Student's Card

Find the Elements – Treasure Hunt

Module 1

Setup and Organization

Introduction

Find the Elements is and educational game meant to make players aware of the problems of critical raw materials, electronic wastes revalorization, urban mining and circular economy. This is achieved by learning information about some important chemical elements, mainly critical ones, present in the most common electronic devices.

The activity works as a revisiting of the classic treasure hunt. Find the Elements can be played indoors, outdoors or a combination of both.

Informational Sheets

These sheets should contain a list of information about all the elements of the devices you want to use for the game. They should be given to each group when they start a course, and their purpose is to give the players additional information that they can use to find the correct answers to the questions.

If you are preparing the game using the sample devices, elements and questions provided in **Module 1 for Teachers**, you can use the following as informational sheets to give to the players. If you are making your own variation of the game with different elements, you should prepare your own informational sheets, and you can use the following just as an example.

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FIND THE ELEMENTS

GOLD - Au

According to a research of Bristol University (UK) and Munster University (Germany) published on Nature, gold and platium may have rained from the sky 4 billion years ago, because of a meteorites bombing which had lasted for 200 million years. If we could reach the centre of the Earth and take all the gold and platinum laid there, we could cover the Earth surface with a layer of gold 4 metres thick.

Pure gold melts at 1063 ° C and boils at about 2800 ° C. It is extremely malleable and ductile: from an ounce (28 grams approximately) it is possible to obtain 80 km of 5 micrometer wire (1/10 of the diameter of a human hair).

The oceans are largereserves of gold: they contain 20 million tons of it. But it is not known how to extract it economically, due to the very low concentration.

40% of all the gold extracted in the world comes from the Witwatersrand basin in South Africa. The largest gold mine in the world in terms of size and annual production is Grasberg Mine, on the island of Papua, Indonesia, at 4,000 meters above sea level.

In its native state gold is in the form of nuggets, grains and specks and can be found in rocks and alluvial deposits.

Gold performs important functions in many computers, telecommunications equipment, jet engines and many industrial applications. Furthermore, it is widely used as a coating material for the surfaces of electrical contacts, because it guarantees the resistance to corrosion over time.

In a Smartphone there are about 0.03 grams of gold. In 2015 Apple extracted 1 ton of gold (value: 40 million dollars) from disused iPhones and iPads.

In addition to hi-tech devices, small amounts of gold can be found in smoke detectors, video recorders, reading glasses, antique book covers, and toners in some photo printers.

MAGNESIUM - Mg

In its pure state, Magnesium is a shiny, silver mineral, but when it is in contact with oxygen it becomes opaque.

It is the eighth most abundant element in the world and constitutes 2.3% of the earth's crust in the form of different compounds (carbonates, oxides, sulphates, silicates and chlorides).

You can find Magnesium in the human body: it has a very important role for several physiological processes and it participates to the synthesis of many enzymes.

Its name comes from the Greek word of a place in Thessaly named Magnesia.

It ignites easily and can be attacked by acids, and this is the reason wny the pure magnesium is not used to make objects, but is used in the composition of superlight and mechanically resistant alloys.

Magnesium is found in large deposits of magnesite, dolomite, and other minerals. But also in food, especially in legumes, whole grains, dried fruits and in all green vegetables: in fact Magnesium is an integral part of chlorophyll.

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COPPER - Cu

1 and 2 Euro coins, 10, 20 and 50 Euro cent coins are minted in copper alloys. Copper was chosen for its recyclability, workability, impact and corrosion resistance and antibacterial properties.

Copper can be worked in complicated shapes. It transfers heat very efficiently: this is why it is used to build stills and boilers for the production of drinks and food, beer and spirits.

Human daily requirement of Copper is around 1 microgram and can be satisfied by food and water. Generally a diet rich in Copper includes crustaceans, nuts, liver, legumes and chocolate.

The alchemic symbol of Copper is the same of the biological symbol of the woman. It is not a coincidence: mythology tells that Venus, goddess of beauty, was born from the waters of the island of Cyprus, where the most famous copper mines of antiquity were located.

Copper is a material which can be used for a long time: the world verified stocks are around 900 million tons, not counting those contained in the manganiferous modules at the bottom of the sea, much more abundant. About a third of world copper production comes from Chile (5.8 Mt out of 19.1 Mt), while in Europe the producing countries are Russia, Poland, Spain.

INDIUM - In

An unusual property of the Indium is to be radioactive, although very weakly. Its atoms decay slowly transmuting into tin atoms.

Indium is a very soft, silver-white, bright and shiny metal. Like Tin, it emits a shrill squeak when bars of indium metal are bent. Like Gallium, Indium is also capable of wetting the glass.

Since the 1980s, the amount of Indium annually consumed is mainly used in the worldwide production of LCD screens.

Indium is produced mainly from residues in the processing of Zinc, but it can also be found in iron, lead and copper minerals.

The first large-scale application of the Indium was to coat the brass bearings of the engines of fighter aircrafts during World War II. Later the production gradually increased as new uses were found in fusion alloys, welding and electronics.

