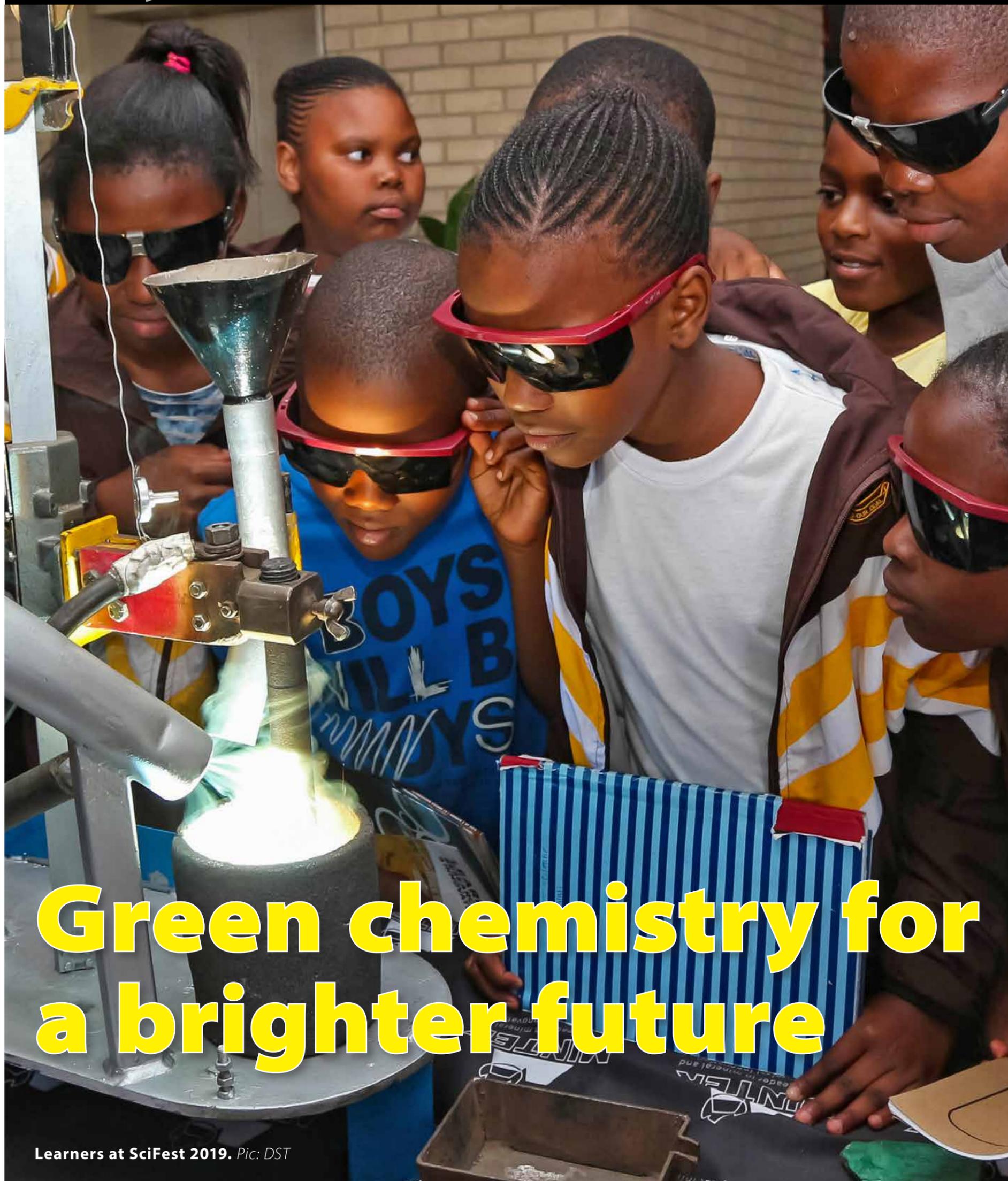


SCIENCE SPAZA SPACE



Knowledge is Ncah!

