Graphs:

Discussion:
The main purpose of this project is to see what helps students remember things better, a hands-on technique, or by learning certain words from a book or blackboard. I tested 50 students from age 6-12 to see what they remembered best when I asked them to remember words that they read over screen, or being able to remember objects that they are given to feel by the five senses.
Students are given 20 objects that they are asked to remember through a hands-on technique; they were able to have each object for five seconds. I compared their hands-on results to a simple word-memory test. In this test, I showed a series of 20 words on the computer screen. During this test the students are given a time limit of five seconds per word. After each test they are asked to write down on paper what they remembered. There was no time limit on how long they took to write down what they remembered.
The 20 words that they were asked to remember by reading were : Birds, Glasses, Pine tree, Clock, Pears, Dog, Pizza, House, Salt, Model car, Piano, Table, Book, Bed, Bicycle, Tooth, Boat, Pocket, Vase and Orange.
The 20 words the students were asked to remember by holding and using a hands-on technique were : Goggles, Watch, Candle, Calculator, Cassette, Bottle cap, Light bulb, Large bouncing ball, Chap stick, Candy bar, Car, Butterfly, Small bouncing ball, Pencil, Ring, Penny, GI Joe, Rock, Lego block, and Battery.

Results:
My results have shown that the hands-on technique for remembering words has helped all of the students to remember better (Graph). I believe the hands-on technique has worked better because the students are able to use more of their senses. I also found out that as we grow older we begin to remember better. I my study, the older students are able to remember more words than the younger. On an average, girls have remembered better than boys in both types of memories. The girl's average in word memory was 8.32 words, and the boy's average was 7.72 words. The girl's average in hands-on memory was 11.96, and the boy's average was 10.96.

Conclusion:
In conclusion, I found out that by using a hands-on technique we remember things better than word-memory. My experiment suggests that students should be taught by hands-on activities, which will help them to remember better.

Bibliography:

1. Wolfe, Patricia. Brain Matters, Translating Research into classroom practice. Association for Supervision and Curriculum Development. Alexandria, Virginia. 2001.
2. Ensen, Eric. Arts with the Brain in Mind.
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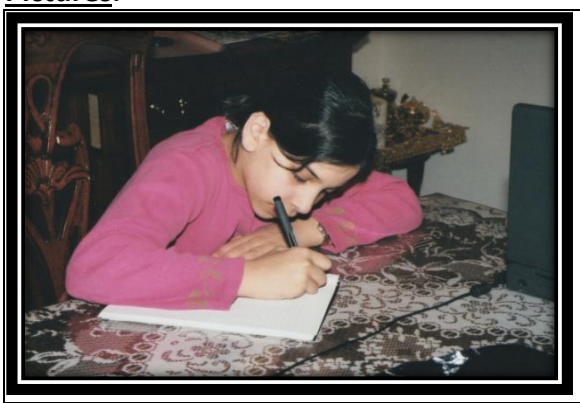
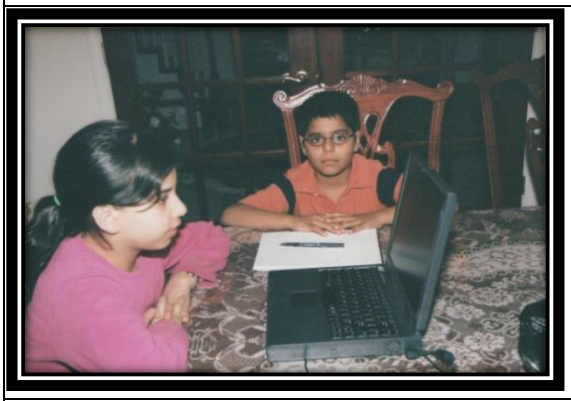
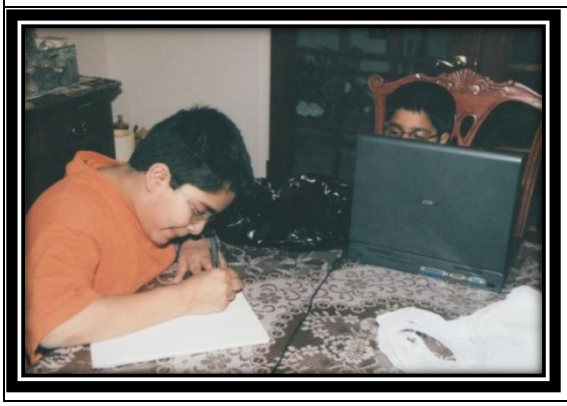
Credits: I would like to thank my sister for helping me with my project.
I would like to thank everyone that participated in my experiment.

