BACCALAURÉATS GÉNÉRAL ET TECHNOLOGIQUE

SESSION 2014

ÉPREUVE SPÉCIFIQUE MENTION « SECTION EUROPÉENNE OU DE LANGUE ORIENTALE »

Académies de Paris-Créteil-Versailles

Binôme : Anglais / Physique Chimie

Sujet n° 10

Cracks in the periodic table

hydrogen 1 H 1.0079																		helium 2 He 4.0026
lithium 3 Li 6.941	beryllium 4 Be 9.0122												boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305												aluminium 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078		scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80
rubidium 37 Rb 85.468	strontium 38 Sr 87.62		yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29
caesium 55 Cs 132.91	barium 56 Ba 137.33	57-70 *	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]
francium 87 Fr [223]	radium 88 Ra [226]	89-102 * *	lawrencium 103 Lr [262]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [269]	meitnerium 109 Mt [268]	ununnilium 110 Uun [271]	unununium 111 Uuu [272]	ununbium 112 Uub [277]		ununquadium 114 Uuq [289]				

*Lanthanide series	lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
* *Actinide series	actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]

In 2010 researchers in Russia announced they had synthesized the first few nuclei of element 117. This new type of atom does not yet have a name, because the science community traditionally waits for independent confirmation before it christens a new element. But barring[1] any surprises, 117 has now taken its permanent place in the periodic table of elements.

All elements up to 116, plus element 118, had been found previously, and 117 filled the last remaining gap in the bottom row. This achievement marks a unique moment in history. When Dmitri Mendeleev—also Russian—and others created the periodic table in the 1860s, it was the first grand scheme to organize all the elements known to science at the time. Mendeleev left several spaces blank in his table, and he made the bold guess that someday new elements would be discovered that would fill those blanks. Countless revisions of the table followed, but all of them had gaps—until now. With element 117, the periodic table is complete for the first time.

Scientific american,
June 27,2013
By Eric Scerri

[1] barring : sauf en cas

To make your presentation, you may use the following suggestions

- ✓ The periodic table seems to be a great tool for chemists. Explain why, and, if possible, give a few examples.
- ✓ Researchers synthetized a new nuclei. Give your opinion about the use of the atomic research.

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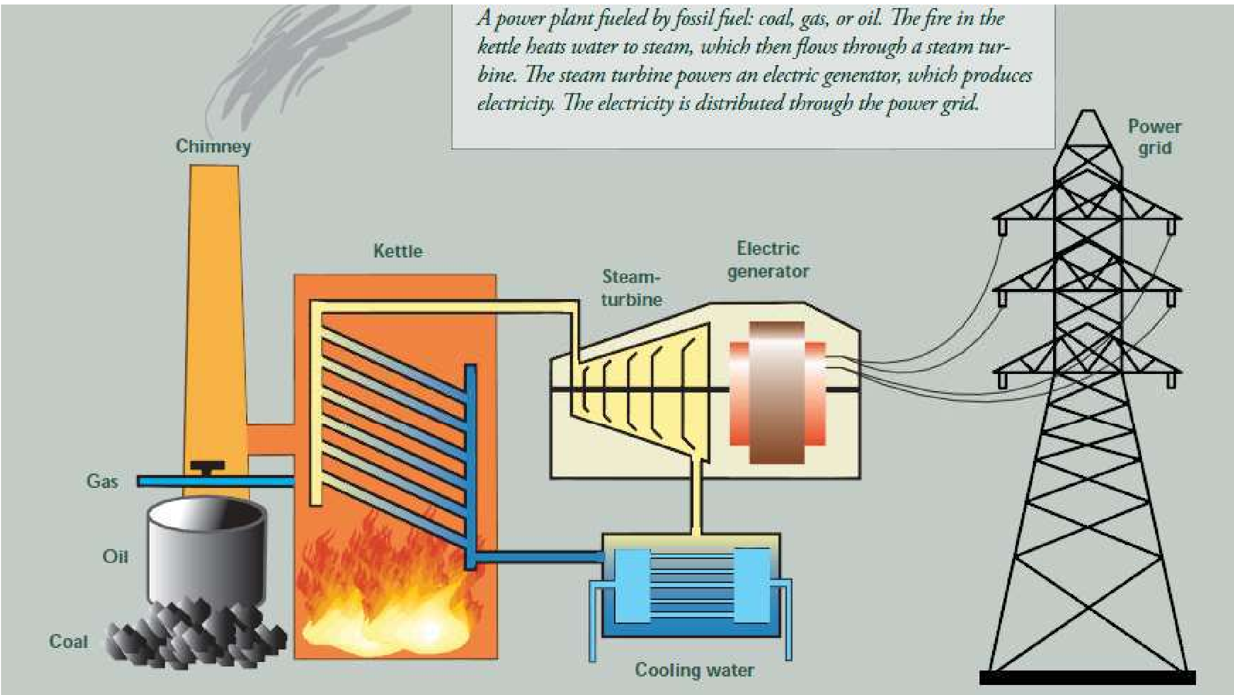
Sujet n° 11

