

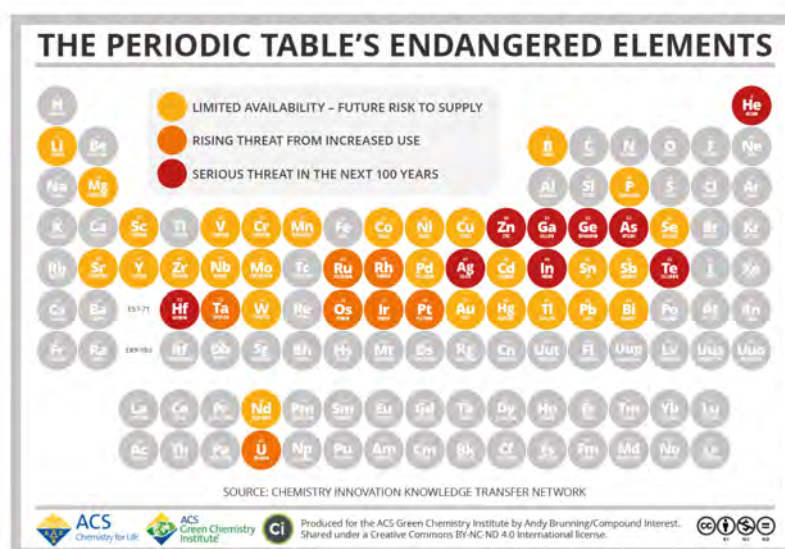
Suggested STICE Activities for the classroom

(not an exhaustive list...)

SSN STICE Symposium

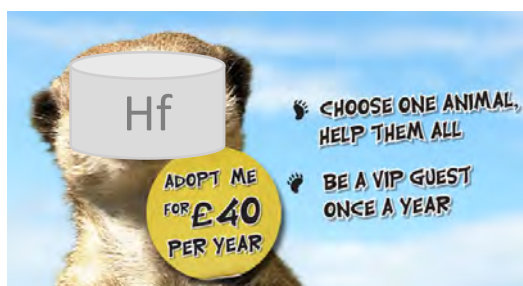
Endangered Elements

- Why are they endangered?
- Where are they sourced from?
- What are they used for?
- What happens if an element becomes scarce?



Endangered Elements

- Adopt an Endangered Element campaign



Endangered Elements

- Periodic Table of Sustainable Elements Chemistry Outreach for Schools
- Australian National Commission for UNESCO 2019 Grant winner

The Periodic Table of Sustainable Elements:

An Outreach Program of school activities for learning and engagement



At this time, we are seeking the involvement of **DEAKIN UNIVERSITY VOLUNTEERS** with an interest in chemistry education and sustainability to help run school outreach activities.

To celebrate the **International Year of the Periodic Table in 2019**



this project involves secondary students participating in hands-on, inquiry-focussed chemistry activities. Students will learn about the relevance of chemistry to sustainability.





The Periodic Table of Sustainable Elements has received grant funding from the Commonwealth Government through the Australian National Commission for UNESCO

Endangered Elements

- Free activity for regional schools in November, 2019
 - *Still recruiting! If you have a colleague at a school in regional Victoria who might be keen, let us know today!*
- Practical activities highlighting elements
 - Aluminium-Air battery
 - Copper crystals growing on Al sheets in agar gel
 - Zinc plating on copper coins
 - Mini-thermite 😊

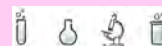
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For further information or to register your interest in involvement, please email Seamus Delaney at s.delaney@deakin.edu.au or call 03 9244 6402.



International Year of the Periodic Table

iypt2019.org

HOME ABOUT ACTIVITIES PARTNERS CONTACT

The International Year of the Periodic Table

A Common Language for Science

The Periodic Table of Chemical Elements is one of the most significant achievements in science, capturing the essence not only of chemistry, but also of physics, medicine, earth sciences and biology.

1869 is considered as the year of discovery of the Periodic System, and Dmitri Mendeleev was a major discoverer. 2019 will be the 150th anniversary of the Periodic Table of Chemical Elements and has therefore been proclaimed the "International Year of the Periodic Table of Chemical Elements (IYPT2019)" by the United Nations General Assembly and UNESCO.

Discover everything about IYPT2019 via this website. Join the celebrations!

