

BANQUE DE SUJETS

ANGLAIS / PHYSIQUE-CHIMIE

SECTION EUROPÉENNE

SESSION 2014

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° 1

The new oil and gas boom



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Over the past decade, America has experienced a technological revolution – not in renewable energy but rather in the extraction of oil and natural gas. By the end of this decade, the U.S. will become the world's largest producer of oil and liquid natural gas. But fracking – the procedure by which shale gas¹ and oil are extracted from deep rock formations – remains controversial and arouses great passion. The Oscar-nominated documentary *GasLand* suggests that fracking could damage the environment: unlocked gas could burst out of people's taps², because of fracking. These charges are important but they need more thorough investigation.

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The environmental impact of the natural gas boom is also positive. The US's greenhouse-gas emissions in 2011 were 9% lower than in 2007. The main reason is that gas is replacing coal everywhere as an energy source, and gas emits half as much carbon dioxide as coal.

Yet, we should not forget that there is ultimately a better future for energy – namely wind, solar and other renewables – that provides unending supply, low price and almost no environmental damage.

But the much larger question is nuclear energy. If Americans want a constant supply of energy with zero carbon emissions, nuclear is the only game in town right now.

Fareed Zakaria 2012-10-29, TIME Magazine

¹ shale gas: gaz de schiste

² taps: robinets

To make your presentation, you may use the following suggestions

- ✓ Explain the ecological impact of this new source of energy.
- ✓ Discuss why we are constantly looking for new sources of energy.

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Sujet n° 2

Tower of power

In the California desert, Ivanpah, the biggest solar thermal plant in the world, is out to prove that renewable energy can work on a massive scale. By the time the entire plant is completed later this year, it will produce 392 megawatts of electricity, enough to power 140,000 homes in California.

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Ivanpah will not convert sunlight directly into electricity as traditional solar photovoltaic panel does. Instead, mirrors concentrate the sun's energy on a solar tower which contains water that turns into superheated steam, which is piped to a turbine at the base of the tower to generate electricity. Desert sunlight does the work that a coal-or-natural-gas-fired furnace¹ does in a conventional plant – except that Ivanpah produces no carbon emissions and no pollution.

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Challenges came when biologists discovered that more than 150 tortoises², protected by the Endangered Species Act, were living on the construction site. The tortoises were eventually moved, at a cost of more than \$50 million.

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The big economic question is whether solar-thermal projects like Ivanpah can compete effectively against cheaper fossil fuels or familiar solar photovoltaic technology. Since construction began in 2010, the price of photovoltaic panels has plummeted³. That's made solar photovoltaic panels increasingly popular. Still, Ivanpah has its advantages: the electricity that will be produced throughout the day will be more predictable than that generated by a photovoltaic panel.

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Bryan Walsh 2013-06-24, TIME Magazine

¹ furnace: fourneau

² tortoise : tortue

³ to plummet: dégringoler

To make your presentation, you may use the following suggestions

- ✓ Describe the difference between solar photovoltaic panels and solar thermal plants.
- ✓ Talk about the pros and cons of renewable energies.

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Sujet n° 3

What is the Carbon trade?

The carbon trade came about in response to the Kyoto Protocol. Signed in 1997 by some 180 countries, the Kyoto Protocol calls for 38 industrialized countries to reduce their greenhouse gas emissions between the years 2008 to 2012 to levels that are 5.2% lower than those of 1990.

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Carbon is an element stored in fossil fuels such as coal and oil. When these fuels are burned, carbon dioxide is released and acts as what we term a "greenhouse gas".



The idea behind carbon trading is that carbon would be given an economic value, allowing people, companies or nations to trade it. If a nation bought carbon, it would be buying the rights to burn it, and a nation selling carbon would be giving up its rights to burn it. The industrialized nations for which reducing emissions is a daunting¹ task could buy the emission rights from nations whose industries do not produce as much of these gases.

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On the one hand, carbon trading seems like a win-win situation: greenhouse gas emissions may be reduced while some countries reap² economic benefit. On the other hand, critics of the idea suspect that some countries will exploit the trading system and the consequences will be negative. While carbon trading may have its merits, debate over this type of market is inevitable, since it involves finding a compromise between profit, equality and ecological concerns.