The improvement in electrical production

With the exception of solar cells and fuel cells, all electricity is produced by some type of electric generator. In an electric generator electricity is made by turning a coil[1] in a magnetic field. The changing magnetic field drives the electric current through the coil and into the external circuit, where it can be used to do something useful. There are many ways of providing mechanical power to turn the generator, such as steam turbines, gas turbines, or wind turbines.
In the case of a steam turbine, a heat source – such as burning fossil fuels or the heat released by nuclear reactions – is used to make steam. The steam is then fed through a steam turbine, which is mechanically coupled to an electric generator. The electric generator then produces the electricity as shown in figure below. A gas turbine works in a similar way: the gas is ignited and burns, and the combustion products expand in the turbine, which is again coupled to an electric generator. Sometimes, the heat of the burning gas is then used to make steam, which powers a steam turbine. This process is called *combined cycle*, and it has a high efficiency. If the waste heat of the steam turbine is also used, for example by a factory or for household heating, it is called a *Cogeneration Plant* or *Combined Heat and Power Plant.* In the case of a wind turbine, the spinning blades drive an electric generator connected to them. In the case of hydro power, the water is channeled through a hydraulic turbine, which drives an electric generator.

from Energy, Powering Your World, p.26 2005



[1]coil: bobine électrique

To make your presentation, you may use the following suggestions.

- ✓ Using the text, talk about the different energy conversions.
- ✓ Comment upon the different sustainable ways of producing electricity.

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Sujet n° 12

See Ya, Voyager: Probe Has Finally Entered Interstellar Space

NASA's two Voyager spacecraft, launched in 1977, have made history in a dramatic fashion by exploring the outer planets: Jupiter, Saturn, Uranus and Neptune. Now one of the vehicles, Voyager I, has made another pioneering leap[1]. It is the first spacecraft to leave the vast bubble of hot gas that surrounds our solar system. At long last, Voyager 1 is now in interstellar space.

There was no question that the Voyager spacecraft would someday become the first objects made by human beings to get there. Unknown, though, was whether the probes would still be able to send back the news when they did.

"Most of us felt that we could at least get to Neptune, but we had no idea how much farther it would be," says Edward Stone, who has been the Voyager chief scientist for more than 40 years.

He and the other scientists have been waiting patiently for the moment when they could say that Voyager has finally entered interstellar space. That's defined as the region outside a huge bubble of hot gas that flows from the sun: the solar wind.

When the Voyagers launched in 1977, nobody knew exactly how far away from Earth this boundary would be. "It's really incredible how far we are. We're three times as far as Pluto — more than that, actually," Gurnett[2] says.

Another way to look at the distance: It takes 17 hours for the radio signal to get back to the Earth, traveling at the speed of light. In comparison, it takes about 8 minutes for light to reach Earth from the sun.

Stone says there is still a lot to learn, and Voyager 1 probably has another decade of power from its nuclear generator to keep going.

Figure 1: Voyager space probe

by Richard Harris, http://www.npr.org/ , September 12, 2013

[1]leap : bond
[2]Gurnett: a physics and astronomy professor

To make your presentation, you may use the following suggestions

- ✓ Explain why it took so much time for the craft to get to the interstellar space.
- ✓ Discuss why it's important for science and mankind to explore the universe.

