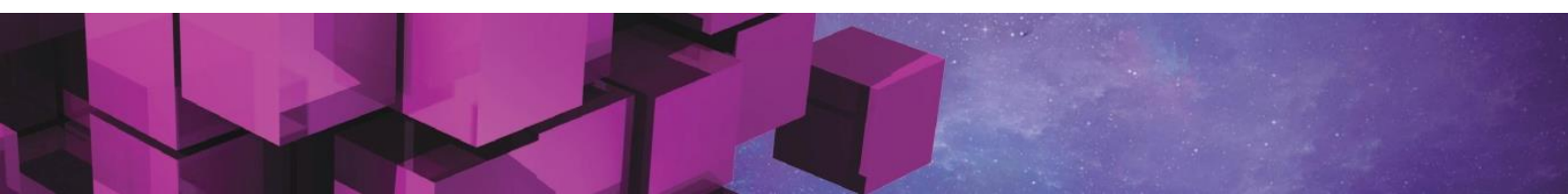
Science Projects

Instruction Booklet



ساي فيست دبي
SciFest Dubai

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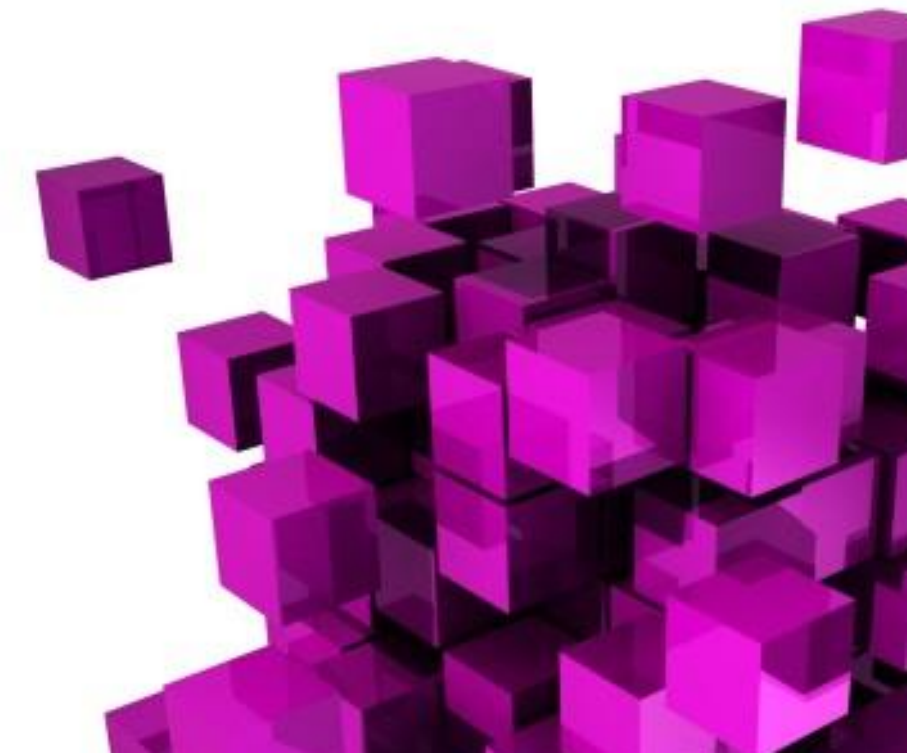

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Aims of the Science Project

Aims

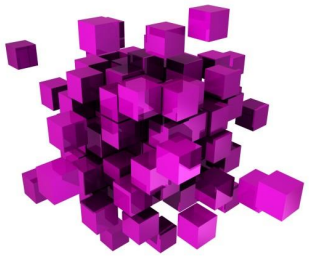
- To use experiments to explore the world around us
- To follow the scientific-method
- To encourage evidence-based reasoning in arriving at conclusions
- To promote critical inquiry

Key Points

- Three winners will be selected by the Science Project Coordinator and a panel of judges.
- All participants will receive a certificate of participation.
- Winners will receive special recognition at the Awards ceremony
- All projects will be displayed at the exhibition venue during the festival.
- You may enter as an individual or as a team (max. 3 students)

Prizes

Category 1: Age 13-15
Category 2: Age 16-18
Category 3: Ages 19-21



The Scientific Method

The Scientific Method is a body of techniques for investigating phenomena, acquiring new knowledge, or correcting and integrating previous knowledge.

The scientific method is based on evidence, repeatable experiments and empirical data. The Oxford English Dictionary defines the scientific method as: "a method or procedure that has characterized natural science since the 17th century, consisting in systematic observation, measurement, and experiment, and the formulation, testing, and modification of hypotheses."

