SCIENCE RENDEZVOUS KINGSTON 2016

SATURDAY MAY 7, 2016
10:00AM to 3:00PM
The Rogers K-ROCK Centre
& The Tragically Hip Way

Program & Schedule and Science Experiments to Do at Home

Welcome

Queen's University | Community Outreach Centre

Faculty of Education
Duncan McArthur Hall, Room A342
511 Union Street, Queen's University
Kingston, ON K7M 5R7
educ.queensu.ca/coc

Welcome to ***Science Rendezvous Kingston 2016,*** the flagship event for our city's celebration of *Science Odyssey*—a ten-day tribute to science, technology, engineering and mathematics (STEM), designated by Science and Technology Canada and the Natural Sciences and Engineering Research Council (**NSERC**). *Science Odyssey* is a collaborative event geared to engage and inspire Canadians of all ages with accomplishments and activities in STEM.

This is Kingston's 6th annual ***Science Rendezvous*!** Every year, we strive to bring new features and displays to our exciting program to ensure that each one of our visitors—new or returning—has an exciting encounter with any and all branches of STEM including medicine, biology, physics, environmental science, kinesiology, chemistry and mathematics and has the privilege and opportunity to meet and talk to the Researchers/Ambassadors who have dedicated their professional (and often personal) lives to the study of that field.

What's new and exciting? LOTS! Come check out *The Mathematics Midway* funded by **NSERC's PromoScience** program and ride our square-wheeled tricycles, solve the pentomino and Tower or Hanoi puzzles and get creative with the ancient Tangram geometry puzzle. Enter the Quarantine Tent: a novel street theatre event that allows visitors to meet people transported from the past who have vaccine-preventable diseases. The actors will talk to passersby about how so-called childhood diseases affected families and communities in an era before vaccines. Meet Nobel Laureate Dr. Art McDonald and *Students on Ice* superstar, Will Sanderson (Sydenham H.S.). Plan your day wisely so that you can attend the *Chemistry Magic Show,* watch the Birds of Prey and Kingston Police Force Canine unit demonstrations on The Tragically Hip Way, learn the art of resuscitation, sterilize your cell phone, measure your heart health, go into a bat cave, meet Ontario's endangered salamanders, and…participate in 55 other interactive stations hosted by Faculty members, graduate and undergraduate students, citizen scientists and organizational volunteers from Queen's, The Royal Military College of Canada, St. Lawrence College and STEM groups from across southeastern Ontario.

Our purpose today is to excite learners of all ages by showcasing the many interesting and important places that STEM education may lead. Each one of our research and citizen scientists is both a mentor and member of our community.

How fortunate are the citizens of Kingston to be treated to the country's largest STEM celebration? So, may I take this opportunity, on behalf of the greater Kingston community, to extend a HUGE and SINCERE thank you to the 350 STEM enthusiasts and professionals who are here today to share their passion for and commitment to STEM and plant some seeds of wonder. May those seeds take root, grow and blossom.

Professor, Faculty of Education,
Founder of Science Rendezvous Kingston and
Coordinator, Queen's Education Community Outreach Centre

SCIENCE RENDEZVOUS KINGSTON 2016

WHAT?	WHERE?	WHEN?
Chemistry Magic Show *Dr. Phillip Jessop and The Queen's Chemistry Graduate Student Society*	Inside the Rogers K-ROCK Centre Mini-Bowl	10:30 a.m. and 1:30 p.m.
Birds of Prey *James Cowan and Celebrities from the Canadian Raptor Conservancy (Bald Eagle, Great Horned Own, Vulture, Falcon and Hawk)*	Outside on The Tragically Hip Way	11:00 a.m. and 2:00 p.m.
Lasers: from nanotech to epic movies *Dr. James Fraser (Queen's, Physics)*	Inside the Rogers K-ROCK Centre Mini-Bowl	11:30 a.m.
The Sudbury Neutrino Observatory: Observing Massive Neutrinos from the Sun *Dr. Arthur McDonald*	Inside the Rogers K-ROCK Centre Mini-Bowl	Noon
Kingston Police Force Canine Unit *Officers Jeff Dickson and Zeus & Mark McCreary and Titan*	Outside on The Tragically Hip Way (weather permitting)	1:00 p.m.
Will Sanderson (Sydenham SS) Arctic and Antarctic Expedition Member with *Students on Ice and Global Vision*	Inside the Rogers K-ROCK Centre Mini-Bowl	2:30 p.m.

SCHEDULE OF EVENTS

What's New!

Dr. Arthur McDonald

The Sudbury Neutrino Observatory was created by an international scientific collaboration to study neutrinos produced in the core of the sun, with little radioactive background in this detector the size of a ten story building, 2 km underground. The cosmic rays that produce the northern lights were stopped by the rock above the detector and the whole laboratory was operated as an ultra -clean room to eliminate local radioactivity. With this detector it was possible to observe that neutrinos change from one flavour to another, requiring that they have a rest mass greater than zero.

Professor Emeritus Arthur McDonald from the Department of Physics, Engineering Physics and Astronomy is the co-winner of the 2015 Nobel Prize in physics.

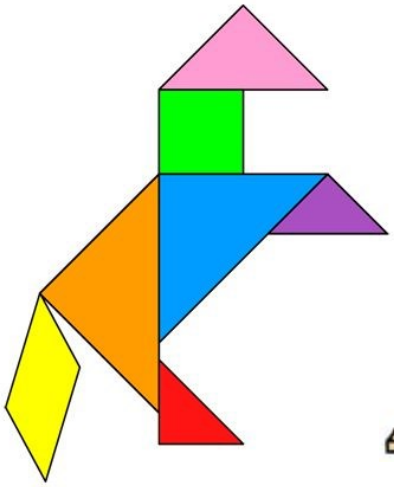
Dr. McDonald won the prestigious award alongside Takaaki Kajita. The royal Swedish Academy of Sciences in Stockholm said the award was presented "for their key contributions to the experiments which demonstrated that neutrinos change identities."

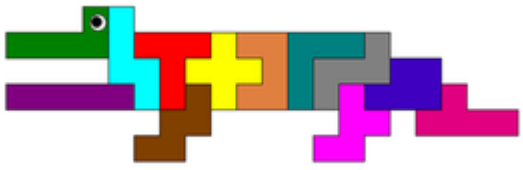
Dr. McDonald will present at NOON in the Mini-Bowl.

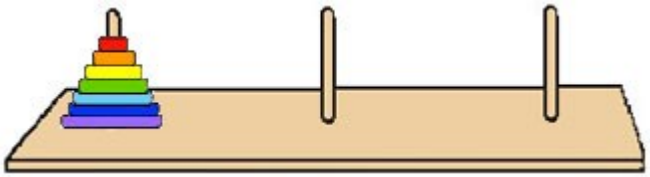
Queen's University | Community Outreach Centre

NSERC CRSNG promo Science

THE MATHEMATICS MIDWAY







Visit Canada's first **Mathematics Midway** (funded by NSERC Promoscience and Science Odyssey) and presented by The Education Community Outreach Centre at Queen's). Come and ride a square-wheeled tricycle on our special roadway! The ride is smoother than you think! Thanks to the 18 APPSCI 100 students from Queen's Faculty of Engineering and Applied Science for designing and building the trikes and to Simon Smith for overseeing the construction of our inverted catenary trail!

All day in the bowl

Try to solve tangram and pentomino puzzles and challenge yourself with the ancient Tower of Hanoi puzzle.

Best of all...take home your own puzzles to continue the fun with friends and family at the kitchen table!

What's New This Year!

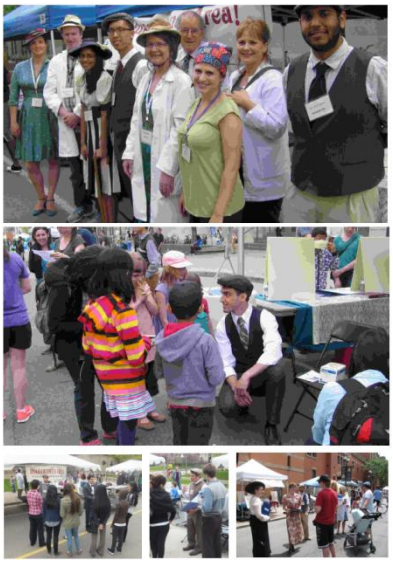
What's New This Year!

The Raptor Conservancy:

Science Rendezvous Kingston 2016 welcomes James Cowan from the Canadian Raptor Conservancy, an organization dedicated to education about the important role of birds of prey in our world. James is joined today by a Great Horned Owl, a Bald Eagle, Vulture, Hawk and Falcon. You can meet these magnificent birds and learn about the organization's efforts to restore endangered species, support breeding facilities, care for ill and injured birds and control bird populations at airports, industrial sites and landfills.

The Quarantine Tent:

The Quarantine Tent is an exhibit that shows people what life was like before vaccination. The Tent features people dressed-and made-up as disease sufferers, who will describe their condition, the disease's history, and the invention of vaccines. At the Quarantine Tent you will meet a polio "victim" partly paralyzed in childhood as well as "victims "of diphtheria, smallpox, influenza, 1918 flu, and whooping cough. The Tent combines street theatre, history and public health. It was created by science writer Pippa Wysong whose grandfather, Dr. Gordon Bates, was a Canadian public health pioneer. Thanks to the Faculty of Health Science for its support of this feature.



Lasers: from nanotech to epic movies:

We all cheered as Rey, Finn, and Poe laser-blasted their way to safety and triumphed over the First Order, but does the science fiction of light sabres, laser blasters and star killer planets have any connection to science fact? Join Prof. James Fraser and his students to explore the science of everyone's favorite epic star movie and the (sometimes strange) connections to the science world around us. Can a laser beam cut through solid steel? Can you stop light in midflight? Can an entire star's mass be converted into energy and sent through space? Finally, we go beyond all this laser destruction to see how we can use a laser beam to build real 3-D objects.

Will Sanderson Arctic Explorer:

Science Rendezvous Kingston 2016 is proud to present Will Sanderson who has been part of expeditions to the Arctic (Global Vision) and the Antarctic (Students on Ice). Meet our local polar adventurer and learn about his journey to the Antarctic on the centennial of Sir Ernest Shackleton's epic expedition. Hear Will share his experiences taking ice cores and monitoring instruments that measure glacier movements, encountering penguins and much more!

SPECIAL THANKS

Lynda Colgan, Coordinator & *Science Rendezvous* Kingston Founder
Kim Garrett, Coordinator
Chelsea Elliott, Floor Plan
Adrienne Montgomerie, Social Media
Jeffrey Wamboldt, Take-Home & Presenter Packages
Andrew Seal and Sana'a Abu Eid, Take-Home Book
Graham Mathers, Square-Wheeled Tricycle Road Show

Dr. Richard Reznick, Dean, Faculty of Health Sciences
Professor Michael Kawaja, Associate Dean – Life Sciences and Biochemistry

Stephen Peck, General Manager
John Noon, Promotions and Web Director

Lyn Carlotto, General Manager
Nick DeLuco, Assistant General Manager
Simon Van Asseldonk, Coordinator Events Services
Matt Pollard, Events Services
Joe Serson, Operations
Rob Moeys, Operations
Kyle St. Croix, Operations
Andrew Kerslake, Director, Food & Beverage

Jeff Thurlby, Printing Production Coordination
Casandra Asselstine, Graphic Design

Rick Mercer, Host of *The Mercer Report*

Vicky Arnold, Communications Officer, Promotion

Liz Cooper, Event Photographer

VOLUNTEER APPRECIATION

SCIENCE RENDEZVOUS KINGSTON IS MADE POSSIBLE BY OVER 350 VOLUNTEERS FROM QUEEN'S, THE ROYAL MILITARY COLLEGE OF CANADA, ST. LAWRENCE COLLEGE AND THE GREATER KINGSTON COMMUNITY… THANK YOU! YOUR EFFORTS ARE APPRECIATED

VOLUNTEER APPRECIATION

	Thanks to…	Thanks to…	Thanks to…
	**Chemistry Graduate Student Society** Lily Huang Tham Adhikari Josh Clarke Zach Ariki Lacey Reid Lucas Choma Marc-Etienne Berner Sarah Piotroski Marshall Timmermans Ryan Yuan Kyle Bachus	**Chemistry Magic Show** Philip Jessop Mina Narouz Christene Smith Jesse Vanderveen Kelsey Viner Jaddie Ho Jennifer McLeod Andrew Seal	**Department of Physics SNOLab Institute Project** Alivine Kamaha Alex Wright Ian Lam Wheng-Kit Caleb Miller Yan Liu Ted Zhao Sarah Olson Daniel Bartlett Matthew Stukel
	Psychology (Child and Adolescent Development Group) Valerie Kuhlmeier Mark Sabbagh Stanka Fitneva Amanda Rose Hammons Tara Karasewich Amy O'Neill Haykaz Mangardich Nicole Bardikoff Kirsten Quistberg Caitlin Atkinson	**CNS Center for Neuroscience** Dayna Scott Angela Luedke Julia Morris Noor Al Dahhan Ashley Parr Ethan Heming Shelby Thompson Chloe Soutar Christina Ou Yu-Qing Liu	**Community Outreach Math Midway** Graham Favell Alex Buchanan Julian Alexander-Cook Haider Chishty Sean Balsillie Abby Jorgenson Luming Huang Patrick Haynes Cassidy Jantzi Nicholas Girotti Peter Silins Brodie Shannon Peter Revington Cole MioBertolo Alexander Mathers Graham Mathers Liz MacConnachie Frank Pfendt
	Department of Chemical Engineering Barz Research Group Dominik Barz Ali Khazaeli Mahmoud Khademi Merit Barz Melissa Barz Sreeman Myapati	**Biomechanical and Ergonomics Lab (School of Kinesiology)** Tara Diesbourg Amarah Epp-Stobbe Alex Kobetich Raisah Mohamed Nick Romanchuk	**Elbow Lake** Carolyn Bonta Emily Shapiera Sofie Hemprich **Enrichment Unit** Linda Lamoureux Joon Oh
	Faculty of Engineering and Applied Science Connections Scott Compeau	**Innovation Park Nanofabrication Lab** Farouk Azizi Graham Gibson Robert Knobel	**Society for Conservation Biology Kingston Chapter** Brigitte Simmatis Katie Birchard Ange Malevich Jade Goodman Rowan Sandford Ladon
	Laboratory for Percutaneous Surgery, School of Computing Vinyas Harish Brandon Chan Aidan Baksh Zac Baum Christina Yan Grace Underwood Hilary Lia	**Let's Talk Science** Sean George Chloe Hudson Geoff Harrison Colleen Gilhuly Anja Cui Yulun Wu Joy Yin Sarah Abdullah Dima Hijleh Jessica Liu Alana Rangaswamy Tanya Tran	**Clinical Simulation Lab** Kim Garrison Alicia Clark Emily Klaassen Jake Garofalo

VOLUNTEER APPRECIATION

	Thanks to…	Thanks to…
	Chemistry Neda Bavarian Sarah Creber Kaitlin McNeil	**Biology Langlois Lab** Sarah Wallace Valerie Langlois Tash-Lynn Clson Christina Emerton Paisley Thomson Barry Madison
	Civil Engineering Kristine Mattson Yazan Qasrawi Majda El-Jaat Afaf Moumin Daniel Cruz Roxanna Gholami Matthew Beirnes John Kingswood	**Nuclear Slowpoke** Pavel Samuleev Paul Chan Kathy Nielsen Bob Whitehead Tim Nash Mohamed Hussein
	Astronomy and Astrophysics Colin Lewis Ananthan Karunakaran Matt Shultz	**Biology** Carolina Dahmer Barb Zeeb Kassandra Yun Alyssa Eves Logan Morris
	Environmental Sciences Group Dean Morrow	

	Thanks to…	Thanks to…
St. Lawrence College	**Instrumentation & Control Program** Robert Woudsma Jason Murduck Adam Rushton Bonnie Chan	**Energy Systems Program** Steve Lapp Ian Kilborn

Did You Know? The fastest land animal in the world is the Cheetah, clocking a max speed of around 113 km per hour (70 mph).

Did You Know? The largest organ of the human body is the skin.