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Sujet n° 13

Food miles

Surprise, your potatoes are better traveled than you are. American food travels an average of 1,500 to 2,500 miles from farm to table, reports the Worldwatch Institute.

A "food mile" is the distance food travels from the farm to the store where you buy it, and these miles are costly to the environment. They are, in fact, among the fastest-growing sources of greenhouse gas emissions worldwide. Long-haul trucking requires enormous amounts of fossil fuel, the combustion of which releases carbon dioxide and other pollutants into the atmosphere. Keeping food cold and unbruised[1] requires even more fuel in the form of refrigeration and packaging. And let's not forget the impact of long-distance such as apples from New Zealand and Chilean grapes. Distances have been increasing in recent decades, as foods increasingly are imported.

We've all seen those rock-hard tomatoes. By the time they arrive, you forget exactly what they're supposed to taste like.

A Swedish study looked at the ingredients of a typical Swedish breakfast (apple, bread, butter, cheese, coffee, cream, orange juice, and sugar) and determined the food traveled a distance equivalent to the circumference of the Earth. That's 24,901 miles.

There's a debate going on that argues that it's more energy-efficient to raise particular foods in particular places, such as lamb in New Zealand, as noted in a 2007 New York Times story. So, could it be more environmentally sound to ship some foods long distances? Here's a study that hints at an answer: Tomatoes grown in the ground in Spain and shipped to Sweden require less overall energy to produce and ship than tomatoes grown in a hot greenhouse in Sweden, according to a study by the Leopold Center. It argued that it's important to examine fuel use and carbon-dioxide emissions across all sectors of the food system.

By Sally Deneen from http://www.thedailygreen.com/living-green/definitions/Food-Miles, 2012

[1]unbruised: en bon état

To make your presentation, you may use the following suggestions

- ✓ Using the text, list the different components which weigh on carbon footprint.
- ✓ Explain how our modes of consumption influence our ecological footprint.

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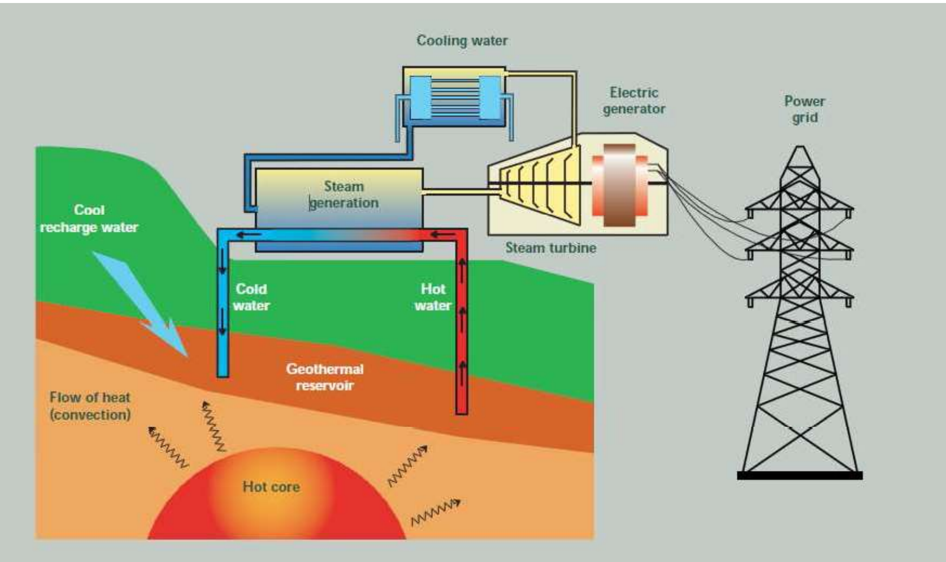
Sujet n° 14

Geothermal energy

Geothermal energy derives from the Greek words *geo*, meaning 'earth', and *therme,* meaning 'heat'. The idea is to use the heat of the inside of the earth to generate electricity. The nucleus of the Earth is red hot: about five thousand degrees centigrade. Sometimes, hot molten rock or magma comes to the surface during volcano eruptions. It is this enormous source of energy that geothermal plants try to harness for the production of heat or electricity. If you dig a hole in the earth, the temperature rises about 17 to 30° Celsius per kilometer depth. A geothermal well can be up to 2500 meters deep. Water that is injected into the well is heated to steam, and can be used to generate electricity as shown in the figure below. Alternatively, the hot water can be used directly to warm homes and buildings. Twenty countries around the world have built over 250 geothermal power plants. In the United States, geothermal power supplies the city of San Francisco with energy, and in El Salvador, 40% of the electricity comes from geothermal energy. Iceland uses only geothermal power for its electricity.

