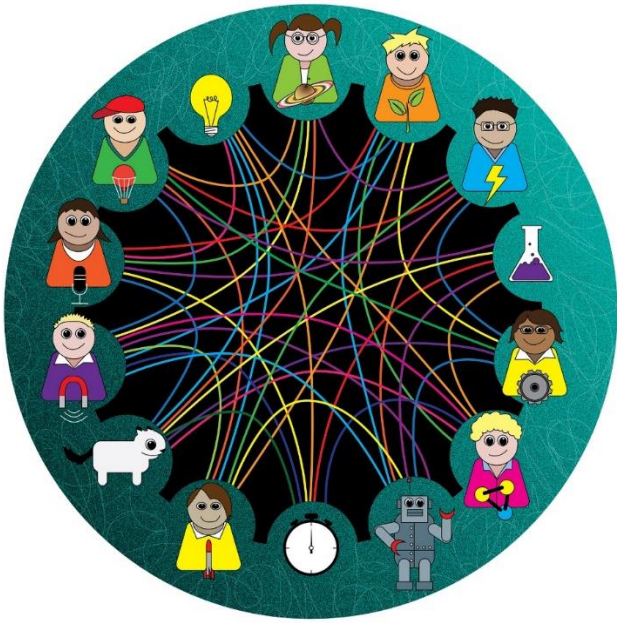
A student's guide to the NIWA Waikato Science & Technology Fair



2020

7th – 8th August
Hamilton Gardens

WHAT CAN I ENTER?

Students will enter their exhibits under one (or more) of the following classes:

Class	Year Group	Interest Area	Criteria
1	Year 7	Living World	Entry is individual or in pairs
2	Year 8	Living World	
3	Year 7	Material World	
4	Year 8	Material World	
5	Year 7	Physical World	
6	Year 8	Physical World	
7	Year 7 & 8	Planet Earth and Beyond	
8	Year 9 - 10	Living World	
9	Year 9 - 10	Material World	
10	Year 9 - 10	Physical World	
11	Year 9 - 10	Planet Earth and Beyond	
12	Year 11 - 13	Senior Sciences	
13	Year 7 & 8	Junior Invention	
14	Year 9 - 13	Senior Invention	
15	Year 7 & 8	Junior Scientific Wall Chart	Entry is individual
16	Year 9 - 13	Senior Scientific Wall Chart	Entry is individual
17	Year 7 - 13	Scientific Video	Entry is individual or in pairs
18	Year 7 & 8	Junior Observational Drawing	Entry is individual
19	Year 9 - 13	Senior Observational Drawing	Entry is individual
20	Year 7 - 13	Scientific Photography	Entry is individual

Classes 1-12, Science investigation

ENTRY CRITERIA: Individual or pairs

LIVING WORLD includes topics such as: Horticulture, Forestry, Plants, Animals, Marine Studies, Conservation, Agriculture, Behaviour and Health.

MATERIAL WORLD includes such topics as: Chemistry, Metals, Corrosion, Water Pollution, Chemical Product Testing, Fabrics and Chemical Change.

PHYSICAL WORLD includes topics such as: Electricity, Light, Heat, Material Strength, Insulation, Magnetism, Speed and Friction.

PLANET EARTH AND BEYOND includes: Geology, Soils, Pollution, Astronomy, Climate Change, Resource Extraction and Weather.

For further instructions see following sections on following the investigation process.

Class 13-14, Inventions & Technical Innovations

ENTRY CRITERIA: Individual or pairs

Inventions and innovations are applications of science and technology which solve a problem.

For this class you are asked to apply your knowledge to make a device that has a practical application. The steps and stages in development should be recorded so that it is clear how you overcame any problems that were encountered. You will also need to discuss the scientific principles and ideas used in solving the original problem that was identified.

Originality and creative thought are important aspects of this Class.

Exhibitors will use the standard display board to present their invention/technical innovation.

