CHARTERS TOWERS SCIENCE CONTEST

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AIMS OF THE CHARTERS TOWERS SCIENCE CONTEST

1. Stimulate ongoing interest in the study of sciences, by:
    a. encouraging independent self-motivated project work amongst students of science;
    b. giving students the opportunity to communicate their achievements to a wider audience;
    c. according recognition of effort and achievement in a scientific enterprise.
2. Promote the direct involvement of the Charters Towers community in the processes of science and its communication.
3. Give the Charters Towers Community an opportunity to see the quality of work being achieved in science by local students.

WHY PARTICIPATE IN THE CHARTERS TOWERS SCIENCE CONTEST?

We believe that science teachers have a professional responsibility to encourage students to develop a broader understanding and application of science and technology which is fundamental to sound social and personal judgment, now and in the future.

This contest is for everybody: for those planning a career in one of the sciences or technological disciplines, for those interested in scientific hobbies, or for anyone concerned enough to present a point of view about science.

We believe that by participating in the science contest, students will develop skills and attitudes that will contribute to the wellbeing and development of the wider community.

IMPORTANT DATES

Wednesday 18th July	Online entry registration opens
Monday 6th August, 11:59 PM	Online entry registration closes
Monday 13th August, 11:59 PM	Electronic submission (for Scientific Investigation category) closes
Wednesday 15th August, 5:00 PM - 7:00 PM	Exhibition and Judging Day (Innovation Fair)

CONTACT DETAILS

For any queries about National Science Week or the Charters Towers Science Contest, please contact Shauna McCormack. Email is preferred: smccormack@btc.qld.edu.au. Alternatively you may phone 07 4787 5100, ext. 5144.

HOW TO ENTER

Decide the category that you want to enter your project into and submit your project proposal as soon as possible via the link below. You will hear back within three days.

Please note:

- Your project does not need to be finished by the registration close date – you just need to have an idea of what you are going to do.
- You may enter existing work as long as it meets the criteria of the category you enter. Refer to the criteria sheets at the end of this handbook.
- Entries can be as an individual or as a team. A team may consist of up to THREE members only.
- Entry is free.
- All students will require permission from their parent, guardian, or teacher before submitting the online form.

Complete the online form here: http://bit.ly/ctscience

Divisions

Students will compete in two divisions:

- Primary School Students
- Secondary School Students

Categories

Projects should fit into one of three categories:

Scientific Investigations

Projects that investigate an inquiry question following scientific methodology and are accompanied by a journal or notebook. Investigations, inquiry projects and extended experimental investigations (EEIs) generally fit this category.

Engineering and Technology Projects (Inventions)

Projects that investigate solutions to problems or innovations that meet a need. Projects follow the technology process to investigate, design, produce and evaluate new products. In primary schools, this process is sometimes referred to as 'design-make-appraise'.

Communicating Science using Working Models

Entries should explain, clarify or communicate a scientific idea or concept to a particular audience. Entries should be in the format of a working model – physical, or computer-generated.

PRIZES AND ADVANCEMENT TO THE QUEENSLAND SCIENCE CONTEST

There will be up to eight prizes awarded – one for the winner of each category in each division, and *Pride of the Towers* prizes in both primary and secondary divisions. A *Certificate of Scientific Endeavour* will be awarded to all students who are successful with their entry.

All finalists of the Charters Towers Science Contest will advance into the Queensland Science Contest with over $12000 worth of prizes on offer. The finalists will be put forward with the support of their science teachers and schools.

JUDGES OF THE CHARTERS TOWERS SCIENCE CONTEST

Steph Piper has a background in biofabrication and 3D printing for medical grade implants. She is the Patron of the Brisbane Hackerspace and the Community Engagement Coordinator at USQ, looking after the Library Makerspace. She teaches 3D printing, 3D modelling and Arduino classes. She has hosted talks and workshops for the Wonder of Science Program, QUT Creative Enterprise Australia, Brisbane Workshop, Woodford Folk Festival, The Planting Festival and much more. She's part of the 2017 Digital Champions Program, has been featured by Peppermint Magazine, was a finalist in the Women in STEM awards and was selected for the Startup Catalyst Youth Mission to Silicon Valley. She's also presented at the STEMaker Conference and STAQ Science is Primary Teacher's Conference about building maker culture with older age groups.