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<http://www.investopedia.com/>

¹daunting: considérable, décourageant

² to reap: récolter

To make your presentation, you may use the following suggestions

- ✓ Explain if carbon trading is really a win-win situation.
- ✓ Discuss why this ecological issue requires a global solution.

In spacewalk, astronauts complete repairs to station.

In a seven-and-a-half-hour spacewalk, their second in four days, the astronauts, Col. Michael S. Hopkins of the Air Force and Richard A. Mastracchio, installed a new pump module on the outside of the space station. The module, a 780-pound box about the size of a refrigerator, contains a pump and accompanying apparatus that circulate ammonia coolant through one of two loops¹ on the station.

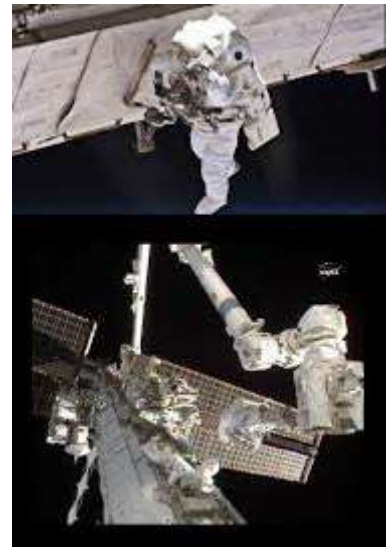
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"It's like Christmas morning opening up a little present here," said Mr. Mastracchio, an engineer, as the spacewalk unfolded on NASA Television. Operations on the space station, including some science experiments, have been curtailed² since a valve in the pump module malfunctioned two weeks ago. (...)

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The first spacewalk, on Saturday, went quickly and almost flawlessly³, and the astronauts were able to get far ahead of schedule and remove the old module, a task that had originally been scheduled for the second spacewalk. On Tuesday, they ran into trouble when one of the ammonia fluid lines would not detach. With brainstorming help from mission control, they finally succeeded, but then some toxic flakes of frozen ammonia leaked out. The astronauts had to take a few precautions at the end of the spacewalk to ensure their spacesuits were decontaminated.

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KENNETH CHANG, December 25, 2013, on page A19 of the New York Times

¹ loop : boucle

² curtailed : limité

³ flawlessly : sans problème

To make your presentation, you may use the following suggestions

- ✓ Describe what happened in the space station and discuss if an astronaut could be an efficient plumber back to Earth.
- ✓ Discuss why science in space is a major issue for space conquest.

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Sujet n° 5

Galaxy Zoo : a successful citizen science project¹



Pictured above, a sample of galaxies of different shapes resembling letters of the alphabet. For fun, the team has been using the images to spell out words.

Explanation: You, too, can Zoo. The Galaxy Zoo project has been enabling citizen scientists -- inquisitive people like yourself armed with only a web browser — to sort through the universe. Specifically, after a brief training session, volunteers are asked to use the superior image-processing power of their minds to classify and measure properties of galaxies in the vast *Sloan Digital Sky Survey*². In its two short years of existence, millions of galaxies have already been inspected by thousands of enthusiastic volunteers. Using Galaxy Zoo data, for example, the universe has been discovered to create no preferred rotation axis, an unusual and unclassified object was found that is still being investigated, and a whole class of small galaxies dubbed Green Peas were uncovered where star formation occurs at an extraordinarily high rate. Further, the Galaxy Zoo may be setting a precedent for a new type of scientific inquiry where the web helps collect, focus and coordinate human and machine intelligence.

Astronomy Picture Of the Day, 2009 October 26 (<http://apod.nasa.gov/apod/ap091026.html>)

¹ *Citizen science projects* are activities sponsored by a wide variety of organizations so average people can meaningfully contribute to scientific research.

² The *Sloan Digital Sky Survey* is a major imaging and spectroscopic redshift survey using a dedicated optical telescope in New Mexico, United States.

To make your presentation, you may use the following suggestions

- ✓ Describe the discoveries made thanks to the Galaxy Zoo project.
- ✓ Comment about the interest of astronomical research.

How to visualize a macromolecule?