[READ MORE](#)

Share your IYPT2019 activities with the world via #IYPT2019 on Instagram, Facebook and Twitter.

facebook.com/IYPT2019
twitter.com/IYPT2019
instagram.com/IYPT2019

International Year of the Periodic Table

RACI: Stories from the Periodic Table



raci
Royal Australian Chemical Institute

The RACI | News | Events & Awards | Jobs & Careers | Education | Members

STORIES FROM THE PERIODIC TABLE

In celebration of the [International Year of the Periodic Table](#) in 2019, The Royal Australian Chemical Institute is sharing personal stories in connection to elements. **The final round of submissions is now open, closing on 30 September.**

Home > International Year of the Periodic Table > Stories from the Periodic Table

Submit a Story from the Periodic Table

Whether it's from your work, studies or just everyday life, the Royal Australian Chemical Institute (RACI) wants to hear of your personal connection to this element. Submissions for the final round are now invited. **Submit your story by 30 September!**

SUBMIT STORY

Connecting chemistry with global issues

Sustainable Development Goals



Connecting chemistry with global issues

- SDG Resources for Educators – UNESCO
- teachSDGs.org
- Worldlargestlesson.globalgoals.org (UNICEF)
- sdgs.org.au
 - Search for Australian examples

UNESCO
Building peace in the minds of men and women

Sustainable Development Goals - Resources for educators

Secondary Education

Pedagogical Resources

- **Responsible Consumption & Production: Why it Matters** - Technical Note presenting SDG 12, what the goal is, what are some of the current consumption and production patterns that need to change, how we can help as a business and how we can help as consumers.
- **Learning and Learning for a Sustainable Future** - "Learning and Learning for a Sustainable Future" is a UNESCO programme for the UN Decade of SDG. It supports professional development for teachers, curriculum developers, education policy-makers, and education actors.
- **Consumer Choice** - The new edition of the Back-to-School kit provides background information and practical exercises for making your students more aware of their consumer choices on: food labelling, advertising and the environmental impact of transport.

Ideas for Classroom Activities

- **Understanding Sustainable Living 1** - This resource aims to:
 - Explain the concept of sustainability;
 - Evaluate lifestyle choices for sustainability using an online ecological footprint calculator to real-life data;
 - Identify actions students can take.
- **Understanding the Challenge of Finite Resources 1** - This resource aims to:
 - Understand the urgent challenge that finite resources pose to our current economic system;
 - Explore economic history since the industrial revolution;
 - Critically evaluate our current consumption and production systems.

Multimedia Educational Resources

- **The Story of Built** - The Story of Built, originally released in December 2007, is a 20-minute, fast-paced, fact-filled look at the underside of our production and consumption patterns. It exposes the connections between environmental and social issues.
- **Re-thinking Progress - The Circular Economy 1** - The Thinking Progress explores how through a change in perspective we can re-design the way our economy works - designing products that can be made again and powering the system with renewable energy.
- **Combating Plastic Pollution With Sustainable Bio-Based Packaging 1** - In this video, FAO highlights the importance of substituting fossil-based with sustainable bio-based food packaging made of agriculture and wood residues. If these are sourced locally, it will also help improve farmers' livelihoods and enhance rural development.

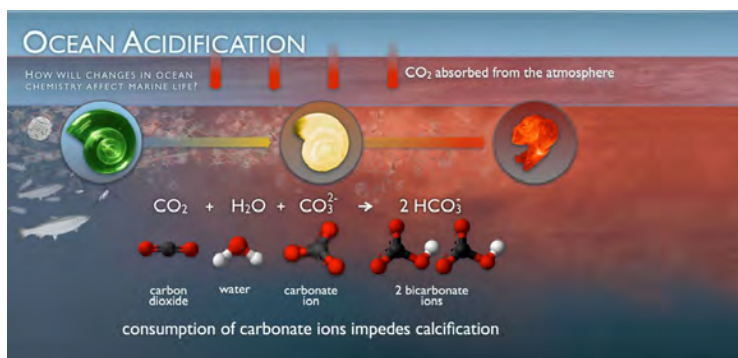
Get Inspired

- **Recycling our waste and reducing our landfill** - **Filmation for Environment Education** - Three years ago it cost us €15,000 a year to pay for waste to go to landfill, now we only spend €3,000 a year. This saved €12,000 a year goes back into the education of the public. Girls are much more aware of recycling/habitat issues than they used to be. Many of them have taken these ideas home and have encouraged their parents to recycle. Most of our waste is being recycled or re-used now.