Sara Guevara is a physiotherapist who worked at the Australian Institute of Sport as a Post Graduate Scholar in 2017. She has a Masters Degree in Sports Physiotherapy. Sara has worked with many sports over her career including Rugby Union, Soccer, Volleyball and Combat Sport. This year she has be gallivanting the globe working with different National Sporting teams – including Boxing, Taekwondo and currently Triathlon. She has also been privileged enough to work at big international sporting events such as World Universidad, World Taekwondo Championships and at the Commonwealth Games. Sara loves all sport, and her passions are injury prevention, education and rehabilitating athletes back to the sporting field.

Dr Paul Harvey is currently the director responsible for testing Joint (Army + Navy + RAAF) equipment entering into operational use with the Australian Defence Force (ADF). Examples of Joint Systems include updates to ADF satellite and radio communication methods and associated networks. Previously Paul has worked with the Australian Antarctic Division where he undertook site assessment and fuel spill remediation at Casey station, Antarctica. During that time he completed a Ph.D. after building an enhanced chemical analysis instrument and 'showed it worked' by using it to map a fuel plume at Macquarie Island (Southern Ocean) and publishing results.

GUIDELINES FOR EXHIBITION AND JUDGING DAY (INNOVATION FAIR)

You will be provided with a table. You can be imaginative with how you display your project but the overall dimensions may not exceed the width or depth of your table (dimensions to be advised after registration).

You may use cardboard, pull cords, whatever material you can bring that you would like to decorate your table. You are exhibiting not just for the judges but for the rest of the community.

Any students from Charters Towers School of Distance Education who are unable to attend on the day can still submit their project and it will be placed on a table. They will need to fill in a special form and create an informative A3 poster to be displayed alongside their project.

Please note:

- Exhibiting students should arrive **45 minutes before** the start time in order to set up their exhibition tables.

In addition to student exhibitions, there will be a 3D Printing workshop including live 3D printing to watch, lots of samples to touch and feel, 3D scanning demonstrations and a hydrodipping tutorial from one of the guest judges, Steph Piper (http://www.piper3dp.com/).

SCIENTIFIC INVESTIGATIONS (PRIMARY DIVISION)

How to get started on a scientific investigation

This involves:

1. Choosing and defining a topic. Pick a topic that interests you. Does not need to be based on this year's theme.
2. Asking questions about your topic. Why? What if...? How? It would be a good idea to do some reading about your selected topic. Libraries and the internet are very useful resources. You could also discuss ideas with others familiar with your topic.
3. Forming an hypothesis. This is an educated "guess" as to what you think will happen in a certain set of circumstances or conditions. (Look at ONE change at a time).
4. Investigating your hypothesis. To do this properly you will need to design and carry out experiments in a safe manner.
    a. Data logging equipment can be used to collect data.
    b. If able, repeat the experiment a number of times to reduce random errors.
    c. Use experimental controls eg. variables, to make results more meaningful.
5. Carefully recording the results of the experiments. A survey, if it is used to collect data as part of an investigation, is regarded by the Charters Towers Science Contest as an experiment. (Keeping a log book or taking photographs are useful ways of recording).
6. Analysing results. What do your results mean?
7. Being prepared to change your original ideas and procedures as you get results which may be unexpected.
8. Working logically through your results so as to support or disprove your hypothesis.
9. Writing a report to tell others what you did and what you found, based on experiments you carried out. The experimental report is NOT a research assignment.

Writing an experimental research report

Tick that you have satisfied each of the guidelines below.

Your report format may be written in passive or active voice but must include the following:

- ❏ **Introduction -** What gave you the idea? How did you get started? Provide some background information on the topic.
- ❏ **Aim** - What you are trying to find out?
- ❏ **Hypothesis -** A scientific guess on what you think will happen based on your initial understanding of your idea

- ❏ **Materials** - List everything used!
- ❏ **Method** - List everything you did, but remember to keep them in order (like a recipe).
- ❏ Describe the **safety requirements** you followed in conducting this experiment. Attach Risk Assessment Form – see template at the end of this handbook.
- ❏ **Results** - Everything you discovered (or found out). Keep a little book (logbook) and record everything as you go. To show all this use graphs, tables, pie charts, photos etc...
- ❏ **Discussion** - Judges pay particular attention to the quality of your discussion. Consider using the following questions as prompts. (Discussion should not be question/answer style)
    - ❏ What happened and what did you learn?
    - ❏ Did it reflect your hypothesis? Do you think you know why?
    - ❏ Did you find any unexpected results? Can you explain this?
    - ❏ What problems did you encounter?
    - ❏ How could you improve on your experiment or data collection?
- ❏ **Conclusion** - This is a simple paragraph that links back to your aim and hypothesis. Did you find out what you wanted? Was your hypothesis right?
- ❏ **Acknowledgements and References** - Make sure you include a list of people who gave you help/advice and outline the ways they helped you. List any books or websites you used.
- ❏ When your report is finished ask your teacher or parent(s) to check your report to make sure it follows the guidelines.
- ❏ Keep a full electronic copy of your work, including scans of log book etc.

