HARMONICS

The Engineering Explorations Newsletter

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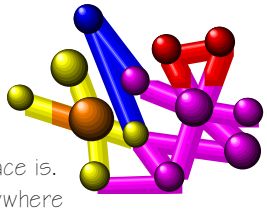
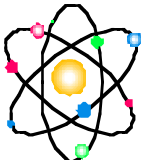
WHAT IS CHEMICAL ENGINEERING?





You and I, and everything else in the Universe (a reasonably big place) are made up of matter. Matter is a scientific term for anything which takes up space - no matter how small that space is. Matter exists in one of three forms - solid, liquid or gas. As far as we can tell, all matter everywhere is made up of combinations of just over 100 basic chemical building blocks called elements. People who study chemistry look at how these elements - things like hydrogen, oxygen, iron and uranium -combine to create matter and how matter reacts to changing conditions - like temperature and pressure. It's a huge field of study.

Chemical engineers take their knowledge of chemistry, combine it with math and physics, and apply it (remember engineers are called applied scientists) to processes in which a transformation or change of matter takes place. That may be a little difficult to understand but think about these questions.

How does your community process its sewage? Who came up with that process?

How many times a week do you or one of your family members put gasoline in the car (or truck or snowmobile)? Where does that gasoline come from?

How many things do you see and use everyday that are made from plastic or other synthetic materials? Where did those materials come from?

Chemical engineers are involved in the design and development of all of these things.

Chemical Engineering is one of the "Big Four" disciplines in engineering (Civil, Mechanical and Electrical are the other three). Chemical Engineers tend to focus on one of three main areas.

Energy

This area includes things like oil production and processing as well as nuclear power plant functions and by-products.

Materials

Chemical engineers in this area look at how to increase food production with fertilizers, and develop versatile materials like nylon, mylar and rayon.

Environment

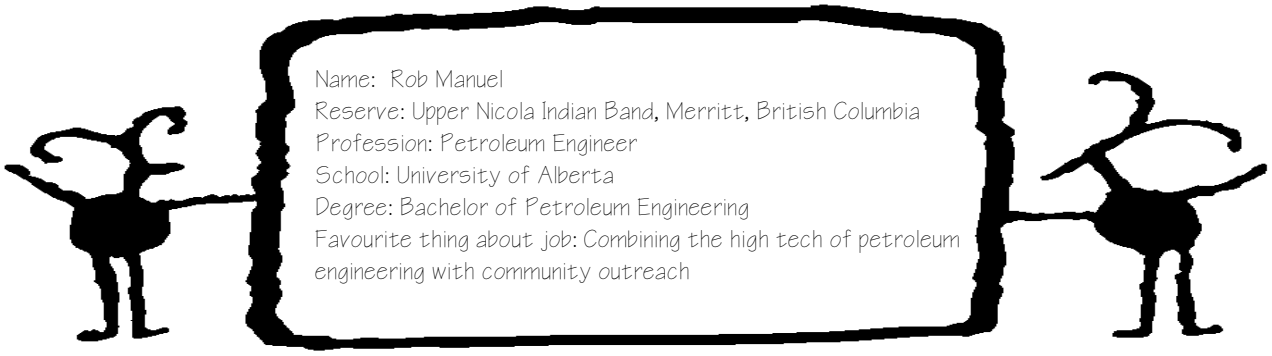
The focus of chemical engineers in this area is on pollution control, waste conversion and clean-up.

These areas often overlap because the processes used by chemical engineers in one area may work just as well in others. For instance, the process of distilling water for cleaning wounds is almost exactly the same as the process of distilling petroleum for gasoline! Also, the process which produces plastic may be used to make hair brushes or to make tubes for feeding premature babies in incubators.

As Native communities develop economically and move towards self-government, the specialised knowledge of chemical engineers can contribute to development in a number of ways. In negotiations with forestry, mining or petrochemical companies, Aboriginal chemical engineers will be well placed to ensure that community needs are represented and met. They could help to develop local industry, commerce or agriculture based on local resources or crops which maintain a respect for traditional practices and the land. Through their understanding of both the community and its geography, they could also help to solve problems of waste disposal from sewage or industrial processes.

NATIVE ENGINEERS

A place to meet engineers from your community.