VOLUNTEER APPRECIATION

	Thanks to…		Thanks to…
3710 CYBER FALCONS KINGSTON ONTARIO	Lydia North Jori Bird Carter Garrah Michelle Pitre Brendan Gillot Matthew Armstrong Dylan Neves Patricia Neves Savannah Wilson	Seeds Grow Food Kingston Area Seed System Initiative	Cate Henderson Kathy Rothermel Dianne Dowling
Information inspiring imagination KINGSTON FRONTENAC PUBLIC LIBRARY YOUR PUBLIC LIBRARY	Emma Alls Anthony Fragomeni Derek Fenlon Brenda MacDonald Elgin Hamilton	KINGSTON POLICE	Constable Jeff Dickson Zeus Constable Mark McCreary Titan Sgt. Paul Doak
KINGSTON FIELD NATURALISTS	Mark Read Polly Aiken (L) Janis Grant	W.A.F.F.L.E.S. 4479 Community Robotics	Christine Bibic Duncan Stevenson Meena Bahsk Aidan Baksh Logan Bibic Anica Bibic Eden Bibic Kaley Bibic Christine Bibic Goran Bibic Griffin Sawchuk Cole Sequillion Michael Allen Sara Byers Ryan Cooper Matthew North Josh Sequillion
MILLER MUSEUM	Mark Badham Noah Frymire Ryan Shannon		
Professional Engineers Ontario Kingston Chapter	Doug Hamilton Jeff Oke Brenden MacKinnon Leila Notash Kazi Haque	*Bringing Canada's healthcare story to life!* MUSEUM OF HEALTH CARE AT KINGSTON	Jenny Stepa Kelly Buckholtz Tabitha Renaud Gael Young
		PumpHouse STEAM MUSEUM	Gordon Robinson Melissa Cruise

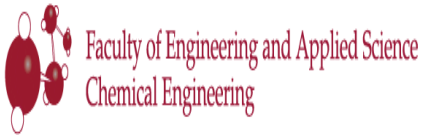
Did You Know? Because of differences in gravity, a 200 pound person would only weigh 76 pounds on Mars.

VOLUNTEER APPRECIATION

	Thanks to…		Thanks to…
Frontenac, Lennox and Addington Science Fair Expo-Sciences de Frontenac, Lennox & Addington	Dave Creber Liz Suriyuth And Young FLASF Scientists	Prince Edward Point Bird Observatory	Peter Fuller Cheryl Anderson Rosemary Kent
King's Town	Kate Beattie Roxanne Garwood Bryan Little Rachel Rooney Tess Fraser Ava Simpson Simon Rooney David Patterson Gryffin Litle Inés de Bettignes Stella Koven	LEAHURST COLLEGE AETERNUM EXCELLERE	Elizabeth Turche Jen Rees Robert Chatelain Brad Pronovost Charlotte Tessier Jesse Straight Hana Turcke Josh Sequillion Madison Massari Emily Crawford Lucas Olmsted Meena Baksh Eden Bibic Logan Bibic Anica Bibic Cole Sequillion Isabel Therrin Sophia Minder Stephane Gagnon Eila Bergeron Caroline Whitehead
RIOT Research Information Outreach Team CRI Cancer Research Institute	Piriya Yoganathan Katrina Cristall Catherine Crawford-Brown Carmen Chan Mathieu Crupi Zaid Taha Max Niit Stephanie Guy	epilepsy ontario	Claire Notman Melanie Seaward Debra Swan
Save the STS Salamanders	Matt Ellerbeck Kenny Ruelland Clint Alexander	Queen's University Faculty of Health Sciences University of Toronto Dalla Lana School of Public Health	Pippa Wysong Max Chouinard Michael Anderson, MD Gemma Woticky Nilita Sood Danchen Wu Janelle Zhan TJ Colby Hall Chris Rutty
Heart & Stroke Foundation Queen's University	Melinda Knox Karen Logan Leigh Cameron Chloe Hudson	Firefly Adventures	Walt Sepic
MacLachlan Woodworking Museum	Tom Riddolls	Bricks 4 Kidz we learn, we build, we play with LEGO® Bricks	Colleen Brick

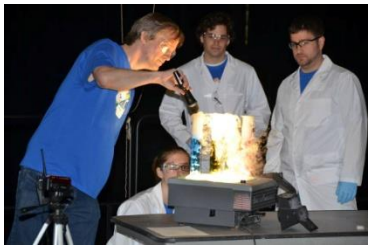
PRESENTATIONS, DEMONSTRATIONS, HANDS-ON ACTIVITIES, MAKE & TAKE WORKSHOPS

Activities by Queen's University Faculty, Students & Staff

Who we are…	What you'll be doing at our station…	Thanks to…
SKHS School of Kinesiology and Health Studies Biomechanics Ergonomics Lab http://www.skhs.queensu.ca/ergbio/	**Biomechanics at the Circus:** Have you ever wondered how the tricks and stunts performed by your favorite circus performers are accomplished? We can help explain it with biomechanics! How does a tightrope walker keep from falling off the high wire? How does a strongman lift such a heavy weight without dropping it? You will find all of these answers and more at our booth!	Tara Diesbourg PhD Candidate
 http://neuroscience.queensu.ca/	Get inside your brain and find out how it works! Come and talk to some neuroscientists and learn about some tools we use to study the brain. From behaviour to cells, come learn how we can take information from our surrounding environment, process information in our brains, and turn that into an appropriate response. Come and see all the fun, hands on activities we have on how to study brain functioning!	Dayna Scott Research Assistant
 http://www.chemeng.queensu.ca/people/Faculty/DominikBarz/	Hands on experiments on power generation. Turn lemons into batteries and build your own electrolyser.	Dominik Barz, PhD, Assistant Professor, Chemical and Mechanical Engineering

Did you know? Tangrams can be arranged into many different shapes, such as a person or dog, and can be put together in an infinite number of combinations, and since the 1800s, there has been over 6500 documented, different tangram puzzle arrangements.

Activities by Queen's University Faculty, Students & Staff

Who we are…	What you'll be doing at our station…	Thanks to…
Queen's Chemistry JESSOP GROUP QUEEN'S UNIVERSITY http://faculty.chem.queensu.ca/people/faculty/Jessop/	Dr. Philip Jessop and his team of chemistry magicians will dazzle and amaze you. You'll wonder *How did they do that?* as you see glowing pickles, Genie in a bottle, Elephant toothpaste, Flour fireball, Non-burning paper towel, and Flaming snowball appear before your eyes at **The Chemistry Magic Show.** 	Dr. Philip Jessop, Professor and Canada Research Chair in Green Chemistry
Queen's Chemistry http://faculty.chem.queensu.ca/grad/	Learn about chemistry, the science of matter, through hands-on activities including ph indicator, silly putty, and bubbles.	Lily Huang, PhD Candidate
HEART & STROKE FOUNDATION Queen's UNIVERSITY http://www.heartandstroke.com/	**Play for a healthy heart:** Your heart health started before you were born (it starts in the womb!) and having a healthy ticker will be important your whole life! The heart pumps blood through the blood vessels of the circulatory system, which provides our bodies with oxygen and nutrients, and eliminates waste. It is a vital organ, which is why we all need to keep it as healthy and strong as possible. Queen's University in partnership with the Heart & Stroke Foundation will present some simple steps you can take to keep your heart healthy.	Melinda Knox, Coordinator, Research Activities and Communications

Did You Know? The Tower of Hanoi puzzle was originally designed and sold as a toy by the French mathematician Edouard Lucas in 1883.

Activities by Queen's University Faculty, Students & Staff

Who we are…	What you'll be doing at our station…	Thanks to…
CHILD and ADOLESCENT DEVELOPMENT Queen's University http://www.queensu.ca/psychology/index.html	**What are you thinking?** Come and play a game that is only possible by using the frontal lobe of the brain – which is one of the areas that takes the longest to development over childhood and adolescence.	Valerie Kuhlmeier, Associate Professor, Infant Cognition Group
ELBOW LAKE ENVIRONMENTAL EDUCATION CENTRE http://elbowlakecentre.ca/	In our fast-paced world, we often overlook the other life that shares our environment. Do you really know your neighbours? Big and small, come meet them all! From the tiniest residents of our water to the largest of our feathered friends soaring overhead, all have stories to share with you. 	Carolyn Bonta Acting Coordinator
Queen's UNIVERSITY Faculty of Engineering and Applied Science http://engineering.queensu.ca/Outreach/	Join us in learning how to program a robot mouse to help navigate its way to finding a cheesy snack. Our hands-on activity introduces children to coding with pictorial direction coding cards, while challenging them to think critically and solve problems.	Scott Compeau Outreach Coordinator, EngConnect
ESU enrichment studies unit http://esu.queensu.ca/	Go beyond with Queen's Enrichment Studies Unit. Come challenge yourself with a variety of exciting critical thinking and problem solving activities.	Linda Lamoureux, Program Coordinator

Activities by Queen's University Faculty, Students & Staff

Who we are…	What you'll be doing at our station…	Thanks to…
Innovation Park Queen's University Kingston Nano-Fabrication Laboratory Queens http://knfl.ca/booked/web/view-schedule.php	Come join the Kingston NanoFabrication Lab for some Nano fun! We'll explore microfluidics, lithography and the world of Nano fabrication! he KNFL is a fabrication facility at Innovation Park available to researchers. CMC Microsystems manages scheduling of the KNFL and offers some financial assistance through the MNT portal	Farouk Azizi, PhD, KNFL Operations Manager CMC Microsystems Graham Gibson, PhD KNFL Lab Engineer CMC Microsystems
Laboratory for Percutaneous Surgery http://perk.cs.queensu.ca/	Come and see the Mobile Image Overlay System (MIOS) and computer-assisted surgery pig! The MIOS is a demonstration of a medical system that allows a user to perform a complex procedure in relation to a pre-operative MRI/CT image. When a user moves the position of the model skull, the CT image on the screen also moves accordingly. Our computer-assisted surgery pig is a simple demo to show how surgical instruments can be tracked in relation to a patient.	Vinyas Harish PhD Candidate
let's talk science inspiring discovery http://outreach.letstalkscience.ca/queensu.html	Come discover some of the amazing properties of light with Let's Talk Science. Investigate how light travels through different materials, make objects disappear, and capture your own rainbows to take home!	Sean George, PhD Candidate, Chemical Engineering Chloe Hudson, MSc Candidate, Clinical Psychology Geoff Harrison, MSc Candidate, Cognitive Studies
Queen's CSC Clinical Simulation Centre http://meds.queensu.ca/education/simulation/	Be a medical student for a while and learn how to resuscitate a non-breathing person. See how residents learn how to do laparoscopic surgery.	Kim Garrison, Operations Manager

Activities by Queen's University Faculty, Students & Staff

Who we are…	What you'll be doing at our station…	Thanks to…
SNOLAB http://www.sno.phy.queensu.ca/group/	**Life at the bottom:** SNOLAB @ Science rendez vous Squeezing paper so hard it explodes! Learn to make your own submarine out of a straw! Seeing the science of sound and many more!!!	Alvine Kamaha PhD Candidate
Society for Conservation Biology Kingston Chapter http://post.queensu.ca/~scb/chapter.htm	**Society for Conservation Biology**: At this station you will learn about cave features and some organisms that call the cave ecosystem their home.	Brigitte Simmatis SCB Co-President

Did You Know? How many times can you fold a piece of paper in half and how thick will it get? Folding a standard piece of paper in half three times will get you about the thickness of a nail. Seven folds will be about the thickness of a notebook of 128 pages. 10 folds and the paper will be about the width of a hand. 23 folds will get you to one kilometer. 30 folds will get you to space: 100 kilometers high. 42 folds will get you to the Moon. With 51 you will burn in the Sun.

Did You Know? The length of your thumb is about the same as that of your nose.

Did You Know? Electric eels can stun both predators and prey with electric shocks of around 500 volts.

Did You Know? If you pour a handful of salt into a full glass of water, the water level will actually go down rather than overflowing the glass.

Activities by Faculty, Students & Staff from The Royal Military College of Canada

Who we are…	What you'll be doing at our station…	Thanks to…
http://www.rmc.ca/aca/phy/rdp/ssr-rss-eng.php	**Astronomy and Astrophysics:** Local astronomers will answer questions about astronomy and astrophysics. We will provide advice and tools that will assist with observing stars and planets in the night sky. Weather permitting, visitors will be able to observe the sun, sunspots and solar prominences using solar telescopes.	Colin Lewis, PhD Candidate, Queen's
http://langlois-lab.com/?lang=en	**Biology:** Visit our 3-D model fish tank to learn how drugs enter the water systems, how they affect fish, and how you can help to protect aquatic ecosystems. Then try to spot the fish/frog/turtle in camouflage activities. Next, learn about turtle, fish, and frog morphology, behavior, and more. Finally, play a trivia frog metamorphosis active game where children will be asked a series of frog-related questions in order to advance to the next stage of frog's metamorphosis.	Valerie Langlois Assistant Professor
http://zeeb-lab.com/lab-members/	**Biology:** Learn about the secret world of mud. Explore the power of plants and plant a pumpkin!	Carolina P. Dashmer MSc. Candidate

Did You Know? A "light year" is a measure of distance, not time. It is defined as the distance light travels in one year. Light moves at a velocity of about 300,000 kilometres each second, so in one year, it travels about 9,500,000,000,000 kilometres.

Activities by Faculty, Students & Staff from The Royal Military College of Canada

Who we are…	What you'll be doing at our station…	Thanks to…
http://zeeb-lab.com/lab-members/	**Chemical Engineering:** Learn how plants can be used to clean up contaminated sites (phytotechnologies). Everyone will be able to plant their own pumpkin to take home and can learn about the importance of worms as bioindicators.	Barbara Zeeb Professor and Canada Research Chair Biotechnologies & Environment
http://www.rmc.ca/aca/cce-cgc/index-eng.php	**Fun with Chemistry:** Chemistry is an exciting science! It helps us learn about the many compounds that surround us, from paints and plastics to foods and medicines. We could also learn about different sources of energy using fun experiments. We will explore various aspects of chemistry with some exciting hands-on activities and demonstrations. Wear some safety glasses and gloves and feel like a real scientist!	Neda Bevarian Chemistry Technologist
http://www.rmc.ca/aca/ce-gc/index-eng.php	**Civil Engineering:** There are three activities for you to do…investigating the effects of loading on bridges; observing how chemicals move through soil; and, creating a landslide or earthquake.	Kristine Mattson Environmental Laboratory Technician

Did You Know? The human heart beats around 100,00 times every day or about 30 million times in a year.

Activities by Faculty, Students & Staff from The Royal Military College of Canada

Who we are…	What you'll be doing at our station…	Thanks to….
http://www.environmentalsciencesgroup.ca/ http://www.weberwetlandlab	**Environmental Sciences Group:** "Green Environmental Science – Cleaning up the Environment Using Natural Resources and Living Organisms" Constructed Wetlands Natural and constructed wetlands can act as a natural filter for removing contaminants from water. Demonstration of how a constructed wetland can be used to remediate or transform contaminants in the environment. Display will include mock wetland with a hands on experiment to showcase real-time the removal of contaminants by wetlands. You can also learn about bioremediation: Bioremediation is the use of plant material (phytoremediation) or other organisms to uptake or transform contaminants. Demonstration of hydroponically grown vegetables to study the uptake of contaminants.	Dean Morrow Project Leader
http://www.rmc.ca/aca/cce-cgc/per/ss-ps/nielsen-ks-eng.php	The "**SLOWPOKE-2**" nuclear reactor at the Royal Military College of Canada (RMCC) became critical in the fall of 1985. The Facility housing the reactor is located in the Department of Chemistry and Chemical Engineering at RMCC. The reactor and associated laboratory equipment are used for the education of undergraduate and postgraduate students, for research and analytical applications, and for training and support of Canadian Armed Forces personnel. Specific capabilities include neutron activation analysis, neutron radioscopy and tomography, gamma spectroscopy, delayed neutron counting and liquid scintillation counting. Staff at RMCC will demonstrate radiation shielding, detection and survey. A model and the use of SLOWPOKE will be presented. A computer game on reactor operation will also be available.	Dr. Pavel Samuleev Research Associate & Katherine Neilson Director of Slowpoke Facility

St. Lawrance College

Who we are…	What you'll be doing at our station…	Thanks to….
St. Lawrence College http://www.stlawrencecollege.ca/	**Energy Systems Engineering Technology (ESET) :** How much power can you produce? Try peddling our recumbent bike and make a light bulb shine!	Steve Lapp, Professor, Energy Systems Engineering
St. Lawrence College http://www.stlawrencecollege.ca/	**Instrumentation & Control program:** There is virtually no product that you consume today that hasn't been produced, purified packaged or delivered to you using instrumentation and control systems. Learn about automation, instrumentation, control systems and robotics all around us. Smartie, the robot, will be there sorting Smarties all day long.	Robert Woudsma, Instrumentation Engineering

Did You Know?If you took all of the DNA in your body and stretched it end to end it would reach from the earth to the sun 4 times!! That's over 1.2 Billion Kilometers!!

Did You Know? The average speed of a sneeze is around 160 km per hour.

Did You Know? Unlike many substances, water expands as it freezes. An ice cube takes up about 9% more volume than the water used to make it.