APRIL 2019



Green chemistry for a brighter future

Learners at SciFest 2019. Pic: DST

Hi Science Spaza clubs! Science and technology has given us the power to improve our everyday lives, but we're also starting to see the side effects of these improvements. This edition of *Spaza Space* focuses on chemistry and how we use it every day of our lives. But you will also find out more about **green chemistry** and how it is transforming an industry. What's new in green chemistry in South Africa? Find out on page 6!

Get excited and win prizes in our upcoming **COMPETITION** to celebrate the international year of the periodic table on page 3, and read the terrifying article about how **plastics are destroying our oceans**. Then, complete the activities in the Save Our Seas worksheet.

Catch up on all the action from **SciFest 2019**, thanks to the Department of Science and Technology, on pages 4 and 5. Finally, check out the cool worksheet and articles on **edible stinkbugs!**

The Science Spaza Team



Spaza Space is the official publication of the Science Spaza programme, which is an initiative of research communication specialists, Jive Media Africa.

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We are talking to our future leaders. Are you?

What is green chemistry?

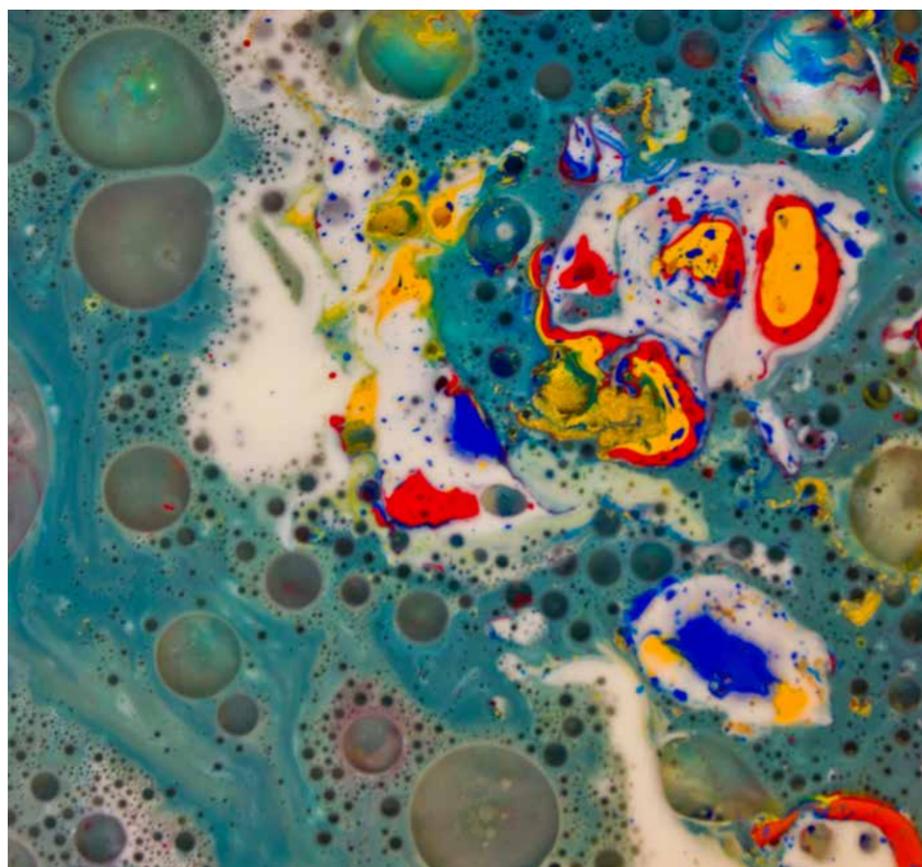
Green chemistry seems to be an oxymoron (those words that go together, but seem to contradict each other, such as "seriously funny"). "Green" is associated with what is ecologically friendly, sustainable and good for the environment, while "chemistry" makes us think of chemical reactions, processes and laboratories where scientists mix strange-looking liquids together and (in cartoons) often seem to end in an explosion.

First, let's explore chemistry... it's the fascinating science that studies substances and matter. For example, what are things really made of (chemical composition), how do they react with each other (chemical reactions), and what new, different products are created?

Chemistry has many practical applications: from making plastic, fertilizer, paint and washing powder, to medication. There is hardly any aspect in our daily lives that is not affected by

So, what is the difference between chemistry and physics?