Of course, the right conditions to exploit geothermal energy in this form exist only in a very limited number of places around the world. For this reason, the total potential of energy production from geothermal energy is very limited. Once built, geothermal power plants provide cheap and clean energy. However, the initial construction of a geothermal power plant is expensive.



from Energy, Powering Your World, p.39, 2005

To make your presentation, you may use the following suggestions

- ✓ Using the text, discuss about heat exchange and energy conversion in geothermal energy.
- ✓ Develop different ways of producing energy in today's world.

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Sujet n° 15

CLIMATE CHANGE IMPACTS

Climate change is already beginning to transform life on Earth. Around the globe, seasons are shifting, temperatures are climbing and sea levels are rising. And meanwhile, our planet must still supply us – and all living things – with air, water, food and safe places to live. If we don't act now, climate change will rapidly alter the lands and waters we all depend upon for survival, leaving our children and grandchildren with a very different world.

Scientists point to higher ocean temperatures as the main culprit, since hurricanes and tropical storms get their energy from warm water. As sea surface temperatures rise, developing storms will contain more energy.

As the Earth heats up, sea levels rise because warmer water takes up more room than colder water, a process known as thermal expansion. Melting glaciers compound the problem by dumping even more fresh water into the oceans.

Heat-trapping gases emitted by power plants, automobiles, deforestation and other sources are warming up the planet. In fact, the five hottest years on record have all occurred since 1997 and the 10 hottest since 1990, including the warmest years on record – 2005 and 2010.

High temperatures are to blame for an increase in heat-related deaths and illness, rising seas, increased storm intensity, and many of the other dangerous consequences of climate change.

Adapted from http://www.nature.org/ourinitiatives/urgentissues/global-warming-climate-change/threats-impacts/

To make your presentation, you may use the following suggestions

- ✓ Explain how global warming works and give ideas to reduce it.
- ✓ List some of the most dangerous consequences of climate change.

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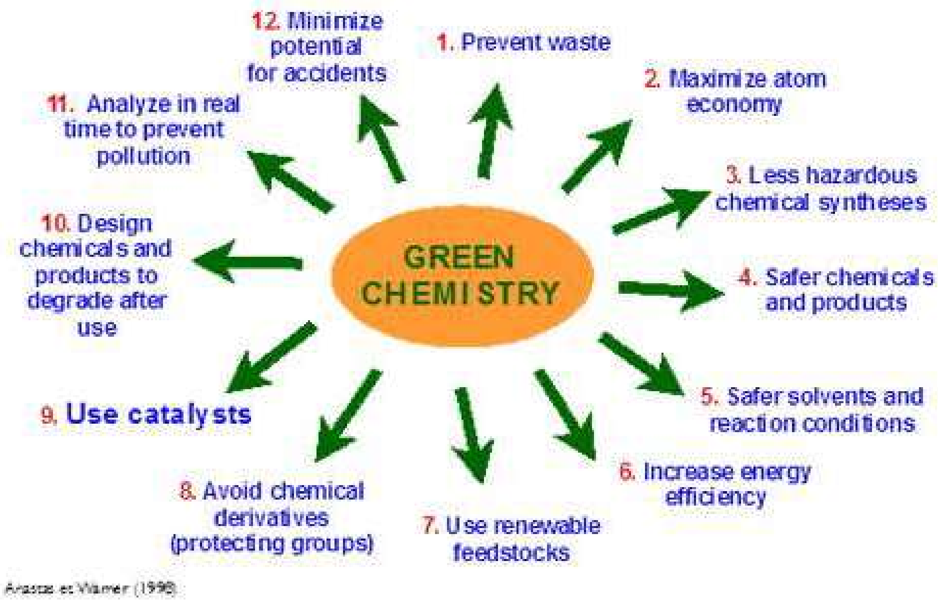
Sujet n° 16

WHAT IS GREEN CHEMISTRY?