Activities by Community Organizations & Citizen Scientists

Who we are…	What you'll be doing at our station…	Thanks to…
W.A.F.F.L.E.S. 4479 Community Robotics 3710 CYBER FALCONS KINGSTON ONTARIO http://www.cyberfalcons.com/ http://kbotics.ca/ http://wafflesrobotics.com/	FIRST CANADA **Come and meet the members of two of Kingston's *FIRST ROBOTICS CANADA* teams:** FRONTENAC CYBERFALCONS, THE KCVI K-BOTICS, and W.A.F.F.L.E.S. The robots will engage in play-offs throughout the day at the centre of the bowl.	Lydia North Cyberfalcons Christine Bibic W.A.F.F.L.E.S.
Frontenac, Lennox and Addington Science Fair http://www.flasf.on.ca	**FLASF:** is excited to be invited to this year's Science Rendezvous. We will have an interactive science demonstration area where children and parents can experiment with Science Fair type projects while learning about the scientific process and nurturing an excitement about science. We will bring our Special Award category winners to provide these students with an opportunity to share their amazing projects with the community	Dave Creber Chair FLASF
Seeds Grow Food Kingston Area Seed System Initiative www.providence.ca/**seeds**/ seedsgrowfood.org/	**Kingston Area Seed System Initiative:** Did you know that almost all our food relies on SEEDS? Learn how flowers make seeds with our giant interactive flower models by becoming a bee yourself! What IS a seed? Let's find out!"	Kate Henderson, Professional Horticulturalist

Activities by Community Organizations & Citizen Scientists

Who we are…	What you'll be doing at our station…	Thanks to…
MILLER MUSEUM http://geol.queensu.ca/museum/	**Mapping and Measuring the Earth:** How big is the Earth? How heavy? How round? How high are the mountains and how deep are the oceans? Geologists and physical geographers want to know! See the different ways that we measure and map our planet.	Mark Badham, Curator
Bringing Canada's healthcare story to life! MUSEUM OF HEALTH CARE AT KINGSTON http://www.museumofhealthcare.ca/	**Museum of Healthcare Kingston:** Delve into DNA by exploring traits on a family tree, manipulating a DNA model, and extracting your own DNA from saliva!	Jenny Stepa, Museum Manager and Program Director
 http://www.canadianraptorconservancy.com/	**Canadian Raptor Conservancy:** Come see the birds of prey in action. There will be a hawk, Owl, Falcon, Vulture and Bald Eagle performing for your enjoyment.	James and Shauna Cowan Directors of the Canadian Raptor Conservancy
 http://www.savethesalamanders.com/	**Save The Salamanders/Reptile and Amphibian Advocacy display:** This exhibit will feature harmless live species - both local and exotic	Matt Ellerbeck
bricks 4 kidz we learn, we build, we play with LEGO® Bricks  http://www.bricks4kidz.com/	**Bricks 4 Kidz®:** uses the LEGO bricks that children know and love to teach STEM principles!	Colleen Brick Manager, Education Programs

Activities by Community Organizations & Citizen Scientists

http://www.kfpl.ca/	**KFPL:** Your library is about much more than books! In addition to having the opportunity to borrow some books to inspire your inner scientists, you are invited to see our 3-D printer in action, play a fruit piano and drop by the ***Lego Build*** table..	Emma Alls Children's Programming
https://kpf.ca/	Come and meet Constable Jeff Dickson and his canine partner, Zeus and Constable Mark McCreary with his canine partner, Titan. 	Sgt. Paul Doak Emergency Response Unit
http://www.fireflyadventures.ca/	**Firefly Adventures:** Will be presenting an interactive solar energy display.	Walt Sepic Environmental Educator

Did You Know? Human lungs inhale over two million liters of air every day, without even thinking. Their surface area is large enough to cover one side of a tennis court.

Did You Know? A human red blood cell takes 20s to circulate around the human body.

Activities by Community Organizations & Citizen Scientists

Who we are…	What you'll be doing at our station…	Thanks to…
http://kingstonfieldnaturalists.org/	**KFN Presents… CITIZEN SCIENCE FOR ALL:** It's all the rage. It's plastered across the Internet. It's 'trending' right now. But what is Citizen Science? Visit the Kingston Field Naturalists' display to discover how YOU can make a difference with your everyday sightings of birds, butterflies, bugs and more.	Mark Read Leader
http://www.leahurstcollege.ca/	**Leahurst College:** will be demonstrating static electricity and exploring the mechanics of human motion. We will be building "mechanical" hands with straws and string.Come on over and feel the *energy*!	Elizabeth Turcke, Founder and Head
http://woodworkingmuseum.ca/	**Rediscovering simple machines:** take an in depth look at how woodworking tools can be understood through the six simple machines.	Tom Riddolls, Curator
http://torontoriot.com/	**Uncovering the complexities of cancer:** At this station, you will learn about the hallmarks of cancer, current cancer statistics and probability, recent cancer treatment methods, and recent cancer research progress here in Kingston, and nationally in Canada through interactive, hands-on activities.	Piriya Yoganathan PhD Candidate

Did You Know? Canada has the longest coastline in the world at 243,793 KM long and that the Great Lakes contain 18% of the world's fresh water

Did You Know? When traveling at 80 kilometers per hour, cars use around half of their fuel just to overcome wind resistance.

Activities by Community Organizations & Citizen Scientists

Who we are…	What you'll be doing at our station…	Thanks to…
Professional Engineers Ontario Kingston Chapter http://kingston.peo.on.ca/wordpress/	**The Kingston Chapter of The Professional Engineers of Ontario (PEO):** will set up a booth with displays and hands-on projects to show students how Engineers take scientific principles and develop items that people use. The projects would include building a paper airplane designed to fly a maximum distance, designing a bridge made of drinking straws, masking tape, and paper clips that would carry a pre-determined weight.	Doug Hamilton, P. Eng.
Pump House STEAM MUSEUM http://steammuseum.ca/	**Learning lab H_20:** Come pump it up at our mobile learning lab and learn about the properties and power of water. Our interactive water table and water pumps will delight both young and old.	Gordon Robinson, Curator Melissa Cruise, Museum Assistant
Prince Edward Point Bird Observatory http://www.peptbo.ca/	**Prince Edward Point Bird Observatory:** tracks and bands some of the millions of birds that migrate through our area every spring and fall. What kinds of birds are migrating through? What do they need? Where and when can we see them? How can we help migrating birds? Visit our display and play the Migration Game to help our feathered friends get safely from wintering areas to their summer breeding grounds.	Peter Fuller **PEPtBO** IBA monitoring coordinator
epilepsy ontario http://epilepsyontario.org/	**The Brain and Epilepsy:** Did you know the brain is the control centre of your entire body? Every day our brain sends messages to our body so we can do things like kick at ball or ride a bike. But what happens if those messages get mixed-up? Find out how epilepsy and seizures affect the brain through hands-on games. Play with your brain at Epilepsy South Eastern Ontario's booth! Just look for the BIG brain.	Clare Notman, Education Coordinator

ACTIVITIES, EXPERIMENTS, INFORMATION AND RESOURCES TO TRY AND USE AT HOME

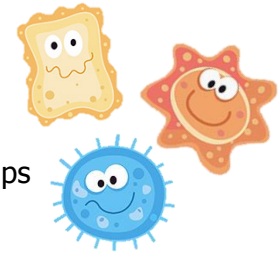
SCIENCE RENDEZVOUS KINGSTON 2016

COMPOST CRITTERS

Phytotechnologies Lab | Royal Military College of Canada

Have you ever recycled something? Well did you know that in nature, plant materials can be recycled too? Over time, dead plants decompose and turn into nutrients that help to feed other plants. You can do this too by composting your own kitchen and garden waste! Many people enjoy making compost piles to help fertilize their plants and aid the environment. Every compost pile is a complex ecosystem of decomposition experts (bacteria and other microbes that live in soil and love to help you compost). These piles can take a long time to make – you may have to wait for several weeks (or longer) for a pile of plant waste to decompose. The experiment below will allow you to explore the process of decomposition and learn how bacteria, other microbes, and worms can help!

What you will need:



1. Compost material
   - ✓ Leaf litter
   - ✓ Fruit and vegetable scraps
   - ✓ Shredded newspaper
   - ✓ Grass clippings
2. Soil (there are bacteria & other microbes living here!)
3. Composting worms!!!
4. Water
5. Two medium containers with lids (eg, pasta sauce jars or tupperware)
6. Marker
7. Sunlight
8. Something sharp to poke holes in your lids

Instructions:

1. Label your containers: "Control" and "Worms"
2. Poke a few holes into the lids (these provide oxygen for your microbes to work!)
3. Collect compost material (fill your containers ½ full)
4. Place soil in each container (¼ full – the soil naturally contains bacteria and other microbes)
5. Add worms to the "Worms" container (1 pound of worms per 1 pound of material)
6. Add enough water to make the compost moist (but not soggy)
7. Close the lids, place in a sunny location, and wait for a few weeks to see what happens
9. Add water to keep the soil moist when necessary!
8. Record the temperature in the containers with a thermometer or notice what is happening to the food every week by taking pictures

Make sure you keep those microbes happy!

Results & Discussion:

- ✓ Do you notice any differences in the two containers?
- ✓ How long did it take for the food to decompose in each container?
- ✓ What is the temperature like in the compost containers? Why?
- ✓ Try this experiment with different combinations of material or add less water to one than the other. What other factors affect decomposition?

Fun Fact!

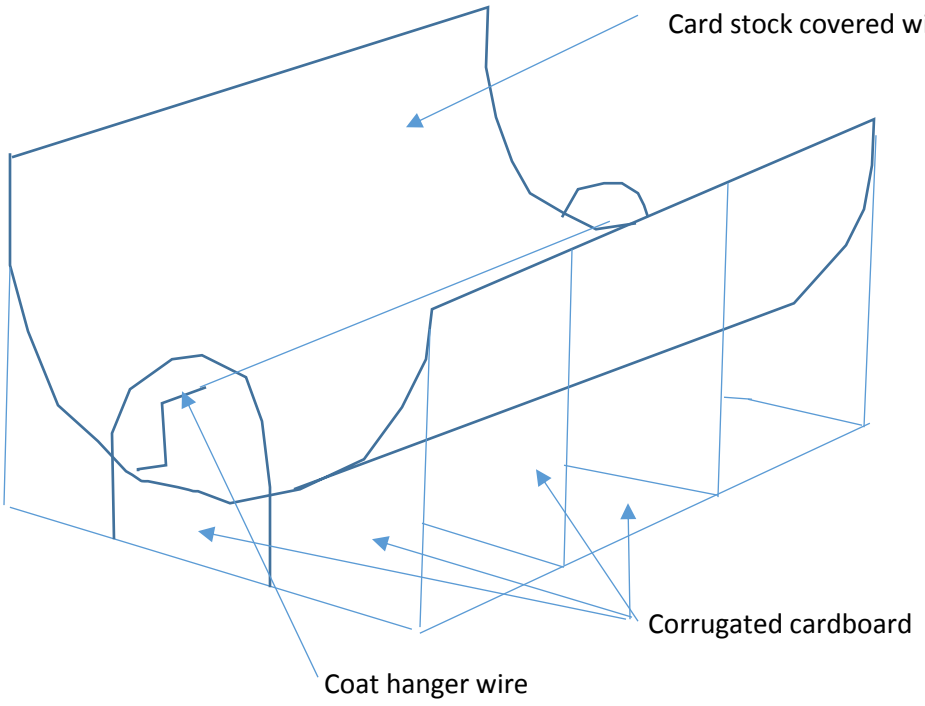
Did you know that approximately 40% of the food we produce in Canada is wasted every year? Some of that food can be recycled into compost, which acts like vitamins for plants! In one teaspoon of compost you can find up to 1 billion bacteria that helped decompose the material in your pile. Composting worms eat half of their own body weight every day and can help us recycle our wasted material into organic matter by aerating the compost pile. You can add this dark, rich, organic matter to plants to help them grow!

Take Home Activity for Science Rendezvous - Adult Supervision Required

Make Your Own Parabolic Solar Reflector

Please ask an adult for help cutting the cardboard pieces and wire. Label all parts clearly ("A", "B", etc.)

Step 1. Trace image "A" four (4) times on good corrugated cardboard and carefully cut out.
Step 2. Do the same for "B", so that you will end up with 4 cardboard cut outs of both "A" and "B".
Step 3. Glue the smaller part "B"s together in pairs, ending up with 2 thicker part "B"s.
Step 4. Punch a hole carefully at point "C" (the dot to the left of the "C") in the two "B" pieces large enough to fit a coat hanger wire. This is the focal point of the reflector.
Step 5. Get help cutting a piece of coat hanger wire (or similar wire) 40 cm long.
Step 6. Carefully cut 6 rectangles of cardboard 7 cm by 10 cm. These are the spacers for the "A" parts.
Step 7. Glue the 2 thick part "B"s in the middle of 2 of the "A" parts with the flat sides down. These will be the outside "A"s that will hold the wire.
Step 8. Keeping the outside "A"s on the ends, tape and glue the 6 spacers vertically between the 4 "A"s keeping the "A"s 7 cm apart. You will end up with a strange but beautiful rectangular cardboard sculpture. To make the it sturdier, tape and glue the sculpture on to a 28 x 30cm cardboard base.
Step 9. Carefully cut a piece of card stock (or cereal box board) 21cm by 30cm. Tape and glue this to the "A" parts while bending it to fit their curve. Place a light weight on it till it dries.
Step 10. Cover the curved surface with tin foil while trying not to 'crinkle' it too much.
Step 11. Make a 90 degree bend in the wire 3cm from an end and then another 90 degree bend in the opposite direction, 6cm from the same end. This will be the handle of the wire so you can turn the hot dog. **The last step.** To use your reflector, slide the long end of the wire through one of the "B" parts and through 2 hot dogs, then into the hole of the other "B". Aim (tilt) the reflector and support it directly facing the sun until the hot dogs are cooked (usually when they 'sweat' and drip).



W.A.F.F.L.E.S. Community Robotics

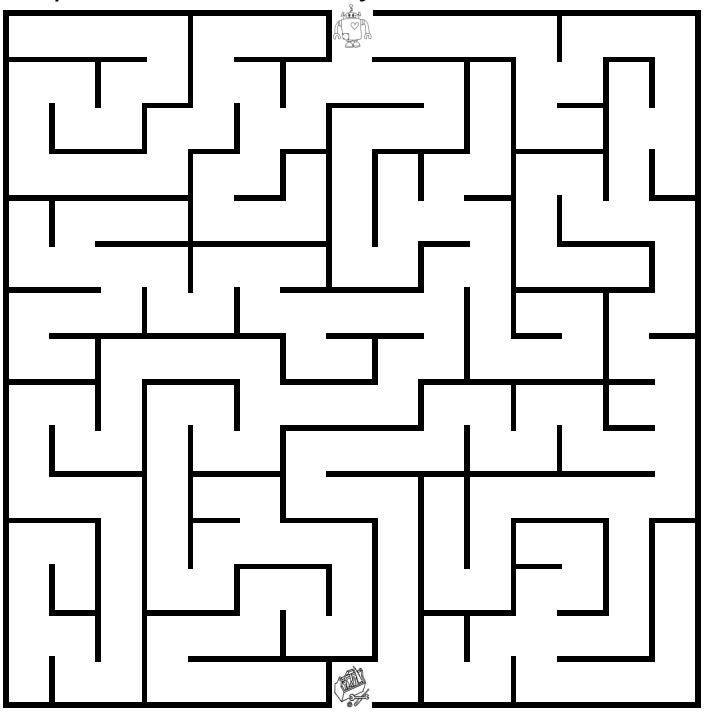
Word Scramble

Unscramble the following robot related words.

SAERG
NOGGRAMRPMI
MLTEA
EHELWS
SSOERN
LBTSO
FNU

Maze

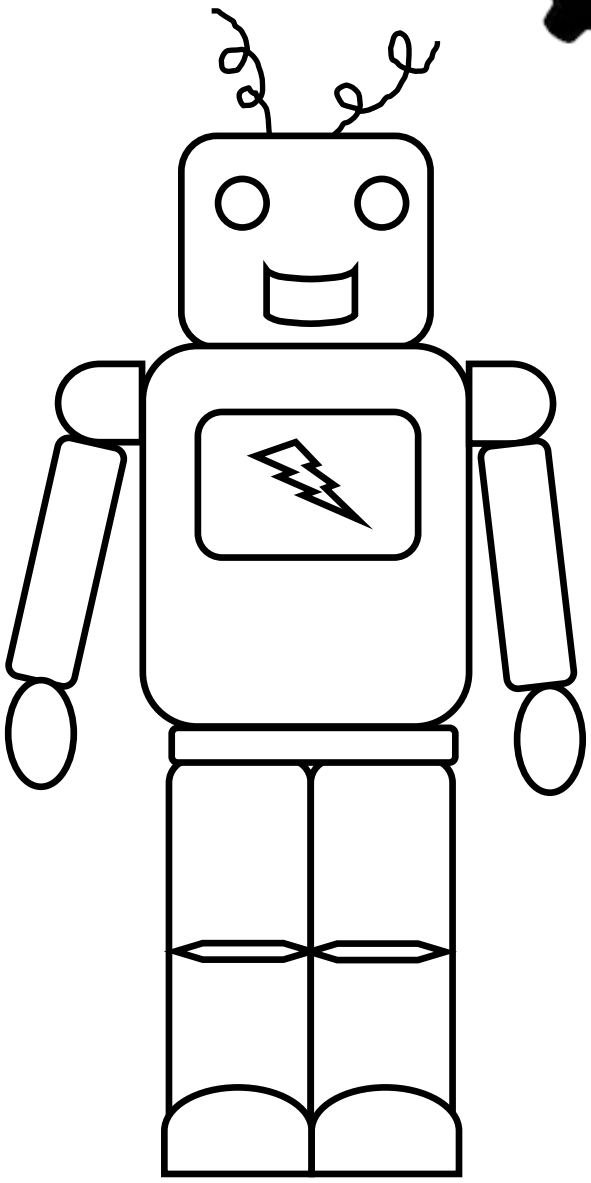
Help the robot find its way to the tool box.