Have you guys ever wondered what the difference is between chemistry and physics? Physics deals with the physical change of things/matter. Things may change their colour, size, shape or even their state (solid, liquid, gas), but they stay the same when you look in detail (particles). Chemistry deals with substances/matter reacting with each other and making something new or breaking something apart. For example, if you dissolve salt (NaCl) in water (or your food), and the water evaporates, you still have salt (NaCl), though in a different form. So, dissolving



Most paints are damaging to the environment, but a company called Procter and Gamble has replaced the harmful chemicals with a mixture of soya oils and sugar, making them less damaging to the environment. *Pic: Pexels*

chemistry. But making many of these products is a long and costly process, with many reactions and many by-products that may never land on the shelves of the supermarket.

Green chemistry is an idea that's been gaining popularity for nearly 30 years, and its goal is to make chemistry more "green" – yes, more sustainable,

ecologically friendly and less harmful to the environment. Green chemistry is the process of designing chemical products in such a way that they reduce or remove the use or creation of hazardous substances. It can be applied across the entire life cycle of a chemical product, making it better for the environment. It can also be referred to as "sustainable chemistry".



salt (or sugar) in water is simply a physical change. However, if you throw salt (NaCl) in a pool with a little machine (called a chlorinator) that uses electricity and electrolysis to separate the salt (NaCl) into Sodium (Na) and Chlorine (Cl), it is a chemical reaction. Some chemical reactions are happening all by themselves (rusting, for example), but others

need you to add energy to start them off – like our electrolysis example.

TERMS THAT YOU SHOULD KNOW:

Electrolysis – The breakdown of chemicals using an electric current through a liquid or solution that contains ions.

The international year of the periodic table!

The creation of the periodic table of Chemical Elements in 1869 marked one of the most important scientific events in recent history. 2019 celebrates 150 years since the establishment of the periodic table by Russian scientist Dmitri Mendeleev.

EXCITING NEWS! YOU COULD WIN...

Science Spaza has exciting news for our science clubs. You have the chance to WIN Periodic Table T-shirts for yourself and two friends. All you have to do is create a word from the symbols of chemical elements on the periodic table, just like we did to wish all our readers a happy holiday.

1 H Hydrogen 1.008	15 P Phosphorus 30.974	15 P Phosphorus 30.974	39 Y Yttrium 88.906	1 H Hydrogen 1.008	8 O Oxygen 15.999	3 Li Lithium 6.94	66 Dy Dysprosium 162.500	16 S Sulfur 32.06
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You can submit your entries to us via email (info@sciencespaza.org) or WhatsApp (076 173 7130). We will then upload your entries onto Facebook for other Science Spaza members to vote on, and once a winner has been chosen, we will print your message on T-shirts for you and your friends! You will also be featured in our next edition of *Spaza Space!* Good luck!

Plastic is suffocating our oceans

Earth is called the “blue planet” due to its massive oceans that stretch between the continents, making it look blue from outer space. All our rivers lead to the ocean, and those rivers bring lots of our litter with them. Most of the litter is plastic, resulting in a huge plastic problem in the ocean. Plastic is a human-made, artificial, synthetic product and not a natural product; therefore, it does not break down or rot like paper or wood. Plastic is also produced in huge quantities, using oil – which is a non-renewable resource

– and lots of energy. A plastic bag gets used for an average of 12 minutes, but takes hundreds of years to break down. Let’s think about all those chip packets, takeaway boxes, straws and plastic bottles that we use every week. *Can you figure out your plastic footprint by taking note of how much plastic you are throwing away?*

Plastic pollution is a real environmental concern, and there are great ideas on how all of us can do our bit to help our environment. Prevention is the key! Let’s REDUCE by saying

“no” to plastic where possible, even if you just say “no” to the plastic bag or the straw in the

shop, RESTORE what is broken, REUSE those plastic bottles and don’t forget to RECYCLE!