Classes 15-16, Scientific Wall Charts

THEME: **The Science behind the Olympics.**

ENTRY CRITERIA: Individual

Give a scientific description/explanation of the what, why and how of this topic. Be concise.

Requirements for judging:

1. A2 (59.4cm x 42cm) cardboard (160gms)
2. No attachments that are not flat (i.e. no 3D models)
3. No attachments that stick outside the poster
4. Reference list or Bibliography to be displayed on the REVERSE of the poster
5. Label on the back of the poster with
    - Full student name
    - Year level
    - School name
    - Teacher name

Wallcharts hints:

1. Border
2. Colourful (eye catching presentation)
3. Balance of graphics (pictures, tables, diagrams) and text (writing)
4. Diagrams should be clear, labelled and easy to read
5. Writing should be concise, easy to read and so a non-scientist can understand.
6. Sub-headings – information broken down into small sections.

Classes 17, Scientific Video

THEME: **The Science behind the Olympics.**

ENTRY CRITERIA: Individual or pairs

Requirements for judging:

1. 2 minute video uploaded to YouTube
2. Must include voice of exhibitor
3. Video must be ‘new’ (maximum of 20 seconds can be taken from another video)
4. Pictures and other media added can total another 20 seconds.
5. Credits included at the end of the video

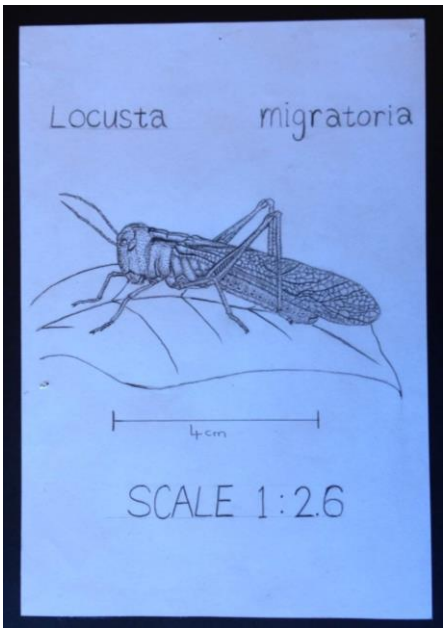
Class 18-19, Observational Drawing

THEME: **Shells**

ENTRY CRITERIA: Individual

Requirements for judging:

1. Drawing on white paper cut to 19cm x 27cm
2. Mounted on A4 black card (140gms +)
3. Label on the back of the poster with
    - Full student name
    - Year level
    - School name
    - Teacher name



Rules:

1. Use a PENCIL
2. Heading – Biological Name, centred at the top of the drawing
3. Biological name – Genus and species
4. Scale bar – draw a scale bar
5. Large drawing – (no labels)
6. Lines – must be continuous (not sketched)
7. Illustrating – use dots or stippling to show dark areas (not shading)
8. A photo of the specimen needs to be attached to the back of the drawing

Class 20, Scientific Photography

THEME: **Engineering in harmony**

ENTRY CRITERIA: Individual

Requirements for judging:

1. 1 photo, size 8” x 10” (20cm x 25cm), landscape or portrait.
2. Mounted on A3 black card (160gms +)
3. A caption to the photo (maximum of 200 words), briefly explaining the photo and linking to the theme.
   - Where the structure is located?
   - Why it is inspiring to you?
   - How the structure is used?
   - How does the structure fit into its environment or surroundings (Engineering in harmony)?
4. Photos MUST be taken by the exhibiting student and have a New Zealand focus
5. Label on the back of the board with
   - Full student name
   - Year level
   - School name
   - Teacher name

Step 1: Coming up with ideas

One of the easiest ways of thinking up ideas is to find a general topic that you enjoy or have an interest in and start brain storming for ideas. Come up with lots of ideas first. This can be done by jotting down everything you can think of that relates to your broad topic, any questions you would like answered and highlighting anything that interests you about it.