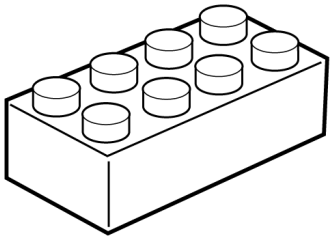


Word Scramble: Gears, Programming, Metal, Wheels, Sensor, Bolts, **Fun Fill In The Blanks:** Team, LEGO, Robotics, Museum, Summer

Colouring

Colour the robot's legs blue, head orange, arms green, and body yellow.





Fill In The Blanks

Everything is cool when you're part of a _____! Find out how to join W.A.F.F.L.E.S. or how to start your own team by visiting our website at **wafflesrobotics.com**. We offer FIRST _____ League programs for ages 6-9 and 9-14 as well as a FIRST _____ Competition team for area high school students. Come build with us at the Pump House Steam _____. Be sure to check out our fun and educational _____ camps as well.

W.A.F.F.L.E.S. Community Robotics is a local non profit group run by volunteers that are passionate about inspiring students in science, technology, engineering, and math. Follow us on Facebook and Twitter. @WAFFLESRobotics www.wafflesrobotics.com

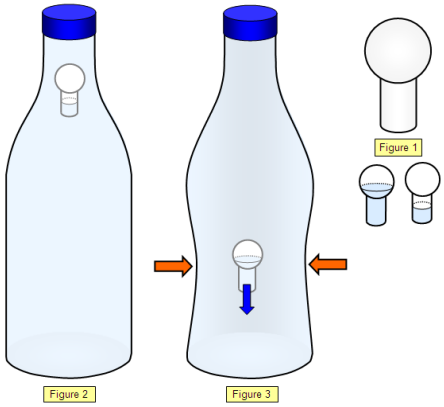
"Jelly" the magical straw diver

Scientifically named a Cartesian diver experiment (after René Descartes), this experiment combines the buoyancy principle and the ideal gas law to make a rigid object (open at one end) float and sink at will inside a water bottle.

This will be a fun way to learn about two key concepts in physics: the buoyancy and the ideal gas law.

Materials:

- An empty & clear plastic soda bottle.
- Water.
- A drinking straw.
- A pair of scissors.
- A split shot sinker.



Instructions:

1. Fill the bottle with water till it is almost full.
2. Use scissors to cut about 2" off the straw.
3. Bend the straw to make a U shape. Ensure that the ends of the folded straw are equal.
4. Use a split shot sinker to clip the two ends of the straw together on the sides that are touching. Leave a space for water to go inside the straw.
5. Drop the straw into the bottle and check if it floats. If it does, your "straw diver" is ready and you can move to step 6. If it does not, repeat step 4 making sure that there is a space for water.
6. Put the cap and close the bottle.
7. Squeeze and release the bottle. When you squeeze the bottle, your straw diver should sink and when you release it, your straw diver should float.

Explanation:

Initially, the straw (diver) floats because its overall density is less than that of the surrounding water. When the bottle is squeezed, the pressure on the water and on the air bubble (originally trapped inside the straw) increases. Water is forced into the straw and compresses the air bubble into a smaller volume. With more water inside the straw, its overall density increases and the straw (diver) sinks once its density becomes higher than that of the surrounding water. When you release the bottle, the air bubble expands to its initial volume and pushes the water out of the straw causing the diver to float.

Reference

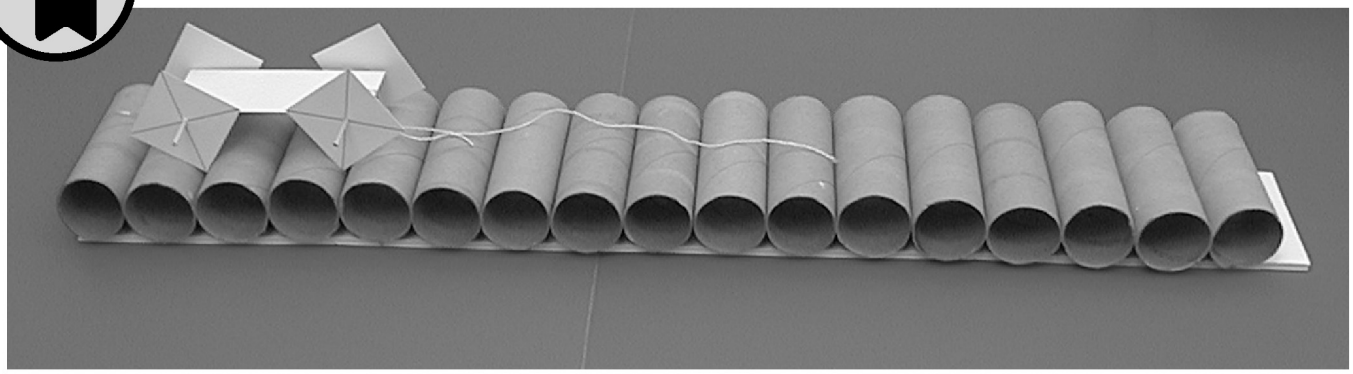
http://www.schoolphysics.co.uk/age11-14/Matter/text/Cartesian_divers/index.html

http://www.physicsexperiment.co.uk/content/diver.html

Square Wheels

You may not be able to put a square peg in a round hole, but you can make a square wheel roll on a round road.

A square wheel will roll smoothly, with its axle at a constant height, on a surface with properly spaced bumps of the right size and shape.



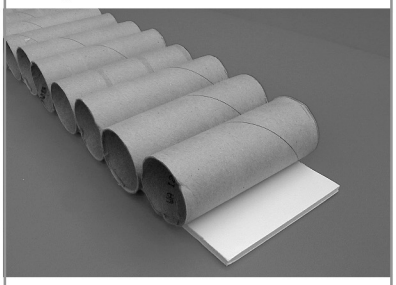
Materials

- hot glue gun and glue sticks
- about 20 cardboard toilet paper tubes (all approximately the same diameter)
- foam core, stiff cardboard, or mat board to serve as a base for the cardboard tubes, about 4 in × 30 in (10 cm × 75 cm)
- ruler
- poster board or mat board, approximately 8 in × 10 in (20 cm × 25 cm)
- pencil or pen
- pushpin
- scissors
- drinking straw
- 2 bamboo skewers
- paper clip
- string, about 12 in (30 cm)

ASSEMBLY

1 Use hot glue to attach a cardboard tube at one end of the base. The length of the tube should be placed across the base, as shown in figure 1.

Figure 1



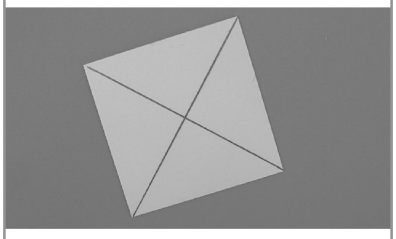
Toilet paper rolls glued to base

2 Continue gluing tubes to the base, with each tube just touching the one before it, until you reach the other end of the base.

3 Measure the diameter of three or four of the cardboard tubes. The diameters should be approximately $1\frac{11}{16}$ inches (4.3 cm). If this is the case, cut four square wheels from the poster board, with sides of 2 inches (5.1 cm). If the tubes you obtain have a significantly different diameter, then make the sides of the square wheels equal to 1.2 times the diameter (see Box o' Math at the end of this snack).

4 Locate the center of each square wheel by drawing two diagonals, as shown in figure 2.

Figure 2



Using diagonals to locate the center of the square wheel

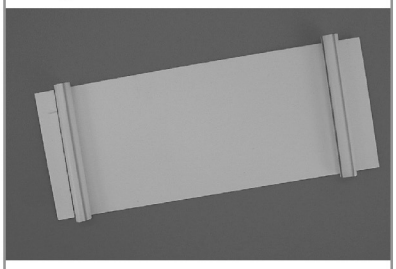
5 Poke a small hole in the center of each square wheel with a pushpin, taking care not to bend or crease the wheel.

6 From the poster board, cut out a 2- × 5-inch (5- × 12-cm) piece for the cart body.

7 Cut two sections of straw, each 2 inches (5 cm) long.

8 Hot glue the straw sections to the rectangular piece of poster board $\frac{3}{8}$ inch (1 cm) from each end, as shown in figure 3. This assembly will be the body of a small cart.

Figure 3

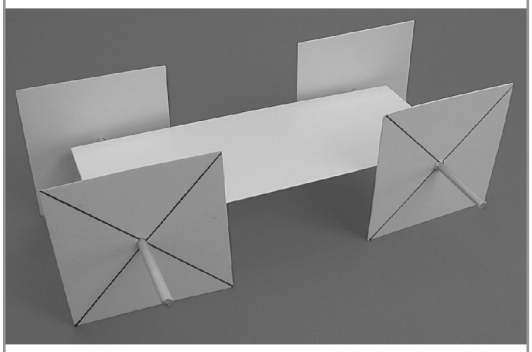


Drinking-straw axle holders

9 Cut the skewers into two 5-inch-long (12-cm) pieces, each with a point at one end. These will be axles. (If you are unable to cut the skewers with the scissors, just break the skewers or cut them with a utility knife.)

10 Slide one of the square wheels onto a skewer until it is about $\frac{3}{4}$ inch (2 cm) from the non-pointed end. Slide the pointed end through the straw, and then slide the other square wheel onto the skewer. Adjust the positions of the wheels so that they are aligned with each other and are fairly close to the edge of the cart. The wheel-and-axle assembly should turn freely in the straws. Assemble the other set of wheels the same way. When all the wheels are on, the cart should look like the one in figure 4.

Figure 4

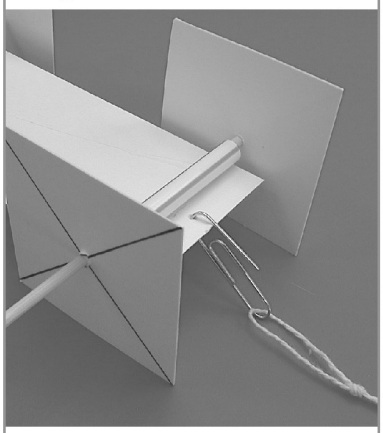


Cart with wheels

11 Use the pushpin to poke a hole in the body of the cart between the straw and one end, equidistant from the edges. Put one end of the paper clip through the hole, and adjust until it is positioned as shown in figure 5.

12 Tie a loop in the end of the string, and place it on the paper clip as shown in figure 5.

Figure 5



Paper clip and string on cart

Helpful Hint

When you place the cart on the road, the wheels on each axle should be aligned with each other, as shown in figure 6. Also, be sure that the wheels are reasonably perpendicular to the axles and are not excessively wobbly. If you have trouble keeping the wheels on the same axle aligned, or if they are too tilted or wobbly, use a small amount of hot glue to hold them in place on the axle.

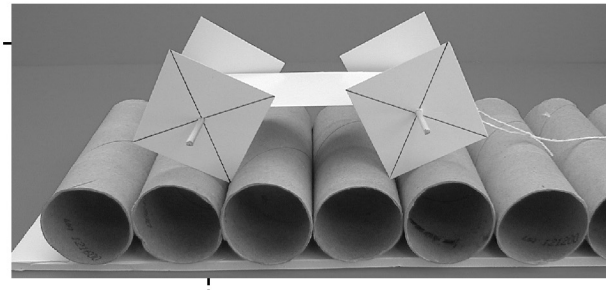


Figure 6 *Square wheels on the rounded road*

To Do and Notice

Place the cart at one end of the cardboard-tube "road" and pull gently on the string so that the cart travels along the road. Notice that the cart rolls along smoothly and that the axles stay at a reasonably constant height.

What's Going On?

The cart rolls smoothly along the bumpy road because the vertical distance from each axle to the horizontal base of the road is always about the same. Each axle moves from a point above a low spot between two tubes (see figure 7) to a point above a high spot on a tube (see figure 8). The increasing height of the point on the circular tube where the tube contacts the wheel is compensated for by the decreasing distance on the wheel between the axle and the edge of the square where it contacts the tube. The same thing happens in reverse as each axle moves from a position above a high spot to a position above a low spot.

A special shape called a *catenary curve* (see Did You Know?), not a circle, is the curve that will give an absolutely level ride with square wheels. A road made with circles is a reasonably close approximation, however, and is easier to build from commonly available materials.

On a flat road, this would be the ultimate exercise bike! Mathematician Stan Wagon was inspired to build his square-wheeled tricycle after seeing the Exploratorium's Square Wheels exhibit.

Figure 7

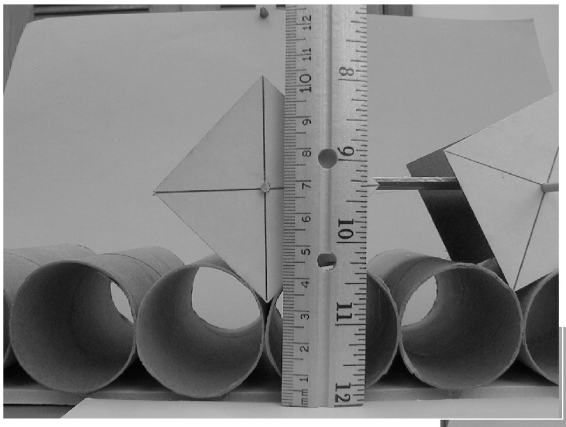
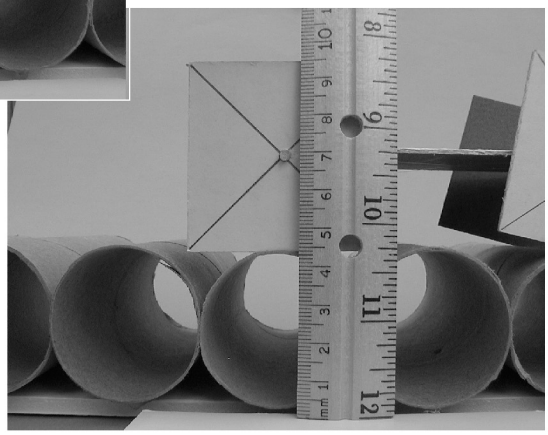


Figure 8



The height of the axle always remains about the same distance from the base (6.8 cm in figure 7 and 6.9 cm in figure 8). In figure 7, the vertical distance between the axle and the bottom of the wheel is maximum; because the wheel is in a depression, however, the remainder of the distance to the base is minimum. In figure 8, the situation is reversed. The vertical distance between the axle and the bottom of the wheel is minimum, but the remainder of the distance to the base is maximum.

So What?

A key problem in designing automobile transmissions involves gear teeth. Gear teeth must mesh together without slipping, because slipping results in frictional wear. In order for gears to mesh smoothly, engineers must design teeth that have matching shapes—a problem that's quite similar to designing the particular bumpy road that will provide a smooth ride for square wheels.

