

Hydrogen - H

Chemical properties of hydrogen - Health effects of hydrogen - Environmental effects of hydrogen

Atomic number	1
Atomic mass	1.007825 g.mol ⁻¹
Electronegativity according to Pauling	2.1
Density	0.0899*10 ⁻³ g.cm ⁻³ at 20 °C
Melting point	- 259,2 °C
Boiling point	- 252,8 °C
Vanderwaals radius	0.12 nm
Ionic radius	0.208 (-1) nm
Isotopes	3
Electronic shell	1s ¹
Energy of first ionisation	1311 kJ.mol ⁻¹
Discovered by	Henry Cavendish in 1766*



* Hydrogen was observed and collected long before it was recognized as a unique gas by **Robert Boyle in 1671**, who dissolved iron in diluted hydrochloric acid.

source: homepage.mac.com/dtrapp/Elements/properties.html

Hydrogen

First element in the periodic table. In normal conditions it's a colourless, odourless and insipid gas, formed by diatomic molecules, H₂. The hydrogen atom, symbol H, is formed by a nucleus with one unit of positive charge and one electron. Its atomic number is 1 and its atomic weight 1,00797 g/mol. It's one of the main compounds of water and of all organic matter, and it's widely spread not only in The Earth but also in the entire Universe. There are three hydrogen isotopes: protium, mass 1, found in more than 99,985% of the natural element; deuterium, mass 2, found in nature in 0.015% approximately, and tritium, mass 3, which appears in small quantities in nature, but can be artificially produced by various nuclear reactions.

Uses: The most important use of hydrogen is the ammonia synthesis. The use of hydrogen is extending quickly in fuel refinement, like the breaking down by hydrogen (hydrocracking), and in sulphur elimination. Huge quantities of hydrogen are consumed in the catalytic hydrogenation of unsaturated vegetable oils to obtain solid fat. Hydrogenation is used in the manufacture of organic chemical products. Huge quantities of hydrogen are used as rocket fuels, in combination with oxygen or fluor, and as a rocket propellant propelled by nuclear energy.

Hydrogen can be burned in internal combustion engines. Hydrogen fuel cells are being looked into as a way to provide power and research is being conducted on hydrogen as a possible major future fuel. For instance it can be converted to and from electricity from bio-fuels, from and into natural gas and diesel fuel, theoretically with no emissions of either CO₂ or toxic chemicals.

Properties: Common hydrogen has a molecular weight of 2,01594 g. As a gas it has a density of 0.071 g/l at 0°C and 1 atm. Its relative density, compared with that of the air, is 0.0695. Hydrogen is the most flammable of all the known substances. Hydrogen is slightly more soluble in organic solvents than in water. Many metals absorb hydrogen. Hydrogen absorption by steel can result in brittle steel, which leads to fails in the chemical process equipment.

At normal temperature hydrogen is a not very reactive substance, unless it has been activated somehow; for instance, by an appropriate catalyser. At high temperatures it's highly reactive.

Although in general it's diatomic, molecular hydrogen dissociates into free atoms at high temperatures. Atomic hydrogen is a powerful reductive agent, even at ambient temperature. It reacts with the oxides and chlorides of many metals, like silver, copper, lead, bismuth and mercury, to produce free metals. It reduces some salts to their metallic state, like nitrates, nitrites and sodium and potassium cyanide. It reacts with a number of elements, metals and non-metals, to produce hydrides, like NaH, KH, H₂S and PH₃. Atomic hydrogen produces hydrogen peroxide, H₂O₂, with oxygen.

Atomic hydrogen reacts with organic compounds to form a complex mixture of products; with ethylene, C₂H₄, for instance, the products are ethane, C₂H₆, and butane, C₄H₁₀. The heat released when the hydrogen atoms recombine to form the hydrogen molecules is used to obtain high temperatures in atomic hydrogen welding.

Hydrogen reacts with oxygen to form water and this reaction is extraordinarily slow at ambient temperature; but if it's accelerated by a catalyser, like platinum, or an electric spark, it's made with explosive violence.

Health effects of hydrogen

Effects of exposure to hydrogen: Fire: Extremely flammable. Many reactions may cause fire or explosion. Explosion: Gas/air mixtures are explosive. Routes of exposure: The substance can be absorbed into the body by inhalation. Inhalation: High concentrations of this gas can cause an oxygen-deficient environment. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting and depression of all the senses. The skin of a victim may have a blue color. Under some circumstances, death may occur. Hydrogen is not expected to cause mutagenicity, embryotoxicity, teratogenicity or reproductive toxicity. Pre-existing respiratory conditions may be aggravated by overexposure to hydrogen. Inhalation risk: On loss of containment, a harmful concentration of this gas in the air will be reached very quickly.