Stuck finding ideas?
Look at the different 'classes' to help you decide.
Think about ideas with family and friends, or a teacher.
Look in books or magazines to get more ideas.
Study the internet, especially the science fair website. Choose something that interests you otherwise you will lose interest in the investigation.

The investigation must follow the Scientific Investigations Process. It must be an original idea and not just an experiment in a book or downloaded from the internet. It must be driven by inquiry and must be an investigation not just a display. The science involved must be clearly explained.

Step 2: Choosing a topic

Before choosing an idea from your brainstorm, you need to be aware of three different categories that your idea should fall into:

1. **Experimental Research**: a project that involves a controlled experiment
   e.g. what solution makes plants grow the highest?

2. **Technology Development**: this is where your idea involves creating or designing something to help people or make life easier.
   e.g. inventing a new, more user-friendly mailbox

3. **Research to increase knowledge for environmental or social systems**: this is where your idea is tested by gathering and analysing data instead of using controlled experiments, such as doing a survey.

When looking at your ideas ask yourself:

1. Does my idea fall into one of the three categories?
2. Can I design a method that is feasible?
3. Can I finish the project within a few months, in order to meet the deadline?
4. If I have to buy equipment to do the project, will it be cheap?
5. Is the project appropriate for my year level?
6. Do I really enjoy finding out the answer or the solution?

Step 3: Start a log book

A log book is like a diary where you record everything you do from the day you start thinking of ideas to the day you present your exhibit for marking.

Include:

- All of your ideas and attempts (even failed ones)
- Decisions you've made and WHY you made them (e.g. Why did you decide to have that amount?)
- Research
- Methods
- Raw data and calculations
- Problems you encountered
- Help you received
- Tentative conclusions, etc.

Your book can either be physical - a simple school exercise book (1B5) or you could complete it on Google Drive (sharing in the teacher you are working with, your class room team, and if possible, your parents. If you do it online, you will need to print it out to be included with your project).

Remember to date every entry as well.

Step 4: Search for background information

- Use the library, write to experts, and use the Internet. There is lots of information available so find what you need and record your findings.

- Record all the book titles in your logbook and collect all website details as you go. Paste copies of resources with web addresses into your logbook. This will make it easier when you type up your *List of Sources* later.

Step 5: State your aim

An aim is simply your problem in answer form. State what you are trying to find or show in your investigation. What is your purpose?

Step 6: State your hypothesis

- The hypothesis is an educated guess or a prediction of what you think will happen during your experimentation.
- Use background information to help you prepare this prediction.
- The results do not have to support this hypothesis in order for the experiment to be a success.

Step 7: Experimental design

- Design your experiment first on paper.
- Determine what you will need to complete your project. People? Lab equipment? Tools? Make a complete list of all the materials you will need.

- Consider your variables. An experiment usually has three kinds of variables: independent, dependent, and controlled. The independent variable is the one that is changed by the scientist.
- Determine your procedure/method. The procedure should explain the steps to be followed in order to find the answer to your question or problem.

Step 8: Gather your equipment and begin your experiment

- Follow your procedure.
- Collect and record all data by accurately, observing, measuring, describing, counting, and photographing.
- If necessary make changes during your procedure and record what changes you made and why.
- REMEMBER TO TAKE LOTS OF PHOTOS AS YOU GO.

Step 9: Repeat the experiment (if possible)

The results will be more reliable/valid if you repeat the experiment as many times as possible.

Step 10: Collate and analyse the data

- Decide what the results mean.
- Try to find explanations from your observations and data.
- If possible examine your results mathematically. (e.g., look for a trend)
- Construct graphs or tables to show the results more clearly. The most basic forms of data analysis are bar or line graphs.

Step 11: Evaluation / discussion

The discussion is where you not only state the results of your experiment but get to interpret your data and results.

- Do you see any patterns? Did you find anything interesting and exciting?
- What problems did you have and how did you solve them?
- What next? Do you need to go back and make another hypothesis?
- What could this lead to? What further thinking and investigations could take place?

