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The term transition metal (sometimes also called a transition element) has two possible meanings: In the past it referred to any element in the d-block of the periodic table, which includes groups 3 to 12 on the periodic table. All elements in the d-block are metals (In actuality, the f-block is also included in the form of the lanthanide and actinide series).

It also states that a transition metal is "an element whose atom has an incomplete d sub-shell, or which can give rise to cations with an incomplete d sub-shell." Group 12 elements are not transition metals in this definition.

**List of all transition elements and their applications in organic chemistry:**

[**Scandium**](https://www.thoughtco.com/scandium-facts-sc-or-element-21-606592)**:** The addition of scandium to aluminium limits the grain growth in the heat zone of welded aluminium components. This has two beneficial effects: the precipitated Al3Sc forms smaller crystals than in other [aluminium alloys](https://en.wikipedia.org/wiki/Aluminium_alloy), and the volume of precipitate-free zones at the grain boundaries of age-hardening aluminium alloys is reduced. Both of these effects increase the usefulness of the alloy However, [titanium alloys](https://en.wikipedia.org/wiki/Titanium_alloy), which are similar in lightness and strength, are cheaper and much more widely used.

[**Titanium**](https://www.thoughtco.com/titanium-facts-606609)**:**Titaniun is used in the synthesis of chiral organic compounds via the Sharpless epoxidation, and is also used in [steel](https://en.wikipedia.org/wiki/Steel) as an alloying element ([ferro-titanium](https://en.wikipedia.org/wiki/Ferro-titanium)) to reduce [grain size](https://en.wikipedia.org/wiki/Crystallite) and as a deoxidizer, and in [stainless steel](https://en.wikipedia.org/wiki/Stainless_steel) to reduce carbon content.

[**Vanadium**](https://www.thoughtco.com/vanadium-facts-606617)**:** Vanadium is used for treating diabetes, low blood sugar, high cholesterol, heart disease, tuberculosis, syphilis, a form of “tired blood” (anemia), and water retention (edema); for improving athletic performance in weight training; and for preventing cancer

[**Chromium**](https://www.thoughtco.com/chromium-element-facts-606519)**:** chromium (III) is an essential element in human health and its toxicity is moderate. Care must be taken when handling chromium (VI) reagents (for example [PDC](http://www.organic-chemistry.org/chemicals/oxidations/pyridinium-dichromate-pdc.shtm)) in finely powdered form, because such compounds have extremely high toxicity from inhalation and oral exposure

[**Manganese**](https://www.thoughtco.com/manganese-facts-606557)**:** Manganese helps the body form connective tissue, bones, blood clotting factors, and sex hormones. It also plays a role in fat and carbohydrate metabolism, calcium absorption, and blood sugar regulation. Manganese is also necessary for normal brain and nerve function

[**Iron**](https://www.thoughtco.com/iron-facts-606548)**:** Anemia. The most important use of iron supplements is to treat iron deficiency anemia, a condition marked by low levels of iron in the blood. Iron is important because it is a key component of hemoglobin, which carries oxygen to the entire body.

[**Cobalt**](https://www.thoughtco.com/cobalt-element-facts-606520): Medical treatment. Cobalt is used (as a part of the vitamin B12) in pernicious anemia by improving blood because it promotes the formation of red blood cells (erythrocytes). Cobalt must be entered in large quantities (with food or vitamin B12) in vegetarians.

[**Nickel**](https://www.thoughtco.com/nickel-facts-606565)**:** nickel is used as a catalyst for hydrogenation and used for Stainless Steels, nickel alloys, and other nickel-containing alloys are usedextensively in the medical field. Included in the scope of medical applications is surgical implants, medical tools, health care equipment and fixtures, as well as dental tools and implants.

[**Copper**](https://www.thoughtco.com/copper-facts-chemical-and-physical-properties-606521)**:** Copper is used as medicine. Copper is used for treating copper deficiency and the anemia it may cause. Having too little copper (copper deficiency) is rare. It sometimes occurs in people who get too much zinc from diet or supplements, have intestinal by pass surgery, or are fed by feeding tubes.

[**Zinc**](https://www.thoughtco.com/zinc-facts-606621)**:**  immunological and antibacterial mechanisms of zinc oxide nanoparticles (ZnO-NPs) against human pathogens. ZnO-NPs showed more activity against Staphylococcus aureus and least against Mycobacterium bovis-BCG. However, BCG killing was significantly increased in synergy with antituberculous-drug rifampicin. Antibacterial mechanistic studies showed that ZnO-NPs disrupt bacterial cell membrane integrity, reduce cell surface hydrophobicity and down-regulate the transcription of oxidative stress-resistance genes in bacteria. ZnO-NP treatment also augmented the intracellular bacterial killing by inducing reactive oxygen species production and co-localization with Mycobacterium smegmatis-GFP in macrophages. Moreover, ZnO-NPs disrupted biofilm formation and inhibited hemolysis by hemolysin toxin producing S. aureus. Intradermal administration of ZnO-NPs significantly reduced the skin infection, bacterial load and inflammation in mice, and also improved infected skin architecture. We envision that this study offers novel insights into antimicrobial actions of ZnO-NPs and also demonstrates ZnO-NPs as a novel class of topical anti-infective agent for the treatment of skin infections.

