The mobile phone

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The mobile phone

An object that accompanies us at any time of the day, with which we have become so close. **Have we ever wondered with what, these objects, are made ?**

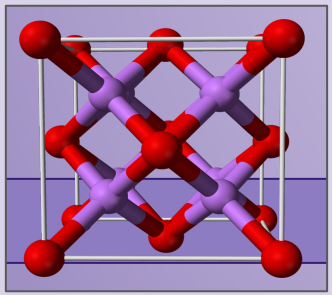
And, above all, where do we put cell phones when they break or die? **DEFINITELY THEY DO NOT HAVE TO BE THROWED**!

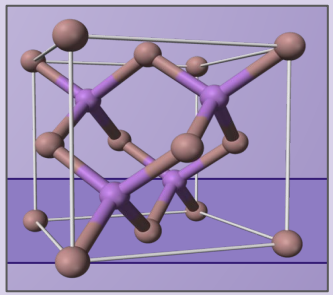
What are the main things that are used to create a moblie-phone ?

We could talk about this topic for many hours. But, shortly, we may say that:

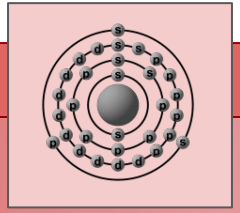
There are **4 main elements** that are extremely important :

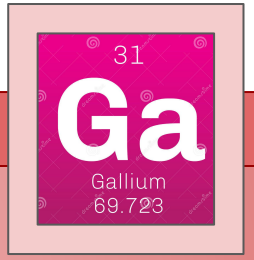
- ➔ ***Gallium***
- ➔ ***Lithium***
- ➔ ***Rare-earth elements***
- ➔ ***Indium***





Gallium





Gallium is a rare, soft, silvery-colored metal; is very **brittle** at room temperature and its **melting point** is 29.76 °C, therefore it can melt if the temperature of the environment in which it is found is about 30 degrees or if held in the hand. It is found in **trace amounts** in bauxite and zinc ores. Gallium arsenide is an important **semiconductor** used in many electronic devices, especially in LED diodes.

Applications

- **Digital and analog integrated circuits** and **optoelectronic devices** (LED diodes and laser diodes) are the most common application of gallium.
- **Semiconductors** and **manufacturing solid-state electronic components** such as transistors.

- **Metal alloy fabrication**: it is used as a component of low melting point alloys. **Nuclear weapons plutonium** wells employ a gallium alloy to stabilize an allotropic form of plutonium. Much research has been done on gallium as a **substitute for mercury** in dental amalgams, but new compounds have yet to prove their worth. The addition of gallium (up to 2%) in common solder pastes increases their **wettability** and **fluxing capabilities**.

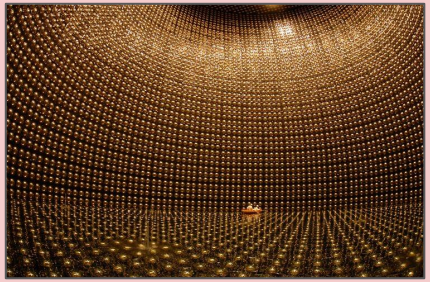
Applications

- Isotope 68 is used in **nuclear medicine** for the localization of neuroendocrine tumors.
- Construction of high-temperature thermometers: a eutectic **alloy of gallium, indium, and tin** is now used instead of mercury in most clinical thermometers. This alloy, with the trade name Galinstan, has a freezing point of -20 °C.

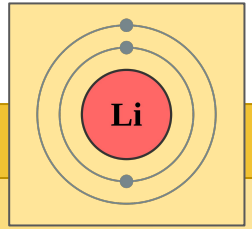
- Gallium has been used in the **SAGE** and **GALLEX experiments** in order to detect the flux of electron neutrinos produced within the Sun. By **absorption of a neutrino**, gallium is converted to germanium with emission of an electron. The **emitted electrons** are then detected by photomultipliers and studied by nuclear physicists. It is possible that the values of spin and angular momentum of the gallium atom (-3/2) determine an **instability of the element**, which could undergo a spontaneous decay, accelerated however by the absorption of the electron neutrino.

