

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° 18

THE HAMMER AND THE FEATHER DROP

5 A famous story about Galileo, which was first told in an early biography, recounts that he performed an experiment from the top of the Leaning Tower of Pisa in which he threw a cannonball and a smaller wooden ball off the tower at the same time. His intent, reputedly, was to disprove an assertion attributed to Aristotle that heavier objects would fall faster than light ones.

The account has long been doubted and it seems pretty clear now that Galileo never did perform this experiment, but it still makes for a good story – such a good story that the commander of the Apollo 15 Moon Mission, David Scott, performed a live demonstration for the television cameras.

10 Mission controller Joe Allen described the demonstration in the “Apollo 15 Preliminary Science Report”:

15 A heavy object (a 1.32-kg aluminum geological hammer) and a light object (a 0.03-kg falcon feather) were released simultaneously from approximately the same height (about 1,6 m) and were allowed to fall to the surface. Within the accuracy of the simultaneous release, the objects were observed to undergo the same acceleration and strike the lunar surface simultaneously, which was a result predicted by well-established theory, but a result nonetheless reassuring considering both the number of viewers that witnessed the experiment and the fact that the homeward journey was based critically on the validity of the particular theory being tested.

From <http://nssdc.gsfc.nasa.gov>

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

- ✓ Discuss the idea of performing Galileo’s experiment on the Moon.
- ✓ Discuss the importance of experimenting to prove or disprove a theory.

WHY SOLAR ENERGY?

We know that relying on coal, oil and natural gas threatens our future with toxic pollution, global climate change and social unrest caused by diminishing fuel supplies.

5 Instead of relying on unsustainable fossil fuels, we must transform our economy and learn to take advantage of the planet's abundant supply of renewable energy.

These are some reasons why you should opt for solar energy.



- 10
- ◆ No monthly bills to worry about. Solar panels are extremely reliable. There are no moving parts so you don't have to worry about replacing anything. In fact, most people generate electricity for thousands of hours with little or no maintenance.
 - ◆ Solar energy is environmentally friendly. Compared to fossil fuels which release greenhouse gases, carcinogens and carbon dioxide, solar cells don't release anything into the air.

15

 - ◆ Solar energy is renewable. We never have to worry about running out of sunlight or using it all up. The sun is a consistent power source meaning it's always going to be there every day.
 - ◆ Solar energy can be used in remote areas where it is too expensive to extend the electricity power grid.

From <http://solarafrica.org/>

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

- ✓ Discuss on the importance of relying on sources of energy other than coal, oil and natural gas.
- ✓ The text only provides the advantages of solar energy. Think of possible disadvantages.

X RAY IMAGING

X-rays are a form of high energy light particles; because our eyes can't detect them, they, too, fall in the category of "invisible light."

5 X-rays pass through light elements such as the hydrogen, oxygen, and carbon that make up our flesh, but they are absorbed by heavy elements such as the calcium in our bones. When X-rays pass through matter, the shadow that results is called an X-ray image. Such images have multiple uses for medicine, industry, and national security.

10 Some very important applications come from the fact that **not all** of the X-rays pass through the light elements; some will bounce¹ off the electrons that orbit the atoms. Send a beam of X-rays toward a person, and a few will bounce straight back to you - and any detector that is nearby.

This phenomenon is called X-ray backscatter.

15 Intelligence agencies can use X-ray backscatter to look inside things even if they can't get behind them to get a shadow. X-ray backscatter can be used on trucks to look for smuggled contraband and more. The spectacular image on the right revealed illegal immigrants attempting to enter southern Mexico from Guatemala in a truckload of bananas. This was not an image that could be
20 taken in the United States, since our laws prohibit the use of X-rays without permission, even for non-citizens.



From "Physics for future presidents" Richard A Muller

To make your presentation, you may use the following suggestions

- ✓ Discuss the various uses of X rays
- ✓ Give arguments in favor or against the use of X rays in terms of ethics.

