# Scorpio Technology NEWSLETTER

## INSIDE THIS ISSUE



### TEACHER CONFERENCES & WORKSHOPS

Scorpio is attending or supports these Design & Technology teacher activities:

**DATTA QLD - 4-5/06/2021 National & State Conference, Brisbane**
**DATTA AUSTRALIA** – 11-17/10/2021 Design & Technologies Week Theme: "*Developing Creative Problem Solvers*"
**iTE** – 24-26/12/2021 Technology Education Conference, Sydney
**DATTA VIC** – 2-3/12/2021 Conference

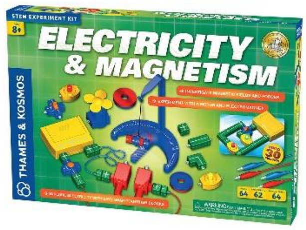
## WELCOME

Welcome to our newest e-newsletter bringing you real information that you can use in your classroom.

We're here to support you, however we can. Contact us at (03) 9802 9913 or email us at sales@scorpiotechnology.com.au

## PRIMARY STEM: ELECTRICITY AND MAGNETISM

Electricity and magnetism are two exciting topics with so much scope for all levels of the Primary curriculum.




- Includes easy to follow page full colour experiment manual.
- Ages 8+

**Electricity & Magnetism STEM kit** (Code: SN620417)

- 60+ hand-on experiments with electric circuils and magnetic contraptions.
- Easy to use snap-together blocks and components.
- Discover series & parallel circuits, switches, motor, magnetic materials, magnetic poles and fields and more.

## TIME

One of the most difficult concepts to teach children is time, so anything to make this concept come alive is always helpful. Making a clock at the end of a Time Unit is a great conclusion to the topic. Clock making also can encompass mathematics concepts such as angles and measuring. Did you know that even numeral placement provides great Mathematics teaching opportunities?

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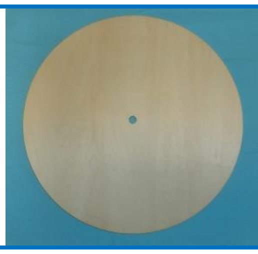
|  |  |  |
| **Cd Clock** (Code: CDCLOCK) | **LP Clock** (Code: LPCLOCK) | **Clock Face –** 25cm Diameter - Plywood (Code: CLPLYF) |

**How do I know where to place the numerals on my clock face?**
There are a number of ways to determine the placement of numerals including:

a) Prepare a dial template. You can find examples on the web or make one yourself.

**LEARN TO MAKE, MAKE TO LEARN**

*"Say and do something positive that will help the situation; it doesn't take any brains to complain."*
***Robert Hooke – Scientist (1635 – 1703)***

b) Use a compass to draw a circle the size of your clock face. Use a ruler to draw a small mark at 12 o'clock, 3 o'clock and 6 o'clock. Use the ruler to measure the distance between the centre of the 12 and the 3. Divide the number by three. This is the distance between each number on the clock face.
c) Use a protractor to determine the degrees. 12 o'clock is at 90 degrees. There are 30 degrees between each numeral.
d) Place all clock hands at 12 o'clock. Move the minute hand (longest hand) around the clock face. Mark the place the hour hand stops when the minute hand reaches the 12 o'clock position. Continue until all positions are marked.
e) A clock face and numerals can be designed using a wide range of techniques and skills. There are no rules stating that you must use numerals.

**Click on link:** https://www.scorpiotechnology.com.au/catalogues

## PRODUCTS: EXPERIMENTING WITH HOOKE (SEE FEATURE ARTICLE)

| | | |
|---|---|---|
|  |  |  |
| **Multi Spring Hooke's Law Apparatus**<br>Code: PH0323SP3<br>A more sophisticated apparatus to demonstrate Hooke's Law. | **Helical Spring & Mass Set**<br>Code: PH0325<br>Consists of 20cm steel spring and several masses, all with hooks on both ends. Used to demonstrate Hooke's Law. | **Elastics Materials Kit**<br>Code: PH0324<br>Contains various materials such as springs and wire to provide for class experiments to explore "elasticity". |
|  |  |  |
| **Hooke's Law Springs – Proportional – Set of 6**<br>Code: HL1918-101<br>Set of 6 springs with diameters and lengths in convenient ratios to one another, suitable for experiments relating to Hooke's Law. | **Set of Springs - Set of 6**<br>Code: AR1010140-2<br><br>**Set of Springs - Set of 12**<br>Code: AR1010140-3<br>Useful in the study of the characteristics of springs and Hooke's Law. | **Wire Testing Clamp with Wing Nut Fixings**<br>Code: PH0327WT<br>Great for physics experimentation such as testing breaking strain and strength of wire. Suitable for testing fine ductile materials such as nylon, elastic bands, human hair. *(**NOTE**: Weights not included)* |

