

## USES FOR DIFFERENT MINERALS

(Copper, Zinc, Gold, Silver, Nickel, Molybdenum, Uranium,  
Titanium, Vanadium, Silica, Manganese, Iron, Lithium)

SOURCE :

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

Metal	Uses
Copper	<ul style="list-style-type: none"> <li>• wire</li> <li>• coinage metal</li> <li>• copper compounds such as Fehling's solution are widely used in analytical chemistry in tests for sugar</li> <li>• the electrical industry is one of the largest users of copper</li> <li>• copper sulphate is used as an agricultural poison, and water purifier</li> </ul>
Zinc	<p>The alloy brass contains copper and anywhere from 20-45% of zinc, depending upon the type of brass. Brass is easy to work and is a good electrical conductor. Substitutes for brass are sometimes preferred because of the price of copper and these alloys also contain zinc. Zinc alloys with many other metals. Nickel silver, typewriter metal, commercial bronze, spring brass, soft solder, and aluminum solder all contain zinc.</p> <p>A large proportion of all zinc, perhaps more than a third, is used to galvanize metals such as iron so as to prevent corrosion. Typically this involves dipping the object to be coated in molten zinc for a short time but electroplating or painting methods are also used. Zinc protects any exposed iron sacrificially because of the relative positions of zinc and iron in the electrochemical series.</p> <p>Zinc metal is used for dry batteries, roof cladding, and to protect iron structures from corrosion by attaching zinc as sacrificial anodes. Zinc metal is also used in lightweight coins (for instance, USA and Canadian one cent coins are zinc coated with bronze plate)</p> <p>The oxide (ZnO) is used in the manufacture of paints, rubber products, cosmetics, pharmaceuticals, floor coverings, plastics, printing inks, soap, textiles, electrical equipment, and other products. It is also used in ointments.</p> <p>The sulphide (ZnS) is used in making luminous dials, X-ray and TV screens, paints (relatively non-toxic) and fluorescent lights.</p>

Metal	Uses
Gold	<p>Gold has been used for centuries for jewellery and decoration. In addition to the more familiar rings, brooches, necklaces, and ear rings, gold is used as gold leaf for decoration and protection, screen printing (directly on to bone china, earthenware, porcelain, and glass surfaces or decals). Gold is the key component for "liquid gold", preparations containing up to 12% gold ideal for decorative application using brushes and gold pastes used for screen printing. The <a href="#">UtiliseGold directory</a> contains many links to gold suppliers and products for these gold applications and those outlined below.</p> <p>Gold is also well known as a coinage metal (because of its scarcity, inertness, and decorative features) and is a standard for monetary systems in many countries. Apart from gold coins, gold ingots, and gold bars, gold is available in many forms including pure gold and alloys as gold flakes, foil gauzes (meshes), grain, powders, sheet, sponges, tubes, wires and even single gold crystals.</p> <p>Recently, gold catalysts as gold supported on carbon or metal oxides are becoming useful in the chemical industry. Many other gold compounds including neutral gold halides (AuBr<sub>3</sub>, etc.), aurates (K[AuBr<sub>4</sub>], etc.) gold cyanides, gold oxides, phosphine gold complexes, gold hydroxides and gold nitrates are available to industrial users. Chlorauric acid (HAuCl<sub>4</sub>) is used in photography for toning the silver image.</p> <p>Gold is a really useful metal for electronics because of its inertness and physical properties. Gold is used for electrical contacts, spring contacts, bonding wire, solder alloys, bonding wire, bumping wire, electroplating, and sputtering targets. Gold is also a useful brazing material. Gold is used for coating space satellites, as it is a good IR reflector and is inert.</p> <p>Since gold is inert and possesses useful properties when alloyed, gold is used extensively for dentistry in gold teeth, dental attachments, inserts, and solders. Similarly, gold is used increasingly for medical implants in eyes and ears, as well as many other medically useful wires, tubes, sheets, and foils. Disodium aurothiomalate is administered (intramuscular) as a treatment for arthritis. The gold isotope <sup>198</sup>Au is used for treating cancer and other conditions. Gold is used in nanotechnology applications as colloids, conjugates, nanoparticle inks, nanoparticle solutions, and nanopowders.</p>