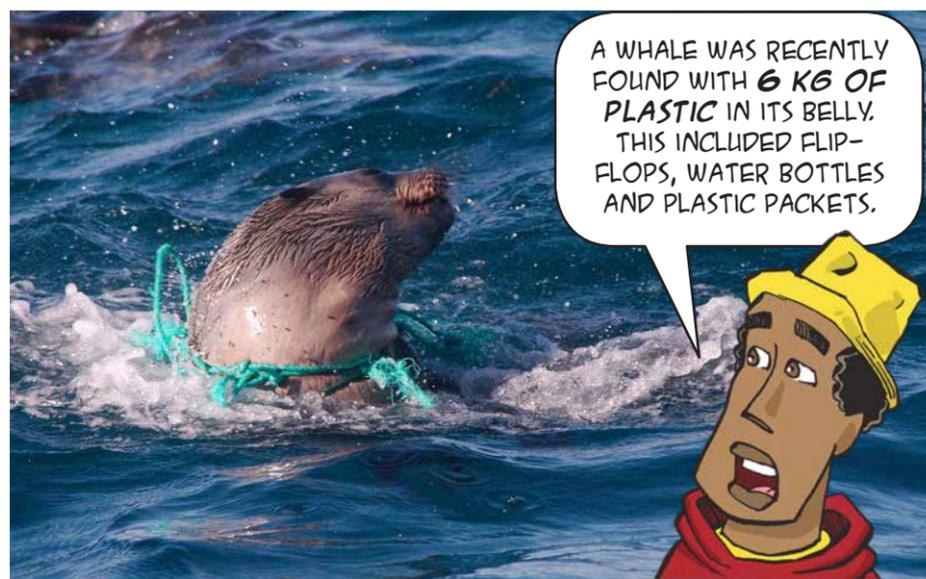
Plastic pollution litters a beach. Pic: Flickr/vaidehi shah

Green chemistry to the rescue!

Green chemistry comes into action to help us with reducing our pollution, for example, using corn and sugar cane to make plastic that will break down easily. Plastic is recycled to make new plastic, or, if we have to use new resources (petrochemicals/oil), companies are now adding substances that help to break down the plastic more easily. There is a Mexican company making plastic out of avocado pips, and

another company making plastic bottles out of algae! Plastic is a huge problem in the oceans, and is threatening the wildlife and the base for our own survival. It is encouraging to see that politicians, NGOs and companies are working together to find a solution. What is your school doing about plastic?

Right: A seal becomes distressed by a piece of plastic around its neck. Pic: Max Pixel



SciFest Africa remains a firm favourite

The science extravaganza, now in its 23rd year, was held under the theme “Discover your element”, in celebration of the international year of the periodic table of chemical elements, as proclaimed by the United Nations.



Learners at SciFest 2019. Pic: DST

SciFest Africa serves as one of the Department of Science and Technology’s (DST’s) key science engagement platforms. The six-day event makes science accessible to learners, parents and the public from across the country. It provides a platform for young scientists, both local and international, to engage with the youth and inspire them to embark on careers in science, technology, engineering and mathematics (STEM).

The theme also celebrated several anniversaries in the history of chemistry, including 350 years since the discovery of phosphorus in 1669, the categorisation of 33 elements by Antoine Lavoisier in 1789, Döbereiner’s Law of Triads of 1829, and the 150th anniversary of the periodic table’s creation by Dmitri Mendeleev in 1869.

SciFest Africa manager, Pumza Tshebe, said they hope the 2019 theme will inspire young people, when thinking about their future careers, to consider the endless opportunities that exist in the field

of science. SciFest attracts tens of thousands of learners annually.

Lunga Nkosi, the silver medallist in the Science Communication category of the Eskom Expo for Young Scientists competition, presented an exciting paper on sharks, entitled ‘Sustainable Shark Barrier’, during the 2019 instalment of SciFest Africa. The grade 10 learner from Höerskool Bergvlam in Mpumalanga began developing an innovative shark barrier after noticing how the fear of sharks prevented people from enjoying their visits to the beach.

“The aim of this investigation was to develop a device that would reduce shark encounters in an effective way and guarantee safety to beachgoers, without causing harm to marine animals, and using an inexpensive and sustainable measure,” explained Nkosi. Her solar shark barrier makes use of an electromagnetic field and a rechargeable battery source to repel sharks within its detection range. The system has been tested numerous times, showing favourable

results. Nkosi thrilled learners during the SciFest opening event, held on 6 March 2019.