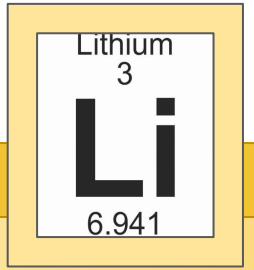
Curiosity

- **Liquid gallium** cannot be kept in a glass or metal container because it expands 3.1 percent when it freezes.
- Gallium has the **largest liquid range** of any metal.
- The **Neutrino Observatory in Italy** uses large amounts of gallium trichloride to study solar neutrinos produced in the sun. Neutrinos are particles created in the first second of the universe, even before atoms, and are continually being made through nuclear reactions of the sun and other stars, according to the University of Wisconsin-Madison.
- In its purest extracted form, gallium is a vibrant **silver color**. As a solid, it is **blue-gray**.Approximately 95 percent of gallium consumption is in the electronics industry, according to LibreTexts. Gallium arsenide and gallium nitride represent about 98% of gallium consumption in the **United States**.
- When painted on glass, gallium turns into a **lustrous mirror**.



Lithium





Like the other alkali metals, lithium has a **single valence electron** that is easily given up to form a cation. Because of this, lithium is a **good conductor** of heat and electricity as well as a highly reactive element, though it is the least reactive of the alkali metals. Lithium's **low reactivity** is due to the proximity of its valence electron to its nucleus (the remaining two electrons are in the 1s orbital, much lower in energy, and do not participate in chemical bonds). However, **molten lithium** is significantly more reactive than its solid form.

- is **soft** enough to be cut with a knife.
- has a very **low density**
- Lithium has the **highest mass specific heat capacity** of all solids. (3.58 kilojoules per kilogram-kelvin)

Applications

- The most important use of lithium is in **rechargeable batteries** for mobile phones, laptops, digital cameras and electric vehicles. Lithium is also used in some **non-rechargeable batteries** for things like heart pacemakers, toys and clocks.
- Lithium metal is made into **alloys** with aluminium and magnesium, improving their strength and making them lighter. A magnesium-lithium alloy is used for **armour plating**. Aluminium-lithium alloys are used in aircraft, bicycle frames and high-speed trains.

- **Lithium oxide** is used in special glasses and glass ceramics.
- **Lithium chloride** is one of the most hygroscopic materials known, and is used in air conditioning and industrial drying systems (as is lithium bromide).
- **Lithium stearate** is used as an all-purpose.
- **Lithium carbonate** is used in drugs to treat manic depression, although its action on the brain is still not fully understood.
- **Lithium hydride** is used as a means of storing hydrogen for use as a fuel.
- **Lithium deuteride** was an early consideration for thermonuclear bomb fuel.

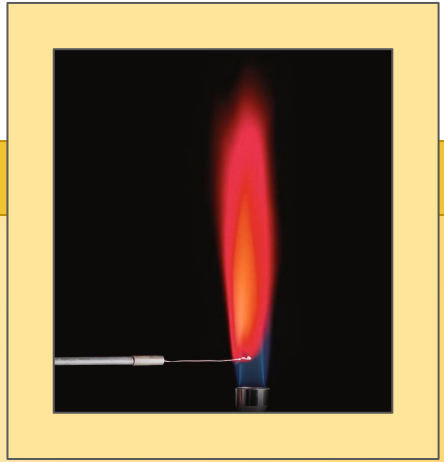
Environmental Impact

Mining and processing of lithium, however, turns out to be **environmentally harmful**:

- In May 2016, **dead fish** were found in the waters of the Liqi River, where a toxic chemical leaked from the Ganzizhou Rongda Lithium mine. **Cow and yak carcasses** were also found floating downstream, dead from drinking contaminated water.

- The **lithium extraction** process uses a lot of water—approximately 500,000 gallons per metric ton of lithium. In Chile's Salar de Atacama, mining activities consumed 65 percent of the region's water, which is having a large impact on local farmers to the point that some communities have to get water elsewhere.
- As in Tibet, there is the potential for **toxic chemicals** to leak from the evaporation pools into the water supply including hydrochloric acid, which is used in the processing of lithium, and waste products that are filtered out of the brine.

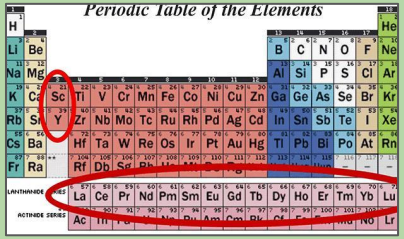
Curiosity



- Lithium is the **lightest metal**.
- Lithium has the **lowest densit**y of any metal. Lithium can float on water.
- Lithium is a shiny, soft metal which reacts violently with **water forming** a strong corrosive base. Lithium is often stored in oil for this reason.
- Lithium burns with a bright **red color.** Lithium is added to fireworks to make red sparks.