Name: Rob Manuel
Reserve: Upper Nicola Indian Band, Merritt, British Columbia
Profession: Petroleum Engineer
School: University of Alberta
Degree: Bachelor of Petroleum Engineering
Favourite thing about job: Combining the high tech of petroleum engineering with community outreach

Rob Manuel is a Petroleum Engineer who works for Shell Canada. He often goes out to talk to Aboriginal students about engineering careers. "I tell them, hey, I grew up on a reserve, I failed grade 10 math and I got a degree in engineering. It pretty much takes away their excuses."

Mr. Manuel worked for Shell for 2 summers before graduating from the University of Alberta in 1995. The company hired him right away. He is part of a team which is studying the possibility of extracting heavy oil from the ground, and he loves it. "There is an awesome potential for the future of Canada in heavy oil reserves," he explains, "It's exciting to be a part of this type of team. I get to work with top level people."

Oil is a hydrocarbon. Its molecules are made up of made up of hydrogen and carbon atoms. It is refined into a number of different products like gasoline, kerosene and jet fuels. One of the main differences between these products is the number of carbon atoms in their molecules - natural gas molecules, for instance, contain only 4 carbon atoms, and are very light. Heavy oil has a lot of carbon atoms in its molecules (over 60 as a matter of fact), and is much heavier. Special processes are needed to extract it from the ground and to refine it into useful products.

As a Native person working at Shell, Mr. Manuel says, "I bring a different way of thinking to the table - some people embrace it. I have a passion for the Aboriginal side that sometimes outweighs engineering. I count on elders and parents and what people have taught me to be there. When I speak, it's them speaking." Balancing his two worlds is all part of the challenge he loves, "My mentality is where's the biggest challenge and I'll show you I can do it."

Mr. Manuel encourages young Native people to stay in school and get an education so they can contribute to the development of their communities. "Try to develop an attitude where you'd rather attempt to do something great and fail, than do nothing and succeed. And, if you don't know why you should try to do something great, find a reason, get a reason." Failure, he explains, is all part of learning, "I speak like I do today because of the times I failed. I don't beat myself up about it. Next time it happens, whatever it is, I won't do it that way again."

The University of Alberta is located in downtown Edmonton. It offers undergraduate and graduate degrees in 13 faculties: Agriculture, Forestry and Home Economics; Arts; Business; Education; Engineering; Law; Medicine and Oral Health Sciences; Native Studies; Nursing; Pharmacy and Pharmaceutical Sciences; Physical Education and Recreation; Rehabilitation Medicine; and, Science. For more information you can contact the Office of the Registrar at (403) 492-3113, or check out the website at http://www.ualberta.ca.

UPLIFTING ELEMENTS

Hydrogen and helium are the most common elements in the Universe. They are also the lightest. In fact, they are both lighter than air, so balloons filled with these gases will float.

At the beginning of this century, before commercial air travel took off, hydrogen was used to fill huge, passenger-carrying airships called dirigibles or zeppelins. Hydrogen is a very flammable, explosive gas, and, in 1937, a hydrogen-filled zeppelin from Germany called the Hindenberg exploded as it was landing in New Jersey. By that point, most other countries were filling their airships with helium which is an inert gas. Inert gases don't react with other chemicals and therefore don't burn or explode. Because the Nazi party was in power in Germany, scientists in the United States, who discovered how to manufacture helium, didn't share that technology with German scientists.

While using hydrogen for it's lighter than air properties is dangerous, engineers have found a great way to harness its explosive properties to get things into the air. Hydrogen is one of the two gases used to lift the Space Shuttle and other rockets into orbit around the earth - the other is oxygen. When hydrogen and oxygen are combined they both explode. On the Shuttle, all the energy from the explosion is channeled towards the ground and the force of the explosion actually pushes the spacecraft hard enough and fast enough to let it escape the Earth's gravity.

Source: http://www.cnn.com

ENGINEERING FAILURES?

Do you worry about failure? Of course you do. When engineers talk about failure they're not necessarily talking about failing a test or failing a course. They're probably talking about what happens when something they've built or designed or analysed doesn't work. Engineering failure can mean that a computer program doesn't work properly, but it can also mean that a bridge collapses or a power plant shuts down or a satellite spins out of its orbit. Engineering failures may not happen often, but when they do there is often a loss of life, and there is always a huge cost. Engineers study failures indepth so that they can understand what went wrong and avoid recreating the same problem. In engineering, as in life, there are valuable lessons to be learned from failure.

