SOLAR CELL CHALLENGE

Australian Research Council Centre of Excellence in exciton science

Welcome to the inaugural
Solar Cell Challenge, hosted by the
ARC Centre of Excellence in Exciton Science.

Please note that this challenge was originally planned for Term 2 2020, it has been postponed to Terms 3 and 4 to accommodate for the disruptions to the school calendar as a result of COVID-19.

TEACHER INFORMATION- HOW THE CHALLENGE WORKS.

What is the Solar Cell Challenge?

Get your students doing hands-on science and converting light into electricity! This challenge gets your students thinking creatively around manipulating experimental variables, producing a scientific product and communicating process and findings through video.

What are the categories of the challenge?

- Challenge Level 1- Dye-sensitized solar cells

The objective of this challenge is to produce a dye-sensitized solar cell and manipulate experimental variables to explore this specific type of technology. In this category, students are provided with a basic method and a few key materials (posted to schools) and they then get to apply their creative thinking in the production of the cell. Students record their journey and show their scientific product in action via video.

- Challenge Level 2- Open solar cells

The objective of this challenge is to produce any type of solar cell through first researching how solar cells are constructed and what types there are. In this category, students will need to apply a range of techniques and create a method to enhance an existing or new simple solar cell. Students record their journey and show their scientific product in action via video.

Who is the challenge for?

The competition is to be completed in small groups (2-3 participants) in science classes/clubs across Australia. Participating schools can be from any state or territory.

- Challenge Level 1: Years 7-9
- Challenge Level 2: Years 10-12

When is the challenge?

The Challenge will take place across Terms 3 and early Term 4, 2020 and can be completed at any time that suits the participants and their teachers/parents between 10 August- 30 October.

What are the key dates in 2020?

Registrations close	24 July
Teacher resources and judging criteria released	10 August
Resource package send out	10 August (week of)
Submissions open	24 August
Submissions close	30 October
Winners announced	November

How long does the challenge take to complete?

It is expected that approximately 3 x 1hr school lessons will be sufficient for the introduction, planning and experimentation phases of either challenge. Extra time should be dedicated to the video production and editing by students, either in class or at home.

What is the cost of the challenge?

- Challenge Level 1- Dye-sensitized solar cells

To cover equipment costs, there is a $20 entry fee per team in Challenge Level 1.

> *For example, if a school has 6 teams entering the challenge at level 1, then they will need to pay (6 (level 1 teams) x $20) = $120.*

- Challenge Level 2- Open solar cells

As the product produced in Challenge Level 2 is open, equipment is not provided to teams. Therefore, there is no cost per team at level 2. However, teams/schools must supply and purchase their own equipment, the total cost of which should come to no less than $50 per team.

> *For example, if a school has 6 teams entering the challenge at level 2 then they will need to pay (6 (level 2 teams) x $0) = $0.*

- Schools entering both challenge Levels:

> *For example, if a school has 6 teams entering the challenge at level 1 and 6 teams at level 2, they will need to pay (6 (level 1 teams) x $20) + (6 (level 2 teams) x $0) = $120.*

- Exemptions

If your school is placed in a rural or remote area, or hosts a low Index of Community Socio- Educational Advantage (ICSEA) value, then please contact us to request a registration and team entry fee exemption.

How do students present their process?

Students will need to produce a short video (1-2 minutes) that summarizes their research and experimental processes and shows their solar cell in action.

This submission will be due by October 30.

What equipment is provided and what does the school or students need to provide?

Level	What is provided by Exciton Science?	What does the school/student need to provide?
Level 1- Dye-sensitized solar cells	- Teaching resources (introductory presentations linking to key curriculum ideas around energy, light and galvanic cells) - Methods for teachers including relevant risk assessments - Methods for students - Titanium dioxide (TiO_2) powder - ITO conductive glass (6 slides per team)	- 1 x Multimeter (with µA sensitivity) - 2 x Alligator clips - 1 x Plastic chopping board/lab-safe surface - 10-20cm Masking tape - 1 x Electronic measuring scales - 1 x Small spatula - 1 x Mortar and pestle - 0.035M Acetic acid (pH 3-4) (<10mL) - I_3^-/I^- electrolyte solution (<10mL) - 1 x Measuring cylinder (≈10mL) - 3 x Plastic pipettes - Glass stirring rod - Forceps/Laboratory tweezers - Hot plate - 3 x Small beakers - Deionised water (for rinsing) - Ethanol (for rinsing) - Matches - 1 x Tea candle - 2 x Q-tips - 2 x Small bull dog paper clips - Video production equipment (Camera/phone/laptop/Ipad/Editing software) - Dye solution (Be creative! A great idea to get your students to source this!)
Level 2- Open Solar Cells	- Teaching resources (introductory presentations linking to key curriculum ideas around energy, light and galvanic cells)	- Materials as dictated by student method - Video production equipment (Camera/phone/laptop/Ipad/Editing software) - Risk assessments where relevant *Note: It is expected that the materials that students choose will be readily available and safe to use. Students are encouraged to use recycled equipment as much as possible. A 'zero to low impact' approach to the solution is a must!*

How are students judged?

A detailed challenge judging criterion will be released on August 10 along with teacher resources. However, there will be prizes for students based on performance in multiple categories including:

- Innovation in variable manipulation and method modification
- Creativity and production value of video
- The 'zero to low impact' nature of the materials used in the construction of the cell (i.e. recycled nature, availability and cost)- Relevant only to Level 2.

There will also be **overall winners** for each level of challenge.

What are the prizes?

For the overall winning teams, their schools will receive a starting grant to initiate a new and/or enhance an existing energy sustainability initiative. The schools will also receive a researcher visitor to speak to a group of students and/or at an assembly.

Individual student winners will receive a prize pack of goodies depending on the category!

What is the composition of the student teams?

Level 1- Dye-sensitized solar cells

- Group of 2-3 students
- Students must be in Years 7-9 in 2020
- Students can be of a mixed year level grouping (for example 2 x year 8 students and 1 year 9 student)

Level 2- Open Solar Cells

- Group of 2-3 students
- Students must be in Years 10-12 in 2020
- Students can be of a mixed year level group (for example 1 x year 10 students and 2 x year 12 students etc.)

What is the expected teacher involvement?

The main role of teachers is to provide administrative and educational support during the challenge in performing the roles outlined below:

- Registering school and teams for challenge and organizing payment where appropriate
- Preparing time for students to perform the experiments (with appropriate supervision)
- Liaising with lab technicians and/or collecting appropriate equipment
- Presenting an introduction (with provided resources) around the science and importance of solar energy

Teachers (and parents) are not to directly help a team and/or contribute to the challenge solution itself. They may support students by performing a scientific technique in the case of negating significant risk at their discretion. For example, diluting a concentrated solution or soldering a circuit for students if required.

How do I find out more if I'm still unsure about something?

Email us at outreach@excitonscience.com