Isaac Asimov says, "Science is a mechanism. It's a way of trying to improve your knowledge of nature; it's a system for testing your thoughts against the universe and seeing whether they match.

Science is more than a body of knowledge, says Carl Sagan. It's a way of thinking. And, in the words of Neil deGrasse Tyson, when you look at the world through a scientifically literate lens, the world is a very different place.

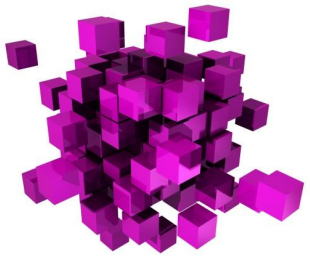
The steps of the scientific method are:

1. Formulating a question
2. Hypothesis
3. Research
4. Experiment
5. Collect data
6. Make Observations
7. Arrive at conclusions

1. **The Question**: A good question is fundamental. This is the reason for your investigation. What will you have discovered by the end of the process? Your choice of question will probably stem from an initial observation that you've made.

2. **Hypothesis**: This is an educated guess/answer to your question based only upon your prior knowledge and completed research.

3. **Research**: Gather basic background information related to your question. Make sure you're confident that your sources are reliable.



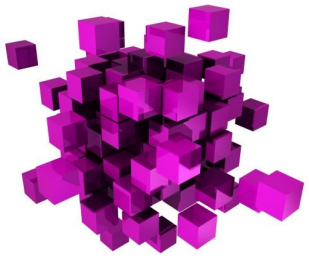
4. **Experiment**: The heart of good scientific method is your experiment. You'll need to record what you do, including a list of materials, diagrams of experimental set-up, and step-by-step instructions/procedure on how the experiment will be conducted. Another scientist should be able to follow your methodology based on your records.

5. **Data**: You may collect two types of information during an experiment:

Qualitative (descriptive) observations (see point 6)
Quantitative (measurements and values) observations
Visual representations (i.e. graphs) of the quantitative data should also be included.

6. **Observations**: These are descriptive, qualitative observations made before, during and at the conclusion of the experiment. Include environmental factors, errors that occur, and any other information that could have affected the results.

7. **Conclusions**: After you've completed your experiment, write a conclusion in a narrative form, analysing the data and observations and using it to answer the original question. You should be able to verify or refute your original hypothesis.



Types of Projects:

Investigations and Inventions

Think of investigators as research scientists and inventors as engineers. Investigators find out things for themselves. Inventors are engineers who design and make things that will solve problems.

Investigations

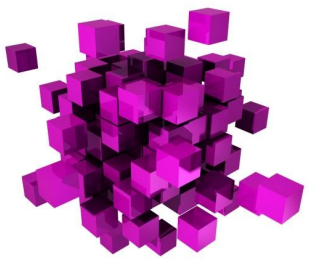
An investigation is a science fair project that uses scientific methodology (which includes experimenting) to carry out an investigation.

During an investigation, the student starts out with a question based on a scientific problem; develops a hypothesis (or educated guess) as to the answer; designs and conducts an experiment to test the hypothesis; measures and collects data; documents and analyses the results; and draws a conclusion.

In an investigation, students:

- Ask a testable question
- Research the topic
- Make a hypothesis about the outcome based on the research or their own knowledge
- Design the investigation
- Conduct the investigation
- Collect Data
- Make sense of the data and draw a conclusion
- Present their findings for peer review

What is a Testable Question?
The key to a good and manageable investigation is to choose a topic of interest, then ask what is called a "testable question." Testable questions are those that can be answered through hands-on investigation by the student. The key difference between a general interest science question and a testable question is that testable questions are always about changing one thing to see what the effect is on another thing.



Inventions

An invention is an original design that serves a purpose and solves a real problem. It can also be something that improves an object previously invented by someone else or takes it in a completely different direction.

Students who are good problem solvers and especially students who like to think "outside the box" are good candidates to invent something for their science fair project. All students can become better at engineering, but for some, it is the most interesting way to apply their science skills.

Just as with an investigation, it is important to recognize that the process of invention is just as important as the final product—which means mistakes and problems should be treated as valuable steps and should be documented along with other notes and sketches in a record-keeping journal. Parents, teachers, and fair organizers should all be on the same page in recognizing the value of students' learning science process.