Box o' Math

Calculating Wheel Size

To travel smoothly over the array of tubes, the sides of the square wheels have to be 1.2 times the diameter of the tubes. The equations below explain how this relationship is derived; the diagram shows you how the math applies to the square wheels and the "road." Note that l is the side of the square and d is the diameter of the circle (which represents the tube). The circumference of the tube $= 2\pi r$.

$$\cos 45 = \frac{AC}{AB}, \text{ or } AB = \frac{AC}{\cos 45} = \frac{r}{\cos 45}$$

$$AD = r$$

$$DB = AB - AD = \frac{r}{\cos 45} - r = r\left(\frac{1}{\cos 45} - 1\right) = r\left(\frac{1}{.71} - 1\right) = r(1.41 - 1) = 0.41r$$

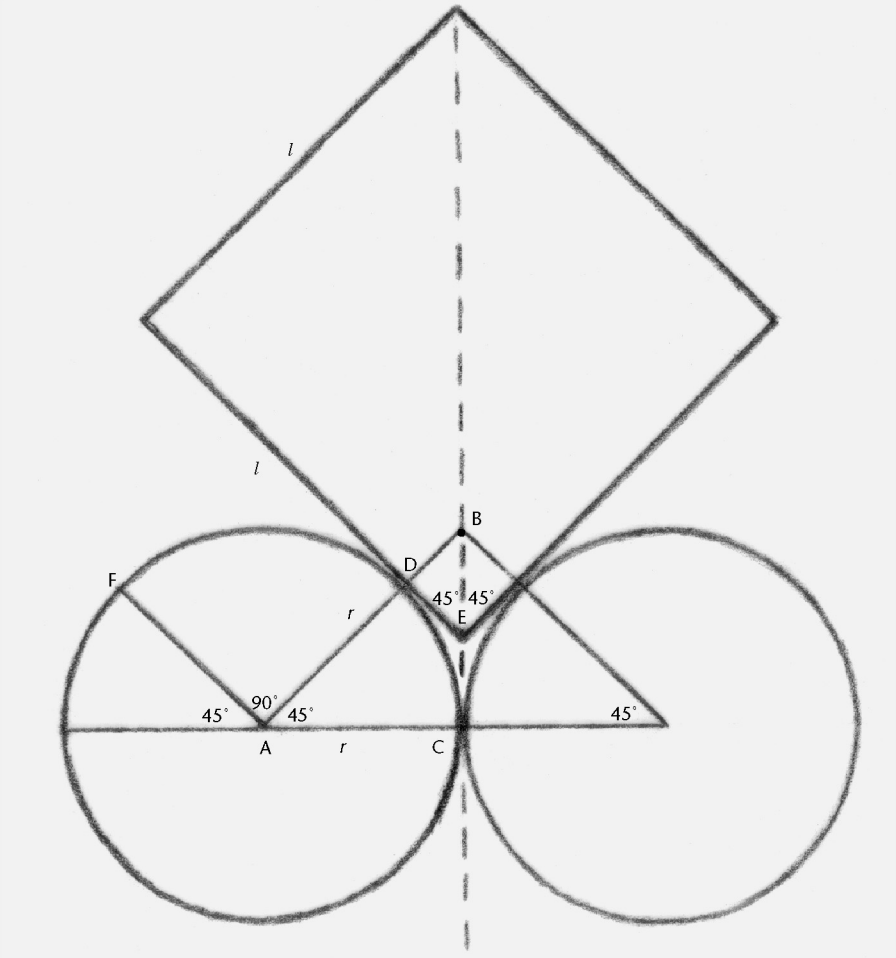
$$l = \widehat{DF} + 2DE$$

$$\widehat{DF} = \frac{2\pi r}{4}$$

$$DE = DB = 0.41r$$

$$l = \frac{2\pi r}{4} + 2 \times 0.41r = 0.5 \times 3.14r + 0.82r = 1.57r + 0.82r = 2.4r$$

$$r = \frac{d}{2}, \therefore\ l = 2.4 \times \frac{d}{2} = 1.2d$$



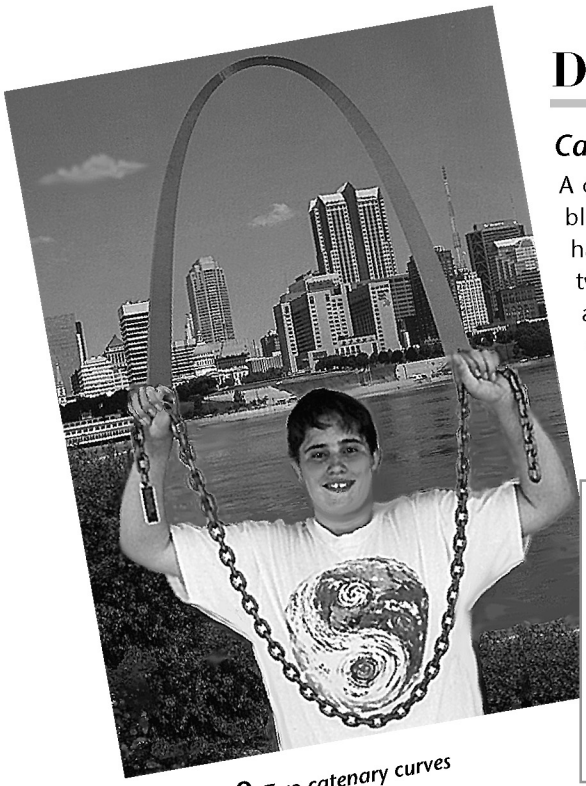


Figure 9 *Two catenary curves*

Did You Know?

Cat and Who?

A catenary curve is the shape a flexible rope or chain assumes when it hangs loosely and freely between two supports. Turned upside down, a catenary curve is the shape that will provide the greatest strength to an arch supporting only its own weight, such as the Gateway Arch in St. Louis.

Going Further

Deluxe Version

The article listed in the Credits & References section contains a template for a catenary curve and instructions for building a catenary road and a set of matching square wheels from plywood. If you have access to power tools, you might consider building this project.

Credits & References

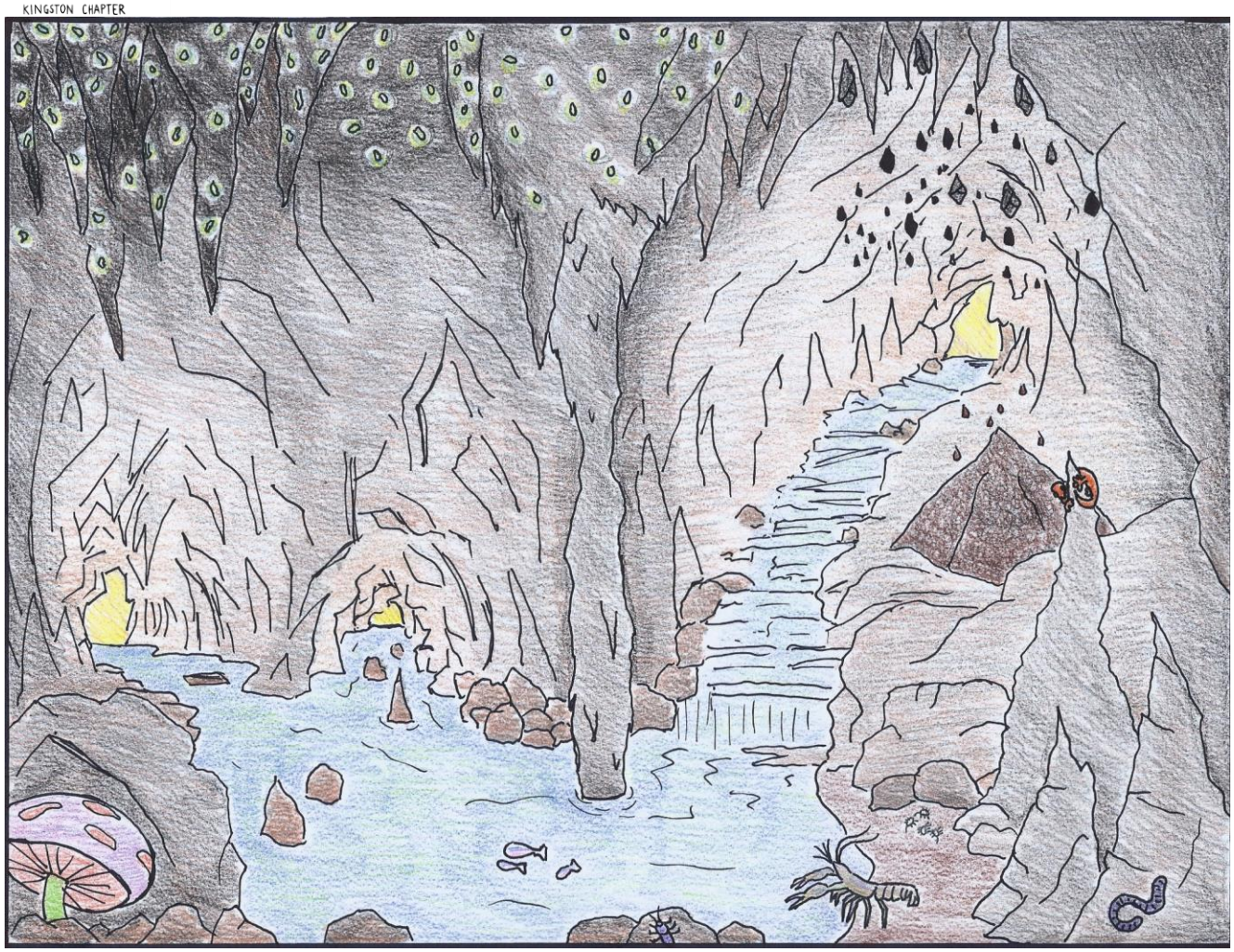
This snack is based on the Exploratorium exhibit of the same name.

Regester, Jeffrey. "A Long and Bumpy Road." *The Physics Teacher,* April 1997. (Also reprinted in *Apparatus for Teaching Physics: A Collection of "Apparatus for Teaching Physics" Columns from The Physics Teacher,* 1987–1998, edited by Karl Mamola, American Association of Physics Teachers, 1998, pages 46–47.)

SOCIETY FOR CONSERVATION BIOLOGY

KINGSTON CHAPTER

CAVE ECOSYSTEM HIDDEN OBJECT GAME!



Use the clues below to help you find cave features and some organisms that call the cave ecosystem their home in the picture above! Make sure to look closely some of the organisms may be small!

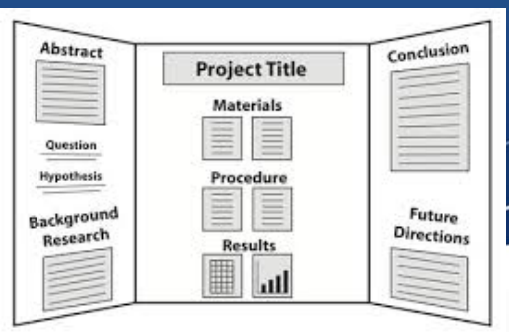
1. Find the object in the cave that is formed by precipitation of minerals from water dripping through the cave ceiling
2. Circle the rock formation that is created on the cave floor due to the buildup of material deposited from ceiling drippings
3. Circle the organism that is one of the most common *trogloxenes* (an organism that moves in and out of caves but does not live exclusively in caves) to cave ecosystems (Hint, it flies like a bird, but it's a mammal!)
4. Find the organism that uses *bioluminescence* (makes its own light, or glows) as a lure for prey that exhibit *positive phototaxis* (animals that move toward light)
5. Find the material that is an essential source of organic material that bacteria and fungi feed off of in the cave
6. Find the organism that was the first cave insect to be described (Hint, their name starts with a "B"!)
7. Find the group of organisms that cause *white nose syndrome* in cave-dwelling North American bats
8. Circle the organism that is known to be one of the worlds oldest living creatures, living up to 175 years (Hint, it looks like a lobster, but its name starts with a "C"!)
9. Find the organism that saves energy by forgoing *circadian rhythms* (behavioural cycles, like sleeping) that control *metabolism* (the conversion of food into energy)
10. Circle the formation formed when *stalagmites* and *stalactites* meet
11. Find the organism that is one of the most ancient and widespread of animals and is insect like and uses a *furca* (tail) to quickly move away from predators and dangers (Hint, it has "tail" in it's name!)
12. Circle the animal that represents one of the *troglobite* (can only live in caves) *amphibian* (lives on land and in water) species common in caves that have completely lost their eyesight
13. Find the organism that is a *detritus feeder* (scavenging on animal and plant remains) and can live in the deep zones of caves where little food is found

Answers: 1. *Stalactite* 2. *Stalagmite* 3. Bat 4. Glowworm 5. Bat *guano* (poop) 6. Cave beetle 7. Fungi 8. Cave crayfish 9. Blind cave fish 10. *Column* 11. Springtail 12. Cave salamander 13. Cave millipede

Spring 2016

Frontenac, Lennox and Addington Science Fair

FLASF Regional Science Fair is an opportunity for students Grades 5-12 to explore hands-on science investigation, create science projects based on inquiry and present to professional scientist judges!



Can't Keep a Good Ball Down!

Introduction: Density is a property of matter measured by its mass per unit volume (how much space it takes up). Two objects of equal size may have different densities depending on their masses. A very dense object tends to fall down through less dense particles.

Question: How do two objects of the same size but different densities act when placed in a medium that has an intermediate density?

Materials: Large glass jar, bag of dried pinto beans, Ping-Pong ball, metal ball or glass marble (same size as Ping-Pong ball)

Methods:

1. Place the Ping-Pong ball in the bottom of the glass jar.
2. Pour the pinto beans into the jar so the Ping-Pong ball is completely covered.
3. Place the metal ball or marble on the top of the pinto beans.
4. Gently shake the jar from side to side and watch what happens.

Science Fair Projects

Question	Your question can be big or small and will help you investigate something of interest to you!
Hypothesis	What do you think the answer is? Why?
Methods	What steps will you take to perform your experiment? What materials do you require?
Results	Present your findings visually in graphs or tables. What answers did you discover?
Discussion	What do you results mean? Was your hypothesis proven or not proven?

Visit www.flasf.on.ca for more information on experiments, our regional science fair and more!

ESU
enrichment studies unit

Queen's University

Rainbow in a Jar

Materials:

- 1/2 cup of white corn syrup
- 1/2 cup of olive oil
- Food colouring
- 5 small mixing bowls and spoons
- 1/2 cup of rubbing alcohol
- 1/2 cup of blue dishwashing soap
- one jar with a tight lid
- aprons and safety glasses

Procedure:

1. Careful and slow pouring down the inside wall of the jar is the key to success!
2. Mix 1/2 cup of white corn syrup with 2 drops of blue and 2 drops of red food colouring. This is your purple layer.
3. Carefully pour it into the bottom of your jar and then pour the blue dishwashing soap down the inside of the jar.
4. Mix 1/2 cup of water with 3 drops of green food colouring and pour the green water carefully into the jar.
5. Gently pour the olive oil down the inside of the jar.
6. Mix 1/2 cup of rubbing alcohol with 3 drops of red food colouring and pour down the inside of your jar.
7. Carefully place the lid on top and enjoy your rainbow. Do not shake!

What do you want to learn about rainbows?

Who can you ask?

What can you read?

Enrichment for Everyone!

SEEDS – Seven Eight Enrichment Days
Grade 7-8 April and May

EMC – Enrichment Mini Course
Grade 9-12 in May

SEEQ – Summer Enrichment Experience at Queen's
Grade 8-12 in August

QuEST – Queen's Excellence in Skills Training
Grade 7-10 May and August

ACHIEVE! With ESU and DUKE of ED

esu.queensu.ca

Royal Military College of Canada
Nuclear Engineering

What We Do

Nuclear engineering means harnessing the power that's contained within the atom for the purpose of generating electricity, and powering our society. It means building, operating, and maintaining the reactors that we use to extract nuclear energy. More than power generation, nuclear engineering has applications in material science, radiation safety and medicine. At RMC, we model the performance of nuclear fuel, research radiation exposure in airplanes and spacecraft, investigate atmospheric dispersion, and design the next generation of reactors.

Oodles of Elements

There are 118 elements on the periodic table. The elements are the building blocks of matter, and everything around us and everything that we're made of is made out of them. At their heart, there is a tiny nucleus composed protons and neutrons.

Hydrogen, the lightest of all elements, is made out of only a single proton. Helium, the next lightest, has two protons and two neutrons. Heavier and heavier elements can be made simply by adding more protons and neutrons, and we get the wonderful variety of elements, from oxygen, to iron, to gold, to plutonium.

But there's a limit: the more protons and neutrons you cram in, the harder it is to keep them all together. Eventually, if you add even one more, the whole nucleus will break apart.

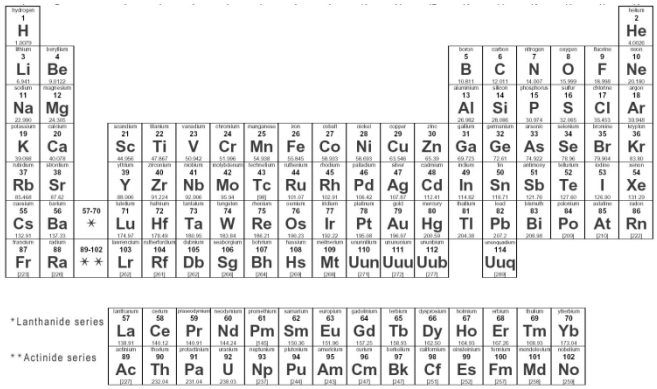


Image Source: Wikimedia Commons

Fission and the Chain Reaction!

You can picture the nucleus of a large atom like uranium as an unstable droplet of liquid. When hit by a neutron, the nucleus splits in half. The two parts fly off with great speed and great energy. You get 4 million times more energy for a gram of uranium than you do from a gram of gasoline.

But more than this, when you split uranium with a neutron, you get more neutrons. These neutrons go on to cause more fission in fresh uranium atoms in a chain reaction. The power from nuclear reactors is adjusted by controlling the number of free neutrons, so that for every fission, you get exactly one neutron to maintain the reactivity.

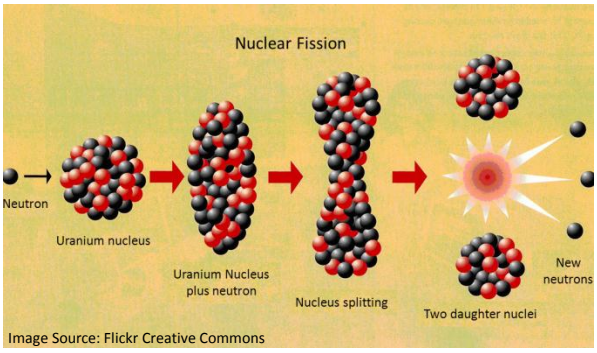
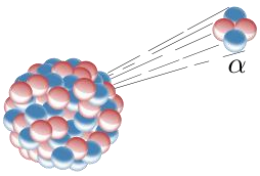
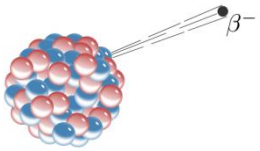


Image Source: Flickr Creative Commons

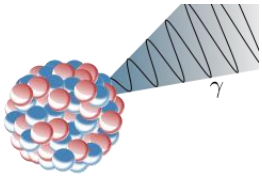
Types of Radiation



Alpha Particle, α
These are 2 protons and 2 neutrons bound together. They're ejected from heavy radioactive elements. They're very energetic, but can't penetrate very far!