Sometimes failures aren't as bad as they first appear - especially during research. In fact, several really useful things wouldn't exist if someone hadn't failed at something else first!

Source: http://www.3m.com/Post-it/notes/index.htm

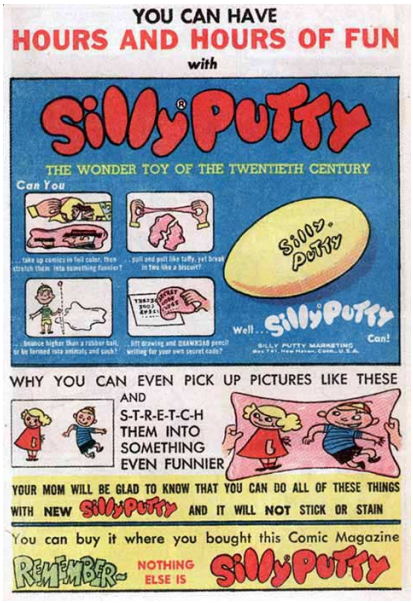
- Spence Silver, the chemical engineer who developed the reusable, weak glue on Post-It Notes, was actually trying to make a stronger glue for tape. He thought he had failed until one of the other engineers in the lab realized what this new glue was good for.

- The problem was just the opposite for Leo Baeckeland. He was trying to find a synthetic substitute for varnish (a substance which protects wooden furniture and floors), but what he produced was too tough. He made the substance even tougher and ended up developing one of the world's first moldable, dyeable plastics.

- Another chemical engineer, James Wright, was trying to create a rubber substitute out of silicon. What he ended up with was just way too gooey and bouncy to be used for anything practical, so he put it aside. Five years later, someone else put the bouncy goo in an egg and sold it as "Silly Putty."

So, the next time you think you've failed at something, maybe you should try looking at it in a different way.

Some of the information in this article comes from the October 98 edition of ASEE Prism Magazine On-line which can be found at http://www.asee.org/prism/october/html/the_importance_of_failure.htm



Source: http://www.steveconley.com/pages/silla.htm

COMMUNITY PROFILE

Haida Gwaii, Haida Nation

One hundred kilometers west of the northern coast of British Columbia (and 600 km north of Vancouver), on the very edge of the Pacific continental shelf, lies a group of 200 islands. Since 1787, this archipelago has appeared on maps under the name of the Queen Charlotte Islands (Queen Charlotte was the wife of wife of George III of England). The people of the Haida nation, who have lived there for thousands of years, call their land Haida Gwaii or "Islands of the People."

It is estimated that at one time the Haida people numbered close to 30,000. Contact with Europeans was devastating; small pox and other diseases killed about 95% of the islands' population. Today, approximately 4,000 Haida live on the islands. Most of the population live on Graham Island which has two fairly large towns - Skidegate in the south and Old Massett in the north. Sandspit on Moresby Island is home to about 600 people, and is the only community in the archipelago not on Graham Island.

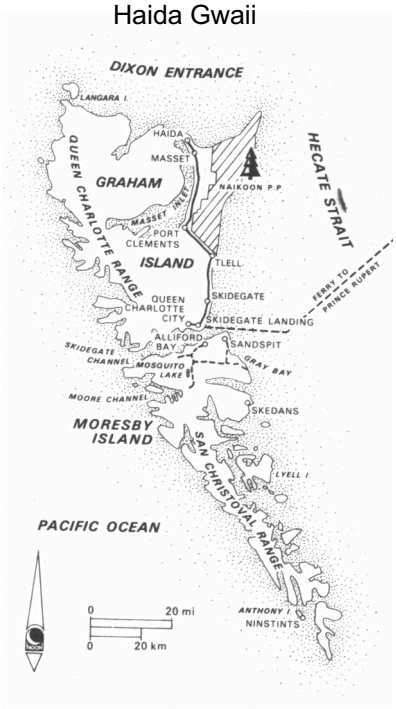
Far off shore, surrounded by the northern Pacific, Haida Gwaii is the most isolated land mass in Canada. It can only be accessed by boat, ferry or airplane. But the ocean currents around the islands have provided the people there with an abundance of forest and ocean-based resources which have sustained them for at least 9,000 years. Since the 1930s, the islands' economy has been based on forestry and commercial fisheries. With the decline in fish stocks and the need protect old-growth forests, the Haida have begun to develop their economy in new directions.