According to the National Academy of Sciences, engineering is the application of science and technology to solving a problem. Invention is really about engineering a solution. For students, this can be:

- A problem they want to solve
- A process or physical design they want to improve

In designing and engineering a solution, students:

- Find a local problem or something that needs to be improved
- Research it to find out what others know
- Suggest a solution and explain why it should work
- Design the solution and the method for testing to see if it works
- Build and test the solution
- Collect data to be sure your solution made a change
- Make sense of the data – how do you know it worked, or didn't work?
- Develop a report and share it with your fellow scientists

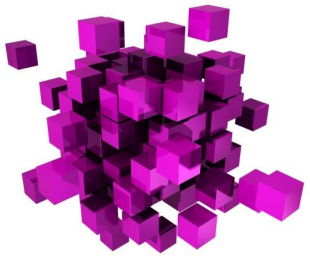
For more information on the difference between inventions and investigations visit this link.

Rules

The decision of the Science Project Manager and the judges will be final. There will be no discussion or negotiation on the results.

The most important rule is to read and re-read the rules below. Non-compliance will result in disqualification.

1. Only participants between the ages of 13-21 may apply.
2. Get permission from your parents.
   (See appendix i: Parental Permission to take part in the Science Fair Project).
3. No vertebrates may be used in any experiments. Insects and other invertebrates may be used if absolutely necessary (but no gratuitous suffering).
4. Observation of animal behaviour is fine for vertebrates and invertebrates.
5. Avoid using toxic chemicals. Any experiments involving any chemicals must be approved by your science teacher.
   (See appendix ii: Science Teacher's Approval for use of Chemicals).
6. Avoid explosive chemicals. These may be used under adult supervision in the case of model rockets. These may not be used at the display venue.
7. Have clear signs/labels for any chemicals that are part of your project display at the exhibition venue.
8. Any experiments involving heat, flames, electricity must be under adult supervision.
9. Plagiarism will result in summary disqualification.
10. Submit your presentation before the deadline.



Points to Keep in Mind

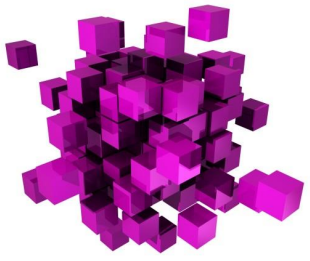
- Remember to register your project at the earliest (As soon as you've decided the title of your project)
- All work presented must be the student's work.
- Parents can be guides. Adults can supervise the investigation, but not take part except in cases of safety.
- Parents should not participate in the preparation or presentation at the exhibition, except to help with materials and act as an audience for practice.
- Students must cite research.
- Label any charts, graphs or illustrations.
- Provide a caption for each photograph.
- Proofread your submission. This is very important.
- Use Times Roman, black font, size 12
- Ensure your work is neat and all the work is in order.
- Ensure you type your work on the MS Word document titled 'Project Submission'
- Convert your final document to PDF and submit.
- Email to: raya.bidshahri@scifestdubai.com
- Ensure the email subject title is "*SciFest Project submission*"

Deadlines

Deadline to **register** the title of your project: **30th September 2016** (register here)

Deadline to **submit** your project: **20th October 2016**

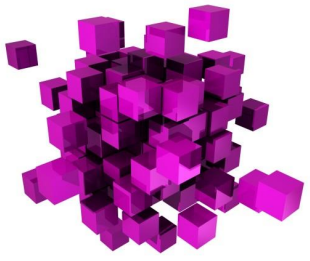
After you submit your project, you will receive an email about what preparations you need to make to display your project at the science festival.



What are the Judges looking for?

Please have a look at the judging criteria in appendix iii to give you a sense of the categories and level of detail involved. Along with the standard factors you see outlined on the sample scoring sheet, judges also look for certain qualities like curiosity, enthusiasm for one's subject, and willingness to try new things in the name of scientific discovery. Though not as easy to measure, these are high in importance, impress many judges, and should not be underestimated.

It is essential that you follow the 'Rules' and 'Points to Keep in Mind' mentioned in the section above.



Structure of Your Project Submission

The structure of the project submission is based closely on the Google Science Fair project. This is to encourage students to submit their work to Google as well.

Use the separate document titled '**Project Submission**' to type and submit your work.

Section 1: Summary (Max. 200 words)

A brief overview of your Project. *Optional* additions to your summary (submit only 1 of the following options):

- 2-minute YouTube video
- slideshow with a maximum of twenty (20) slides

Section 2: About Me: (Max.200 words)

Introduce yourself / your team.

Section 3: Question / Proposal (Max. 500 words)

Describe the question that you are investigating and your hypothesis, or the problem that you are going to try to solve and the outcome that you expect.

Section 4: Research (Max. 500 words)

An account of the research that you have done into your chosen category, and how this has influenced your Project.

Section 5: Method / Testing and Redesign (Max. 700 words)

Describe in detail how you carried out your experiment or tested your solution.