“The science awareness engagements this week will not only awaken interest in science, but also demonstrate the impact of science, technology and innovation on our everyday lives,” said Dr Daniel Adams, the DST’s acting Deputy Director-General: Research Development and Support.

Dr Adams, who opened this year’s event, encouraged learners to pursue mathematics and science, as these are gateway subjects that will open up various careers to them in the STEM fields. “SciFest’s diverse set of activities and experiences

will help to change the all-too-persistent perception that science is beyond most of us, and meant only for a select few. I am confident that over this week, visitors to SciFest Africa will enjoy a rich programme that reveals not only the impact and relevance of science in society, but also its beauty and fun,” added Dr Adams.

The festival proved to be a real eye-opener for many learners who were attending for the first time. Aviwe Dzingwe was amazed to discover that snake venom can be used for medicinal purposes. “I regarded snakes as enemies to humans, and thought that they should be avoided at all costs, but the lesson learnt today has changed my attitude towards snakes,” said Dzingwe.

PUZZLE YOUR MIND

FIND THE LISTED WORDS IN THE PUZZLE BLOCK, AND DRAW A RING AROUND EACH WORD. **THE WORDS RUN IN ALL DIRECTIONS, SO LOOK CAREFULLY!**

- BARRIER
- BATTERY
- ELECTROMAGNETIC
- RECHARGEABLE
- SCIFEST
- SHARKS
- SUSTAINABLE



C	S	D	D	V	G	X	E	A	W	Y	R	T	E	S
I	S	C	U	W	N	S	Z	C	T	R	I	Q	L	W
T	X	X	I	V	O	A	O	K	R	J	A	E	W	K
E	E	O	O	F	J	I	E	O	D	V	L	H	M	S
N	J	F	P	Z	E	U	O	B	O	B	W	I	Y	B
G	R	H	W	D	S	S	R	M	A	Y	K	I	W	A
A	J	U	O	C	D	G	T	E	Z	T	Q	P	N	R
M	I	M	V	Z	U	R	G	R	Q	Q	Y	S	G	R
O	W	I	Q	H	K	R	Z	V	I	B	W	I	Z	I
R	T	H	F	E	A	U	J	Q	A	G	R	T	P	E
T	D	A	W	H	U	Q	Q	T	F	B	K	Q	K	R
C	C	O	C	S	U	S	T	A	I	N	A	B	L	E
E	O	E	Q	T	B	E	S	K	R	A	H	S	W	Q
L	R	L	I	N	R	K	Z	F	J	Q	E	E	I	Q
E	Z	B	H	Y	M	F	B	L	V	P	L	P	Q	Y



science
& technology

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

This content was sponsored by the
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Are you ready for the digital age?

The Department of Science and Technology hosted thousands of high school learners from around Rustenburg on Friday 1 March at a science, technology, engineering and mathematics (STEM) career expo.

The exhibition featured over 30 interactive exhibits highlighting various projects in the national system of innovation. The learners had an opportunity to participate in scientific demonstrations and talk to researchers.

The DST regularly hosts such events to inform learners of the various STEM career paths available, and to assist them in deciding which courses to take after school. The exhibition teemed with curious learners, who engaged with exhibitors about science fields such as radio astronomy, forensic science and tissue engineering.

Exhibitors from organisations such as the South African Radio Astronomy Observatory, the South African Weather Service, the South African Police Service, the South African Agency for Science and Technology Advancement, the Council for Scientific and Industrial Research, and the Tshwane University of Technology's Centre for Tissue Engineering were kept on their toes as grade 12 learners bombarded them with queries.

The Minister of Science and Technology, Mmamoloko Kubayi-

Ngubane, encouraged the learners to engage with exhibitors and to study subjects that they are passionate about. The minister herself described what the department was doing in the nanosatellite sphere. "South Africa has a problem with fires, which destroy property, and nanosatellites, such as ZACUBE, provide early warnings of wildfires so that disaster management teams can respond before the fires cause too much damage," said the minister.