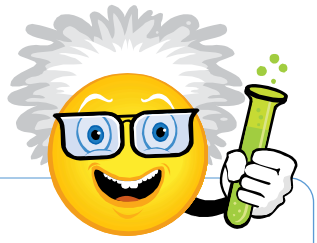
Step 12: Make a conclusion

- What can you conclude about your topic? Did your results match your hypothesis? Why or why not?
- Make your conclusion short and simple.

Step 13: Make references and acknowledgements

- Record a list of websites, books, magazines, etc. that you have used.
- Remember all the people or organisations who helped you throughout your project and thank them for their help and support.

SCIENTIFIC INVESTIGATION



Research

- Do some background research on the topic
- Find out what others have done
- Use the research as the basis of your questions

Aim

- What do want to find out?
- Why do you want to do the experiment?

Hypothesis

- What do you think will happen?
- Make an educated guess from the background research you have done

Equipment

- Find out and list all the equipment and resouces you need
- Also list all the independent, dependent and controlled variables

Method

- Give the instructions clearly and consisely to your experiment in order, so that some-one esle can repeat it
- Number each step, and begin each step with a verb, e.g. place, mix, cut

Results

- Record all the raw data in a table. Include samples, photos, diagrams, etc where appropriate
- Process the data by drawing a fully-labelled graph

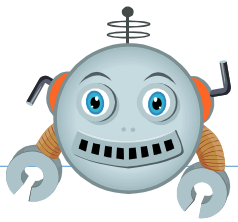
Discussion

- Discuss the difficulties you've encoutered and how you can do better next time

Conclusion

- Was your hypothesis right? Why?
- Do you have any theories to explain the data and the hypothesis?
- Have you learnt anything?

TECHNOLOGY DEVELOPMENT



Problem

- Start with a need or opportunity
- Are you improving existing technology or designing a technological innovation? Think about how it would benefit certain groups of people

Research

- Find out what others have done about the identified problem
- Find out about the cost of equipment and resources

Solution

- Start with a drawing/model, then build a series of prototypes
- Keep a log book of everything you do, espeically any new "fair test", performance measurements, etc.

Testing

- Try your solution with a sample of people
- Ask for feedback and keep making improvements until you're satisfied
- Again keep a record of all the testing

Discussion

- Has your development been successful?
- Discuss the application of your solution. Will others find it useful?

Market

- Come up with creative ideas for production, packaging and marketing

THE RESEARCH PROCESS

Research

- Give the reader some background information to your topic and reasons why you choose this area of research

Plan

- List key questions
- Identify possible resources

Collect

- Collect relevant information from a range of sources, e.g. books, multimedia, surveys
- Think about the science ideas and technology involved in the research

Process

- Organise and evaluate selected information on the topic
- Summarise your research findings
- Select relevant and useful illustration, diagrams and graphs

Interpret

- Think about what the selected information means in terms of your reserach topic
- Link to the science ideas and technology pripciples

Discussion

- Did you encouter any problems during your research?
- If so, how can you improve next time

Report

- Write the final draft of the report
- The final report can include illustrations, graphs, models, etc.
- Include a full list of references of resources used