This in-depth study demonstrates properties of ZnO nanoparticles in infection prevention and treatment in several skin infection models, dissecting the potential mechanisms of action of these nanoparticles and paving the way to human applications.

[**Yttrium**](https://www.thoughtco.com/yttrium-facts-606620)**:** It is also used to make superconductors. Yttrium oxysulfide used to be widely used to produce red phosphors for old-style colour television tubes. The radioactive isotope yttrium-90 has medical uses. It can be used to treat some cancers, such as liver cancer

[**Zirconium**](https://www.thoughtco.com/zirconium-facts-606622)**:** Zirconium uses

* (a)Zirconium is used for the cans that hold reactor fuel rods in the nuclear industry.
* (b)It is used as pressure tubes in Canadian nuclear reactors and in the reactors of the US Navy’s nuclear submarines.
* (c)Zirconium is used as an ingredient to increase the strength of [magnesium](http://metalpedia.asianmetal.com/metal/magnesium/magnesium.shtml) alloys. For example, when such alloys are used in aircraft this results in lighter weight components for the same strength. This in turn leads to more efficient use of fuel and a consequent reduction in air pollution.
* Zirconium oxide
* **Ceramics**
* Zirconia can be used to make ceramics, and it is this use of zirconia which has most excited scientists over the past few years.
* Ceramics have been used for thousands of years for making vases, tiles etc. The first ceramic was probably discovered by accident - possibly by noticing that lumps of soft clay become extremely hard when they are left to dry and then fired. The drawback with traditional ceramics is that they are brittle, but zirconia ceramics suffer less from this disadvantage. In fact zirconia ceramics have remarkable properties of strength, hardness and wear resistance in addition to withstanding attack from molten [metal](http://metalpedia.asianmetal.com/indexen.shtml), organic solvents, acids and alkalis. They can also withstand high temperatures for long periods even under severe mechanical stress.
* One of the new applications is knives and scissors, where the zirconia ceramic can be engineered to produce extremely fine and sharp blades which have a hardness of about 9 on the Mohs scale (on which diamond has a value of 10). This is significantly harder than [steels](http://metalpedia.asianmetal.com/steel/indexen.shtml), and of course, ceramics do not rust. These implements give an exceptionally good, smooth cut in even the toughest of uses – they can be used to cut through Kevlar® – as used in riot shields and bullet proof vests!
* High performance scissors and knives are produced for everyday use, and these are also in great demand by deep sea divers who require sharp blades which will not corrode in marine environments. Zirconia ceramic blades flex as well as steel and are non-magnetic, anti-static, and don’t cause any metallic contamination. A new type of golf club head has been manufactured from zirconia ceramics where the extreme hardness enables a crisper and harder driving force to be delivered to the ball.
* As a result of their strength, hardness and other properties, zirconia ceramics are being considered for a huge range of industrial applications which include motor engine components, high speed cutting tools, heat resistant linings in furnaces, containers for molten metals and heat shields for space vehicles. Zirconium oxide is also used in dentistry for the crowning of teeth because of its biocompatibility, strength and appearance.
* \*Cubic zirconia gemstones (‘fake diamonds’) — the optical properties of which are superior to those of diamonds.
* \*Catalysts: zirconia is not only used as a catalyst in its own right, but also as a support medium and enhancer for other catalysts. This enables catalysts to be used at higher temperatures or under severe conditions. Catalytic converters in vehicles contain zirconia.
* \*Ceramic colours: made by adding compounds of other transition metals to zirconia, used in ceramic tiles and sanitary ware—baths, wash basins and toilet bowls—that can replace lead in paint. Monoclinic zirconia is used here.
* \*Electroceramics used in piezoelectrics—gas lighters etc.—and capacitors. (Zirconia has some rather peculiar electrical properties and can under certain circumstances become electrically conducting.)
* \*Solid electrolytes: used in fuel cells and in oxygen sensors used in combustion control systems in boilers and in some car engines.
* Other zirconium compounds
* Zirconium phosphate is used in the ion-exchange medium in kidney dialysis machines.

