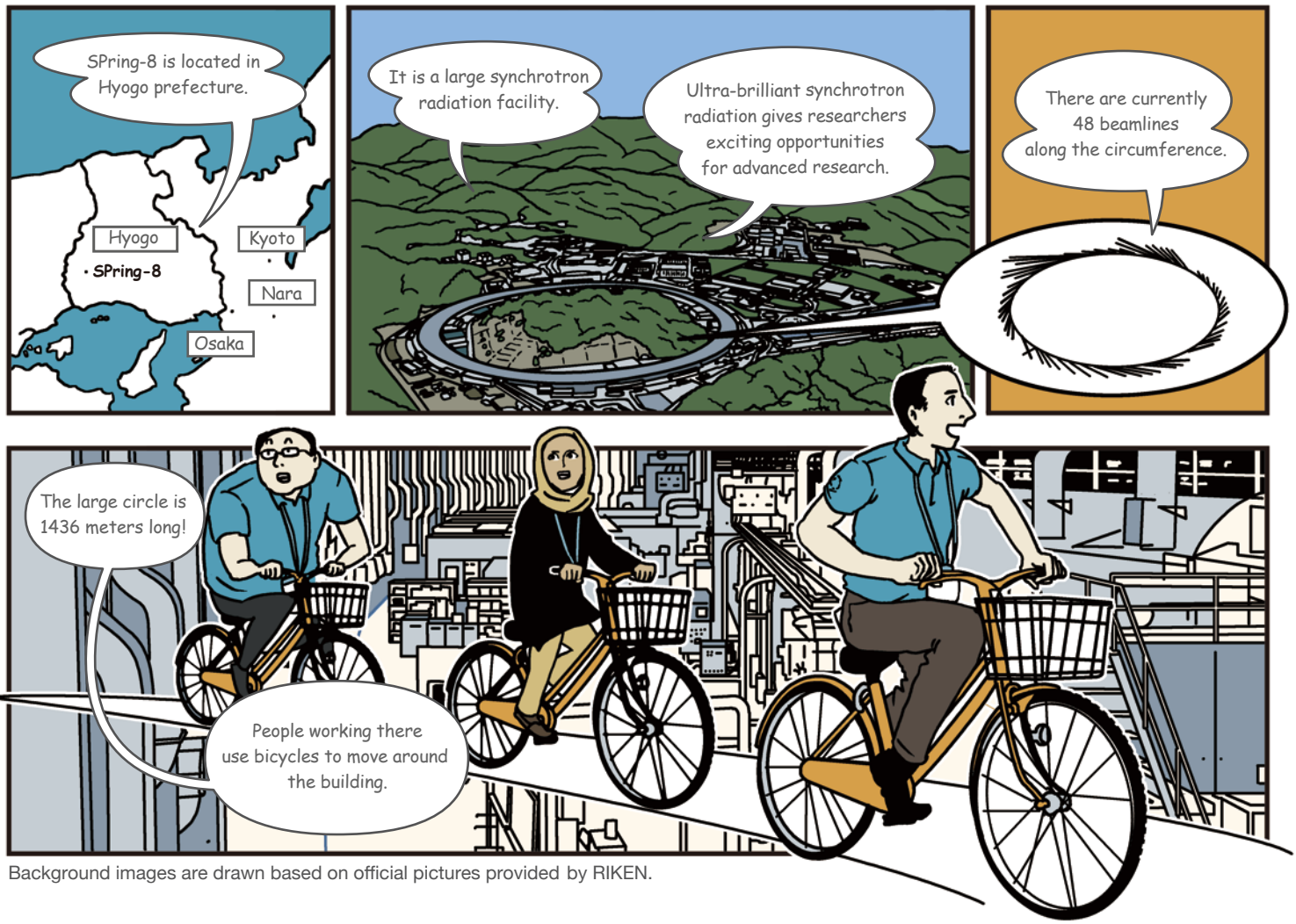
IChO2021
Catalyzer
No. 5
Jul. 29 2021

Chemistry! It's Cool!

53rd International Chemistry Olympiad, Japan

Cover illustration : Scientific Program (SPring-8)



Background images are drawn based on official pictures provided by RIKEN.