This will need to be submitted via email to smccormack@btc.qld.edu.au no later than Monday 13th August. Files should be saved in the following format: SurnameFirstname_ProjectTitle.

Exhibition and Judging Day

Students will be expected to give an oral presentation that demonstrates to the judges how their Investigation ran and discuss the following aspects:

- ❏ Your description of what you did and what you achieved.
- ❏ Posters, videos and other accessories are not judged.
- ❏ Your understanding of the **scientific principles** used in the investigation.
- ❏ Your discussion of the investigation.

Judges will look for evidence of depth of research into the science behind your investigation.

SCIENTIFIC INVESTIGATIONS (SECONDARY DIVISION)

How to get started on a scientific investigation

This involves:

1. Choosing and defining a topic. Pick a topic that interests you, preferably one which will give you the opportunity to learn something you did not already know.
2. Asking questions about your topic. What if...? Search out what has been done previously (libraries, internet) in this area. Maybe also discuss ideas with others familiar with your topic. If it is a standard experiment (from the web, for example), make some changes, or repeat the experiment a few times under different conditions.
3. Forming an hypothesis: what you think will happen in a certain set of circumstances/conditions. Make it specific, so that at the end, you can clearly say "proven" or "dis-proven".
4. Investigating your hypothesis. To do this properly you need to design and carry out experiments in a safe manner.
    a. The method should be logical and test the hypothesis.
    b. Allow sufficient time to get meaningful results.
    c. Repeat the experiment several times to reduce random errors.
    d. Use Experimental Controls to make results meaningful.
5. Carefully recording the results of the experiments.
    a. A survey, if it is used to collect data as part of an investigation, is regarded by the Charters Towers Science Contest as an experiment. (Keeping a log book or taking photographs are useful ways of recording).
6. Analysing results. What do your results mean?
7. Being prepared to change your original ideas and procedures as you get unexpected results. You may want to completely change the topic if something unexpected shows up.
8. Working logically through your results to support or disprove your hypothesis.
9. Writing a report to tell others what you did and what you found, based on experiments you carried out. The experimental report is NOT a library research assignment.

Writing an experimental research report

Tick that you have satisfied each of the guidelines below.

Your report format may be written in passive or active voice but must include the following headings:

- ❏ **Abstract** - Give a brief description of what you did and what you achieved. Around 100 words should suffice.

- **Introduction** - This must be relevant to the topic and explain why you chose this topic. It must define key terms and provide some background information as well as answering the question "what were you looking at?" Some information from your background reading would be useful.
- **Aim** - this must give a clear indication of your investigation. Include your specific hypothesis.
- **Materials** - List or describe the equipment you used to carry out your experiment.
- **Method** - Presentation of the method should allow someone else to follow your experiment step by step. Method should report what was actually done, not what you should do. Include any mistakes.
- Remember to include a description of the **safety precautions** you used to conduct the experiment. Attach **Risk Assessment Form** – see template at the end of this handbook.
- **Observations and Results** - Present your results in an easily understood format which may include tables, graphs, photos, maps and descriptions. All information should be clearly labelled. Where possible, results should involve measurement. Avoid subjective results such as those involving likes and dislikes.
- **Discussion** - Judges pay particular attention to the quality of your discussion. Analyse what your results show. Discuss the implications and validity of your results. Did your results support or disprove your hypothesis? What problems did you encounter? How could you improve on your experimental design or data collection? What errors could you have made? Reflect on unexpected results.
- **Conclusion** - The conclusion must relate to the aim. Has the hypothesis been supported or disproved?
- **Acknowledgements and references** - A reference list must be included. All research is based on some background information. You should list the books, journals and websites you referred to. Acknowledge the people who gave you help or advice and explain in what ways they helped you. Specific information from another source, when used, must be cited. When finished ask your teacher or parent(s) to check your report to make sure it follows the guidelines.
- **Keep a full electronic copy of your work**, including scans of log book etc.

