

Hydrogen (H)

The lightest element connects stars, water, acids, fuels and isotope science. Start with one proton and one electron, then see why its chemistry does not fit a simple "alkali metal" label.

1	H	1.008
Atomic number	Hydrogen	Relative atomic mass

1. Quick facts

Property	Value	Meaning for a student
Atomic number	1	1 proton
Electrons	1	neutral H atom
Electron configuration	1s ¹	one electron in the first shell
Relative atomic mass	1.008	natural isotope-weighted value
Key isotopes	¹ H / ² H / ³ H	protium, deuterium, tritium
Group / period	1 / 1	s-block; nonmetal

2. Atomic structure and electron configuration

Atomic feature	Value	How to read it
Protons	1	Atomic number fixes the proton count.
Electron configuration	1s ¹	Ground-state orbital bookkeeping.
Shell arrangement	1	Compact shell-count view.
Common oxidation states	+1; -1 in hydrides	Formal oxidation-state bookkeeping, not permanent atom charges.

3. Signature idea

Same element, very different nuclei

Switch among hydrogen isotopes. Proton number stays at 1, so all remain hydrogen; neutron count changes the mass number and nuclear stability.

Model / case	Key result	Why it matters
¹ H / protium	1p + 0n	Stable; about 99.9885% of natural terrestrial hydrogen in the NIST composition table.
² H / deuterium	1p + 1n	Stable; about 0.0115% in the NIST natural-isotope composition table.
³ H / tritium	1p + 2n	Radioactive. It is not assigned a normal natural abundance in the NIST composition table.

4. Properties, phase behavior and evidence

Property	Value	Meaning for a student
Atomic radius	1.10 Å	Non-bonded RSC value; radius depends on definition.
Covalent radius	0.32 Å	Typical covalent-radius reference value.
Electron affinity	72.769 kJ/mol	Energy released in forming H ⁻ from gaseous H.
Electronegativity	2.20	Pauling scale.

Evidence context

Atomic properties and isotope compositions shown here are evaluated reference values. The ³H row intentionally avoids a normal natural-abundance percentage.

5. Where on Earth?

Hydrogen on Earth: global reservoirs, not "hydrogen countries"

Hydrogen is widespread but usually chemically bound. On Earth the largest familiar reservoir is water; atmospheric H₂ is only a trace. A country-dot map would misrepresent natural occurrence.

Global occurrence view

Oceans + water / Living matter / Hydrocarbons + minerals. Country dots are intentionally not used for this layer.

6. Representative compounds / forms

Water / H₂O
Hydrogen is covalently bonded to oxygen; polarity and hydrogen bonding give water many unusual bulk properties.

Ammonia / NH₃
A major nitrogen-hydrogen compound and industrial fertilizer feedstock.

7. Isotope snapshot

Isotope	Nucleus	Natural abundance / status
¹ H	1 p / 0 n	~99.9885% - Stable
² H	1 p / 1 n	~0.0115% - Stable
³ H	1 p / 2 n	No standard natural abundance - Radioactive

8. Questions to ask next

Why is hydrogen in Group 1 if it is not an alkali metal? Hydrogen has a 1s¹ outer configuration, matching the one-electron pattern at the top of Group 1, but its nonmetallic molecular chemistry is distinctive.

What is the difference between protium, deuterium and tritium? All have one proton. They contain 0, 1 and 2 neutrons respectively.

Sources

Royal Society of Chemistry - Hydrogen element data
NIST - Hydrogen atomic data
NIST - Isotopic compositions of hydrogen
PubChem - Hydrogen

Full interactive guide: <https://elementlookup.com/hydrogen/>