Connecting chemistry with global issues

Context: Ocean acidification

Content: covalent bonding
Lewis structure
formal charges
equilibrium
pH
solubility of CaCO_3
dynamic processes



<https://www.noaa.gov/education/resource-collections/ocean-coasts-education-resources/ocean-acidification>

Systems thinking / socio-scientific literacy

- Contaminants in water systems
- Unit 2
- Melb High EEI Outcome 3 example

VCE Chemistry Unit 2 Outcome 3

Practical Investigation of a farmland water sample.

Introduction:
In response to increased food demands from within Australia and our trading nations, the Victorian farming community has increased the use of inorganic fertilisers. The unusually heavy seasonal rains along the east coast of Australia have created much runoff to be washed into local waterways and streams carrying with it large quantities of fertiliser. This has resulted in unprecedented concentrations of sulphates, phosphates, nitrates and changes in pH affecting water quality.

A trout farm in a particular location north east of Melbourne has suffered an unexpected mass killing of its fish stock. The trout farmer smells something fishy. It is suspected that runoff from local farmlands may be the cause of the trout deaths. The surrounding farms use a well-known brand of fertiliser rich in ammonium, sulphate and phosphate ions.

The Task: Your task is to work in pairs to chemically analyse the stormwater runoff to determine whether the use of the well-known fertiliser is contributing to the death of trout in the lake. Case time will be allocated to discuss, research and conduct the experiments required to complete this task.

Maintain a log book:
You will be required to maintain a logbook of your investigation, including the preliminary research questions below as well as the various components required to design and perform an experimental analysis of stormwater runoff into the lake.
Note: One logbook per team.

Experimental Design:
Read the relevant sections of your textbook to understand the process and steps required to design an appropriate experiment (or number of experiments) to analyse the water samples provided.
Procedure: (Individual submission)
Present the findings of your experimental investigation in the form of a pamphlet to the local farming community. This pamphlet will cover the main components of an experimental investigation, including aim, hypothesis, an outline of the method, and appropriately presented results. It will also present the conclusions to your investigation.

VCE Chemistry Unit 2 Outcome 3

Preliminary exercise:
Complete the following questions in your logbook:
1. Using the examples listed in the introduction above as a starting point, list the possible pollutants/chemicals found in run-off from farmland waterways.
2. What specific impacts do each of the chemicals you listed in question 1 have on the biosphere of the waterway?
3. For each of the chemicals listed above identify possible analytical methods to determine their presence and concentrations in water samples collected from rural waterways. You notes should cover the analytical techniques described in your logbook.

SULPHATE ION TEST:

Some background information about water quality. Use this information as the starting point of your research.

- If the sulphate concentration in a water source is less than 10 mg/L, it is an indication that the water source is fresh and unpolluted!
- Higher levels of sulphate in any water source can be indicative of some form of pollution.
- Typical pollution sources are mine discharge and effluent return flows, which can contain sulphate concentrations of as high as 500 mg/L!

Water Use	Desired Sulphate as mg/L SO ₄	Maximum concentration, not to be exceeded at any time.
Drinking Water	10	"Alert level to monitor health of aquatic biota populations on an operational basis"
Aquaculture	10	
Freshwater Aquatic Life	750	

Table 1: Summary of Water Quality Guidelines for Sulphates

For protection of ecosystems	For drinking water	For recreation	For agriculture/aquatic
TRIGGER (TRIG) Guidelines for the prevention of eutrophication	No specific guideline necessary	Recreational use can be impacted indirectly through eutrophication effects such as algae blooms.	Phosphorus is generally not an issue in the use of water for agricultural purposes.
Total phosphorus (mg/L) Flow & stream: 0.07 - 0.100 Lakes and reservoirs: 0.005 - 0.020	Phosphorus is generally not an issue in the use of water for drinking.	Primary contact: No specific guideline Secondary contact: No guideline Visual use: Protection of ecosystems guidelines.	Phosphorus is generally not an issue in the use of water for agricultural purposes.
Reactive phosphorus (mg/L) Estuaries: 0.005 - 0.020 Coastal waters: 0.001 - 0.010			Lowest: No specific guideline

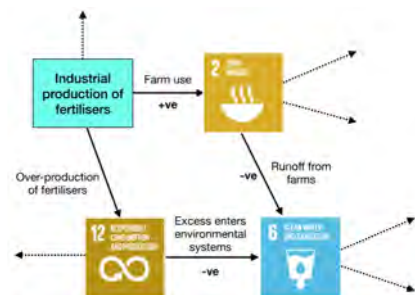
http://www.vic.gov.au/stormwater-log-book/index.php?title=VCE_Chemistry_Unit_2_Outcome_3

Systems thinking / socio-scientific literacy

Pre-activity

Consider the context of the use of fertilisers in the local farmland community in this assignment.