This will need to be submitted via email to smccormack@btc.qld.edu.au no later than Monday 13th August. Files should be saved in the following format: SurnameFirstname_ProjectTitle.

Exhibition and Judging Day

Students will be expected to give an oral presentation that demonstrates to the judges how their Investigation ran and discuss the following aspects:

- Your description of what you did and what you achieved.
- Posters, videos and other accessories are not judged.
- Your understanding of the **scientific principles** used in the investigation.
- Your discussion of the investigation.

Judges will look for evidence of depth of research into the science behind your investigation.

COMMUNICATING SCIENCE USING WORKING MODELS (BOTH DIVISIONS)

Students are encouraged to explore ANY scientific area of interest.

Scale models

This is a scaled representation of an existing device/invention. You are asked to make a WORKING model that simulates the operation of, and the scientific principles behind, an existing technology. You should choose a model which clearly illustrates a scientific principle. For example, you could construct a scale model of an operating small scale radio telescope demonstrating the process of receiving radio waves.

Information models

Information models are WORKING models that either demonstrate a scientific principle or concept, or simulate a scientific technique. These models are intended to educate people about the concept being illustrated. For example, if you wanted to show how electrons flow through a wire you couldn't use electrons (because they are too small) but would use something large enough to see to represent the electrons.

Note that Information and Scale Models is a separate category to Engineering and Technology Projects (Inventions). See the next section for information about the Engineering and Technology Projects (Inventions) category.

Entry guidelines and criteria

Tick that you have satisfied each of the guidelines and criteria below.

- ❏ Your model must be a WORKING model.
- ❏ Your model must be no larger than 0.5m x 0.5m x 0.5m.
- ❏ Your model must be safe to operate in a crowded area. All models must have appropriate safety features; e.g. boilers must have correctly operating safety valves. Dangerous chemicals must not be used, and rocket models will not be judged. Projects that involve cruelty to animals will not be judged.
- ❏ Your model must be original (volcanoes will score poorly!!). Models made from kits without original input do not score well.
- ❏ The best Scale models will clearly and accurately illustrate only one or two scientific concepts. These should be the major concepts in the operation of the model.
- ❏ Information models should show original, creative and innovative presentation.
- ❏ Your Model is well constructed.
- ❏ You have shown resourcefulness in the parts you have chosen to use, including consideration of properties of the materials.
- ❏ Your Model is easy to use and has operating instructions.

- ❏ **The scientific principle used is clearly understood and demonstrated.**

Written report

You must include with your Model a written report that includes the following:

- ❏ **Introduction** – What the model represents and ideas behind it. Identify your model either as a scale model or an information model.
- ❏ **Design brief** – describes how you went about building and testing, problems you encountered and how they were solved, and the science principles used and applied to the design. **Draw and label diagrams of your prototype designs, including relevant explanations.**
  - ❏ Scale model: you must address how appropriate your model is in the explanation of the science concept being demonstrated. Also include how accurate your scale model is and note where exceptions were made to the size ratio.
  - ❏ Information model: you should show original, innovative and creative design in the implementation of the scientific principle(s) being demonstrated.
  - ❏ List any safety considerations in your design. Attach **Risk Assessment Form** – see template at the end of this handbook.
- ❏ **Instructions** – Operating instructions of your model.
- ❏ **Discussion** – Discuss the scientific principles involved and how they apply to the Model. What are the limitations of your design and/or suggest how you would make further improvements.
- ❏ **Acknowledgements and References** – Make sure you include a list of people who gave you help/advice and outline the ways they helped you. Also list other sources of information used.
- ❏ Include or attach a photo(s) of your Model in your report.
- ❏ Your report should be no more than 1000 words in length, (log books and appendices are not included in word count) on A4 paper and presented in a paper manila folder (not plastic) with a copy of the completed Face Sheet firmly attached to the front.
- ❏ **Keep a full electronic copy of your work**, including scans of your log book etc. See pg 23 for naming your file.

Exhibition and Judging Day

Students will be expected to give an oral presentation that demonstrates to the judges how the Model works and discuss the following aspects:

- ❏ Scale model: The accuracy of the scale model and its appropriateness in demonstrating the scientific principles and/or concepts
- ❏ Information model: How your Information Model is original and creative in demonstrating a scientific principle and/or concept.
- ❏ Your understanding of the **scientific principles** used in the design and its application.