¹ to bounce = rebondir

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Sujet n° 21

DESALINATION

Even with all of the water in Earth's oceans, we satisfy less than half a percent of human water needs with desalinated water. We currently use on the order of 4,000 cubic kilometers of freshwater¹ a year, and overall there's enough water to go around. There is increasing scarcity³, though.

5 So why don't we desalinate more to reduce shortages and growing water conflicts?

The problem is that the desalination of water requires a lot of energy. Salt dissolves very easily in water, forming strong chemical bonds, and those bonds are difficult to break. Energy and the technology to desalinate water are both expensive, and this means that desalinating water can be pretty costly.

10 That means it's still almost always cheaper to use local freshwater than to desalinate seawater. This price gap, however, is closing.

So how is energy used to separate salt from water?

There are two basic methods for breaking the bonds in saltwater: thermal distillation and membrane separation.

15 Thermal distillation involves heat: boiling water turns it into vapor -leaving the salt behind- that is collected and condensed back into water by cooling it down.

The most common type of membrane separation is called reverse osmosis. Seawater is forced through a semipermeable membrane that separates salt from water. Because the technology typically requires less energy than thermal distillation, most new plants now use reverse osmosis.

20

[Source : http://www.scientificamerican.com/article.cfm?id=why-dont-we-get-our-drinking-water-from-the-ocean](http://www.scientificamerican.com/article.cfm?id=why-dont-we-get-our-drinking-water-from-the-ocean)

¹freshwater : eau douce

²scarcity : rareté

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

- ✓ Comment on the importance of desalination today.
- ✓ Find the main disadvantage of desalination.
- ✓ Think of other ways to reduce freshwater shortage.

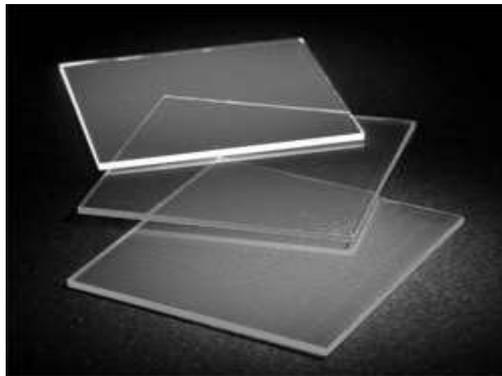
BRINGING COLOR TO SOLAR PANELS

Covering a roof or a façade with standard solar cells to generate electricity will change a building's original appearance — and not always for the better. Nowadays only dark solar panels are widely available on the market. "Not enough work has been done so far on combining photovoltaics and design elements to really do the term 'customized photovoltaics' justice," says Kevin Fuchs, project manager at the Fraunhofer Institute for Applied Optics and Precision Engineering (IOF) in Jena (Germany).

Fuchs is currently working with his "efficient design" team on the fundamentals of how to make colored solar cells from paper-thin silicon wafers. These will be particularly suited to designs for decorative façades and domestic roofs. The silicon semiconductor material, just a few micrometers thick, absorbs light and turns it into electricity.

The simple construction of this new solar cell, with its transparent outer layer, has a further advantage: not only does it capture more light, it means solar panels can be made in different colors and shapes. "The color comes from changing the physical thickness of the transparent conductive layer, or modifying its refractive index," Fuchs says. But not every color allows you to generate the same amount of electricity. There are restrictions for example with certain blends of red, blue and green.

Kevin Fuchsek and al, Fraunhofer Research News, Jul 01, 2013



Credit : Greensun Energy

To make your presentation, you may use the following suggestions

- ✓ Discuss the relevance of increasing the efficiency of solar panels or improving the design flexibility.
- ✓ Imagine numerous possibilities to use a building to communicate information, like displaying the name of a company or artistic work.