[**Niobium**](https://www.thoughtco.com/niobium-or-columbium-facts-606566)**:** Niobium is used as a precious metal in commemorative coins, often with silver or gold. For example, Austria produced a series of silver niobium [euro](https://en.wikipedia.org/wiki/Euro) coins starting in 2003; the colour in these coins is created by the [diffraction](https://en.wikipedia.org/wiki/Diffraction) of light by a thin anodized oxide layer In 2012, ten coins are available showing a broad variety of colours in the centre of the coin: blue, green, brown, purple, violet, or yellow. Two more examples are the 2004 Austrian €25 [150 Years Semmering Alpine Railway commemorative coin](https://en.wikipedia.org/wiki/Euro_gold_and_silver_commemorative_coins_%28Austria%29#2004_coinage), and the 2006 Austrian €25 [European Satellite Navigation commemorative coin](https://en.wikipedia.org/wiki/Euro_gold_and_silver_commemorative_coins_%28Austria%29#2006_coinage). The Austrian mint produced for Latvia a similar series of coins starting in 2004, with one following in 2007.[[91]](https://en.wikipedia.org/wiki/Niobium#cite_note-91) In 2011, the Royal Canadian Mint started production of a $5 [sterling silver](https://en.wikipedia.org/wiki/Sterling_silver) and niobium coin named Hunter's Moonin which the niobium was selectively oxidized, thus creating unique finishes where no two coins are exactly alike.

[**Molybdenum**](https://www.thoughtco.com/molybdenum-facts-606561)**:** Molybdenum metal is used in:

•         Alloying agent – contributing hardenability, toughness to quenched/tempered steels. It also improves the strength of steels at high temperatures (red-hardness).

•         In nickel-based alloys (such as Hastelloys®) and stainless steels it imparts heat-resistance and corrosion-resistance to chemical solutions.

•         Electrodes for electrically heated glass furnaces and forehearths.

•         Nuclear energy applications, as missile and aircraft parts (where high temperature resistance is vital).

•         As a catalyst in the refining of petroleum.

•         As a filament material in electronic/electrical applications.

•         As a support members in radio and light bulbs.

•         Arc resistant electric contacts.

•         Thermocouple sheaths

•         Flame- and corrosion-resistant coatings for other metals (generally arc deposited for metallising).

[**Technetium**](https://www.thoughtco.com/technetium-or-masurium-facts-606601)**:**

[Technetium-99m](https://en.wikipedia.org/wiki/Technetium-99m) ("m" indicates that this is a [metastable](https://en.wikipedia.org/wiki/Nuclear_isomer#Metastable_isomers) nuclear isomer) is used in radioactive isotope [medical tests](https://en.wikipedia.org/wiki/Nuclear_medicine). For example Technetium-99m is a [radioactive tracer](https://en.wikipedia.org/wiki/Radioactive_tracer) that medical imaging equipment tracks in the human body.[[16]](https://en.wikipedia.org/wiki/Technetium#cite_note-blocks-17)[[78]](https://en.wikipedia.org/wiki/Technetium#cite_note-bbc-20150530-82) It is well suited to the role because it emits readily detectable 140 [keV](https://en.wikipedia.org/wiki/Electronvolt) [gamma rays](https://en.wikipedia.org/wiki/Gamma_ray), and its half-life is 6.01 hours (meaning that about 94% of it decays to technetium-99 in 24 hours). The chemistry of technetium allows it to be bound to a variety of biochemical compounds, each of which determines how it is metabolized and deposited in the body, and this single isotope can be used for a multitude of diagnostic tests. More than 50 common [radiopharmaceuticals](https://en.wikipedia.org/wiki/Radiopharmaceuticals) are based on technetium-99m for imaging and functional studies of the [brain](https://en.wikipedia.org/wiki/Human_brain), heart muscle, [thyroid](https://en.wikipedia.org/wiki/Thyroid), [lungs](https://en.wikipedia.org/wiki/Human_lung), [liver](https://en.wikipedia.org/wiki/Liver), [gall bladder](https://en.wikipedia.org/wiki/Gall_bladder), [kidneys](https://en.wikipedia.org/wiki/Kidney), [skeleton](https://en.wikipedia.org/wiki/Human_skeleton), [blood](https://en.wikipedia.org/wiki/Blood), and [tumors](https://en.wikipedia.org/wiki/Tumor).[[83]](https://en.wikipedia.org/wiki/Technetium#cite_note-87)

The longer-lived isotope, technetium-95m with a half-life of 61 days, is used as a [radioactive tracer](https://en.wikipedia.org/wiki/Radioactive_tracer) to study the movement of technetium in the environment and in plant and animal systems.

**Rhodium:** is used as an alloying agent for hardening and improving the corrosion resistance of platinum and palladium. These alloys are used in furnace windings, bushings for glass fiber production, thermocouple elements, electrodes for aircraft spark plugs, and laboratory crucibles.