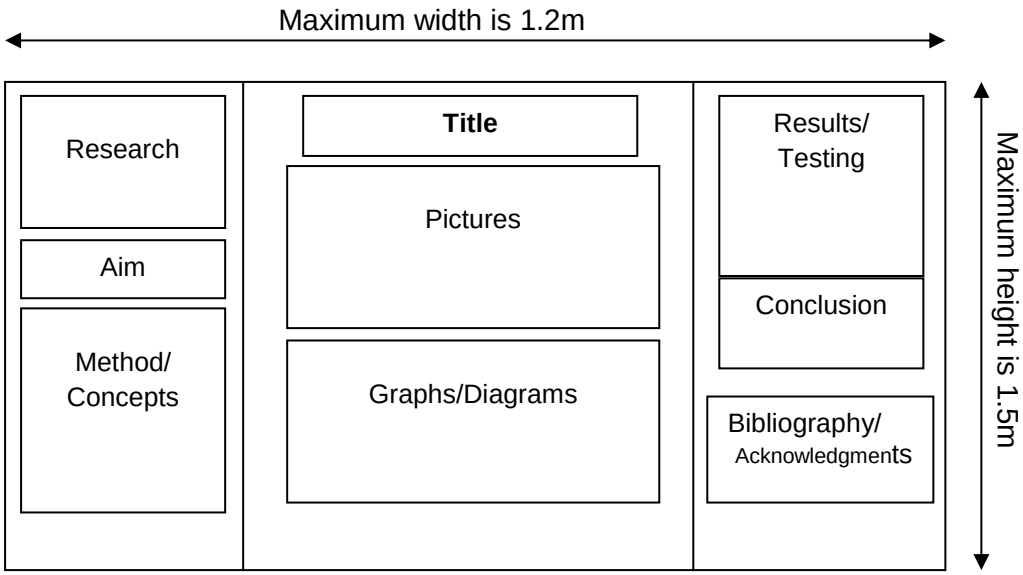
Conclusion

- Make generalisations and form judgments
- Have you answered all the key questions in your plans?

PRESENTATION

This is a very important step as your entry can only be judged on the information you communicate – so communication is very important.

To give you an idea of how to start, have a look at the board below and see how different sections are *typically* arranged:



You are limited to a table space of 1.2m wide X 0.75m deep X 1.5m high.

MAKE SURE:

- Your display is free standing and robust
- Your display is eye catching
- There are no spelling mistakes or errors
- Nobody will be offended by any of the content
- Any graphics are relevant
- The information is clear and easy to read
- All extra material/models/support information must fit inside your display area *Oversized entries will not be accepted unless you have written permission from the science fair organisers*
- Please check safety rules for any that may apply to your exhibit.

JUDGING CRITERIA

It's a good idea to look at your project carefully alongside the judging criteria and look to improve any areas you feel you might not have covered strongly.

Judges will generally use the following criteria in assessing your project:

Scientific Thought & Understanding

- clear scientific thought, the application of appropriate scientific methods, an appreciation of the need for accuracy in observation, measurement, data collection and reporting
- an understanding of the underlying or related scientific principles embraced within the project

Technical & Graphic Skill

- assembled with skill and dexterity, equipment, models and the frame of the project have been well constructed
- graphic materials have been carefully prepared and presented
- living plants and animals have been well cared for
- working parts are reliable
- the whole is well planned and neatly finished

Originality

- uniqueness of approach
- resourcefulness in obtaining and interpreting data
- ingenious use of illustrative objects, inventive apparatus
- insight conclusions
- inspired applications of the principles, process or product

Thoroughness & Effort

This is reflected in:

- the scope of the topic
- the scale of the investigation
- the detail obtained
- the extent of the results
- the repetition of the experiments
- the construction of the project and its illustrative items
- written material and other displays

Presentation

- well designed and developed to be attractive, visually interesting, informative on all aspects of the investigation
- well illustrated with photographs, models, specimens or samples
- has wide public appeal

WHAT CAN I WIN?

MAJOR PRIZES

Best in Fair	$800 + trophy
Best in Fair Runner Up	$450 + trophy
NIWA work experience scholarship for senior student (Age 16+)	Paid work experience
Best Year 7 Exhibit	$200 + trophy
Runner-up Year 7 Exhibit	$100 + trophy
Best Year 8 Exhibit	$200 + trophy
Runner-up Year 8 Exhibit	$100 + trophy
Best Year 9 Exhibit	$200 + trophy
Runner-up Year 9 Exhibit	$100 + trophy
Best Year 10 Exhibit	$200 + trophy
Runner-up Year 10 Exhibit	$100 + trophy
Best Year 11-13 Exhibit	$200 + trophy
Runner-up Year 11-13 Exhibit	$100 + trophy
Best Inventions and Technical Innovations Exhibit	$200 + trophy
Runner-up Inventions and Technical Innovations Exhibit	$100 + trophy