**Click on link:** https://www.scorpiotechnology.com.au/catalogues

## PRIMARY AND SECONDARY:

## Victorian Model Solar Vehicle Challenge

### Registration is open for MSVC 2021

Message from Clint Steele, VMSVC Chair,

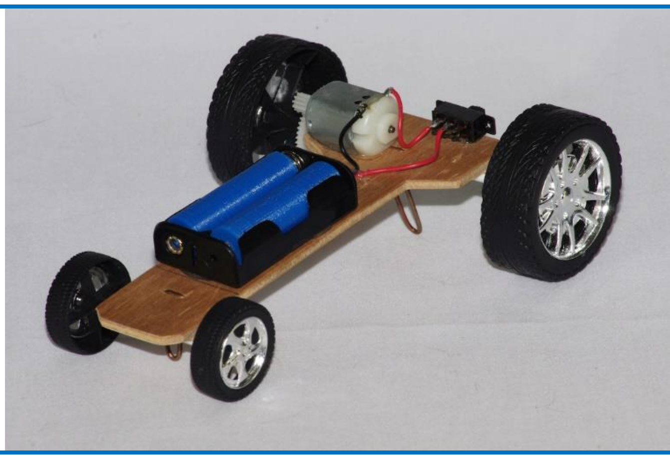
- You can now register for the competition. You need not pay yet nor confirm the specific teams you will enter. You can simply register that you plan to attend. You can do this on the home page - https://www.modelsolar.org.au/home.
- MSVC will be organising an **Applied Mathematics PD session at ScienceWorks** before the event.
- There will be an **online information session** about how to best participate in the event. This is more for people new to the event, but it might be of interest to people who have been involved for a while.
- In an effort to more schools involved, we have set up a **grant for first time schools**. Please share this with anyone you know who has not yet gotten involved and wants a **STEM project** - https://www.modelsolar.org.au/the-challenge/first-timer-grant
- Contact for Clint Steele VMSVC Chair at csteele@modelsolar.org.au

## SECONDARY:

## This Month's Q&A Technology Tips: Dragster

The DRAGSTER: it is a very useful Mechanical-Electrical kit, which lends itself to many applications.

- It can be used to teach (apart from construction and soldering techniques) a variety of subjects: e.g. Speed vs acceleration, gearing, materials.
- It can be a major project for year 7 or 8, but it can also be used as an end of year filler.
- The students can race DRAGSTERS to test speed and gear ratios. Learning needs some fun!



**Q. Size and design posibilities for the DRAGSTER.**

**A.** We don't provide the dimensions for many of our kits' platforms to encourage student involvement in the Design Process.

- Consider component orientation and placement (for example turning battery holders at 90 degrees to conventional allows a different size or shape).
- The main restriction to making a Dragster too wide is the steel axle, on which a gear and two wheels are mounted on – anything narrower is fine.
- Get creative! There are no reasons why the entire class can't make the Dragsters look (looking) different, but still performing the same" The Dragster allows wedges, triangles, wing shaped, F1 designs etc. You may like your students to "patent" a shape, to encourage them to not copy each other.
- Why not try a different wheel configuration instead of the suggested one?
- Suitable materials for the base include: plywood, balsa, acrylic, aluminium sheet.

