



# Hydrogen

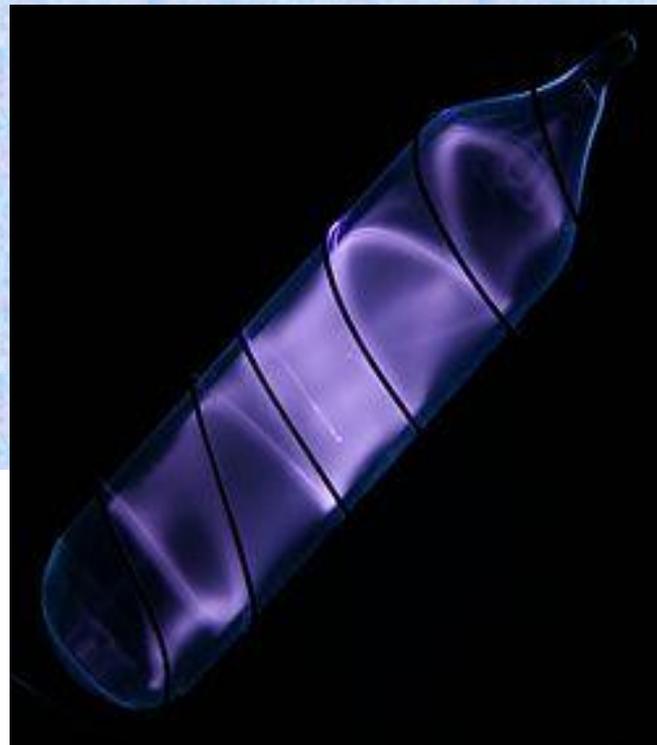
# Hydrogen engines

I.T.I.S. Pininfarina COMENIUS I&R

# Hydrogen

## What is hydrogen?

Hydrogen is the chemical element with the atomic number 1 and it is the first element on the periodic table. It is represented by the symbol **H**. Hydrogen is the lightest and most abundant chemical element, constituting roughly 75 % of the Universe elemental mass



1 H IDROGENO																	2 He ELIO
3 Li LITIO	4 Be BERILLIO											5 B BORO	6 C CARBONIO	7 N AZOTO	8 O OSSIGENO	9 F FLUORO	10 Ne NEON
11 Na SODIO	12 Mg MAGNESIO											13 Al ALLUMINIO	14 Si SILICIO	15 P FOSFORO	16 S ZOLFO	17 Cl CLORO	18 Ar ARGON
19 K POTASSIO	20 Ca CALCIO	21 Sc SCANDIO	22 Ti TITANIO	23 V VANADIO	24 Cr CROMO	25 Mn MANGANESE	26 Fe FERRO	27 Co COBALTO	28 Ni NICKEL	29 Cu RAME	30 Zn ZINCO	31 Ga GALLIO	32 Ge GERMANIO	33 As ARSENICO	34 Se SELENIO	35 Br BROMO	36 Kr KRITON
37 Rb RUBIDIO	38 Sr STRONZIO	39 Y ITTRIO	40 Zr ZIRCONIO	41 Nb NIOBIO	42 Mo MOLOBDO	43 Tc TECNEZIO	44 Ru RUTENIO	45 Rh RODIO	46 Pd PALADIO	47 Ag ARGENTO	48 Cd CADMIO	49 In INDIO	50 Sn STAGNO	51 Sb ANTIMONIO	52 Te TELLURIO	53 I IODIO	54 Xe XENO
55 Cs CESIO	56 Ba BARIO	57 La LANTANIO	58 Ce CERIO	59 Pr PRASSIOLIO	60 Nd NEODIMIO	61 Pm PROMETIO	62 Sm SAMARIO	63 Eu EUROPIO	64 Gd GADOLINIO	65 Tb TERBIO	66 Dy DIPROSIO	67 Ho OLIO	68 Er ERBIO	69 Tm TULIO	70 Yb ITTERBIO	71 Lu LUTETIO	
87 Fr FRANCIO	88 Ra RADIO	89 Ac ATTINIO	90 Th TORIO	91 Pa PASTAFANNO	92 U URANIO	93 Np NETUNIO	94 Pu PLUTONIO	95 Am AMEZICCO	96 Cm CURIO	97 Bk BERKELIO	98 Cf CALIFORNIO	99 Es EINSTEINIO	100 Fm FERMI	101 Md MOSCOVIO	102 No Nobelio	103 Lr LAWRENCIO	

