= Avogadro constant =

In chemistry and physics , the Avogadro constant (named after the scientist Amedeo Avogadro) is the number of constituent particles , usually atoms or molecules , that are contained in the amount of substance given by one mole . Thus , it is the proportionality factor that relates the molar mass of a compound to the mass of a sample . Avogadro 's constant , often designated with the symbol NA or L , has the value 6 @.@ 022140857 (74) × 1023 mol ? 1 in the International System of Units (SI) .

Previous definitions of chemical quantity involved Avogadro 's number , a historical term closely related to the Avogadro constant , but defined differently : Avogadro 's number was initially defined by Jean Baptiste Perrin as the number of atoms in one gram @-@ molecule of atomic hydrogen , meaning one gram of hydrogen . This number is also known as Loschmidt constant in German literature . The constant was later redefined as the number of atoms in 12 grams of the isotope carbon @-@ 12 (12C) , and still later generalized to relate amounts of a substance to their molecular weight . For instance , to a first approximation , 1 gram of hydrogen element (H) , having the atomic (mass) number 1 , has 6 @.@ 022 × 1023 hydrogen atoms . Similarly , 12 grams of 12C , with the mass number 12 (atomic number 6) , has the same number of carbon atoms , 6 @.@ 022 × 1023 . Avogadro 's number is a dimensionless quantity , and has the same numerical value of the Avogadro constant given in base units . In contrast , the Avogadro constant has the dimension of reciprocal amount of substance .

Revisions in the base set of SI units necessitated redefinitions of the concepts of chemical quantity . Avogadro 's number , and its definition , was deprecated in favor of the Avogadro constant and its definition . Changes in the SI units are proposed to fix the value of the constant to exactly 6.02214X × 1023 when it is expressed in the unit mol ? 1 , in which an " X " at the end of a number means one or more final digits yet to be agreed upon .

= = History = =

The Avogadro constant is named after the early 19th @-@ century Italian scientist Amedeo Avogadro , who , in 1811 , first proposed that the volume of a gas (at a given pressure and temperature) is proportional to the number of atoms or molecules regardless of the nature of the gas . The French physicist Jean Perrin in 1909 proposed naming the constant in honor of Avogadro . Perrin won the 1926 Nobel Prize in Physics , largely for his work in determining the Avogadro constant by several different methods .

The value of the Avogadro constant was first indicated by Johann Josef Loschmidt , who in 1865 estimated the average diameter of the molecules in air by a method that is equivalent to calculating the number of particles in a given volume of gas . This latter value , the number density <formula> of particles in an ideal gas , is now called the Loschmidt constant in his honor , and is related to the Avogadro constant , NA , by

<formula>

where p0 is the pressure , R is the gas constant and T0 is the absolute temperature . The connection with Loschmidt is the root of the symbol L sometimes used for the Avogadro constant , and German @-@ language literature may refer to both constants by the same name , distinguished only by the units of measurement .

Accurate determinations of Avogadro 's number require the measurement of a single quantity on both the atomic and macroscopic scales using the same unit of measurement . This became possible for the first time when American physicist Robert Millikan measured the charge on an electron in 1910 . The electric charge per mole of electrons is a constant called the Faraday constant and had been known since 1834 when Michael Faraday published his works on electrolysis . By dividing the charge on a mole of electrons by the charge on a single electron the value of Avogadro 's number is obtained . Since 1910 , newer calculations have more accurately determined the values for the Faraday constant and the elementary charge . (See below)

Perrin originally proposed the name Avogadro 's number (N) to refer to the number of molecules in

one gram @-@ molecule of oxygen (exactly 32g of oxygen , according to the definitions of the period) , and this term is still widely used , especially in introductory works . The change in name to Avogadro constant (NA) came with the introduction of the mole as a base unit in the International System of Units (SI) in 1971 , which recognized amount of substance as an independent dimension of measurement . With this recognition , the Avogadro constant was no longer a pure number , but had a unit of measurement , the reciprocal mole (mol ? 1) .

While it is rare to use units of amount of substance other than the mole , the Avogadro constant can also be expressed in units such as the pound mole (lb @-@ mol) and the ounce mole (oz @-@ mol) .