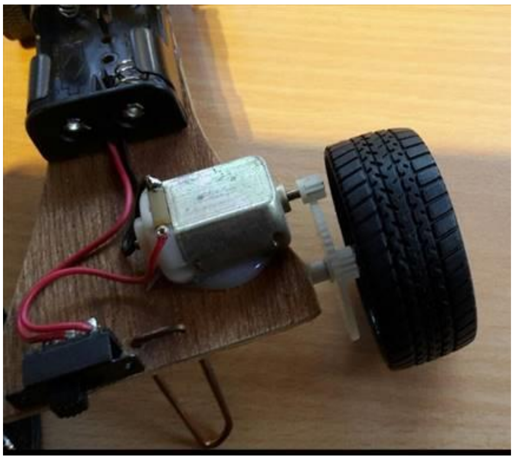
- 3D printers, vacuum formers, milling machines or laser cutters can be used.

**Q. Is it necessary to include the hooks on the Dragster model and then use the fishing guide line or can it be successfully raced without them?**

**A.** The use of fishing line and guide hooks is recommended, as – when racing 2 cars – it keeps both running straight. The axles must be parallel, but if they aren't, the car can head off on an angle and won't necessarily get to the other end of the corridor. Experiment and see what happens without the fishing guide line.

**Q. How can we experiment with different gear ratios?**

**A.** The DRAGSTER is provided with a choice of 8, 10 and 12 Tooth (shortened to T) pinion gears (motor shaft) and a 50 T and 60 T spur gear for the axle. This means that before making the device, the students learn about gearing, speed and acceleration etc., so that they can select which gear combination to use (if they're racing down a certain length track they work out the best combination for that).



- The DRAGSTER has a direct drive system that makes it go fast.
- As the DRAGSTER can only use one pinion and one spur gear at a time, the other gears remain as "spares", which can be used to try other combinations. If you want to experiment with different ratios, what you could do is to make up one of each gear combination, and then test / time the various cars over e.g. 5m track, 7.5m then 10m track etc. and observe the difference that gearing and distance make.
- To change gears on a DRAGSTER, the motor needs to move each time, as the diameter / radius of each gear is different. The gears are 0.5mm, so:

  For example a 60 T spur gear is 30mm diameter/15mm radius, whereas the 50 T is 25mm diameter / 12.5mm radius. So to change the gear in that case the motor needs to be moved 2.5mm in one direction.

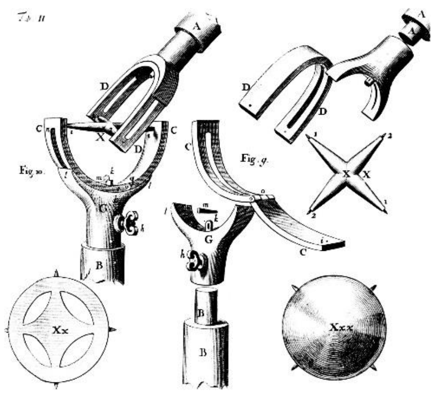
  For example the 10 T pinion is 5mm d/ 2.5mm radius, and the 12 T is 6mm d /3mm radius – a difference of 0.5mm
- Assuming that each student will make up the DRAGSTER:

  With the 60 T spur and try that with each of the 3 pinions. Then replace the 60 T with the 50 T and do the same – i.e. try that with each of the 3 pinions. (Codes: GEAR50/10/2.4, GEAR60/10/2.4).

  If you want spares to give each student, those 3 pinions are the gears to order – the 8T, 10T, 12T with the 1.9mm holes (Codes: GEAR8/1.9, GEAR8/1.9 and GEAR12/1.9).

# A MAN OF MANY TALENTS - ROBERT HOOKE (1635 – 1703)

Article written by Alex Kapoyanis



*Engraving of a universal joint invented by Robert Hooke to allow directional movement of astronomical instruments; from Hooke's A Description of Helioscopes (1676).*

In 1996, British historian of science, Allan Chapman, gave a speech to the Royal Institution of Great Britain titled “Britain’s Leonardo: Robert Hooke and the Art of Experiment in Restoration England”. Robert Hooke was a man of many talents and an exceptional experimental scientist. His interests, experimentation and work crossed over not only multiple science disciplines (physics, biology, chemistry, geology and astronomy), but also into other areas such as architecture, art, mechanics (flying machines, toys, clocks), languages (Greek and Latin), and maths (geometry).

As a sickly young child who was home schooled by his father, his talents as an artist were recognised and which he utilised by drawing incredibly detailed diagrams, including those for new clock mechanisms. As an adult he would use his artistic skill to provide detailed drawings for his record of observations in his 1665 published book “Micrographia”, documenting his observations made using the compound microscope he developed. The word “cell”, as the basic unit of an organism, was first penned by Hooke in this famous work.