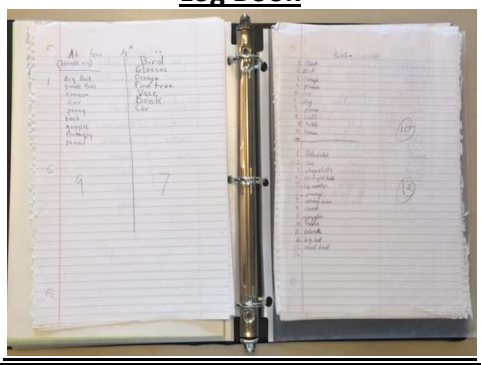
Pictures:



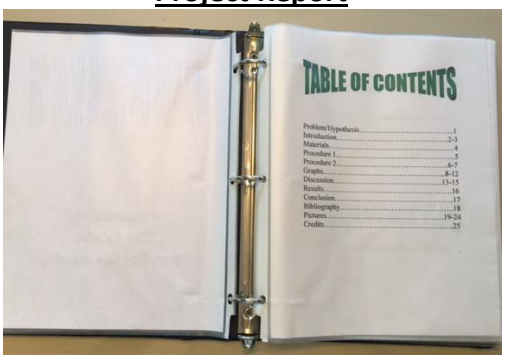





Log Book



Project Report



Sample Project – 2 "Solar Cooker for Cooking Food"

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PURPOSE

The purpose of this research was to find out the suitable timings to cook the selected food item. As there is increasing demand for natural gases and fuels and it is also getting expensive, it gave me an idea to use solar energy as one of the source of cooking.

The information gained from this research would be useful for cooking food, with the help of solar cooker.

INTRODUCTION

In today's world the growing energy needs and increasing environmental concern, alternatives to the use of non-renewable and polluting fossil fuels have to be investigated. One such alternative is solar energy.

The Earth receives an incredible supply of solar energy from the sun, an average star. Solar energy is the energy produced directly by the sun. Solar energy is a free, inexhaustible resource, yet harnessing it is a relatively new idea. The ability to use solar power for heat was the discovery.

Instruments which work with the help of Solar energy:-

Solar water heater, Solar cooker, Solar toys, Solar calculator, Solar vehicles.

The basic science of solar energy and the role it plays for the earth's climate can be understood.

The only 2 primary disadvantages of using solar power is amount of sunlight and cost of the equipment.

ABSTRACT

Solar cooker for cooking food

By **S. Aasiya Parveen**

i Max Nursery and Primary School

Royapettah.

Hypothesis of the project: Solar cooker can be used for cooking some food items.

Method of Research: The sample food items were cooked using solar cooker and the cooking time was noted.

Pertinent Data: The results collected shows that the selected food items can be cooked in a solar cooker.

Conclusion: The results therefore supports the hypothesis.

Application: Solar energy can be used as a alternate source of energy for cooking.

HYPOTHESIS

My Hypothesis was that habitual food item such as Vermicelli & Macroni can be cooked using solar energy.

QUESTION OR PROBLEM

- Increasing demand of fuels.
- Need of alternate resources.
- Increasing demand for the LPG cylinders.

MATERIALS USED

Item description	Quantity
Cardboard boxes	2
Aluminium foil sheet	3 rolls
Black paint	250 ml
Table Glass	32.6 x 17.5 inches
Thermocol pieces	-
Thermometer (110°C)	1 no.
Aluminium Vessel Size	15 cm.

PROCEDURE

Fabrication of Solar cooker:

- Two card board boxes – each of dimension, Outer box - 20.5x11.2x7 inches, Inner box - 12x6.8x4.5 inches were taken.
- The inner base of the smaller card board box was painted black.

