

# 1 1.008 H

## Hydrogen

Density =  $0.084 \times 10^{-3} \text{ g/cm}^3$

Melting point =  $-259 \text{ }^\circ\text{C}$

Boiling point =  $-252.9 \text{ }^\circ\text{C}$

Electronegativity = 2.2

Ionization energy = 1312  
kJ/mol

Electron shell:  $1s^1$

Oxidation states: **+1**, **-1**

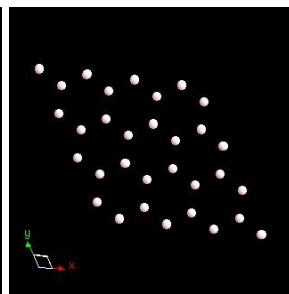
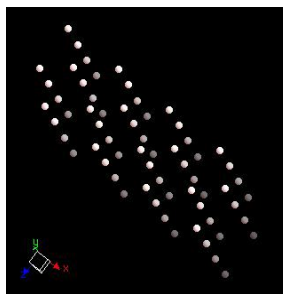
Abundance on Earth: 3.1 log

Isotopes:  $^1\text{H}$ ,  $^2\text{H}$  (D),  $^3\text{H}$  (T)

Cost: \$12/100g



Crystal structure: hexagonal close-packed; space group: P63/mmc



- Hydrogen was discovered in 1766 by Henry Cavendish in London, England.
- Name originated from the Greek words “hydro” and “genes” meaning “water” and “generator”
- Properties: Hydrogen does not react with dilute bases or acids. Mixtures of hydrogen gas and air do not react unless ignited with a flame or spark, in which case the result is a fire or explosion with a characteristic reddish flame whose only products is water,  $\text{H}_2\text{O}$ . Hydrogen gas,  $\text{H}_2$ , reacts with fluorine,  $\text{F}_2$ , in the dark to form hydrogen fluoride.
- Availability: commercially in pressurized tanks
- Uses: commercial fixation of nitrogen from the air in the haber ammonia process, hydrogenation of fats and oils, production of hydrochloric acid, filling balloons, liquid  $\text{H}_2$  is important in cryogenics and in the study of superconductivity since its melting point is only just above absolute zero, hydrogen as water ( $\text{H}_2\text{O}$ ) is absolutely essential to life and it is present in all organic compounds
- Common Compounds: HF hydrogen (I) fluoride, HCl hydrogen (I) chloride, HBr hydrogen (I) bromide, HI hydrogen (I) iodide,  $\text{H}_2\text{O}$  hydrogen (I) oxide,  $\text{H}_2\text{S}_2$  hydrogen (I) persulphide,  $\text{H}_2\text{Se}$  hydrogen (I) selenide,  $\text{NH}_3$  hydrogen (I) nitride, etc.
- Health effects: Hydrogen gas is not toxic but is dangerous if mixed with air or oxygen because of the fire and explosion risk. It can asphyxiate through denying the body access to oxygen.