The minister also urged learners to read about the Fourth Industrial Revolution (FIR), which would be driven by the youth. "South Africa needs critical skills in data science and machine learning, so that computer programmes and algorithms can be used to solve problems."

The mayor of Rustenburg local municipality, Mpho Khunou, echoed the minister's sentiments, and advised young people to prepare for the FIR, as South Africa needs young people to be at the forefront of the new digital age. "The FIR represents entirely new ways in which technology becomes embedded within societies," said the mayor, going on to explain that South Africa needs scientists to thrive and respond to new ways of doing things.

Galaletsang Bantsijang of Sunrise View Secondary School said she felt privileged to have been part of the event, and was looking forward to pursuing a medical engineering



Minister of the Department of Science and Technology, Mmamoloko Kubayi-Ngubane with learners at the Rustenburg Career Expo 2019. Pic: DST



Learners at Rustenburg Career Expo 2019. Pic: DST

degree at the University of the Witwatersrand next year. Another inspired learner, 18-year-old Seleke Gadihele from Boitekong Secondary School, planned to give back to her community by becoming a maths and life sciences teacher. The energetic learner was excited to receive information about the Funza Lushaka bursary programme, and was hopeful that she would be

able to study at the University of Pretoria.

The Funza Lushaka programme promotes teaching as a profession, and enables eligible students to complete teaching qualifications in national priority subjects. After graduation, bursary recipients are required to teach at a public school for the same number of years for which they received the bursary.

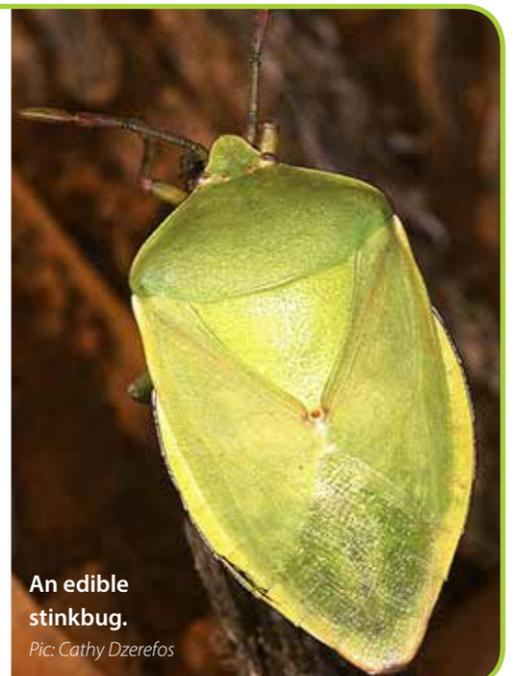
Would you like to work with insects?

Insect farming is a growing industry. Developed nations like Japan, the Netherlands and the United States of America are farming insects as mini-livestock, because they are an efficient protein source to produce, have high nutrient value and can be used to improve future food security.

South Africa has a rich history of using many different edible insects, which are considered by many as a cultural delicacy. Advertising has influenced us to perceive insects as disease-carriers and crop-destroyers; however, it is important to learn about the positive impact of insects on people's health and the economy. Insects play a large role in food security, nutrition, pollination, soil enrichment and the green economy.

There are various career paths in the insect industry. Check them out in our **Stinkbugs** worksheet!

This work is based on the research supported by the National Research Foundation. The Grantholder acknowledges that opinions, findings and conclusions or recommendations expressed in any publication generated by the NRF-supported research are those of the author(s), and that the NRF accepts no liability whatsoever in this regard.



An edible stinkbug.

Pic: Cathy Dzerefos

Lubricants keep the world turning...



but at what cost?

Oil pollutes a river. Pic: Wikipedia/ Kallol Mustafa

Have you ever thought about what keeps the engine gears in our cars or the compressor in your fridge turning? Lubricants are slippery substances that quite literally keep the world turning, but often leave behind a very big environmental footprint.

Common lubricants include oil or grease, and have bases that are made up of mineral or petroleum oils. These types of lubricants need to be replaced quite often, therefore generating large amounts of waste that is harmful to our environment.