- The sides of the inner box was wrapped with Aluminum foil.
- And placed inside the bigger box.
- The gaps were filled with thermo cols.
- A glass plate was used to cover the top of the outer box.
- One of the side's of outer box was raised like a flap and it was also wrapped with aluminium foil, which acts as a reflector.

Process of cooking Vermicelli

- An aluminum container was filled with 200ml of water and placed inside the box.
- The initial temperature of water was noted.
- The water was allowed to get pre-heated for ½ an hour and the final temperature of water was noted.
- Then 100gms of Vermicelli was added.
- The whole apparatus was covered with glassware.
- The Vermicelli got cooked within 15 min.
- The whole process was repeated for 5 times and the results were recorded.
- The same process of cooking was repeated for Macroni.

TO STUDY THE TIME TAKEN FOR COOKING.

Results of five replication of cooking Vermicelli on consecutive days.

Table: 1

Expt. No.	Date	Duration of exposure	Initial temp. of water (°C)	Final temp. of water after 30 min. of exposure (°C)	Time taken for cooking
1	24/11/14	12:30 - 1:00 pm	28.2	40.0	30 min
2	25/11/14	12:30 - 1:00 pm	28.4	41.0	15 min
3	26/11/14	12:30 - 1:00 pm	28.0	41.0	15 min
4	27/11/14	12:30 - 1:00 pm	28.2	41.3	15 min
5	28/11/14	12:30 - 1:00 pm	28.4	40.3	15 min

Results of five replications of cooking macroni on consecutive days.

Table: 2

Expt. No.	Date	Duration of exposure	Initial temp. of water (°C)	Final temp. of water after 30 min. of exposure (°C)	Time taken for cooking
1	29/11/14	12:30 - 1:00 pm	28.0	40.0	12 min
2	30/11/14	12:30 - 1:00 pm	28.2	41.0	12 min
3	01/12/14	12:30 - 1:00 pm	28.0	40.0	12 min
4	02/12/14	12:30 - 1:00 pm	28.4	40.0	12 min
5	03/12/14	12:30 - 1:00 pm	28.0	41.0	12 min

TO STUDY THE EFFECT OF TIME OF EXPOSURE ON TIME TAKEN FOR COOKING.

Results of three replications of cooking Vermicelli on consecutive days.

Table: 3

Expt. No.	Time of exposure	Date	Initial temp. of water (°C)	Final temp. of water after 30 min. of exposure (°C)	Time taken for cooking
1	11:00 - 11:30 pm	22/12/14	28.0	40.0	18 min
	11:00 - 11:30 pm	23/12/14	28.2		18 min
	11:00 - 11:30 pm	24/12/14	28.2		18 min
2	12:30 - 1:00 pm	22/12/14	28.0	40.0	15 min
	12:30 - 1:00 pm	23/12/14	28.2		15 min
	12:30 - 1:00 pm	24/12/14	28.2		15 min
3	02:00 - 02:30 pm	22/12/14	28.0	41.0	20 min
	02:00 - 02:30 pm	23/12/14	28.2		20 min
	02:00 - 02:30 pm	24/12/14	28.2		20 min

Results of three replications of cooking Macroni on consecutive days.

Table: 4

Expt. No.	Time of exposure	Date	Initial temp. of water (°C)	Final temp. of water after 30 min. of exposure (°C)	Time taken for cooking
1	11:00 - 11:30 pm	25/12/14	28.0	40.0	17 min
	11:00 - 11:30 pm	26/12/14	28.2		17 min
	11:00 - 11:30 pm	27/12/14	28.2		17 min
2	12:30 - 1:00 pm	25/12/14	28.0	40.0	12 min
	12:30 - 1:00 pm	26/12/14	28.2		12 min
	12:30 - 1:00 pm	27/12/14	28.2		12 min
3	02:00 - 02:30 pm	25/12/14	28.0	41.0	20 min
	02:00 - 02:30 pm	26/12/14	28.2		20 min
	02:00 - 02:30 pm	27/12/14	28.2		20 min

RESULTS & DISCUSSION

- The experiment was carried out for five subsequent days, the time taken is 15 min. for cooking Vermicelli and 12 min. for Macroni {Refer Table 1 & 2}
- The suitable time to cook Vermicelli is 12.30 to 1.00 pm {Refer Table 3}
- The suitable time to cook Macroni is 12.30 to 1.00 pm {Refer Table 4}
- From the above result we conclude that the selected food items can be cooked in a solar cooker.
- This method of cooking can be more effectively used in the summer season (i.e.,) March to May.
- The food items like half-fried egg, toasting of bread can be tested.