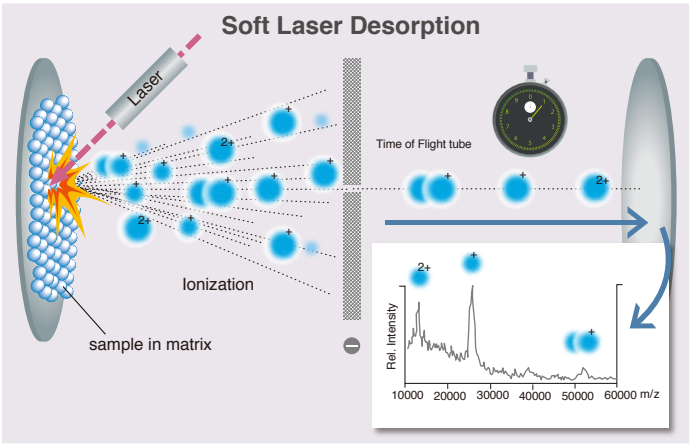
Nobel Prize Research from Japan 05

Soft Laser Desorption for Mass Spectrometry ..... Koichi Tanaka

Recent years have seen a growing need for methods to determine the structure of biomolecules such as proteins, carbohydrates, and lipids. Koichi Tanaka, an engineer at Shimadzu Corporation, has developed an innovative method to enable mass spectrometry of such large biomolecules. Mass spectrometry (MS) is an analytical method for measuring the mass of a material in its ionic state, based on its mass-to-charge ratio, and to do this, the sample (analyte) must first be ionized. Previously, electron ionization (EI), in which the sample is irradiated with thermal electrons, was mainly used for this process, but this did not provide useful information on the mass of biological macromolecules with high molecular weights such as proteins, because they are hard to volatilize and are easily decomposed by heat. On the other hand, in the soft laser ionization method such as the matrix-assisted laser desorption/ionization (MALDI) method, the analyte is mixed with a viscous liquid known as a matrix and irradiated with an ultraviolet laser beam, which causes rapid heating and ablation of the matrix as well as vaporization and ionization of the sample, enabling a soft ionization of the analyte. It is said that this method was conceived when a sample was mistakenly prepared using glycerin instead of acetone, and the sample was analyzed so as not to waste it. This method becomes a particularly powerful tool when analyzing compounds with large molecular weights, making it possible to measure compounds with molecular weights of 100,000 or more. MALDI, and another method known as electrospray ionization (ESI), developed by John B. Fenn, are currently the main methods used for ionizing organic compounds for mass spectrometry. The 2002 Nobel Prize in Chemistry was awarded "for the development of methods for identification and structure analyses of biological macromolecules" to Koichi Tanaka, John B. Fenn, and Kurt Wüthrich for their achievements in protein structure analysis. This particular year's Nobel Prize in Chemistry was unique in that it was awarded for the development of fundamental technologies that support advanced research.

Photo by Shimadzu Corporation

Dr. Koichi Tanaka
(1959–)



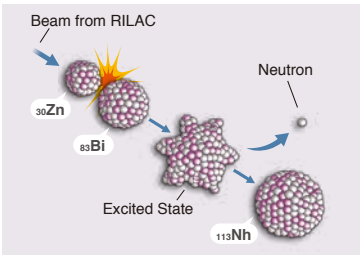
Remote Examination on Jul. 28

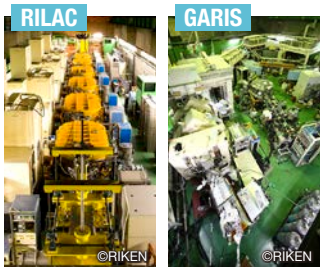
Chemistry! It's Japan!

New Nomination to Periodic Table

Nihonium is the 113th element (symbol: Nh) of the periodic table. This element was first discovered in July 2004 by Kosuke Morita and his group at RIKEN, Japan's largest multidisciplinary research institution. After two successful follow-up tests and certification of the element's discovery at the end of December 2015, the name nihonium and the symbol Nh were officially ratified in November 2016. This became the first element to be named in the Asian region, as all the elements identified until then had been found in Western countries. Nihonium (^{278}Nh), was artificially synthesized by fusing two types of nuclei: a thin film of bismuth (^{209}Bi) with atomic number 83 and mass number 209 was irradiated with a beam of zinc (^{70}Zn) with atomic number 30 and mass number 70 that had been accelerated to about 10% of the speed of light. In this experiment, a large linear accelerator (RILAC) with the world's highest beam intensity and a gas-filled recoil separator (GARIS), which extracts only the 113th element from the countless particles produced by irradiation, played a major role. The probability of nuclei fusing is extremely small, and only three atoms of nihonium were obtained after 400 trillion collisions. It was also revealed that the lifetime of nihonium is only 344 microseconds.

Elements up to the 118th, oganesson (Og), have now been reported, completing the 7th period of the periodic table.