Researchers at the Catalysis Center for Energy Innovation (CCEI), which is headed by the University of Delaware, are working towards a solution for decreasing the amount of waste

that is generated by lubricants. This is being done by creating lubricants using a base oil that is renewable and originates from materials such as wood, grass and other sustainable organic waste items and raw materials that are abundantly available. These researchers hope to eventually minimize the carbon footprint that lubricants are leaving behind.

However, there is still a long way to go.

How is green chemistry keeping our country **GREEN**?

The mission and vision of green chemistry is to make chemistry – the process and the product – more energy-efficient and less dangerous, so that, in the long run, it is better for the environment and for us as people. Green chemistry is a relatively young discipline (around since 1991), and is slowly gaining momentum in South Africa. The South

African Chemistry Institute (SACI) has its own division for green chemistry. There are several universities whose chemistry departments focus their research on green chemistry, from analysing environmental data, to developing greener chemistry processes. Dr Nyamori from SACI sees lots of potential for green chemistry in developing

renewable energy. The National Cleaner Production Centre of South Africa is taking part in an exciting initiative from the United Nations Industrial Development Organization (UNIDO) and Yale University's green chemistry centre. The goal of this initiative is to create awareness within the industry, and to develop training programmes to help South Africa

grow the green chemistry sector. Prof. Gengan from Durban University of Technology (DUT) calls green chemistry a “novel philosophical approach” that requires the industry to change their thinking. Watch this space: remarkable things are about to happen!

NEWS FROM THE CLUBS



NETHERLANDS PARK SECONDARY SCHOOL: Awesome learners from our Netherlands Park Secondary School science club starting their science club's 2019 with *Spaza Space*!



ROCK-ET SCIENCE CLUB: The awesome learners from Rock-et Science Club at Borakanelo High School with their *Spaza Space*. This is what they have to say: “The *Spaza Space* newspapers brought the universe closer to our classrooms. Learners were able to see and learn more about visible planets and stars. The Space edition gave learners more information about astronomy in our country and careers. This encouraged them to study hard and smart.”

Science can move heaven and earth

Do you love star-gazing? Then, astronomy might be for you. Which is the closest planet that can support life? Or, are you “down to earth”? Then, you might like to find ways of ensuring food security! How can we end hunger forever? Whether your sights are SET on heaven or earth ... science, engineering or technology (SET) will be a rewarding career choice.

Why science, engineering or technology?

The options are endless. In South Africa, water is scarce and getting scarcer. Everything needs water to survive, and water is a human right. Build your studies and career around making clean water accessible, get your creative juices flowing, and save the country!

Be a computer geek, and pursue a career in IT (Information Technology). Your keyboard moves could programme the world of tomorrow!

Distressed about people suffering from diseases? Pursue a career in medicine and help to discover cures no-one has ever thought of!

How about the buzz words “climate change”? Are you interested in helping to solve this global problem? Studying what our mother ship, Earth, is up to and how she copes with climate change, might make you a famous scientist – and, you could be an Earth-saver!

If animals and plants are your thing, there are millions of organisms to study, and millions

more to discover. Imagine discovering a species that was thought to be extinct. Animal-lovers, bird-chasers or tree-huggers around the world would know your name!

Tired of people complaining about load-shedding? Engineers are the ones who will solve our electricity problems in the future!

Gone are the days when scientists were seen as nerds with white coats and thick-rimmed glasses. And engineers are no longer only big men with hard hats, getting their hands dirty! Scientists and engineers come from all walks of life, and are not constrained by race, gender, wealth, culture or background. Although they work hard, they also play sport, make music or play computer games to relax. Others write bestselling books that can be understood by anyone. Some start successful businesses or use a scientific discovery to change people’s lives.

Did you know that South African scientists and engineers developed a high-tech laser machine that uses advanced manufactured materials to build parts for the Airbus?

What else?

Pursuing a career in science or engineering will make borders invisible. Scientists and engineers throughout the world communicate with each other and even work together on projects. Scientists and engineers are in short supply all over the world, and if you are a high achiever, you could literally go anywhere.

What next?

There is a tool on the internet that can help you pursue a successful career in science or engineering. It provides information on bursaries for studying the sciences and all branches of engineering. You’ll also find info on places to study, possible careers, and stories of successful young people like yourself.