Beta Particle, β
These are high energy electrons or positrons (anti-elections) that are ejected from the nucleus of a radioactive atom. Beta particles can be found in bananas!



Gamma Photon, γ
An electromagnetic wave (photon) emitted from the nucleus of an atom. It's able to travel through many materials and is used to treat cancers!

Image Source: Wikimedia Commons

How Does a Reactor Work?

Nuclear power reactors are used to generate the electricity that runs our homes, our factories, and our businesses. It's even used for some ships and submarines!

Fission of uranium atoms occurs in the reactor vessel. The heat that is generated is extracted in a two-step process and is used to produce steam. The steam that is generated flows to a turbine, which in turns drives a generator that produces electricity.

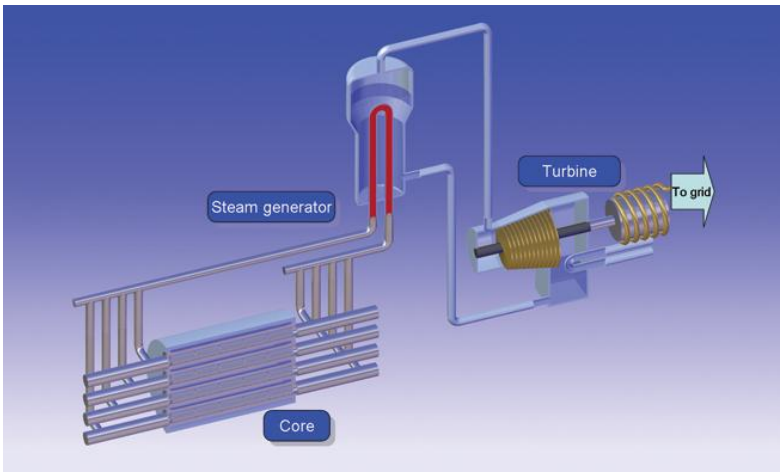


Image Source: Ali El-Jaby

CANDU reactors use natural uranium and have several layers of defense-in-depth that make the design unique. Worldwide, we get about 14% of our electricity from nuclear. In Ontario, it's over 50%!

Not Just about Energy

The DNA Dosimeter

Something that everyone in the nuclear power industry has to wear is a dosimeter, which measures the amount of radiation a person gets. This is one of the many safeguards in place to keep workers safe.

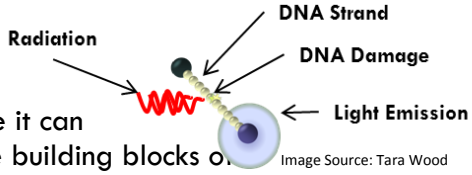


Image Source: Tara Wood

The reason radiation can be harmful is because it can damage DNA, the building blocks of life. A clever idea, however, is to use this damage as a way to measure how much radiation dose a person receives. Researchers have designed a detector made up of synthetic DNA which emits light when the DNA is damaged. The amount of light emitted tells us how much dose was received.

Space Radiation

Space radiation from the Sun (solar flares), from deep space, and trapped within the Van Allen belts make for an extreme environment that impacts orbiting satellites, astronauts on-board the International Space Station, and even airline pilots travelling between continents. Part of the research being done at RMC is to model the amount of radiation astronauts receive and also, to figure out how solar flares travel through the atmosphere and impact pilots. This is being done so that whether a pilot is flying to Paris, or an astronaut is orbiting Earth, both can stay safe!


Image Source: Wikimedia Commons

Making Jet Planes Safer!

Neutrons can be used to take images of the internal components of materials like aircraft wings. Just like taking an x-ray, neutrons can penetrate objects, and we can get images of the internal structure of objects. This technique is being used to maintain Canada's fleet of CF-18 jet fighters by finding corrosion and water ingress before serious damage is allowed. to occur.


Image Source: RCAF

Staying Prepared

Safety is taken very seriously in the nuclear power industry. Workers, engineers, and scientists are constantly on the lookout for problems, always trying to improve engineered safety and prevent accidents. But if an accident does happen, and if all of the containment barriers are breeched, radioactive material can spread through the air. By modeling this, we can better predict what areas will become affected, and take measures to ensure that the public is kept safe. Last year during the accident at the Fukushima Daiichi nuclear power plant, atmospheric dispersion models were used to predict where radioactivity would spread. This helped the response teams decide what areas needed to be evacuated.

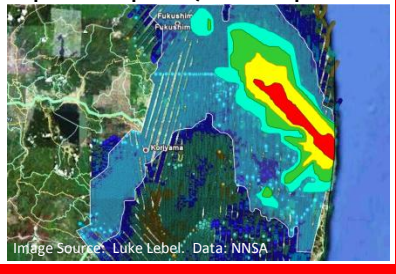


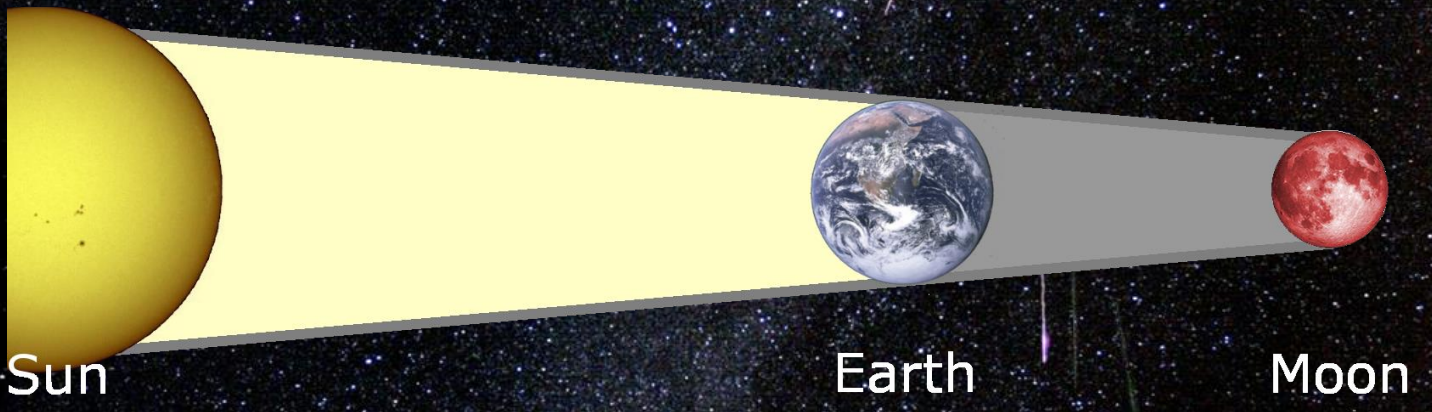
Image Source: Luke Lebel. Data: NNSA

Royal Military College of Canada

Astronomy and Astrophysics presents:

Meteor Showers And Lunar Eclipses

When the **Earth** is between the **moon** and the **sun** and the **full moon** passes through **earth's** shadow, we see a **lunar eclipse**



When **Earth** passes through a **comet's** orbit, bits of material released from the comet fall through Earth's atmosphere as a **meteor shower**

Partial lunar eclipses that can be observed from Kingston:

March 23, 2016 at sunrise

February 11, 2017 at sunset

Meteor showers that may be observed from Kingston:

Lyrids: April 19 – April 26

Perseids: July 17 – Aug 24

Orionids: Oct 2 — Nov 7

Leonids: Nov15– Nov 20

Image credits: NASA

OUR MOST UNWANTED INVASIVE SPECIES

ELBOW LAKE ENVIRONMENTAL EDUCATION CENTRE

Queen's University

Stop the Invasion!

Every year, new plants and animals from faraway places arrive in our forests, meadows and waters. They travel here by road, boat or even hitchhike on your boots! Some are harmless, but others hurt native plants and animals – including us. **Become aware of these most *un*-wanted species!**

Dog-Strangling Vine

Monarch butterflies are tricked into laying their eggs on my leaves because I look like native Milkweed, but their caterpillars can't eat me… and without food, they die.

www.ontario.ca/environment

Wild Parsnip

I grow in open, sunny areas, but watch out: If you get my sap on your skin and then expose it to sunlight, the chemical reaction might give you rashes, burns and blisters.

www.weedinfo.ca

European Buckthorn

You can find me almost everywhere! I compete with native plants for soil nutrients and water, growing tall enough to shade my competitors and steal their sunshine, too.

www.invadingspecies.com

Jenny and Tom have a garden with many wonderful native plants. They work hard to keep their garden free of harmful invasive species, but one has gotten in!

Search among the native plants to find out which species has invaded and needs to be pulled out!

Native Plants:
Aster, Bergamot, Ginseng, Bunchberry, Dogwood, Mint, Yarrow, Primrose, Milkweed, Hepatica, Harebell, Iris, Pink Corydalis, Lady's Slipper, Joe-Pye Weed, Lily, Red Raspberry, Sunflower, Goldenrod, Violet Trillium, Jewelweed.

Invasive Species:

www.bccdvt.org

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

__ __ __ __ __ __ __ __ __ __ __ __ __ __ __

Learn about Invasive Species *and much more* at Eco-Adventure Camp this summer!
One-week sessions in July & August for outdoor enthusiasts and young naturalists aged 9 to 14.
Weekly family nights! http://ecoadventurecamp.ca

ECO ADVENTURE CAMP

PRINCE EDWARD POINT BIRD OBSERVATORY

How You Can Be a Part of Bird Research—Join eBird

Become an eBirder! In 2002 the Cornell Lab of Ornithology and National Audubon Society launched **eBird,** an online checklist program that anyone can add to. It gathers lists from birders all over the world and creates a data base that is used for all kinds of research. Your lists of which birds you see help with bird research and conservation.

What does eBird let you do?

- Submit your checklists from your feeder, yard or trip
- See lists from other birders in your area
- Find local Hotspots where you can see other species
- Research where specific species are found
- Try out interactive maps
- Start your own life list of bird species
- See photos or rare birds in your area
- Read about interesting research and contests

How do you start?

Visit www.ebird.ca and select Explore Data (free for everyone) or Submit Observations (you'll need to create a free account)

Visitors welcome at the Observatory - it's free!

SPRING MIGRATION
April 15—May 31
(dawn to noon)

FALL MIGRATION
Aug 16—Oct 31
(dawn to noon)

SPRING BIRDING FESTIVAL
(May 14-23)

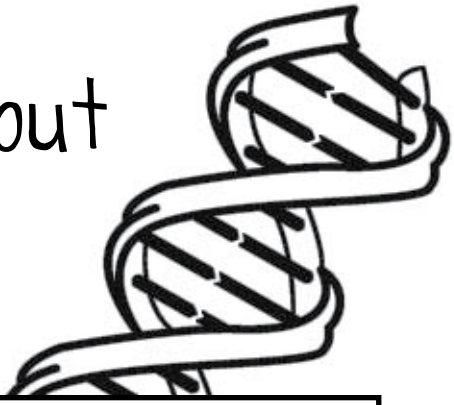
- Guided walks
- Demonstrations
- Lots of birds!

Directions/Maps/Details at

www.peptb.ca

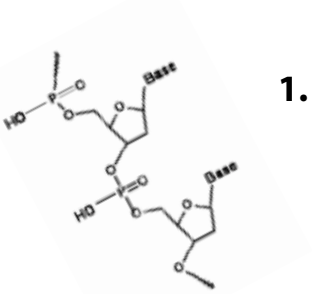
Indigo Bunting (Photo: David Okines)

How much do you know about DNA?



Fun facts:

The spiral structure of DNA was first discovered by Rosalind Franklin



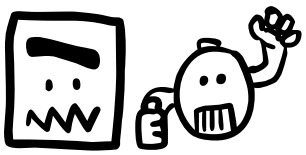
1. DNA stands for:

a) dominant nucleic acid
b) deoxyribonucleic acid
c) dominant nitrogen acid

2. We get our DNA from our: (circle all that apply)

a) brothers and sisters
b) parents
c) grandparents

Fruit flies are commonly used to study changes in DNA.



3. DNA is found in all livings things. – True or False?

4. All humans are _____ identical in their DNA.

a) less than 58% b) exactly 100% c) about 99.9%

5. If you unraveled all the DNA molecules in your body and placed them end to end, it would...

a) stretch to the Sun and back several times.
b) equal your height.
c) reach the moon.

6. DNA was first isolated by Friedrich Miescher in:

a) 1869 b) 1950 c) 1590

Did you know?

Your DNA influences how you look (what "traits" you have)

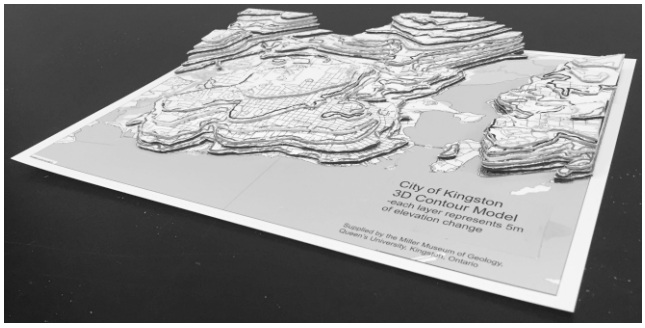
(Visit our website for online activies & to learn about our events & programs!)

Answers
1B
2 B & C
3T
4C
5A
6A

Bringing Canada's healthcare story to life!

Ann Baillie Building National Historic Site
32 George Street, Kingston, ON K7L 2V7
Phone: **(613) 548-2419 ● www.museumofhealthcare.ca**

Museum of Health Care at Kingston



Make your own

3D Map of Kingston

Queen's University

A topographic map of an area shows the topography (shape) of the land using **contour lines**. If you could hike along a contour line, you would follow a path that stays at exactly the same height above sea level all the time.

In this activity, you will glue topographic maps to thick sheets of craft foam, cut out the contour shapes for each 5 metres of elevation rise (the "contour interval"), and then stack them one on top of another to make a 3d map of the landscape around our city!

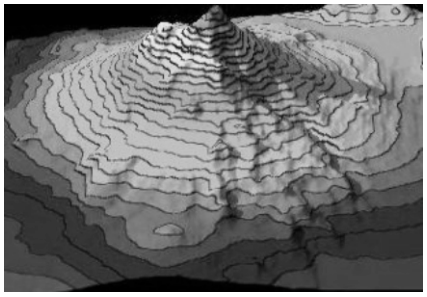
Material List

1. 12 sheets of 2mm thick "neoprene foam" craft/activity sheets (letter sized) (these are often found at "dollar stores" or arts and craft stores)
2. glue stick or spray glue
3. scissors
4. Download the Kingston topographic map set from:

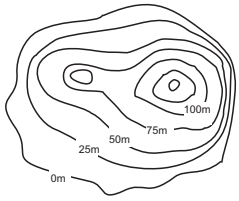
ftp://geoladm.geol.queensu.ca/pub/badham/sci_rend2016.zip

What are Contour Lines?

If you started at sea level and sliced through the land every 25m above sea level, the outline of each "slice" would be its **contour line** on a flat map. Look at the picture of the volcano to the right. The "slice" at sea level would be the 0 metre contour line on the map, and it would be the shape of the island that the volcano is on. The next slice at 25 metres above sea level would be the 25m contour line, and so on until you reach the tops of the two peaks of the volcano.



3D view of a Hawaiian volcano. Each line is a slice through the volcano at the same height above sea level.



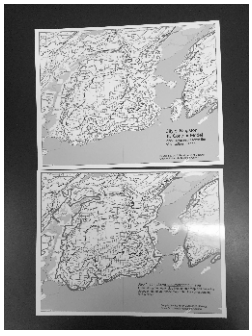
Contour Interval 25m

A topographic contour map view of a similar volcano with two peaks.

Making the 3D Map of the Kingston Area

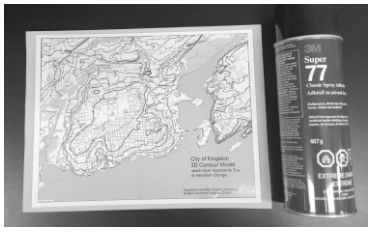
Step 1:

Download and unzip the map images from the Miller Museum web server. Print each page in colour.



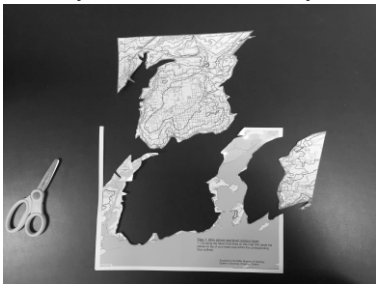
Step 2:

Use spray glue or glue stick to glue each print to a single sheet of neoprene craft foam.



Step 3:

Cut out the shapes for each contour level as indicated by the heavy coloured line. It takes a while to cut all of them out! Start with layer 2, cut the pieces out and do step 4 before you cut out the next layer.