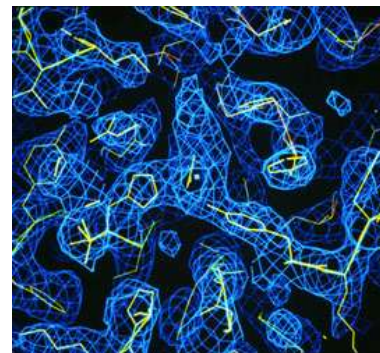
2014 : the International Year of Crystallography

5 Our scientific journey into the molecule turned 100-years-old last year as the technology of X-ray diffraction which allows the detailed study of crystalline material was invented in 1913 by William Henry Bragg and his son, William Lawrence Bragg. With the advent of crystallography — the science of how matter is arranged — we learned how to visualize molecules in 3D, helping us make everything from better medicines to stronger materials. Despite that huge advance, if you stopped someone in the street and asked them what crystallography was, chances are you would get a blank stare. To help raise awareness, and to celebrate a century of amazing discoveries, 2014 has been declared the International Year of Crystallography.

10 **How crystallography is used to determine the structures of the largest macromolecules**

X-rays have wavelengths around 10^{-10} m, they can be used to “see” macromolecules. Crystallography is the technique of determining structures from the x-ray diffraction patterns¹ generated by crystals of a substance made of macromolecules. In some ways it is like using a microscope to view an object.

15 The electron map (grids) allows the scientist to determine where the atoms and the chemical bonds (lines) of the macromolecule are located. Using a computer and knowing the bond lengths for the atoms a scientist can build a model of the macromolecule. The models shown on the right side are for several toxins. Their structures were determined in Minnesota. Work on developing a vaccine is in progress.

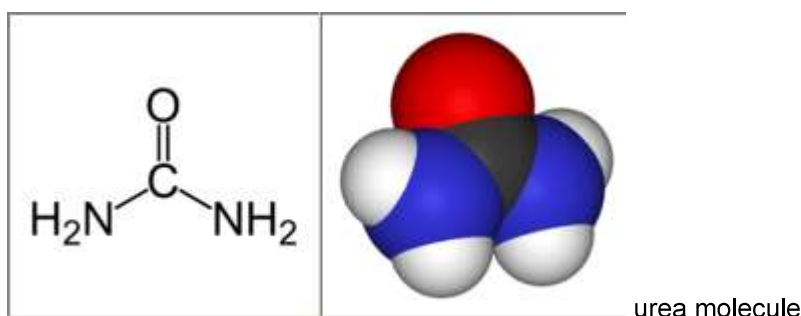


Source : College of Biological Sciences, University of Minnesota
(http://www.cbs.umn.edu/lab/ohlendorf/mission_10/01/2014)

¹ diffraction pattern : figure de diffraction

To make your presentation, you may use the following suggestions

- ✓ Explain the aim of crystallography.
- ✓ Talk about how physics technologies help the improvement of medicine.

A friendship in chemistry which started with a dispute

5 Justus von Liebig (1803–1873) and Friedrich Wöhler (1800–1882) were friends who helped make organic chemistry a field of systematic study within the framework of known chemical laws. Jöns Jakob Berzelius had earlier named those compounds that were formed from four elements alone—carbon, oxygen, hydrogen, and nitrogen—“organic,” because they always seemed to be the products of living beings composed of complex yet highly organized systems. The thinking was that such substances could not be created in the laboratory from inorganic materials, and thus a “vital force” beyond the understanding of chemists was necessary to explain their existence.

10 The friendship between Liebig and Wöhler began in 1825 after they amicably resolved a dispute over two substances, cyanic acid and fulminic acid, that had apparently the same composition but very different characteristics. These and similar substances, called “isomers” by Berzelius, led chemists to suspect that substances are defined not simply by the number and kind of atoms in the molecule but also by the arrangement of those atoms.

15 Perhaps the most famous creation of an isomeric compound was Wöhler’s accidental synthesis of urea in 1828, when he was attempting to prepare ammonium cyanate. The feat of imitating nature in the laboratory was a truly exciting experience—as Wöhler expressed it in his often-quoted letter to Berzelius: “I can no longer, so to speak, hold my chemical water and must tell you that I can make urea without needing a kidney¹, whether of man or dog; the ammonium salt of cyanic acid is urea.”