SERIE DEI LANTANIDI

58 Ce CERIO	59 Pr PRASSIOLIO	60 Nd NEODIMIO	61 Pm PROMETIO	62 Sm SAMARIO	63 Eu EUROPIO	64 Gd GADOLINIO	65 Tb TERBIO	66 Dy DIPROSIO	67 Ho OLIO	68 Er ERBIO	69 Tm TULIO	70 Yb ITTERBIO	71 Lu LUTETIO
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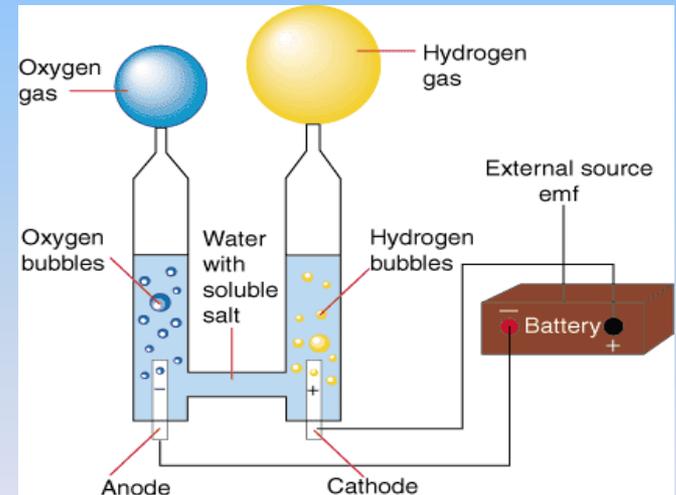
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# HOW CAN WE PRODUCE HYDROGEN?

1. **From water:** Hydrogen is produced on an industrial scale by the electrolysis of water
2. **The Sulfur-Iodine Cycle:** it is much more efficient than water splitting.
3. **From urine:** Hydrogen can also be made from urine. Using urine, hydrogen production is 32% more energy efficient than using water.
4. **Fermentative hydrogen production**
5. **Biocatalysed electrolysis**

*-The fermentative hydrogen production and biocatalysed electrolysis use biological materials*

## Electrolysis of water



# Hydrogen in vehicles

## Vehicles

Buses, trains, canal boats, golf cars, motorcycles, ships, airplanes and submarines can already run on hydrogen in various forms. NASA uses hydrogen to launch Space Shuttles into space.



There is even a working toy model car that runs on solar power, using a regenerative fuel cell to store energy in the form of hydrogen and oxygen gas. It can then convert the fuel back into water to release the solar energy.

A hydrogen vehicle is an alternative fuel vehicle that uses hydrogen as its onboard fuel for motive power. The power plants of such vehicles convert the chemical energy of hydrogen into mechanical energy either by burning hydrogen in an internal combustion engine or by reacting on hydrogen with oxygen in a fuel cell to run electric motors. Many companies are working to develop technologies that might efficiently exploit the potential of hydrogen energy for mobile uses.



The advantages of using hydrogen as an energy are the following:

1. hydrogen is prepared without using fossil fuel inputs
2. the vehicle propulsion would not contribute to carbon dioxide emissions

# *Hydrogen advantages*

1. It is ecological: hydrogen is a clean fuel and if its production happens through renewable energy sources it doesn't create any type of polluting emissions. Furthermore the result of its combustion is simple water!
2. It is inexhaustible because we obtain hydrogen from water and it is the most abundant element on the Earth . Hydrogen is an economical material
3. Hydrogen is versatile, for example we can use it to produce electric power or as a fuel for vehicles
4. If we develop the technology necessary for a massive use of hydrogen, we will be able to stop burning fossil fuels