- Which SDGs do you think relate to this community (you'll be surprised how many 😊)
- For each of the SDGs you identify, is the farming practice...
 - Contributing positively towards that SDG (intended consequence)?
 - Or... contributing negatively towards that SDGs (unintended consequence)?
- Using arrows, draw a **systems map**, to show how these intended and unintended consequences are *interconnected*. Use the example below to start...



Systems thinking / socio-scientific literacy

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(Mahaffy, 2019)

Systems thinking / socio-scientific literacy

Mahaffy (2019, p. 367)

- Conventional v. systems thinking approach emphasising circular nature

Loss of fixed nitrogen from fertilizer production to the environment

Not usually discussed

Develop a simple model to **trace the loss of N atoms through the food chain**, and apply this model to evaluate different strategies based on green chemistry and engineering principles to **minimize matter and energy inefficiencies in critical processes** along the chain

Systems thinking / socio-scientific literacy

Mahaffy (2019, p. 367)

- Conventional v. systems thinking approach emphasising circular nature

Energy considerations

Energy use in the industrial production not usually discussed

Evaluate the claim that 1.8% of global fossil fuel combustion is directed to the industrial synthesis of ammonia (connection to SDG 7)

Systems thinking / socio-scientific literacy

Mahaffy (2019, p. 367)

- Conventional v. systems thinking approach emphasising circular nature

Connections between reactive nitrogen production and global climate change

Global climate change usually receives little more than a passing mention in textbooks, and the link to reactive nitrogen is not explored

Inventory the contribution of nitrous oxide (N₂O) gas to the total radiative forcing of greenhouse gases since the industrial revolution, and **allocate the main sources** from which it enters the environment.

Systems thinking / socio-scientific literacy

- Case study analysis
 - Finite resources
 - Phosphorus

There are 70bn tons of phosphate globally - the five locations with the largest reserves hold almost 60bn tons



The three most populous nations on earth have between 23 to 37 years of reserves left



Phosphate fertiliser 'crisis' threatens world food supply

Use of essential rock phosphate has soared, but scientists fear it could run out within a few decades



▲ Unrefined phosphate in Western Sahara. Photograph: AFP/Getty Images

The world faces an "imminent crisis" in the supply of phosphate, a critical fertiliser that underpins the world's food supply, scientists have warned.

The Guardian, Sept 6, 2019

Systems thinking / socio-scientific literacy

- Case study analysis
 - Value from waste – the new recycling economy
 - Fabrics from waste and recovered material

<https://www.ellenmacarthurfoundation.org/publications/a-new-textiles-economy-redesigning-fashion-future>



Life cycle analysis activities

- What does LCA mean?
- Describe the five stages of an LCA
- For one stage, think about alternatives to reduce waste

Examples: mobile phones
 leather shoes
 nappies



<https://www.stem.org.uk/resources/elibrary/resource/447095/life-cycle-analysis>

https://www.istc.illinois.edu/UserFiles/Servers/Server_427403/File/99-031.pdf

Redesigning plastics

- Video to initiate thinking
 - What is made of plastic?
 - What properties make plastic useful?
 - What properties make plastic problematic?
 - How is plastic made?
 - What happens when we have finished with it?
 - What alternatives are there?

<https://www.ellenmacarthurfoundation.org/our-work/activities/new-plastics-economy>

HOW ARE PLASTICS PRODUCED?

A linear system



DESIGN CHALLENGE

The potato journey



1 Potatoes were grown, then harvested



2 They were taken to a factory where they were baked, sliced and processed.



3 The crisps were baked then put into a bag



4 I bought them at the shop



5 Then I ate them



6 The packet will go to the dump

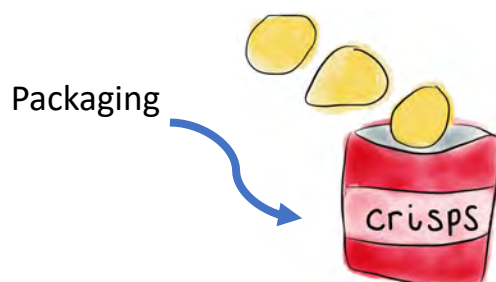


DESIGN CHALLENGE

Small groups, big change



How might we re-design packaging?



Source for more resources.... Soon!

www.eschemistry.org

eschemistry@deakin.edu.au

#eschemistry

#sustainableelements

- Content from this symposium
- School activities
- Teacher resources / teacher PD