OMNITOUCH: WEARABLE MULTITOUCH INTERACTION EVERYWHERE

OmniTouch, a wearable projection system developed by researchers at Carnegie Mellon University and Microsoft Research, enables users to turn pads of paper, walls or even their own hands into graphical, interactive surfaces. The system employs a depth-sensing camera, similar to the Microsoft Kinect, to track the user's fingers on everyday surfaces. This allows users to control interactive applications by tapping or dragging their fingers, much as they would with touchscreens found on smartphones. The projector can superimpose keyboards, keypads and other controls onto any surface, automatically adjusting for the surface's shape and orientation to minimize distortion of the projected images.

"It's conceivable that anything you can do on today's mobile devices, you will be able to do on your hand using OmniTouch," said Chris Harrison, a Ph.D. student in Carnegie Mellon's Human-Computer Interaction Institute. "With OmniTouch, we wanted to capitalize on the tremendous surface area the real world provides," said Benko, a researcher in Microsoft. Harrison previously worked with Microsoft Research to develop Skinput, a technology that used bioacoustic sensors to detect finger taps on a person's hands or forearm. Skinput thus enabled users to control smartphones or other compact computing devices. The optical sensing used in OmniTouch, by contrast, allows a wide range of interactions, similar to the capabilities of a computer mouse or touchscreen.

Harrison and al. OmniTouch: Symposium on User interface Software and Technology (Santa Barbara, California), 2011-19-11



Credit : Carnegie Mellon University

To make your presentation, you may use the following suggestions

- ✓ Imagine the possibilities of both the Skinput and Omnitouch systems if you are physically challenged/disabled.
- ✓ Explain how this system can change our habits at home.

WHY DOES HOT WEATHER CAUSE POWER OUTAGES?

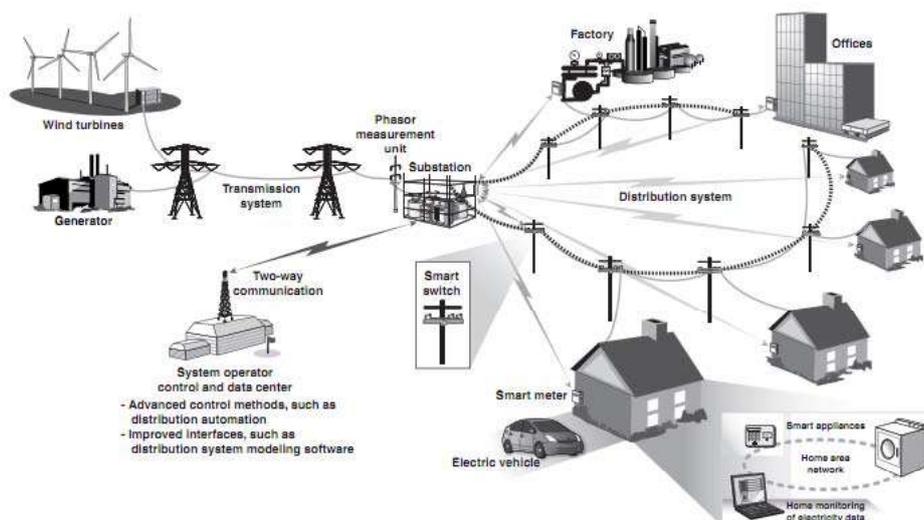
It's quite simple really. First, we certainly love our air conditioners, and air conditioners demand a lot of power. Second, power is generated at only a few places in the country, and yet our air-conditioned homes and businesses and factories are everywhere.

5 Transmission lines have to carry power from these relatively few power injection points to all these different destinations. However, they are just wires and have limited capacity. In fact, their capacity actually goes down when it's hot. This is worsened by the fact that, when a transmission line is carrying a lot of power, it heats up. The metal conductor in the line expands, causing the line to droop¹. If the line droops too much, it makes contact with foliage² on the ground, resulting in a short circuit and an end to that line's ability to carry power. With that line now out of service, other lines have to pick up the slack³, but they, too, become overloaded and prone⁴ to the same problem.