Step 4:

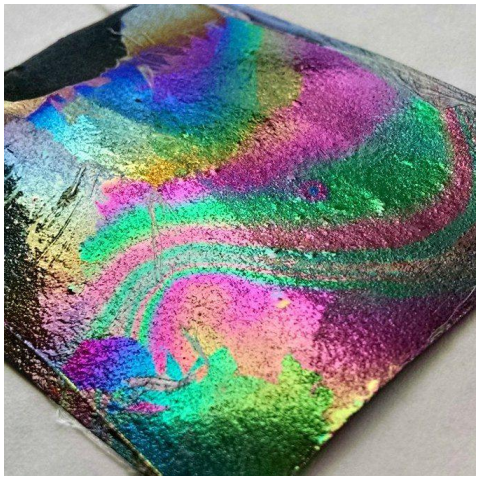
Glue the cut out shapes from each layer onto the base map (layer 1), one on top of the other, for each contour level until you have built the entire 3D map model!

Rainbow Paper – Home Activity

Rainbows are a natural phenomenon and demonstrate that white light (like sun light), is actually a combination of all colours, like red, green, and blue. In this activity, you can capture your own rainbow on a piece of paper and discover the hidden colours of light!

What You Will Need:

- Some black paper (smooth/glossy works best, but construction paper works too)
- A bowl of water
- Clear nail polish (not top coat)



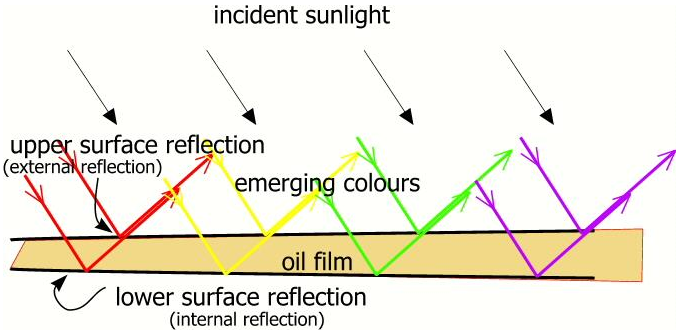
Step-by-step Procedure:

1. Place the piece of paper under water.
2. Add a small drop of clear nail polish to the water surface. You should see a colourful layer appear.
3. Raise the black piece of paper out of the water so that it "catches" the colourful layer.
4. Let the paper dry for a moment, then examine it under light (sun light works best) at different angles to observe the colours.

Scientific Questions:

- How many different colours can you see on your paper?
- Repeat the experiment several times. Do you see different patterns or colours?
- Experiment with different colours of paper, what do you notice?

Why Does it Happen?



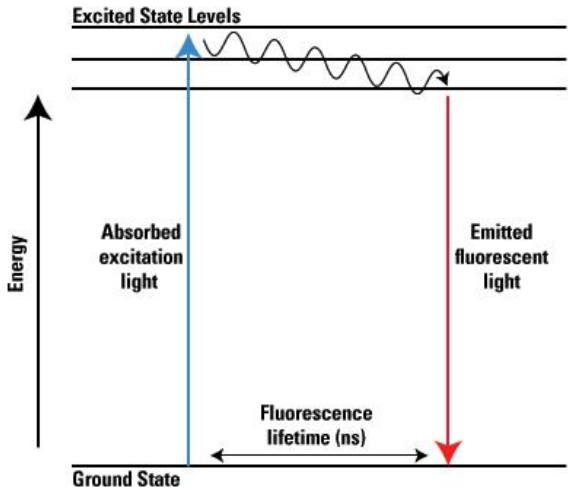
Rainbow paper is not actually a rainbow, but an effect known as **thin film interference**. You may have seen this in a soap bubble, or a parking lot puddle contaminated with oil. Light reflected from the top surface of the film can interfere with light reflected from the bottom surface. Whether the interference is **constructive** (brighter) or **destructive** (darker) depends on the wavelength (colour) of the light, and the thickness of the film. So the different colours on your paper show you nanoscale differences in the film thickness!

Let's Talk Science, 2016. Based on http://www.sciencekiddo.com/rainbow-paper-kid-color-science/

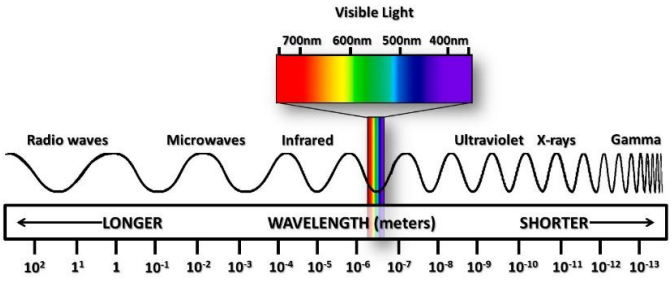
How to make glow-in-the-dark flowers

Fluorescence

Glow-in-the-dark paints and stickers are fun to play with but have you ever wondered how they worked? Atoms and molecules could become excited when light hits them, causing the electrons to jump from the ground state to a higher energy level. When the electrons relaxes back to ground state, light is emitted! The excitation of the electron is dependent on the energy of the light, called photons, which is dependent on the wavelength of the light. The lower the wavelength the higher the energy.

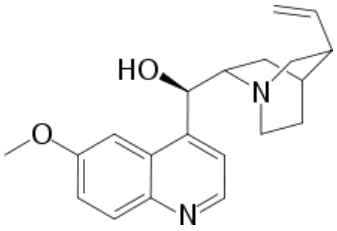


In some cases, a type of emission called **fluorescence**, the wavelength of the absorbed light is lower than the emitted light. This means that the absorbed light could be invisible to us but we would be able to see the emitted light!



What makes tonic water glow?

Tonic water glows because of a dissolved chemical called quinine. This is an extract from the bark of a tree, used to treat malaria.



Quinine

Quinine can fluoresce, absorbing light at 350nm which falls in the UV range, light that is invisible to us. It will emit light with a wavelength of 460 nm, which is part of the visible spectrum (~390-700 nm), giving that bright blue colour.

If quinine is destroyed from the reaction of a strong oxidizer, such as bleach, the glowing effects will cease!

To make glow-in-the-dark flowers

Materials

- Tonic water
- Vase
- Fresh white or pale flowers (such as carnations or daisies)
- Scissors
- Black light

Method

1. Pour tonic water into the vase
2. Cut off a small bit of the stem of the flower for a fresh surface and place the flower into the vase
3. After a few hours, the flower should have absorbed enough tonic water. Turn on the black light to see the glowing effects!

Queen's Chemistry

LEAHURST COLLEGE

AETERNUM EXCELLERE

Science at Leahurst!

Look for the list of words hidden within the search box.

I	T	I	V	R	F	O	R	E	C	A	S	T	J	C
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M	A	H	K	K	E	G	R	T	I	I	N	S	O	R
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AIR
CELSIUS
CREATIVITY
CRYSTAL
DIAMOND
EARTH
EXPERIMENT
FLOW
FORECAST
GOLD
GRAVITY
LEAHURST
MAGMA
MAROON
MINERAL
NAVY
PLANET
POTENTIAL
SENTIENCE
SOLAR
SUN

Science at Leahurst!

Look for the list of words hidden within the search box.

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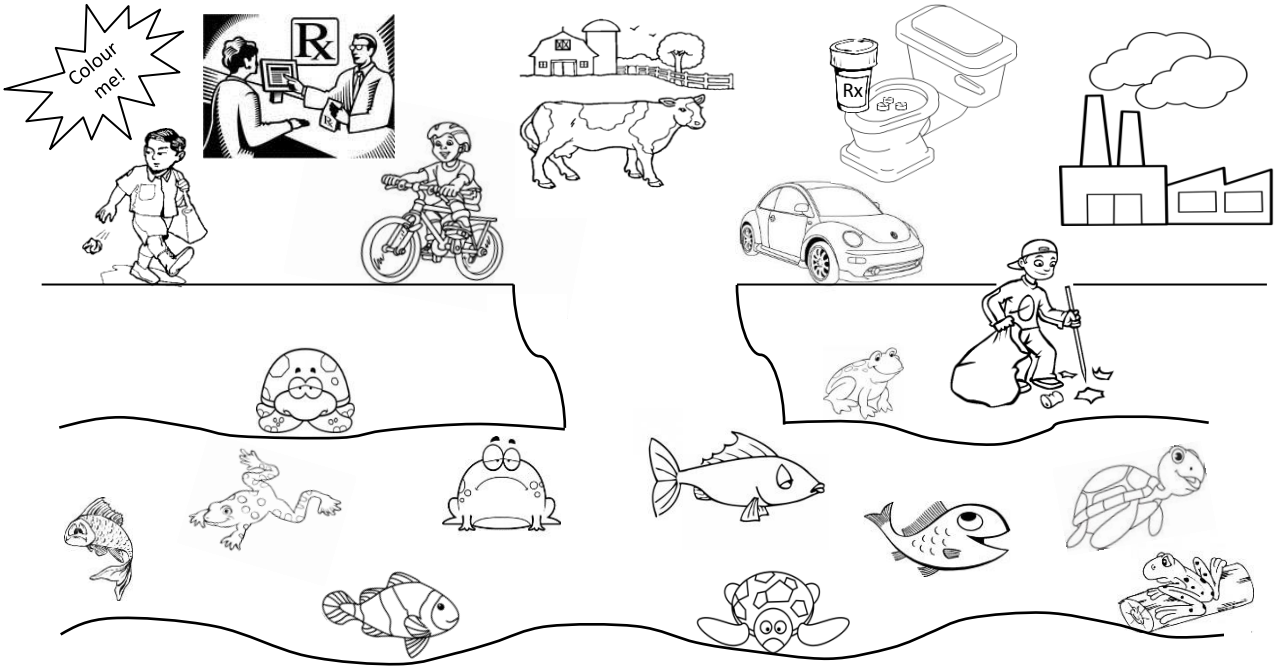
F	Q	V	K	T	W	A	E	Y	B	U	C	S	E	N	T	I	E	N	C	E	I	S	W	X	L	S	P	O	I
W	F	I	J	P	M	E	R	I	D	I	A	N	D	Q	C	V	C	H	E	Z	I	E	Y	R	O	V	I	Q	N

ALVEOLI
ASTEROID
BAROMETER
BOHR
CARCINOGEN
CILIA
CONGLOMERATE
CREATIVITY
CUMULUS
DREAM
EPIGLOTTIS
EPOCH
FAHRENHEIT
FLOW
GALAXY
GOLD
IONIC
LEAHURST
LIQUIDATION
LITHOSPHERE
MALLEABILITY
MAROON
MERIDIAN
METAMORPHIC
NAVY
NEWTON
NICE
OXIDATION
PHOTOSYNTHESIS
PISTIL
POTENTIAL
SENTIENCE
SEPALS
TITRATION
WORK

How can we help save aquatic animals?

Which of the pictures below are making some of the frogs, fish, and turtles so sad? Circle the activities that are polluting the environment.



Word Search

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

FISH AMPHIBIAN ENVIRONMENT
FROG CHEMICALS PESTICIDES
TURTLE POLLUTION

Why are frogs, fish, and turtles so important?

- They are good indicator species meaning by studying them we can learn about the conditions of the aquatic environment.
- Frogs, fish, and turtles are becoming increasingly endangered due to human pollution including the chemicals that are put into the environment.
- A turtle's life span is very long, this increases the time they are exposed to harmful chemicals found in their environment.
- Frogs have permeable skin meaning chemicals can easily pass through their skin.
- Fish breathe through their gills so they are continuously up taking chemicals from water.

***Langlois Lab*,**
Department of Chemistry and Chemical Engineering,
Royal Military College of Canada

Environmental Toxicology and Endocrinology Laboratory
Laboratoire en Endocrinologie et Toxicologie Environnementale

Paper Chromatography Art

WHAT IS PAPER CHROMATOGRAPHY ?

- Chromatography is used to separate mixtures into their components. There are several different forms of chromatography, however they all work on the same principle.
- All chromatography techniques involve a **stationary phase** (a solid, or a liquid supported on a solid) and a **mobile phase** (a liquid or a gas). The mobile phase flows through the stationary phase and carries the components of the mixture with it. Different components travel at different rates.
- In paper chromatography, the stationary phase is an absorbent paper. The mobile phase is a suitable liquid solvent that carries the mixture through absorbent paper.
- In our activity, a coffee filter or paper towel acts as the stationary phase and water acts as the mobile phase, carrying the mixture of pigments in the marker ink. The different parts of the ink move along the paper at different rates and separate. A colourful **chromatograph** is produced.

MATERIALS

- Absorbent paper – coffee filter or paper towel
- Coloured washable markers
- Permanent marker
- Water
- Bowl
- Eye dropper (optional)

METHOD

1. Write your name or draw a design in the center of the absorbent paper with a permanent marker.
2. Using a variety of coloured water soluable (washable) markers, make dots or designs around your name.
3. Pour water into bowl.
4. Dip absorbent paper into water far enough so that the coloured dots are slightly submerged. Paper should not be saturated. You may also experiment with dabbing water onto the absorbent paper or using an eye dropper to drop the water onto the ink instead of dipping it.
5. Remove absorbent paper from water and watch the liquid solvents separate into individual components as they absorb into the paper!

Did you know? Chromatography is used by forensic scientists to test sample found at crime scenes.

KING'S TOWN SCHOOL

Information inspiring imagination

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FRONTENAC
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Design a 3D object! Consider all the angles as you sketch it below.

Top	Bottom
Left Side	Right Side
Back	Front

kfpl.labs

Bring your design to life! Learn all about 3D design using Lynda.com at **http://www.kfpl.ca/online-learning/lyndacom**. Once you have your digital design ready, visit us at **www.kfpl.ca/library-services/3d-printing** to learn about using our 3D printers.

Citizen Science for all

Making a difference for wildlife.

We all love butterflies. Send your observations to eButterfly.

www.e-butterfly.org

Seen a bird? Submit your bird records to eBird and see your sightings live on the website!

www.ebird.ca

What did *you* see today?

Birds rely on suitable habitat to breed. Perhaps you have a nest in your backyard?

www.nestwatch.org

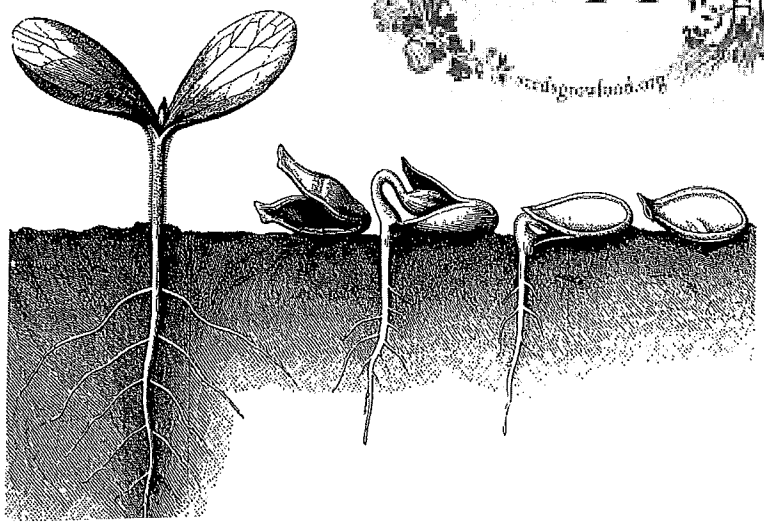
Marshlands need our help. Consider signing up for marsh monitoring.

www.birdscanada.org

Have birds coming to your feeder? Project FeederWatch would love to know more.

www.feederwatch.org

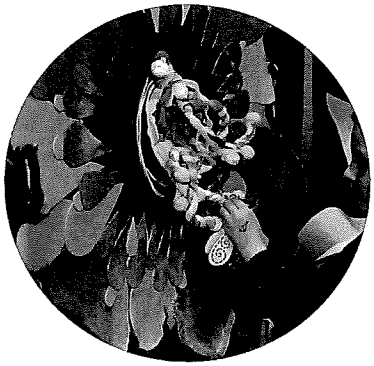
Better still; join your local nature club. Kingston Field Naturalists has junior, teen and adult sections.



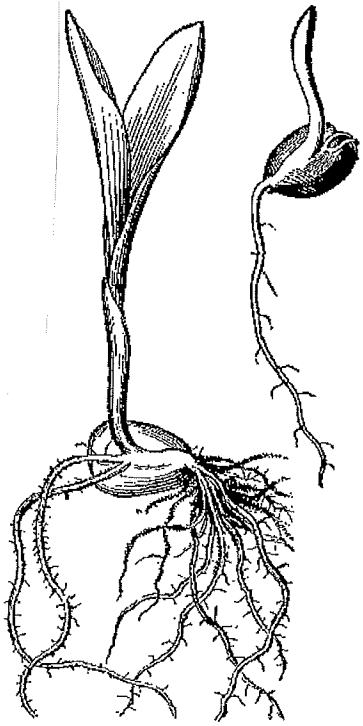
Background:

Every seed encases a tiny embryonic plant that can rest dormant for years in dark, cold and dryness until the right conditions for growth awaken it. When touched by moisture, warmth and air the seed swells up with life.