- Lithium is not found in its elemental form. Lithium is produced by **electrolysis of ores** containing lithium.
- The first man-made nuclear reaction was the transmutation of lithium into **tritium**.
- Like other alkali metals, lithium can be used to create soap. Lithium soap is used in many commercial lubricants.

Rare-earth elements



The REE group is composed of **15 elements** that range in atomic number from 57 (lanthanum) to 71 (lutetium) on the periodic table of elements, and are officially referred to as the "**lanthanoids**," although they are commonly referred to as the "**lanthanides**." qMost REEs are not as rare as the group's name suggests. They were named "**rare-earth elements**" because most were identified during the 18th and 19th centuries as "earths" (originally defined as materials that could not be changed further by heat) and in comparison to other "earths," such as lime or magnesia, they were relatively rare.

How Do We Use the Rare-Earth Elements?

- Due to their unusual physical and chemical properties, such as **unique magnetic** and **optical properties**, REEs have diverse applications that touch many aspects of modern life and culture. Specific REEs are used individually or in combination to make **phosphors**—substances that emit luminescence—for many types of ray tubes and flat panel displays, in screens that range in size from smart phone displays to stadium scoreboards. Some REEs are used in **fluorescent** and **LED lighting**.
- The **glass industry** is the largest consumer of REE raw materials, using them for glass polishing and as additives that provide color and special optical properties. Lanthanum makes up as much as 50 percent of digital camera lenses, including cell phone cameras.

Where Do Rare-Earth Elements Come From?

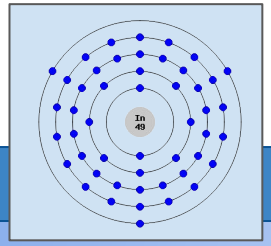
- The REEs are commonly found together in the **Earth's crust** because they share a trivalent charge (+3) and similar ionic radii. In nature, REEs do not exist individually, like gold or copper often do, but instead occur in minerals as either minor or major constituents.

- In recent years **Chinese production** has accounted for about **95 percent** of the REE global market.

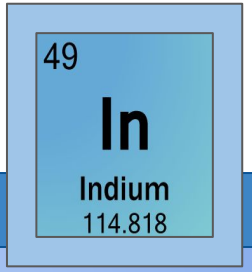
- One important aspect in the development of a property for REE mining is the **cost and complexity** of processing the REE ores. Recovery of REEs can be complex because they occur in minerals as a group of similar elements, and at many deposits the REEs are hosted within more than one mineral.

Curiosity

- **Rare-earth magnets** are stronger per unit weight and volume than any other magnet type. Clean energy technologies, such as large wind turbines and electric vehicles, use rare-earth permanent magnets (meaning permanently magnetized) that usually contain four REEs: **praseodymium**, **neodymium**, **samarium**, and **dysprosium**.
- In the 1940s, as part of the Manhattan Project that created the nuclear bomb, **Frank Spedding and others** in the United States developed **chemical ion exchange procedures** that could separate and purify individual REEs. This method was first used to separate plutonium-239 and neptunium from uranium, thorium, and actinium in materials generated by nuclear reactors.



Indium



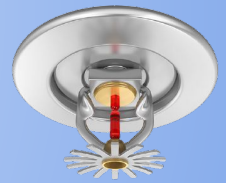
Indium is the softest metal that is not an **alkali metal**. It is a silvery-white metal that resembles tin in appearance. It is a post-transition metal that makes up 0.21 parts per million of the Earth's crust. Indium has a **melting point** higher than sodium and gallium, but lower than lithium and tin. Chemically, indium is similar to gallium and thallium, and it is largely intermediate between the two in terms of its properties. Indium was discovered in 1863 by **Ferdinand Reich** and **Hieronymous Theodor Richter** by spectroscopic methods. They named it for the **indigo blue line** in its spectrum. Indium was isolated the next year. Indium has **no biological role**. Its compounds are toxic when injected into the bloodstream. Indium is one of the **least abundant minerals** on Earth. It has been found uncombined in nature, but typically it is found associated with zinc minerals and iron, lead and copper ores. It is commercially produced as a by-product of zinc refining.

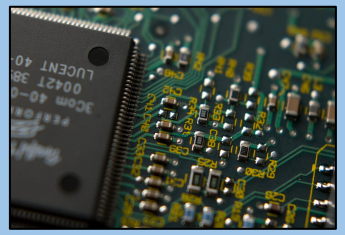
Applications

★ Most indium is used to make **indium tin oxide** (ITO), which is an important part of **touch** screens, flatscreen TVs and solar panels. This is because it conducts electricity, bonds strongly to glass and is transparent.