More than half of the BC sea lion population live in the waters around the Haida Gwaii; more than a quarter of the nesting seabirds in the Canadian Pacific are supported by the islands; and, the forests of Haida Gwaii contain some of the largest trees on the planet. In 1993, the Government of Canada and the Council of the Haida Nation signed the Gwaii Haanas Agreement to protect the unique wildlife, plant life and heritage of the islands. Gwaii Haanas National Park covers the southern part of the archipelago and is a protected heritage site. It includes the remains of Skung Gwaii which, with the agreement of the Haida, was declared a World Heritage Site by UNESCO (a United Nations organization) in 1981.

Gwaii Haanas and Skung Gwaii are staffed by Haida Watchmen who ensure that tourists respect the sites and the wildlife. They are part of a growing tourism industry on the islands, which is contributing to local economic development. To further support tourism and local education in Haida culture, the Haida plan to build a new $10 million cultural centre near Skidegate. Among other things it will house a museum containing a large portion of world-renowned Haida artist Bill Reid's work.

This article was written based on information at the following websites:
http://www.chin.gc.ca/haida (a site featured at Expo '98 in Spain); http://www.island.net/~crettich (a site by Haida Gwaii resident Clemens Rettich); and, http: //quarles.unbc.edu/keen/releases/skid.htm.

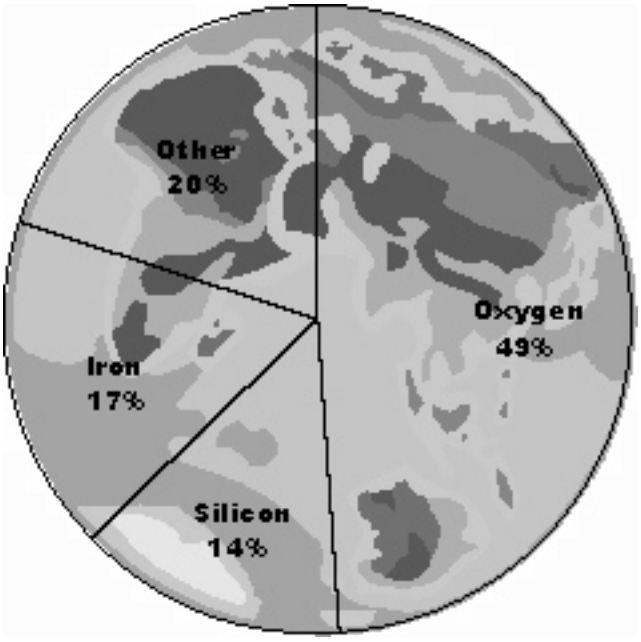
Haida Gwaii



Fun Facts and Things to Think About

That's a lot of horse…

When cars started driving on the streets of New York City in 1900 they were hailed as pollution relieving devices. At the time there were 120,000 horses in the city; they produced more than a million kilograms of manure each day!

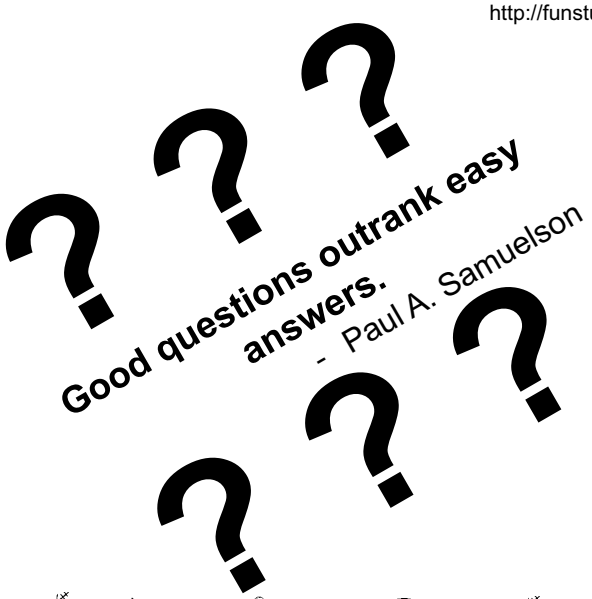


Oxygen, iron and silicon are the most abundant elements on Earth. Aluminum, calcium, magnesium, nickel and sulfur make up most of the remaining 20%. The other 100+ elements account for only about 1% of everything on Earth!