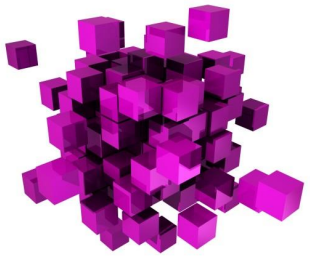
Section 6: Results (Max. 500 words)

Your data and observations gathered during your experiment or testing, presented clearly with a description of any patterns or trends.

Section 7: Conclusion / Report (Max. 500 words)

An explanation of how your experiment or testing answers your question, or why it fails to do so, and whether or not the outcome was as you expected.

Section 8: Bibliography, References and Acknowledgements



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Appendix i
Parental Consent Form

Dear Parents,

As you know, science, technology and engineering are basic skills expected by employers. As Twenty First Century citizens, these students will also have to make some of the toughest decisions of any generation, based on their understanding of emerging science and technology. Science fairs involve students in the practices of science and engineering, requiring them to apply those skills to a topic of interest to them. *Doing* science is key to *understanding* science.

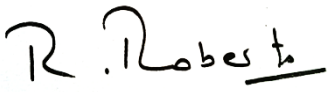
SciFest Dubai is holding a science project competition. Students between the ages of 13-18 are invited to participate. Hands-on scientific investigation and invention are the focus of the Science Festival Project.

As part of the project your child will design, test, analyse, and present a project that uses scientific methods to solve a problem. The sky's the limit!

Please note that the bulk of the work will be done at home and much of the work will be self-directed. Parents are encouraged to offer emotional support and reminders, but to allow children to do the projects by themselves.

If you have any questions please email the coordinator of the Science Projects Manager, Raya Bidshahri: raya.bidshahri@scifestdubai.com

Yours sincerely,



Rohan Roberts
Director, SciFest Dubai

Parental Consent

I give permission for my son/daughter to take part in the Science Festival Project. I am aware that their project will be displayed for the duration of the festival. I have read the project rules and am aware that the decision of the judges is final.

Name of Student:
Age of Student:
Name of Parent/Guardian:
Signature of Parent/Guardian:
Email:
Name of School:
Date:

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Appendix ii

Science Teacher Consent Form

Chemical Use Approval Form

I give my consent for the use of the following **non-toxic** chemicals as part of the Science Festival Project:

List chemicals here:

1.

2.

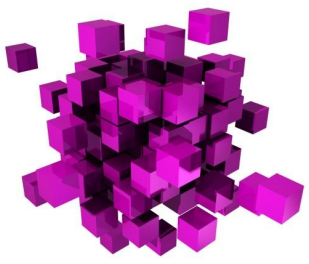
3.

4.

5.

6.

Name of Student:
Age of Student:
Name of Science Teacher:
Signature Science Teacher:
Email:
Name of School:
Date:



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Appendix iii
Sample Judge's Scoring Sheet

Name of Student:	
Age of Student:	
Name of Science Teacher:	
Signature Science Teacher:	
Email:	
Name of School:	
Date:	

Project Element	Max. Score	Score
Presentation: • Neatness (PDF document is well-formatted) • Clarity of Text • Use of images, graphics, tables, and graphs	10	
Section 1: Summary An excellent summary will provide a clear, brief overview of the question or problem you are investigating, the stages of your project, what you set out to achieve and how far you succeeded.	20	
Section 2: About me / the team Excellent Entrants/Teams will show a real passion for science or engineering and be able to present their ideas with confidence, clarity and enthusiasm, and explain what winning would mean to them.	10	
Section 3: Question / Proposal An excellent question or proposal will be interesting, creative, worded scientifically and relevant to the world today. Entrants/Teams will include a hypothesis or expected outcome that leads on from the question, is tightly focused and builds on existing knowledge.	10	
Section 4: Research Excellent Entrants/Teams will undertake research to help them shape their Project and to put their work into a relevant, real-world context.	10	
Section 5: Method / Testing and Redesign Excellent Entrants/Teams will demonstrate that they have used good experimental techniques or testing processes and describe their method clearly and in detail	10	
Section 6: Results Excellent Entrants/Teams will record relevant data, results or observations accurately, present them clearly and will describe patterns or trends supported by these.	10	
Section 7: Conclusion / Report An excellent conclusion or report will explain how the experiment or testing answers the question or problem, or why it fails to do so and whether or not it supports the hypothesis.	10	
Section 8: Bibliography, References and Acknowledgements Excellent Entrants/Teams will acknowledge and provide clear references for sources of information that they have consulted and/or referenced and acknowledge any assistance received (e.g. to find equipment and materials, to stay safe or to use unfamiliar equipment or techniques).	10	
Total	100	

N.B. Project procedure and judging criteria are modelled after the Google Science Fair project. This is to encourage students to take part in the Google Science Fair Project as well.