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NEODYMIUM - Nd

Neodymium is connected with music because it is used in alloys for magnets and offers an excellent sound quality. For example, in loudspeakers that are particularly sensitive to high frequencies, it guarantees a high brightness of the sound. This is why it is also used in the construction of ergonomic earphones and for magnetic components of different types of professional microphones.

Neodymium is the second most abundant element in nature belonging to rare-earth elements and is almost as abundant as copper.

Neodymium has a silvery and shiny appearance, although it is usually light yellow because of oxidation.

Metallic neodymium powder is reactive to the air and can ignite spontaneously.

Neodymium is emitted into the environment in many different places, especially by petrol-producing industries. It can also enter into the environment when home appliances are thrown away. Neodymium gradually accumulates in soils and in soil water, and this can lead to increased concentration in humans, animals and soil particles.

The use of rare-earth elements and neodymium magnets are strategic for high technology such as the production of lasers, lamps, computer screens, batteries for mobile phones and in nanotechnology.

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YTTERBIUM - Yb

Ytterbium has a shiny metallic appearance; it is tender, malleable and quite ductile. It belongs to the rare-earths elements.

Some alloys containing Ytterbium are used in dentistry. Some of its salts are used for the production of laser devices.

More recently, Ytterbium has been used in the construction of the atomic clock.

It can be easily dissolved by acids. It slowly reacts with water and oxidizes with exposure to air. At high temperatures it ignites spontaneously converting itself into its oxide.

Ytterbium, like other rare-earth elements, is fundamental in the realization of many high-tech products, in which it is present in the form of oxides or alloys with other metals: for example computers, smartphones, tablets, lasers, sensors, systems of navigation, superconductors, catalytic converters, batteries for electric cars.

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NICKEL - Ni

The name comes from the Swedish name Nickel, diminutive of Nicolaus, formerly associated with a madman or restless boy.

It is a fairly good conductor of heat and electricity.

Nickel cannot be found in nature in the free state, but only associated with other minerals. With the iron it composes the Earth's core (NiFe).

In 2011, Russia was the largest nickel producer with around 20% of the world production, followed closely by Canada, Australia, Indonesia and the Philippines.

The main use of nickel is in the preparation of alloys, whose main properties are strength, ductility and resistance to corrosion and heat.

65% of nickel consumed in the western world is used to make stainless steel, the composition of which can vary, but it is typically iron with 18% chromium and 8% nickel. 12% of all nickel consumed ends up in superalloys. The remaining 23% is divided between alloy steels, rechargeable batteries, catalysts and other chemical products, coining, foundry products and plating.

Dark chocolate contains 2.6 micrograms of nickel per gram, milk chocolate 1.2 micrograms / gram and cocoa powder 9.8 micrograms / gram. Other food that contains Nickel is: tomatoes, spinach, cashews, legumes and dried fruit.

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LITHIUM - Li

Lithium is a moderately abundant element and is contained in the earth's crust in 65 ppm (parts per million). In the rank of the most abundant elements Nickel is under Copper and Tungsten and above Cerium and Tin.

It is mainly used in heat-conducting alloys and batteries.

It is the lightest solid metal, is soft, silver-white color, with a low melting point (180.5 ° C) and it oxidizes rapidly on contact with air or water.

Lithium is also used in many applications for heat transfer, for ceramics and glass processing and for lubricating greases. Lithium oxides, for example, are components of tableware.

Lithium is a precious metal for human brain and for the stabilization of the mood. It was even thought to add it to tap water to prevent suicide.

Like all alkaline metals, Lithium reacts easily with water and cannot be found in nature n the free state, due to its high reactivity.

LANTHANUM - La

Lanthanum is one of the rare chemicals that can be found in our homes in equipment such as color televisions, fluorescent lamps, energy-saving lamps and glass. The use of Lanthanum is growing, as it is suitable for the production of catalysts and for cleaning glass.

Lanthanum is a light, metallic, silver-white, malleable and ductile element: it is also so pliable that it can be cut with a knife.

The origin of the name comes from the Greek word "lanthanein", whose meaning is "hide".

It is one of the most reactive metals of rare earths: it oxidizes quickly in air and reacts with water to form hydroxide. Lanthanum burns easily, its salts are often very insoluble.

Lanthanum can hardly be found in nature, in very low quantities. Lanthanum is usually found only in two different types of minerals. The world production of Lanthanum oxide is around 12,000 tons per year and the currently known reserves are around 6 million tons.

Lanthanum is dangerous in the workplace, as dust and gas can be inhaled with the air. This can cause pulmonary embolisms, especially in the case of long-term exposure. Lanthanum, when inhaled, can also cause lung cancer in humans. Finally, it can be a threat for the liver when it accumulates in the human body

Lanthanum is released into the environment in many different places, especially by the gasoline producing industries. It can also enter the environment when appliances are thrown away. Lanthanum gradually accumulates in the soils and in the soil water and this eventually leads to an increase in concentration in humans, animals and soil particles.

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