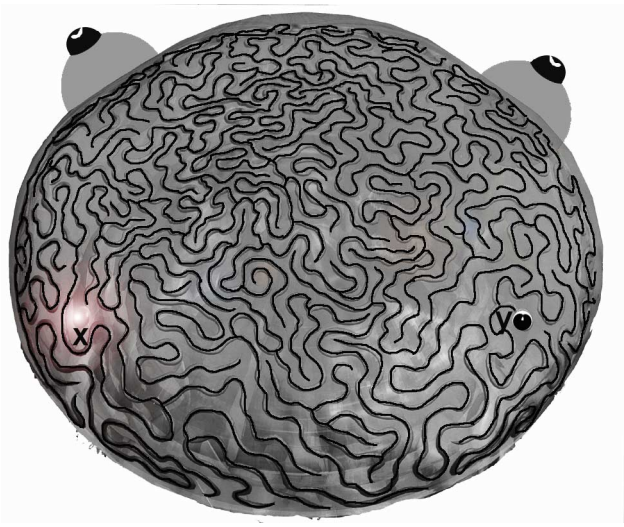
Silly Putty Practice

- Silly Putty has been to space. The astronauts of Apollo 8 were given a special silver egg of Silly Putty to play with during their flight. They used it to keep tools from floating around the rocket cabin while in zero gravity.
- The Columbus Zoo in Ohio has used Silly Putty to make hand and foot prints of gorillas.
- Some non-smoker groups tell their members to play with Silly Putty when they're trying to quit smoking. It gives them something to do with their hands.
- Silly Putty can be used to clean computer keyboards, plug leaks, remove lint and animal hair from clothing and steady wobbly tables.

Sources: http://www.wackyuses.com/silly.html
http://funstuffusa.com



PUZZLES AND GAMES

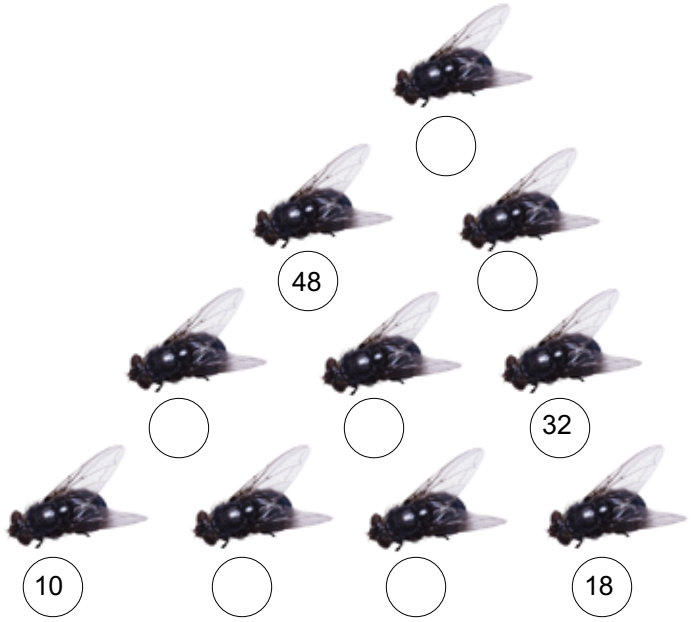


Amazingly alien

This ugly looking creature is a very nasty google-eyed Gwerp from the planet Dweezil. You're looking at him (or maybe her) from up in a tree - which is where you hid when he arrived in town. Gwerps pretty much shoot first and think about things later because their brains are rather slow. This one has actually just thought maybe he shouldn't blow up Earth, but that thought needs to get from point X to point Y before he can stop shooting. Can you help him?

The flies have it...

Flies have not just one or two eyes but sometimes hundreds. In the pyramid below, just by fluke, each fly has landed so that it has as many eyes as the sum of the two directly underneath it. Using addition and subtraction, and with the help of the numbers given, can you figure out how many eyes each fly has? (Warning: This one may be a little tough.)



All about us

Native Access provides culturally relevant learning opportunities in science, math, engineering and technology to Aboriginal students and their teachers across Ca nada.

Established in 1993, the projectÕs ultimate goal was to increase the representation ofAboriginal peoples among the the ranks of practicing engineers and scientists in Canada.

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