★ Indium nitride, phosphide and antimonide are **semiconductors** used in transistors and microchips.

★ An **indium alloy** has been used for fire-sprinkler systems in shops and warehouses because of its low melting point.

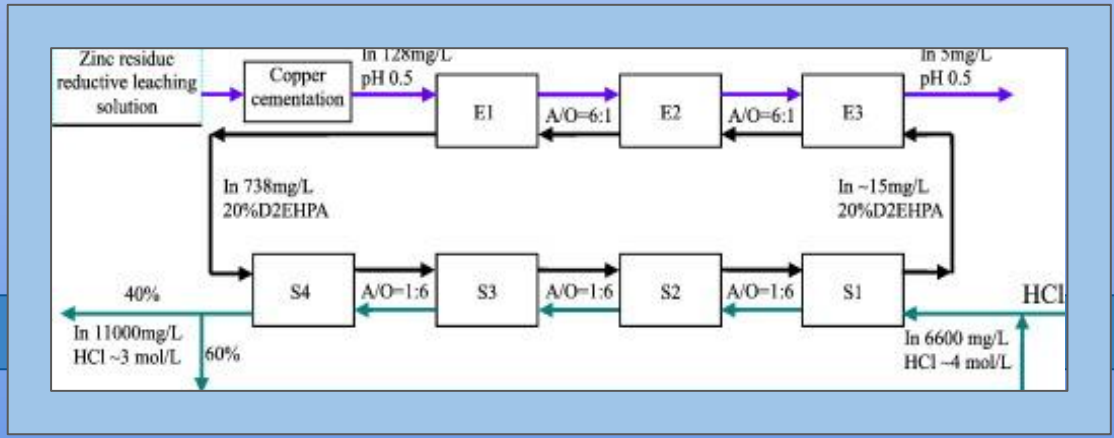




★ **Indium metal sticks** to glass and can be used to give a mirror finish to windows of tall buildings, and as a protective film on welders' goggles. It has also been used to coat ball bearings in Formula 1 racing cars because of its low friction.

Extraction of indium

A direct **solvent-extraction process** was developed to selectively recover indium from solutions generated by **reductive leaching of zinc residues**. This approach avoids the traditional steps of intermediate precipitation, solid–liquid separation, and re-leaching. Copper in the leach solution is easily removed by cementation with iron powder and the remaining Fe(III) is reduced to the ferrous state, which **avoids the possibility of its co-extraction with indium**. Indium is effectively extracted from the **zinc sulfate solution** by 20% (v/v) di (2-ethylhexyl) phosphoric acid (D2EHPA) dissolved in kerosene at an initial pH of 0.5 and aqueous-to-organic phase ratio (A:O) of 6:1 using three countercurrent stages. Indium extraction is **96.1%, zinc** and iron are barely extracted, and the separation factors of indium with respect to zinc and iron are 3640 and 4809, respectively. The complete stripping of indium from the **loaded organic phase** is achieved using 4 mol/L HCl at an A:O of 1:6. A scheme for direct solvent extraction of indium in **zinc hydrometallurgical** processing is suggested, by which indium can be concentrated into a small volume of strip solution containing 11 g/L of indium, which is 85 times its concentration in the **feed solution**.



Curiosity

★ There are **thirty-nine known indium isotopes**, but only one of them is considered stable. Of the unstable isotopes, the two most stable have half-lives of more than one hundred trillion years, and 2.8 days. All of the remaining unstable indium isotopes have **half-lives of less than five hours**.

★ Indium is found in the **crust** at around forty-nine parts per billion, or about as common as mercury.

★ There are less than **ten known indium minerals**, and none are found in major deposits on Earth.

★ **Demand** for indium has increased greatly since it is used in the production of LCD monitors, televisions, and display screens. Due to demand for this application, the **price** of indium per kilogram **has increased** almost tenfold since 2002.

★ Indium is characterized by a **high-pitched screaming** or **crackling sound** when it is bent, which is a phase change at its structure's atomic level.

★ Indium production is currently about **475 tons per year from extraction**, and another **650 tons per year from recycling**.

Sitography

Gallium - Element information, properties and uses | Periodic Table Gallium

Indium - Element information, properties and uses | Periodic Table Indium

Extraction of indium from indium-zinc concentrates

REE - Rare Earth Elements - Metals, Minerals, Mining, Uses

Rare-earth element

lithium mical-element

It's Elemental - The Element Lithium

lithium