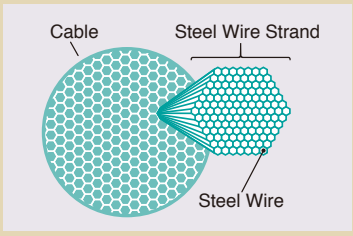
Akashi Kaikyo Bridge

Kansai Scenes 5

the longest suspension bridge in the world

The Akashi Kaikyo Bridge is one of the world's longest bridges. It crosses the Akashi Strait (or Akashi Kaikyo in Japanese), linking Kobe on the mainland of Honshu with Iwaya on Awaji Island, and has a total length of 3,911 meters and central span of 1,991 meters. Awaji is then linked with the island of Shikoku by another suspension bridge called the Onaruto Bridge that crosses the Naruto Strait, well-known for the massive Naruto Whirlpools. Together, these two great bridges provide a seamless route for people travelling between the islands of Honshu and Shikoku.

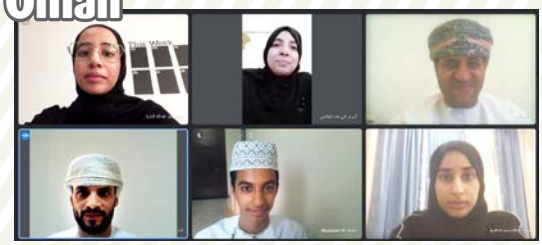
The suspension cables of the Akashi Kaikyo Bridge are supported by two main towers, which rise 288.3 meters above the sea. The main cables of the supporting towers consist of 290 strands (wire bundles with regular hexagonal cross sections), each of which is made of 127 high-tensile galvanized steel wires. Each cable has a diameter of 112.2 centimeters and can support a load of up to 60,000 tonnes. To protect the wires from wind and rain and to prevent corrosion, their surfaces are coated with rubber, and the cable interiors are protected with desalted and dehumidified air, maintaining the strength and durability of this marvelous suspension bridge.



Early Bird Communication

Montenegro

Oman



Malaysia

This is the picture of the final selection test which was conducted online. The best four candidates from this test are representing Malaysia for IChO 2021.

Today's schedule Jul. 29

Student

- Activity (SPring-8 Virtual tour)

Mentor

- Receive the solution and the grading scheme

J 09:00 C 09:00 E 20:00 (Jul. 28)

J : JST = UTC + 9 C : CET = UTC + 2 (summer time) E : EST = UTC - 4 (summer time)

Early Bird Communication

Thailand

Philippines

ELEMENT QUIZ Q5

Which chemist discovered the most elements from nature in history?

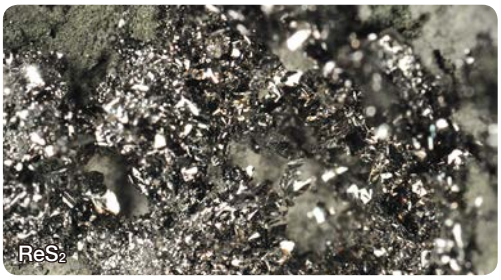
1. Marie Curie
2. Davy
3. Lavoisier
4. Humboldt

Element # 4 Japanese mineral resources Rhenium

Basic Information

Origin of the name: the Latin name of the River Rhine, *Rhenus*
Discovered by: W. Nodak, I. Tacke, and O. Berke (Germany) [1925]
Global reserves: 2,400 tons
Major reserve countries: Chile, the USA, Russia
Global production: 53 tons
Major producers: Chile, Poland, the USA

In 1908, Masataka Ogawa, who was studying at the University of London at the time, reported his discovery of element 43, which he named nipponium (Np), in the mineral trianite produced in Sri Lanka (then Ceylon). Unfortunately, his analysis was later found to be inaccurate, and the element Ogawa had discovered was actually element 75, rhenium, which is one row down on the periodic table. If his analysis had been accurate, there might have been an element named after Japan more than 100 years before nihonium (Nh).



© Crystal Museum

Answer for Q4

1 Gold

Density (weight per cubic centimeter = g/cm^3) is used to compare the weights of substances. The density of water is defined as 1.0 g/cm^3. The densities of the four metals are 19.3, 10.5, 8.96, and 13.6 g/cm^3 for gold, silver, copper, and mercury, respectively; thus, gold is the heaviest of the four. The heaviest of all known metals is osmium, with a density of 22.6 g/cm^3.

Chemistry! It's Cool!

53rd IChO 2021 JAPAN™

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Official Website
https://www.icho2021.org/

icho2021

Jul. 29
1836
Completed!
Triumphal arch in Paris

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