15 Fortunately, the Smart Grid is giving operators a lot more opportunities to keep a weakened grid from falling apart. The Smart Grid is a national effort to modernize the electrical grid by adding lots of automatic, computerized controls to it. Some of these controls can actually communicate with each other autonomously, making decisions in real time without operator intervention. Some of the controls can actually be used to throttle⁵ individual customers' energy use to reduce consumption in one area so that other areas can remain safe.

Dr. Ray Klump, Lewis University, 2013-19-07

¹to droop: s'affaisser ²foliage: feuillage ³to pick up the slack: prendre la relève
⁴prone to: susceptible de subir ⁵to throttle: ralentir, diminuer



Credit: Government Accountability Office

To make your presentation, you may use the following suggestions

- ✓ Discuss if renewable sources can supply local or national needs of energy.
- ✓ Discuss the importance of detecting emerging problems before they spread.

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Sujet n° 25

AN OBSESSED MAN

5 In his later years, Isaac Newton was asked how he had arrived at his theory of universal gravitation. “By thinking on it continually,” was his matter-of-fact response. “Continual thinking” for Newton was almost beyond mortal capacity. He could abandon himself to his studies with a passion and happiness that others experience in love affairs. The object of his study could become an obsession, possessing him nonstop, and leaving him without food or sleep, beyond fatigue, and on the edge of breakdown.

10 The world Newton inhabited in his ecstasy was vast. Richard Westfall, Newton’s principal biographer in this century, describes this “world of thought”: “Seen from afar, Newton’s intellectual life appears unimaginably rich. He embraced nothing less than the whole of natural philosophy [science], which he explored from several vantage points¹, ranging all the way from mathematical physics to alchemy. Within natural philosophy, he gave new direction to optics, mechanics, and celestial dynamics, and he invented the mathematical tool [calculus] that has enabled modern science further to explore the paths he first blazed².”

15 But, after all, Newton was human. His passion for an investigation would fade, and without synthesizing and publishing the work, he would move on to another grand theme. “What he thought on, he thought on continually, which is to say exclusively, or nearly exclusively,” Westfall continues, but “[his] career was episodic.” To build a coherent whole, Newton sometimes revisited a topic several times over a period of decades.

Cropper, Great Physicists: The Life and Times of Leading Physicists from Galileo to Hawking, 2001

¹vantage points: angles d’attaque

²blazed: montré, tracé



Credit: Oxford University Press

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

- ✓ Discuss the way the theory of gravitation was discovered.
- ✓ Comment on the advantages of not focusing on your field of research.

CHINA LAUNCHES FIRST MOON MISSION

China launched its first lunar probe early on the second of December, which, if all goes well, will make it only the third nation to soft-land on the moon. The Chang'e-3 blasted off from a Long March 3B rocket in Sichuan province located in southwest China and is expected to land on the moon's surface in mid-December.

- 5 The new space effort comes just over a decade after the country first sent an astronaut into space. Unlike the soft-landing of the U.S. and the Soviet Union's unmanned¹ spacecraft, Chang'e-3 will be able to survey the landscape first and determine the safest spot.

- 10 Researchers say an impact crater named Sinus Iridum, or Bay of Rainbows, is its likely destination. In 2010, China's previous lunar mission captured images of the crater while scouting potential landing sites for the 2013 probe.



Credit : PETER PARKS / AFP FILES / AFP

On landing, the unmanned spacecraft will release Jade Rabbit - a six-wheeled lunar rover equipped with four cameras and two mechanical legs that can dig up soil samples, a designer for the solar-powered rover told Xinhua news agency last month. The slow-moving rover will patrol the moon's surface for at least three months, according to Xinhua.

Sophie Brown, www.cnn.com, 2013-14-12

¹Unmanned : sans équipage

To make your presentation, you may use the following suggestions

- ✓ Explain which challenges were overcome by this mission.
- ✓ Discuss if the space conquest is a national or global concern.