As per 2019 (Subject to change in 2020)

CLASS & SPECIAL PRIZES

Class Prizes		
For Classes 1 - 14	1st	$100.00
	2nd	$70.00
	3rd	$40.00
For Classes 15 - 20	1st	$70.00
	2nd	$40.00
	3rd	$30.00
NOTE: Merit certificates and special prizes are awarded at the discretion of the judges.		

Special Prizes (Award focus and sponsors from previous year as indication ONLY)

Award focus	**Sponsor**
1. Water/Atmosphere	NIWA
2. Statistics	NZ Statistical Association
3. Soil Science	NZ Soil Society
4. Environment	Waikato Regional Council
5. Baking	NZ Baking Industry Research Trust
6. Agricultural Science	NZ Institute of Agricultural Sciences
7. Food Science & Technology	Dairy Goat Co-operative
8. Food Science & Technology	NZ Institute of Food Science & Technology
9. Science excellence	Kudos
10. Sociology	Sociological Association of Aotearoa
11. Microbiology	NZ Microbiological Society
12. Judges special choice	McGowan Special Award

As per 2019 (Subject to change in 2020)

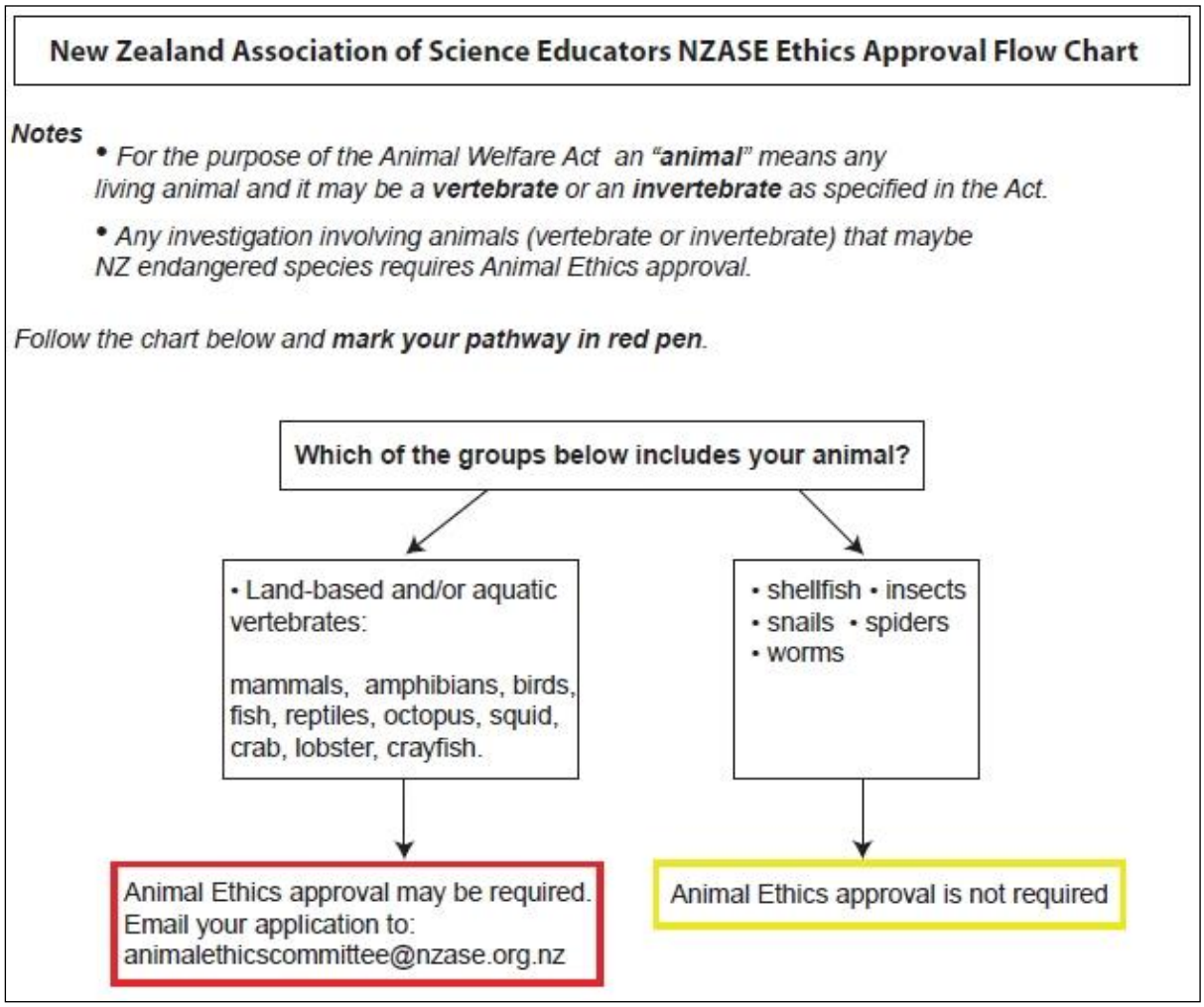
ETHICS APPROVAL

Human ethics approval

If your project involves adults and children as subjects (e.g., taste testing) then you need to get the informed consent of all participants. There are no human ethics committees but information and guidelines are available from the above website. Select Royal Society of New Zealand, then students (secondary) then Science and Technology Fairs and scroll down to Human Ethics.

Animal ethics approval

If your investigation involves animals, including humans you may need animal/human ethics approval **prior** to beginning your project. Refer to the flowchart below to determine whether or not you require ethics approval. Online application forms, information and ethics approval be obtained from www.nzase.org.nz.



SAFETY RULES

The following safety rules for construction of projects are necessary to prevent electrical fires and prevent injury to exhibitors and visitors:

1. Construction must be durable and stable when on display

2. Electrical Rules:
