



Avogadro's law

Gay-Lussac discovered that the ratio in which gases combine to form compounds can be expressed in whole numbers: for instance, water is composed of one part oxygen and two parts hydrogen. In the language of modern chemistry, this is expressed as a relationship between molecules and atoms: one molecule of water contains one oxygen atom and two hydrogen atoms.

In the early nineteenth century, however, scientists had yet to recognise a meaningful distinction between atoms and molecules, and Avogadro was the first to achieve an understanding of the difference. Intrigued by the whole-number relationship discovered by Gay-Lussac, Avogadro reasoned that one litre of any gas must contain the same number of particles as a litre of another gas. He further maintained that gas consists of particles – which he called molecules – that in turn consist of one or more smaller particles.

In order to discuss the behaviour of molecules, Avogadro suggested the use of a large quantity as a basic unit, since molecules themselves are very small. Avogadro himself did not calculate the number of molecules that should be used for these

comparisons, but when that number was later calculated, it received the name “Avogadro’s number” in honour of the man who introduced the idea of the molecule. Equal to 6.022137×10^{23} , Avogadro’s number designates the quantity of atoms or molecules in a mole.

Today the mole (abbreviated mol), the SI unit for “amount of substance”, is defined precisely as the number of carbon atoms in 12.01 g of carbon. The term “mole” can be used in the same way we use the word “dozen”. Just as “a dozen” can refer to twelve cakes or twelve chickens, so “mole” always describes the same number of molecules. Avogadro’s law describes the connection between gas volume and number of moles. According to Avogadro’s law, if the volume of gas is increased under isothermal and isobarometric conditions, the number of moles also increases. The ratio between volume and number of moles is therefore a constant.

(Taken from <http://www.scienceclarified.com/everyday/Real-Life-Chemistry-Vol-1/Gases-Real-life-applications.html>)

EXERCISES

1 True or false?

- a. Water is composed of one part hydrogen and two parts oxygen. T F
- b. Avogadro was the first to understand the difference between atoms and molecules. T F
- c. The mole is the SI unit for “amount of substance”. T F
- d. Avogadro’s number designates the number of atoms or molecules in a mole. T F

2 Find the mistake in each sentence and correct.

- a. The term “mole” cannot be used in the same way we use the word “dozen”.
- b. The ratio between mass and number of moles is constant.
- c. Avogadro’s number designates the quantity of atoms or molecules in a dozen.
- d. Avogadro suggested the use of a small quantity as a basic unit to discuss the behaviour of molecules.
- e. The mole is defined precisely as the number of carbon atoms in 12 g of carbon.

3 Match questions and answers.

QUESTIONS		ANSWERS	
A	What did Gay-Lussac discover?	1	He did not, but when that number was later calculated, it received the name “Avogadro’s number” in honour of the man who introduced the idea of the molecule.
B	What does Avogadro’s law describe?	2	He discovered that the ratio in which gases combine to form compounds can be expressed in whole numbers.
C	Did Avogadro personally calculate “Avogadro’s number”?	3	The connection between gas volume and number of moles.

A

B

C