- ❏ What materials and their properties you have used in your model. Would you use anything else to construct your model if you could do it again?

Judges will look for evidence of depth of research into the science behind your Model.

ENGINEERING AND TECHNOLOGY PROJECTS (INVENTIONS) (BOTH DIVISIONS)

Students are encouraged to explore ANY scientific area of interest.

What is an invention?

Inventions are original applications of technology which solve a problem. The scope for inventions is limited only by your imagination. You are asked to apply your knowledge of science to make a WORKING invention that has a practical application. Your invention may be a new device, method or process that has not existed before or you may choose to look at an existing device and invent a solution that works better. Note that Inventions is a separate section to Information and Scale Models. See previous section for information about the Working Models category.

Entry guidelines and criteria

Tick that you have satisfied each of the guidelines below.

- ❏ Your invention must be presented as a WORKING invention.
- ❏ Your invention must be safe to operate in a crowded area and must have appropriate safety features (e.g. boilers must have correctly operating safety valves). Dangerous chemicals must not be used and rocket- type inventions will not be judged. Projects that involve cruelty to animals will not be judged.
- ❏ Your invention solves a **real problem**.
- ❏ Your invention is well constructed.
- ❏ You have shown resourcefulness in the parts you have chosen to use including consideration of properties of the materials.
- ❏ Your invention includes a **design brief** that clearly shows the scientific principles involved and/or how it applies to the invention.
- ❏ Your invention is easy to use and comes with instructions on how it operates.
- ❏ **Your invention demonstrates a high level of applied scientific principles.**
- ❏ Your invention must be highly **original, innovative and inventive**. (Scale models of existing devices should be entered in the Working Models section.) Be sure to research thoroughly that your invention has not been tried already.

Written report

You must include with your invention a written report that includes the following:

- ❑ **Aim(s)** - Explains the purpose of your invention and how it solves a problem
- ❑ **Introduction** - Explains what is original or new about your invention, and your ideas behind it. How your invention is important or relevant to an existing problem.
- ❑ **Instructions** - operating instructions of your invention.
- ❑ **Design brief** - describes how you went about building and testing, problems you encountered and how they were solved, and the science principles used and applied to the design. Draw and label diagrams of your prototype designs, including relevant explanations.
- ❑ List any safety considerations in your design. Attach **Risk Assessment Form** – see template at the end of this handbook.
- ❑ **Discussion** – discuss the scientific principles involved and how they apply to the invention. Explain how your invention solves a problem. Analyse and include the results of your field tests. Describe the limitations of your design and/or suggest how you would make further improvements.
- ❑ **Acknowledgements and References** – Make sure you include a list of people who gave you help/advice and outline the ways they helped you. Also list other sources of information used.
- ❑ Include or attach a photo(s) of your invention in your report.
- ❑ Your report should be no more than 1000 words in length (word count does not include any appendix or logbook attached).
- ❑ **Keep a full electronic copy of your work**, including scans of your log book etc.

Exhibition and Judging Day

Students will be expected to give an oral presentation that demonstrates to the judges how the invention works and discuss the following aspects:

- ❑ How it solves a problem.
- ❑ How your invention is original, innovative and/or inventive.
- ❑ Your understanding of the **scientific principles** used in the design and its application.
- ❑ What materials and their properties have you used in your device. Would you use anything else to construct your invention if you could do it again?

Judges will look for evidence of depth of research into the science behind your Invention.

CHARTERS TOWERS SCIENCE CONTEST

RISK ASSESSMENT FORM:

Title of Entry: ____

Student name:_________________________________ Signature: _____________ Date: ___________

Student name:_________________________________ Signature: _____________ Date: ___________

Student name:_________________________________ Signature: _____________ Date: ___________

Your assessment should include sample handling, storage, disposal, spill procedures and use of machinery...

Use as many Risk Assessment Form pages as necessary.

Type of Risk	Hazard	Level of Risk	Precaution taken to control risk	Source of information
□ Chemical or microorganism □ Procedure or equipment				
□ Chemical or microorganism □ Procedure or equipment				
□ Chemical or microorganism □ Procedure or equipment				
□ Chemical or microorganism □ Procedure or equipment				

Possible sources of information to complete your risk assessment

- www.riskassess.com.au
- CLEAPSS Student Safety Sheet (available online)