   - Apparatus must be constructed following standard electrical safety laws. Check with an electrician or other qualified person.
   - An AC 230 volt supply is available if required, but only NZ standards approved switches can be used and these must be suitable mounted.
   - All wiring, switches and metal parts that carry current from a supply of 230 volts (or higher) must be completely enclosed by barriers that positively prevent observers from reaching into the exhibit and receiving an electrical shock. The barrier material can be clear to allow working parts to be seen.
   - Properly solder and tape electrical joints.
   - Wire used must be properly insulated for the voltage in use.
   - A clearly visible sign must warn of voltages higher than 230 volts.
   - Heating elements and light bulbs must be well ventilated and insulated to prevent hazard from fires.

4. Dangerous chemicals and explosives must not be exhibited.

5. No gas supply is available. You may only use a portable gas supply with permission from the organising committee.

6. Animals must be fed daily and their containers kept clean. A certificate of approval from the NZASE Animal Ethics Committee is needed for projects that involve manipulation of animals (see pg. 17).

7. Human participants in projects must be fully informed – see your teacher for information and before carrying out your investigation, get approval (see pg. 17).

ALL PROJECTS WILL BE INSPECTED BY THE SCIENCE FAIR COMMITTEE AND THOSE THAT DO NOT COMPLY WITH THE FOLLOWING RULES WILL BE DISQUALIFIED.

Responsibilities:
The Science Fair Committee will take due care of equipment and exhibits on display, but does not take responsibility for loss or damage. Exhibitors are to remove any valuables after judging.

FURTHER INFORMATION

For further information about the NIWA Waikato Science & Technology Fair see the website or contact the committee via email:

www.waikatosciencefair.org.nz wrstfair@gmail.com

Proud sponsors of Regional Science and Technology Fairs