Metal	Uses
Silver	<ul style="list-style-type: none"> <li>• Sterling silver is used for jewellery, silverware, etc. where appearance is paramount. This alloy contains 92.5% silver, the remainder is copper or some other metal</li> <li>• photography (AgBr)</li> <li>• dental alloys</li> <li>• solder and brazing alloys</li> <li>• electrical contacts</li> <li>• high capacity silver-zinc and silver-cadmium batteries</li> <li>• silver paints are used for making printed circuits</li> <li>• used in mirror production and may be deposited on glass or metals by chemical deposition, electro deposition, or by evaporation. When freshly deposited, it is the best reflector of visible light known, but it rapidly tarnishes and loses much of its reflectance</li> <li>• the iodide is used to seeding clouds to produce rain</li> <li>• the nitrate, (lunar caustic) is used extensively in photography</li> <li>• coinage metal</li> </ul>
Nickel	<ul style="list-style-type: none"> <li>• chiefly valuable for the alloys it forms such as stainless steel and other corrosion-resistant alloys</li> <li>• tubing made of a copper-nickel alloy is extensively used in making desalination plants for converting sea water into fresh water</li> <li>• used extensively in coinage and in making nickel steel for armour plate and burglar-proof vaults</li> <li>• nickel added to glass gives a green colour</li> <li>• nickel plating is often used to provide a protective coating for other metals</li> <li>• finely divided nickel is a catalyst for hydrogenating vegetable oils</li> <li>• batteries</li> <li>• electroplating</li> </ul>

Metal	Uses
Molybdenum	<ul style="list-style-type: none"> <li>• valuable alloying agent (contributes to the hardenability and toughness of quenched and tempered steels). Almost all ultra-high strength steels contain molybdenum in amounts from 0.25 to 8%</li> <li>• improves the strength of steel at high temperatures</li> <li>• electrodes for electrically heated glass furnaces</li> <li>• nuclear energy applications</li> <li>• missile and aircraft parts</li> <li>• valuable catalyst in petroleum refining</li> <li>• filament material in electrical applications</li> <li>• essential trace element in plant nutrition. Some soils are barren for lack of this element in the soil</li> <li>• molybdenum disulphide is a good lubricant, especially at high temperatures where normal oils decompose</li> </ul>
Uranium	<ul style="list-style-type: none"> <li>• a nuclear fuel</li> <li>• conversion into plutonium in "breeder" reactors</li> <li>• used in nuclear fuels to generate electrical power</li> <li>• synthesis of isotopes</li> <li>• nuclear explosive</li> <li>• X-ray targets for production of high-energy X-rays</li> <li>• the nitrate has been used as photographic toner</li> <li>• acetate is used in analytical chemistry</li> </ul>

Metal	Uses
Titanium	<p>Titanium metal is used for alloys with aluminum, molybdenum, manganese, iron, and other metals. These alloys of titanium are used principally in the aerospace industry, for both airframes and engines, where lightweight strength and ability to withstand extremes of temperature are important. Titanium is as strong as steel, but much lighter. It is twice as strong as aluminum. It is nearly as resistant to corrosion as platinum.</p> <p>Titanium is a component of joint replacement parts, including hip ball and sockets. These may last for 20 years or so. Titanium is used in dental implants because it is able to "osseointegrate" (an unusual ability by which titanium fuses with bone tissue, perhaps through the titanium oxide layer on titanium metal). This results in implants that, while not cheap, can last 30 years.</p> <p>It has excellent resistance to sea water and is used for propeller shafts, rigging, and other parts of ships exposed to salt water. A titanium anode coated with platinum provides cathodic protection from corrosion by salt water. Titanium paint is an excellent reflector of infrared radiation, and is extensively used in solar observatories where heat causes poor viewing conditions.</p> <p>Pure titanium dioxide is relatively clear and has an extremely high index of refraction with an optical dispersion higher than diamond. It is produced artificially for use as a gemstone, but it is relatively soft. Star sapphires and rubies exhibit their asterism as a result of the presence of TiO<sub>2</sub>. The dioxide is used extensively for paint as it is permanent and has good covering power. Titanium oxide pigment accounts for the largest use of the element.</p> <p>Titanium is extremely elastic (springy), lightweight, corrosion resistant and non-magnetic and this results in new uses such as for money clips used to hold bank notes and even credit cards (as titanium is non-magnetic it has no effect upon the card's magnetic strip).</p> <p>Titanium is normally coated by a very thin oxide layer. This layer can be thickened through an anodization process to give a product whose perceived colour may be tuned by controlling the thickness of the oxide. Titanium is also used for jewellery (titanium rings and earrings), despite difficulties working it, because it is regarded as hypoallergenic and does not discolour skin.</p>