Every seed contains a tiny plant baby (embryo) and the nourishment to feed the tiny plant when it first starts to grow. The seed holds rich food with concentrated nutrients (protein, starch and minerals). When a seed germinates, sweet sugars are produced that nourish the tiny seedling. This makes sprouts delicious, nutritious, full of life and easy to digest.



Plants make flowers in order to make seeds!



Monocots and Dicots

Inquiry: Which seedlings start with two leaves? Which grow from only one leaf?

Activity: Soak squash and bean, corn and wheat seeds. Place in a clear container supported by or covered with moist towels for good observation. Carefully examine daily. Using a magnifying glass, examine and draw each stage of growth.

Extension: Make a flip book or cartoon strip of a plant growing.

Seeking the Source

Leaves are drawn to light. Roots reach down below. Whatever way you plant the seed, it knows which way to go.

Inquiry: How do seeds know which way to grow?

Activities:

* **Seed Spiral** - Soak beans overnight. Place one on the center of a cardboard circle covered with a moist paper towel. Wrap in plastic wrap with holes for air. Open up to mist daily. Place upright and rotate daily. Watch the seedling germinate and reach to the light and earth. Compost it after the experiment.

* Place a pot of seedlings on a bright window sill. Rotate and watch the leaves turn towards the light.

From Seed Saving by Eli Rogosa 18 Kaufman, a publication of Fed Co Seeds

Electrochemical energy conversion

The Barz Research Group, Department of Chemical Engineering, Queen's University

dominik.barz@queensu.ca

We would like to present some theoretical background on electrochemical energy conversion. Additionally, we will provide hands-on experience for the kids to build electrochemical devices such as batteries by means of some simple ingredients.

Theoretical background will be delivered by 3 posters. One poster describes how a battery works. The second poster describes how electrolyser and fuel cell work. Third poster is concerned with an electrical grid which utilizes alternative energy sources such as solar and wind. The buffer for this intermittent supply is based on hydrogen conversion in fuel cells and electrolyser.

Practical display includes 1 Fuel Cell Technologies Solar Hydrogen Education Kit and 1 Fuel Cell Technologies Fuel Cell Car Science Kit to connect the theoretical background provided by the posters with some praxis.

Hands-on experience is delivered by three simple experiments that the kids perform on their own with some assistance:

1) Make a battery using two nails and a lemon.

2) Make an electrolyser to produce hydrogen and oxygen from simple things like two pencils, a battery, water and baking soda.

3) Make a fuel cell which produces electrical power from hydrogen and chlorine using simple things like two pencils, a battery, water and sodium chloride.

The amount of hydrogen and chloride is very small and does not present threat.

We would need regular electrical power and 4..5 benches. Additionally, 3 movable walls/room dividers to put the posters on.

Connections
QUEEN'S ENGINEERING EXPERIENCE PROGRAM

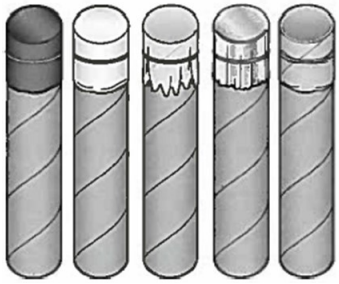
Connections is Queen's Faculty of Engineering and Applied Science Outreach Program that provides opportunities to raise awareness of the Engineering profession among kids, youth, teachers and the community. For more information about the program, please visit www.appsci.queensu.ca/Outreach

Make it Loud!

How can an engineer turn up the sound?

Advanced Preparation:

Supplies include: 5 cardboard paper towel tubes, 5 strong rubber bands, and 5 different types of materials (e.g. waxed paper, aluminum foil, paper towel, felt, plastic wrap).



Cover one end of each paper towel tube with a different square of material. Secure the material tightly with a rubber band.

Activity Steps:

1. Hold the open end of one tube to your ear.
2. Have someone else tap lightly on the covered end. What do you notice?
3. Repeat using the other tubes, keeping the same level of tapping.

Which material makes the tapping sound louder?
Which material makes the tapping sound quieter?

Engineering Connection

Biomedical engineers design devices and procedures that solve medical related problems, and help doctors diagnose and treat their patients. One tool that is designed to make sounds louder is a ***stethoscope***. These are used by doctors to make the sounds inside of people and animals easier to hear.

Congratulations on designing your first stethoscope!

* This activity was adapted from the 3-2-1 Contact teacher's Guide, Season II, 1983 Sesame Workshop *

SCIENCE RENDEZVOUS
WHERE PEOPLE AND SCIENCE MEET

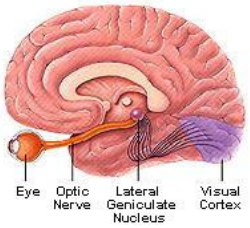
@QEngConnection

Connections - Queen's Engineering Experience Program

Queen's University
FACULTY OF ENGINEERING AND APPLIED SCIENCE

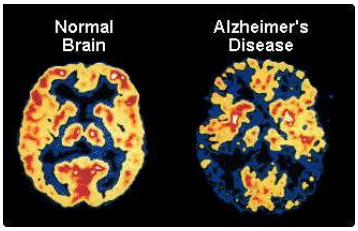
EXPLORING THE WORLD OF NEUROSCIENCE

What do neuroscientists study?

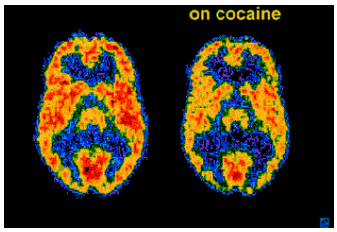


The Senses

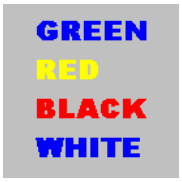
Genes



Diseases/injury



Drugs and Medicine



Cognition and Behaviour

What is a neuron?

The cells in the nervous system are called neurons. Neurons communicate through sending electrochemical signals. The adult human brain is made up of 100,000,000,000 (100 billon) neurons!

Can you find all the different words related to a neuron?

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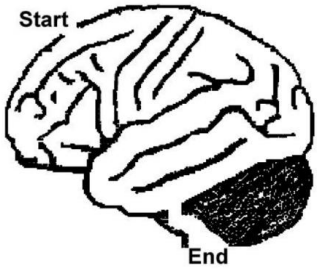
A	J	B	U	A	F	R	F	N	E	R	X	N	D	N
U	M	Q	L	R	I	I	M	N	D	M	F	O	I	A
P	G	O	E	L	C	A	W	N	P	C	I	R	W	P
H	C	X	S	U	L	O	E	L	C	U	N	C	G	S
R	J	G	U	M	K	D	F	A	Z	Z	G	I	A	E
S	T	L	O	E	H	Z	W	N	T	Y	N	M	J	L

Word List

Axon
Bipolar
Chromosomes
Dendrite
Electrochemical
Micron
Microtubules
Mitochondria
Multipolar
Myelin
Neurofibrils
Neuron
Nissl
Node
Nucleolus
Nucleus
Soma
Synapse
Unipolar



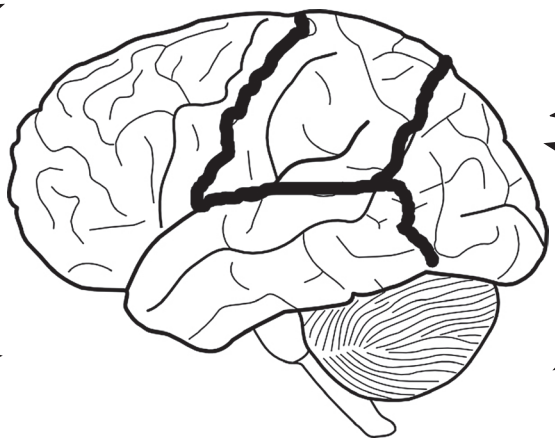



Science at home!

LEARN ABOUT YOUR BRAIN!
With a parent, use the internet to find an image of the human brain (we've listed some good websites below)

Can you colour the different brain regions?

Try using the following colours:
Parietal Lobe = red
Temporal Lobe = blue
Frontal lobe = purple
Occipital Lobe = green
Cerebellum = brown
Brain Stem = yellow

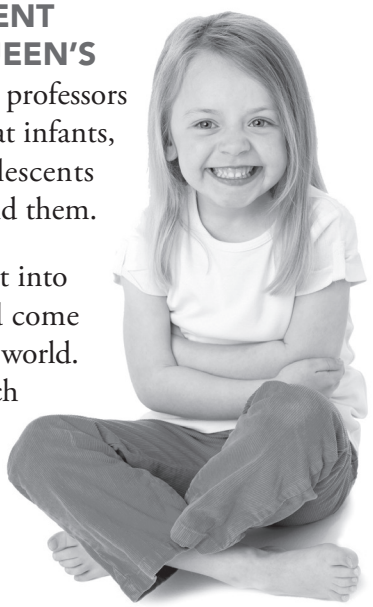


Learn about the brain on these websites:
http:/www.childrenshospital.org/research-and-innovation/research/labs/laboratories-of-cognitive-neuroscience/kids-corner/learn-about-your-brain

www.brainfacts.org

CHILD AND ADOLESCENT DEVELOPMENT AT QUEEN'S

We are team of students and professors interested in finding out what infants, toddlers, children, and adolescents know about the world around them.



Our research provides insight into how people grow, learn, and come to interact successfully in the world. The findings from our research have important implications for how best to educate children and how to help children with special needs.

HOW DO I PARTICIPATE?

- Contact us to make an appointment.
- Come to Queen's University to participate in our fun and interactive studies.
- Parking is provided and siblings are always welcome.

CONTACT US:

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62 Arch Street, Kingston, ON K7L 3N6

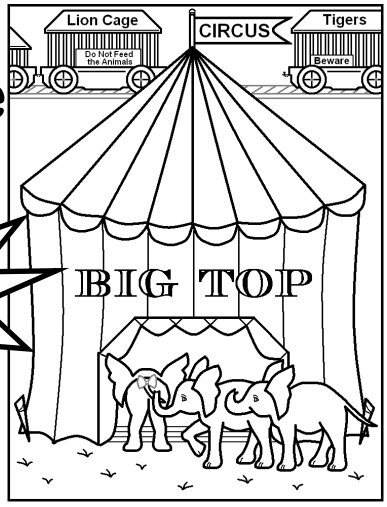
Phone: **613-533-2476**
E-mail: **child.studies@queensu.ca**
Web: **www.queensu.ca/psychology/developmental**

Like us on Facebook for updates and study results! **(search for Child and Adolescent Development)**

613.533.2476
child.studies@queensu.ca
Twitter: @QueensChildDev

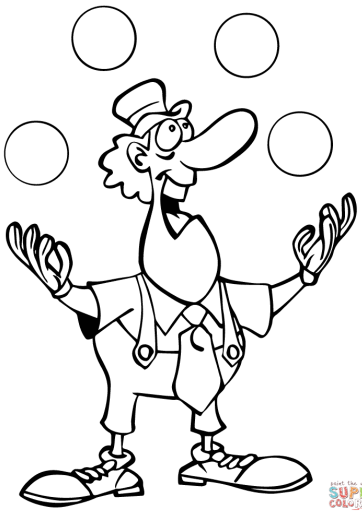
CHILD and
ADOLESCENT
DEVELOPMENT
Queen's University

BIOMECHANICS at the

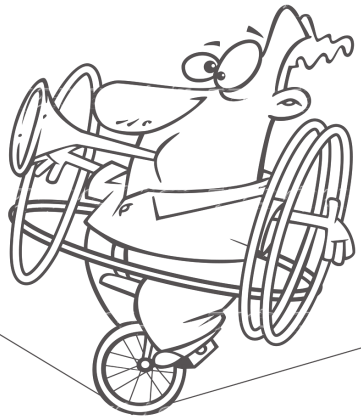


WITH THE QUEEN'S BIOMECHANICS AND ERGONOMICS LAB!

Colour us!



At the **circus**, the **clown** can be seen **juggling** several different items, including balls. The speed and direction of the **balls** in the air can be measured using an **accelerometer**.

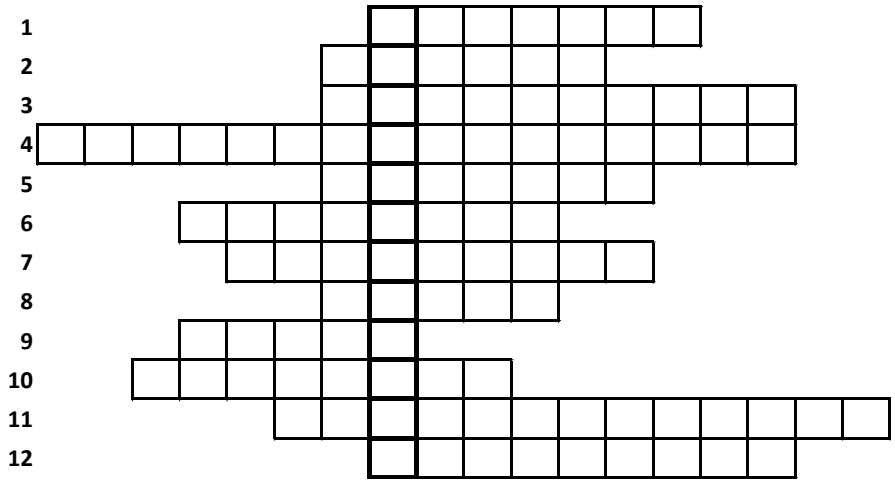


This man is very strong, some may even call him a Strongman. His muscles make him strong. What is happening in his muscles when he lifts a heavy weight can be measured using **electromyography.** What is happening to the weight can be measured using a load cell. A **load cell**, like a force plate, measures forces (in Newtons).

High in the air on the **tightrope**, the circus performer uses **balance** in order to perform their death-defying stunts. Biomechanists use a **force plate** to measure force (in **Newtons**). The location of this force while moving helps us measure balance.

ACROSTIC INSTRUCTIONS: Using the clues and **some** of the bolded words in the descriptions above, fill in the puzzle. The word down the middle (outlined in black) is the **Secret Word!** Can you solve it?

1. Seals are able to _____ a ball on their nose.
2. You find elephants, strongmen and clowns at the _____.
3. This measures how hard you push off of, or land on the ground. (2 words)
4. Biomechanists use this to measure the activity of muscles.
5. Force is measured in _____.
6. This tool measures pulling forces (2 words).
7. A high wire that performers walk along.
8. Jugglers juggle _____, clubs and fire.
9. This performer has a red nose and wears big shoes.
10. If you can keep three balls in the air at once, you are _____.
11. A tool used to measure the speed and direction of something or someone
12. These performers raise heavy weights over their heads



Secret Word:

_____

BIOMECHANICS ERGONOMICS LAB

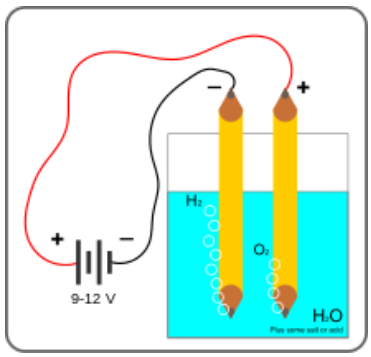
Energy

ENERGY: It runs your computer and phone, heats your home and cooks your dinner.

Did you know that every time you use energy it was produced using a chemical or nuclear process? The energy is produced in power plants which utilize water, coal, uranium, wind, and the sun. The sun and the wind are called alternative sources and their use is better for the environment. However, sun and wind are not reliable. We can use hydrogen to store energy and make it available when we need it.

Hydrogen is a chemical element with the chemical symbol H. It is the lightest element and the most abundant chemical substance in the universe.

Figure 1: A hydrogen atom



We can use electrical energy to split water into hydrogen and oxygen using an electrochemical process which happens in a so-called electrolyzer. The hydrogen can be stored and used as a fuel for example to drive cars.

Figure 2: Electrical energy splits water in hydrogen and oxygen.

We can "burn" hydrogen in a fuel cell to produce energy and water . The coupling of electrolyzer and fuel cell along with alternative energy sources may be our future energy economy.

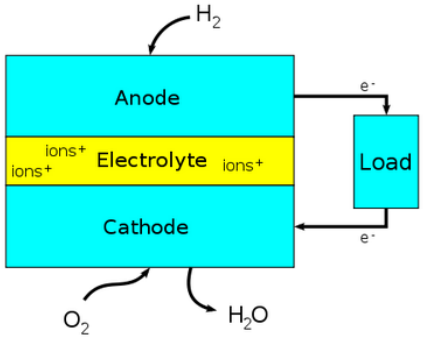


Figure 3: A fuel cell converts hydrogen into water and we gain electrical energy

Microchemical System Research Group; Contact: barzd@queensu.ca

Faculty of Engineering and Applied Science
Chemical Engineering

Queen's University

SAVE THE DATE…SEE YOU NEXT YEAR

SATURDAY MAY 6, 2017

May 2017

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
18		1	2	3	4	5	6
19	7	8	9	10	11	12	13
20	14	15	16	17	18	19	20
21	21	22	23	24	25	26	27
22	28	29	30	31			

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