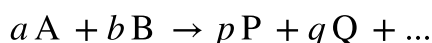


rate of reaction, ν

Also contains definition of: rate of appearance

For the general chemical reaction :



occurring under constant-volume conditions, without an appreciable build-up of reaction intermediates, the rate of reaction ν is defined as:

$$\nu = -\frac{1}{a} \frac{d[A]}{dt} = -\frac{1}{b} \frac{d[B]}{dt} = \frac{1}{p} \frac{d[P]}{dt} = \frac{1}{q} \frac{d[Q]}{dt}$$

where symbols placed inside square brackets denote amount (or amount of substance) concentrations (conventionally expressed in units of mol dm⁻³). The symbols R and r are also commonly used in place of ν . It is recommended that the unit of time should always be the second. In such a case the rate of reaction differs from the rate of increase of concentration of a product P by a constant factor (the reciprocal of its coefficient in the stoichiometric equation, p) and from the rate of decrease of concentration of the reactant A by α^{-1} . The quantity:

$$\dot{\xi} = \frac{d\xi}{dt}$$

defined by the equation:

$$\dot{\xi} = -\frac{1}{a} \frac{dn_A}{dt} = -\frac{1}{b} \frac{dn_B}{dt} = \frac{1}{p} \frac{dn_P}{dt} = \frac{1}{q} \frac{dn_Q}{dt}$$

(where n_A designates the amount of substance A, conventionally expressed in units of mole) may be called the 'rate of conversion' and is appropriate when the use of concentrations is inconvenient, e.g. under conditions of varying volume. In a system of constant volume, the rate of reaction is equal to the rate of conversion per unit volume throughout the reaction. For a stepwise reaction this definition of 'rate of reaction' (and 'extent of reaction', ξ) will apply only if there is no accumulation of intermediate or formation of side products. It is therefore recommended that the term 'rate of reaction' be used only in cases where it is experimentally established that these conditions apply. More generally, it is recommended that, instead, the terms 'rate of disappearance' or 'rate of consumption' of A (i.e. $-\frac{d[A]}{dt}$, the rate of decrease of concentration of A) or 'rate of appearance' of P (i.e. $\frac{d[P]}{dt}$, the rate of increase of concentration of product P) be used, depending on the concentration change of the particular chemical species that is actually observed. In some cases reference to the chemical flux observed may be more

appropriate. The symbol ν (without lettered subscript) should be used only for rate of reaction; ν with a lettered subscript (e.g. ν_A) refers to a rate of appearance or rate of disappearance (e.g. of the chemical species A).

See also: chemical relaxation, lifetime, order of reaction

Source:

PAC, 1994, 66, 1077 (*Glossary of terms used in physical organic chemistry (IUPAC Recommendations 1994)*) on page 1157

See also:

PAC, 1996, 68, 149 (*A glossary of terms used in chemical kinetics, including reaction dynamics (IUPAC Recommendations 1996)*) on page 181