Metal	Uses
Vanadium	<p>Vanadium metal is important in a number of areas. It's structural strength and neutron cross section properties makes it useful in nuclear applications. The metal is used for producing rust-resistant springs and steels used for making tools. About 80% of the vanadium now produced is used as ferrovanadium or as a steel additive. Vanadium foil is used as a bonding agent in biding titanium to steel.</p> <p>The pentoxide <math>V_2O_5</math> is used in ceramics and as a chemical catalyst. Vanadium compounds are used for dyeing and printing fabrics.</p> <p>A vanadium-gallium mixture is used in producing superconductive magnets.</p>
Silica (silicon)	<ul style="list-style-type: none"> <li>• doped with boron, gallium, phosphorus, or arsenic, etc. to produce silicon for use in transistors, solar cells, rectifiers, and other electronic solid-state devices</li> <li>• silicones are important products of silicon. They are prepared by hydrolysing a silicon organic chloride, such as <math>Me_2SiCl_2</math></li> <li>• silica, as sand, is a principal ingredient of glass, a material with excellent mechanical, optical, thermal, and electrical properties</li> <li>• computer chips</li> <li>• lubricants</li> <li>• used to make concrete and bricks</li> <li>• used in medicine for silicone implants</li> </ul>
Manganese	<ul style="list-style-type: none"> <li>• used to form many important alloys. In steel, manganese improves the rolling and forging qualities, strength, toughness, stiffness, wear resistance, hardness, and hardenability. With aluminum and antimony, especially with small amounts of copper, it forms highly ferromagnetic alloys. Manganese metal is ferromagnetic only after special treatment</li> <li>• the dioxide is used in the preparation of oxygen, chlorine, and in drying black paints</li> <li>• the dioxide (pyrolusite) is used as a depolariser in dry cells, and is used to "decolourise" glass that is coloured green by impurities of iron. Manganese by itself colours glass an amethyst colour, and is responsible for the colour of true amethyst</li> <li>• important in the utilisation of vitamin <math>B_1</math></li> <li>• the permanganate is a powerful oxidising agent and is used in quantitative analysis and in medicine</li> </ul>

Metal	Uses
Iron	<ul style="list-style-type: none"> <li>• pig iron is an alloy containing about 3% carbon with varying amounts of S, Si, Mn, and P. It is hard, brittle, fairly fusible, and is used to produce other alloys, including steel</li> <li>• wrought iron contains a few tenths of a percent of carbon, is tough, malleable, less fusible, and has usually a "fibrous" structure</li> <li>• carbon steel is an alloy of iron with carbon, with small amounts of Mn, S, P, and Si</li> <li>• alloy steels are carbon steels with other additives such as nickel, chromium, vanadium, etc</li> <li>• iron is the cheapest and most abundant, useful, and important of all metals</li> </ul>
Lithium	<p>Both lithium metal and its compounds have many uses.</p> <ul style="list-style-type: none"> <li>• lithium stearate is mixed with oils to make all-purpose and high-temperature lubricants</li> <li>• lithium hydroxide is used to absorb carbon dioxide in space vehicles</li> <li>• lithium is alloyed with aluminum, copper, manganese, and cadmium to make high performance alloys for aircraft</li> <li>• Bahmetall consists of lead containing 0.04% lithium, 0.7% calcium and 0.6% sodium is harder than pure lead and was used for railroad car bearings in Germany.</li> <li>• compounds such as <math>\text{LiAlH}_4</math> and organo lithium reagents (LiMe, LiPh, etc.) are very important as reagents in organic chemistry</li> <li>• lithium metal has the highest specific heat of any solid element and so heat transfer applications</li> <li>• various nuclear applications</li> <li>• lithium is sometimes used as battery anode material (high electrochemical potential) and lithium compounds are used in dry cells and storage batteries</li> <li>• lithium is used in the manufacture of special high strength glasses and ceramics</li> <li>• sometimes, lithium-based compounds such as lithium carbonate (<math>\text{Li}_2\text{CO}_3</math>) are used as drugs to treat manic-depressive disorders.</li> </ul>