CALCULATION OF AMOUNT OF FUEL SAVED IN 15 MIN.

- Initial weight of the cylinder before cooking – 21 kg
- Final weight of the cylinder after cooking – 20 kg (for 1 hour)
- Amount of gas consumed for cooking - 1kg
- In 60 min. gas consumed is 1 kg
- For 15 min. how much gas can be saved?
- 0.25 kg gas can be saved.
- The amount of money saved for 0.25 kg of fuel is 7.

CONCLUSION

- The result obtained indicates that this hypothesis can be retained.
- The hypothesis was solar energy can be used to cook different food items using a solar cooker.
- The result supports the hypothesis.

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2. Science fair on Solar Energy
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3. Solar Power
http://en.wikipedia.org/wiki/Solar_power

Project Entry - Application Format

Title of the Project :

Level : Junior **/** Senior Level

Category : Life Sciences/Physical Sciences/Mathematics etc.

Name of the Student & Class :

Contact No. of Student :

Name of the School & Address :

Guided by :

Hypothesis :

Method of Research :

Data :

Conclusion :

Application :

Dos and Don'ts of Science and Engineering Fairs

Dos:

1. Start the project months before the date of science fair as collecting and interpreting the data takes lot of time.
2. Repeat the experiment to check whether you are getting the same results.
3. Follow all the steps required in scientific and engineering methods depending on your project.
4. While explaining the project, take the help of illustrations and pictures to explain your findings and results.
5. Keep the logbook of your project to record your day today results.
6. Take pictures and draw graphs and tables to illustrate the project.
7. Be original in your ideas. Tell the judges how you got the idea.
8. Draw attention of judges and visitors towards the most interesting and exciting part of your experiment.
9. Arrange and organize the items on the posters from left panel to the right panel. Keep the pictures and graphs possible in the center panel of the poster.
10. The text material should be in black letters. The fonts should be larger legible and should be readable from the distance of four feet. As a general rule, use 24 pt. type for headings, 16 pt. type for text blocks.
11. Keep the good space in between different items, do not over crowd or cluster them.
12. Label all the charts and graphs including labeling the X-axis and Y-axis.
13. Figures, drawings, and pictures should be captioned.
14. In engineering projects, prototypes of mechanical gadgets are allowed including computers. These projects may require electric outlets.

Don'ts:

1. Poster should not be hand-written. They should be typed and neatly posted on the board by using colorful borders.
2. Do not forget to proof read and spell check the drafts.
3. Do not rely on memory; note the results in the logbook.
4. Don't over decorate a poster that takes away the excitement and content of the project.
5. Don't copy the projects from the internet or science fair books.
6. Do not memorize the written material and method of the project. While describing to the judges use simple understandable language as you do in conversation.
7. Edibles including water, bacteria either harmful or non-harmful, animal tissue wet or dried (mummified), and toxic substances and chemicals as simple as table salt should not be displayed.
8. Do not do experiment in front of judges or visiting people, as you have already performed the experiment. A convincing oral presentation is all that is required.

9. Science fair organizers should not allow teachers or mentors, who have supervised the projects. This causes disruption in presentation, fear and apprehension in students.
10. Do not read texts from the posters, look into the eyes of the judges and talk to them with a smile.

List of Schools participated in 2015 interschool Science Fair

Given below is the list of school that has participated on 14th Nov in 8th inter school Science Fair conducted by National Science Fair Academy Hyd.@ Mount Mercy School

1. Mount Mercy High School
2. Neo Rosary High school
3. MS Creative School
4. Imam Bakhsh Memorial High school
5. Crescent High School
6. Iqbalia International School
7. Crown High School
8. Insight International school
9. Focus High School
10. Alliance International School
11. Neo Holy Fatima
12. Genius Grammar High School

Picture Gallery

Picture Gallery

Picture Gallery

Picture Gallery