Green chemistry is the design, development, and implementation of chemical products and processes to reduce or eliminate the use and generation of substances hazardous to human health and the environment.

This definition becomes clearer when we consider the 12 basic principles of green chemistry enacted by Paul T. Anastas et John C. Warner in a seminal work published in 1998.



Extract : Anastas P. T. et Warner J. C. (1998). Green Chemistry: Theory and Practice. Oxford University Press

Traditionally, chemists', and more specifically the synthetic chemists', main concern was to prepare a target molecule and obtain optimal yield for each step in a sequence. Little attention was paid to the amount of waste that was generated or the energy required by the chemical reactions that were used. The practice of synthesis using this approach gives rise to reaction sequences that are energy-consuming and it tends to produce large amounts of waste that are sometimes greater than the amount of the desired product obtained.

In green chemistry, an established approach consists in performing chemical transformations in a more efficient manner by replacing stoichiometric reagents with catalysts, by using less energy, by using little or no solvent, and, for reactions where solvent use cannot be avoided, using less harmful solvents.

Adapted from http://www.chimie.umontreal.ca/en/research/research-centres/CGCC/

To make your presentation, you may use the following suggestions

- ✓ Compare traditional chemistry and green chemistry.
- ✓ Explain some of the twelve principles of green chemistry and explain their goal.

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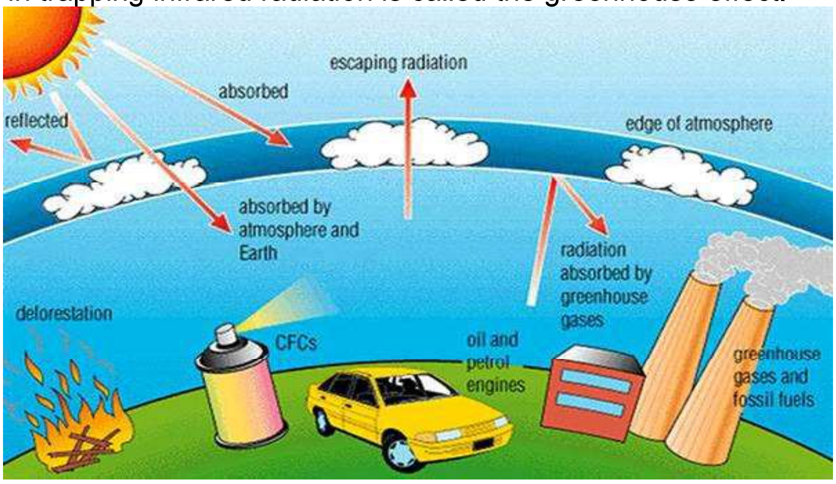
Sujet n° 17

GREENHOUSE GASES

The action of carbon dioxide and other greenhouse gases (as methane, nitrous oxide and fluorinated gases) in trapping infrared radiation is called the greenhouse effect.



Scientists use satellites and other instruments to measure the amount of greenhouse gases in the air all around the world. The Earth also gives us clues about the levels of greenhouse gases that existed in the past. For example, ancient air bubbles trapped deep in the ice of Greenland and Antarctica reveal how much carbon dioxide was present long ago.

A startling discovery has been done: there's more carbon dioxide in the atmosphere now than at any other time in at least 650,000 years! And the amount of carbon dioxide and other greenhouse gases is continuing to increase.

As global temperatures continue to rise, we'll see more changes in our climate and our environment. These changes will affect people, animals, and ecosystems in many ways.

Less rain can mean less water for some places, while too much rain can cause terrible flooding. More hot days can dry up crops and make people and animals sick. In some places, people will struggle to cope with a changing environment. In other places, people may be able to successfully prepare for these changes. The negative impacts of global climate change will be less severe overall if people reduce the amount of greenhouse gases we're putting into the atmosphere and worse if we continue producing these gases at current or faster rates.

Adapted from http://www.epa.gov/climatestudents/basics/today/greenhouse-gases.html

To make your presentation, you may use the following suggestions

- ✓ Explain why greenhouse gases effect is responsible for global warming.
- ✓ Discuss why climate change requires global action.