Source : Chemical Heritage foundation (<http://www.chemheritage.org>)

¹ kidney : rein

To make your presentation, you may use the following suggestions

- ✓ Using the text explain why organic chemistry was a turning point in scientific research.
- ✓ Give examples of the use of chemistry in everyday life.

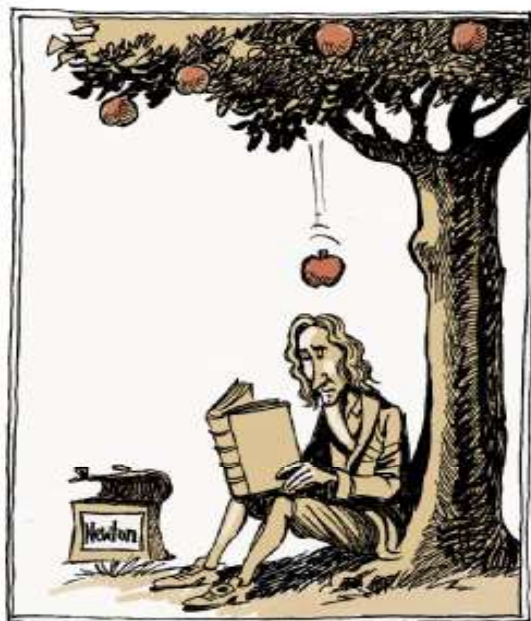
Higgs boson-like particle discovery claimed at LHC

5 CERN scientists reporting from the Large Hadron Collider (LHC) have claimed the discovery of a new particle consistent with the Higgs boson. The particle has been the subject of a 45-year hunt to explain how matter attains its mass. Both of the Higgs boson-hunting experiments at the LHC (Atlas and CMS) see a level of certainty in their data worthy of a "discovery". More work will be needed to be certain that what they see is a Higgs, however. The results announced at Cern (European Organization for Nuclear Research), home of the LHC in Geneva, were met with loud applause and cheering...

10 A confirmation that this is the Higgs boson would be one of the biggest scientific discoveries of the century; the hunt for the Higgs has been compared by some physicists to the Apollo programme that reached the Moon in the 1960s. Scientists would then have to assess whether the particle they see behaves like the version of the Higgs particle predicted by the Standard Model, the current best theory to explain how the Universe works. However, it might also be something more exotic. All the matter we can see appears to comprise just 4% of the Universe, the rest being made up by mysterious dark matter and dark energy. A more exotic version of the Higgs could be a bridge to understanding the 96% of the Universe that remains obscure

Paul Rincon, BBC News website, 4 July 2012

Collisions That Changed The World



To make your presentation, you may use the following suggestions

- ✓ Comment upon the possible scientific and technological implications of the discovery of the Higgs boson.
- ✓ Discuss the usefulness of financing scientific research.

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Sujet n° 9

Tar sands¹



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Mordor is the realm of the evil Sauron in "The Lord of the Rings." Tolkien describes it as "a barren wasteland, riddled with fire and ash and dust, the very air you breathe is a poisonous fume." If you look at Canada's Alberta tar sands you might imagine it's something like Mordor. The gigantic effort to extract oil has turned the province into a hydrocarbon kingdom. And it may be one of the most environmentally destructive projects on earth. Tar sands burn more carbon than conventional oil; destroy forests; kill wildlife; poison the water supply and communities downstream; drain the Athabasca, the river that feeds Canada's largest watershed, and contribute to climate change. The Keystone XL pipeline from Alberta to refineries in the U.S. has been put on hold because of protests but it is likely to resurface.

Website : <http://www.alternativeradio.org>
Recorded in Calgary, Alberta on March 02, 2012.
Interview by David Barsamian.

¹ Tar sands : sables bitumeux (d'où l'on extrait les gaz de schistes)

² barren : stérile

³ riddled : criblé

⁴ watershed : Bassin versant

To make your presentation, you may use the following suggestions

- ✓ Explain the environmental impact of the use of Tar sands.
- ✓ Discuss how physics and chemistry may help to find solutions to energy issues in the near future.