*“**Progress**”, Oil painting by Rita Greer, history painter, 2011. Shows Hooke at a bench, surrounded by his microscope, book with working drawings, a spring, universal joint, etc. The three windows show his pillar (The Monument), wind turbines and the shuttle. (Wikimedia Commons).*

Hooke worked as an assistant to Irish-English chemist Robert Boyle, studying the properties of gases (Boyle’s Law). Although a version of an air pump already existed, the vacuum chamber air pump that Hooke constructed for Boyle is essentially a modern air pump. His time working with Boyle would influence some of his work on springs and the elasticity of objects.

***“The Reason of making Experiments is, for the Discovery of the Method of Nature, in its Progress and Operations.”***

**Robert Hooke (1635 – 1703)**

***University Teacher, Physicist, Experimental scientist, Astronomer, Architect***

Following the Great Fire of London in 1666, Hooke was hired by the City of London as a Surveyor and assisted the great architect Sir Christopher Wren, in designing the rebuild of the city. His works include the Monument, Royal Greenwich Observatory, and the dome of St. Paul's Cathedral. The Monument is of particular interest, in that when it was completed in 1677, it allowed Hooke to use it as a gigantic telescope (albeit short lived due to the vibrations from London's heavy traffic), with an underground laboratory where Hooke could conduct scientific experiments.

Hooke worked on multiple ideas at the same time and often did not develop these further. It was not inconceivable, then, that other scientists adopted and developed Hooke's initial ideas into comprehensive theories. Hooke would frequently enter into bitter disputes with some of his follow scientist by accusing them of either stealing his ideas or failing to properly acknowledge him in their papers. One of his most bitter disputes was with Isaac Newton. Another dispute was with Dutchman Christiaan Huygens.

Robert Hooke was a remarkable man. His work included making two improvements to the pendulum clock by inventing the anchor escapement and using a spiral spring to control the balance (he is believed to have invented the balance spring 10 years before Huygens independently invented it). By attaching his balance spring to a balance wheel, regular oscillation was produced, which in turn allowed accurate time keeping in pocket watches.

Hooke invented or improved the following instruments:

- The barometer
- An anemometer, to measure wind speed
- A hygrometer, to measure humidity, using an oat-beard seed which swelled in humid air.
- The universal joint, still used in cars today.
- The Gregorian telescope, which used concave mirrors to magnify the object viewed
- The first screw-divided quadrant
- A 'weather-clock'
- A marine telescope
- An odometer to measure the distance travelled by a wheeled vehicle.
- An 'otocousticon' as an aid to hearing
- A reflecting quadrant
- The anchor escapement inside clocks
- The sprung watch, with the pendulum replaced by a more reliable spring

http://roberthooke.org.uk/

Let us not forget for what Robert Hooke is probably most famous – his *theory of elasticity* – now known as Hooke's Law. Hooke's Law is the basis for the study of stress and strain and can even be applied to simple harmonic oscillators and vibrational oscillations in diatomic molecules.

Hooke's Law basically states that the force of a spring (or any elastic material) is directly proportional to the amount of compression or elongation (stretching). It is expressed by the equation: $F = -kx$
Where *k* is the force constant (i.e. it reflects the stiffness of the spring).

This is easily demonstrated using springs and weights, or in more advanced demonstrations, using a more sophisticated tensile test of elastic materials. Scorpio Technology offer many products to help demonstrate these to your students – see Products section in this newsletter.

## REFERENCES


- https://phys.org/news/2015-02-law.html
- https://www.britannica.com/biography/Robert-Hooke
- https://www.historic-uk.com/HistoryUK/HistoryofEngland/Dr-Robert-Hooke/
- https://www.engineersedge.com/material_science/hookes_law.htm
- https://mathshistory.st-andrews.ac.uk/Biographies/Hooke/
- https://www.britannica.com/biography/Robert-Boyle
- Image: Photos.com/Jupiterimages
- https://upload.wikimedia.org/wikipedia/commons/c/cb/Robert_Hooke_1635-1703_Engineer.jpg
- http://roberthooke.org.uk