So, what are you waiting for?

Visit <http://www.nstf.org.za/bursary/> – your passport to a bright future in science!

Brought to you by the National Science and Technology Forum (NSTF)

Bursary tips

Find science, engineering and technology bursaries in one place



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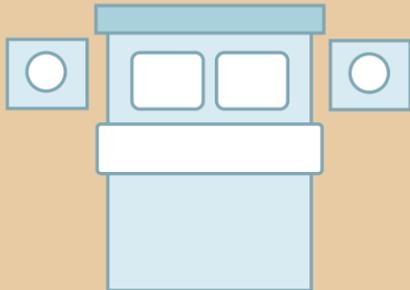
(Green) chemistry in our everyday lives



CHEMISTRY IS NOT ONLY HAPPENING IN FACTORIES WHERE PEOPLE PRODUCE NEW THINGS, BUT ALSO RIGHT INSIDE YOU AND ALL AROUND YOU, IN OUR EVERYDAY LIVES. EVERY TIME YOU COOK OR CLEAN, THERE IS CHEMISTRY IN ACTION. LET'S TAKE A WALK AROUND YOUR HOUSE AND DISCOVER HOW YOU USE CHEMISTRY EVERY DAY!

OUTSIDE

Lead-free paint being used in construction has been a big area for change in green chemistry over the last 20 years. Lead was used in many products, from petrol to paint. However, as it has horrible health consequences, we now have lead-free petrol and lead-free paint.



BEDROOM

Cell phones are great gadgets that help us to communicate, stay in touch with friends and family and chill while listening to our favourite music. But they are only fun while charged. Batteries are small units producing chemical energy. When the battery is flat, we have to plug the phone in to reset/recharge the battery, so that the chemical reaction can happen again. There are now solar chargers available, using the sun's energy to recharge your phone.

BATHROOM

Soap is an amazing chemical product; it combines with fats, but also washes away in water, making it a fantastic substance for cleaning. Washing powder is much more than soap, and has many components. Washing powders are a great example of green chemistry, for example, phosphate content in products is now regulated, because phosphate resulted in eutrophication (too many nutrients) in water. There are many highly concentrated washing powders now available using less packaging, and reducing waste and their carbon footprint.



KITCHEN

Normally, our cells need oxygen to gain energy (respiration), but there is something called "anaerobic reaction", where our cells gain energy through chemical reactions without oxygen. This happens when you do a sprint, and your muscle cells need more energy than your body can provide. The same anaerobic (meaning without oxygen) reactions happen when bacteria and fungi ferment, something that is used in baking bread, making cheese or brewing your own beer.

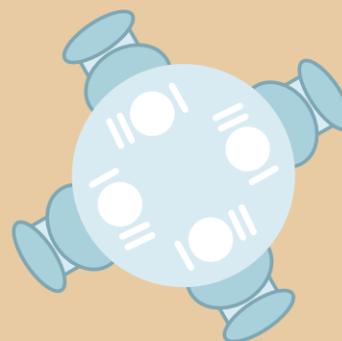
LOUNGE

When you use a fire for cooking or for warming up in winter, burning the wood produces a chemical reaction called combustion. Many gases are set free during burning, so it has become important for factories that burn things to have filters to reduce air pollution.



DINING ROOM

There are a whole lot of chemical reactions happening inside you, each time you eat something (digestion). Through digestion, our food is breaking down into fats (lipids), proteins and carbohydrates/sugars, which help our bodies to grow and stay strong and healthy.



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SCIENCE SPAZA APPLICATION FORM

Complete the form below and send it to PO Box 22106, Mayor's Walk, 3208, email: info@sciencespaza.org or submit your application online at www.sciencespaza.org

Name of school: _____	To be filled in by responsible adult (parent/teacher)
Municipality: _____	Name: _____
Province: _____	Surname: _____
Name of your science club: _____	Position: _____
Name of contact person: _____	ID Number: _____
Telephone number: _____	Signature (parent/teacher): _____
Email address: _____	_____
Postal address: _____	_____
_____	Date: _____

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