A molecule of dihydrogen contains two atoms, in which the nuclei of both the atoms are spinning. Depending upon the direction of the spin of the nuclei, the hydrogens are of two types:

**Ortho** hydrogen molecules are those in which the spins of both the nuclei are in the same direction. Molecules of hydrogen in which the spins of both the nuclei are in the opposite direction are called **para** hydrogen.

![Ortho and para hydrogen](image)

Figure 1: Ortho and para hydrogen

Ordinary dihydrogen is an equilibrium mixture of ortho and para hydrogen.

\[
\text{ortho hydrogen} \rightleftharpoons \text{para hydrogen} \nonumber
\]

The amount of ortho and para hydrogen varies with temperature as:

- At 0°K, hydrogen contains mainly para hydrogen which is more stable.
- At the temperature of liquefaction of air, the ratio of ortho and para hydrogen is 1 : 1.
- At the room temperature, the ratio of ortho to para hydrogen is 3 : 1.
- Even at very high temperatures, the ratio of ortho to para hydrogen can never be more than 3 : 1.

Thus, it has been possible to get pure para hydrogen by cooling ordinary hydrogen gas to a very low temperature (close to 20 K) but it is never possible to get a sample of hydrogen containing more than 75% of ortho hydrogen.

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**Contributors**